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SKILLS FOR SMART SPECIALISATION IN ALBANIA

Healthy and sustainable food chain

This report was prepared Greatvisory for the European Training Foundation.

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1. INTRODUCTION

In 2010 the European Commission (EC) adopted the *Europe 2020 – Strategy for smart, sustainable and inclusive growth*, and since then the European Union (EU) regions and Member States were required to prepare smart specialisation strategies. Smart specialisation is a place-based approach (thus applied primarily at the regional level) characterised by the identification of strategic areas for intervention based both on the analysis of the strengths and potential of the economy and an evidence-based process of stakeholder engagement (i.e. the Entrepreneurial Discovery Process).

The implementation of smart specialisation is likely to necessitate a need for both advanced and medium-level technical skills. It should be rooted in a realistic supply of relevant skills, which serve as the driving force behind smart specialisation. Thus, human capital development is a key determining factor for smart specialisation, and points to an important role for VET, higher education and training, opening up discussions about upskilling, reskilling and career development support in the context of Europe's twin digital and green transitions.

The EC has been sharing the advantages of the smart specialisation approach beyond EU borders to promote decentralised and innovation-led economic transformation, and to foster interregional and cross-border partnerships. In this context, the Joint Research Centre (JRC) of the EC has been providing guidance and assistance on the development of smart specialisation. The Smart Specialisation Community of Practice (S3 CoP)[1], established by the EC, is the central node providing various kinds of support regarding smart specialisation including guidance, networking and peer-learning to regional authorities and stakeholders involved in Smart Specialisation across the EU.

The European Training Foundation (ETF) has been working with the EU neighbouring (Enlargement, East and South Neighbourhood) and other partner countries to support human capital development as a key priority. In particular, the ETF's work is linking VET and SMEs competitiveness, productivity-enhancing skills, and quality of work. To strengthen the skills dimension in implementing smart specialisation, the ETF has developed a methodological approach for analysing skills implications of smart specialisation strategies. The approach was first tested between 2018 and 2019 in Montenegro and Moldova, and between 2020 and 2021 at sub-national level in Ukraine. Since 2022 the ETF has applied the approach across the Western Balkan region in the agri-food sector, a priority in the region.

Albania started its smart specialisation process in 2016. Since then, the country has been taking steps to prepare a national strategy for smart specialisation. The national smart specialisation working group is facilitated by the Deputy Prime Minister's Office. The mapping study was carried out from end-2020 to end-2022 and the Entrepreneurial Discovery Process in end-2022. As a result, three priority domains have been identified in Albania: Renewable energy and natural resources, Sustainable and diversified tourism, and Healthy and sustainable food chain.

The ETF received a request from the Deputy Prime Minister's Office to support the national smart specialisation efforts with a study on technology and skills needs in the three priority areas for smart specialisation. The key objectives of this study were to formulate: (i) a vision for technology and skills; and (ii) a roadmap for skills development with concrete measures. The main aim was to identify skills related implications of the national smart specialisation strategy for each of the three priority domains.

The methodology for the study included a desk review, as well as stakeholder consultations and interviews with the relevant central and regional institutions. A preliminary desk review was done at the EU level, and the results of previous ETF research[2] were used, to study technological developments and trends impacting technology-related and non-technical skills development in other countries that have relevance for the three priority domains. Further desk review focused on Albania and consisted of a background analysis to identify: (i) which key technology trends, based on the

[1] The DG REGIO's Smart Specialisation Community of Practice replaced the previous Smart Specialisation Platform that had been hosted by the JRC.
[2] The ETF study (2022) "Future skill needs in the Albanian energy sector", and the ETF study (2024) Skilling up the Western Balkans agri-food sector: Albania

developments in the EU, are shaping the priority domains in the country; (ii) employment profile, technology-related and non-technical skills needs (current and future) identified in the priority domains, as well as; (iii) skills provision, with a focus on business intermediary organisations, VET and adult learning.

To enhance the desk research, the further step was a qualitative analysis stage to validate the preliminary findings and recommendations. This consisted of three half-day face to face stakeholder consultations aimed at addressing the following key topics: (i) technology adoption in the three priority domains; (ii) skills needs to develop the three priority domains; (iii) current skills provision and available business support services in the three priority domains. The invited participants included representatives of various institutions such as: policymakers and their implementing agencies, education and training providers, SME managers and employees as well as specialised sector associations with an understanding of technology transfer and adoption in the three priority domains.

Following the consolidation of the results of the quantitative and qualitative research and analysis, the outcomes were three comprehensive reports, one for each priority domain. Each report discusses present and future technological developments, technology related and non-technical skills and occupations necessary for developing the priority domains, skills provision at different education and training levels, as well as findings and recommendations. The findings and recommendations were developed to serve as a roadmap for the stakeholders who are working to address the present and future skills shortages for various types of education and training providers, particularly business intermediary organisations, VET and adult learning institutions. These recommendations should not be seen in isolation but should be considered as an additional tool in the context of the National Strategy for Smart Specialisation action plan and the ongoing priorities of the Albanian government.

The following report focuses on the ‘Healthy and sustainable food chain’ priority domain, as well as its four subdomains: sustainable organic farming and certification; food processing and value-added products; sustainable fisheries and aquaculture; and production of medicinal aromatic plants, oils and extracts.

2. EXECUTIVE SUMMARY

The report aims to provide insights and recommendations for developing the necessary skills in the context of the preparation, adoption and implementation of the national strategy for smart specialisation and, consequently, the enhancement of the healthy and sustainable food chain priority domain in Albania, aligned with EU priorities. It emphasises aligning education and training programmes and business support services with industry needs to support economic growth and job creation

The EU agri-food sector is significant, employing over 44 million people and contributing substantially to GDP. However, it faces challenges such as gender disparity, high levels of informality, and the need for modernisation and sustainable practices. Key EU policies such as the Common Agricultural Policy, the European Green Deal and the Farm to Fork Strategy support improved agricultural productivity, sustainable farming practices and the creation of a fair, healthy and environmentally-friendly food system.

The EU agri-food sector has experienced rapid transformation thanks to new technology, digitalisation and green transitions. Digital tools and smart technologies are being introduced across the sector, clearly changing the production process with automation processes, communication and new business management. In the light of future limited availability of land for food production, and with the global population projected to reach 10.4 billion by the end of this century, the sector needs to speed up the adoption of precision agriculture technologies for better land use to sustain the population. As a result, the EU agri-food sector requires a new set of technical skills such as digitalisation, precision farming and sustainable agricultural practices, as well as non-technical skills such as communication, management, business development, entrepreneurship, regulatory compliance and marketing. Furthermore, there is widespread awareness of emerging technologies shaping the industry, such as hydroponics and aeroponics, non-thermal food processing, genome editing, cold plasma, etc. The EU is responding to these trends through collaborative initiatives, including the Better Training for Safer Food Academy.

Similarly, Albania's agricultural sector, despite its decreasing GDP contribution, remains a major employer (about 35% of total employment), contributing around 20% of GDP in 2022. Despite the decreasing share of agriculture in GDP, agricultural production has increased at an average rate of 3-3.5% per year since 2003. However, the sector is characterised by small-scale, family-run farms with significant informal employment and low productivity. Enterprises operating in the agro-processing industry face difficulties in hiring high-skilled workers – 56% of farm managers only had secondary education, and only 0.4% of workers graduated from specialised universities for agriculture in 2021. Therefore, one of the main challenges is related to insufficient quantity and quality of the education and training offer, as well as insufficient business support services.

In the context of smart specialisation, the relevant Albanian policy framework includes the National Strategy for Development and Integration and the Inter-Sectoral Strategy for Agriculture and Rural Development, which aim to modernise the agricultural sector, enhance market access, increase competitiveness and ensure sustainable development in rural areas.

To address the challenges outlined above and provide a qualified workforce, the Albanian education and training sector needs to focus on delivery of the in-demand technical skills such as sustainable farming techniques, organic certification, precision agriculture, as well as skills for key emerging technologies such as non-thermal food processing, soil-less farming and genome editing. Moreover, non-technical and soft skills to support the development and marketing of new food products will be needed, including entrepreneurship, business management, internationalisation, effective communication, sales, marketing and compliance with international standards. It is also essential to provide direct business support services (training, hands-on advice, mentoring, coaching, etc.) to companies on issues such as implementation and use of new technologies and digital tools, improving operational efficiency and accessing available funds for investments. In particular, upskilling green and

digital skills is essential for an economically, digitally and environmentally viable future for the Albanian food sector.

Main findings and recommendations

Based on the results of desk research and the stakeholder consultations carried out, the assignment concluded that technological changes and innovation in the agri-food sector result in higher demand for: (i) business support services; (ii) skills provision for current and future in-demand occupations; and (iii) deeper EU-level cooperation.

An analysis of the available evidence resulted in the formulation of nine main recommendations to address the skills needs for smart specialisation in Albania in the healthy and sustainable food chain and its subdomains. These have been grouped under three main pillars. The recommendations are addressed to the national smart specialisation working group in Albania, facilitated by the Deputy Prime Minister's Office.

Pillar 1: Business support services for companies

- Conclusion No 1: Dissemination of up-to-date and comprehensive information on the training offer, including funding sources remains fragmented and inefficient. This information gap impedes the ability of businesses, particularly micro, small and medium sized enterprises (MSMEs), to enhance their workforce skills.

  Recommendation No 1: Foster business investment in skills by enhancing access to information on the training offer. Establish a platform or an information hub to collect, update and disseminate information on training offer for MSMEs.

- Conclusion No 2: Education and training provision falls short of addressing the increasing demand for skilled workers in line with technological developments. Although there are a number of business intermediary bodies that provide training on the application of new technologies in the agri-food sector, most of the skills provision to MSMEs concerns training in areas such as business development, marketing and financing.

  Recommendation No 2: Provide targeted technical upskilling and reskilling to boost growth and competitiveness of businesses. Develop new targeted and demand-driven technical training (upskilling and reskilling) services for MSMEs within each subdomain to help improve knowledge and skills related to services innovation and innovative technologies and solutions. The technologies to be considered are: precision agriculture, non-thermal food processing technologies (e.g. high-pressure processing, cold plasma), soil-less farming (e.g. hydroponics, aeroponics), biotechnologies (e.g. genome editing), advanced satellite technologies, remotely operated vehicles, IoT applications for control of traceability/temperature/etc., AI to support design of plant-based products, big data to support optimal planting of trees and crops, etc.

- Conclusion No 3: Transversal, non-technical, skills are increasingly important due to the evolving nature of the business landscape. However, there is currently insufficient support for upskilling and reskilling MSME managers, entrepreneurs and their employees in digital literacy, business development, networking and building relations, as well as in skills and capacities to attract funds for agricultural investment projects.

  Recommendation No 3: Provide targeted non-technical upskilling and reskilling to boost growth and competitiveness of businesses. Develop new targeted and demand-driven non-technical training services to MSMEs within each subdomain to help improve knowledge and skills related to non-technical issues. The aspects to be considered are: business development and strategic planning, marketing and sales, internationalisation, project management, supply chain management, digital literacy, language skills, etc.

- Conclusion No 4: Companies in the agri-food sector, especially MSMEs, have limited resources and lack the capacity to bear the costs and risks of developing technologies in-house. Therefore, they need support to effectively engage with the digital transformation and new technologies. However, the current models, delivery mechanisms and types of assistance offered by business support services, regarding needs assessment and technology adoption, need to be strengthened.

  Recommendation No 4: Boost direct business support to leverage technology adoption for increased productivity. Foster direct assistance to support MSMEs in identifying and implementing necessary technologies as well as in adopting innovative solutions (process/product innovation), in order to drive sustainable growth and competitive advantage in a rapidly evolving market.

Pillar 2: Skills provision for current and future in-demand occupations

- Conclusion No 5: Adaptation of curricula to labour market needs is slow and insufficient. There are no formal training programmes that combine specialist digital skills with education in agriculture or food processing. Technology programmes do not have a focus on, or include subjects in, the healthy and sustainable food chain domain. In higher education, there are no related subjects in the tertiary programmes focused on specialist ICT skills (they only concern the use of ICT rather than development of technological solutions).

  Recommendation No 5: Add new technology-related skills to curricula to accelerate technology diffusion. Update and reform the curricula of existing programmes at all levels of education to include emerging technologies, evolving industry trends, and other innovative practices within the sector. The technologies and practices to be considered are genetic engineering, microtechnology and nanotechnology, robotics, GPS/drones/sensors for precision agriculture, digital tools for monitoring and managing crops, integrated pest management, organic farming, water conservation techniques, sustainable farming practices, etc.

- Conclusion No 6: Available research indicates that the Albanian labour force in the agri-food sector lacks digital literacy, communication skills, the ability to learn on the job, innovativeness and risk-taking. There is a need to develop holistic education and training on transversal/soft skills which are currently not systematically included in the secondary and tertiary education.

  Recommendation No 6: Add new non-technical and non-technology related skills to curricula to cater for the needs of the labour market. Update and reform the curricula of existing programmes at all levels of education to include non-technical and non-technology related skills. The skills to be considered are digital literacy, general communication, language skills, business development, marketing and sales, networking, teamwork, risk-taking, problem solving, etc.

- Conclusion No 7: The agri-food sector faces a significant challenge in providing diverse learning opportunities leading to a qualification. VET and university level education and training is mainly focused on the broader field of agriculture and food processing rather than specific food chain subdomains and related emerging technologies. The non-formal training offer that focuses on food chain subdomains is rather limited, and mostly takes a broader scope on agriculture, food safety and food technology.

  Recommendation No 7: Improve relevance of and access to learning opportunities reflecting technological developments. Expand learning opportunities, including development of new programmes reflecting latest technology trends, particularly in post-secondary education and non-formal short-term courses leading to a qualification.

Pillar 3: Mobilising potential for deeper EU-level cooperation

- Conclusion No 8: Albania faces challenges in disseminating best practices within its agri-food industry due to weak connections and collaboration among food chain stakeholders. These factors limit knowledge sharing and impede innovation and long-term investments.

Recommendation No 8: Develop targeted measures to support companies and business support organisations in cooperation with EU peers. Establish long-term collaboration and investigate funding possibilities to allow peer learning between professionals, entrepreneurs, experts and researchers in Albania and in 'matched' EU regions.

- Conclusion No 9: There is insufficient cooperation between public institutions and there are weak links between food chain actors, leading to a limited diffusion of knowledge and constraining innovation and long-term investments in the domain.

  Recommendation No 9: Develop targeted measures to support public institutions' cooperation with EU peers. Establish long-term collaboration and promote funding possibilities to allow peer learning between public institutions in Albania and in 'matched' EU regions.

3. EU POLICY AND EMPLOYMENT CONTEXT

The agri-food value chain is an essential part of the EU's economy and policy landscape. The broad agri-food value chain provides over 44 million jobs in the EU, encompassing forestry, agriculture, the food industry and retail food services, and the production of inputs such as fertilisers, machinery and crop protection.

The agricultural sector itself employs around 8.7 million on a full-time basis while also providing work for nearly 20 million people. Agriculture alone contributed 1.3% to the EU's GDP in 2021, creating an estimated gross value added of EUR 184.2 billion in 2021. Moreover, farmland covers almost half (46.4%) of the total land area of the EU, thus capturing the geographic extent of the industry. The food and beverages industry is the largest manufacturing sector per turnover and employment in the EU.

Based on the Eurostat employment data, the total number of people employed in the agricultural production and food processing levels of the agri-food value chain in the second quarter of 2022 amounted to 11 135 100, which constitutes 6% of the total employment in the EU for that period. More than half of them were employed in NACE sector A1 – crop and animal production, hunting and related service activities. In the period between 2019 and 2022, the sector experienced a steady decrease in the number of employees, with the biggest drop in 2021, while the other agri-food sectors remained more stable.

A gender gap in employment is evident across agri-food sectors (A1, A3, C10 and C11), with male workers prevailing. While this gap is not as large in the food processing industry (C10 and C11), it is much more pronounced in agriculture (A1), with the number of female workers being half as high as the number of male workers, and in fishing and aquaculture (A3), where male workers largely dominate.

At the same time, a considerable share of employment might not be captured by statistics, as the agricultural sector is traditionally associated with high levels of informality. The exact size of the informal economy in agriculture is difficult to measure due to the breadth of subsistence farming, family work and undeclared employment, seasonal work and use of an irregular immigrant workforce. Moreover, farmers sell products in local markets without documenting these activities. According to some estimations, the highest numbers of unregistered agricultural workers in the EU are found in Greece (94%), Cyprus (85%) and Poland (56%).

In the EU, the Member States leading in terms of number of organic agricultural producers are Italy, Spain, France, Greece (29 896), Austria and Poland. However, organic processors are much less numerous and tend to be concentrated in a few Member States. The biggest number of organic processors in 2020 was in Italy (21 389) and France (14 859), followed by Spain.A comparison of the demographic structure of organic and conventional farm management demonstrates that managers of organic farms tend to be younger. Potentially, this can lead to higher technology uptake on such farms, as farmers who are older have been identified as slower on technology uptake. At the same time, as organic farms tend to be smaller, they face difficulties in finding financial resources to introduce more technologically advanced solutions, due to subsidies being based on farm size.

It is difficult to estimate the number of employees working in organic and functional food production. While for raw agricultural production, the issue of high informality remains relevant for organic and functional foods similarly to conventional foods, it can be expected to be lower for processing in the agri-food value chain. Manufacturing is less prone to informality; therefore, informality is expected to be less pronounced in food processing companies.

In 2022, the EU fishing fleet numbered 70 986 vessels.[3] While the total number of vessels in the EU fishing fleet continues to decline, other fleet capacity indicators, such as engine power and gross tonnage are increasing. Direct employment generated by the sector, amounted to 119 702 fishers.

[3] JRC Publications Repository - Scientific, Technical and Economic Committee for Fisheries (STECF) - The 2024 Annual Economic Report on the EU Fishing Fleet (STECF 24-03 & 24-07)

Aquaculture is an important sector of the EU's blue economy and has the potential to play a more vital role as a sustainable food supplier under the European Green Deal. Almost 29% of the employed persons were estimated as being unpaid labour.[4] In 2020, the EU aquaculture sector directly employed around 57 000 people, working for approximately 14 000 enterprises[5]. The enterprises are primarily small, and family owned. The sector on average employs 77% men and 23% women[6].

In 2020, total EU aquaculture production was 1.1 million tonnes, which was less than 1% of global production the value increased by 25% but between 2014 and 2020[7]. The number of employees in aquaculture (full-time equivalents) fell from 40,000 to 35,000[8].

The EU's self-sufficiency rate for fishery and aquaculture products is rather low. Despite the European Commission's efforts to promote the development of aquaculture within the EU, the production rate is stagnating and the EU is dependent on imports. 67% of the aquaculture production in the EU is concentrated in four countries: France, Greece, Spain, and Italy. More than half of the total aquaculture production volume focuses on shellfish, while marine and freshwater fish account for around 21% and 28% of the total volume. The most farmed species are mussels, trout, oysters, seabream, seabass, carp, and tuna. The sustainable development of aquaculture is one of the main objectives of the common fisheries policy. Aquaculture production is also recognised by the European Green Deal as a source of "low carbon" protein for food and feed. The sustainable development of aquaculture is one of the main objectives of the common fisheries policy. Aquaculture production is also recognised by the European Green Deal as a source of "low carbon" protein for food and feed.

In terms of policy, the EU's Common Agricultural Policy (CAP) is one of the most important and – at 60 years old – oldest EU-level policies related to agri-food. It represents roughly 40% of the overall budget of the EU. Since the EU is one of the leading exporters of agri-food production globally, the CAP's role in consolidating the EU's agri-food market in the face of various crises (e.g. Russia's war against Ukraine) helps the EU's agri-food sector provide European citizens with food security and access to high-quality food while also exporting high-quality food outside of the EU. The CAP's size, therefore, reflects the relevance of the whole agri-food sector to the EU.

Currently, the EU's agri-food sector is undergoing significant transformations in the context of digitalisation and the green transition. The green transition is the European Commission's (EC) policy priority, as reflected in the European Green Deal and the Climate Law. In the EU, agriculture makes up approximately 10% of total GHG emissions, particularly methane (CH_4) and nitrous oxide (N_2O), which are by-products of animal farming and fertilisers.

As part of the European Green Deal, the EC has proposed the Farm to Fork (F2F) Strategy and the European Biodiversity Strategy. The F2F, for example, highlights the need to make food systems more climate-resilient and sustainable in the face of climate change-related insecurities. The Biodiversity Strategy for 2030 emphasises the need to protect natural areas on land and sea. Conserving marine stocks, for example, could 'increase annual profits of the seafood industry by more than EUR 49 billion. In addition, the Green Deal includes provisions for CAP reform, proposed in 2018, which substantially affects the implementation of the strategies. The reformed CAP specifically focuses on supporting the agricultural sector through improved management of resources used for agriculture, sustainability of food systems, and more robust protection for biodiversity.

The Commission aims to make European fisheries and aquaculture emission-neutral by 2050. In 2023 the European Commission presented a new package of measures to improve the sustainability and resilience of the EU fisheries and aquaculture sector. The package consists of an action plan to protect and restore marine ecosystems, a communication on energy transition in the fisheries and

[4] JRC Publications Repository - Scientific, Technical and Economic Committee for Fisheries (STECF) - The 2024 Annual Economic Report on the EU Fishing Fleet (STECF 24-03 & 24-07)
[5] European Commission. Overview of EU aquaculture (fish farming). Available at: https://oceans-and-fisheries.ec.europa.eu/ocean/blue-economy/aquaculture/overview-eu-aquaculture-fish-farming_en
[6] Nichevaa, S., Waldob, S., Nielsenc, R., Lasnerd, T., Guillene, J., Jacksonf, E., Motovag, A., Cozzolinoh, M., Lamprakisi, A., Zheleva, K., Llorente, I. (2022). Collecting demographic data for the EU aquaculture sector: What can we learn? Aquaculture 559(2022) 738382. Available at: https://literatur.thuenen.de/digbib_extern/dn064970.pdf
[7] Europe's aquaculture production is stagnating in spite of EU funding - Eurofish
[8] Europe's aquaculture production is stagnating in spite of EU funding - Eurofish

aquaculture sector, an evaluation on the Common Fisheries Policy and a report on the Common Market Organisation in these sectors. The Commission's objective is threefold: to promote the use of cleaner energy sources; to limit dependence on fossil fuels; and to reduce the impact of the sector on marine ecosystems. This third point raises concerns again about bottom fishing gear, as the Commission calls on Member States to phase out current gear by 2030 in all marine protected areas The Commission calls on Member States to adopt fishery conservation measures in these areas with a clear timetable. The first measures should be in place by 2024 for all Natura 2000 space. Regarding the Common Fisheries Policy (CFP), these proposals seek its full implementation and its adaptation to the environmental and climatic impacts of fisheries and agriculture. A Fisheries and Oceans Pact is proposed to bring together all stakeholders and contribute to adapting the CFP whenever the Commission seems necessary[9].

To achieve its green goals in relation to the agri-food sector, the EU has combined its green transition priorities with those of the digital transition. The green transition requires the sector to become more resource efficient. This is also in part because of the future lack of available land for food production. As the global population projected to grow to 10.4 billion by the end of this century, increasing food security will depend on the efficiency of the use of the available agricultural land. Hence, the agri-food sector will require a higher intensity of precision technologies for better land use to sustain such a population. The uptake of precision technologies is a core feature of digitalisation in the agri-food sector.

Digitalisation, alongside the green transformation, is one of the EU's policy priorities. The European Digital Decade's targets, expected to be achieved by 2030, includes the digital transformation of businesses, secure and sustainable digital infrastructures, and digital skills development. Digital and data solutions can help optimise agri-food production practices and help cut down carbon emissions.

3.1 In-demand technology-related skills and occupations in the EU

3.1.1 Sustainable organic farming and certification[10]

At its essence, organic farming is supposed to respect natural life cycles. Organic regulations prohibit or restrict the use of certain practices in food production (e.g. use of GMOs, ionising radiation, artificial fertilisers, herbicides and pesticides, hormones and antibiotics for animal health).[11] EU regulations on organic production exclude products from fishing and hunting of wild animals but include the harvest of wild plants when certain natural habitat conditions are respected, as well as products from aquaculture.[12]

Consumer trends are an important factor driving the technological changes that affect organic farming. For instance, sellers of organic products started employing digital technologies such as blockchain to ensure traceability, allowing consumers to scan the QR-code of a particular product to make sure that it was organically produced.[13]

The current EU organic regulations are incompatible with a growing trend in the EU agri-food sector – Controlled Environment Agriculture, commonly referred to as vertical farming. Vertical farming is a high-tech farming method where produce is mainly grown in water (hydroponics) or air (aeroponics), using mineral solutions to provide nutrients instead of soil. The current EU regulations allow organic

[9] Fundación Galicia Europa (2023). The European Commission presents new measures to ensure sustainability of fisheries. Available at: https://fundaciongaliciaeuropa.eu/en/a-comision-europea-presenta-novas-medidas-para-garantir-a-sostenibilidade-da-pesca/

[10] The chapter is based on the ETF report 'Identifying technological changes and skills needs in the Western Balkan agri-food sector: EU trends report'. Chapter – Organic foods (2023).

[11] European Court of Auditors (2018). Organic Food in the EU. Available at: https://www.eca.europa.eu/en/publications?did=45193

[12] European Commission (2022). Organic production and products. Available at: https://agriculture.ec.europa.eu/farming/organic-farming/organic-production-and-products_en

[13] Interview with a representative of a European organic association

products to only be grown in soil, which makes it impossible to merge the potential or vertical and organic farming. While in the USA and some other countries vertical farming can be certified as organic, this is not the case in the EU. Vertical farming has the potential for the fully automated production of crops and vegetables, allowing a reduction in labour costs. Such produce is grown locally and can be used in urban settings, thus reducing transportation costs and emissions. Photonics technologies are used in vertical farming. Photonics are also used to monitor soil health and hydrology, predict protein levels in grain harvests, and determine when to pick fruit, etc.

Organic agriculture requires up to 32% less energy compared to conventional agriculture[14]. Digital technologies are increasingly important especially for organic farmers. However, although organic farming is an innovative sector, this is primarily in the sense of designing new agronomic models for a sustainable and resilient food and farming system rather than in the sense of having more high-tech solutions[15]. Yet, due to limited opportunities to rely on pesticides or mineral fertilisers, organic producers depend much more on information about crop or animal health[16]. Therefore, precision agriculture technologies could become key for the growth of the organic sector. The European Commission intends to dedicate at least 30% of the budget for research and innovation actions in the fields of agriculture, forestry and rural areas to the organic sector, with a focus on, for example, increased crop yields, genetic biodiversity and alternatives to contentious products[17].

Key technologies summarised

Hydroponics Aeroponics Precision agriculture	Photonics[18] (the main photonics technologies are sensors, laser systems, advanced lighting): • smart sensors[19] (help cut energy costs, support SMEs by increasing efficiency, providing better quality control, improving food safety and ensuring sustainable production); • scanning and imaging (digital sorters that use scanning and imaging for food safety); • laser systems (technologies for labelling and measuring of food); • advanced lighting (for vertical farming).

As per ETF research[20], in companies active in organic agricultural production in the agri-food value chain, there is a demand for soil scientists (ESCO 2133.11), agronomists (ESCO 2132.2), and agricultural engineers (ESCO 2144.1.2). These specialisations require a higher education in agricultural sciences, with a specialisation suitable for a particular vacancy, such as agronomy or agricultural engineering. Skills generally required for such occupations include management of projects, staff and machinery, knowledge of English and MS Office skills. More specific demands for different job positions include knowledge of plant nutrition and crop protection, skills in crop planning, designing of fertilisation plans, scheduling irrigation and fertigation, carrying out phytosanitary monitoring and control, supplying fertilisers and auxiliary material, knowledge of regenerative farming practices, soil modelling, data handling and using specialised computer programmes such as

[14] UNEP-CTCN. Organic agriculture. Available at: https://www.ctc-n.org/technologies/organic-agriculture#:~:text=Organic%20farming%20restricts%20the%20use,mechanical%20cultivation%20for%20weed%20control

[15] Innovation News Network (2020). Organic farming opportunities in Europe. Available at: https://www.innovationnewsnetwork.com/organic-farming-opportunities-in-europe/5941/

[16] Interview with a representative of a government agency in Germany that manages a fund for financing R&D projects for the development and application of digital solutions in agriculture

[17] European Commission. Organic action plan. Available at: https://agriculture.ec.europa.eu/farming/organic-farming/organic-action-plan_en

[18] Food Pack Lab. Deep Tech for food. Available at: https://www.foodpacklab.eu/photonics-for-food/

[19] European Commission. CORDIS - EU research results. Smart digital tools help Europe's food processing industry tackle high energy costs. Available at: https://cordis.europa.eu/article/id/436432-smart-digital-tools-help-europe-s-food-processing-industry-tackle-high-energy-costs

[20] ETF (2023). Identifying technological changes and skills needs in the Western Balkan agri-food sector: EU trends report

AutoCAD and GIS, and knowledge of policy frameworks such as the CAP and the Rural Development Programme[21].

ETF research also identifies that among technicians and associate professionals (ISCO group 3), there is a demand for agricultural technicians (ESCO 3142.1) and industrial maintenance technicians (ESCO 3114.1.7). For these occupations, employers usually demand a vocational education (ISCED level 4-5) in related fields. For agricultural technicians, training in agricultural engineering is necessary. The technical skills sought are qualitative and quantitative monitoring of harvests, monitoring of agronomic trials, and knowledge of cultivation techniques, agricultural machinery and computer tools. In terms of transversal skills, leadership skills are desired[22].

For industrial maintenance technicians, employers require training in industrial maintenance, electrotechnics, electromechanics, or electrical engineering. Technical skills include automation and industrial IT, in particular knowledge of computerised maintenance management systems (CMMS), mechanical and electrical engineering skills, as well as knowledge of pneumatic and hydraulic technologies. Transversal skills that employers look for include analytical and synthesis skills[23].

With the new developments in the market, the adoption of automation and development of novel products, the demand for 'traditional farming' workers will decrease in the future. By contrast, there will be a higher demand for laboratory assistants and chemical technicians, as well as new profiles such as hydroponics technicians.

According to ETF research[24], job postings for lower occupational levels (ISCO groups 8 and 9) in agri-food, such as food production operators (ESCO 8160.34), agricultural labourers (ESCO 9211) and horticulture workers (ESCO 9214.2), usually do not have specific education requirements, but relevant industrial/agricultural/storekeeping training is sometimes mentioned as desirable. In some cases, basic digital skills are needed (for instance, one job posting for seasonal corn collection workers requires making computer records). For some job postings, workers also need basic farm/industrial maintenance skills, knowledge of hygiene practices and English language skills[25].

[21] Agricultural service company, Italy. Agritechnician/Agronomist; Nuts cultivation company, Spain, Agronomist engineer; VILMORIN ITALIA (seed producer), Italy. Agronomist; Agrifirm (agricultural cooperative), Netherlands. Soil specialist – regenerative farming; Agrifirm (agricultural cooperative), Netherlands. Soil specialist – regenerative farming; Agricultural service company, Italy. Agritechnician/Agronomist

[22] Bioviver (pasteurized and sterilized organic fruits and vegetables), France, Industrial Maintenance Technician; Jean et Lisette, France, Industrial Maintenance Technician; Eureden (agricultural cooperative), France. Potato Specialist Technician; Eureden (agricultural cooperative), France. Potato Specialist Technician.

[23] Bioviver (pasteurised and sterilised organic fruits and vegetables), France, Industrial Maintenance Technician; Jean et Lisette, France, Industrial Maintenance Technician; HappyVore (organic vegan meat producer), France, Maintenance technician

[24] ETF, Identifying technological changes and skills needs in the Western Balkan agri-food sector: EU trends report (2023)

[25] Yooji (organic baby food), France. Food processing operator; Infarm (vertical farming), Denmark. Urban Farmer

Helping organic farmers reach their full potential in Ireland

National Organic Training Skillnet (NOTS) is a not-for-profit network that offers high-quality, low-cost training for the expanding organic sector throughout the Republic of Ireland. This National Organic Training Skillnet programme is co-funded by the Government of Ireland (through Skillnet Ireland), the European Union, and network companies via the ESF+ (European Social Fund) initiative.

NOTS is providing a wide variety of in-depth courses to farmers, food businesses, growers, agricultural professionals, processors, organic and food consultants.

For example the four-day course on 'principles of organic farming'. The course is accredited and it includes visits to organic farms. The learning outcomes of the course are: stating the principles of organic production, interpreting organic standards, completing an organic conversion plan, assessing economic viability and market opportunities for organic production, preparing a business plan for farmers considering conversion, background to organic production, principles of organic production, organic standards and economics of organic production.

In addition to training, the network facilitates organic producers and processors into networks that can address issues and opportunities for the sector. Events such as farm walks and local group meetings are organised all over the country. National Organic Training Skillnet is co-funded by Skillnet Ireland and network companies. Skillnet Ireland is funded by the National Training Fund through the Department of Further and Higher Education, Research, Innovation and Science.

3.1.2. Food processing and value-added products[26]

The European Food Information Council (EUFIC) defines food processing as any method used to turn fresh foods into food products. This can involve one or a combination of the following: washing, chopping, pasteurising, freezing, fermenting, packaging and many more. Food processing also includes adding components to food, for example to extend shelf life, or adding vitamins and minerals to improve the nutritional quality of the food (fortification)[27].

One of the main technological trends in food processing is the development and adoption of non-thermal food processing technologies (e.g. high-pressure processing, pulsed electric fields), as well as novel thermal technologies (e.g. ohmic heating, microwave). These innovations generally aim to reduce the negative effects of conventional thermal technologies. In particular, they aim to save energy and water, reduce toxic waste, improve the organoleptic qualities of products (such as flavour, texture and smell) and increase their nutritional value, which makes these technologies highly relevant for the production and processing of organic food. Another trend is the use of nano/microtechnologies, such as microencapsulation of ingredients[28].

According to a survey of food professionals in Europe in 2015, the main technologies which were applied at that time, and which were expected to be applied in the following five years, were microwave, high-pressure processing (HPP) and pulsed electric fields (PEF). As for technologies that were expected to lead in 2015-2025, cold plasma and PEF were named as the most important[29].

[26] The chapter is based on the ETF report 'Identifying technological changes and skills needs in the Western Balkan agri-food sector: EU trends report', Chapter – Organic foods (2023).
[27] EUFIC: https://www.eufic.org/en/
[28] European Commission (2015). Business Innovation Observatory. Sustainable, Safe and Nutritious Food: Food processing technologies. Available here
[29] Jermann, C., Koutchma, T., Margas, E., Leadley, C., & Ros-Polski, V. (2015). Mapping trends in novel and emerging food processing technologies around the world. Innovative Food Science & Emerging Technologies. P. 14–27

Key technologies summarised

Non-thermal food processing technologies (e.g. high-pressure processing, pulsed electric fields) Novel thermal technologies (e.g. ohmic heating, microwave) Nano/microtechnologies (e.g. microencapsulation of ingredients) High-pressure processing (HPP) Pulsed electric fields (PEF) Cold plasma	Photonics[30] (main photonics technologies are sensors, laser systems, advanced lighting): • smart sensors[31] (help cut energy costs, support SMEs by increasing efficiency, providing better quality control, improving food safety and ensuring sustainable production); • scanning and imaging (digital sorters that use scanning and imaging for food safety); • laser systems (technologies for labelling and measuring of food); • advanced lighting (for vertical farming).

Conventional food processing technologies are not sustainable: they use more energy, can lead to problems with toxic waste and perform worse in the preservation of nutrients[32]. Many of the innovative solutions offer greener and more efficient alternatives, thus having potential to contribute to achieving the goals of the European Green Deal and the F2F Strategy in particular.

The wide adoption of innovative technologies, however, faces difficulties[33]. While conventional methods can be more affordable but time-consuming, innovative technologies are faster but have lower investment yields[34]. Some of the technologies that are still considered 'novel' have been around for several decades but have not yet gained widespread acceptance by producers due to the costs of investments and availability of technologies[35].

As per ETF research[36], food processing companies look for engineering professionals such as process engineers (ESCO 2141.10), production engineers (ESCO 2141.4.2), and food technologists (2145.1.4 ESCO), and for life sciences professionals including food biotechnologists (ESCO 2131.5) and biochemists (ESCO 2131.4.2). For these professionals, employers usually look for candidates with higher education (ISCED level 6-7, or level 8 for few positions) in agriculture engineering, processing technology, biotechnology engineering, mechanical engineering, food science, biochemistry, and chemical engineering. Commonly sought technical skills are laboratory skills for designing and conducting experiments. Specialised knowledge and skills for food (bio) technologists and biochemists include, depending on the company's activities, new product development, food safety certifications, food chemistry and food processing and, more specifically, reaction flavour chemistry and making new textured material, design and development of bioprocesses, optimisation of fermentation parameters, and preparation of samples for analysis with techniques such as high

[30] Food Pack Lab. Deep Tech for food. Available at: https://www.foodpacklab.eu/photonics-for-food/
[31] European Commission. CORDIS - EU research results. Smart digital tools help Europe's food processing industry tackle high energy costs. Available at: https://cordis.europa.eu/article/id/436432-smart-digital-tools-help-europe-s-food-processing-industry-tackle-high-energy-costs
[32] Granato, D., Barba, F. J., Bursać Kovačević, D., Lorenzo, J. M., Cruz, A. G., & Putnik, P. (2020). Functional foods: Product development, technological trends, efficacy testing, and safety. Annual review of food science and technology, 11, 93-118.
[33] Granato, D., Barba, F. J., Bursać Kovačević, D., Lorenzo, J. M., Cruz, A. G., & Putnik, P. (2020). Functional foods: Product development, technological trends, efficacy testing, and safety. Annual review of food science and technology, 11, 93-118.
[34] Granato, D., Barba, F. J., Bursać Kovačević, D., Lorenzo, J. M., Cruz, A. G., & Putnik, P. (2020). Functional foods: Product development, technological trends, efficacy testing, and safety. Annual review of food science and technology, 11, 93-118.
[35] Interview with a researcher in food processing in a leading European research institution; Piatti, C., Graeff-Hönninger, S. & Khajehei, F. (Eds.). (2019). Food Tech Transitions: Reconnecting Agri-Food, Technology and Society. Springer Cham.
[36] ETF (2023). Identifying technological changes and skills needs in the Western Balkan agri-food sector: EU trends report

performance liquid chromatography (HPLC), ultraviolet–visible spectroscopy (UV-Vis), and gas chromatography–mass spectrometry (GC-MS)[37].

For industrial maintenance technicians, employers require training in industrial maintenance, electrotechnics, electromechanics or electrical engineering. Technical skills include automation and industrial IT, in particular knowledge of computerised maintenance management systems (CMMS), mechanical and electrical engineering skills, as well as knowledge of pneumatic and hydraulic technologies[38].

The 'Better Training for Safer Food Academy' initiative

The Better Training for Safer Food (BTSF) Academy is a European Commission training initiative to improve knowledge and implementation of EU rules covering food and feed law, animal health and welfare, as well as rules on plant health and plant protection products.

The BTSF Academy is the single learning and information portal for competent authorities and stakeholders in Member States and non-EU countries.

The main objectives of the BTSF Academy are:

- Maintaining a high level of consumer protection and food safety, plant, animal and One Health
- Promoting a harmonised approach to the operation of EU and national control systems
- Creating a level playing field for all food business operators
- Enhancing trade of safe food, animals and plants, and products thereof
- Ensuring fair trade with third countries and in particular developing countries

Training is usually organised by external contractors who design and deliver courses with technical experts:

- Workshops: a group of participants from several countries meet in one location to receive training and take part in practical exercises and group discussions.
- Sustained training missions: a group of participants from one country or a regional grouping of countries receive training on a specific subject.
- eLearning: individuals take part in self-paced on-line learning including self-assessment exercises throughout the course.

The National Contact Points coordinate participation and liaise with the European Commission services and contractors.

The contact point for Albania is: Gejsa Dervishi, Specialist, General Directorate of Development in the Field of Food Safety, Veterinary, Plant Health and Fisheries, Ministry of Agriculture and Rural Development, Boulevard 'Dëshmoret e Kombit' No 2, Tirana, ALBANIA.

3.1.3. Sustainable fisheries and aquaculture

Aquaculture, or fish farming, is the production of fish and other aquatic organisms under controlled conditions in freshwater or marine water. It is one of the fastest growing food production sectors in the world and increasingly important for global food supply.

Many people who work in the aquaculture sector have academic degrees, either specifically in aquaculture, or in a related subject such as biology, marine biology, marine sciences, etc. Many aquaculture and aquaculture-related training courses and qualifications are offered by VET schools

[37] Syngenta (producer of seeds, organic), Netherlands. Process engineer; GEA Group, New Food (production of plant-based meat), Germany. Process engineer; Bosque Foods (vegan meat producer), Germany, Food Technologist; Onego Bio (producing animal-free white egg without chickens), Finland. Lead Food Scientist; Mushlabs (food products from fungi), Germany. R&D intern

38 Bioviver (pasteurised and sterilised organic fruits and vegetables), France, Industrial Maintenance Technician; Jean et Lisette, France, Industrial Maintenance Technician; HappyVore (organic vegan meat producer), France, Maintenance technician

and universities[39]. A JRC report on the EU Aquaculture Sector (2021) identified that 39.9% of people employed in aquaculture had a low level of education (ISCED 1-2), followed by 31.6% with a medium level of education (ISCED 3-4), and 7.7% with a higher-level education (ISCED 5-8)[40]. The majority (83%) of people employed in the EU aquaculture sector were nationals of their own country, followed by 2.7% from non-EU/EEA nations, 2.6% from the EU, 1.3% from the EEA and 10.5% of employees with an unknown nationality.

The current high average age of fishermen, the initial start-up costs and the precarious future means too few young people are choosing fisheries as a livelihood. In most high seas fishing fleets (e.g. pelagic trawlers, tuna long liners and purse seiners) the percentage of migrant workers has increased rapidly over the last decades. Recently, also in small-scale vessel segments the numbers of migrant workers are rising. It is challenging to find sufficient youth interested in a job in the fisheries sector

Roles in the aquaculture sector are often clearly defined. Many of the tasks are done by farm workers, including the farm manager and those undertaking wider management roles. However, specialised work areas such as the management of fish hatcheries, stock health and/or veterinary practitioners, laboratory services and engineering will usually have dedicated staff with higher skill levels.[41] EU mapping of qualifications and skills needed in the industry was conducted in 2009 and lists the following job roles (list not exhaustive)[42]: area manager, assistant farm manager, assistant hatchery manager, boat skipper, casual farm technician, electrician, engineer, farm manager, farm technician, freshwater business manager, freshwater production coordinator, grading team manager, grading technician, hatchery manager, health manager, health observer, maintenance mechanic, moorings – assistant manager, pen & mooring manager, smolt production unit manager, temporary hatchery technician, temporary farm technician, trail unit manager, weekend feeder.

Key knowledge and technology gaps still remain in the production of macroalgae in Europe, where there is a need for innovation and knowledge transfer from research to direct implementation at an appropriate industry level. Production barriers exist along the whole value chain from hatchery production, on-growing on land or at sea sites and bio-based processing for food and other high value compounds. Due to the developing phase of the macroalgae production industry from research, innovation and implementation, the industry is constrained by legislative, licencing, governance and economic issues, which differ across all EU producing countries.

More work is needed to better manage disease within aquaculture systems, improve the quality and quantity of products produced through genetic selection, enhance welfare and understand the microbiome of the species being farmed[43]. European producers also come up against legislative difficulties, such as finding space to develop new aquaculture farms.

The most important aspects in terms of environmental sustainability of EU fisheries and aquaculture relate to: energy intensiveness and reliance on fossil fuels for their operations. the assessment, monitoring and limitation of the environmental impact of aquaculture activities (e.g. in terms of nutrients and organic matter discharge from aquaculture farms in waters), the use of alien or locally absent species, feed ingredients for carnivorous fish (alternatives to wild fish), management of

[39] Seafish. Careers and Training in Aquaculture. Available at: https://www.seafish.org/safety-and-training/careers-in-the-uk-seafood-industry/seafood-industry-career-paths/careers-and-training-in-aquaculture/

[40] European Commission (2021). JRC Publications Repository. Scientific, Technical and Economic Committee for Fisheries (STECF) – The EU Aquaculture Sector – Economic report 2020 (STECF-20-12). Available at: JRC Publications Repository - Scientific, Technical and Economic Committee for Fisheries (STECF) – The EU Aquaculture Sector – Economic report 2020 (STECF-20-12) (europa.eu)

[41] Seafish. Careers and Training in Aquaculture. Available at: https://www.seafish.org/safety-and-training/careers-in-the-uk-seafood-industry/seafood-industry-career-paths/careers-and-training-in-aquaculture/

42 Lifelong Learning Programme. (2009). European Qualifications Framework (EQF). Projects Transversal Programme. Validation of All Lifelong Learning in Aquaculture. Occupational map of the European Aquaculture Sector. Available at: Microsoft Word - 2007_1034_FR_VALLA (vallaproject.com)

[43] The European Marine Biological Resource Centre (EMBRC). Press release 12.07.2024. Available here: EMBRC continues to promote innovation in aquaculture by joining the European Aquaculture Technology & Innovation Platform (EATIP) | EMBRC

diseases and use of veterinary medicines and other substances with low environmental impact. Another increasingly important aspect is animal welfare in fish farming. [44]

The key technologies summarised are

Artificial intelligence (AI) Sensor technologies Advanced satellite technologies[45] Remotely operated vehicles (aerial drones, surface drones)[46] Buoys[47]	Small radar detectors mounted on marine animals Recirculating aquaculture systems (RAS)[48] Genome editing[49] Offshore farming[50] SRC/VHF radio

Technology has changed, costs of doing business has increased, the regulations have changed and become more complex, and there is an ever-growing demand for fish that is sustainably and responsibly caught. To meet the demand, aquaculture and fishing enterprises are facing significant recruitments difficulties, both in finding and maintaining workers, including for unskilled positions. Both demand the development of appropriate skills through specialised curriculum, knowledge and skills (e.g. specialised veterinary studies for fish and training on fish health for aquaculture operators, remotely operated vehicles, advanced satellite imagery, offshore farming, genome editing, and recirculating aquaculture systems), as well as life-long training for farmers on innovative approaches for the aquaculture sector. The increase in migrant workers in both aquaculture and fisheries mean that language barriers and related communication challenges on board make it even more important that all crew have received proper training and are competent to carry out their work, as dependency on co-workers is high.

The International Convention on Standards of Training, Certification and Watchkeeping for Fishing Vessel Personnel (STCW-F) sets certification and minimum training requirements for crews of seagoing fishing vessels with the aim to promote the safety of life at sea and the protection of the marine environment, taking into account the unique nature of the fishing industry and the fishing working environment[51]. Ratification of the convention facilitates the harmonization of fishermen's training in the EU.

The digitisation of aquaculture provides an opportune context for accelerating sustainable food production. Aquaculture businesses need to recruit, develop, and retain a digitally capable workforce. To adopt green and circular economy in the aquaculture and fisheries sectors, upskilling and reskilling is needed.

[44] European Commission. Overview of EU aquaculture (fish farming). Available at: https://oceans-and-fisheries.ec.europa.eu/ocean/blue-economy/aquaculture/overview-eu-aquaculture-fish-farming_en

45 Rahmati, E., Khoshtaghaza, M. H., Banakar, A., Ebadi M.-T. (2022). Decontamination technologies for medicinal and aromatic plants: A review. Wiley Online Library. Available at: https://onlinelibrary.wiley.com/doi/full/10.1002/fsn3.2707

[46] Environmental Defense Fund (EDF) (April 2021). New and Emerging Technologies for Sustainable Fisheries: A Comprehensive Landscape Analysis. Available at: Manual-New_and_Emerging_Technologies_for_Sustainable_Fisheries.pdf

[47] Idem

[48] Idem

[49] Rahmati, E., Khoshtaghaza, M. H., Banakar, A., Ebadi M.-T. (2022). Decontamination technologies for medicinal and aromatic plants: A review. Wiley Online Library. Available at: https://onlinelibrary.wiley.com/doi/full/10.1002/fsn3.2707

[50] Idem

[51] International Maritime Organization (IMO). International Convention on Standards of Training, Certification and Watchkeeping for Fishing Vessel Personnel (STCW-F), 1995. Accessed 28.02.2025. Available at: International Convention on Standards of Training, Certification and Watchkeeping for Fishing Vessel Personnel (STCW-F), 1995

3.1.4. Medicinal aromatic plants, oils and extracts production

Medicinal aromatic plants (MAPs) contribute to integrated agro-industrial pathways by providing plant raw materials and intermediate products which have significant economic value to different industrial sectors beyond agriculture. Apart from technological innovations, there is a need to create opportunities for diversification in rural areas through sustainable social innovations, e.g. preservation of biodiversity.

The EU has a long tradition of collecting wild plant resources. Uncounted MAP species are used in the cosmetic and botanical industries and the great majority of these materials are provided by collecting MAPs from natural habitats. MAPs are cultivated on an area exceeding 200 000 ha, most of which is in France (52 000 ha), Poland (30 000 ha), Spain (27 800 ha), Bulgaria (16 800 ha), Germany (13 000 ha), Croatia (8 500 ha), Czech Republic (7 225 ha), Italy (7 191 ha), Greece (6 800 ha) and Austria (4 136 ha). Although many farmers may consider MAP cultivation more profitable than traditional crops, domestic cultivation of MAPs in the EU is still very small compared to other crops.

There are four types of plant materials, according to the degree of processing, preparation and transformation: fresh plant material (whole, cut or specific parts of fresh and cleaned plant raw material, dried plant material (whole, or selected parts of MAPs), essential oil (product derived from the distillation of MAPs), plant extract (product derived from dissolution and extraction of the active ingredients).

In the last few decades, rising concerns about potentially harmful synthetic additives, have resulted in a reallocation of consumer preferences to the use of natural resources as functional ingredients for products in the pharmaceutical, food & beverage, cosmetic and agrochemical industries. This has included a shift toward the use of MAPs, their extracts and essential oils. Nowadays, there is an expanding interest in plant-based extracts where end-use industries are looking for efficacious, safe and cost-effective natural bio-actives with clearly defined modes of action and proven benefits. The increasing demand for plant materials is also an opportunity for farmers and foresters to diversify their production and improve their income.

Although collection of MAPs from wild resources is a common practice, it often reduces the natural population's size, resulting in highly heterogenous raw material. Given its positive impact on local economies and higher value to local collectors, sustainable collection is often considered the most important conservation strategy for wild plant species. The actors in the value chain should address consumers' expectations, e.g. raw material sourcing, product innovation, traceability, quality regulation, efficacy and safety (MP4), while also considering sustainability in different contexts, e.g. environmental, social and economic and transparency throughout the supply (value) chain.

Microbial quality assurance has always been an important subject in the production, trade and consumption of MAPs. As MAPs can become infected with microorganisms due to poor hygienic conditions during cultivation and post-harvest processes, technologies such as ozonation, cold plasma, ultraviolet, infrared, microwave, radiofrequency and combination of these technologies have been developed to ensure quality products[52].

[52] Rahmati, E., Khoshtaghaza, M. H., Banakar, A., Ebadi M.-T. (2022). Decontamination technologies for medicinal and aromatic plants: A review. Wiley Online Library. Available at: https://onlinelibrary.wiley.com/doi/full/10.1002/fsn3.2707

The key techniques and technologies are summarised here[53][54]

Techniques :	Technologies:
Hot Continuous Extraction (Soxhlet) Aqueous Alcoholic Extraction by Fermentation Counter-current Extraction Ultrasound Extraction (Sonication) Supercritical Fluid Extraction	Photonics process (products mostly extracted by this process are fragrant components of essential oils and biological or phytopharmacological extracts which can be used directly without further physical or chemical treatment) Ozonation Cold plasma Ultraviolet Infrared Microwave Radiofrequency

The rising public interest in using MAPs is attracting new, mostly rural, MAP entrepreneurs. Often, they have little information on MAPs, botanical identification, wild harvesting etc. New training modules are needed to ensure harvesters respect laws and good practices. Access to information and training for example on varieties, active compounds, harvesting time and practices, post harvesting processing, and market information should be made available locally. Today, many harvesters use obsolete technology for post harvesting processing resulting in a low-quality product and need upskilling of their manufacturing knowledge and skills. Non-professional harvesters, commissioned by buyers, need training to ensure the sustainability of MAPs. Upskilling and reskilling local administration to oversee and control responsible harvesting and prevent overexploitation is needed.

3.2. In-demand non-technical skills and occupations in the EU

As per ETF research[55], the agri-food sector is increasingly digitalised, and digital skills are increasingly sought after for all occupational levels, including lower-level occupations.

Teams that work in agri-food companies are becoming increasingly multidisciplinary, bringing together people with backgrounds in ICT, social sciences, life sciences and others. This makes 'social' transversal skills such as group facilitation, moderation, communication, teamwork, networking and flexibility/adaptability especially important for the future, as shared by our interviewees.

As innovative companies emerge and grow, demand for specialists with skills related to new food product development will increase. This includes knowledge of quality assurance and of food legislation.

To market their products, companies will need to better understand consumer demand, health and wellbeing, and will need to possess marketing and export/internationalisation skills. As novel food products (such as insect-based food or plant-based meat) are being developed, the way these goods are marketed becomes the crucial element in shaping their acceptance by consumers. Marketing skills will be important in creating trust in new products, as well as retaining trust in already established products, such as organic foods.

[53] ICS-UNIDO (2008). Extraction Technologies for Medicinal and Aromatic Plants. Available at: https://www.unido.org/sites/default/files/2009-10/Extraction_technologies_for_medicinal_and_aromatic_plants_0.pdf
[54] Rahmati, E., Khoshtaghaza, M. H., Banakar, A., Ebadi M.-T. (2022). Decontamination technologies for medicinal and aromatic plants: A review. Wiley Online Library. Available at: https://onlinelibrary.wiley.com/doi/full/10.1002/fsn3.2707
[55] ETF (2023). Identifying technological changes and skills needs in the Western Balkan agri-food sector: EU trends report

Finally, as environmental awareness of companies and consumers grows and the EU continues to foster the green transition, knowledge related to sustainable production, carbon footprint and animal welfare will become progressively important[56].

Both vocational and higher education skills will remain in demand, as these are complementary. At farm level, vocational skills are more relevant, while at supply chain level, higher education is more suitable. As production becomes more technologically advanced, there is less need for low-skilled and unskilled workers, and more need for skills at VET and university levels.

All in all, the most common skills required include knowledge of English and MS Office, followed by specialised knowledge and education in specific areas related to companies' activities. Vacancies for managers (ISCO group 1) and professionals (ISCO group 2) typically demand higher education and managerial skills. This confirms the conclusion that the domain is undergoing a shift related to the adoption of new technologies and a shift in the traditional role of the farmer, where farmers will increasingly have to be equipped with broader technical knowledge.

Transversal skills include the ability to work in (multidisciplinary) teams,[57] adaptability and flexibility, resilience, problem-solving, creative/innovative thinking[58], communication skills[59], project management[60], leadership skills[61], multi-tasking, planning and organisational skills, attention to detail[62], and knowledge of English[63]. Transversal skills that employers look for include analytical and synthesis skills[64].

Skills such as robotics, automation, data management, digital security, general computer skills and e-commerce are especially relevant for the niche.

[56] Confirmed by the interviews
[57] Syngenta (producer of seeds, organic), Netherlands. Process engineer; GEA Group, New Food (production of plant-based meat), Germany. Process engineer; Bosque Foods (vegan meat producer), Germany, Food Technologist
[58] GEA Group, New Food (production of plant-based meat), Germany. Process engineer; Bosque Foods (vegan meat producer), Germany, Food Technologist
[59] Bosque Foods (vegan meat producer), Germany, Food Technologist
[60] Onego Bio (producing animal-free white egg without chickens), Finland. Lead Food Scientist; Syngenta (producer of seeds, organic), Netherlands. Process engineer
[61] Onego Bio (producing animal-free white egg without chickens), Finland. Lead Food Scientist
[62] Bosque Foods (vegan meat producer), Germany, Food Technologist
[63] Mushlabs (food products from fungi), Germany. R&D intern; Bosque Foods (vegan meat producer), Germany, Food Technologist; Onego Bio (producing animal-free white egg without chickens), Finland. Lead Food Scientist; Syngenta (producer of seeds, organic), Netherlands. Process engineer; GEA Group, New Food (production of plant-based meat), Germany. Process engineer
[64] HappyVore (organic vegan meat producer), France, Maintenance technician; Bioviver (pasteurized and sterilized organic fruits and vegetables), France, Industrial Maintenance Technician

4. ALBANIA POLICY AND EMPLOYMENT CONTEXT

During the past decade, despite a contraction in 2020 because of the Covid-19 pandemic, an upward trend has been recorded for the income generated by the agri-food industry in Albania.

Some 24% of Albanian territory is classified as agricultural land[65]. Economic growth during the second decade of transition in Albania has largely been the result of a shift in the labour force from low to higher productivity sectors and structural transformation, which have created jobs in manufacturing industries and services, while the share of agriculture – still prevailing in employment terms – has decreased. The contribution of the agricultural sector has been progressively decreasing, from 54.6% in 1995 to 20.4% of GDP in 2021. However, it is still almost three times higher than the regional average for Western Balkan countries[66]. Despite the decreasing share of agriculture in GDP, agricultural production has increased at an average rate of 3-3.5% per year since 2003. The increase in yields has been substantial for grapes, potatoes, milk from cattle and goats, eggs, fruit and fodder. Fruit production (including grapes) increased by 70% between 2000 and 2008, animal production by 21% and arable crops by 10% (even though wheat-growing areas decreased markedly). The production of vegetables has increased significantly, particularly in greenhouses[67] .

Employment in the agricultural sector in Albania represented about 35% of the total employment in 2022[68]. In 2021, there were 1 354 registered enterprises in the sector of agriculture, forestry and fishing in Albania[69]. Informal employment, although on a downward trend, remains relatively higher among young people, low-skilled workers and in certain sectors of the economy, including agriculture, construction, and food and accommodation services. In 2021, only around 48% (compared to around 41% in 2016) of the employed (or 0.6 million out of 1.25 million) were employed with a salary, while the share of the unpaid workers was around 20%[70].

Agriculture is primarily family-based and oriented towards subsistence or semi-subsistence. In 2022 there were around 320 000 farms in Albania[71], with an average surface of about 1.26 ha[72]. These are divided into several plots per farm ranging from around 0.3 to 0.5 hectares.[73] As a result, Albania has

[65] Food and Agricultural Organisation (2019)
[66] Blanco, F. and Qorlazja, L. (2024). Unlocking Albania's agricultural potential - From fields to finance. World Bank. Available at: https://blogs.worldbank.org/en/agfood/unlocking-albanias-agricultural-potential-fields-finance
[67] European Commission (2022). Agriculture in the enlargement countries. Available at: https://agriculture.ec.europa.eu/international/international-cooperation/enlargement/candidates_en
[68] World Bank (2024). Employment in agriculture (% of total employment) (modeled ILO estimate) – Albania: https://data.worldbank.org/indicator/SL.AGR.EMPL.ZS?end=2023&locations=AL&skipRedirection=true&start=2000&view=chart
[69] UNDP, FAO (2023). Stocktaking report. Qualitative assessment of the SDGs principles and positive practices adopted by the main actors in Albania's agro-processing sector. Available at: https://www.undp.org/sites/g/files/zskgke326/files/2024-01/stocktaking_report_agro-processing_sector_albania_dec23_0.pdf
[70] Ministry of Finance and Economy in Albania (2022). National Employment and Skills Strategy (NESS) 2023-2030
[71] Ministry of Agriculture and Rural Development (2022). Rural Development Programme 2021-2027. https://bujqesia.gov.al/wp-content/uploads/2022/09/Programi-IPARD-III_2021-2027_English.pdf
[72] FAO (2021). Annual Statistical Yearbook of Agriculture. Available at: https://openknowledge.fao.org/server/api/core/bitstreams/ac5a3c00-d3ef-4102-9300-00b1363c3145/content/cb4477en.html https://www.fao.org/3/cb4477en/online/cb4477en.html. See also: Myslym Osmani, Andoni, Mira (2022). Moving Albanian agriculture forward: An effective and inclusive policy agenda matters. Journal of the Austrian Society of Agricultural Economics (JASAE). p. 1225. Available at: https://www.sagepublisher.com/volume/JASAE/18/08/moving-albanian-agriculture-forward-an-effective-and-inclusive-policy-agenda-matters-632566ed7ca97.pdf
[73] FAO (2021). Annual Statistical Yearbook of Agriculture. Available at: https://openknowledge.fao.org/server/api/core/bitstreams/ac5a3c00-d3ef-4102-9300-00b1363c3145/content/cb4477en.html

on average the smallest farms in the Western Balkans region[74] and the lowest value added per agricultural worker.

According to a World of Organic Agriculture survey (2023), the share of agricultural land under organic farming in Albania was only 0.09%[75] but has increased by 5% between 2017 and 2021.[76] The main organic products in Albania are fresh herbs and vegetables, table grapes, olive oil, medicinal and aromatic plants (MAPs), chestnuts and forest mushrooms[77]. MAPs make up around 85% of the total organic production in Albania. The most in-demand plant in this sector is sage, which accounts for about 50% of all exports. Other significant crops are oregano, thyme, lavender and savory[78]. If the collection of wild products were considered part of organic land, according to MARD, then the number might be higher[79].

The MAPs lead in terms of exports of organic foods, as 95% of their production is exported. This represents 20% of the total of agricultural exports[80]. The export of MAPs has increased threefold since 2010, reaching more than EUR 33 million in 2019, while the export of essential oils extracted from MAPs has increased twelvefold, reaching EUR 4.6 million. According to sector associations, the volume of international trade stands at around EUR 50 million per year. As of 2020, Albania ranked 16th in the world in terms of MAP exports[81].

According to the Albania Investment Council 2020 report, over 65% of all processing is focused on flour, baked goods, pasta, cookie and sweet production, while only 5.4% of food processing companies deal with meat and fish products, and only 1.2% of food processing companies deal with fruit, vegetables, and MAPs[82]. Some positive changes in the sector are evident, such as the establishment of food safety and food quality systems, albeit only in larger food processing companies. Investments to comply with standards of environmental protection and treatment of waste are limited. Such developments require significant skills upgrade and specialisation courses for sector's workforce both managerial, specialists and other categories of workers.

The fish and seafood industry currently represents a small part of the national economy, but the 'blue economy' is seen as a good opportunity for new businesses[83]. About 75% of the fish is exported[84].

Despite the efforts made by the government and the private sector, the competitiveness of Albanian agricultural products suffers from ineffective farming methods, distribution issues, low subsidies, rising fertiliser prices, the inability to process products resulting in underselling, difficulties meeting food

[74] Myslym Osmani, Andoni, Mira (2022). Moving Albanian agriculture forward: An effective and inclusive policy agenda matters. Journal of the Austrian Society of Agricultural Economics (JASAE). p. 1225. Available at: https://www.sagepublisher.com/volume/JASAE/18/08/moving-albanian-agriculture-forward-an-effective-and-inclusive-policy-agenda-matters-632566ed7ca97.pdf

[75] FiBL (2023). The world of organic agriculture. p.43. Available here See also FiBL (2019). The world of organic agriculture. p. 50. Available at: https://www.fibl.org/fileadmin/documents/shop/2020-organic-world-2019.pdf. FiBL, (2021).The world of organic agriculture. p.43. Available at: https://www.fibl.org/fileadmin/documents/shop/1150-organic-world-2021.pdf

[76] INSTAT (2022). Regional Statistical Yearbook. Available at: https://www.instat.gov.al/media/11124/regional-statistical-yearbook-2022_04.pdf

[77] Agro-Processing Opportunities for Investment in Albania. Foreign Investors Association of Albania. Available at: https://fiaalbania.al/wp-content/uploads/2016/05/brochure-AP.pdf

[78] Agro-Processing Opportunities for Investment in Albania. Foreign Investors Association of Albania. Available at: https://fiaalbania.al/wp-content/uploads/2016/05/brochure-AP.pdf

[79] Development of the value chain for chestnuts and chestnut honey in the area of Rec, Tropoje and the surrounding area. March 2015-September 2016

[80] Albania Agribusiness Support Facility (2019). Medicinal and Aromatic Plants Sector Study. Available at: https://aatsf.com.al/wp-content/uploads/2019/08/Map-EN.pdf

[81] GIZ (2021). Medicinal and Aromatic Plants Sector Study. Available at: https://bujqesia.gov.al/wp-content/uploads/2021/12/04-MAP-Sector-Study_FINAL.pdf

[82] Albania Investment Council (2020). Technical note. Domestic production, import substitution and investment promotion in agro-processing. Available at: https://www.investment.com.al/wp-content/uploads/2021/01/EN_Technical-Investment-Promotion-in-Agro-processing.pdf

[83] Fabbri, E., Gerussi, E., Hollanders, H., Sinjari, I. (2022). The identification of Smart Specialization priority domains in Albania. A mapping exercise. Publications Office of the European Union. ISBN 978-92-76-56980-0

84 Invest-in-Albania.org. Invest in Agriculture in Albania. Available at: Invest in Agriculture in Albania • IIA (invest-in-albania.org)

safety standards, technical requirements such as traceability and certification requirements, and competition from foreign products. There is insufficient government support in the development of strategies, skills, adequate structures for standards, technology adoption and marketing practices in the sector, thus reflecting negatively on the export balance. EU markets typically offer far higher prices than Western Balkan markets, yet Albanian exports to the EU remain largely restricted to minimally processed commodities with low levels of value addition[85].

The healthy and sustainable food chain is increasingly affected by the need to adopt enabling ICT technologies, for example by incorporating digital skills and associated technologies in practically all parts of the value chain. Albania started laying the groundwork for its national digitalisation in agriculture (e-agriculture) strategy and vision in 2019[86]. Although there has been an increase in the use of ICT in Albania, the National Plan for Sustainable Development of Digital Infrastructure, 'Broadband 2020-2025', notes that there is a significant digital divide between rural and urban areas, especially due to the lack of adequate infrastructure for internet connectivity. For example, almost 90% of the total fixed connections are in urban areas and only 10% in rural areas[87]. However, some larger farms and greenhouses do use sensing technologies.

In terms of support for technology transfer and adoption, there are four regional agencies for advisory services (RAAE), as well as six Agricultural Technology Transfer Centres (ATTC) in the country (Fush, Kruja, Korca, Vlora, Lushnja and Shkodra). The ATTCs are supposed to support MARD in strategy formulation and the design of national schemes and strategies, facilitate technology transfer to agriculture and food processing businesses, conduct applied research in various fields of agriculture, etc. However, they do not appear to be active in the area of technology transfer. In addition, activities of organisations such as SME Albania, the Albanian Agribusiness Council (AAC) and the Tirana Chamber of Commerce and Industry (CCIT Tirana) include implementation of donor projects as well as workshops and policy initiatives of government agencies.

The Albanian National Land Consolidation Strategy (2014-2028) promotes the creation of economically viable, competitive and sustainable family farms. The objective of the strategy is to reduce land fragmentation and enlarge farm sizes – a pre-condition for boosting technology absorption and competitiveness of Albanian farms[88].

4.1. In-demand technology related skills and occupations in Albania

Skilled agricultural occupations and workers in commercial agricultural activities accounted for 46.9 % of the total employment in 2021[89]. Other relevant occupations were clerical, service and sales workers, plant and machine operators, and assemblers.

Workers in agriculture have predominantly lower levels of education. In fact, 55.9% of farm managers only have a secondary level of education (e.g. high school) and only 0.4% were graduates of specialised universities for agriculture in 2021. More granular data on the occupation structure in the agri-food sector is not available.

[85] Blanco, F. and Qorlazja, L. (2024). Unlocking Albania's agricultural potential - From fields to finance. World Bank. Available at: https://blogs.worldbank.org/en/agfood/unlocking-albanias-agricultural-potential-fields-finance
[86] ITU (2020) Status of Digital Agriculture in 18 countries of Europe. Available at: https://www.itu.int/en/ITU-D/Regional-Presence/Europe/Documents/Events/2020/Series%20of%20Webinars/20-00244_Status_digital_Agriculture-revFAOV4.0-MASTER-FILE-20-JUNE_REVIEW-FAO_PL_print%20%28002%29.pdf
[87] AKEP and INSTAT (2019). Regional Population Figures
[88] FAO.FAOLEX database (2013). Albanian National Land Consolidation Strategy. Available at: https://www.fao.org/faolex/results/details/en/c/LEX-FAOC149566/
[89] INSTAT (2022). Labour Market 2021. Available at: https://www.instat.gov.al/media/10066/tregu-i-punes-2021.pdf

Farm managers by education level, 2021

	Total	Elementary	Secondary	General high school	Agricultural high school	General university	Agricultural university
Total no.	321,492	38,058	179,670	76,495	17,552	8,345	1,372
Total in %	100.0	11.8%	55.9%	23.8%	5.5%	2.6%	0.4%

Source: INSTAT (2022). Regional Statistical Yearbook. Available here.

The healthy and sustainable food chain domain suffers from a scarcity of labour due to mass emigration, particularly from rural areas. At the same time, women, who constitute a significant part of the agricultural workforce, often face unequal access to resources and decision-making processes[90].

4.1.1. Sustainable organic farming and certification

Organic production is still not developed and is dominated by wild collection. In 2022, there were 149 organic operators, comprising 129 producers, 8 processors and 12 exporters. Less than 700 ha of crop land is organic-certified, which is 0.1% of the crop area. However, Albania is strong with regards to certified organic wild collection area – 462,459 ha – which puts Albania in third position in Europe after Finland and North Macedonia[91].

In accordance with Law No 106/2016 on organic production, labelling of organic products and control thereof, the Commission for Organic Production under the Ministry of Agriculture and Rural Development has authorised 'Albinspekt bio.inspecta'[92] as a certification body. With over 90 % market share, Albinspekt dominates control and certification. Ecocert ranks in second place[93].

There are some examples of Albanian organic farms using modern technological solutions, e.g. Rea's organic egg production with more than 10 000 hens in 2019. The henhouse is built with state-of-the-art German technology. Shkalla, located at Tirana's East Gate, was the first olive oil factory to receive certification back in 2001. Musai from Vlora followed in 2011. Their oils are decanted with German technology and kept in subsoil stainless steel tanks in the dark and cold. Nevertheless, organic farming in Albania requires investment, for example in post-harvest infrastructure for fruit and vegetable producers, and mechanisation[94].

Key technologies relevant for Albania are summarised below

Hydroponics Aeroponics Precision agriculture	Photonics[95] (main photonics technologies are sensors, laser systems, advanced lighting): • smart sensors[96] (help cut energy costs, support SMEs by increasing efficiency, providing better

[90] FAO (2023). FAO partners with Albania for sustainable and resilient agrifood systems and rural development. Available at: https://www.fao.org/europe/news/detail/fao-albania-partner-for-sustainable-and-resilient-agrifood-systems-and-rural-development/en
[91] FiBL & IFOAM – ORGANICS INTERNATIONAL The world of organic agriculture. Statistics & emerging trends 2024. Available at: https://www.fibl.org/fileadmin/documents/shop/1747-organic-world-2024_light.pdf
[92] bio.inspecta: https://www.bio-inspecta.al/en/home
[93] Ministry of Agriculture and Rural Development. Other certification bodies are available here: https://bujqesia.gov.al/prodhim-bio/21905-2/
[94] Arndt, C. (2022). Country Report Organic. Albania. Report on the Status of Organic Agriculture and Industry in Albania. Ecoconnect. Available at: https://aam.al/wp-content/uploads/2023/06/Country-Report-Organic-ALBANIA-EkoConnect-2022.pdf
[95] Food Pack Lab. Deep Tech for food. Available at: https://www.foodpacklab.eu/photonics-for-food/
[96] European Commission. CORDIS - EU research results. Smart digital tools help Europe's food processing industry tackle high energy costs. Available at: https://cordis.europa.eu/article/id/436432-smart-digital-tools-help-europe-s-food-processing-industry-tackle-high-energy-costs

	quality control, improving food safety and ensuring sustainable production); • scanning and imaging (digital sorters that use scanning and imaging for food safety); • laser systems (technologies for labelling and measuring of food).

A previous ETF study[97] found that the skills which companies active in the production of organic foods seek are as follows:

- agriculture and agronomics, with a specific focus on organic production (e.g. practices of organic food production, technical and technological skills for the processing of organic products, especially MAPs; practices of organic farming and relevant farming procedures);
- standards, certification and labelling of organic products (e.g. knowledge of quality labels of organic products such as protection of origin, indicators of origin and brand protection rules, knowledge of legal standards related to organic farming and organic products;
- skills for work in modernised organic agriculture holdings (e.g. IT skills, smart agriculture).

The companies interviewed emphasised that skills acquired through traditional ways of doing organic farming will become obsolete in the future, while digital and technological skills will become more important. All interviewees also emphasised that finding specialised workers is likely to become a challenge. Modernisation of processing and production capacities will determine a new demand for technical skills, such as operating machinery and working with new (digital) technologies.

Technical skills will be linked to the types of enabling technology, for example: smart farming, including geo-spatial technologies such as remote sensing, robotics and drones; digital tools to support production and production management; food manufacturing and food safety; and new processing technologies.

Associated occupations will include: different categories of engineers, analysts, operators and technicians; biotechnologists and biochemists, soil scientists, food technologies and agronomists; and different levels of managers, e.g. R&D managers and food production managers[98].

4.1.2. Food processing and value-added products

About 90% of registered enterprises in the sector were micro-enterprises with one to four employees[99]. Except for a few large companies, most of Albania's 2 813 food-processing companies are micro and small businesses, small-scale, artisanal, rural and informal[100]. The vast majority (90%) of enterprises in the industry sector are owned by Albanians, with only 3.2% co-owned by foreign investors[101].

[97] ETF (2023). Identifying technological changes and skill needs in the Western Balkan agri-food sector. Cross-country report
[98] Strengthening the Sustainability of Albania's Growth Model (2021). Albania Country Economic Memorandum, IBRD-IDA
[99] INSTAT (2021). Business Registers: Active enterprises by economic activity and size. Available at: https://www.instat.gov.al/media/10065/regjistrat-e-biznesit-2021.pdf
[44] ITU, FAO (2020). Status of Digital Agriculture in 18 countries of Europe. Available at: https://www.itu.int/en/ITU-D/Regional-Presence/Europe/Documents/Events/2020/Series%20of%20Webinars/20-00244_Status_digital_Agriculture-revFAOV4.0-MASTER-FILE-20-JUNE_REVIEW-FAO_PL_print%20%28002%29.pdf
[100] AKEP and INSTAT (2019). Regional Population Figures
[100] FAO.FAOLEX database (2013). Albanian National Land Consolidation Strategy. Available at: https://www.fao.org/faolex/results/details/en/c/LEX-FAOC149566/
[101] UNDP, FAO (2023). Stocktaking Report. REPORT Qualitative assessment of the SDGs principles and positive practices adopted by the main actors in Albania's agro-processing sector. Available at: https://www.undp.org/sites/g/files/zskgke326/files/2024-01/stocktaking_report_agro-processing_sector_albania_dec23_0.pdf

A summary overview of some subsectors is given below[102].

- The meat sector is a sizable item, contributing to Albanian international trade's deficit (exports are very low). Recent improvements in primary meat production showed some positive trends, especially in beef and broiler production. However, some key issues for product traceability and environment protection have still not been successfully addressed, despite investments in new or renovated slaughterhouses.
- Milk production includes mainly cow milk (approx. 85%), followed by sheep milk and goat milk. The industry is very fragmented, with an average of three employees and processing capacity of 1-2 tonnes of milk per day. Most of the processing units are small cheese plants with simple, traditional technology, and the hygiene conditions mostly do not conform with Albanian and EU standards.
- Olive oil production has also increased significantly, triggered by the increase in production of raw olives. While there have been many investments in the olive oil processing sector, there is a need to support technology renovation for a significant part of processing plants (that are getting older or outdated). Investment in olive oil storage capacity is a major factor in olive oil quality, together with fruit quality and processing technology and know-how.
- Regarding wine production, there is an upward trend, particularly for wineries producing high and medium quality wine. Trends show that the main types of investment are construction of winery facilities (reception area, processing area, cellars, expository and testing rooms), the complete wine production line or partial investment such as tankers for fermentation, grape crushing and pressing equipment, barrels for storing or ageing, packaging and labelling equipment, equipment for cold stabilisation and storage, etc.

Key technologies relevant for Albania are summarised below

Non-thermal food processing technologies (e.g. high-pressure processing, pulsed electric fields) Novel thermal technologies (e.g. ohmic heating, microwave) Nano/micro technologies (e.g. microencapsulation of ingredients) High-pressure processing (HPP) Pulsed electric fields (PEF) Cold plasma	Photonics[103] (main photonics technologies are sensors, laser systems, advanced lighting): • smart sensors[104] (help cut energy costs, support SMEs by increasing efficiency, providing better quality control, improving food safety and ensuring sustainable production); • scanning and imaging (digital sorters that use scanning and imaging for food safety); • laser systems (technologies for labelling and measuring of food).

According to the National Employment and Skills Strategy 2023-2030, enterprises operating in the agro-processing industry face difficulties in hiring highly-skilled workers. The challenges relate to insufficient quantity and quality of the education and training offer. The agro-processing sector faces challenges both in finding workers with the right skills and in low labour productivity, both of which hamper the sector's growth potential[105].

Food processing employs around 11 300 people in formal jobs and many more informally, especially during high seasons in agriculture and as part of informal businesses. Most young people working in

[102] Ministry of Agriculture and Rural Development (2022). Rural Development Programme 2021-2027. Available at: https://bujqesia.gov.al/wp-content/uploads/2022/09/Programi-IPARD-III_2021-2027_English.pdf
[103] Food Pack Lab. Deep Tech for food. Available at: https://www.foodpacklab.eu/photonics-for-food/
[104] European Commission. CORDIS - EU research results. Smart digital tools help Europe's food processing industry tackle high energy costs. Available at: https://cordis.europa.eu/article/id/436432-smart-digital-tools-help-europe-s-food-processing-industry-tackle-high-energy-costs
[105] UNDP, FAO (2023). Stocktaking Report. REPORT Qualitative assessment of the SDGs principles and positive practices adopted by the main actors in Albania's agro-processing sector. Available at: https://www.undp.org/sites/g/files/zskgke326/files/2024-01/stocktaking_report_agro-processing_sector_albania_dec23_0.pdf

agro-processing are unskilled manual workers, employed along the processing line – grading, handling, or packing products. Despite the low income, many young people consider food-processing as one of the only stable, formal and off-farm employment options in rural or semi-rural locations. Managerial and technical positions – such as food technologists or quality control – are few but in high demand[106].

Food processing is the sector with the highest needs in terms of technical profiles. Particularly, the profiles needed are: food safety technician, agrifood technician and olive processing technician[107].

4.1.3. Sustainable fisheries and aquaculture[108]

There are approximately 34 companies in the fish processing industry, distributed throughout the country, and the main fish processing plants are medium sized. Fisheries and aquaculture employ over 4 200 people full-time. Women represent about 90% of employees in the fish processing sector from preparing products for shipment (i.e. sorting, packaging, etc.) to administration. Women also contribute indirectly through ancillary services such as fishing net repair and maintenance, inland aquaculture and fish processing[109].

Key technologies relevant for Albania are summarised below

Artificial intelligence (AI) Advanced satellite technologies Remotely operated vehicles (ROVs)	Genome editing Offshore farming Recirculating aquaculture systems

The current technological landscape of the Albanian fishery sector highlights areas for improvement and opportunities for utilising new technologies. Currently, there is almost no focus on energy-saving measures. The use of renewable energy sources like solar panels or wind turbines in processing plants and aquaculture facilities would support the progress of the sustainable fishery sector.

Major fish farms in the aquaculture sector are already operating with a high technological level. They rely on advanced software for monitoring the health, density and weight of animals in cages. Additionally, they use advanced technology for implementing feeding plans, analysing data for future planning, projecting biomass, costs and profits, etc.

Even though the processing sector is technologically much more advanced than the primary production sector, the need for modernisation of production, storage and transportation technologies and practices remains evident.

4.1.4. Medicinal aromatic plant, oil and extract production

According to previous studies, about 20 000 households are engaged in the collection of MAPs, and about 4 000 in cultivation[110].

According to the Medicinal and Aromatic Plants Sector Study (2021), medicinal and aromatic plants companies have made substantial investments in upgrading their cleaning, sorting and grinding technologies, as well as in expanding their warehousing capacity (e.g. Relikaj ltd, Mucaj ltd, MEIA ltd, Erba M.M. ltd, Herba Fructus ltd, Wita Herbs ltd, Alb-Kalystyan ltd, Filipo Ltd and Gjedra ltd.). The primary motivation driving these investments in new technological advancements is the desire to enhance the quality of their products. This is largely motivated by the heightened standards set by international buyers and the fierce competition among Albanian exporters. Several other companies,

[106] Invest-in-Albania.org. Invest in Agriculture in Albania. Available at: Invest in Agriculture in Albania • IIA (invest-in-albania.org)
[107] Skills and territory (2021). PEMA Report. Analysis of skills needs for a renewed VET strategy in the agricultural sector in Albania. Final version. Available at: https://pemaproject.org/wp-content/uploads/2021/08/pema-vet-needs-analysis-skills-and-territory.pdf
[108] AGT & DSA (2022). Sustainable Development of rural areas in Albania - Fishery Sector Study Report
[109] AGT & DSA (2021). Sustainable Development of rural areas in Albania - Fishery Sector Study Report
[110] GIZ (2021). Medicinal and Aromatic Plants Sector Study. Available at: https://bujqesia.gov.al/wp-content/uploads/2021/12/04-MAP-Sector-Study_FINAL.pdf

such as Relikaj ltd, Alb-Kalystyan ltd, have made significant efforts to enhance the quality of their products through investments in modern facilities and cutting-edge processing technology. Their primary goal is to command premium prices and boost the value added to each unit[111].

Key technologies relevant for Albania are summarised below

Techniques	Technologies
Hot Continuous Extraction Aqueous Alcoholic Extraction by Fermentation Counter-current Extraction	Photonics process (products mostly extracted by this process are fragrant components of essential oils and biological or phytopharmacological extracts which can be used directly without further physical or chemical treatment) Ozonation Cold plasma Ultraviolet Infrared Microwave

To move towards professionalisation of MAPs, extraction of active compounds from MAPs requires technical and operational know-how in order to get the most out of the plant matrix and is therefore carried out by three to four professional companies in Albania. Companies in Albania export fresh and dried MAPs, extract oils and also export them.

Key profiles needed include: collectors, growers, material suppliers, input suppliers, machinery and technology providers, and processors[112].

4.2. In-demand non-technical skills and occupations in Albania

The healthy and sustainable food chain domain is under increasing pressure to adapt to technological and economic change, climate change, complex global value chains, etc. In turn, such challenges require that the necessary skills and competences are identified at various levels and within specific subdomains. However, while the transition towards novel technologies and processes requires technical skills, the research also underlines that the sector needs relevant transversal and non-technical skills including soft skills.

The research conducted in the Western Balkans region reveals the transversal and non-technical skillsets needed in Albania in the healthy and sustainable food chain domain. While there is not sufficient information on the non-technical skills needed in particular subdomains, the research suggests that they are similar in the whole healthy and sustainable food chain domain.

The key takeaways from the available research[113] are as follows:

- companies stress the importance of skills in business development and internationalisation;
- skills necessary for commercialisation of products i.e. sales, marketing, and management skills, are another important aspect, but companies face difficulties in recruiting such profiles, including due to salaries being lower than in other innovative sectors (e.g. ICT);

[111] GIZ (2021). Medicinal and Aromatic Plants Sector Study. Available at: https://bujqesia.gov.al/wp-content/uploads/2021/12/04-MAP-Sector-Study_FINAL.pdf
[112] EIP-AGRI Focus Group Plant-based medicinal and cosmetic products (2020). Final report. Available at: https://ec.europa.eu/eip/agriculture/sites/default/files/eip-agri_fg_medicinal_plants_final_report_2020_en.pdf
[113] ETF (2023). Identifying technological changes and skill needs in the Western Balkan agri-food sector. Cross-country report

- companies emphasise the importance of cross-cutting skills, e.g. digital literacy skills, networking and building relations, willingness to continuously learn and improve professionally; research also reveals a low level of skills related to ability to learn on the job, innovativeness and risk-taking;[114]
- general communication skills and language skills are highlighted as increasingly important across various occupations (as companies expand into foreign markets);
- companies underline that they face difficulties in recruiting personnel combining occupation-related skills with cross-cutting capabilities, such as motivation for personal development, teamwork and effective communication;
- sought-after occupational profiles are expected to combine skills in developing digital technologies with business skills for understanding how those technologies can be commercialised and marketed.

Currently, attracting new personnel with the necessary skills is difficult in areas in which pay is not considerably high (e.g. organic food production). Therefore, to meet their immediate skills needs, many companies turn to in-house training and job-based learning, or they hire external consultants.

4.3. Relevant skills supply in Albania

There is a huge variety of education and training providers in Albania, but the provision does not cover the current needs of the labour market. Technical occupations are being offered through vocational training, vocational education and higher education. However, there is a big demand in the labour market for updating the curricula, introducing new technologies as well as non-technical skills.

Non-technology-related skills[115] are skills that are not directly related to technology or its use. Non-technical skills[116] are soft skills that complement technical abilities in any field, including technology-related jobs. Non-technical skills are valuable and often necessary in technology-related jobs, even though they do not involve technical expertise. Non-technology-related skills, on the other hand, may have little direct application in technology fields, although they can still be valuable in a broader sense or in specific niche areas.

Initial and Continuing Vocational Education and Training

At the provision level, there are two types of public VET providers in Albania: secondary vocational education schools and vocational training centres. secondary vocational education schools offer long-term vocational education (with a duration of up to four years, 2+1+1, 2+2 or 4 in a block) and their target group is young people who finish compulsory education (compulsory 9-year schools) and are between the ages of 15 and 17 when they have to start the qualification. These programmes are all initial VET offers.

Vocational training centres, on the other hand, offer short-term vocational training courses (up to 4.5 months) and their target groups are: people over 16 years old who do not want to continue education; people over 17 years old who do not have other entry points into the system; unemployed jobseekers; and employed jobseekers who wish to change their careers. Some of these courses are continuing VET and some are initial VET. These are all formal VET and the qualifications that can be acquired are levels 2, 3, 4 and 5 of the Albanian Qualification Framework.

[114] Radovanovic, N., Gerussi, E., Nikolic, A., & Banse, M. (2022). Smart Specialisation in the Western Balkans–the first thematic workshop on agri-food. Available at: https://publications.jrc.ec.europa.eu/repository/handle/JRC130187
[115] They may include abilities specific to other fields such as art, music, physical education or traditional crafts. Some non-technology-related skills could still be considered non-technical skills if they are transferable to technology roles (e.g. creativity, critical thinking)
[116] They include interpersonal and cognitive skills such as communication, teamwork, decision-making, leadership, adaptability and situation awareness, and they are important in both technical and non-technical roles within the technology industry and other sectors

Currently, there are 31 secondary vocational education schools and 10 vocational training centres. At least 20 VET institutions in Albania are offering courses that support the healthy and sustainable food chain domain. The secondary vocational education schools are focused mainly on food technology, agribusiness, veterinary, agriculture, transport and agro-mechanics, and less on forestry and on fishery. Nutrition, culinary, food service and catering are topics developed also in the curricula of tourism and hospitality programmes. The public vocational training centres also offer several courses in organic food processing and MAP subdomains (see Annex 3).

In addition, the public vocational training centres offer the following courses: StartSMART course which consists of soft skills for the workplace; on-demand foreign languages courses in languages such as Italian, English, German; business entrepreneurship courses such as 'Entrepreneurship and small business management' or 'Digital Marketing'; as well as courses on basic and mid-level digital skills.

Several private licensed institutions in Albania offer formal courses of initial and continuing VET courses and non-formal courses (i.e. not linked to a qualification) to support the healthy and sustainable food chain domain. Training courses on agrifood technicians, culinary, nutrition, food safety are mostly common. However, private institutions that offer specialised non-formal courses in the domain are not so visible and therefore not evidenced.

Higher Education institutions

Three higher education institutions in Albania offer relevant study programmes: the Agricultural University of Tirana, which offers more than 52 study programmes in the fields of agriculture, fisheries, forestry, veterinary medicine, food sciences, technology, and nutrition; as well as the Natural Sciences Faculty in Tirana and the University 'Fan S Noli' in Korca, which provide skills for healthy and sustainable food chain. They are offering study programmes that further developed and updated under EU capacity building projects.

5. FINDINGS AND RECOMMENDATIONS TO MEET THE SKILLS NEEDS FOR SMART SPECIALISATION

The following findings are the result of mainly desk research conducted at EU level and in Albania, followed by stakeholder consultation meetings and interviews with the key stakeholders. The available evidence led to the conclusion that technological changes in the healthy and sustainable food chain domain result in higher demand for: (i) business support services, (ii) skills provision for current and future in-demand occupations, and (iii) deeper EU-level cooperation.

The three distinct areas of intervention are presented under the three pillars below.

- 'Business support services' include enhancing access to information on training offer, providing technical and non-technical upskilling and reskilling, as well as boosting direct support services to increase technology adoption.
- 'Skills provision for current and future in-demand occupations' refer to adding new technology-related and non-technical skills to curricula at all levels, and improving relevance and access to adult learning opportunities.
- 'Deeper EU-level cooperation' included developing targeted measures to support companies, business support organisations and public institutions to engage in deeper cooperation with EU peers.

5.1. Pillar 1: Business support services for companies

Conclusion No 1: Businesses lack information on the training offer

Micro, small and medium-sized enterprises (MSMEs) have limited capacity to attract, foster or leverage human capital. They often lack awareness of training needs, organisational learning culture, and the financial resources to identify and engage in relevant training for workers, managers and entrepreneurs. MSMEs are also in general less aware of the benefits of reskilling and upskilling, the public resources available to them for training, and they invest less of their own resources than their larger counterparts in human capital.

Despite efforts by various stakeholders, including government agencies, academic institutions and international organisations, the dissemination of up-to-date and comprehensive information on the training offer and funding sources remains fragmented and inefficient. This deficiency impedes the ability of businesses, particularly MSMEs, to enhance their workforce skills and secure the necessary financial resources for growth and expansion, thus hindering their competitiveness[117]. Addressing this information gap through coordinated efforts, improved communication channels and centralised platforms is crucial for fostering a conducive environment for business development and support services in Albania[118].

[117] World Bank/IFC (2022). Creating markets in Albania. Taking Advantage of New Trade and Investment Opportunities for a More Robust Private Sector. Available at: https://www.ifc.org/content/dam/ifc/doc/mgrt/cpsd-albania-summary.pdf

[118] International Journal of Economics, Commerce and Management (2021). University-business cooperation: The case of Albania. Available at: https://www.researchgate.net/publication/360219483_UNIVERSITY-BUSINESS_COOPERATION_THE_CASE_OF_ALBANIA

Recommendation No 1: Foster business investment in skills by enhancing access to information on training offer

Regular dialogue and collaboration between healthy and sustainable food chain domain enterprises, business support institutions, as well as education and training institutions, should be encouraged and facilitated, through the establishment of a platform or an information hub. The aim of the platform/hub would be to collect, update and disseminate information on the training offer for MSMEs.

Description

Information on the training offer for MSMEs should include at least the following aspects (for each subdomain):

- education and training providers/institutions, both public and private,
- training programmes (e.g. by providing links to different websites), by topics and particular subdomains,
- funding, including international and national sources, for company level investment in HR.

Additionally, other supporting information could be placed on the platform/hub, such as latest developments in key technology areas, skills needed to support technology adoption, changing policies and regulations impacting the company level HR development, etc.

Conclusion No 2: Businesses lack technology-related upskilling and reskilling

New technologies are disrupting how businesses work, requiring companies to commit to upskilling and reskilling to remain competitive. Upskilling due to adopting a new technology involves training employees on new techniques and technologies to enhance their existing roles. It builds on a foundation of knowledge and experience that an employee already possesses. Reskilling due to adopting a new technology, on the other hand, entails equipping an individual with entirely new technology-related skills to transition into a new role or occupation, which may or may not be related to their current role or area of expertise.

Comparatively low levels of basic skills among the current adult workforce in Albania, as in the other countries in the region, combined with population ageing, increase the need for individuals to maintain and update their skills over longer working lives. As stated in ETF research in the agri-food sector[119], the education and training provision in the Western Balkan region, including Albania, falls short of addressing the increasing demand for skilled workers in line with technological developments. Although there are a number of business intermediary bodies that provide training on the application of new technologies in the domain in Albania[120], generally most of the skills provision to MSMEs (that either focus specifically on agri-food or a wider range of sectors, including agri-food) concerns training in areas related to business development in general, such as marketing, financing, etc. With this in mind, there is a need to expand and diversify the offer of complementary short-term training programmes supporting major technology trends, to ensure that the agri-food industry is well-prepared to meet future challenges and seize opportunities.

Recommendation No 2: Provide targeted technical upskilling and reskilling to boost growth and competitiveness of businesses

New targeted and demand-driven technical training (upskilling and reskilling) services for MSMEs should be developed within each particular subdomain to help improve knowledge and skills related to innovative technologies and solutions.

[119] ETF (2023). Identifying technological changes and skill needs in the Western Balkan agri-food sector. Cross-country report

[120] Training offered by: ATTCs, Chamber of Commerce and Industry of Tirana, SME Academy, Risi Albania, ABA Online

Description

It is assumed that the growing interest in a particular technology in Europe will lead, sooner or later, to a growing need in Albania for professionals able to use that technology. The scale of demand may vary for a number of reasons, but if that technology is adopted in Albania, the skills related to its adoption will be needed at least to a certain extent.

More focus should be given to the provision of upskilling and reskilling for MSMEs to help them in successful technology adoption. Some examples of upskilling and reskilling topics in line with the key areas per each subdomain are given below.

- Sustainable organic farming and certification
  - Adoption of digital technologies such as QR-codes to verify organic production
  - Adoption of technology to enable automated production of crops and precision agriculture
  - Designing of new agronomic models for a more sustainable and resilient food and farming systems
- Food processing and value-added products
  - Adoption of non-thermal food processing technologies (e.g. high-pressure processing, pulsed electric fields)
  - Adoption of novel thermal technologies (e.g. ohmic heating, microwave)
  - Use of nano/microtechnology, such as microencapsulation of ingredients and photonics
  - Use of intelligent packaging of processed foods
  - Use of nanotechnology techniques in food
- Sustainable fisheries and aquaculture
  - Use of advanced satellite technologies and remotely operated vehicles (ROVs)
  - Adoptions of recirculating aquaculture systems and offshore farming methods
  - Use if new technologies such as genome editing
- Medicinal aromatic plants, oils and extracts production
  - Adoption and use of new techniques e.g. hot continuous extraction (soxhlet), aqueous alcoholic extraction by fermentation, counter-current extraction, ultrasound extraction (sonication), supercritical fluid extraction
  - Adoption and use of new productions and processing technologies e.g. photonics process, ozonation, cold plasma, ultraviolet, infrared, microwave and radiofrequency

Key areas for business support services to MSMEs in adopting new and emerging technologies in Albania that cut across all subdomains are:

- IoT applications for control of traceability, temperature, humidity, colour, consistence etc, and enhancement of sustainability performance, including:
  - integration of satellite-based internet connectivity to improve the IoT networks in non-connected farms;
  - development of mobile IoT platforms (such as drones and autonomous vehicles) with continuous connectivity;
  - use of edge-computing and machine learning to enhance the capability of the agricultural systems.
- Artificial intelligence (AI), including for rational food design, to support the design of plant-based products from information on ingredients, recipes, operational conditions, and sensorial responses.
- Big data to support optimal planting of trees and crops using data extracted from satellite and unmanned aerial vehicle imagery, and to support improvement of controlled environment

agriculture and mitigating post-harvest losses, as well as managing fruit and vegetable quality through machine learning.

- Other digital technologies, including 3D printing to meet customised nutrition plans, automation and robotics to perform multiple tasks in the production field, and blockchain applications in the food supply chain.

Conclusion No 3: Businesses lack relevant non-technical upskilling and reskilling

Transversal, non-technical skills are increasingly important due to the evolving nature of the business landscape and the growing integration of technology in all aspects of companies. Advances in technology have transformed companies, creating new areas of competitive advantage and disrupting traditional ones. This requires MSMEs and their employees to be adaptable and able to learn new skills quickly. Moreover, technology has made it easier for companies to outsource work, meaning that employees need to have skills that cannot be easily replaced by automation or cheaper labour abroad.

Currently there is insufficient support for the upskilling and reskilling of MSME managers, entrepreneurs and their employees in business development related skills. Albanian companies highlighted a demand for a variety of skills necessary for business development, and underlined difficulties in securing the necessary skillsets. They also emphasised the importance of cross-cutting skills, e.g. digital literacy, skills in networking and building relations, and language skills.[121] Moreover, as noted by MARD, there is limited knowledge and understanding among small farmers regarding national and EU funding opportunities, and also regarding standards required in the implementation of agricultural investment projects.[122]

Recommendation No 3: Provide targeted non-technical upskilling and reskilling to boost business growth and competitiveness

New targeted and demand-driven non-technical training for MSMEs should be developed within each particular subdomain to help improve knowledge and skills related to non-technical aspects, targeting professionals already working in the sector.

Description

All subdomains are experiencing constant and accelerating changes. In addition to technical skills, employees need upskilling and reskilling in interdisciplinary skills that should be provided by business support services in line with the key areas listed below.

- Business development and strategic planning (based on market trends, policies, regulations, and economics that affect the viability and profitability of a business)
- Marketing, sales and internationalisation
- Economics, financial management, accounting
- Project management
- Supply chain management
- Human resources management
- Digital literacy
- Language skills
- How to apply for and implement projects:

[121] ETF (2023). Identifying technological changes and skill needs in the Western Balkan agri-food sector. Cross-country report

[122] Ministry of Agriculture and Rural Development (2022). Rural Development Programme 2021-2027. Available at: https://bujqesia.gov.al/wp-content/uploads/2022/09/Programi-IPARD-III_2021-2027_English.pdf

- EU funding (European Agricultural Fund for Rural Development (EAFRD), Farm to Fork strategy, Agri-Food Pact for Skills, Horizon Europe, Erasmus +, EIT Food, COSME, etc.);
- National funding (projects on skills development in enterprises, investment in new technology and equipment, collaborative ventures, etc.).

Conclusion No 4: Small businesses tend to be slower than their larger counterparts to adopt new technologies

MSMEs often lack awareness of technological developments, corresponding training needs to adopt new technologies and the resulting innovative processes and products. As a result, workers in MSMEs are less likely to participate in training activities than their peers working in larger companies. Moreover, MSMEs' resources are limited and their capacity to absorb the costs and risks associated with in-house technology development is insufficient. The lack of investment in identifying, assimilating and acquiring new technology correlates with the lower-innovation absorptive capacity of MSMEs, hampering productivity and competitiveness. Therefore, MSMEs are often dependent on technology transfer to take advantage of the benefits gained by technology and innovation.

The need to adopt new technologies, including enabling ICT, and to assess MSMEs' related needs is visible in practically all parts of the value chain. However, considering the current and evolving development needs of the healthy and sustainable food chain domain in Albania, the models and delivery mechanisms of the support services for needs assessment and technology adoption, as well as the types of support offered, are not sufficiently effective and sustainable.[123]

Recommendation No 4: Boost direct business support to leverage technology adoption for increased productivity

Direct business support services should be fostered with the aim to support MSMEs active in the healthy and sustainable food chain domain in identifying and implementing necessary technology and in adopting innovative solutions (process/product innovation), in order to drive sustainable growth and competitive advantage in a rapidly evolving market.

Description

To facilitate technology adoption by MSMEs, the following areas of direct business support services (through training, hands-on advice, mentoring, coaching, etc.) should be considered:

- Develop technical assistance programmes to provide targeted technical support on implementing new technologies and improving operational efficiency.
- Provide practical advice and coaching in the field on how to use new technologies.
- Provide advice on available funds (e.g. grants, credit lines, risk-sharing facilities) for investments to incentivise technology adoption and modernisation.
- Encourage adoption of digital tools for farm management, precision agriculture, supply chain optimisation, etc., including training and subsidies for relevant software/hardware.
- Create platforms to connect agribusinesses with local and international experts who can advise on best practices and emerging technologies in the sector. Considering making use of diaspora entrepreneurs.
- Provide expertise for food processors to adopt modern equipment and technologies that improve efficiency, quality and food safety standards.
- Utilise Albania's potential for organic agriculture by supporting relevant certifications and technologies that enable production of high-value crops for export markets.

[123] Ministry of Agriculture and Rural Development (2022). Rural Development Programme 2021-2027. Available at: https://bujqesia.gov.al/wp-content/uploads/2022/09/Programi-IPARD-III_2021-2027_English.pdf

5.2. Pillar 2: Skills provision for current and future in-demand occupations

Conclusion No 5: Curricula across all education levels are in need of a technology update

The agri-food industry is currently at the forefront of technological revolution and the range of technological innovations is vast: automation, agricultural robots, autonomous vehicles, big data, predictive analytics, weather monitoring, predictive maintenance, etc. The gradually increasing interest in new technologies will boost the demand for skilled professionals capable of using them effectively. As the agri-food industry evolves and adopts new technologies, VET programmes must adapt to equip individuals with the necessary skills and competencies.

The number one challenge in Albania, as in the other countries in the region, identified by participants of the ETF's international networking event 'Skilling up the Western Balkan agri-food sector', organised in 2023, was the lack of alignment between the agri-food sector and the curricula – 'slow and limited adaptation of [training] programmes to labour market needs'[124]. There are no formal training programmes that combine specialist digital skills with education in agriculture or food processing. On agriculture programmes, ICT subjects only concern user-level skills. Meanwhile, technology programmes do not have a focus on or include subjects on the healthy and sustainable food chain domain. In higher education, there are no related subjects in the tertiary programmes focused on specialist ICT skills, and the courses on ICT at agricultural faculties concern usage rather than development of technological solutions. Furthermore, both VET and higher education provision in Albania is characterised by a lack of practical learning and excessive emphasis on theory rather than practical knowledge. The cooperation between companies belonging to the digitalisation niche and educational institutions is limited and mostly ad hoc, and the technical skills gained are increasingly obsolete given the developments in research, innovation and labour markets[125].

Recommendation No 5: Add new technology-related skills to curricula to accelerate technology diffusion

The curricula of existing healthy and sustainable food chain domain programmes at all levels of education should be regularly updated and reformed to include emerging technologies, evolving industry trends, and other innovative practices within the sector, while regularly incorporating practical, real-world applications and case studies to improve technology adoption across various food chain subdomains.

Description

The curricula of VET schools and higher education institutions should be updated to include the skill sets currently in demand, for example:

- important skills required by the sector in the short, medium and long term: genetic engineering, microtechnology and nanotechnology, robotics, image analysis, data-mining, waste management, metagenomics, gene sequencing[126];
- sustainable agriculture practices, such as organic farming, integrated pest management, and water conservation techniques,

[124] ETF. International networking event: Skilling up the Western Balkan agri-food sector Skopje, 5–7 December 2023: https://www.etf.europa.eu/en/news-and-events/news/international-networking-event-skilling-western-balkan-agri-food-sector

[125] ETF (2023). Identifying technological changes and skill needs in the Western Balkan agri-food sector. Cross-country report

[126] ETF. International networking event: Skilling up the Western Balkan agri-food sector Skopje, 5–7 December 2023: https://www.etf.europa.eu/en/news-and-events/news/international-networking-event-skilling-western-balkan-agri-food-sector

- precision agriculture: using digital tools such as GPS, drones and sensors;
- agricultural machinery operation and maintenance, such as harvesters and irrigation systems;
- data analysis and digital tools – data analysis techniques and the use of digital tools for monitoring and managing crops;
- greenhouse management, e.g. climate control, pest management and crop rotation;
- agroecology: i.e. sustainable farming practices that work with nature rather than against it[127].

Conclusion No 6: Conclusion No 6: Curricula at all levels of education need to be updated in terms of relevant non-technical and non-technology-related skills

Non-technical skills, often referred to as transversal/soft skills, and non-technology related skills set the foundation for personal development, resilience, the ability to communicate and work constructively with others, solve problems, and manage one's learning and career. As defined by the European Classification of Skills, Competences, Qualifications and Occupations (ESCO) 'Transversal skills and competences are learned and proven abilities which are commonly seen as necessary or valuable for effective action in virtually any kind of work, learning or life activity'.

Furthermore, research indicates a need to develop holistic transversal/soft skills training and education, especially in terms of business and economics, management, sales, presentation, negotiation, problem solving, etc. which are not systematically included in secondary and tertiary education at the moment. In addition, teamwork, general communication skills and knowledge of English were highlighted by businesses as increasingly important transversal skills across various occupations. These findings are in line with previous research, which also found that the labour force in the Western Balkan agri-food sector lacks digital literacy, communication skills, the ability to learn on the job, innovativeness and risk-taking[128]. All these skills not only complement technical abilities but they are equally important.

Recommendation No 6: Add new non-technical and non-technology related skills to curricula to cater for the needs of the labour market

The curricula of existing healthy and sustainable food chain domain programmes at all levels of education should be regularly updated and reformed to include non-technical and non-technology-related skills in order to prepare the current and future labour force for the evolving needs of companies.

Description

The curricula of VET schools and higher education institutions should be updated to include the non-technical and non-technology skill sets currently in demand, for example:

- digital literacy
- general communication and language skills
- business development, internationalisation
- sales, presentation, marketing, management
- networking, building relations, teamwork
- innovativeness, risk-taking, problem solving
- willingness to continuously learn and improve professionally

[127] GIZ (2024). Green and Digital Skills in the Agriculture Sector in Albania
[128] ETF (2023). Identifying technological changes and skill needs in the Western Balkan agri-food sector. Cross-country report

Conclusion No 7: Learning opportunities do not sufficiently respond to technological advances

The healthy and sustainable food chain domain in Albania faces a significant challenge in providing education and training opportunities that embrace technological advancements and lead to a qualification. Despite the growing demand for expertise in technology and innovation within the food chain subdomains, the availability of learning opportunities[129] reflecting the current technological developments remains limited. VET and university level education are mainly provided by education and training institutions that focus their programmes on the broader field of agriculture rather than specific food chain subdomains and related emerging technologies. The higher education and training offer is generally sufficient for broader agriculture and food processing sectors. However, there is a need for more targeted programmes, e.g. in modern food processing, organic food production, and other food chain subdomains affected by technological advancements.

On-the-job learning and training of new employees is an important element in filling in the gaps left by formal education and meeting companies' skill needs, but short-term training programmes are mainly related to developing technical skills for using machines and equipment. The non-formal training offer that focuses on food chain subdomains is rather limited, and mostly takes a broader approach to agriculture, food safety and food technology[130].

Recommendation No 7: Improve the relevance of and access to learning opportunities that reflect technological developments

Learning opportunities in the healthy and sustainable food chain domain should be expanded in terms of relevance of and access to education and training provision, including development of new programmes reflecting latest technology trends, particularly in post-secondary education and non-formal short-term courses leading to a qualification.

Description

Learning opportunities should be improved at several levels and in regard to different knowledge and skills aspects.

- Develop new qualification programmes / learning opportunities which reflect technological advancements in the healthy and sustainable food chain domain and its subdomains as well as new emerging subdomains.
- Develop new levels of education and training, such as post-secondary education, to improve the education value chain fulfilling an actual gap in such studies that may be beneficial, not only for students coming from high school and studies for the 3rd and 4th level of qualifications, but also some adults who currently work in the sector.
- Develop flexible non-formal short-term training opportunities such as modular learning programmes that allow adults to complete training in manageable segments (online and/or hybrid) to provide greater accessibility and flexibility for adult learners.
- Incentivise smaller businesses and educational institutions to develop and deliver specialised training programmes. Collaborative efforts between industry stakeholders and educational institutions can help ensure that training programmes are relevant, up-to-date and aligned with industry needs.

[129] Learning opportunities should be understood broadly as short-term vocational training courses leading to a qualification, secondary and post-secondary vocational education with a dual approach (dual VET), graduate and postgraduate studies

[130] ETF (2023). Identifying technological changes and skill needs in the Western Balkan agri-food sector. Cross-country report

5.3. Pillar 3: Mobilising potential for deeper EU-level cooperation

Conclusion No 8: Companies and business support organisations would benefit from closer cooperation with their EU counterparts with matching smart specialisation priorities

Albania faces challenges in disseminating best practices within its agri-food industry due to weak connections and collaboration among food chain stakeholders. These factors limit knowledge-sharing and impede innovation and long-term investments.

Many regions within EU member states have undertaken numerous projects and initiatives focused on advancing specific areas of the healthy and sustainable food chain. These efforts have likely provided them with significant experience, particularly in integrating new technologies into businesses and developing the necessary skill sets. Their expertise could provide valuable guidance to Albania, especially in the realms of technology adoption, skill enhancement and fostering innovation. This could offer Albanian businesses a chance to improve their capabilities and seize new market opportunities.

Recommendation No 8: Develop targeted measures to support the cooperation between companies and business support organisations with their EU counterparts

Long-term collaboration with relevant EU counterparts should be established and funding possibilities should be investigated to allow peer learning to take place between the Albanian food chain subdomains professionals, entrepreneurs, experts and researchers, and the 'matched' EU regions.

Description

The European Commission emphasises the value of peer learning and exchange of practices to find common solutions to cross-national and cross-regional challenges in skills development and digital adoption[131]. Peer exchange is considered one of the most useful measures for enhancing learning and teaching, according to a survey of European universities[132]. International and national training opportunities for staff involved in digital transformation are also highly valued. The European Union has undertaken initiatives such as the 'Blueprint for Sectoral Cooperation on Skills' and the Pact for Skills[133], to foster sustainable partnerships among stakeholders within the agri-food industry. These collaborations aim to develop a comprehensive skills strategy that addresses existing skills gaps and promotes responsible business practices.

Peer learning from EU regions would offer Albania an opportunity to accelerate its adoption of good practices for the smart specialisation domains and potentially subdomains, if a 'fit' can be found. This could be an opportunity for new and existing companies in the healthy and sustainable food chain domain in Albania to gain new skills, make use of new technology and ultimately innovate independently to realise commercial opportunities.

Regions that have a good match to Albania are visible on the S3 platform through the S3 CoP (Community of Practice) Observatory. Some are shown below.

[131] European Commission (2023). Proposal for a Council recommendation on improving the provision of digital skills in education and training. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX%3A52023DC0206

[132] Gaebel, M., Zhang, T., Stoeber, H. and Morrisroe, A. (2021). Survey report. Digital enhanced learning and teaching in European higher education institutions. Available at: https://eua.eu/downloads/publications/digihe%20new%20version.pdf

[133] European Commission (2020a). EU Pact for Skills Strategy. Department of Employment, Social Affairs and Social Inclusion. Available at: https://ec.europa.eu/social/main.jsp?catId=1517&langId=en

Healthy and Sustainable Food Chain
Nouvelle Aquitaine (FRI)
Autonomous Province of Bolzano (ITH1)
Örebro County (SE124)
East Netherlands (NL2)
Navarre (ES22)
+ more

In this context, the role of the public authorities at all levels (central, regional, local) would primarily consist of having a leading role in various initiatives to foster and facilitate collaboration between Albanian and EU businesses and business support organisations. This approach could lead to increased innovation, competitiveness and growth.

To maximise the benefits of peer learning, Albanian public authorities could engage in activities such as:

- Organising and facilitating business forums, trade fairs, networking events, exchange programmes etc. where businesses can learn from EU counterparts on instruments for skills development and technology adoption targeting the areas of the smart specialisation action plan. This could also involve sharing information and jointly identifying/exploring: advanced agricultural methods and innovations, prototype digital tools tailored to the needs of the healthy and sustainable food chain domain, preparation of research concepts/projects, etc.
- Supporting the establishment of regional business support centres that provide services such as market research, legal advice and partnership facilitation for international cooperation
- Empowering chambers of commerce to take an active role in fostering international partnerships, including setting up dedicated EU desks.
- Encouraging and funding R&D projects that partner with EU institutions, and developing regional innovation hubs and incubators that facilitate cross-border entrepreneurial ventures and tech start-ups.
- Establishing/strengthening partnerships with municipalities in EU countries, fostering city-to-city cooperation and business exchanges.
- Offering grants, subsidies and tax incentives for businesses that engage in cross-border cooperation with EU partners.

Conclusion No 9: Closer cooperation with EU member states with matching smart specialisation priorities would help accelerate peer learning among public institutions

As mentioned in the previous recommendation, there is a noticeable gap in Albania regarding the dissemination of best practices from successful industry players. An insufficient degree of cooperation on the part of public institutions and the weak links between food chain actors lead to limited diffusion of knowledge and constrain innovation and long-term investments in the domain.

Public institutions in various regions of EU countries have already implemented many projects and initiatives related to developing particular healthy and sustainable food chain subdomains, and are expected to have accrued experience including how best to support companies to integrate/adopt new technologies and build their associated skills base. They can offer valuable insights for Albania's

public institutions, particularly in providing support for technology development and integration, skills development and innovation. This presents an opportunity for Albania to enhance capabilities and capitalise on good practices.

Recommendation No 9: Develop targeted measures to support cooperation between public institutions and their EU counterparts

A long-term collaboration with relevant EU countries' public institutions counterparts should be established and funding possibilities should be investigated to allow peer learning to take place between the Albanian public institutions and 'matched' EU regions.

Description

Peer exchange within public institutions is considered one of the most useful measures for enhancing learning and teaching. International and national training opportunities for staff involved in digital transformation are also highly valued. Promoting cooperation among educational institutions and public sector organisations can help address barriers to skills development, such as through industry-education cooperation platforms and competence centres that foster 'skills ecosystems'. Governments can devise measures to promote such sectoral and cross-organisational cooperation, which facilitates the pooling of resources, knowledge sharing and joint strategies, particularly benefiting small and medium enterprises. One example of a mechanism that could be used is the Smart Specialisation Community of Practice (S3 CoP), which is DG REGIO's major source of support for S3 implementation and the central node on guidance, networking, support and peer learning on S3[134].

The Albanian public institutions should identify all similar EU regions, establish partnerships, participate in EU initiatives, and adapt their local, regional and national strategies to the current context. This approach could also lead to increased capacities of the public organisations. Some of the EU regions that are well matched with Albania are shown in the table in the previous recommendation.

Participants in these processes should include public institutions working in the healthy and sustainable food chain domain at all levels (ministries, agencies, regional/municipal offices), and education and training providers such as universities, VET centres, regional vocational training centres, vocational schools, etc.

[134] European Commission. S3 Community of Practice. Available at: https://ec.europa.eu/regional_policy/policy/communities-and-networks/s3-community-of-practice_en

ANNEXES

Annex 1. Summary of recommendations by estimated level of priority, difficulty, costs and timeframe

The following recommendations are addressed to the S3 authorities in Albania, led by the Deputy Prime Minister's Office (DPMO)

Recommendations for action to develop S3 related skills	Decision-making aspect (High/Medium/Low)			Time-frame		
	Priority	Difficulty	Costs	Short	Medium	Long
PILLAR 1: BUSINESS SUPPORT SERVICES TO COMPANIES						
Recommendation No 1: Foster business investment in skills by enhancing access to information on training offer Regular dialogue and collaboration between healthy and sustainable food chain domain enterprises, business support institutions, as well as education and training institutions, should be encouraged and facilitated, through the establishment of a platform or an information hub. The aim of the platform/hub would be to collect, update and disseminate information on the training offer for MSMEs.	H	L		X		
Recommendation No 2: Provide targeted technical upskilling and reskilling to boost growth and competitiveness of businesses New targeted and demand-driven technical training (upskilling and reskilling) services for MSMEs should be developed within each particular subdomain to help improve knowledge and skills related to innovative technologies and solutions.	H	M			X	
Recommendation No 3: Provide targeted non-technical upskilling and reskilling to boost business growth and competitiveness New targeted and demand-driven non-technical training for MSMEs should be developed within each subdomain to help improve knowledge and skills related to non-technical aspects, targeting professionals already working in the sector.	H	M			X	
Recommendation No 4: Boost direct business support to leverage technology adoption for increased productivity Direct business support services should be promoted with the aim of supporting MSMEs active in healthy and sustainable food chain domain to identify and implement the necessary technologies and adopt innovative solutions, in order to drive sustainable growth and gain a competitive advantage in a rapidly evolving market.	H	L		X		
PILLAR 2: SKILLS PROVISION FOR CURRENT AND FUTURE IN-DEMAND OCCUPATIONS						
Recommendation No 5: Add new technology-related skills to curricula to accelerate technology diffusion	H	M			X	

Recommendations for action to develop S3 related skills	Decision-making aspect (High/Medium/Low)			Time-frame		
	Priority	Difficulty	Costs	Short	Medium	Long
The curricula of existing programmes in the healthy and sustainable food domain at all levels of education should be regularly updated and reformed to include emerging technologies, evolving industry trends and other innovative practices within the sector, while regularly incorporating practical, real-world applications and case studies to improve technology adoption across various food chain subdomains.						
Recommendation No 6: Add new non-technical and non-technology related skills to curricula to cater for the needs of the labour market The curricula of existing healthy and sustainable food chain domain programmes at all levels of education should be regularly updated and reformed to include non-technical and non-technology-related skills, in order to prepare the current and future labour force for the evolving needs of businesses.	H	M			X	
Recommendation No 7: Improve the relevance of and access to learning opportunities that reflect technological developments Learning opportunities in the domain of healthy and sustainable food chain should be expanded in terms of the relevance of and access to education and training, including the development of new programmes that reflect the latest technology trends, particularly in post-secondary education and non-formal short-term courses leading to qualifications.	H	M			X	
PILLAR 3: MOBILISING THE POTENTIAL FOR DEEPER COOPERATION AT EU LEVEL						
Recommendation No 8: Develop targeted measures to support the cooperation between companies and business support organisations with their EU counterparts Long-term collaboration with relevant EU counterparts should be established and funding opportunities should be investigated to enable peer learning between the Albanian professionals, entrepreneurs, experts and researchers in the domain of healthy and sustainable food chain and the 'matched' EU regions.	H	M		X		
Recommendation No 9: Develop targeted measures to support cooperation between public institutions and their EU counterparts Long-term cooperation should be established with the relevant public institutions of EU Member States and funding opportunities should be explored to enable peer learning between the Albanian public institutions and the 'matched' EU regions.	H	M		X		

Annex 2. Education and training providers

	Name of provider	Degree/Course	Location	VET	HEI	Adult learning (upskilling & reskilling)	Formal learning	Non-formal learning
Organic	Agricultural University of Tirana	▪ Agriculture ▪ Horticulture ▪ Plant Protection Agrifood ▪ Engineer Food Technology, Viticulture-Oenology ▪ Food Biotechnology ▪ Nutrition Science ▪ Sustainable Food Production Systems ▪ Quality and Food Safety ▪ PhD 'Sciences and Food Biotechnology'	Tirana		X		X	
	University of Tirana, Natural Sciences Faculty	▪ Molecular Biotechnology ▪ Food Engineering ▪ Food Technology	Tirana		X		X	
	Institute of Strategic Studies and Training	▪ Technician of Food Industry ▪ Irrigation management	Tirana	X				X
	Professional High School of Kamez	▪ Agriculture, Food Technology	Kamez	X			X	
	Professional School 'Mihal Shahini', Cerrik	▪ Agriculture, Horticulture, Plant protection	Cerrik	X			X	
	Agrobusiness High School 'Charles Telford Erikson', Golem	▪ Agrobusiness	Golem	X			X	

	Name of provider	Degree/Course	Location	VET	HEI	Adult learning (upskilling & reskilling)	Formal learning	Non-formal learning
	Industrial High School 'Arben Broci', Shkoder	▪ Agricultural Mechanisation	Shkoder	X			X	
	Agricultural High School 'Rakip Kryeziu', Fier	▪ Agriculture	Fier	X			X	
	High School 'Irakli Terova' Korce	▪ Agriculture	Korce	X			X	
	VTC Elbasan	▪ Fruit-growing	Elbasan	X		X	X	
	Can be offered by all 10 VTCs	▪ Cattleman farmer		X		X	X	
	Can be offered by all 10 VTCs	▪ Beekeeping services		X		X	X	
Food processing	Agricultural University of Tirana	▪ Agrifood Engineer Food Technology, Viticulture-Oenology ▪ Food Biotechnology ▪ Nutrition Science ▪ Sustainable Food Production Systems ▪ Quality and Food Safety ▪ Food Analysis ▪ PhD 'Sciences and Food Biotechnology' ▪ Agriculture, Horticulture, Plant Protection, Animal Husbandry ▪ Veterinary Medicine	Tirana		X		X	
	Agricultural University of Tirana, Natural Sciences Faculty	▪ Chemistry and Food Technology ▪ Biology ▪ Biotechnology	Tirana		X		X	

	Name of provider	Degree/Course	Location	VET	HEI	Adult learning (upskilling & reskilling)	Formal learning	Non-formal learning
		▪ Industrial Chemistry and environment ▪ Molecular Biology ▪ Molecular Biotechnology						
	University 'Fan S. Noli', Korce	▪ Food Technology ▪ Food Quality and Safety ▪ Agriculture	Korce		X		X	
	Qiriazi University College	▪ Food Technology, ▪ Nutrition	Tirana		X		X	
	Tourism Hotel School of Tirana	▪ Food Technology	Tirana	X			X	
	Professional High School of Kamez	▪ Agriculture, Food Technology	Kamez	X			X	
	High school of Technology 'Hysen Cela' Durres	▪ Food Technology	Durres	X			X	
	Professional High School 'Kolin Gjoka' Lezhe	▪ Food Technology	Lezhe	X			X	
	Professional High School 'Ndre Mjeda', Shkoder	▪ Agriculture ▪ Food Technology	Shkoder	X			X	
	Agricultural High School 'Rakip Kryeziu', Fier	▪ Food technology, Transport	Fier	X			X	
	High School' Isuf Gjata', Korce	▪ Food Technology	Korce	X			X	

	Name of provider	Degree/Course	Location	VET	HEI	Adult learning (upskilling & reskilling)	Formal learning	Non-formal learning
	VTC Elbasan	▪ Butcher	Elbasan	X		X	X	
	VTC Durres	▪ Fish processing	Durres	X		X	X	
	Can be offered by all 10 VTCs	▪ Milk processing		X		X	X	
	VTC Durres	▪ Fruit and vegetable processing		X		X	X	
	VTC Durres, VTC Elbasan	▪ Meat processing	Durres, Elbasan	X		X	X	
	Can be offered by all 10 VTCs	▪ Agricultural mechanics		X		X	X	
Fish	Agricultural University of Tirana	▪ Food Biotechnology ▪ Nutrition Science ▪ Sustainable Food Production Systems ▪ Quality and Food Safety ▪ Food Analysis ▪ PhD 'Sciences and Food Biotechnology' ▪ Aquaculture ▪ Veterinary Medicine	Tirana		X		X	
	Tirana University Natural Sciences Faculty	▪ Molecular Biology						
MAPs	Agricultural University of Tirana	▪ Sustainable Food Production Systems ▪ Quality and Food Safety	Tirana		X		X	

	Name of provider	Degree/Course	Location	VET	HEI	Adult learning (upskilling & reskilling)	Formal learning	Non-formal learning
		▪ PhD 'Sciences and Food Biotechnology' ▪ Environment Science ▪ Agriculture, Horticulture, Plant Protection						
	Agricultural University of Tirana	▪ Garden Management	Tirana		X		X	
	Professional School 'Mihal Shahini', Cerrik	▪ Agriculture, Horticulture, Plant protection	Cerrik	X			X	
	Agrobusiness High School 'Charles Telford Erikson', Golem	▪ Agrobusiness	Golem	X			X	
	Can be offered by all 10 VTCs	▪ Worker for collection, cultivation and processing of medicinal plants		X		X	X	
	Mobile VTC for the Northeast	▪ Worker for collection, cultivation and processing of mountain fruits	Kukes, Diber, Puke	X		X	X	

GLOSSARY

AI	Artificial intelligence
CAP	Common Agricultural Policy
CFP	Common Fisheries Policy
CVET	Continuing vocational education and training
ESCO	European Skills, Competences, Qualifications and Occupations
ETF	European Training Foundation
EU	European Union
EUFIC	European Food Information Council
FS	Food systems
F2F	Farm to Fork
GDP	Gross domestic product
HSFC	Healthy and sustainable food chain
ICT	Information and communication technology
IoT	Internet of things
ISCED	International Standard Classification of Education
ISCO	International Standard Classification of Occupations
MAPs	Medicinal aromatic plants
NESS	National Employment and Skills Strategy
R&D	Research and development
S3	Smart Specialisation Strategy
SMEs	Small and medium enterprises

SFS	Sustainable food system
STECF	Scientific, Technical and Economic Committee for Fisheries
VET	Vocational education and training
VSS	Secondary vocational education schools
VTC	Vocational training centres
AI	Artificial intelligence
CAP	Common Agricultural Policy
CFP	Common Fisheries Policy
CVET	Continuing vocational education and training
ESCO	European Skills, Competences, Qualifications and Occupations
ETF	European Training Foundation
EU	European Union
EUFIC	European Food Information Council
FS	Food systems
F2F	Farm to Fork
GDP	Gross domestic product
HSFC	Healthy and sustainable food chain
ICT	Information and communication technology
IoT	Internet of things
ISCED	International Standard Classification of Education
ISCO	International Standard Classification of Occupations
MAPs	Medicinal aromatic plants

NESS	National Employment and Skills Strategy
R&D	Research and development
S3	Smart Specialisation Strategy
SMEs	Small and medium enterprises
SFS	Sustainable food system
STECF	Scientific, Technical and Economic Committee for Fisheries
VET	Vocational education and training
VSS	Secondary vocational education schools
VTC	Vocational training centres

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