



Developing skills for introducing circular business models and digital technologies in olive oil sector

Deliverable 2.6

National guidelines for revising and/or developing professional profiles and qualifications

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Identification of olive sector



Holistic circular business



VET curricula



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National guidelines for revising and/or developing professional profiles and qualifications

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Contents

1. INTRODUCTION	7
1.1 About the Circolive project.....	7
1.2 Purpose and objective of the deliverable.....	7
VET SYSTEM IN GREECE	8
1. Overview of the VET system	8
2. National skills gaps and needs in professional profiles	8
2.1 Analysis of existing profiles and identified gaps in professional profiles.....	8
2.2 Key competencies required for circular business management/circular economy....	9
3. Guidelines for revising or developing the professional profiles	9
3.1 Identification/revision of the professional profiles based on ESCO.....	9
3.2 Tailoring profiles to the country needs.....	10
3.3 Key competencies and learning outcomes needed for circular economy roles.....	10
4. Policy and institutional ecosystem supporting professional profile development	11
4.1 National VET systems and sectoral frameworks in Greece.....	12
4.2 Pathway for adoption of a new professional profile.....	12
5. Conclusions	14
6. Appendices/references/sources	14
VET SYSTEM IN ITALY	15
1. Overview of the VET system	15
2. National skills gaps and needs in professional profiles	16
2.1 Analysis of existing profiles and identified gaps in professional profiles.....	16
2.2 Key competencies required for circular business management/circular economy..	16
3. Guidelines for revising or developing the professional profiles	17
3.1 Identification/revision of the professional profiles based on ESCO.....	17
3.2 Tailoring profiles to the country's needs.....	18
3.3 Key competencies and learning outcomes needed for circular economy roles.....	19
4. Policy and institutional ecosystem supporting professional profile development	20
4.1 National VET systems and sectoral frameworks in Italy.....	20
4.2 Pathway for adoption of a new professional profile.....	20
5. Conclusions	22
6. Appendices/references/sources	23
VET SYSTEM IN SPAIN	24
1. Overview of the VET system	24
2. National skills gaps and needs in professional profiles	25
2.1 Analysis of existing profiles and identified gaps in professional profiles.....	25
2.2 Key competencies required for circular business management/circular economy..	26
3. Guidelines for revising or developing the professional profiles	26
3.1 Identification/revision of the professional profiles based on ESCO.....	26
3.2 Tailoring profiles to the country's needs.....	27
3.3 Key competencies and learning outcomes needed for circular economy roles.....	28
4. Policy and institutional ecosystem supporting professional profile development	29
4.1 National VET systems and sectoral frameworks in Spain.....	30
4.2 Pathway for adoption of a new professional profile in Spain.....	31
5. Conclusions	32
6. Appendices/references/sources	33
VET SYSTEM IN CROATIA	34
1. Overview of the VET system	34
2. National skills gaps and needs in professional profiles	35
2.1 Analysis of existing profiles and identified gaps in professional profiles.....	35
2.2 Key competencies required for circular business management/circular economy..	35
3. Guidelines for revising or developing the professional profiles	36
3.1 Identification/revision of the professional profiles based on ESCO.....	36



3.2 Tailoring profiles to the country needs.....	36
3.3 Key competencies and learning outcomes needed for circular economy roles.....	37
4. Policy and institutional ecosystem supporting professional profile development	38
4.1 National VET systems and sectoral frameworks in Croatia	38
4.2 Pathway for adoption of a new professional profile in Croatia.....	39
5. Conclusions	40
6. Appendices/references/sources	41
VET SYSTEM IN PORTUGAL	42
1. Overview of the VET system	42
2. National skills gaps and needs in professional profiles	44
2.1 Analysis of existing profiles and identified gaps in professional profiles	44
2.2 Key competencies required for circular business management/circular economy ..	45
3. Guidelines for revising or developing the professional profiles	46
3.1 Identification/revision of the Professional Profiles based on ESCO	46
3.2 Tailoring profiles to the country’s needs	47
3.3 Key competencies and learning outcomes needed for circular economy role	48
4. Policy and institutional ecosystem supporting professional profile development	50
4.1 National VET systems and sectoral frameworks in Portugal	52
4.2 Pathway for adoption of a new professional profile in Portugal.....	55
5. Conclusions	57
6. Appendices/references/sources	57



1. INTRODUCTION

1.1 About the Circolive project

The project “CIRCOLIVE - Developing skills for introducing circular business models and digital technologies in olive oil sector” (hereinafter CIRCOLIVE) aims to support the EU transition to the CE by improving/enhancing the circular business skills in the olive oil sector in Greece, Portugal, Italy, Spain, and Croatia in order to promote the adoption of circular entrepreneurial models for waste and by-product valorization of the whole olive oil value chain.

More specifically, it aims at:

1. Boosting adaptation of VET provision to emerging circular business skills needs by designing transnational curricula. This is important in shaping VET system responses to cope with CE transition of the olive sector.
2. Building small operators’ skills on the implementation of circular business models and on deep tech domains in agrofood sector, and stimulating a sense of initiative entrepreneurial attitudes and mind-sets across the olive oil value chain, enabling them to become innovative and more competitive e.g. launching new services/products etc.
3. Facilitating the flow and co-creation of knowledge between higher education and vocational and training, research, the public sector and the business sector and/or other stakeholders, in Greece, Portugal, Italy, Spain, and Croatia to support/promote the development and implementation of holistic circular business models for olive waste and by-product valorisation for the transition of the olive oil sector to CE.

1.2. Purpose and objective of the deliverable

This deliverable, titled "National guidelines for revising and/or developing professional profiles and qualifications", serves as an operational tool to guide the adaptation, revision, or creation of professional profiles within each partner country of the CIRCOLIVE project. Its primary purpose is to respond to identified skills gaps in the circular economy and related sectors, ensuring that training pathways and occupational profiles are aligned with national needs, labour market dynamics, and the evolving demands of sustainable development.

Building upon the findings of Deliverable 2.5 “Guidelines for revising and/or developing professional profiles and qualifications”, which mapped existing professional profiles and assessed sector-specific skill requirements across partner countries, this document focuses specifically on the national contexts. It provides tailored guidance that reflects the structure of the national VET system, regulatory frameworks, institutional stakeholders, and existing qualifications. The deliverable aims to support the systematic integration of new or updated professional profiles into national and regional qualifications frameworks, ensuring their relevance, recognition, and sustainability.

Through this document, CIRCOLIVE partners will be equipped with a country-specific reference that not only identifies strategic pathways for profile development and accreditation but also offers insights on how to interface with national policy instruments and institutional ecosystems. Ultimately, the deliverable contributes to a shared European goal of fostering green, circular, and innovation-driven skills while maintaining sensitivity to local realities and implementation pathways.



VET SYSTEM IN GREECE

1. Overview of the VET system

In Greece, the integration of circular economy practices into vocational education and training (VET), especially within the olive oil sector, is still in its early stages. Generally, circular practices and entrepreneurship aren't yet well developed across the Greek educational landscape.

At the undergraduate level, for instance, institutions like the Agricultural University of Athens don't offer dedicated courses focused solely on circular practices in the olive sector. However, postgraduate courses do delve deeper into this field. Some undergraduate classes such as "Olive Cultivation" and "Environmental Microbiology" touch on circular topics through shorter lectures, discussing methods like composting and the use of olive waste to cultivate mushrooms or plant growth-promoting microbes.

In Crete, the Hellenic Mediterranean University offers Agroecology courses that incorporate circular techniques such as converting agro-food waste into biochar through pyrolysis.

Beyond the academic setting, some non-profit organizations and regional partnerships are stepping in. A notable example is "New Agriculture - New Generation", which collaborated with local authorities to offer free training in agrocircularity, including a module on olive farming. They also launched the "Open Olive Academy", a program that spans the olive oil value chain – from cultivation and production to marketing – and combines theoretical and experiential learning.

Public institutions are also contributing. The Institute of Agricultural Sciences, under the Ministry of Rural Development and Food, has offered seminars to individuals interested in returning to rural life and engaging in olive farming. Meanwhile, ELGO-DIMITRA operates six higher agricultural schools and 28 training centers nationwide, though courses specifically focused on circular entrepreneurship in the olive sector are not yet widely available.

Additionally, there are short courses and events organized by farmer cooperatives and local authorities that occasionally feature sessions on sustainable waste management in the olive oil sector.

2. National skills gaps and needs in professional profiles

2.1. Analysis of existing profiles and identified gaps in professional profiles

The Greek olive oil sector plays a central role in the country's economy, but it still faces some serious gaps when it comes to modern and circular business practices. Most producers are small, family-run operations that have inherited traditional know-how in olive farming and oil extraction. While their expertise in cultivation and production is solid, they often lack the business, marketing, and digital skills needed to grow their operations or adopt innovative models like circular economy practices.

A few producers have started reusing by-products or reducing waste in sustainable ways, but this is not yet common. Most stakeholders across the olive oil value chain don't have enough awareness or training in how circular practices could benefit their businesses. This makes the need for targeted training and support in circular economy especially important, particularly



for rural or small-scale producers.

Another major gap lies in digital literacy. Many producers aren't using modern technology to improve efficiency or manage their supply chains. Tools like precision agriculture, IoT sensors, or AI could help lower costs and reduce environmental impact, but adoption is still low. The same applies to eco-friendly packaging and energy-efficient logistics, where current practices often lead to higher carbon footprints.

There's also a disconnect between producers and consumers when it comes to circularity. Although consumers care more about product quality, their awareness of circular practices is limited. If this changes, it could open up new market opportunities for sustainable, value-added products.

Finally, financial barriers make it hard for small and medium-sized producers to invest in circular technologies. Even though some policy frameworks support sustainability, there are still very few financial incentives specifically for circular business models in the olive oil sector.

2.2. Key competencies required for circular business management/circular economy

To effectively adopt circular economy principles in the Greek olive oil sector, professionals need to develop a mix of traditional agricultural knowledge and modern, sustainability-focused skills. One of the most critical areas is by-product and waste management. Understanding how to turn waste into useful products like compost, biofuels, or other value-added materials is essential for adding value while minimizing environmental harm.

Another key skill is the design and production of sustainable products, which means thinking through a product's entire lifecycle, from farming and harvesting to processing, packaging, and disposal. This requires a systems-thinking approach and an understanding of how to integrate circular economy strategies across all stages of the supply chain.

Professionals should also be able to develop and run recycling and reuse programs, with the goal of reducing waste and improving resource efficiency across production processes. There's also growing importance placed on renewable energy integration, such as using bioenergy or other clean sources, to lower the carbon footprint of olive oil operations.

Finally, the ability to assess the environmental impact of the entire value chain is crucial. Life cycle assessments help identify opportunities for reducing resource use and environmental harm. This means professionals need a blend of technical, environmental, and project management skills to make informed, strategic decisions.

3. Guidelines for revising or developing the professional profiles

3.1 Identification/revision of the professional profiles based on ESCO

Two key professional profiles stand out for revision and alignment with the circular economy goals in Greece's olive oil sector: the Sustainability Manager and the Waste Valorization (Treatment) Engineer. These roles should be developed based on the ESCO occupation groups and, where possible, aligned with the Greek National Qualifications Framework (NQF).

The Sustainability Manager profile should incorporate competencies related to sustainability strategy, life cycle assessment, eco-design, waste management, and circular packaging. According to ESCO, this aligns with profiles like Environmental Manager, Sustainability Specialist, or Corporate Social Responsibility Manager. In the context of the Greek olive sector, these professionals need to guide small producers through designing and applying sustainable



practices tailored to their specific production processes.

The Waste Valorization Engineer fits within the ESCO framework under roles like Environmental Engineer or Waste Management Specialist. In the Greek olive sector, this professional should bring expertise in managing agricultural waste and implementing technologies that convert waste into useful products like compost, biogas, or biochar. They need hands-on knowledge of waste streams from olive oil production and be capable of designing efficient, closed-loop systems that support circular economy goals.

Both of these profiles would benefit from being mapped to relevant NQF levels and formalized through vocational and higher education programs that emphasize practical training in circular economy, environmental impact assessment, and resource efficiency.

3.2 Tailoring profiles to the country needs

Developing these two profiles, Sustainability Managers and Waste Valorization Engineers, is directly relevant for Greece's olive oil sector, given its size, economic impact, and environmental challenges. The sector is made up largely of small, family-run businesses that still rely on traditional farming and processing methods. As a result, there's a significant gap in modern skills and expertise needed to adopt circular practices.

Sustainability Managers are crucial in helping these producers integrate environmental strategies into daily operations. For example, they can guide olive oil businesses to reduce waste, switch to sustainable packaging, or explore the reuse of by-products like pomace. These professionals can also support producers in getting certifications, like the EU Organic Label or Circular Economy seals, that boost product value and consumer trust.

They can also foster partnerships across the value chain. By connecting local farmers, municipalities, and processors, they can help close resource loops, promote shared infrastructure for waste treatment, and facilitate circular innovation.

Waste Valorization Engineers, meanwhile, can help address one of the sector's biggest issues, such as waste. Olive mills generate large volumes of organic waste, often without a proper plan for treatment. These engineers can implement technologies for reusing materials, recovering energy, and reducing pollution. They're also key to piloting new uses for waste, like turning pomace into fuel or fertilizers.

In short, these profiles are not just technically important, they are also essential for the broader transition of the Greek olive sector into a more sustainable and competitive industry.

3.3 Key competencies and learning outcomes needed for circular economy roles

A critical competency in this context is the ability to manage by-products and waste effectively. This includes converting organic waste into useful products such as compost, biogas, or eco-friendly materials—skills especially necessary for professionals involved in waste treatment and valorization. Equally important is the capacity to design sustainable products and processes by applying life-cycle thinking and embedding sustainability throughout the supply chain. Professionals need to understand how to optimize production systems not just for profitability, but for environmental efficiency and long-term resilience.

Another important area is the development and coordination of recycling programs. This involves setting up systems that minimize waste, promote reuse, and improve overall resource efficiency in the olive oil production process. In addition, integrating renewable energy into the production chain, such as using olive by-products like pomace to generate energy, requires specialized technical knowledge in renewable systems and energy management.



Professionals will also need to assess the environmental footprint of production activities through lifecycle assessments. This kind of analysis helps identify environmental impacts at each stage of the olive oil value chain and is essential for shaping sustainability strategies and setting measurable goals. For these roles, a strong foundation in data analysis, environmental metrics, and sustainability reporting is required.

In terms of learning outcomes, professionals should be able to demonstrate an understanding of circular economy principles tailored to the olive oil sector, apply practical techniques for waste reuse and valorization, design and implement sustainable business models, and monitor environmental performance. They should also be equipped to communicate the importance and benefits of circular practices both within their organizations and to external stakeholders, including consumers.

The most critical future skills identified in the CIRCOLIVE field research include expertise in waste and by-product valorization, circular product design, eco-packaging, renewable energy integration, and environmental impact management. According to the responses collected, many stakeholders in the sector—such as olive oil producers, experts, and VET providers—agreed that these competencies are essential for successfully adopting circular economy principles.

To address these needs, the development of training pathways should focus on combining theoretical instruction with hands-on learning, such as field visits to olive groves and oil mills. Training should be accessible to stakeholders regardless of academic background and delivered in formats that include face-to-face sessions and asynchronous online modules. This approach would ensure that new skills are transferred effectively, preparing the workforce to support a greener, more sustainable olive oil sector in Greece.

4. Policy and institutional ecosystem supporting professional profile development

To ensure the sustainability and impact of the professional profiles and training pathways developed under the CIRCOLIVE project, it is essential to align them with relevant EU and national policy frameworks, funding instruments, and institutional mandates. This section must outline how the proposed guidelines can interface with existing structures to ensure uptake and scalability.

In Greece, the development of professional profiles related to circular economy in the olive oil sector should be embedded within an institutional ecosystem composed of public education bodies, sector-specific public organizations, non-profit organizations, and key ministries, notably the Ministry of Rural Development and Food.

Currently, there is no unified or standardized pathway for updating or creating professional profiles in the circular economy sector, especially within agri-food industries like olive oil production. However, specific institutions are well-positioned to take on this role.

For the CIRCOLIVE profiles, such as Sustainability Manager and Waste Valorization Engineer, to be fully integrated into Greece's training and employment system, they must be formally aligned with the National Qualifications Framework (NQF) and mapped to relevant ESCO occupational categories. This process will ensure recognition, transparency, and labor market relevance, both nationally and within the European Union.

Aligning professional profiles with these existing structures and leveraging national and European funding instruments will be essential for ensuring their widespread uptake, institutional validation, and long-term scalability across the Greek olive oil sector.



4.1 National VET systems and sectoral frameworks in Greece

Greece's national Vocational Education and Training (VET) system for the olive oil sector is composed of formal academic institutions, public training bodies, and non-formal education initiatives. However, regarding circular economy and sustainability skills, especially in the olive oil sector, the system remains fragmented and underdeveloped.

At the academic level, there are no undergraduate programs dedicated to circular economy in agriculture. Some postgraduate programs, focusing on applied economics and sustainability, include relevant topics. Institutions such as the Agricultural University of Athens and Hellenic Mediterranean University (Crete) incorporate circular practices into broader subjects, like olive waste valorization and biochar production.

The public sector plays a crucial role, particularly through ELGO-DIMITRA, which operates under the Ministry of Rural Development and Food. ELGO-DIMITRA manages agricultural training schools and regional centers across the country. Although its current curricula do not formally include circular economy topics, its existing infrastructure, organizational capacity, and sector mandate make it the most suitable institution to act as the National VET Body for Circular Economy in the Olive Sector. Sector experts confirm ELGO-DIMITRA's readiness to lead the development, certification, and delivery of specialized training for emerging professional profiles like Sustainability Manager and Waste Valorization Engineer.

Other relevant institutions include the Institute of Agricultural Sciences, which offers seminars for new or returning farmers, primarily focusing on olive cultivation. These activities, however, are not yet linked to structured circular economy skill development.

In the non-formal education space, initiatives like "New Agriculture – New Generation" provide valuable, hands-on training across the olive oil value chain. Programs such as the "Open Olive Academy" address sustainability, quality control, and innovation. Although these programs are not formally recognized under the National Qualifications Framework (NQF), they represent a flexible model for future training pathways.

Currently, Greece lacks an accredited, unified pathway for developing and certifying professional profiles in circular economy for the olive sector. This highlights the urgent need for institutional cooperation and formal integration of new profiles into the national VET and sectoral frameworks. Alignment with ESCO occupational groups and incorporation into the NQF will be essential to ensure formal recognition, labor market relevance, and EU-wide comparability.

4.2. Pathway for adoption of a new professional profile

The adoption of new professional profiles within Greece's VET and agricultural training systems, such as the Sustainability Manager and Waste Valorization Engineer, requires a coordinated and phased approach that involves both institutional engagement and policy alignment. These profiles respond directly to skill gaps identified in the olive oil sector and reflect broader EU priorities on green skills, sustainability, and circular economy.

1. Needs Analysis and Stakeholder Consultation

The process should begin by identifying the current skill gaps and future needs in the olive oil sector, using the research already conducted in the CIRCOLIVE project. This includes consultations with stakeholders such as olive producers, cooperatives, regional authorities, VET providers (like ELGO-DIMITRA), universities (like Agricultural University of Athens), and NGOs (such as "New Agriculture – New Generation"). Their input will help confirm the demand for new roles like Sustainability Manager and Waste Valorization Engineer, and ensure the



profiles are practical and needed.

2. Alignment with the National Qualifications Framework (NQF)

Once validated, the new profiles must be formally aligned with the National Qualifications Framework (NQF) and referenced to the European Qualifications Framework (EQF). They should also be linked to appropriate ESCO occupation groups, ensuring EU-wide transparency and recognition. This step requires the definition of learning outcomes in terms of knowledge, skills, and competences, following EU standards. The involvement of ELGO-DIMITRA as a central VET body is essential to ensure that these profiles meet sectoral and educational requirements.

3. Curriculum Design and Pilot Testing

Based on these learning outcomes, a modular and flexible curriculum should be developed. This will allow for different levels of participation, from basic upskilling to full qualifications. The curriculum should combine theoretical knowledge with practical, hands-on training in real production environments. ELGO-DIMITRA, given its infrastructure and national reach, is best positioned to lead curriculum development and implementation. The Agricultural University of Athens can contribute academic expertise, while “New Agriculture – New Generation” can support pilot delivery through its experience in applied, place-based training (e.g., “Open Olive Academy”). Pilots can be funded through EU instruments such as the CAP Strategic Plan, LIFE programs, and ESF+, ensuring financial sustainability and supporting initial deployment.

4. Accreditation and Formal Recognition

To be officially adopted, the new curricula and profiles must go through a formal approval process by national and regional education authorities. Upon accreditation, they should be included in Greece’s official training catalogs and qualification registries, making them eligible for delivery by public and private VET providers. This process should be coordinated by ELGO-DIMITRA in collaboration with the Ministry of Rural Development and Food and other relevant bodies.

5. Mainstreaming and Dissemination

Once accredited, the profiles must be widely promoted across the Greek VET ecosystem. ELGO-DIMITRA’s training network, regional VET providers, local cooperatives, and municipalities should be engaged to integrate these profiles into their training offers. Strategic communication campaigns should highlight the economic and environmental value of circular economy skills for the olive oil sector, targeting both producers and younger professionals.

6. Sustainability and Funding

For long-term viability, the integration of these profiles must be supported by sustainable funding mechanisms, including the CAP Strategic Plan, ESF+, and national rural development programs. Partnerships between public bodies, private companies, and non-profit organizations are essential to ensure continuous curriculum updates, respond to evolving sector needs, and scale up training nationwide. The role of ELGO-DIMITRA as the central coordinator for VET in the circular economy of the olive sector will be key to maintaining momentum and ensuring long-term impact.



5. Conclusions

The transition of Greece's olive oil sector toward circular economy practices presents a major opportunity to combine sustainability with economic resilience. While awareness is gradually increasing, the sector still faces significant gaps, especially in the areas of waste management, resource efficiency, and the integration of renewable technologies. The findings from the national research highlight that although some stakeholders have begun to apply circular practices, these efforts are isolated and not yet mainstream. Many producers lack the technical skills, financial support, and access to training necessary to adopt and scale circular models.

Given these challenges, piloting two new professional profiles, Sustainability Manager and Waste Valorization Engineer, is not only timely but essential. These roles respond directly to the sector's needs and can serve as key drivers in promoting more sustainable, efficient, and innovative practices across the olive oil value chain. Sustainability Managers will support producers in designing and implementing environmental strategies, managing certifications, and engaging with stakeholders to close resource loops. Meanwhile, Waste Valorization Engineers will provide the technical know-how required to convert organic waste into value-added products like biofuels or fertilizers, reducing environmental impact and increasing profitability.

Introducing training programs tailored to these two profiles will help bridge the gap between traditional agricultural methods and the demands of a modern, circular economy. These programs should not only deliver theoretical knowledge but also provide hands-on learning opportunities in real production settings such as olive groves, oil mills, and processing units. As shown through the CIRCOLIVE project, there is already interest and willingness among stakeholders to engage in such training, especially when it's practical, accessible, and directly linked to their day-to-day operations.

By piloting these profiles and training pathways, Greece has the chance to lead in the development of circular practices in the agri-food sector. The skills that emerge from this initiative will not only improve environmental outcomes but also create new jobs, enhance competitiveness, and open up new markets for sustainable products. It represents a strategic investment in the future of the sector, one that aligns with European policy goals, supports local economies, and empowers rural communities with the tools they need to thrive sustainably.

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VET SYSTEM IN ITALY

1. Overview of the VET system

Vocational Education and Training (VET) in Italy plays a crucial role in providing specialized skills needed across various sectors, particularly in agriculture and the agri-food industry. The system is diverse, offering both formal education and training programs designed to meet the needs of the labor market, with a growing emphasis on sustainability and innovation, especially in sectors like olive oil production. Italy's VET system is structured into various educational pathways, including secondary education programs, higher technical institutes (ITS), and university courses, and is essential in regions where agriculture is a key part of the economy.

In the context of the olive oil sector, the VET system equips workers with the necessary skills to address challenges such as sustainability, waste management, and the integration of circular economy practices. However, there is currently a lack of specialized courses that combine circular economy principles with olive oil production, despite several initiatives, particularly in southern Italy, aimed at filling these gaps. For instance, institutions like the University of Bologna and Florence offer specialized courses in olive growing and olive oil production, focusing on agronomy, technical practices, management, and marketing aspects of the sector. Furthermore, programs offered by organizations such as Treccani Academy and EvooSchool provide master's courses specifically focused on extra virgin olive oil, blending innovation, sustainability, and finance. Despite these offerings, the integration of circular economy concepts into these programs remains limited. Moreover, the VET system in Italy includes various specialized training programs, such as those offered by the Istituto Tecnico Superiore (ITS). These programs provide hands-on experience and technical skills relevant to sectors like olive oil production. Notable examples include the "Higher Technician in Olive Oil Supply Chain Management" and "Higher Technician in Production and Processing in the Olive Oil Supply Chain" programs available in regions like Puglia and Calabria. These courses focus on management, technical skills, and operational processes in the olive oil industry.

As Italy undergoes a transition toward more sustainable agricultural practices, the adoption of innovative technologies and circular economy principles in sectors such as olive oil production is becoming more pronounced. For example, in Emilia-Romagna, where the olive oil supply chain is growing, there is a notable shift toward the use of advanced technologies, such as precision agriculture, data management, and digital tools for crop monitoring. This trend highlights the need for specialized training programs that incorporate these innovations into the curriculum. Despite the growing recognition of the importance of sustainability and circular economy practices, the current VET system still shows gaps in integrating these principles within the olive oil industry. The potential exists for VET to play a significant role in the transition toward a more sustainable and circular olive oil industry, but there is a need for more structured and targeted programs that address these challenges. By offering specialized courses in sustainability and circular economy practices, Italy's VET system could better support the competitiveness of the olive oil sector in the global market.



2. National skills gaps and needs in professional profiles

2.1. Analysis of existing profiles and identified gaps in professional profiles

Current professional profiles in the olive oil sector include agronomists, olive oil mill operators, quality control specialists, and food technologists. These roles are fundamental in managing the production process, ensuring quality, and maintaining the industry's competitive edge. However, while traditional expertise remains critical, emerging needs for skills in waste valorization, renewable energy integration, and digitalization are becoming increasingly important. The demand for specialized roles such as sustainability consultants, waste valorization engineers, and circular economy managers is rising. These positions are pivotal for the transition to more sustainable practices, especially as the sector faces increasing pressure to reduce its environmental impact. Waste management and the valorization of by-products, such as olive pomace and wastewater, have become central themes, and the need for professionals with expertise in these areas is clear. However, there is currently a shortage of professionals who can seamlessly integrate these principles into the olive oil production process. Furthermore, the olive oil industry is experiencing a digital transformation. There is an increasing need for professionals with digital skills, including data management and precision agriculture. While some olive mills have adopted digital technologies, the uptake is still limited, and many businesses lack the technical capacity to implement digital solutions that can optimize production processes and reduce waste. This technological gap, combined with financial constraints, hampers the industry's transition to more sustainable and efficient production methods.

The existing VET system in Italy provides some relevant programs, particularly at higher technical institutions (ITS), but these programs often focus more on traditional agricultural skills and less on new, innovative practices. There is a clear gap in educational offerings that combine technical, sustainability, and circular economy concepts within the context of the olive oil industry. Moreover, while there is significant interest in sustainable practices, many workers in the olive oil sector lack access to specialized training in circular business models and the application of these models in daily operations.

Italy's olive oil sector needs to address the professional profile gaps by introducing targeted education and training programs that combine traditional agricultural expertise with modern sustainability and technological skills. Bridging these gaps is essential for the sector's long-term competitiveness and environmental responsibility.

2.2. Key competencies required for circular business management/circular economy

As Italy's olive oil sector transitions towards a circular economy, the demand for specialized roles in circular business management is growing. VET in Italy plays a key role in providing specialized skills for these roles, particularly in sectors like agriculture and agri-food, which are increasingly focused on sustainability and innovation.

In the context of olive oil production, waste management and valorization are critical competencies for professionals in circular economy roles. By-products such as olive pomace, pits, and wastewater can be transformed into valuable resources. VET programs must equip professionals with the skills to efficiently manage these by-products, turning waste into revenue-generating materials through recycling, upcycling, or conversion into bioenergy. This requires knowledge of sustainable farming practices, organic farming, soil conservation, and water management to mitigate environmental impacts and align with circular economy goals.



Additionally, expertise in renewable energy systems, such as solar or biogas, is becoming increasingly important. As the sector seeks to reduce its carbon footprint and enhance energy efficiency, professionals must be capable of integrating these solutions into olive oil mills and production facilities, evaluating the economic feasibility of such technologies. Digital skills are also essential for circular business management, as the use of precision agriculture, data management, and digital monitoring tools can improve efficiency and track sustainability performance. VET programs should focus on equipping professionals with digital skills for waste management, supply chain optimization and product traceability to ensure transparency and effectiveness in sustainability efforts.

The adoption of sustainable agricultural practices and innovative technologies is gaining momentum in regions like Emilia-Romagna, where the olive oil supply chain is growing. Implementing advanced technological tools such as precision agriculture and digital technologies for crop monitoring is essential for addressing future challenges and ensuring the resilience and competitiveness of the olive oil industry. VET institutions are increasingly seen as crucial providers of these skills, fostering the transition towards more sustainable and circular olive oil production.

Finally, professionals in circular economy roles must possess strong project management skills to coordinate stakeholders such as farmers, mill operators, and technology providers. Effective communication and regulatory knowledge are also essential to ensure that circular economy practices comply with European and Italian regulations related to waste management, sustainability standards, and environmental policies. The growing focus on circular economy principles in Italy's VET system reflects the increasing need for specialized training to support a sustainable and competitive olive oil industry.

3. Guidelines for revising or developing the professional profiles

3.1 Identification/revision of the professional profiles based on ESCO

In the context of Italy's olive oil sector transitioning to a circular economy, two key professional profiles emerge that align with the ESCO framework: Sustainability Manager and Waste Treatment Engineer. These roles are central to integrating circular business practices and ensuring sustainability in olive oil production. With the growing demand for sustainability, there is a need to revise these professional profiles, particularly to focus on managing by-products like pomace and developing innovative solutions such as biogas production from processing waste.

1. Sustainability Manager

This role in the olive oil sector focuses on integrating sustainability practices across the entire production chain, from cultivation to processing and distribution. According to ESCO (occupation code 1213.8), this figure is responsible for developing strategies to improve environmental impact, ensuring compliance with environmental regulations, and promoting the use of renewable resources. This professional profile is essential for guiding the olive oil sector towards a circular economy model by adopting practices such as waste valorisation, energy efficiency, and sustainable farming methods. Key competencies for this profile include knowledge of sustainable farming practices, environmental management, energy efficiency, waste management, and circular business models. A Sustainability Manager should also have skills in stakeholder engagement, project management, and regulatory compliance. In Italy, this role corresponds to a Level 6 qualification within the National Qualifications Framework (NQF), which typically aligns with a bachelor's or master's degree level. It requires advanced knowledge and management skills in sustainability practices across different sectors, including agriculture and food production.



2. Waste Treatment Engineer

This role (ESCO occupation code 2143.1) is pivotal in developing and implementing processes to manage and treat waste and by-products within the olive oil sector. This includes the management of olive pomace, wastewater, and other residues generated during the oil extraction process. A Waste Treatment Engineer designs and oversees technologies that transform waste into valuable resources, such as biofuels or fertilizers, supporting the circular economy transition. Key competencies for this role include expertise in environmental engineering, waste treatment technologies, renewable energy systems, and pollution control. The ability to design and optimize waste management systems is crucial for minimizing. The figure aligns with a Level 7 qualification in the NQF for Italy, corresponding to a master's degree or an equivalent level of expertise. This profile requires a deep understanding of technical systems, environmental regulations, and advanced engineering principles, typically obtained through specialized academic programs.

3.2 Tailoring profiles to the country's needs

The development of the Sustainability Manager and Waste Treatment Engineer professions is crucial for addressing the unique challenges and opportunities faced by Italy's olive oil sector, which is a cornerstone of the national economy. Tailoring these profiles to the needs of the industry will not only enhance the sector's sustainability but also improve its competitiveness on the global market.

Sustainability Manager

Italy's olive oil sector is under increasing pressure to meet sustainability goals, both in terms of environmental impact and market demand for eco-friendly products. As the country is the second largest producer of olive oil globally, the need for professionals who can integrate circular economy principles into production processes has never been more critical. The Sustainability Manager profile addresses this by offering the expertise needed to implement sustainable practices across the entire supply chain, from cultivation to production and distribution. In the context of Italy, where olive oil production is fragmented and often located in rural areas with unique environmental challenges, the Sustainability Manager is essential for guiding small and medium enterprises (SMEs) toward the adoption of green technologies. This professional helps ensure compliance with stringent European and Italian environmental regulations, supports waste valorisation, and promotes renewable energy solutions. As consumers become increasingly conscious of sustainability, having dedicated professionals to drive these initiatives helps the Italian olive oil sector maintain its reputation as a premium producer of eco-conscious products, thus improving market access and profitability.

Waste Treatment Engineer

Italy's olive oil industry produces significant quantities of waste, including olive pomace, wastewater, and olive pits, which pose environmental risks if not managed properly. The Waste Treatment Engineer plays a critical role in mitigating these risks by developing and applying innovative technologies to treat and recycle these by-products. Olive pomace and wastewater have the potential to be transformed into valuable resources such as biofuels, fertilizers, or even animal feed, aligning with circular economy principles. The role is particularly relevant for Italy's olive mills, many of which operate on a small to medium scale. These mills often face financial and technological constraints that prevent them from efficiently managing waste. By developing cost-effective and scalable waste treatment solutions, Waste Treatment Engineers can significantly reduce environmental harm and improve the economic sustainability of these operations. Furthermore, the integration of



waste valorisation technologies supports Italy's broader environmental goals, aligning the olive oil sector with global sustainability trends.

3.3 Key competencies and learning outcomes needed for circular economy roles

The transition to a circular economy in Italy's olive oil sector requires professionals with a combination of technical, environmental, and managerial competencies. Below are the key competencies and learning outcomes necessary to support this shift.

1. Sustainability and Environmental Management

A deep understanding of sustainability principles and environmental management is essential for circular economy roles. Professionals must be well-versed in sustainable farming practices, renewable energy integration, and resource optimization. They should be able to reduce the environmental impact of production, focusing on waste streams like olive pomace, wastewater, and olive pits.

- **Learning Outcome:** Graduates should be able to assess the environmental impact of olive oil production, propose sustainable waste management solutions, and integrate renewable energy into production processes.

2. Waste Valorisation and Recycling

Turning waste into valuable resources is a core aspect of the circular economy. For the olive oil sector, managing and valorising by-products such as olive pomace and wastewater is crucial. Professionals need to understand technologies that transform these by-products into energy, fertilizers, or other useful materials.

- **Learning Outcome:** Trainees should be capable of applying waste treatment techniques like biogas production or composting, evaluating their economic and environmental benefits, and designing recycling systems for olive mill residues.

3. Digital and Data Management Skills

Technology plays a key role in the circular economy, especially in waste management and resource optimization. Circular economy professionals must be proficient in using digital tools to monitor production processes, track waste, and optimize resource use. Additionally, they should be able to leverage product data management and agriculture-specific digital technologies to enhance sustainability outcomes.

- **Learning Outcome:** Learners should become proficient in using digital platforms for resource tracking, data analysis, and process optimization with a focus on sustainability goals.

4. Regulatory Knowledge and Compliance

Professionals in circular economy roles must have a solid understanding of environmental laws, regulations, and sustainability standards. In Italy, the olive oil sector operates within a complex regulatory framework that requires compliance with both European and national environmental standards.

- **Learning Outcome:** Professionals should be able to interpret and apply environmental laws, ensuring compliance with local and international regulations.

5. Project Management and Stakeholder Engagement

Circular economy roles require strong project management and communication skills. In Italy's olive oil sector, this involves collaborating with SMEs, policymakers, and educational institutions. Professionals must lead multi-disciplinary teams and foster collaboration to implement circular economy strategies effectively.



- **Learning Outcome:** Trainees should develop the skills to manage circular economy projects from initiation to execution, ensuring effective communication and collaboration among all stakeholders.

4. Policy and institutional ecosystem supporting professional profile development

To guarantee the long-term relevance and integration of the professional profiles and training pathways developed through the CIRCOLIVE project in Italy, it is important to ensure alignment with both European Union strategies and national vocational education and training (VET) systems. This includes coherence with EU-level initiatives such as the **European Skills Agenda, Green Deal, and Pact for Skills**, as well as national and regional strategies addressing workforce transformation, green skills, and circular economy priorities.

This section outlines the pathways and mechanisms through which the proposed CIRCOLIVE professional profiles can be embedded within existing policy and institutional structures, ensuring their institutional uptake, validation, and potential scalability across relevant sectors.

4.1. National VET systems and sectoral frameworks in Italy

Italy's VET system is characterized by a multi-level governance structure involving national ministries (notably the Ministry of Education and Ministry of Labour), regional governments, and sector-specific institutions. The development and recognition of new professional profiles must adhere to regulatory frameworks governing qualifications, occupational standards, and curricula, while ensuring responsiveness to emerging labour market needs such as those driven by the green and circular economy.

The relevant Institutions to be involved for the CIRCOLIVE project professional profiles are:

- **Regional VET Agencies:** Operate under regional competence in VET policy and funding, playing a central role in curriculum development, certification, and employer collaboration.
- **ITS Agroindustry (Istituti Tecnici Superiori per l'Agroindustria):** These Higher Technical Institutes represent a key bridge between education and industry, with strong potential to integrate circular economy competencies in agro-food production, processing, and logistics.

4.2. Pathway for adoption of a new professional profile

The successful integration of new or revised professional profiles into Italy's vocational education and training (VET) system requires a structured, multi-step approach that ensures both relevance to the labour market and compliance with institutional and policy frameworks. The pathway outlined below presents a comprehensive route for embedding CIRCOLIVE professional profiles into Italy's educational and occupational systems.

1. Needs Analysis and Stakeholder Consultation

The process begins with an assessment of current and emerging labour market needs, often



triggered by inputs from industry associations, regional economic analyses, or EU-funded initiatives such as the CIRCOLIVE project. This phase is crucial to establish the demand for the new profile and to define its strategic importance in sectors such as agroindustry and the circular bio economy. It involves structured consultations with a wide array of stakeholders, including employers, regional VET agencies, training providers (e.g., ITS), chambers of commerce, and social partners. These actors help validate the relevance of the profile and identify skill gaps that the new training pathway aims to address.

2. Alignment with the National Qualifications Framework (NQF)

Once a profile is validated through stakeholder engagement, it must be formally aligned with Italy's National Qualifications Framework (NQF) and linked to the appropriate level within the European Qualifications Framework (EQF). This alignment ensures transparency, comparability, and mutual recognition across European countries. During this stage, the profile's learning outcomes are clearly defined using standardized descriptors of knowledge, skills, and competences, following established European tools such as EUESCO (European Skills, Competences, Qualifications and Occupations) and EQAVET (European Quality Assurance in Vocational Education and Training). This process guarantees that the profile meets both educational quality standards and labour market relevance.

3. Curriculum Design and Pilot Testing

Following alignment, a tailored curriculum is developed—typically in a modular format—to allow flexible implementation across different training institutions. This curriculum is designed either by ITS (Istituti Tecnici Superiori) focused on the agroindustry sector or by accredited regional training providers. The design includes theoretical components as well as practical, experiential learning modules, often incorporating internships, company-based projects, and case studies inspired by the CIRCOLIVE living labs. Pilot testing of the curriculum can be financially supported by funding streams such as the European Social Fund Plus (ESF+) or regional innovation programs, enabling early implementation and iterative refinement based on feedback from learners and employers.

4. Accreditation and Formal Recognition

For the training pathway to be officially recognized, the curriculum must undergo an approval process by the competent authorities. This could involve regional governments, national education bodies, or sectoral agencies, depending on the qualification's scope and level. Upon approval, the professional profile may be added to regional qualification frameworks or—if it holds national significance—integrated into Italy's national repertory of occupational profiles. This step ensures that the profile becomes part of the formal VET offer and eligible for public and private training delivery.

5. Mainstreaming and Dissemination

After formal recognition, efforts must be made to ensure widespread adoption and integration across the country. This includes promoting the profile through institutional networks such as INDIRE (National Institute for Documentation, Innovation and Educational Research) and ANPAL (National Agency for Active Labour Policies), as well as engaging VET providers and sectoral stakeholders. The profile should also be reflected in strategic planning documents at the regional level, such as Smart Specialisation Strategies (S3) and Green Transition Roadmaps, to secure alignment with broader development priorities. Additionally, support for trainer upskilling and employer engagement helps embed the profile



sustainably into practice.

6. Sustainability and Funding

To ensure long-term viability and replication, the adoption of the professional profile must be embedded within a sustainable funding framework. This includes leveraging Italy's National Recovery and Resilience Plan (PNRR), regional Operational Programmes (OPs), and European funding instruments such as ESF+, ERDF, Erasmus+ (KA2), Interreg, and LIFE. These resources can support scale-up activities, cross-regional collaboration, and continuous improvement. Strategic alliances with innovation clusters, universities, and employer associations further enhance the potential for the profile to evolve with industry needs and remain future-proof.

The pathway ensures that the professional profiles developed are not only aligned with national and European frameworks but are also embedded within the operational realities of Italy's VET and employment systems. This alignment supports both the short-term adoption and long-term scalability of training solutions tailored to the green and circular economy.

5. Conclusions

The transition to a circular economy within Italy's olive oil sector represents a crucial step toward enhancing sustainability, reducing environmental impacts, and strengthening the sector's global competitiveness. To drive this transformation effectively, the development of targeted professional profiles is essential. Key roles such as Sustainability Manager and Waste Treatment Engineer are at the forefront of this transition, requiring a unique blend of competencies that combine traditional agricultural knowledge with modern practices focused on sustainability, waste management, and digitalization.

The VET system in Italy plays a significant role in this shift, providing training in specialized skills across agricultural and agri-food sectors. However, the integration of circular economy principles into olive oil production remains underdeveloped. There is growing recognition of the need for more specialized programs that emphasize sustainable practices, waste valorization, and renewable energy integration. These programs should equip professionals with the skills to manage by-products such as olive pomace, wastewater, and olive pits, transforming them into valuable resources like biofuels or fertilizers. Additionally, the incorporation of digital technologies and precision agriculture is essential for optimizing resource use and improving sustainability outcomes. Despite the technological advancements in some areas, the olive oil industry still faces challenges in digital adoption, leading to a gap in professionals with the necessary digital expertise to support sustainable production methods.

Addressing these gaps within the VET system will help the olive oil sector meet the growing demand for sustainable products and comply with stringent environmental regulations. This is particularly important in rural areas, where olive oil production is a key economic driver. The establishment of clearer educational pathways integrating circular economy practices will empower professionals to implement innovative waste management solutions, adopt renewable energy, and promote sustainability across the production chain.

In regions like Emilia-Romagna, where the olive oil sector is growing, there are challenges related to production fragmentation and attracting qualified professionals. To overcome these issues, targeted training programs must bridge the skills gap, focusing on sustainable agricultural practices, 4.0 agriculture technologies, and by-product valorization techniques. These programs are crucial for enabling the sector's transition to a circular economy and ensuring the long-term sustainability of Italy's olive oil industry. By enhancing the VET system



and aligning it with circular economy demands, Italy can secure its position as a global leader in sustainable olive oil production, benefiting both the industry and the environment. Strategic training initiatives will help develop a new generation of professionals capable of driving change and setting benchmarks for the future.

6. Appendices/references/sources

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VET SYSTEM IN SPAIN

1. Overview of the VET system

Vocational Training (FP) in Spain is an educational system that aims to prepare students for the world of work, providing them with theoretical and practical knowledge in various professional sectors. It is an alternative to traditional university education, focused on the acquisition of specific skills that respond to the needs of the labour market.

Levels of Vocational Training

The VET system is divided into different levels according to the access requirements and the qualification obtained:

1. **Basic Vocational Training:** Aimed at students from the age of 15 who have not completed ESO. It has a duration of two years and allows to obtain the title of Basic Professional Technician, as well as access to the FP of Middle Degree.
2. **Intermediate Level:** It is equivalent to baccalaureate in educational terms and can be accessed after completing ESO or Basic Vocational Training. It has a duration of two years and allows to obtain the title of Technician. Graduates can access directly to the world of work or continue studying a Higher Degree.
3. **Higher Level:** Accessible after passing the Intermediate Level or Baccalaureate. It also has a duration of two years and provides the title of Superior Technician, which allows both access to the labor market and related university studies.
4. **Dual Vocational Training:** A modality that combines training in educational centers with learning in companies. This allows students to gain real experience and improve their job placement options.

Features and benefits:

- Practical orientation: the Vocational Training prioritizes learning through practice, with compulsory stays in companies.
- High labour insertion: In many specialties, VET graduates have a higher employment rate than university graduates.
- Flexibility: There are face-to-face, blended and distance modalities.
- Adaptation to the labour market: The training cycles are updated according to the needs of the market.

Professional Branches

Vocational training offers a wide variety of professional families, such as health, computer science, administration, electricity and electronics, hospitality and tourism, among others. This allows students to choose according to their interests and work demands.

In recent years, the FP in Spain has gained prestige and social recognition, highlighting itself as a solid alternative to university training. The educational and labor authorities promote constant reforms and modernizations of the system to adapt it to the digital transformation, sustainability and new professional profiles that the current economy demands.



In short, professional training in Spain constitutes a strategic pillar for economic and social development, favoring both the labor insertion of young people and the competitiveness of companies.

2. National skills gaps and needs in professional profiles

2.1. Analysis of existing profiles and identified gaps in professional profiles

The Spanish olive oil sector is currently undergoing a significant transition towards the adoption of circular economy principles. However, this transition is hampered by evident gaps in professional skills and knowledge. Existing occupational roles in the sector include agricultural workers, agricultural production managers, agronomists, environmental engineers, oil mill operators, food technologists, quality and safety officers, logistics and supply chain managers, and waste treatment engineers. While these profiles form the backbone of the sector, most lack specialized training in circular economy business models, digitalization, and deep-tech applications.

Survey results and interviews conducted as part of the D2.3 report reveal that most professionals have an informal understanding of circular practices, primarily based on traditional experience rather than structured education or training. For instance, while waste reduction, water reuse, and renewable energy use are common practices among producers, there is little structured knowledge of circular economy frameworks, regulatory requirements, or innovation-driven models. The majority of SMEs lack trained professionals with the ability to design and implement comprehensive circular business strategies.

Another major gap lies in digital and technological skills. Many SMEs have limited knowledge in using digital monitoring tools, precision agriculture technologies, and sustainability reporting systems. This shortfall particularly affects supply chain managers and quality control officers, where tools such as blockchain for traceability, AI for resource optimization, or IoT-based monitoring could significantly improve sustainability performance and regulatory compliance.

Additionally, roles such as food technologists, packaging managers, and waste valorization engineers often lack deep-tech expertise in areas such as automation, AI, and blockchain applied to agri-food waste valorization. There is a notable scarcity of professionals with skills in developing new business models that capitalize on by-products (e.g., converting olive pomace into biofuels or organic fertilizers).

Finally, there is a systemic gap in entrepreneurial and innovation mindsets across traditional roles. Many professionals perceive sustainability primarily as a compliance issue, rather than as a competitive opportunity to create new value streams. This cultural barrier, coupled with financial constraints and low awareness of available incentives, hinders the sector's ability to fully embrace circular economy strategies.

As a result, two key profiles have been identified as critical for the sector's future: the Circular Economy Manager, responsible for driving circular business models and integrating digital technologies, and the Waste Valorization Engineer, focused on developing technical solutions to transform agri-food waste into valuable products.



2.2. Key competencies required for circular business management/circular economy

The transition of the Spanish olive oil sector to a circular economy model requires a new set of multidisciplinary competencies, blending technical, managerial, and digital skills. For roles such as the Circular Economy Manager and professionals involved in sustainability and circular business management, several core competencies have been identified.

First, strategic thinking and business model innovation are essential. Circular Economy Managers must be able to design and implement circular business models that integrate sustainability across the entire value chain. This includes expertise in eco-design, product life cycle assessment, and circular value propositions, such as waste minimization and product-service systems. Another critical competency is regulatory compliance and policy awareness. Professionals must be well-versed in EU and national environmental regulations, including waste management laws, sustainability reporting obligations, and circular economy incentives. Understanding how to align business operations with evolving legal frameworks is crucial for successful circular transition.

Sustainable resource management is a further key area. Knowledge in water and soil conservation, renewable energy integration, and carbon footprint reduction is vital, particularly in olive oil production, which heavily depends on natural resources. This also includes expertise in optimizing material flows and reducing environmental impacts across production stages.

Digital competencies play a growing role. The ability to apply digital tools such as blockchain for traceability, data analytics for sustainability reporting, and IoT for resource efficiency is increasingly in demand. Circular Economy Managers should also be proficient in using digital dashboards to monitor key performance indicators related to sustainability and circularity.

Entrepreneurial and innovation-driven mindsets are necessary to identify new business opportunities arising from circular practices. Professionals need to foster collaboration with stakeholders, integrate circular principles into corporate strategies, and promote cultural change within organizations.

In addition, green marketing and communication skills are becoming essential. Professionals must be able to articulate sustainability efforts transparently, avoiding greenwashing, and effectively engaging consumers and partners through clear and responsible messaging. Finally, supply chain and stakeholder management is crucial.

Coordinating with suppliers, clients, and partners to implement circular economy practices across the value chain requires strong leadership, negotiation skills, and an ability to align diverse actors around shared sustainability goals. These competencies will help professionals not only to implement circular models but also to drive innovation and competitiveness in the Spanish olive oil sector.

3. Guidelines for revising or developing the professional profiles

3.1 Identification/revision of the professional profiles based on ESCO

Based on the analysis of the Spanish olive oil sector and its transition to circular economy practices, two key professional profiles have been identified and aligned with ESCO occupational groups. These profiles address the critical skill gaps and emerging needs in the



sector, particularly in relation to circular business management and deep tech applications.

1. Circular Economy Manager

- ESCO Occupation Group: Sustainability Manager (ESCO Code: 1213.8)
- Spanish NQF Correspondence: EQF Level 6-7, typically aligned with university degrees in Environmental Sciences, Business Management, or Engineering.

This role focuses on designing and implementing circular economy strategies within olive oil businesses. The Circular Economy Manager integrates sustainability principles across the value chain, including eco-design, waste minimization, and circular supply chain management. Key tasks include developing circular business models, ensuring compliance with EU environmental regulations, and optimizing resource efficiency through digital technologies (e.g., blockchain for traceability, data-driven sustainability dashboards). The role also requires an entrepreneurial mindset to identify circular business opportunities and drive cultural change within organizations. Given the context of Spanish SMEs, this professional must adapt circular strategies to local production realities while enhancing competitiveness and regulatory compliance.

2. Waste Valorization Engineer

- ESCO Occupation Group: Waste Treatment Engineer (ESCO Code: 2143.1.4)
- Spanish NQF Correspondence: EQF Level 6-7, generally linked to degrees in Chemical Engineering, Environmental Engineering, or Industrial Process Engineering.
- Also, Spanish NQF Correspondence: Level 5 (EQF Level 5). This profile is proposed at EQF Level 5, corresponding to advanced vocational education (e.g., Técnico Superior) in fields such as Environmental Control, Chemical Processing, or Industrial Maintenance.

The Waste Valorization Engineer is responsible for developing and applying technical solutions to transform by-products and waste streams into valuable products, such as biofuels, organic fertilizers, or new agri-food products. This role demands advanced knowledge in bioeconomy, renewable energy integration, and process engineering, as well as the capacity to implement deep tech innovations (e.g., AI, automation, and IoT) to enhance waste-to-resource processes. Furthermore, this profile requires an understanding of circular bioeconomy principles and expertise in lifecycle assessment, carbon footprint reduction, and circular innovation.

Both profiles are critical to meeting the future skill demands identified in the sector and are essential to bridging the gap between traditional olive oil production practices and advanced circular economy strategies. The combination of managerial and technical expertise will enable the sector to align with EU Green Deal objectives and foster sustainable competitiveness.

3.2 Tailoring profiles to the country's needs

The development of the Circular Economy Manager and Waste Valorization Engineer profiles responds directly to the pressing needs of the Spanish olive oil sector, which is the largest in the world and faces increasing regulatory, environmental, and market challenges.

Spain's olive oil industry generates significant volumes of organic waste—olive pomace, wastewater, and pruning residues—that remain underexploited due to technical and skills-related limitations. The Waste Valorization Engineer profile is particularly relevant for SMEs, which dominate the sector but often lack specialized personnel to develop and implement valorization processes. By focusing this role at NQF Level 5, the sector gains access to



technically trained professionals who can apply practical solutions, such as converting by-products into biofuels, compost, or bioplastics. This contributes to reducing environmental impacts while creating new revenue streams, supporting both circular economy objectives and business competitiveness.

This role could also align with NQF Level 6–7 in cases where more advanced technical and R&D capacities are required. In larger companies or innovation-driven projects, this professional may need to lead the development of complex waste-to-resource technologies, manage pilot projects, or integrate deep-tech solutions (e.g., AI and automation) into valorization processes.

Simultaneously, the role of the Circular Economy Manager is critical to guiding SMEs in adopting circular business models and meeting the growing demand for sustainability from regulators and consumers. In Spain, many olive oil producers still operate under traditional production frameworks, with limited integration of sustainability principles at a strategic level. This role, aligned with higher education qualifications (NQF Level 6–7), ensures the presence of professionals capable of aligning company operations with EU Green Deal targets, implementing digital technologies for supply chain traceability, and improving environmental reporting and compliance.

Additionally, both profiles are crucial to overcoming cultural and structural barriers identified in D2.5, such as the lack of an entrepreneurial mindset within the sector and the perception of circularity as a compliance burden rather than a business opportunity. The introduction of these profiles can help shift business perspectives towards innovation and value creation based on circular economy principles.

In the Spanish context, tailoring these roles also addresses sectoral challenges related to resource scarcity, water stress, and rural depopulation. Empowering SMEs through specialized professionals will support the sustainability transition while generating qualified employment in rural areas, enhancing the resilience and socio-economic development of key olive oil-producing regions.

These profiles are designed to bridge the current gap between traditional agricultural practices and the integration of deep-tech and circular economy innovations essential for the sector's future.

3.3 Key competencies and learning outcomes needed for circular economy roles

Based on the CIRCOLIVE needs analysis conducted in Spain and the ESCO classification, the key competencies and learning outcomes for the Circular Economy Manager and Waste Valorization Engineer profiles have been defined to address the sector's most pressing challenges.

1. Circular Economy Manager (ESCO: Sustainability Manager - 1213.8)

Key Competencies:

- Ability to design and implement circular business strategies in agri-food value chains.
- Advanced knowledge of EU environmental regulations and circular economy policies.
- Proficiency in sustainable supply chain management and resource efficiency.
- Digital skills in data analytics, traceability systems (e.g., blockchain), and sustainability reporting tools.
- Entrepreneurial mindset and innovation management to identify new circular business opportunities.



- Capacity to engage stakeholders and promote a sustainability culture within organizations.
- Expertise in green marketing and communication strategies to avoid greenwashing and effectively position sustainable products in the market.

Learning Outcomes:

- Develop circular business models (eco-design, waste minimization, and extended producer responsibility) tailored to the olive oil sector.
- Apply digital tools to monitor and report sustainability performance.
- Ensure legal compliance with EU and national circular economy regulations.
- Design and implement corporate sustainability strategies aligned with circular economy principles.
- Promote a transition from compliance-driven to opportunity-driven circular practices within SMEs.

These competencies directly address gaps identified in CIRCOLIVE, such as weak regulatory knowledge, lack of digital skills, and limited strategic focus on circularity among olive oil SMEs.

2. Waste Valorization Engineer (ESCO: Waste Treatment Engineer - 2143.1.4)

Key Competencies:

- Technical expertise in waste and by-product valorization processes.
- Knowledge of bio-economy solutions, renewable energy integration, and process optimization.
- Application of deep-tech tools such as automation, AI, and IoT for waste treatment and resource recovery.
- Proficiency in lifecycle assessment and carbon footprint mitigation.
- Understanding of environmental compliance and sustainability certifications.

Learning Outcomes:

- Design and optimize waste valorization systems for the olive oil sector (e.g., production of biofuels, compost, bioplastics).
- Implement advanced technological solutions to improve efficiency in by-product transformation.
- Apply environmental regulations and circular bio-economy principles to valorization projects.
- Collaborate with R&D teams and SMEs to innovate in circular technologies and reduce waste impacts.
- Monitor the environmental and economic performance of valorization processes.

4. Policy and institutional ecosystem supporting professional profile development

The successful implementation and long-term impact of the Circular Economy Manager and Waste Valorization Engineer profiles within the Spanish olive oil sector depend not only on technical relevance but also on institutional integration. Ensuring these profiles are formally recognized and adopted within national and European Qualification Frameworks requires alignment with established policy instruments, regulatory mechanisms, and sectoral governance structures.



Spain possesses a robust Vocational Education and Training (VET) system, underpinned by legal, institutional, and strategic frameworks that are currently being reformed to respond to green and digital transitions. These reforms offer a timely opportunity to embed new professional roles aligned with circular economy objectives and the needs of key productive sectors, such as agri-food and olive oil.

This section outlines how the proposed profiles can be effectively integrated into the Spanish VET and professional qualification ecosystem. It identifies existing pathways and mechanisms for the development and adoption of new qualifications, as well as the institutional actors involved in their recognition, funding, and dissemination. The aim is to provide a roadmap for the formalization and scaling-up of these profiles, ensuring their sustainability beyond the project lifetime and fostering a long-term transformation of the sector's skills base.

4.1 National VET systems and sectoral frameworks in Spain

The Spanish Vocational Education and Training (VET) system operates under the joint responsibility of the Ministry of Education, Vocational Training and Sports (MEFD) and the Ministry of Labour and Social Economy, with strong coordination with regional governments (Autonomous Communities). It comprises both initial vocational training (within the formal education system) and continuing vocational training (lifelong learning), and is governed by Organic Law 3/2022 on the Organization and Integration of Vocational Training.

This law provides the legal framework to modernize VET in Spain, emphasizing flexibility, modularization, and a dual system model that integrates workplace learning. It also facilitates the design of training programs aligned with national qualifications and labor market needs, through mechanisms such as the National Catalogue of Professional Qualifications (CNCP) and the State Public Employment Service (SEPE).

In the agri-food sector, including olive oil production, the relevant professional families are:

- Agrarian (Agraria) – encompassing training for farming, agro-industrial production, and environmental sustainability.
- Chemical Industry (Química) – relevant for profiles involved in waste valorization and processing.
- Energy and Water (Energía y Agua) – touching upon resource management, renewable energy, and sustainability.
- Installation and Maintenance (Instalación y Mantenimiento) – for roles involving industrial automation and process control.
- Business Administration and Marketing (Administración y Gestión / Comercio y Marketing) – especially important for circular economy management, entrepreneurship, and green marketing.

Spain's sectoral frameworks also include sectoral observatories, training clusters, and cooperation with industry associations such as INFAOLIVA, ASOLIVA, and Interprofesional del Aceite de Oliva Español, which contribute to identifying future skills needs and aligning training with innovation priorities.

Additionally, Spain participates in EU programs and frameworks such as Erasmus+, ESF+, and the Recovery and Resilience Facility (RRF), which provide funding for skills development aligned with green and digital transitions.

The CIRCOLIVE professional profiles align with:



- Spain's National Strategy for Vocational Training (2022–2025), which promotes green and digital skills.
- Spain's Circular Economy Strategy (España Circular 2030), which explicitly calls for new skills in circular business models and bioeconomy.
- The Green Skills Pact and ESCO classification, facilitating EU-wide recognition and mobility.

4.2. Pathway for adoption of a new professional profile in Spain

The integration of new professional profiles within the Spanish VET and qualification system follows a structured, multi-stakeholder process coordinated by Instituto Nacional de las Cualificaciones (INCUAL), under the MEFD. The process ensures that emerging labor market needs are reflected in national qualifications and training programs. The adoption pathway includes the following key steps:

1. Needs Identification and Evidence Collection

- Conduct sectoral analysis and stakeholder consultations (e.g., CIRCOLIVE studies).
- Generate quantitative and qualitative data on skill gaps and future needs (e.g., digital, circular, green).
- Align findings with national and EU strategic priorities (e.g., Green Deal, Digital Agenda, Circular Economy Action Plan).

2. Proposal to INCUAL and Sectoral Reference Groups

- Submit a formal request for the creation or revision of a professional qualification to INCUAL.
- Collaborate with sectoral working groups composed of experts from education, industry, and regional authorities.
- Define the professional profile, key competencies, and learning outcomes using National Catalogue of Professional Qualifications (CNCP) methodology.

3. Validation and Approval

- The proposed qualification goes through technical validation, followed by approval by the General Council on Vocational Training (CGFP).
- The new qualification is published in the Official State Gazette (BOE) and integrated into the CNCP.
- The relevant VET curricula are then developed by educational authorities at the national or regional level.

4. Integration into Training Offer

- Regional education and employment services (Consejerías) implement the new qualification in VET centres or continuing training institutions.
- Training pathways may include initial VET (FP Grado Medio or Superior), Dual VET, or adult/continuing education.



- Professional certification (Certificados de Profesionalidad) can be offered through SEPE for modular, employment-oriented training.

5. Uptake by Industry and Institutions

- Collaborate with sectoral organizations, business associations, and clusters to promote uptake among SMEs.
- Include new profiles in employment databases and public job classifications.
- Use public funding instruments (e.g., ESF+, RRF) to support pilot training programs and capacity-building initiatives.

6. Continuous Monitoring and Update

- Establish mechanisms for monitoring outcomes, labor insertion rates, and training quality.
- Update the professional profile periodically in response to evolving technological and regulatory changes.

This adoption pathway ensures that the Circular Economy Manager and Waste Valorization Engineer profiles can be institutionalized within the Spanish VET and lifelong learning system, guaranteeing alignment with labor market needs and national sustainability goals.

5. Conclusions

The transition of the Spanish olive oil sector towards a circular economy is both a necessity and an opportunity. The analysis presented in this document, based on the CIRCOLIVE project's research, confirms that the sector faces significant skill gaps in circular business management, waste valorization, and the application of digital and deep-tech solutions. These gaps, particularly acute among SMEs, are limiting the sector's capacity to comply with evolving EU regulations and to capitalize on new market opportunities linked to sustainability and resource efficiency.

The identification of the Circular Economy Manager and Waste Valorization Engineer as two key professional profiles for Spain is a direct response to these needs. The Circular Economy Manager will play a crucial role in helping companies design and implement sustainable business models, integrate circular practices across the value chain, and adopt digital tools for traceability and performance monitoring. Meanwhile, the Waste Valorization Engineer will bring technical expertise to optimize the transformation of by-products, supporting the sector's move towards zero-waste and bio-economy strategies.

Piloting these two profiles is essential to closing the current skills gap identified in the Spanish olive oil sector. By developing targeted training programs aligned with ESCO standards and adapted to the national context (MECU Levels 5 to 7), we can foster a new generation of professionals equipped with the competencies required for the sector's circular transition. These training programmes will directly contribute to enhancing the competitiveness of SMEs, supporting innovation in waste valorization, and aligning production practices with the European Green Deal and the Circular Economy Action Plan.

Moreover, piloting these profiles will serve as a testing ground for validating the effectiveness of the training pathways, ensuring they address real sectoral challenges and are tailored to the specific needs of Spanish olive oil producers. Successful implementation will also support regional development, particularly in rural areas where the olive oil industry is a key economic



driver.

Ultimately, these professional profiles and the associated training programmes will help create a more resilient, sustainable, and innovative olive oil sector in Spain, reinforcing the industry's leadership position at the global level while advancing its environmental and socio-economic performance.

6. Appendices/references/sources

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VET SYSTEM IN CROATIA

1. Overview of the VET system

The education system in Croatia includes 4 types of education: preschool education, primary education, secondary education and higher education. The types of schools that can be attended in Croatia depend on the type of curriculum and include: gymnasiums, vocational and art schools (ASOO, 2025). In addition to regular education, part of the education system in Croatia is also adult education, which includes adult learning processes intended for education for better employability and personal development of individuals (MZOM, 2025). The Agency for Adult Education was established in 2004 and in 2007 the Adult Education Act (AEA) was passed (AEA, NN 17/07). Today, the planning, development, organization, implementation, monitoring and improvement of adult education are under the jurisdiction of the Agency for Vocational Education and Training and Adult Education (<https://www.asoo.hr/en/>).

The Adult Education Act (AEA, NN 144/21) regulates formal education that is carried out in institutions that have a registered adult education activity. Institutions that implement adult education programs must meet certain conditions:

- Conditions prescribed by standards and norms for the implementation of education programs;
- Material and personnel conditions for the implementation of educational programs that are determined by the educational program adopted by the institution;
- Technical, health and environmental conditions (MZOM, 2025).

Adult education can be carried out in 3 ways: in the form of formal, non-formal and informal learning (AEA, NN 144/21). Formal learning includes the organized implementation of approved educational programs for the purpose of acquiring and improving competencies and is evidenced by a certificate, diploma or other public document, while non-formal learning includes the implementation of informal educational programs that are not evidenced by a public document. Informal learning denotes an unorganized activity of acquiring competencies from everyday experiences for personal, social and professional needs (The Croatian Qualifications Framework Act, NN 20/21).

In the context of VET study programs in Croatia, several public open universities offer programs for olive growers but there is no specialized programs for circular economy in olive sector. At two universities within the framework of professional undergraduate studies and at three universities within the framework of undergraduate and graduate studies, there are courses that could deal with topics from the circular economy in the olive sector, and there is potential for the establishment of new study programs that would have courses dedicated to the sustainable management of residues from olive production and circular economy.

Croatian Employment services also offer vouchers for the acquisition of micro-qualifications and partial qualifications from various sectors, partially co-financed by the Croatian Employment Service and EU Funds. The beneficiary chooses one of the offered educational programs and the education provider. In case that the cost of the education program is higher than the amount of the voucher, the difference in the amount is settled by the beneficiary or employer. Education programs can last up to 12 months (CES, 2025).

The entire system of qualifications at all educational levels in the Croatia is regulated by the Croatian Qualifications Framework – CROQF (<https://www.kvalifikacije.hr/en/register-cqf>)



through qualification standards based on learning outcomes and aligned with the needs of the labor market, the individual and society as a whole (CROQF, 2025). The CROQF also enables the linking of qualification levels in Croatia with the qualification levels of the European Qualifications Framework (<https://europass.europa.eu/en/europass-digital-tools/european-qualifications-framework>).

2. National skills gaps and needs in professional profiles

2.1. Analysis of existing profiles and identified gaps in professional profiles

Occupations that participated in CIRCOLIVE research (D 2.3 - Deliverable 2.3 of this project) from the Croatian olive oil sector represent diverse professions such as agricultural production managers, agronomists, and sales and marketing managers. The lowest representation included researchers, scientists, and oil mill operators. Additionally, agronomists, quality control managers, and higher education professors contributed insights on vocational education and training (VET).

Based on the research results (D2.3), the primary barriers to transitioning to circular economy include financial constraints limiting investments in infrastructure and technologies. Additionally, respondents emphasized the need for stronger regulatory incentives. Half of the participants identified low market demand for sustainable products as a major challenge. Other gaps include limited knowledge of circular economy principles, insufficient understanding of renewable energy technologies, inadequate marketing and communication skills, and a lack of innovation and technical expertise for sustainable production.

Interestingly, respondents did not view a lack of entrepreneurial mindset as a limitation, indicating their readiness to innovate. Digital skills were also not seen as a significant barrier. Instead, experts highlighted financial constraints as the primary obstacle, preventing investments in sustainable solutions like solar panels and wastewater processing technologies.

2.2. Key competencies required for circular business management/circular economy

The key competences required for circular economy roles in the Croatian olive oil sector according to the research (D 2.3) focus on sustainability, environmental protection, and resource optimization. The most important skills identified by respondents include “Waste and by-product management” and “Organic farming and pest control techniques.” Additionally, “Knowledge of sustainable farming practices,” “Energy efficiency in production,” and “Supply chain management” were widely considered essential.

Over 90% of professionals in the sector (D2.3) regard “By-product and waste management” as the most critical skill for their company’s future success. Other essential competencies include “Sustainable product production”, “Renewable energy integration”, and “Green marketing”. However, skills such as “Product data management and digitalization,” “Life cycle assessment of resources,” and “Implementation of marketing strategies” were considered important by only 20% of respondents.

Interviewed experts in the agri-food sector and VET providers (D2.3) emphasized that the future success of companies will depend on adopting renewable energy sources, waste management, sustainable product production, and an entrepreneurial mindset. While digital skills were not rated as highly important by many respondents, all interviewed experts and



VET providers acknowledged their significance in advancing the circular economy. The divergence in opinions may be due to the traditional nature of olive production in Croatia, where digital technologies are not yet widely integrated, despite their potential benefits in efficiency and business optimization.

During CIRCOLIVE research (D2.3), circular economy skills were primarily recognized as crucial for roles related to sustainability, waste disposal, and environmental protection. In contrast, technical occupations such as product development engineering drafter and food technician were perceived as less relevant in this context. Overall, the emphasis remains on waste management, sustainable production, and renewable energy, while the potential of digital technologies is yet to be fully acknowledged.

3. Guidelines for revising or developing the professional profiles

3.1 Identification/revision of the professional profiles based on ESCO

The identification and revision of professional profiles based on the ESCO classification (D2.3) highlight the importance of circular economy skills across various occupations. According to survey results, respondents strongly agreed that roles such as “Recycling specialist”, “Sustainability manager”, “Environmental engineer”, and “Alternative fuels engineer” require circular economy skills. However, nearly half of respondents disagreed that these skills are necessary for “Product development engineering drafter,” and 40% shared the same opinion for “Food technician.”

In addition to ESCO-designated roles, experts in the Croatian olive oil sector (D2.3) identified other key occupations that require circular economy skills. These include “Agronomist”, “Agricultural production manager”, “Oil mill operator”, “Quality control and safety officer”, and “Researcher and scientist”. Opinions were divided on whether “Packaging production manager,” “Sales and marketing manager,” and “Logistics and supply chain manager” should also possess these skills.

Interviews with agri-food sector experts and VET providers (D2.3) reinforced the importance of circular economy knowledge for agronomists, production managers, family farm owners, quality control officers, researchers, and oil mill operators. One expert emphasized the need for both agronomic and economic education to implement circular economy practices effectively. Another noted that all participants in the agri-food chain should understand circular economy principles for sustainable resource management.

Regarding future professional profiles, 80% of respondents (D2.3) identified “Waste valorization engineers” as key, followed by “Renewable energy specialists”. However, “Sustainability consultants” were undervalued despite their recognized importance by interviewed experts. This suggests a sectoral focus on technical solutions while overlooking the role of advisory services and strategic planning, indicating a need for greater awareness of their value.

3.2 Tailoring profiles to the country needs

Agronomist is the occupation that respondents (D2.3 – Croatia) consider the most in need of circular economy skills. Agronomists with circular economy skills are crucial for sustainable agricultural practices in Croatia. As experts in soil management, crop production, and sustainable farming techniques, agronomists play a key role in optimizing resource use, minimizing waste, and ensuring environmentally friendly agricultural methods. Their expertise



is particularly relevant in promoting regenerative farming practices, water conservation strategies, and the responsible use of fertilizers and pesticides, all of which contribute to the circular economy framework in Croatia's olive oil sector. Given the Croatia's reliance on agriculture, particularly the olive oil sector, waste management and renewable energy solutions are crucial for improving efficiency and reducing environmental impact.

Waste valorization engineers play a critical role in transforming agricultural by-products into valuable resources. In the olive oil sector, waste such as olive pomace and wastewater can be repurposed for biofuel production, composting, or other sustainable applications. Their expertise is essential in creating circular value chains that minimize waste and maximize resource efficiency.

Renewable energy specialists are equally important, as Croatia continues to invest in sustainable energy sources. In the olive oil industry, integrating solar power, biomass energy, and other renewable solutions can reduce reliance on non-renewable resources, lower production costs, and enhance sustainability. The expertise of renewable energy specialists is vital for implementing innovative energy solutions that align with national and EU sustainability goals.

The increasing recognition of these professional profiles underscores the need for targeted education and policy support to encourage their integration into the olive oil sector and broader agri-food industry.

3.3 Key competencies and learning outcomes needed for circular economy roles

The survey conducted for the CIRCOLIVE project (D2.3) highlights the essential skills required for the olive oil sector to transition to circular economy. The most critical competence, recognized by 94% of professionals, is “by-product and waste management”. Other key skills include “sustainable product production”, “renewable energy integration”, and “green marketing”, while digital skills and marketing strategies were considered less critical by respondents.

Experts from the agri-food sector and vocational education and training (VET) providers (D2.3) emphasized that future success in the industry will be influenced by expertise in renewable energy, waste management, sustainable production, and an entrepreneurial mindset. In selecting competencies for emerging professions, knowledge of waste and by-product valorization and renewable energy technology expertise were identified as priorities. However, digital and data analytics skills were rated as least important, indicating a sector-wide focus on practical resource management rather than technological innovations.

To strengthen the circular economy transition, targeted education and training programs must prioritize waste valorization, renewable energy expertise, and sustainable resource management, while also raising awareness of the benefits of digital skills and innovative technologies for long-term sector modernization.

1. Waste and by-product management

Knowledge and skills of waste and by-product valorization are essential for the transition of olive oil sector in Croatia to circular economy. Practices such as recycling, composting, valorising wastewater, olive pomace, pits, branches, etc. can help reduce environmental impact and add value to waste materials.

Learning outcomes: Application of different methods of waste reduction, reuse, recycling and treatment in agricultural systems, Knowledge of turning waste into valuable resources (bioenergy, compost, etc.)

2. Sustainable product production



Professionals in circular economy need the knowledge of managing agricultural production in a way that minimizes environmental impact, ensures resource efficiency and promotes sustainable development.

Learning outcomes: Development and application of sustainable agriculture plans in production systems, integration of environmental protection measures in production systems.

3. Renewable energy integration

Knowledge and skills to incorporate renewable energy technologies such as solar, wind, biomass, and biogas into agricultural operations to improve energy efficiency and reduce carbon footprint are essential for circular economy practices.

Learning outcomes: Identification of renewable energy sources suitable for agricultural use, evaluation of renewable energy solutions feasibility in farming systems, understanding of policies and regulations related to renewable energy in agriculture.

4. Data analytics and digitalization for sustainable agriculture

Skills and knowledge in using digital tools, precision agriculture technologies, and data analysis to improve decision-making, optimize resource use, and enhance sustainability in agriculture.

Learning outcomes: Application of digital tools (e.g. IoT, sensors, drones...) for data collection in agriculture, analysis and interpretation of data.

5. Regenerative and holistic agricultural planning

The ability to design agricultural systems that regenerate soil, biodiversity, and ecosystems while considering social, economic, and environmental dimensions of farming.

Learning outcomes: Development and application of plans that enhance biodiversity and soil health, integration of holistic approaches to farm management, evaluation of long-term impact of regenerative practices on farm sustainability.

4. Policy and institutional ecosystem supporting professional profile development

In order to ensure the sustainability and long-term impact of the professional profiles and training pathways developed under the CIRCOLIVE project in Croatia, it is essential to align them with national legislation and strategic priorities, as well as with relevant EU policy frameworks. This chapter emphasizes the policy, institutional, and regulatory framework that supports the structured development, adoption, and implementation of professional profiles in the context of the Croatian vocational education and training (VET) system.

4.1 National VET systems and sectoral frameworks in Croatia

The VET system in Croatia encompasses a range of educational programs leading to the attainment of lower and secondary vocational qualifications. Upon completion of these programs, participants acquire qualifications of a defined level, profile, and quality, certified through an official public document or certificate of acquired competences. This system equips individuals with the specific knowledge and skills required by the labour market and constitutes a key component of the Croatian education framework (<https://www.asoo.hr/obrazovanje/strukovno-obrazovanje/opis-sustava-strukovnog-obrazovanja-i-osposobljavanja/>).



Adult education and training in Croatia (for individuals aged 15 and above) includes a wide array of options, primarily in the form of short (re)training programs. These range from basic or technical skills courses to comprehensive formal secondary education and training. Admission requirements for post-secondary adult VET programs typically include relevant initial vocational education and training and/or several years of professional experience (<https://www.asoo.hr/obrazovanje/obrazovanje-odraslih/>).

Based on research conducted within the CIRCOLIVE project, the development of a professional profile in Croatia requires the involvement of the following institutions:

- An authorized education provider, which must propose a training or advanced training program for the professional profile in question;
- The Agency for Vocational Education and Training and Adult Education, which must issue a positive expert opinion on the proposed professional profile development program;
- The competent state administration body and/or the Ministry of Science and Education which must approve the proposed professional profile development program.

4.2. Pathway for adoption of a new professional profile in Croatia

The legislative procedure for establishing a new professional profile in Croatia is based on the Croatian Qualifications Framework (CROQF), which aligns national qualifications with the levels defined in the European Qualifications Framework (EQF) and the Qualifications Framework of the European Higher Education Area (QF-EHEA). The CROQF Register serves as the central repository of approved occupational standards, qualification standards, and sets of learning outcomes, organized into corresponding sub-registers. Proposals for occupational and qualification standards must follow a defined procedure to be registered in the CROQF Register.

If labour market analysis indicates the need for a new professional profile, an authorized education provider may submit a proposal for the development of the profile and an associated training program. The proposing institution must demonstrate compliance with all material and personnel requirements necessary for program implementation and ensure alignment with the CROQF and EQF.

Key elements in the development of an education and training program include:

- Occupational standard: A document listing key job roles within a specific occupation, along with the competencies required to perform them, grouped into logical units or sets of competencies. The development of occupational standards initiates the process of educational program development and ensures alignment with labour market needs. Market research is conducted using prescribed tools (e.g., labour market or employer surveys, databases), and the resulting key jobs and competencies are agreed upon through employer and employee consensus.
- Qualification standard: A document defining the structure of a specific qualification, based on learning outcomes grouped into logical sets. The qualification standard includes information necessary to determine the qualification's level, scope, and profile, along with data for quality assurance and improvement.
- Set of learning outcomes: A logically grouped set of related learning outcomes of the same level, scope, and profile, forming an integral part of every qualification standard.



Each set typically contains 4 to 10 learning outcomes and is defined by a title that reflects the competencies acquired upon successful completion. Learning outcomes represent the knowledge, skills, and competences gained and demonstrated through the learning process.

- VET curriculum: The final phase involves the development of a VET curriculum that outlines the content to be taught in order to achieve the defined learning outcomes. It must be based on the qualification standard and aligned with the occupational standard. Proposed vocational curricula must comply with the National Curriculum for VET and relevant sectoral curricula.

If no qualification or occupational standard exists for the proposed qualification, the institution may initiate the development of such standards in line with CROQF Act (CROQF Act, NN, No. 20,2021) and, upon their registration in the CROQF Register, develop a program based on them. Alternatively, sets of learning outcomes may be drawn from existing qualification standards already registered. If the institution plans to propose a program for acquiring learning outcomes not currently included in any qualification standard, it may develop new sets of learning outcomes based on the competencies or key tasks described in the occupational standard.

Once the proposed education and training program is approved by the competent authorities, depending on its type, it can be registered in the CROQF Register. Following a positive evaluation and the registration of the qualification standard or sets of learning outcomes, the institution may proceed with the development of an education program based on the approved qualification standard or learning outcome sets.

5. Conclusions

The transition to circular economy in Croatia's olive oil sector is hindered by financial constraints, regulatory challenges, and low market demand for sustainable products. While key competencies such as waste and by-product management, sustainable farming, and renewable energy integration are recognized as essential, there is still a lack of focus on digital skills and advisory roles. To address these gaps, piloting two new professional profiles - Waste Valorization Engineers, Renewable Energy Specialists, is crucial for driving sustainable transformation in the sector.

Waste Valorization Engineers - These professionals specialize in transforming agricultural by-products into valuable resources. In the olive oil sector, they play a crucial role in repurposing waste such as olive pomace and wastewater into biofuels, compost, or other sustainable applications. Their expertise is essential for creating circular value chains that minimize waste, optimize resource efficiency, and align with sustainability goals. Given Croatia's strong reliance on agriculture, waste valorization engineers can significantly improve environmental sustainability while unlocking economic potential in agricultural waste streams.

Renewable Energy Specialists - As Croatia continues investing in sustainable energy solutions, this occupation is key to integrating alternative energy sources into the olive oil production process. Their role includes implementing solar power, biomass energy, and other renewable solutions to reduce reliance on non-renewable resources, lower production costs, and enhance overall sustainability. By facilitating the adoption of clean energy, these specialists help companies meet EU regulations on carbon footprint reduction while improving long-term energy efficiency and cost savings.

Revision of the occupation agronomist - Agronomists equipped with circular economy expertise are essential for promoting sustainable agricultural practices. Their knowledge of



soil management, water conservation, regenerative farming, and responsible pesticide use helps optimize resource use while minimizing environmental impact. In the olive oil sector, agronomists contribute by implementing strategies that reduce waste, improve productivity, and ensure long-term sustainability. Their expertise is particularly valuable in developing farming practices that align with circular economy principles.

Relevant training programs should focus on waste valorization, renewable energy technologies, and sustainable production to equip professionals with the necessary expertise. Vocational education and training should prioritize hands-on resource management skills, as well as, digital and marketing competencies. Strengthening these areas will support Croatia's circular economy goals and enhance sustainability in the olive oil industry.

6. Appendices/references/sources

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VET SYSTEM IN PORTUGAL

1. Overview of the VET system

The Vocational Education and Training (VET) system in Portugal is aligned with European guidelines in this area, namely the European Qualifications Framework (EQF) and the principles of Lifelong Learning. This system aims to provide an effective response to the needs of the labour market, while promoting social inclusion, population qualification and economic competitiveness.

Portugal has adopted the National Qualifications Framework (NQF) with 8 levels of training, in line with the EQF. In Portugal, vocational training is regulated by the Ministry of Labour, Solidarity and Social Security and supervised by the Institute for Employment and Vocational Training (Instituto do Emprego e Formação Profissional [IEFP], n.d.).

It should be noted that Portugal's General Education and Training System is structured as follows:

A. **Elementary School** (compulsory) - consisting of 9 years (from 6 to 14/15 years of age) and is subdivided into 3 Cycles:

i. **1st Cycle**: pupils from 5/6 years old to 9/10 years old;

ii. **2nd Cycle**: students from 9/10 to 11/12 years old. This 2nd cycle of studies, equivalent to the 5th and 6th year of schooling, gives students the 1st qualification level of the National Qualifications Framework (QNQ);

iii. **3rd Cycle**: students aged 11/12 to 14/15. This 3rd cycle of studies, equivalent to the 7th, 8th and 9th year of schooling, gives students a 2nd NQF qualification in general education, or via dual certification pathways, i.e. within the scope of vocational education and training (VET);

B. **Secondary education** (compulsory) - consisting of 3 years (from the age of 14/15 to 17/18), equivalent to the 10th, 11th and 12th year of schooling. Secondary education confers the 3rd level of qualification of the NQF in general education, aimed at pursuing studies at a higher level. In the case of secondary education obtained through dual certification programmes, i.e. within the scope of the EPF, level 4 of the NQF qualification is awarded;

C. **Post-secondary education** - comprising 2 years, corresponds to Professional Higher Technical Courses, conferring the 5th level of qualification of the NQF;

D. **Higher Education**, corresponding to Licenciatura (6th level of qualification in the NQF), Masters (7th level of qualification in the NQF), and Doctorate (8th level of qualification in the NQF).

Compulsory education in Portugal thus covers the 5/6 to 17/18 age group, or until completion a 3rd or 4th level from the NQF.

In secondary education, young people can choose between different training programmes, depending on their interests and goals:

1. **Scientific-Humanistic Courses** - allow access to higher education and are aimed for students who wish to pursue university or polytechnic studies. These courses can take place in areas such as Science and Technology; Socio-economic Sciences; Languages and Humanities; and Visual Arts;



2. **Vocational Courses** - these are initial training courses and allow students to move into the labour market and/or continue their studies. They are aimed for students who are more geared towards a practical component and integration into working life. These courses confer dual certification (school and professional), level 4 of the NQF;

3. **Specialised Artistic Courses and Recurrent Education** - these are initial training courses that allow students to join the labour market and pursue further studies. They are aimed for students who are more orientated towards a practical component and integration into working life. These courses confer dual certification (school and professional), level 2 and level 4 of the NQF;

4. **Courses run by the entity Turismo de Portugal: Hotel and Catering; Tourism and Leisure** - these are initial training courses administered by Portuguese schools of hospitality and tourism run by Turismo de Portugal, a public institute, and allow students to enter the labour market and/or continue their studies. These courses confer dual certification (school and professional), level 4 of the NQF.

We should also mention the possibility of completing compulsory education in Portugal through different types of dual certification courses - VET:

- **Learning courses** - aimed at young people between the ages of 15 and 25, with only the 9th year of schooling; awarded level 2 of the NQF, with a duration of between 2 and 3 years, conferring double school and professional certification, level 4 of the NQF. These courses are run by centres of the Institute for Employment and Vocational Training; sectoral vocational training centres and certified entities;
- **Youth Education and Training Courses (CEF)** - aimed for young people at risk of dropping out school, with the purpose of completing compulsory education and obtaining a professional qualification; Cursos de Educação e Formação para adultos;
- **(EFA)** - aimed for adults who have not completed compulsory schooling, or who wish to obtain professional certification, they are carried out by Centres of the Institute of Employment and Professional Training; Qualifica Centres; professional schools and Training Centres.

Therefore, there are several types of vocational education and training in the National Qualifications System, having previously presented the types that provide the minimum compulsory education in Portugal, i.e. Vocational Courses; Specialised Artistic Courses; Hotel and Catering and Tourism and Leisure Courses run by Turismo de Portugal; Learning Courses; Education and Training Courses for Young People and Education and Training Courses for Adults (Direção-Geral do Emprego e das Relações de Trabalho [DGERT], n.d.).

In the transition from compulsory education there is the possibility, as we have seen, of embarking on **Professional Superior Technical Courses** at Polytechnic Institutes, Superior Schools and Universities. In Portugal, some superior education institutions offer this type of course for the agricultural sector, e.g., a professional superior technical course in Agricultural Production and a professional superior technical course in Agricultural Management at the Polytechnic Institute of Bragança, as well as a course for the olive sector, e.g., a professional superior technical course in Oliviculture, Olive Oil and Table Olives at the Polytechnic Institute of Beja, Report D2.1 (CIRCOLIVE - 2.1 National Report on current situation - Portugal, 2024).

It is also important to mention 3 additional types of vocational education and training:

- **Modular Training** - consists of training units whose duration varies between 25h and 600h, and are integrated into the framework of continuous training and included in the National Qualifications Catalogue (CNR). They enable skills to be acquired in order to obtain professional qualifications and can lead to school / academic qualifications;



- **Micro-credentials** - these are short courses that can be taken face-to-face, online or blended. They enable you to update your skills and certify learning outcomes;
- **Action training** - consists of continuous training aimed at companies and based on the provision of integrated training and consultancy services;
- **Other Training Activities** - consists of initial and ongoing training activities carried out by companies as part of innovation, modernisation and business conversion processes, as well as those aimed at modernising public administration.

In the context of the training needs of the olive oil sector identified in Report D2.1 (CIRCOLIVE - 2.1 National Report on current situation - Portugal, 2024) and the current and future skill levels identified in Report D2.3 (CIRCOLIVE - D2. 3 National Report on the current and future skill levels for transition of the olive oil sector to circular economy - Portugal, 2025), it is imperative to focus simultaneously on training new professionals to adopt circular economy in the olive sector, particularly young people, in order to enhance their future employability, and on strengthening and updating the knowledge of professionals already working in the sector. In this regard, it is suggested that new vocational courses be created in secondary schools and vocational schools, with a level of 4 on the National Qualification Framework, enabling the completion of compulsory schooling, and that more Superior Vocational Technical Courses be created in Polytechnic Institutes, with a level of 5 on the NQF, aimed directly at circular economy in the olive sector. In addition, there should be greater investment in the creation of Modular Training and Micro-credentials, particularly in the management of olive oil waste and by-products, particularly in Superior education.

In addition, there is a need to create more Action Training and Other Training, in training centres and certified entities, with a view to lifelong learning. No less important, it should be understood, is the creation of more training responses at superior education level, generating more knowledge and bringing more innovation to the olive sector through new licenciatura's, master's and doctoral degrees.

2. National skills gaps and needs in professional profiles

2.1. Analysis of existing profiles and identified gaps in professional profiles

The most common professional profiles in the olive oil sector in Portugal are: Agricultural Production Manager and Agronomist and/or Olive Mill Operator.

Despite the lack of specialised professionals in circular economy, there has been a great effort from the sector to implement some circular and sustainable practices and, for this reason, most of the respondents, representative of the olive oil sector, answered that they consider they have good skills and knowledge about circular economy, or acceptable skills, as well as knowledge about circular economy. The skills they consider to be the most likely to contribute to the sector's transition are: knowledge of how to recover waste and by-products and specialised knowledge of sustainable resource management.

Despite the previous indication from the respondents to the questionnaire and interviews with experts in the olive oil agri-food sector, they also identified the following skills gaps in professional profiles: limited knowledge of circular economy principles, i.e., a number of professionals in the sector do not have a fundamental understanding of how to carry out the transition from linear to circular production models; lack of technical skills for sustainable product methods; shortage of marketing and communication skills related to sustainability; lack of regulatory incentives.



As part of the interviews carried out with agri-food specialists and professionals in circular businesses, financial constraints stood out as the main barrier to the transition to the circular economy as well as limited funding opportunities with regard to sustainable technology investment, especially for micro and small companies. Deep tech adoption remains limited, with few specialists in AI, blockchain, or smart farming technologies. The sector lacks agricultural data analysts and experts in digital agriculture exist mainly in big enterprises. Both of these professional profiles are essential for optimizing resource use and implementing predictive analytics.

In addition, there is insufficient demand for sustainable products on the market, as well as poor collaboration between academia and companies in the sector.

To fill these gaps, it is necessary to provide specific training in sustainable soil management, carbon capture, water recycling, innovation in bio-based products and digitalisation in micro and small businesses. Without these skills, Portugal's olive sector risks falling behind in economic resilience, regulatory compliance and long-term sustainability.

2.2. Key competencies required for circular business management/circular economy

The competences considered critical for the sector's transition to circular economy, as identified by MSMEs in the olive oil sector, are the following: By-product and waste management, particularly with regard to the olive pomace processing, which is growing in volume in the southern region of the country, in Alentejo; Knowledge of water and soil protection, essential to guarantee agricultural sustainability; Digital skills, namely in the storage and processing of big data, the use of artificial intelligence programmes and the adoption of blockchain, Intelligence of Things and precision agriculture; Produce sustainable products and energy efficiency in production, which is of great importance given the need to reduce carbon footprint.

It should also be pointed out that the interviewed experts/professionals in the agri-food sector referred the fact that the various skills indicated were interconnected, adding the importance of the following key skills for the circular economy: Knowledge of organic farming techniques and pest control; Renewable energy integration; Green marketing; Development and coordination of waste management processes; Entrepreneurial mindset. They also emphasised the importance of promoting general technical literacy and the creation of a simple code of good practices in circular economy, accessible to the various interlocutors in the sector and structured at different levels, in order to impact the vast majority of Portuguese producers.

From the interviews conducted with VET providers, it became evident that it is important to invest in skills relating to understanding environmental policies and ensuring compliance with them, as there is currently greater valorisation of the sector's waste and by-products, as well as the need for access to sustainability incentives.

On the other hand, the following competences have been identified as less relevant to the sector's transition: Life cycle assessment of resources, digital marketing skills planning; and new food product development.



3. Guidelines for revising or developing the professional profiles

3.1 Identification/revision of the professional profiles based on ESCO

Portugal's olive sector has been making remarkable progress in adopting sustainable practices, but its full transition to the circular economy is still limited by existing skill levels. While many professionals are familiar with basic waste management, water efficiency and environmental compliance, there is still a lack of specialised knowledge in waste recovery, renewable energy integration and precision agriculture.

According to questionnaire respondents, MSMEs in the olive oil sector, several professional profiles should therefore be reviewed and acquire competences in the circular economy, among them, "Agronomist", "Agricultural production manager", "Agricultural labourer", "Oil mill operator", "Quality control and safety officer", "Logistics and supply chain manager", and "Sustainability manager". It was also highlighted additional occupations not provided in the questionnaire, such as financial managers, political managers and decision-makers.

From Experts/professionals in agri-food sector point of view, an official olive oil specialist role should also be provided, as well as a master olive presser, which already exists in the Spanish olive sector.

During the interviews conducted with VET providers, it became evident that the profession of "Environmental engineer" should also be reviewed, as they need to have skills in the field of circularity, particularly in terms of knowledge to control environmental impacts and collaborate in the implementation of more efficient circular processes. The "Sales and marketing manager" profession is also identified as fundamental in conveying a positive message about the company's products, emphasising the concern for circularity in their activity, i.e. using technologies that generate less waste, proper waste treatment and concern for avoiding environmental contamination. These professionals, who would be ambassadors for a sector that aims to be greener and more circular, would help to generate some kind of pressure on competitor companies that are more polluting.

Additionally, several respondents expressed uncertainty about the following occupations: "Food technologist", "Alternative fuels engineer" and "Food technician".

Taking these aspects in consideration, and the fact that the majority of companies in Portugal's olive sector are micro and small enterprises, it is important, in Portugal's context, to start by improving two existing professional profiles, i.e. "Agricultural Production Manager", and "Agronomist/ Olive Mill Operator".

Nevertheless, to fully embrace circularity, the sector must also strengthen skills in by-product processing, soil regeneration, carbon capture and sustainable management of production factors. A deeper understanding of closed circuit production systems and eco-innovation is essential to ensure long-term economic viability, resource efficiency and environmental management in olive growing and processing. Therefore, it is also important to develop three other professional profiles: "Olive By-Products and Circular Economy Manager"; "Specialist in Regenerative Agriculture applied to Olive Groves"; "Technician in and Monitoring of Olive Groves (AgriTech)".

This perspective is corroborated by questionnaire respondents, experts/professionals in agri-food sector, and VET providers interviewed, who recognised mostly "Waste valorization engineers", "Circular economy managers", and "renewable energy specialists" as the emerging occupations in the olive oil sector for the transition to circular economy.



However, some experts/professionals in the agri-food sector are clearly concerned that there are not enough companies in Portugal to justify hiring professionals from various emerging professions, thus limiting them professionally in terms of labour supply. For this reason, they reiterate the need to incorporate circular economy in the olive sector into existing vocational and/or higher education courses.

3.2 Tailoring profiles to the country's needs

Portugal has become one of the main olive oil producers in Europe, with a strong concentration in the south of the country, in Alentejo region, as a result of the expansion of intensive and super-intensive olive groves. This expansion has brought productivity gains, but also new environmental, social and technological challenges, requiring more qualified, multidisciplinary professionals orientated towards sustainable and circular innovation. Therefore, the following are the reasons why it is considered necessary to review 2 existing professional profiles in the olive sector:

Agricultural Production Managers - the majority of intensive olive farms in Portugal depend heavily on the efficient management of natural resources, namely water and soil, and the integration of digital technologies, yet many managers still have outdated technical training, centred only on productivity and not sustainability; the new model of the Common Agricultural Policy 2023-2027 requires solid knowledge such as soil conservation, biodiversity, agri-environmental practices and compliance with climate indicators; according to studies by Portugal's Directorate General for Agriculture and Rural Development, there are deficits in capacity building for regenerative practices, ecological planning and circular management of agricultural inputs. Revising this professional profile would strengthen the following skills: planning regenerative agricultural systems; digital literacy applied to agricultural management; circular management of resources (organic fertilisers, reuse of wastewater) and drawing up sustainability plans and applications for green funding.

Agronomists/ olive mill operator - agronomists working in the olive sector still have a strong focus on classical plant production, with little exposure to bioeconomics, digitalisation and technologies for recovering by-products; olive mill operators are often professionals with a strong empirical component, but without structured training in environmental management, energy recovery and industrial innovation; the National Programme for the Valorisation of Agro-Industrial By-Products identifies the olive sector as a priority for the creation of new value chains, especially using pits, pomace and waste water, where there is a lack of specialised technicians. Revising this professional profile would strengthen the following skills: knowledge of olive by-product flows and their physico-chemical characterisation; recovery technologies; olive mills' energy and water management; waste management and regulation (licensing, transport, agricultural application).

There is also the need to create **3 new professional** profiles in the Portuguese olive sector:

- i. Specialist in Regenerative Agriculture applied to Olive Groves - It becomes essential to implement soil conservation practices, carbon sequestration, increased functional biodiversity and efficient water management in the olive grove. This profession combines technical agronomic knowledge with expertise in applied ecology and the circular economy. At a national level, this professional profile will contribute to mitigating soil erosion in the Alentejo region and the inland regions (Beira Alta and Beira Baixa) of the country; it will reduce the environmental impact of intensive olive groves; it will allow access to green financing and environmental certifications.



- ii. Olive By-Products and Circular Economy Manager - Portugal is one of the largest European Union olive oil producers, but it still wastes a large part of the olive campaign's by-products (pomace, pits, wastewater). The transition to a circular bioeconomy model requires professionals capable of creating value from this waste, whether in the form of solid biofuels, biofertilisers, compost, or cosmetic and nutraceutical ingredients. At a national level, this professional profile will contribute to the imperative of decarbonising the agro-industry; it will create new local value chains, especially in areas of the interior of the country with demographic challenges; it will boost the creation of circular-based cooperatives and start-ups linked to olive groves.
- iii. Olive grove digitalisation and monitoring technician (AgriTech) - The advance of agriculture 4.0 is already transforming Portuguese olive growing, with the integration of sensors, drones, decision support systems (DSS) and IoT to optimise irrigation, predict pests and manage the harvest. Specialised technicians in digital tools applied to olive groves will therefore become key to increasing productivity and reducing the use of inputs (water, fertilisers and phytopharmaceuticals). At national level, this professional profile will contribute to promoting the operational efficiency of farms, especially in the irrigated regions of the Alqueva dam in Alentejo; it will respond to the shortage of skilled labour in the field by automating processes; it will facilitate access to precision agricultural insurance and data-based financing (smart farming).

Adapting these profiles to the needs of Portugal's sector requires structured training, financial incentives and cross-sector collaboration in order to bridge the skills gap and speed up the transition to a more sustainable and competitive olive oil industry.

3.3 Key competencies and learning outcomes needed for circular economy role

In more recent years, the Portuguese olive sector has undergone a major transformation through the expansion of intensive and super-intensive olive groves. This transformation, heavily concentrated in the south of the country, more specifically in Alentejo region, has placed Portugal among the leading olive oil producers in Europe. With this modernisation comes the need to strengthen some existing professional profiles, as well as to create new ones. The aim is to move increasingly towards a sustainable, circular and regenerative olive sector. Thus, through the respondents and interviewees (D2.3 - Portugal), we identified 2 professional profiles to be improved: "Agricultural production manager"; "Agronomist and olive mill operator". "Olive By-Products and Circular Economy Manager"; "Specialist in Regenerative Agriculture applied to Olive Groves"; "Olive Grove Digitalisation and Monitoring Technician" are the 3 professional profiles to be created.

In the professional profile of **agricultural production manager**, with a focus on more sustainable and efficient management, there is a need to strengthen or provide more technical skills such as the use of digital agricultural management tools and environmental skills such as the integration of regenerative practices, since their biggest gaps are: low digital literacy; lack of knowledge of ecological financing instruments. The key competences identified for this professional profile are: Plan and coordinate seasonal agricultural activities, Managing teams and resources on agricultural holdings, Evaluate productivity and sustainability indicators, Apply good agricultural practices and phytosanitary regulations and Use digital farm management tools (agricultural ERP-Enterprise Resource Planning, DSS-Decision Support Systems). As far as learning outcomes are concerned, they are intended to be as follows: Master agricultural planning methodologies based on meteorological and soil data, Be able to integrate regenerative agriculture principles into annual planning, Understand environmental legislation and CAP-Common Agricultural Policy incentives applicable to olive growing and Operate and interpret decision support and remote sensing technologies.



Regarding the professional profile of **agronomist and olive mill operator**, with the need to integrate circular economy practices with a focus on by-product valorisation, energy and water efficiency in olive mills and compliance with environmental standards, the main gaps are the undervaluation of by-products and technological obsolescence in small and medium-sized olive mills. There is therefore a need to strengthen skills in the bioeconomy of waste, sustainable technologies and digitalisation applied to quality control and traceability. The key competences identified for this professional profile are: Plan and supervise olive oil processing operations, Managing the traceability and quality of the final product, Complying with food, environmental and energy regulations, Optimise energy efficiency and the use of resources at olive mills and Identify olive by-product valorisation opportunities. The learning outcomes for this professional profile are intended to be: Be able to apply circular economy practices in olive mill management, Be familiar with technologies for extracting, drying and valorising pits, bagasse and raw water, Integrate good environmental practices into the production process and Develop and implement circular business models.

Olive By-Products and Circular Economy Manager

This new professional profile, focused on the valorisation of by-products from the olive-growing season and the implementation of circular economy strategies in the agro-industry, combines knowledge in bioeconomics, environmental management and circular business design. The aim is to fill gaps such as: low technological incorporation of by-products; the need for specific skills in valorisation technologies; and the integration of digital solutions. This profile will also allow for greater articulation with industries such as cosmetics, pharmaceuticals and energy. Managing agro-industrial waste streams, Developing circular solutions based on biomass, Implementing by-product valorisation processes, Plan industrial decarbonisation strategies and Assessing the economic viability of circular processes are the key competences identified for this profile. As far as learning outcomes are concerned, they are intended to be as follows: Technologies for valorising pomace, pits and raw water, Circular business design in the olive oil chain, Life cycle assessment (LCA) and ecological footprint and Partnerships with cosmetics, pharmaceutical or energy industries.

Specialist in Regenerative Agriculture applied to Olive Groves

This professional profile aims to train people in the sector in soil conservation techniques, functional biodiversity and carbon sequestration, combined with skills in implementing agro-ecological practices and assessing positive environmental impacts. The gaps to be overcome include a lack of knowledge about regenerative certifications and difficulties in quantifying ecological indicators. The key competences for this profile are: Apply agroecology principles, Managing soil fertility through natural methods, Implement regenerative agriculture practices, Assess the environmental impact of agricultural practices and Use vegetation cover systems to control erosion. Soils and their regeneration (composting, biochar, mycorrhizae), Planning carbon sequestration in olive groves, Integration of polycultures and controlled grazing and Certification tools (e.g. Regenerative Organic Certification) are the expected learning outcomes.



Olive Grove Digitalisation and Monitoring Technician

This professional profile is designed to provide technicians specialising in olive grove digitalisation and monitoring technologies, something that responds to the growing incorporation of 4.0 agricultural tools in Portugal. The technician must operate sensors, drones, decision support systems (DSS) and digital agricultural management platforms. The aim is to overcome gaps such as: low digital literacy among agricultural teams; low adoption of remote monitoring tools. The desired future skills centre on data integration, automating agronomic decisions and the interoperability of digital agricultural systems. For this professional profile we consider the essential key competences to be: Operating precision agriculture systems, Use sensors and drones in agricultural management, Interpreting geospatial and meteorological data, Implement intelligent irrigation systems and Programming and maintaining AgriTech equipment. With regard to the expected learning outcomes, they are intended to be as follows: Mapping and geographical analysis software (GIS-Geographic Information System), Moisture and fertility sensors applied to olive groves, Basic programming of sensors and IoT devices and Decision support platforms (e.g. xarvio, Agrosmart).

4. Policy and institutional ecosystem supporting professional profile development

1. National Political Framework

In Portugal, the valorisation of green, digital and sectoral skills is part of the National Skills Strategy 2025 and the National Implementation Plan for the European Youth Guarantee. These instruments aim, among other things, to strengthen the link between professional qualifications and the needs of the economic fabric, promoting employability in strategic sectors such as sustainable agriculture and bioeconomy.

The olive sector, as a pillar of the national agricultural economy and with significant potential in the ecological transition, benefits from strong articulation with sectoral public policies such as the Strategic Plan for the Common Agricultural Policy (Plano Estratégico da Política Agrícola Comum - (PEPAC)) 2023-2027, the National Energy and Climate Plan (Plano Nacional de Energia e Clima (PNEC) 2030) and the National Strategy for Organic Farming. These policy frameworks reinforce the need for specific technical skills linked to regenerative agriculture, circular resource management and technological innovation, which are the basic principles of the CIRCOLIVE project.

2. Key Institutions and Mandates

New professional profiles in the agricultural sector should be developed and validated in conjunction with the following national organisations:

- **Directorate-General for Employment and Labour Relations** (Direção-Geral do Emprego e das Relações de Trabalho (**DGERT**)): responsible for certifying training providers and framing vocational training standards;
- **Institute for Employment and Vocational Training** (Instituto do Emprego e Formação Profissional (**IEFP, I.P.**)): central agency for implementing vocational training and retraining policies, including requalification programmes for strategic sectors;
- **Directorate-General for Agriculture and Rural Development** (Direção-Geral de Agricultura e Desenvolvimento Rural (**DGADR**)): interlocutor in the design of policies to support rural development and agricultural modernisation;



- **National Agency for Qualification and Vocational Education** (Agência Nacional para a Qualificação e o Ensino Profissional (**ANQEP, I.P.**)): guarantees that the profiles are linked to the National Qualifications Catalogue and ensures consistency between formal and non-formal training;
- **Intermunicipal Entities and Intermunicipal Communities** (Entidades Intermunicipais e Comunidades Intermunicipais (**CIMs**)): relevant in adapting the profiles to the regional reality, especially in the olive-growing areas of the Alentejo and the North.

3. Financing and Implementation Instruments

The operationalisation of the training paths and the adoption of the profiles developed by CIRCOLIVE can be supported by several instruments:

- **Portugal 2030**, with emphasis on the regional programmes and the “People 2030” Thematic Programme, which finances qualification and training actions;
- **European Social Fund+** (Fundo Social Europeu+ (FSE+)), which continues to support training and professional retraining measures;
- **IEFP employment support measures**, such as the + Digital/Green Training Cheque, which can finance training in regenerative agriculture, circular economy and agricultural sustainability;
- **PEPAC rural innovation programmes**, particularly in the area of knowledge transfer and innovation.

4. Coordination with Education and Training Structures

The effectiveness of the proposed professional profiles will depend on their integration into existing qualification frameworks, in particular:

- Dual certification courses in the areas of Agricultural Production, Agroecology, Environmental Management and Rural Technologies;
- Certified modular training courses, adaptable to adults and working people in the sector;
- Higher Professional Technical Courses (CTeSP) and QEQ level 5 vocational training courses, as possible routes to specialisation in regenerative and circular practices in the olive grove.

Collaboration with agricultural vocational schools, skills centres, polytechnic higher education centres and certified training providers will be crucial to ensure the dissemination and applicability of the profiles.

5. Conclusion: Integration and Scalability

The Portuguese ecosystem offers a mature political and institutional framework for adopting the professional profiles developed at CIRCOLIVE. Their integration into national qualification structures, aligned with political priorities and available funding instruments, will allow for scalable implementation, with a concrete impact on the olive sector's ecological transition and the qualification of its workforce.

CONDITIONS FOR SCALABILITY

Integration into CNQ references (through ANQEP)
Recognition by certifying agencies (through DGERT)
Direct support for trainees and organisations (through IEFP / FSE+)
Participation of local and regional stakeholders (CIMs, associations, cooperatives)
Alignment with national and EU priorities (green, digital, circular)



4.1 National VET systems and sectoral frameworks in Portugal

The Vocational Education and Training (VET) system in Portugal is organised in such a way to respond to the needs of the labour market, people and society, promoting initial qualifications for young people, retraining for adults and lifelong learning. This architecture combines school, dual and vocational offers, with legal recognition at levels 2 to 5 of the National Qualifications Framework (NQF), articulated with the European Qualifications Framework (EQF).

1. Structure and Modalities of the VET System

The national VET system includes different modalities, grouped into two main areas:

a. VET within the education system (Through schools)

- **Vocational courses (EQF level 4):** aimed to young people, taught in high schools and vocational schools, with a strong technical-practical component and compulsory work-based training. The Agricultural Production area includes qualifications directly linked to olive growing and sustainable agriculture;
- **Youth Education and Training Courses (CEF):** for young people who are at risk of dropping out early, integrating general, technical and practical training;
- **Courses linked to Higher Education (CTeSP - level 5 EQF):** taught at Polytechnic Institutes, with a focus on specialised technical skills. There are relevant CTeSP in the area of precision agriculture, rural technologies and agricultural sustainability.

b. VET within the vocational training system (non-school training)

- **Certified Modular Training (CMT):** especially aimed for adults and working people, allowing the gradual development of complete qualifications;
- **Adult Education and Training Courses (EFA):** to obtain an educational and/or professional qualification;
- **Recognition, Validation and Certification of Competences (RVCC):** recognises lifelong and experiential learning;
- **Work-based Learning (dual):** through IEFP programmes, such as apprenticeship courses, especially relevant to young people.

These offers are included in the National Qualifications Catalogue (CNQ), managed by ANQEP, who defines the competences and training references by professional profile.

2. National Qualifications Framework (NQF) and National Qualifications Catalogue (CNQ)

The **NQF**, in line with **CNQ**, structures qualification levels from 1 to 8, with levels 2 to 5 being the most directly involved in VET.

- The **NQF** organises professional profiles into areas of education and training, matching sectors of activity. In the case of the olive sector, area **621 - Agricultural and Animal Production** encompasses qualifications such as:
 - Agricultural Production Technician
 - Viticulture and Olive Growing Technician
 - Forestry and Natural Resources Management Technician



- Organic Farming Technician

These profiles include modular training referentials that can be used flexibly, both in initial training and in continuing training.

3. Sectoral frameworks and articulation with the olive sector

Although Portugal does not have *formal sectoral qualifications frameworks* like other EU countries, the NQF can be considered a **functional sectoral framework** because of the way it organises professional profiles by area and sector. The articulation with the olive sector can be done in three ways:

- **Adjusting existing referentials:** updating technical and transversal competences in profiles such as Agricultural Production Technician, incorporating regenerative and circular practices;
- **Proposing new professional profiles:** through the mechanisms for reviewing and updating the CNF, promoted by ANQEP, in articulation with sectoral organisations and employers;
- **Pilot and micro-credit actions:** with the support of higher education institutions or certified training organisations, to test emerging profiles (e.g. Circular Farming Systems Manager; Regenerative Soil Fertility Technician).

4. Governance and Institutional Co-operation

The architecture of VET in Portugal is based on a logic of shared governance, with well-defined roles:

Entity	Role in the VET System
ANQEP, I.P.	Management of the NQF, coordination of the training network, recognition of competences
DGERT	Certification of training organisations and validation of referentials
IEFP, I.P.	Implementation of public vocational training and employment policies
Ministry of Agriculture (DGADR)	Technical dialogue in the definition of sectoral profiles for the agricultural sector
Educational establishments and training centres	Provision and implementation of certified training programmes



SYNTHESIS TABLE: NATIONAL SYSTEM OF VOCATIONAL EDUCATION AND TRAINING (VET) IN PORTUGAL

Sub-system / Modality	Target Group	Type of Training	QNQ / EQF Level	Relevance to the Olive Sector
Upper-Secondary Vocational Education	Young people (15–18 years old)	School-based training with practical and work-based components	Level 4	Agricultural Production Technician; Organic Farming; Natural Resource Management
Education and Training Courses (CEF)	Early school leavers at risk	General + Technical + Work-Based Training	Levels 2–4	Initial training for agricultural activities
Apprenticeship Courses (IEFP)	Young people up to 25 years old	Dual training with in-company work experience	Level 4	Practical training with placement in olive farms or mills
Certified Modular Training (FMC)	Adults (employed or unemployed)	Short units from the National Qualifications Catalogue (NQC)	Levels 2–5 (modular)	Skills updating (e.g., pruning, fertilisation, circular practices in agriculture)
Adult Education and Training Courses (EFA)	Adults with low qualifications	School and/or vocational qualification	Levels 2–4	Re-skilling for sustainable agriculture and the bioeconomy
Recognition, Validation and Certification of Competences (RVCC)	Adults with informal experience	Recognition of experiential and prior learning	Levels 2–4	Recognition of traditional olive-growing know-how
Higher Professional Technical Courses (CTeSP)	Youth and adults with upper-secondary education	Short-cycle higher education with technical focus	Level 5	Precision agriculture, rural technologies, circular resource management
Microcredentials / Pilot Actions	Adults and professionals	Flexible, sector-oriented short courses	Variable	Training in emerging profiles (e.g., regenerative agriculture, renewable energy, AgriTech)

Conclusion

We can therefore conclude that the national VET system, through the flexibility of the NQC, institutional articulation and the diversity of qualification modalities, presents solid conditions for absorbing and integrating the emerging professional profiles developed within the scope of CIRCOLIVE. The ability to respond to sectoral and territorial needs makes it possible to adapt the training offer to the reality of the olive sector, promoting its transition to more sustainable, digital and regenerative practices.



4.2. Pathway for adoption of a new professional profile in Portugal

The adoption of a new professional profile in Portugal's national Vocational Education and Training (VET) system requires a structured, inter-institutional approach aligned with national and European priorities. This process aims to ensure the technical legitimacy, training viability, sectoral usefulness and sustainable funding of the proposed qualification. In the context of the olive sector and the circular economy, this path is particularly important, given the need to respond to ecological and technological challenges and the shortage of qualified labour.

1. Identification of Needs and Sector Validation

a) **Diagnosis of skills gaps** from sources such as:

- Sectoral studies (e.g. CIRCOLIVE, PEPAC, Employment Observatories)
- Consultations with employers, cooperatives, CIMs and agricultural associations

b) **Preliminary definition of the professional profile, including:**

- Profession designation
- Main functions
- Education and training area(s) (NQC)
- Qualification level (NQF/EQF)

This step requires strong articulation with the olive sector, ensuring practical relevance and future acceptance.

2. Technical Proposal to ANQEP - Creation or Updating of the NQC

a) Submission of a reasoned proposal to ANQEP, I.P. containing:

- Socio-economic and ecological justification
- Alignment with public policies and the EU (Green Deal, Skills Agenda)
- Map of competences, training units and exit profile

b) Possibilities

- **Creation of a new qualification**
- **Updating an existing profile** with new competences (e.g. soil regeneration, circular economy, renewable energies)

c) The proposal can be submitted by:

- Sector organisations (Certificate of Professional Aptitude (CAP), producer associations)
- Training entities
- Inter-municipal communities
- Funded projects (such as CIRCOLIVE)

3. Pilot Testing and Validation

- **Experimental implementation** with public funding (e.g. ESF+, Portugal 2030, PEPAC), by:
 - ❖ Vocational or agricultural schools



- ❖ IEFP training centres
- ❖ Higher education institutions (CTeSP or micro-credentials)
- **Impact assessment:** referential adjustment based on real-life experience
- Production of teaching materials, teaching resources and certification guides

This phase makes it possible to demonstrate applicability and promote institutional and sectoral acceptance.

4. Integration into the National Qualifications Catalogue (NQC)

- On the basis of the pilot assessment, ANQEP proceeds to:
 - ❖ **Technical validation**
 - ❖ **Formal inclusion in the NQC**
 - ❖ **Publication of the referentials on the official portal**
- The certification of the course can then be carried out by:
 - ❖ Training providers certified by DGERT
 - ❖ Vocational schools and IEFP centres

5. Training Offer Activation and Recognition

- Programming of training in professional courses, FMC, EFA or CTeSP
- Dissemination to employers and the training network
- Possible activation of RVCC mechanisms, allowing recognition of professionals already working in the sector
- Integration into active employment policies (e.g. internships, funded training, retraining of the unemployed)

Critical Success Factors

Factor	Contribution to a successful adoption
Political and strategic alignment	Consistency with national (People 2030, PEPAC) and EU (Green Deal) policies
Institutional articulation	Partnership between ANQEP, IEFP, DGADR, DGERT, CIMs and sector associations
Labour market acceptance	Involvement of producers, cooperatives and companies from the outset
Training flexibility	Modular adaptation (FMC) and cross-cutting between profiles
Available funding	Support for training and recognition (ESF+, Portugal 2030, PEPAC, Erasmus+ (KA2), Interreg)



5. Conclusions

The present deliverable aimed to define a strategic framework for revising and/or developing professional profiles and qualifications in Portugal's olive oil sector, with a view to supporting its transition to a more circular, digital and sustainable economy. Based on the analysis of skill gaps, emerging roles and country-specific needs, it became evident that both the upskilling of the current workforce and the training of new professionals are essential to ensure long-term resilience and competitiveness in the sector.

Portugal, as one of the leading olive oil producers in Europe, faces particular challenges arising from the intensification of production, the growing environmental and regulatory demands, and the need for technological innovation. In this context, the modernisation of existing professional profiles — namely the *Agricultural Production Manager* and the *Agronomist/Olive Mill Operator* — is crucial, incorporating new competences in regenerative agriculture, circular resource management, by-product valorisation and digitalisation.

At the same time, it is urgent to design, implement and pilot new professional profiles such as the *Olive By-Products and Circular Economy Manager*, the *Specialist in Regenerative Agriculture Applied to Olive Groves*, and the *Olive Grove Digitalisation and Monitoring Technician (AgriTech)*. These emerging profiles respond not only to clear gaps already identified by stakeholders but also to future needs, opening new value chains and promoting rural development, particularly in the interior regions of the country.

It is therefore essential to pilot these profiles and the corresponding training programmes in real contexts, involving vocational schools, polytechnic institutes, training centres and companies. Such pilot actions will allow for the validation of technical content, pedagogical approaches and learning outcomes, ensuring their alignment with labour market expectations and national/regional specificities.

In addition, the integration of short-term learning formats (such as modular training and micro-credentials), along with closer cooperation between the VET system, businesses and research institutions, will be key to accelerating the sector's transition towards a more circular and sustainable model. Investing in this direction will ensure the development of future-proof skills, enhancing economic resilience, innovation and social cohesion in Portugal's olive oil value chain.

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