



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

D2.3 National Report on current and future skill levels for transition of the olive oil sector to circular economy

- Portugal -

February 2025



Project management



Identification of olive sector



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National Report on current and future skills levels for transition of the olive oil sector to circular economy - Portugal

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1. Executive Summary

The "National Report on current and future skills levels for transition of the olive oil sector to circular economy" explores the current skills levels and future needs of the olive oil sector in Portugal for occupations and skills in the context of circular economy. The research conducted as part of the CIRCOLIVE project includes surveys, interviews with experts from the agri-food sector and interviews with vocational education providers (VET) in Portugal, which provides insight into the challenges, opportunities and key competences needed for a sustainable transition to a circular economy in the olive oil sector.

The results show that certain circular economy practices are already present, especially in the segments of waste reduction and by-product valorization.

However, there is significant room for progress in areas such as advanced waste management, renewable energies, energy efficiency, digitalization and green finance, as well as the integration of disruptive technologies, such as blockchain, IoT (Intelligence of Things), AI (artificial intelligence) and machine learning, which would optimize the sector's traceability and efficiency. A lack of knowledge about circular business models was also identified, including regenerative agriculture and alternative markets for olive oil by-products.

With regard to future skills needs, there is a focus on waste management and bioeconomy, energy efficiency, digitalization and traceability. There is also a need for more training in green marketing and circular business models to promote sustainable olive oil.

The study identified emerging occupations that are necessary for the sector's transition to the circular economy, i.e. circular economy managers, waste valorization engineers, agricultural digitalization specialists, legal advisors on environmental regulations, and ESG (Environmental, Social, and Corporate Governance) consultants.

The main barriers to the transition to the circular economy are a lack of knowledge, funding difficulties, a lack of regulatory incentives and little specialized training. As opportunities for the circular transition, there is a growing market for sustainable olive oils and European funds available for the ecological transition.

Portugal's olive sector **has the potential to lead the way in the circular economy**, but it needs **investment in qualification, technological innovation and by-product valorization** to ensure competitiveness and long-term sustainability, implying a collective effort and commitment between different players, i.e. producers, companies, professors, researchers and political decision-makers.



2. Introduction

2.1. Purpose and Objectives

This report presents the research on the current and future skills levels and/or emerging professions for transition of the olive oil sector to circular economy in Portugal. The report is a part of Work Package 2 (Identification of olive sector circular needs and emerging skills and/or professions for transition of the olive oil sector to a circular economy in the 5 countries) of the CIRCOLIVE project (Developing skills for introducing circular business models and digital technologies in the olive oil sector) and represents deliverable D2.3. (National Report on current and future skill levels for transition of the olive oil sector to circular economy - Portugal).

The aim of this report is to investigate and analyze current skill levels, factors shaping the demand for skills, skill gaps and future skill needs and occupations related to the circular economy in olive growing sector. The review of the available literature and the analysis of the collected data determined current and future skills levels and/or emerging professions in Portugal, which will be used as basis for further project activities and the creation of a curriculum for vocational education and training on circular business skills in the olive growing sector in Portugal.

2.2. Key Findings

The Portuguese olive oil sector's transition to circular economy is at an early stage (especially with regard to micro and small companies), with some good practices already in place but still major challenges to overcome.

As such, some companies are already adopting circular practices, such as by-product valorization, wastewater recycling and the use of renewable energies, and there is a growing interest in sustainable certifications in order to differentiate Portuguese olive oil on the international market.

There are several skills gaps, including low knowledge about circular economy and a lack of specialized training; a lack of advanced waste valorization, wasting opportunities in biofuels, biofertilizers and bioplastics; a lack of digitalization, given the low adoption of blockchain, IoT (Intelligence of Things) and AI (Artificial Intelligence) for traceability and efficiency; low integration of renewable energies and little knowledge of sustainable financing.

There are several skills gaps, including low knowledge about circular economy and a lack of specialized training; a lack of advanced waste valorization, wasting opportunities in biofuels, biofertilizers and bioplastics; a lack of digitalization, given the low adoption of blockchain, IoT (Intelligence of Things) and AI (Artificial Intelligence) for traceability and efficiency; low integration of renewable energies and little knowledge of sustainable financing.

Therefore, future skills needs were identified as being focused on waste management and the bioeconomy, energy efficiency, digitalization and traceability. There is also a need for greater training in green marketing and circular business models to promote sustainable olive oil.



Through the research carried out, the following emerging occupations were identified: circular economy managers, waste valorization engineers, agricultural digitalization specialists, legal advisors on environmental regulations and ESG (Environmental, Social, and Corporate Governance) consultants.

The main barriers to the transition to circular economy are a lack of knowledge, funding difficulties and little specialized training. As opportunities for the circular transition, there is a growing market for sustainable olive oils and European funds available for the ecological transition.

Portugal's olive sector **has the potential to lead the way in the circular economy**, but it needs **investment in qualification, technological innovation and by-product valorization** to ensure competitiveness and long-term sustainability, implying a collective effort and commitment between different players, i.e. producers, companies, professors, researchers and political decision-makers.

3. Methodology

The chapter "Methodology" describes the methods of data collection and their analysis. The aim of the chapter is to inform the reader about the methodology used and the possibility of repeating the study using the same methodology.

3.1. Data collection methods

The data was collected from two data sources: primary and secondary data sources.

Primary data collection involves the process of preparing tools for data collection and collecting data from a planned sample of respondents. Three data collection instruments were prepared for the purposes of this study: a questionnaire and two interview reminders. The questionnaire was designed with the aim of collecting quantitative data on a sample of professionals in the olive oil sector. The questionnaire (ANNEX 1 (D2.3): Online survey targeting MSMEs in the olive oil sector about current and future skills needs for transition of the olive oil sector to circular economy) contained multiple-choice questions, closed questions, open questions and questions in the form of a Likert scale. The questions related to current skill levels, factors shaping the demand for skills, skill gaps and future skill needs and occupations related to the circular economy in olive growing sector. ESCO occupation groups and skills were used, to the extent possible to identify the most demanded skills (**Table 1.**, **Table 2.**).

Table 1. Occupations from ESCO used in the questionnaire (ANNEX 1 (D2.3))

Occupations in the survey	ESCO occupations	ESCO occupation code
Agronomist	Agronomist	2132.2
Agricultural production manager	Agricultural and forestry production manager	1311



Agricultural labourer	Agricultural, forestry and fishery labourer	921
Environmental engineer	Environmental engineer	2143.1
Oil mill operator	Oil mill operator	7514.2
Food technologist	Food technologist	2145.1.4
Quality control and safety officer	Industrial quality control manager	1321.2.2
	Health safety and environmental manager	1213.7
Packaging production manager	Packaging production manager	2141.9
Logistics and supply chain manager	Supply chain manager	1324.8
	Logistics engineer	2149.2.6
Researcher and scientist in circular economy	Research engineer	2149.2.8
	Soil scientist	2133.11
Sustainability manager	Sustainability manager	1213.8
Alternative fuels engineer	Alternative fuels engineer	2149.9.1
Waste treatment engineer	Waste treatment engineer	2143.1.4
Recycling specialist	Recycling specialist	2143.1.3
Food technician	Food technician	3119.5
Product development engineering drafter	Product development engineering drafter	3118.3.12
Environmental programme coordinator	Environmental programme coordinator	2133.6

Table 2. Skills and knowledge from ESCO used in the questionnaire (ANNEX 1 (D2.3))

Skills in the survey	ESCO skills and knowledge	Concept URI
Knowledge of sustainable farming practices	Follow environmentally-sustainable work practices	http://data.europa.eu/esco/skill/a992f345-7c06-4982-8fc9-5fab55e316af
Knowledge of water and soil protection	Advise on soil and water protection	http://data.europa.eu/esco/skill/3e25fd3e-2bcd-4320-9587-0aadf7fb93b1
Organic farming and pest control techniques	Organic farming	http://data.europa.eu/esco/skill/186da517-9a3e-41cd-9158-4001e3694459
	Perform pest control	http://data.europa.eu/esco/skill/08881cb7-5331-4b11-9442-4d7c9fce749e
Understanding of food policies and	Food policy	http://data.europa.eu/esco/skill/e591f458-93c4-4cc7-a441-2340545c33f3



regulations	Control food safety regulations	http://data.europa.eu/esco/skill/4d7410df-51a9-42bc-83ec-363c201ee631
Waste and by-product management	Waste management	http://data.europa.eu/esco/skill/40f65a56-ccbe-4601-9f32-1cc6cdd24f28
	By-products	http://data.europa.eu/esco/skill/f2412a5c-8072-4cd7-8fa1-806864f91276
Energy efficiency in production	Energy efficiency	http://data.europa.eu/esco/skill/83fc0b2b-6cd2-46af-b1ff-d3fc83604c26
Supply chain management	Supply chain management	http://data.europa.eu/esco/skill/f929c89e-c363-4132-a918-e021d57b307c
Digital skills (e.g. data management, precision agriculture)	Product data management	http://data.europa.eu/esco/skill/e2d0daae-2aa1-40cc-99e2-b340b02f97d3
	Agriculture not further defined	http://data.europa.eu/esco/isced-f/0810
Produce sustainable products	Produce sustainable products	http://data.europa.eu/esco/skill/97725325-5287-4ebb-9f83-1ba2c38f465c
Develop and coordinate waste management processes	Develop waste management processes	http://data.europa.eu/esco/skill/114a79ef-1e62-475b-a862-954f5b4cca20
Develop recycling programs	Develop recycling programs	http://data.europa.eu/esco/skill/862920c8-f2d0-4058-8fb8-9f06fbfc2446
Renewable energy integration	Renewable energy	http://data.europa.eu/esco/skill/f8413360-6114-40de-a276-c59b764b9913
Product data management and digitalization	Product data management	http://data.europa.eu/esco/skill/e2d0daae-2aa1-40cc-99e2-b340b02f97d3
Ensure compliance with environmental legislation	Ensure compliance with environmental legislation	http://data.europa.eu/esco/skill/089ee650-297e-4716-87d1-440743b70a0d
Asses the life cycle of resources	Asses the life cycle of resources	http://data.europa.eu/esco/skill/4e87c852-602a-4a0e-b8d8-20709ce14ac5
Develop new food products	Develop new food products	http://data.europa.eu/esco/skill/090ae6b3-12ab-4c72-b98a-17b790cf416e
Plan digital marketing/digital	Plan digital marketing	http://data.europa.eu/esco/skill/736ef286-fbd3-4e5c-a4b4-d1e2008c9898



skills		
Implement marketing strategies	Implement marketing strategies	http://data.europa.eu/esco/skill/13e2378e-0d10-450d-843a-b3592575826e
Green marketing	Marketing principles	http://data.europa.eu/esco/skill/de03f4fd-c147-4477-a048-7109e5ba2d6f
Thinking creatively and innovatively	Thinking creatively and innovatively	http://data.europa.eu/esco/skill/e84d080a-ff6d-41a7-b7b9-133e97c7bf00
Entrepreneurial mindset	Show entrepreneurial spirit	http://data.europa.eu/esco/skill/bdcf429c-5ccf-4c3d-bb61-4c987573a35e
Deep tech knowledge	Principles of artificial intelligence	http://data.europa.eu/esco/skill/e465a154-93f7-4973-9ce1-31659fe16dd2
	Internet of Things	http://data.europa.eu/esco/skill/f049d050-12da-4e40-813a-2b5eb6df6b51

The planned sample size was 20 respondents, but data was collected from 22 respondents (**Table 3.**). The questionnaires were collected online via Google forms.

Table 3. Description of the sample of respondents who participated in the online questionnaire (N=22)

Variable	N	Percentage (%)
Gender		
Male	16	72.7%
Female	6	27.3%
Age		
Up to 36	3	13.64%
37 - 56	14	63.64%
57 and more	5	22.72%
Education		
High school and lower	3	13.64%
Bachelor degree	1	4.54%
Licenciatura degree	15	68.18%
Master degree	3	13.64%
PhD	0	0.00%
Enterprise size		
Micro (<10 employees)	12	54.55%



Small (<50 employees)	8	36.36%
Medium sized (<250 employees)	2	9.09%
Large sized (>250 employees)	0	0.00%

Two interview reminders were also prepared for the qualitative data collection. One interview reminder was prepared for experts in the agri-food sector (ANNEX 2 (D2.3): Structured interview with circular business agro-food experts/professionals about current and future skill needs for transition of the olive oil sector to circular economy). The other one for providers of education in Portugal (ANNEX 3 (D2.3): Structured interview with VET providers about current and future skill needs for transition of the olive oil sector to circular economy). The reminders contained open ended questions with a selection of possible answers to guide the conversation and conduct the interview as efficiently as possible. The planned sample size was 5 respondents for experts in the agri-food sector and 5 respondents for providers of education, but 6 interviews for experts in the agri-food sector were carried out. Interviews were conducted with respondents through online meetings. The interviews were recorded and a transcript of the conversation was made. Each respondent has voluntarily and expressly consented to the collection and further processing of personal data and has voluntarily agreed to answer questions for the purpose of research within the CIRCOLIVE project. Each respondent has confirmed this with their signature in the documents: a) Statement related to giving consent for the processing of personal data and b) Information form for participation in research – personal informed consent.

Secondary data are ready-collected data that come from various sources, e.g: available studies, skills needs analysis, forecasts, etc. When using this data, the source is always cited in the report and the list of references used can be found in chapter 9 of this Report.

3.2. Data analysis methods

After the data collection was completed, the data analysis was carried out. Quantitative data collected through questionnaires were analysed using descriptive analysis and response frequencies. The data are presented in the form of tables, graphically through graphs and descriptively. The data collected through the interviews were processed through a content analysis.

4. Current Skill Levels regarding Circular Economy in the Olive Oil Sector

The olive sector in Portugal has made remarkable progress in adopting sustainable practices, but its full transition to a circular economy remains 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 expertise in advanced waste valorisation, renewable energy integration, and digital precision agriculture.

To fully embrace circularity, the sector must strengthen competences in by-product transformation, soil regeneration, carbon sequestration, and sustainable input management. A deeper understanding of closed-loop production systems and eco-innovation is essential for ensuring long-term economic viability, resource efficiency, and environmental stewardship within olive farming and processing.

In this section, we will present the results obtained from 22 respondents to an online survey aimed at MSMEs in the olive oil sector in Portugal, regarding their current level of competences in the sector's circular economy. Additionally, the results obtained from 6 interviews with agri-food circular business experts/professionals and 5 interviews with vocational education and training organisations will be presented.

Therefore, in the survey aimed at MSMEs in the olive sector in Portugal, we first tried to understand the occupation/profession of the respondents, having been presented with a list of occupations/professions. The results are presented in the form of a graph, which can be found in **Fig. 1**.

Occupation/profession in the olive oil sector that best describes the respondents current occupation/profession

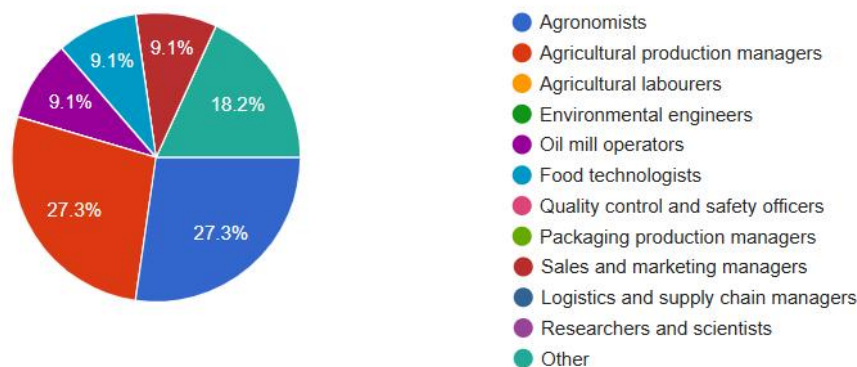


Fig. 1. Occupation/profession in the olive oil sector that best describes the respondents current occupation/profession. Universe of 100% corresponds to a sample of 22 respondents from MSMEs in the olive oil sector.

The top 3 professions were: **Agronomist** with **27.3 %**, **Agricultural production manager** also with **27.3 %** and **others** with **18.2 %**, and in this last option the respondents wrote: CEO of the company; General manager of the AGROINDUSTRIAL company; Managing director;



Questions 6, 7, 8 and 9 of ANNEX 1 (D2.3), which address the respondents' current professional situation, level of skills, the classification of their skills and knowledge and which skills will be most significant in the olive oil sector regarding circular economy, have been taken into account in this part of the report: Online Survey of MSMEs in the Olive Oil Sector on Current and Future Skills Needs for the Olive Oil Sector's Transition to the Circular Economy, which were carried out among 22 respondents.

In order to get a better understanding of the circular economy practices currently implemented, or planned in the respondents' company, they were asked to choose from a list of practices which most applied to their case. The results are shown below in graph form in **Fig. 2**.

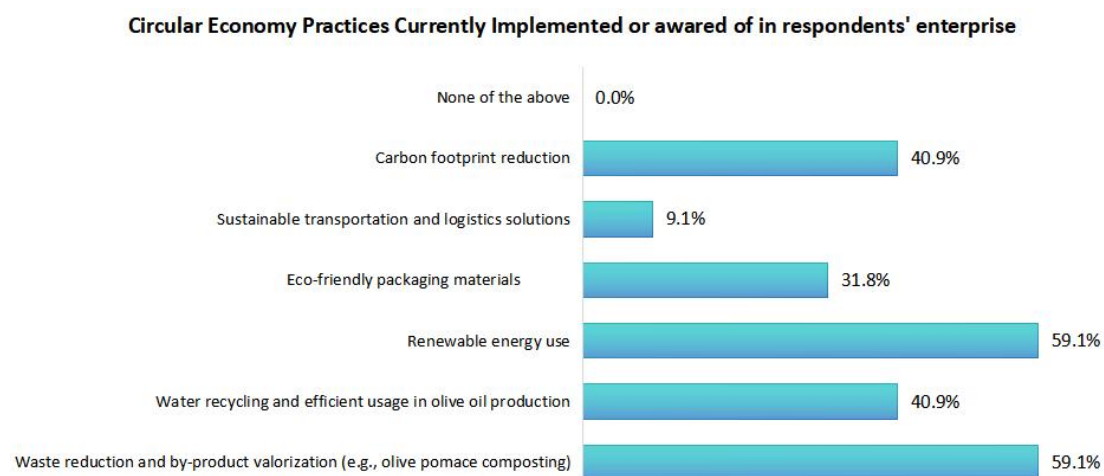


Fig. 2. Circular Economy Practices Currently Implemented or awared of in respondents' enterprise. Universe of 100% corresponds to a sample of 22 respondents from MSMEs in the olive oil sector.

As you can see, the two highest percentages are 59.1% for: waste reduction and valorisation of by-products (e.g. olive pomace composting) and Renewable energy use and 40.9% for: carbon footprint reduction and efficient usage in olive oil production and carbon footprint reduction. We can therefore say that the companies in question already have some circular economy practices in place, but there is potential for many more.

Respondents were also asked to assess their company's competences and knowledge of the circular economy. The results are shown below in **Fig. 3**.

Rate respondents' skills and knowledge about circular economy (methods and possibilities of using olive by-products and waste in olive sector) in respondents' enterprise.

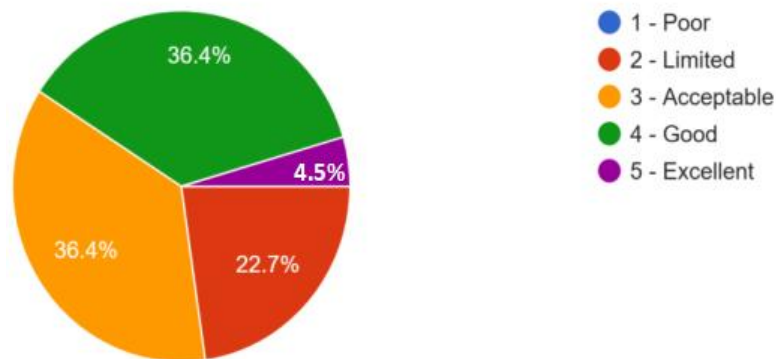


Fig. 3. Rate skills and knowledge about circular economy (methods and possibilities of using olive by-products and waste in olive sector) in respondents' enterprise. Universe of 100% corresponds to a sample of 22 respondents from MSMEs in the olive oil sector.

As can be seen, the majority of respondents consider their knowledge and skills on circular economy to be acceptable or good, but we still have **22.7 %** of respondents saying that they are limited.

According to a list of competences in the olive oil sector in terms of the circular economy, the respondents were asked to choose the competences they consider to be the most relevant. The results are shown in graph form in **Fig. 4.**

Skills that are most significant in the olive oil sector regarding circular economy

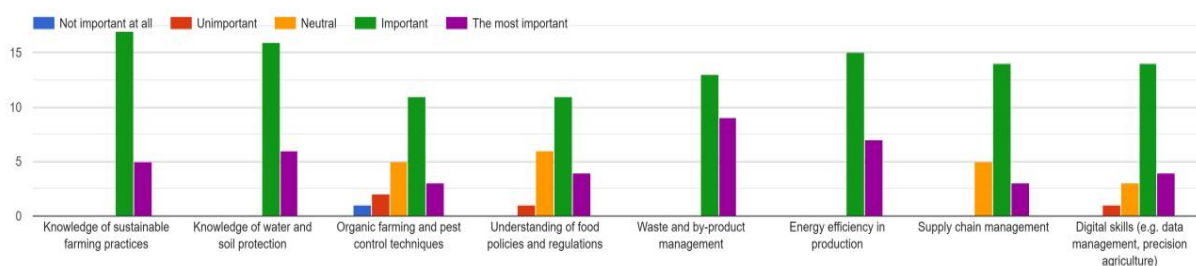


Fig. 4. Skills* that are most significant in the olive oil sector regarding circular economy.

From left to right: Knowledge of sustainable farming practices; Knowledge of water and soil protection; Organic farming and pest control techniques; Understanding of food policies and regulations; Waste and by-product management; Energy efficiency in production; Supply chain management; Digital skills (e.g. data management, precision agriculture). *selected skills from ESCO adapted to the olive oil sector. ESCO - the European multilingual classification of Skills, Competences, Qualifications and Occupations. Universe of 100% corresponds to a sample of 22 respondents from MSMEs in the olive oil sector.

We highlight the 3 most significant competences in the olive oil sector, with regard to the circular economy, chosen by respondents as being “the most important” and “the important”:



The most important:

- Waste and by-product management;
- Energy efficiency in production;
- Knowledge of water and soil protection.

The important:

- Knowledge of sustainable farming practices;
- Knowledge of water and soil protection;
- Energy efficiency in production.

It can be said that the current Skills regarding the Circular Economy, in the olive sector in Portugal are as follows (Fig. 5.):

- **By-product and waste management (75%):** Processing of olive pomace and wastewater treatment;
- **Sustainable production (70%):** Developing and coordinating sustainable agricultural and industrial processes;
- **Compliance with environmental legislation (65%):** Awareness of sustainability regulations and compliance requirements;
- **Renewable energy integration (50%):** Some expertise in incorporating alternative energy sources, but limited;
- **Digitalization and product data management (45%):** Some familiarity with digital tools, but **not fully leveraged for circular economy applications**;
- **Marketing and green business strategies (40%):** A growing but insufficient focus on **green marketing and digital marketing** for sustainable products.

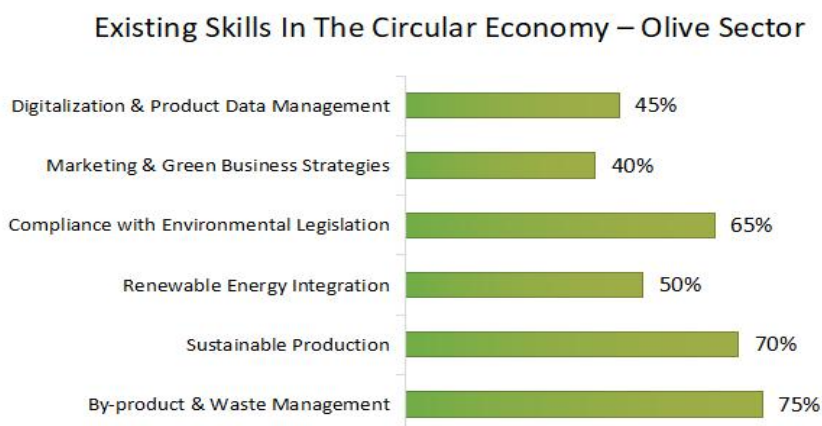


Fig. 5. Existing Skills In The Economy - Olive Sector.

It can thus be seen that the competences currently present in the sector, with the greatest incidence, and according to the respondents, are aligned with competences in waste management, sustainable production and environmental compliance.

In the context of the interviews carried out with **6 agri-food specialists/professionals in circular businesses** (mostly agronomists or agricultural production managers) on their current level of competences regarding the Circular Economy in the olive oil sector, some of the following aspects stand out.



Identify 5 circular economy practices currently implemented in their companies, shown in **Table 4**.

Table 4. Identification of circular economy practices currently implemented in the company of the agri-food experts/professionals of circular businesses interviewed.

Circular economy practices currently implemented in the interviewees' company
- Waste reduction and by-products valorisation
- Renewable energies usage
- Water recycling and efficient use in olive oil production
- Reduction of carbon footprint
- Ecological packaging materials

It should be noted that some of the experts interviewed from the northern region of Portugal, namely from Trás-os-Montes and Alto Douro, indicated the need to create tax benefits for producers who compost, for example. They also indicated the need to create a metric system for the circular transition in the olive sector (e.g. carbon meters), defining indicators and reducing subjective and arbitrary evaluations. Investing in demonstrative circularity practices among promoters, could promote their greater adoption.

Some of the interviewed producers identified resistance on the part of their production workers to adopting some of the circular economy practices indicated, thus requiring constant monitoring of practices in the field.

The majority of interviewees rated the level of skills and knowledge about the circular economy in their companies as “Good”.

One of the agri-food circular business specialists interviewed indicated that there is no Short-Term Training Unit in the National Qualifications Catalogue, with a 25 to 50 hours of duration, on circular economy in general and aimed at the olive sector, highlighting the need for investment in this area in order to train agricultural workers, among other professionals.

With regard to the relevant competences in the olive oil sector, in relation to the circular economy, several interviewees indicated the importance of all the competences initially presented, as they are interconnected. In the end, however, 6 competences stood out, as shown in **Table 5**.

Tabela 5. Relevant competences in the olive oil sector in relation to the circular economy.

Relevant competences in the olive oil sector in relation to the circular economy
- Sustainable agricultural practices knowledge
- Water and soil protection knowledge
- Waste and by-product management
- Digital skills
- Energy efficiency in production
- Organic farming and pest control techniques

It is also important to point out that one of the experts interviewed warned about the need to promote technical literacy in general in the sector, and a simple code of good practice that is accessible and structured at different levels, in order to have an impact on the vast majority of producers in Portugal.



All the experts and professionals interviewed emphasised the need for simple and effective legislation to promote circular economy, particularly in terms of licensing composting. In the absence of an expeditious method/regulation for resolution, it will be difficult, according to them, for the sector to move towards circularity.

In the context of the interviews carried out with **5 vocational education and training organisations** on the level of current skills in the olive oil sector with regard to the Circular Economy, some of the following aspects stand out.

Identification of the 7 most important skills in the olive oil sector in terms of circularity, shown in **Table 6**.

Table 6. The most important competencies in the olive oil sector with regard to the circular economy.

Current Skills Level
- Sustainable agricultural practices knowledge
- Water and soil protection knowledge
- Organic farming and pest control techniques
- Food policy and regulations understanding
- Waste and by-product management
- Digital skills
- Energy efficiency in production

In this regard, the following indications from the organisations interviewed stand out:

- The importance of "**Sustainable agricultural practices knowledge**" was emphasised by all the interviewees, taking into account the importance of knowledge about production factors, such as the agrochemicals used in the sector;
- The importance of understanding the distinction between waste and by-products and relating the legislation that classifies them and the management practices, i.e. what to do with the waste and by-products and what are the potential ways of disposing of them;
- The importance of "**water and soil protection knowledge**", also due to the use of machinery in agriculture and phytopharmaceuticals products sometimes used, and knowledge about different types of irrigation, with a view to saving water, an increasingly scarce resource;
- The competency "**Energy efficiency in production**" is fundamental in the waste and by-product management process, which must be energy efficient and also because of the importance of the carbon footprint issue, i.e. the relevance of the energy spent on the final product, olive oil;
- The importance of "**Understanding food policies and regulations**", according to some organisations, is related to the fact that there is currently greater valorisation of waste and by-products in the sector, so it's important for producers to be as up-to-date as possible on the regulations that guide these issues. In addition, according to one of the researchers interviewed, the process of declassifying a waste product, for example, is very bureaucratic in Portugal. He also mentions the lack of knowledge on food policies and regulations, both on the part of the producers and on the part of the technicians from the organisations that regulate these matters and issue legal opinions. According to the researcher, this situation is linked to the fact that there is no ongoing



training for people in decision-making positions and/or insufficient specific training;

- The importance of “**Digital Skills**” in terms of data storage and processing, *Big Data* and the use of artificial intelligence programmes. For this reason, some of the university professors interviewed mentioned the need for circular economy training in the olive sector to have a course linked to digital skills applied to the olive sector.

With regard to the current offer of circular economy courses in the sector, made available by the education and vocational training organisations consulted, the following aspects stand out:

- There aren't degrees (cTeSP - Technical Higher Professional Courses, bachelor's degrees, master's degrees and doctorates) in circular economy exclusively for the olive sector at *Évora University*, but they do have curricular units and seminars that deal with this area of study, namely in the master's degree in Oliviculture and Olive Oil. In the 2025/2026 academic year, they will have a doctorate in Circular Economy in Agriculture, in association with *Portalegre Polytechnic Institute*. This doctorate will look at circular practices in the olive sector, namely the issue of its by-products and waste.
- There is nothing specific on the circular economy at *Beja Polytechnic Institute*, although they do offer a postgraduate degree in Sustainable Management of the Olive Sector and a higher vocational technical course (VET) in Olive Growing, both of which include more specific curricular units on the circular economy in the olive sector.
- At *Portalegre Polytechnic Institute - Elvas Higher School of Biosciences*, there is a master's programme in Sustainable Agriculture, and for the 2024-2025 academic year, a new curricular plan has been prepared, including a new curricular unit, i.e., circular economy applied to agriculture, also addressing circularity in the olive sector.

Based on the respondents' answers and the interviews carried out, the following current competences regarding the Circular Economy in the olive sector in Portugal can be highlighted:

- **Waste and by-product management** in order to maximise resource recovery;
- **Energy efficiency in production**, necessary to reduce costs;
- **Water and soil protection**, essential to guarantee agricultural sustainability;
- **Digital skills (SMEs)**, enabling the adoption of precision agriculture and traceability;
- **(Deficient) knowledge of environmental regulations and policies**, necessary for regulatory compliance and access to financial incentives.

The olive sector in Portugal is at an intermediate stage in terms of its level of competence in circular economy, seeing progress in waste management and sustainable production, but still with significant gaps in innovation, digitalisation and



renewable energies. Developing technical and strategic capacities will be essential to ensure the sector's competitiveness and its compliance with environmental and market requirements. Training professionals in the sector must therefore be a priority.

5. Current Skill Gaps regarding Circular Economy in the Olive Oil Sector

The olive sector in Portugal is at an impasse, given that traditional production methods need to evolve to align with the principles of the circular economy. Although there is a growing awareness of sustainability, critical skills gaps persist, limiting the sector's ability to optimise the recovery of by-products, resource efficiency and regenerative agricultural practices. The lack of specialised knowledge in waste transformation, renewable energy integration and digital precision agriculture hinders progress towards a truly circular model.

To fill these gaps, specific training is needed in sustainable soil management, carbon capture, water recycling and bio-based product innovation. Without these skills, the sector risks falling behind in terms of economic resilience, regulatory compliance and long-term sustainability. Investing in circular economy skills is not just a necessity, but a strategic imperative for the future of olive growing.

In this section, we will present the results obtained from 22 respondents to the online survey aimed at MSMEs in the olive oil sector in Portugal, in relation to the current skills gaps in the sector's circular economy. In addition, the results obtained from 6 interviews with agri-food circular business experts/professionals and 5 interviews with vocational education and training organisations will be presented.

For this part of the report, questions 10 - In your opinion, which of the following factors are most influencing **the demand for new skills** in your enterprise?, 11 - Are there any noticeable **skills gaps** in your enterprise that limit your ability to transition to a circular economy?, 12 - Do you think that the following **occupations, identified by ESCO, need circular economy skills** in the olive oil sector?, 13 - do you think that following **occupations*** would also **need circular economy skills**? and 14 - please list them below: of *ANNEX 1 (D2.3): Online Survey targeting MSMEs in the Olive Oil Sector about Current and Future Skills Needs for transition of the Olive Oil Sector to Circular Economy*, were taken into account and carried out among 22 respondents.

A number of factors were presented so that the respondents could choose the ones they consider to most influence the search for new competences in their company. The results can be seen in the graph in **Fig. 6**.



Factors that respondents determined as the most influencing the demand for new skills in their enterprise



Fig. 6. Factors that respondents determined as the most influencing the demand for new skills in their enterprise. Universe of 100% corresponds to a sample of 22 respondents from MSMEs in the olive oil sector.

We can conclude that the 4 factors that the respondents determined to be the most influential in their company's search for new competences are: Global market demands and trade dynamics, pressure to improve sustainability performance (e.g., need for cost reduction, supply chain issues), Environmental regulations and policies and consumer demand for sustainable products.

The respondents were then shown some of the skills gaps, visible in their companies, which limit their ability to transition to a circular economy. The results can be seen in the graph in **Fig. 7**.

Noticeable skills gaps in respondents' enterprise that limit their ability to transition to a circular economy

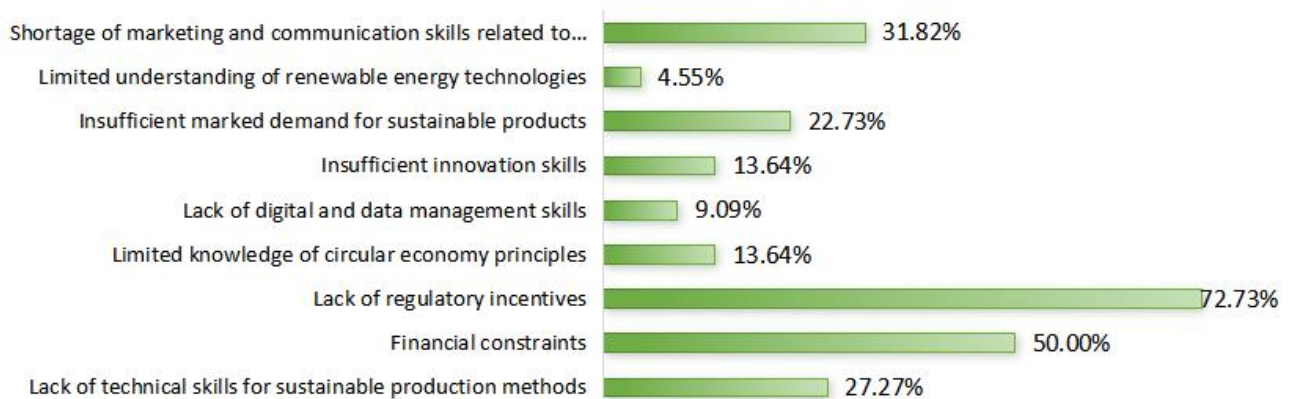


Fig. 7. Noticeable skill gaps in respondents' enterprise that limit their ability to transition to a circular economy. Universe of 100% corresponds to a sample of 22 respondents from MSMEs in the olive oil sector.

We can therefore see that the 4 skills gaps visible in the respondents' companies that limit their ability to transition to a circular economy are: **72.7%** - Lack of regulatory incentives; **50%** - Financial constraints; **31.8%** - Shortage of marketing and communication skills related to sustainability and **27.3%** - Lack of technical skills for

sustainable production methods. We can therefore conclude that, in general, financial issues have the greatest impact.

In question 12, using a list of professions identified by ESCO, respondents were asked to select the ones they felt most needed circular economy skills in the olive oil sector. Below are the results obtained, which can be seen in graph form in **Fig. 8**.

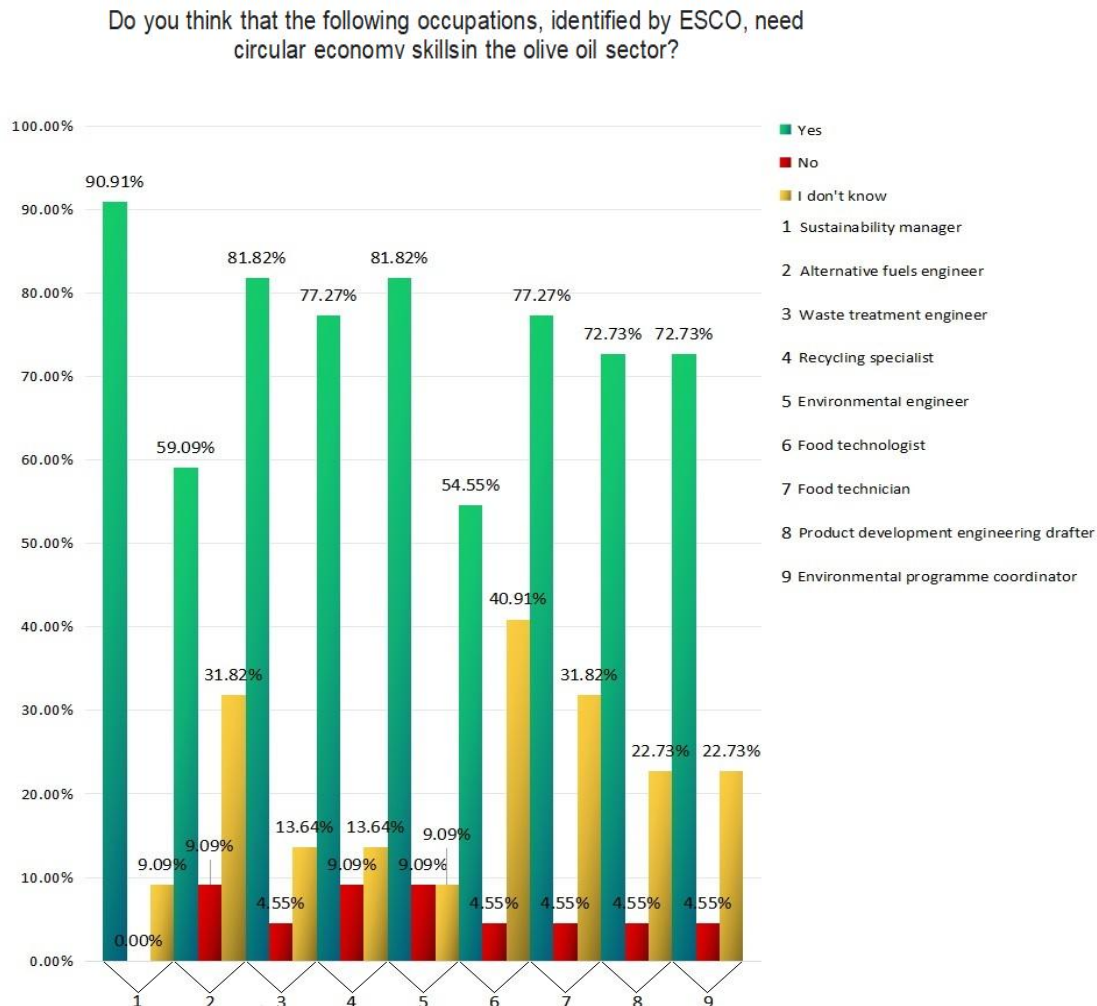


Fig. 8. Graph reflecting respondents' opinions on the need for circular economy skills, in the olive oil sector, in the professions presented (identified by ESCO): 1-Sustainability manager; 2-Alternative fuels engineer; 3-Waste treatment engineer; 4-Recycling specialist; 5-Environmental engineer; 6-Food technologist; 7-Food technician; 8-Product development engineering drafter; 9-Environmental programme coordinator. Universe of 100% corresponds to a sample of 22 respondents from MSMEs in the olive oil sector.

Sustainability manager, Waste treatment engineer and Waste treatment engineer are identified as being most in need of circular economy skills in the olive oil sector were: **90.91%** - Sustainability manager and **81.82%** - Waste treatment engineer and **81.82%** - Environmental engineer.

The 3 professions that are still uncertain about the need for circular economy skills in the olive oil sector are: Food technologist; Alternative fuels engineer; Food technician.

The respondents were also asked, again using a list of professions identified by ESCO, to choose those that they believe also require circular economy skills in the olive oil sector. The results are shown in graph form in **Fig. 9**.

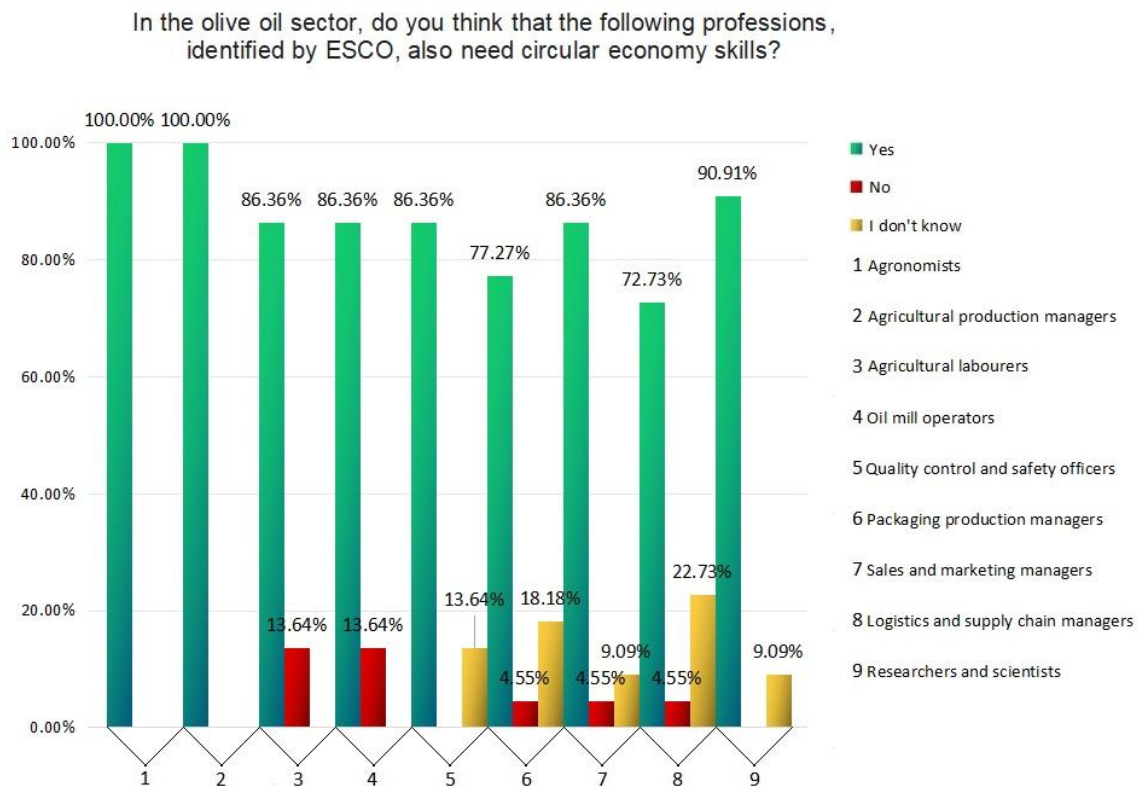


Fig.9. Graph reflecting respondents' opinions on the need for circular economy skills, in the olive oil sector, also for the professions presented: 1-Agronomists; 2-Agricultural production managers; 3-Agricultural labourers; 4-Oil mill operators; 5-Quality control and safety officers; 6-Packaging production managers; 7-Sales and marketing managers; 8-Logistics and supply chain managers; 9-Researchers and scientists. Universe of 100% corresponds to a sample of 22 respondents from MSMEs in the olive oil sector.

There is a greater uniformity of responses, with respondents considering that all the professions presented also need circular economy skills in the olive oil sector. The three professions with the highest ratings stand out: Agronomists, agricultural production managers and **90.91%** - Researchers and scientists.

When asked if there was another profession in the olive oil sector that wasn't on the list above, 2 of the 22 respondents said:

- **Financial managers;**
- **Political managers and decision-makers.**

When the respondents were asked to identify skills gaps regarding the circular economy in the olive oil sector, their answers were diverse and can be seen in graph form in **Fig. 10**.

Circular Economy Skills Gaps in the Olive Sector



Fig. 10. Circular Economy Skills Gaps in the Olive Sector.

In this way, it can be said that the Skills Gaps regarding the Circular Economy in the olive sector in Portugal are as follows:

- **Limited knowledge of circular economy principles (80%):** Many industry professionals lack a fundamental understanding of how to transition from linear production models to circular ones;
- **Lack of expertise in waste valorization 75%):** More technical skills are needed for advanced applications such as **biofuel production from olive waste, composting, and bioplastic manufacturing;**
- **Insufficient innovation skills (70%):** There is a **shortage of technical and engineering knowledge** to develop and implement new sustainable processes;
- **Digital and precision agriculture skills are underdeveloped (65%):** Adoption of **smart farming, AI-based optimization (Artificial Intelligence), and blockchain for traceability** is limited;
- **Renewable energy knowledge is lacking (60%):** Olive mills could integrate solar or biomass-based energy solutions, but industry workers often lack the skills to implement these solutions effectively;
- **Green finance and investment expertise (55%):** A **major challenge is securing funding** for circular economy initiatives due to limited knowledge in **sustainability-oriented financing;**
- **Leadership in sustainability strategy (50%):** While operational staff may be aware of sustainability issues, **managers and decision-makers often lack the strategic vision** to implement circular business models.

It could be indicated that although there is some knowledge about the circular economy, there are still significant areas for improvement.

In the context of the interviews carried out to **6 agri-food specialists/professionals in circular businesses** (mostly agronomists or agricultural production managers) on their current skills needs in relation to the Circular Economy in the olive oil sector, some of the following aspects stand out.



Identification of 7 factors that most influence the search for new skills in the experts/professionals consulted's company, shown in **Table 7**.

Table 7. Factors that most influence the search for new skills in the company of the interviewed circular business agri-food specialists/professionals.

Factors influencing the demand for new skills in the olive sector
- Sustainability performance improvement pressure
- Consumer demand for sustainable products
- Resource scarcity and need for resource management
- Economic changes
- Sector competition and pressure to performance improvement
- Circular economy models adoption
- Environmental regulations and policies

It is important to note that most of the interviewees emphasised the importance of all the identified factors, pointing to the fact that the new generations of producers are more aware and interested in looking for new skills, as they are concerned about sustainability in their final product. Portugal's growing olive tourism sector illustrates this interest, combining environmental and economic sustainability.

With regard to the factor "**Scarcity of resources and the need for resource management**", some interviewees pointed to the lack of labour force in the olive sector in Portugal. For this reason, several olive and olive oil producers have converted their modern canopy olive groves into modern hedgerow olive groves, allowing for mechanised and efficient harvesting.

With regard to the noticeable skills gaps that limit the interviewees' companies' ability to make the transition to a circular economy, 7 gaps stood out, as shown in **Table 8**.

Table 8. Noticeable skills gaps that limit the ability of the company of the agri-food specialists/professionals interviewed to a circular economy transition.

Skills gaps
- Lack of technical skills for sustainable production methods
- Financial constraints
- Lack of regulatory incentives
- Limited knowledge of circular economy principles
- Insufficient innovation skills
- Insufficient market demand for sustainable products

In this regard, the following indications from the interviewed experts/professionals stand out:

- The gap regarding "**Financial Restrictions**" was indicated by several agri-food professionals interviewed as being important to greater investment in the transition to the circular economy. It is worth mentioning that some lines of funding are not eligible for the agricultural component, but only for industry. Furthermore, various financial funds usually require producers to invest between 40% and 60%, preventing micro and small companies from accessing



this type of opportunity. The importance of balancing environmental/agricultural, financial and social sustainability was reiterated;

- With regard to the "**Lack of regulatory incentives**" gap, all the agri-food professionals interviewed praised the Portuguese Environment Agency's change in the classification of olive pits, so that by 2025 they will be considered a by-product and will no longer be considered waste when they are present in the olive pomace;
- With regard to the gap "**Insufficient demand for sustainable products on the market**", one of the agrifood professionals interviewed believes that there is a discrepancy between the demands made by society and the (low) amount that consumers are willing to pay for more sustainable products;
- One of the agri-food professionals in the circular business indicated that there was a lack of communication between the Academy and companies in the olive sector;
- In relation to the competency "**Lack of technical skills for sustainable production methods**", some of the interviewed agri-food professionals pointed out that many agricultural workers and other professionals don't have the digital skills that would allow them to train online.

Indication of 5 occupations considered by the interviewed experts/professionals to be in need of circular economy skills, shown in **Table 9**.

Table 9. Occupations in the olive oil sector that the interviewed agri-food circular business experts/professionals believe need circular economy skills.

Occupations that would need circular economy skills
- Agricultural production manager
- Millers owners
- Farm labourers
- Logistics and supply chain managers
- Circular economy researchers and scientists

Three of the professionals interviewed believe that all the professions listed are interconnected and that they need skills in the field of the circular economy in order to achieve the circular economy they want.

Some agri-food professionals mentioned that there is no profession of olive oil specialist in Portugal, unlike in the wine sector. Therefore, many workers in the olive oil sector do not have a professional licence.

In the context of the interviews carried out with **5 vocational education and training organisations** about current skills needs in the olive oil sector in relation to the Circular Economy, some of the following aspects stand out.

Identification of 9 factors that are influencing the demand for new skills in the olive sector in terms of circularity, shown in **Table 10**.

Table 10. Factors that are influencing the demand for new skills in the olive oil sector: Pressure to improve sustainable performance; Environmental regulations and policies; Consumer demand for



sustainable products; Waste and by-product management; Scarcity of resources and waste management needs; Adoption of circular economy models; New technology and innovation development; Global market demands and commercial dynamics; Economic changes.

Factors influencing the demand for new skills in the olive sector
- Pressure to improve sustainable performance
- Environmental regulations and policies
- Consumer demand for sustainable products
- Waste and by-product management
- Scarcity of resources and waste management needs
- Adoption of circular economy models
- New technology and innovation development
- Global market demands and commercial dynamics
- Economic changes

In this regard, the following indications from the organisations interviewed stand out:

- The importance of the factor **“Consumers’ demand for sustainable products”** was emphasised by a interviewed university professor, given Portuguese consumers’ demands regarding the origin of products, as well as the growing demand for organic and biodynamic products;
- The importance of the **"Regulation and environmental policies"** factor, particularly in the context of the European Green Deal (https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en) and the importance of **"Adopting circular economy models"**, in line with the **"Circular Economy Action Plan"** (<https://op.europa.eu/pt/publication-detail/-/publication/45cc30f6-cd57-11ea-adf7-01aa75ed71a1>) defined by the European Union and aligned with the *European Green Deal*;
- With regard to the **"Pressure to improve sustainable performance"** factor, its importance for ESG certification - *Environmental Social Governance* (<https://www.consilium.europa.eu/en/press/press-releases/2024/11/19/environmental-social-and-governance-esg-ratings-council-greenlights-new-regulation/>), in large companies, from 2025 onwards, making it compulsory to produce a report on environmental, social and corporate governance sustainability, measuring the degree of commitment of organisations to sustainable development objectives;
- The importance of the **“Development of new technologies and innovation”** factor with regard to new ways of treating waste and by-products, by obliging professionals in the sector to have circular economy training and, in this sense, the knowledge to work on new equipment and new processes for treating waste and by-products and new ways of its' utilisation.
- The **"Global market demands and commercial dynamics"** factors, together with **"Economic changes"**, were indicated by one of the interviewed researchers as the main factors in the search for new skills in the sector, particularly in terms of technology. According to this researcher, olive oil producers have to seek competitiveness in production in order to achieve a value-added product on the market. From his point of view, the economic sustainability of production processes will always be a very important factor for companies, followed by social and environmental sustainability.



Indication of 6 occupations considered by the interviewed organisations to be in need of circular economy skills, shown in **Table 11**.

Table 11. Occupations in the olive oil sector that the interviewed vocational education and training organisations believe need circular economy skills.

Occupations that would need circular economy skills
- Agronomists
- Agricultural production manager
- Farm labourers
- Millers owners
- Quality and safety control officers
- Researchers and scientists

In this regard, the following indications from the interviewed organisations stand out:

- Considering that the importance given to the circular economy in the olive sector is recent in Portugal, the interviewees believe that there is a need for some experienced professionals to update their knowledge in this area, as well as to raise awareness of circular economy among agricultural workers and millers;
- The occupations "**Agronomist**" and "**Agricultural Production Manager**" are indicated by 3 university professors as very important for acquiring skills in the field of circularity, because they deal directly with soil conservation, biodiversity, as well as the management of water resources and the possible contamination of soil and water; in addition, they need to know the proper circuits that exist for channelling everything that is considered polluting on a farm;
- The occupation "**Sales and Marketing Managers**" is identified by a university professor as fundamental for "selling" a positive message about a company's product, 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 should therefore act as "ambassadors" for the sector, which is intended to be greener and more circular, generating pressure on more polluting competitor companies;
- The occupations of **environmental engineer**, even though it already exists, was indicated by one of the university professors interviewed as also needing skills in the field of circularity, namely the knowledge to control environmental impacts and collaborate in the implementation of more efficient processes in terms of circularity.

Based on the respondents' answers and the interviews carried out, the following skills gaps can be highlighted in relation to the Circular Economy in the olive sector in Portugal:

- Poor knowledge of circular economy principles;
- Low level of training in circular business models;
- Difficulty in implementing reuse technologies, particularly in technical training in advanced composting and bioextraction processes;
- Lack of innovation in the use of by-products, particularly in terms of strategies



for incorporating waste into the food sector, cosmetics and pharmaceuticals;

- Weak skills in digitalisation and agricultural automation in micro and small companies in the sector - low adoption of IoT sensors, blockchain big data, for production optimisation and traceability;
- Gaps in sustainable management and environmental certification, particularly in green certifications and decarbonisation requirements;
- Lack of specialisation in sustainable finance and the green economy, i.e. difficulty to access investment funds for the circular transition, due to lack of training in green finance and EU taxonomy;
- Lack of training for sustainability leaders so that they can have a strategic vision for implementing circular practices.

The skills gaps in the Portuguese olive sector thus represent a critical obstacle to the full adoption of circular economy. The lack of technical knowledge, digital innovation and integration of renewable energies limits the sustainability and competitiveness of the sector. The creation of specialised training programmes, financial incentives and applied research will be key to accelerating the training of professionals and ensuring an efficient transition to circularity.

6. Future Skill Needs and Emerging Professions for Transition of Olive Oil Sector to Circular Economy

The olive oil sector's transition to a circular economy presents challenges and opportunities for MSMEs in the olive oil sector in Portugal. As highlighted in the survey results, businesses face growing pressure to improve sustainability performance, comply with environmental regulations, and respond to market demands for eco-friendly products. However, existing skills gaps in key areas, such as waste valorisation, renewable energy integration, and digitalisation, limit the sector's ability to fully adopt the principles of the circular economy.

In this section, we will present the results obtained from 22 respondents to the online survey, aimed at MSMEs in the olive oil sector in Portugal, regarding future skills needs and emerging professions for the olive oil sector's transition to the circular economy. In addition, the results obtained from 6 interviews with agri-food circular business experts/professionals and 5 interviews with vocational education and training organisations will be presented.

Addressing these gaps requires a strategic approach to skills development, fostering innovation and sustainability across the entire value chain. This shift is essential for improving resource efficiency, reducing waste, and strengthening economic resilience in the face of evolving regulatory and consumer expectations.

As part of the online survey aimed at MSMEs in the olive oil sector, they were presented with a number of competences and asked to tick the competences they considered most critical to their company's future success in adopting circular economy practices. The results can be seen in the graph in **Fig. 11**.

Critical competences for the future success of companies in adopting circular economy practices

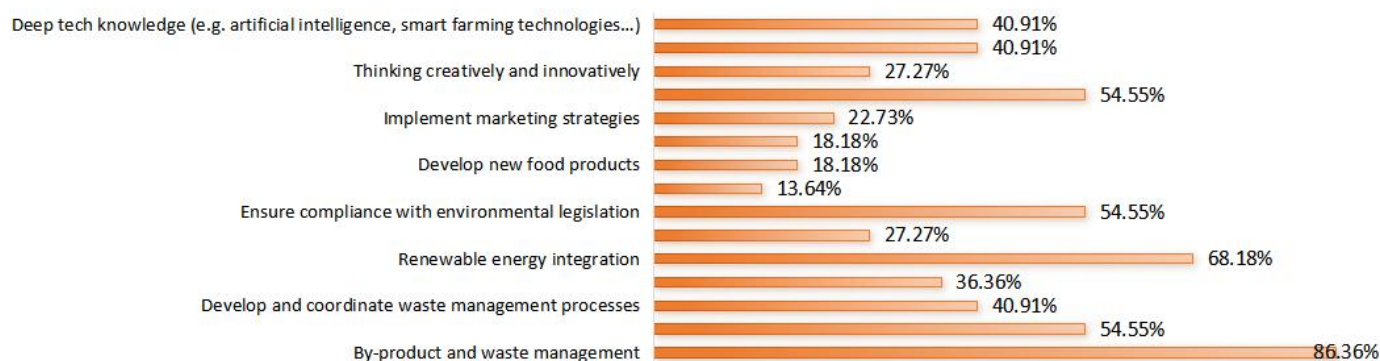


Fig. 11. Critical competences for the future success of companies in adopting circular economy practices. These competences were selected from occupations relevant in the olive oil sector at ESCO. Universe of 100% corresponds to a sample of 22 respondents from MSMEs in the olive oil sector.

It can be concluded that the 8 most critical competences for the future success of the respondents' company, in relation to the adoption of circular economy practices, are the following:

- By-product and waste management;
- Renewable energy integration;
- Produce sustainable products;
 - Ensure compliance with environmental legislation;
 - Green marketing;
- Develop and coordinate waste management processes;
 - Entrepreneurial mindset;
 - Deep tech knowledge (e.g. artificial intelligence, smartfarming technologies..)

Respondents were then presented with a list of some emerging professions and asked to select the ones they expected to become important in the olive oil sector in the future for the transition to the circular economy. The results are presented in graph form and can be seen in **Fig. 12**.

Emerging occupations that respondents expect to become important in the olive oil sector in the future for the transition to the circular economy



Fig. 12. Emerging occupations that respondents expect to become important in the future in the olive oil sector for the transition to the circular economy. Universe of 100% corresponds to a sample of 22 respondents from MSMEs in the olive oil sector.

It can be seen that, for the respondents, the 4 emerging occupations that they expect to become important in the olive oil sector in the future for the transition to the circular economy are as follows: Waste valorization engineers (e.g., biofuel production from waste); Circular economy managers; Sustainability consultants; Data analysts for sustainable agriculture.

Finally, respondents were asked to indicate, from a list of future competences related to the circular economy, those that they consider most critical for emerging professions in the olive oil sector. The results are presented in graph form which can be seen in **Fig. 13**.

What future skills related to the circular economy will be critical for emerging professions in the olive oil sector?

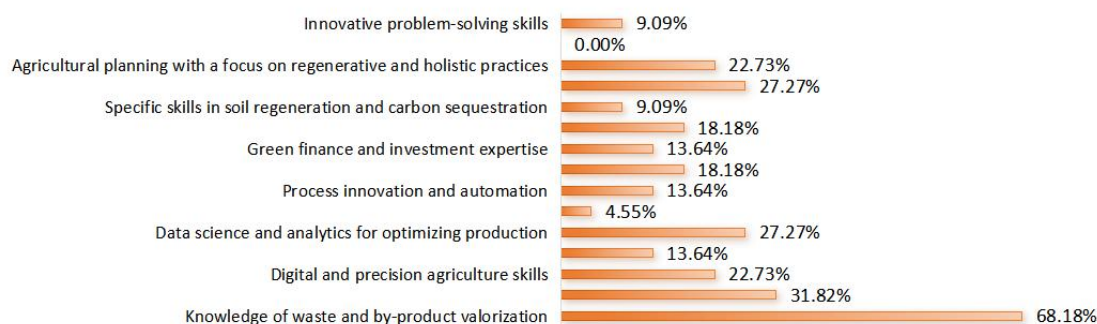


Fig. 13. Future skills related to the circular economy that will be critical for emerging professions in the olive oil sector. Universe of 100% corresponds to a sample of 22 respondents from MSMEs in the olive oil sector.

It can be seen that, for the respondents, the 6 future competences related to the circular economy that will be critical for emerging professions in the olive oil sector are the following: Knowledge of waste and by-product valorization; Expertise in



sustainable resource management; Data science and analytics for optimizing production; Integrated biodiversity management and ecological practices that regenerate ecosystems; Digital and precision agriculture skills; Agricultural planning with a focus on regenerative and holistic practices.

In the context of the interviews carried out with **6 agri-food experts/professionals from circular businesses**, on future skills needs and emerging professions in the context of the olive sector's transition to the Circular Economy, some of the following aspects stand out.

Identification of the 10 most critical skills for the future success of consulted experts/professionals company in adopting circular economy practices, shown in **Table 12**.

Table 12. Most critical skills for the future success of the interviewed circular business agri-food specialists/professionals company in adopting circular economy practices.

Most critical skills for future success in adopting circular practices
- By-product and waste management
- Development and coordination of waste management processes
- Sustainable products production
- Development of recycling / composting programmes
- Integration of renewable energies
- Entrepreneurial mindset
- Advanced knowledge of technology
- Product data management and digitalisation
- Ensuring compliance with environmental legislation
- Identification of <i>blockchain</i> innovation opportunities

In this regard, the following indications from the interviewed experts/professionals stand out:

- The competence "**Ensuring compliance with environmental legislation**" is indicated by some agri-food professionals as fundamental to fair competition between companies;
- It is important to mention, according to the expert from APPITAD - the Association of Integrated Protection Producers of Trás-os-Montes and Alto Douro (northern region of the country), the need to create a credible system for validating circular practices in the olive sector, scientifically validated and standardised, in order to avoid arbitrary evaluation/classification and create consumer confidence.

Identification of the 6 emerging occupations in the olive oil sector that will become important in the future for the transition to the circular economy, shown in **Table 13**.



Table 13. Emerging occupations in the olive oil sector that the interviewed circular business agri-food experts/professionals hope will become important in the future for the transition to circular economy.

Important emerging occupations in the olive oil sector for the transition to circular economy
- Circular economy managers
- Waste valorisation engineers
- Sustainability consultants
- Legal advisors on environmental regulations
- Marketing professionals for ecological products
- Food/pharmaceutical industry professionals for new product development

Regarding this, the following indications from the interviewed experts/professionals stand out:

- One of the agri-food professionals interviewed believes that more important than the emergence of new occupations in the olive sector is the need to incorporate the circular economy into some existing higher education degrees (e.g. Management, Agronomy) and, if possible, also target the olive sector. It is concerned that there are not enough companies in Portugal of a size that can justify hiring professionals from various emerging occupations, thus limiting them professionally in terms of job offers;
- According to the APPITAD specialist - Association of Integrated Protection Producers of Trás-os-Montes and Alto Douro (northern region of the country), and the agri-food professional from Casa Féteira, it is important to mention the need to create the profession of miller master. Both also pointed to the occupation of "**Marketing professionals for ecological products**" as fundamental to creating a positive image of the circular economy and the products associated with it;
- The APPITAD - Association of Producers in Integrated Protection of Trás-os-Montes and Alto Douro (northern region of the country) specialist considers it very important to promote literacy in the olive sector among journalists who write about it.

Identification of the 9 future competences relating to the Circular Economy that will be fundamental for emerging occupations in the olive oil sector, shown in **Table 14**.

Table 14. According to the interviewed circular business agri-food experts/professionals, the future competences for emerging occupations in the olive oil sector with regard to the circular economy are fundamental.

Future skills for the circular economy, essential for emerging professions in the olive sector
- Waste and by-product valorisation knowledge
- Renewable energy technology knowledge
- Skills in digital and precision agriculture
- Marketing and sales of organic products
- Science and data analysis to optimise production
- Process innovation and automation
- Leadership in sustainability
- Advanced technological skills
- Innovative problem-solving skills



In this regard, the following indications from the interviewed experts/professionals stand out:

- The majority of interviewees indicated that all the competences were important, although 9 competences stood out;
- According to some agri-food professionals from circular businesses interviewed, the skill "**Marketing and sales of organic products**" is very important in the sector's transition to circularity, raising awareness and also training consumers about the advantages of consuming olive oil and the difference in quality between refined olive oil, olive oil, virgin olive oil and extra virgin olive oil;
- According to the APPITAD - Association of Producers in Integrated Protection of Trás-os-Montes and Alto Douro (northern region of the country) expert, it is important to mention the need to change the teaching curricula in existing secondary and higher education courses in areas relevant to the circular transition of the sector, including the creation of more national training programmes and new courses.

In the context of the interviews carried out with **5 vocational education and training organisations** on future skills needs and emerging professions in the context of the olive sector's transition to a Circular Economy, some of the following aspects stand out.

Identification of the 10 most critical skills for future success in adopting circular economy practices in the olive oil sector, shown in **Table 15**.

Table 15. Skills generally most critical to future success in adopting circular economy practices in the olive oil sector.

Most critical competences for future success in adopting circular practices
- By-product and waste management
- Development and coordination of waste management processes
- Sustainable product production
- Development of recycling / composting programmes
- Integration of renewable energies
- Entrepreneurial mindset
- Product data management and digitalisation
- Life cycle assessment of resources
- Advanced knowledge in technology
- Identifying <i>blockchain</i> innovation opportunities
- Ensuring compliance with environmental legislation

In this regard, the following indications from the organisations interviewed stand out:

- Considering that the legislation in Portugal is not very clear in relation to waste recycling and composting, some of the interviewees pointed to the importance of skills such as "**By-product and waste management**" and "**Developing recycling programmes**";
- One of the university professors interviewed emphasised the importance of acquiring skills in "**Integration of renewable energies**", since some of the by-products of the sector's industry can be used for co-production of energy, i.e. production of biogas through biodigestion; biobutanol; electricity;



- According to one of the university professors interviewed, the skill "**Advanced knowledge of technology**" will be needed in the future, given the still poor knowledge in artificial intelligence;
- The competence "**Production of sustainable products**" was indicated by one researcher as the most important for the transition to the circular economy, because it responds to market needs, subsequently triggering the search for other competences, namely "Assessment of the life cycle of resources", among others.

Identification of the 9 emerging occupations in the olive oil sector that will become important in the future for the transition to the circular economy, shown in **Table 16**.

Table 16. Emerging professions in the olive oil sector that vocational education and training organisations hope will become important in the olive oil sector in the future for the transition to circular economy

Important emerging occupations in the olive oil sector for the transition to circular economy
- Circular economy managers
- Waste valorisation engineers
- Data analysts for sustainable agriculture
- Sustainability consultants
- Legal advisors on environmental regulations
- Renewable energy specialists
- Marketing professionals for ecological products
- Supply chain specialists for ecological logistics
- Food/pharmaceutical industry professionals for new product development

In this regard, the following indications from the interviewed organisations stand out:

- The "**Circular Economy Managers**" profession, indicated by several university professors, is considered fundamental, namely in identifying business opportunities in the various production processes and reusing by-products, so that companies in the sector can gain economic value. However, they point out that this profession will only be on demand in a medium term in large companies, since the majority of Portuguese companies in the olive sector are small, which is why the production manager is also the innovation manager. In the case of "**sustainability consultants**", the interviewees consider them to be more employable, given their importance in the sector and the fact that they can do this work for several companies at the same time.
- The "**Legal consultants on environmental regulations**" profession was identified by one of the university professors as very relevant, given the complexity of the subject in Portugal, the environmental impacts that waste and by-product management entails, and the fines that are sometimes imposed.
- It's worth mentioning that one of the interviewed university professors suggested creating a degree in circular economy engineering, incorporating the environmental part, the production part, innovation and environmental legislation;



- The profession of “**marketing professionals for ecological products**” was identified as very relevant by one of the interviewed university professors, because she considered it very important to pass on sustainability values to consumers, as well as the positive impact of responsible consumption on planet Earth.

In the interviews, it was pointed out that the occupations highlighted can give a competitive advantage to all olive and olive oil producers who want to innovate and thus become employable.

Identification of the 9 future competences relating to the circular economy that will be fundamental for emerging professions in the olive oil sector, shown in **Table 17**.

Table 17. Future skills, with regard to circular economy, which are fundamental for emerging professions in the olive oil sector, according to the education and vocational training organisations.

Future skills for the circular economy, essential for emerging professions in the olive sector
- Innovative problem-solving skills
- Sustainable resource management skills
- Valorisation of waste and by-products expertise
- Digital and precision agriculture skills
- Science and data analysis to optimise production
- Process innovation and automation
- Sustainability leadership
- Advanced technological skills
- Innovative problem-solving skills

In this respect, the following indications from the interviewed organisations stand out:

- The need for "**Innovative multidisciplinary problem-solving skills**", since problems in the sector are never isolated, requiring professionals to have *know-how* in several areas;
- The competence “**Process innovation and automation**” was indicated by one of the interviewed university professors as being very important, given the need to analyse data in order to optimise production. For example, the use of artificial intelligence in the industrial part of the mills, with machines communicating with other machines, i.e. *IoT - Internet of Things*;
- “**Advanced technological skills**” were indicated by a university professor interviewed as being relevant, namely in the reformulation of olive oil production processes.

When asked about the possibility of implementing courses in their institutions on circular economy practices in the olive oil sector, the representatives of the education and vocational training organisations expressed their interest in doing so, especially in the southern region of Portugal, in Alentejo, where there is a greater production of olives and olive oil. They suggested the provision of micro-credentials, lasting around 20 hours, also aimed at people who don't have higher education, with the condition of access being the minimum compulsory schooling in Portugal, i.e.



secondary education. This possibility, according to a professor at Évora University, could encourage some students to continue their studies. They suggest adopting a hybrid training system, i.e. combining digital and face-to-face training.

When questioned about a participant's/student's prior competences when attending a course on the circular economy, the representatives of vocational education and training organisations indicated the following aspects:

- The need for a degree, for example in agricultural sciences or chemistry, for a more in-depth course on the circular economy for technicians in the sector, due to the fact that some subjects require prior knowledge of certain concepts, particularly in the area of microbiology of the soil, soil chemistry and fertilisation. However, above all, the motivation to learn;
- The need for a minimum level of compulsory schooling ('high school') for farmers, with a view to providing shorter training and introducing/raising awareness of the circular economy in the sector.
- In any of the above situations, the majority of interviewees indicated the need for previous skills in olive oil production, in the industrial process of transformation and valorisation of by-products and knowledge of composting.

Based on the respondents' answers and the interviews carried out, the following future skills needs and emerging professions in the transition of the olive sector in Portugal to the Circular Economy can be highlighted:

Skills

- **By-products management and recovery**, particularly with regard to techniques for converting waste into biofuels, fertilizers and functional compounds;
- **Recycling and reuse of waste water**;
- **Energy efficiency techniques**;
- Use of **Big Data and Artificial Intelligence** applied to Olive Growing
- Use of **Blockchain and digital traceability** to implement quality control and certification systems for sustainable olive oils;
- **Green marketing and product differentiation**, using techniques to promote certified olive oils with a smaller environmental footprint;
- **Environmental financing management**, in order to be able to access European funds and incentives for the green transition.

Occupations

- **Circular economy managers**;
- **Sustainability consultants**;
- **Environmental auditors**, in order to assess companies' ecological performance and ensure regulatory compliance;
- **Waste recovery engineers**;
- **Renewable energy specialists**;
- **Data scientists and precision agriculture** - using big data, IoT and machine learning;
- **Green communication and marketing specialists**;



- **Food researchers and technologists;**
- **Environmental law and circularity jurists;**

In conclusion, it should be noted that the olive oil sector's transition to a circular economy requires a fundamental change in the skills, knowledge and capacities of the labour force. As highlighted in the results of the questionnaire addressed to MSMEs in the olive oil sector in Portugal, in the results of the interviews carried out, the sector faces significant gaps in terms of technical knowledge, integration of renewable energies, waste valorisation, digitalisation and sustainable business practices. These challenges must be addressed in order to increase efficiency of resources, reduce environmental impact and improve economic resilience.

Skills development in the future must focus on innovative waste management, precision agriculture, green finance and regulatory compliance in order to respond to growing consumer demand for sustainable products and stricter environmental regulation. In addition, new and emerging occupations such as circular economy managers, sustainability consultants and waste valorisation engineers will play a crucial role in implementing sustainable solutions in the sector.

Companies that invest in the skills of their workforce will be better placed to comply with the necessary regulations, access finance and innovate on the global market.

7. Conclusions

This report shows that Portugal's olive sector is in transition, with the application of circular practices, although with limitations, preventing the maximization of sustainable and economic potential.

The following are the most relevant aspects:

- i. Progress in circular practices, with an emphasis on by-product valorization, early adoption of renewable energies and agricultural digitalization, especially in large companies;
- ii. Critical skills shortages in key areas, namely advanced waste management, renewable energies, energy efficiency, digitalization and green finance;
- iii. Low integration of disruptive technologies, such as blockchain, IoT, AI and machine learning, which would optimize the sector's traceability and efficiency;
- iv. Lack of knowledge about circular business models, including regenerative agriculture and alternative markets for olive oil by-products;
- v. Regulatory and financial challenges, with difficulties in accessing sustainable financing and adapting to EU environmental requirements;
- vi. Opportunities for innovation and differentiation, with growing interest from international markets in sustainable products, which could place Portuguese olive oil in a prominent position if the transition is well structured.



Therefore, Portuguese olive sector transition to a circular economy is a strategic imperative, not only to comply with European and global environmental directives, but also to guarantee the economic, environmental and social sustainability of a sector that is fundamental to the national economy. The work carried out in this report, in terms of current competencies, existing gaps and future needs, shows that although there has been progress in implementing circular practices, structural challenges remain, limiting the full adoption of regenerative and sustainable models. The circular economy cannot be seen as a mere theoretical concept, but must be incorporated into the sector's entire value chain, from agricultural production to consumption and the by-products valorization. To this end, structured investment in workforce training, technological innovation and the restructuring of business models is essential.

8. Recommendations

The transition of Portugal's olive sector to a circular economy is a strategic necessity. Therefore, in order to ensure an effective and competitive transition, a strategic action plan needs to be defined, which includes professional training, encouraging innovation and adapting to environmental and market requirements.

The following recommendations stand out:

1. Skills Development and Specialized Training
 - Create **technical and professional training programs** focused on **by-product management, waste valorization, energy efficiency and agricultural digitalization**;
 - Strengthen the **integration of circular economy in agronomy, environmental engineering and agro-industrial management courses**, ensuring that future professionals master **regenerative and circular techniques**;
 - Promote **training for managers and decision-makers** in **sustainable business models, green finance and regulatory compliance**;
 - **Encouraging interdisciplinary skills** (agriculture, engineering, data science, business strategy) to foster holistic circular economy approaches.
2. Technological Innovation and Digitalization
 - Encourage the **adoption of smart technologies**, such as **IoT sensors, blockchain for traceability and AI applied to agricultural management**;
 - Develop **cooperation platforms between universities, research centers and companies**, fostering **innovation in the use of by-products and sustainable production**;
 - Create **environmental monitoring systems** to measure the **impact of agricultural and industrial practices**, optimizing the use of resources;
 - Create **Public-private partnerships** to fund sustainability initiatives and provide incentives for training in circular economy.



3. By-product valorization and resource efficiency
 - Implement **strategies for the total valorization of the sector's waste**, transforming olive pomace, raw water and leaves into **biofuels, biofertilizers and pharmaceutical ingredients**.
 - Encourage the use of **sustainable packaging and biodegradable materials**, reducing the sector's ecological footprint;
 - Create **industrial symbiosis networks** that allow the **exchange of by-products between the agri-food and energy industries**.
4. Financial Incentives and Regulation
 - Facilitate **access to sustainable financing** by enabling **companies to obtain European funds and private investments in circularity**;
 - Develop **public incentive policies**, including **tax benefits for companies that adopt circular economy models**;
 - Simplify and strengthen the **implementation of environmental legislation**, ensuring that **companies proactively adapt to new EU requirements**;
5. Restructuring the Business Model and Expanding Markets
 - Encourage the **production of olive oils certified as sustainable**, guaranteeing differentiation in international markets;
 - Raise consumer awareness of sustainable olive oil production and appreciation of this product;
 - Investing in **green marketing strategies and digital traceability** to respond to **growing consumer demand for sustainable products**;
 - Developing **green supply chains**, reducing the carbon footprint of distribution and optimizing circular logistics.

Therefore, in order to guarantee economic resilience, training in sustainability and digitalization, a reduction in environmental impact and leadership in the global market, a collective commitment between producers, companies, teachers, researchers and political decision-makers is essential in Portugal.

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10. Appendices

10.1. Survey Questionnaires and Interviews

10.1.1. Annex 1 (D2.3) – Online Survey targeting MSMEs in the Olive Oil Sector about Current and Future Skills Needs for Transition of the Olive Oil Sector to Circular Economy

ANNEX 1 (D2.3): Online Survey targeting MSMEs in the Olive Oil Sector about Current and Future Skills Needs for transition of the Olive Oil Sector to Circular Economy

This survey is launched as the second consultation activity of the project *“Developing skills for introducing circular business models and digital technologies in olive oil sector (CIRCOLIVE)”*, a three-year project co-funded by the European Union under the Erasmus+ Programme.

The project aims to support the EU transition to the Circular Economy by improving/enhancing the circular business skills in the olive oil sector in Spain, Italy, Greece, Portugal and Croatia, in order to promote the adoption of circular entrepreneurial models for waste and by-product valorization of the whole olive value chain.

The answers to this survey will help us in the identification of skills for developing VET curricula on circular business models and digital technologies in olive oil sector.

In this survey definition of **Circular Economy** presents methods and possibilities of using olive by-products and waste in the olive oil sector. **ESCO** (European Skills, Competences, Qualifications and Occupations), the European multilingual classification of Skills, Competences, Qualifications and Occupations, was used to identify and select existing



occupations and skills relevant to circular economy in the olive oil sector.

The survey takes **about 10 minutes**. Responses will be treated **anonymously** and the results will be used for **CIRCOLIVE project purposes only**.

Your answer is valuable to us and we thank you in advance for your time and effort.

Part 1: General Information

- 1) Respondent's gender
 - a) Male
 - b) Female
 - c) I prefer not to answer

- 2) Respondent's age _____ years old

- 3) Enterprise size:
 - a) Micro (<10 employees)
 - b) Small (<50 employees)
 - c) Medium sized (<250 employees)
 - d) Large size (>250 employees)

- 4) Respondent's education
 - a) High school and lower
 - b) Bachelor degree
 - c) Licenciatura degree
 - d) Master degree
 - e) PhD
 - f) Other _____

- 5) Which segment of the olive oil sector does your enterprise operate in?
 - Olive growing
 - Olive oil production
 - Olive growing and olive oil production
 - Other (Please specify): _____

- 6) Which of the following best describes your **current occupation/profession*** in the olive oil sector? (Select the most relevant)

*selected occupations from ESCO relevant to olive oil sector. ESCO - the European multilingual classification of Skills, Competences, Qualifications and Occupations



- Agronomists
- Agricultural production managers
- Agricultural labourers
- Environmental engineers
- Oil mill operators
- Food technologists
- Quality control and safety officers
- Packaging production managers
- Sales and marketing managers
- Logistics and supply chain managers
- Researchers and scientists
- Other (Please specify): _____

Part 2: Current Skill Levels

7) Which of the following **circular economy practices** are you currently implementing or aware of in your enterprise? (Select all that apply)

- Waste reduction and by-product valorization (e.g., olive pomace composting)
- Water recycling and efficient usage in olive oil production
- Renewable energy use
- Eco-friendly packaging materials
- Sustainable transportation and logistics solutions
- Carbon footprint reduction
- None of the above

8) How do you **rate skills and knowledge** about circular economy (methods and possibilities of using olive by-products and waste in olive sector) in your enterprise?

- a) 1 - Poor
- b) 2 - Limited
- c) 3 - Acceptable
- d) 4 - Good
- e) 5 - Excellent

9) According to your opinion, which of the following **skills*** are most significant in the olive oil sector regarding circular economy? (Rank in order of importance, 1 not important at all to 5 being the most important)

* selected skills from ESCO adapted to olive oil sector. ESCO - the European multilingual classification of Skills, Competences, Qualifications and Occupations

- Knowledge of sustainable farming practices



- Knowledge of water and soil protection
- Organic farming and pest control techniques
- Understanding of food policies and regulations
- Waste and by-product management
- Energy efficiency in production
- Supply chain management
- Digital skills (e.g. data management, precision agriculture)

Part 3: Factors Shaping Skills Demand

10) In your opinion, which of the following **factors** are most influencing **the demand for new skills** in your enterprise? (Select all that apply):

- Pressure to improve sustainability performance (e.g., need for cost reduction, supply chain issues)
- Economic changes (e.g., global markets, trade policies)
- Adoption of circular economy models
- Environmental regulations and policies
- Consumer demand for sustainable products
- Industry competition and performance improvement pressures
- Development of new technologies and innovation
- Resource scarcity and waste management needs
- Global market demands and trade dynamics

Part 4: Skill Gaps

11) Are there any noticeable **skills gaps** in your enterprise that limit your ability to transition to a circular economy? (Select all that apply)

- Lack of technical skills for sustainable production methods
- Financial constraints
- Lack of regulatory incentives
- Limited knowledge of circular economy principles
- Lack of digital and data management skills
- Insufficient innovation skills
- Insufficient market demand for sustainable products
- Limited understanding of renewable energy technologies
- Shortage of marketing and communication skills related to sustainability
- Lack of entrepreneurial mindset
- Lack of deep tech knowledge (e.g. artificial intelligence, smart farming technologies...)



12) Do you think that the following **occupations, identified by ESCO, need circular economy skills** in the olive oil sector? (Yes/No/I don't know)

- Sustainability manager
- Alternative fuels engineer
- Waste treatment engineer
- Recycling specialist
- Environmental engineer
- Food technologist
- Food technician
- Product development engineering drafter
- Environmental programme coordinator

13) In the olive oil sector, do you think that following **occupations*** would also **need circular economy skills**? (Yes/No/I don't know)

*selected occupations from ESCO relevant to olive oil sector. ESCO - the European multilingual classification of Skills, Competences, Qualifications and Occupations

- Agronomists
- Agricultural production managers
- Agricultural labourers
- Oil mill operators
- Quality control and safety officers
- Packaging production managers
- Sales and marketing managers
- Logistics and supply chain managers
- Researchers and scientists

14) If you think that any other occupation in olive oil sector not listed above would also need circular economy skills, please list them below:

Part 5: Future Skill Needs and Occupations

15) Which of the following **skills*** are most critical for your company's **future** success in adopting circular economy practices? (Select all that apply):

*skills from ESCO adapted to olive oil sector. ESCO - the European multilingual classification of Skills, Competences, Qualifications and Occupations

- By-product and waste management
- Produce sustainable products



- Develop and coordinate waste management processes
- Develop recycling programs
- Renewable energy integration
- Product data management and digitalization
- Ensure compliance with environmental legislation
- Assess the life cycle of resources
- Develop new food products
- Plan digital marketing /digital skills
- Implement marketing strategies
- Green marketing
- Thinking creatively and innovatively
- Entrepreneurial mindset
- Deep tech knowledge (e.g. artificial intelligence, smart farming technologies...)

16) In your opinion, what **emerging occupations** do you expect will become important in the **future** in the olive oil sector **for transition to circular economy?** (Please, select 3)

- Circular economy managers
- Sustainability consultants
- Renewable energy specialists
- Waste valorization engineers (e.g., biofuel production from waste)
- Environmental impact auditors
- Data analysts for sustainable agriculture
- Marketing professionals for eco-friendly products
- Supply chain specialists for green logistics
- Legal advisors on environmental regulations
- Professionals in the food and pharmaceutical industry for the development of new products

17) In your opinion, which **future skills**, regarding circular economy, will be critical for these emerging **occupations** in the olive oil sector? (Please, select 3)

- Knowledge of waste and by-product valorization
- Expertise in sustainable resource management
- Digital and precision agriculture skills
- Circular product design and eco-packaging
- Data science and analytics for optimizing production
- Renewable energy technology expertise
- Process innovation and automation
- Marketing and sales of green products
- Green finance and investment expertise
- Leadership in sustainability strategy



- Specific skills in soil regeneration and carbon sequestration
- Integrated biodiversity management and ecological practices that regenerate ecosystems
- Agricultural planning with a focus on regenerative and holistic practices
- Deep tech skills (e.g. robotics, blockchain...)
- Innovative problem-solving skills

18) Dear respondent,

Thank you for your time and contribution to CIRCOLIVE project

19) I consent to have the information stated above used by the CIRCOLIVE project partners solely for meeting the purposes of this survey.

Yes – No

20) In case you want receive information about the project and activities, please enter your e-mail _____

10.1.2. Annex 2 (D2.3) – Structured Interview with Circular Business Agro-food Experts/professionals about Current and Future Skills Needs for transition of the Olive Oil Sector to Circular Economy

Instructions for Structured interview

General information:

- useful tool of quantitative research and social surveys
- standardized interview schedule
- each interviewee gets the same questions, in the same way and order
- minimizes variation between interviews

Conducting structured interviews:

- Introduce the research

(identify yourself, general information about CIRCOLIVE project, purposes of research and procedure of interview)

- Ethical issues

(GDPR, recording interview) – need to be signed

ANNEX 2 (D2.3): Structured Interview with Circular Business Agro-food Experts/professionals about Current and Future Skills Needs for transition of the Olive Oil Sector to Circular Economy

In this interview definition of **Circular Economy** presents methods and possibilities of using olive by-products and waste in olive sector. **ESCO** (European Skills, Competences, Qualifications and Occupations), the European multilingual classification of Skills,



Competences, Qualifications and Occupations, was used to identify and select existing occupations and skills relevant to circular economy in the olive oil sector.

Part 1. General Information

Date:

Location:

Interviewees' years:

Interviewees' educational level:

Enterprise name:

Enterprise email address (in case you want receive further information about the Circolive project):

Enterprise size:

- Micro (< 10 employees)
- Small (< 50 employees)
- Medium sized (< 250 employees)
- Large size (> 250 employees)

Which segment of the olive oil sector does your enterprise operate in?

- Olive growing
- Olive oil production
- Olive growing and olive oil production
- Other (Please specify): _____

1. What is your **occupation/profession** in the olive oil sector?

- For e.g. agronomist, agricultural production manager, agricultural labourer, environmental engineer, oil mill operator, food technologist, quality control and safety officer, etc.

Part 2. Current Skill Levels

2. Which **circular economy practices** are you currently implementing, or aware of in your enterprise?

- For e.g. waste reduction and by-product valorization, water recycling and efficient usage in olive oil production, renewable energy use, eco-friendly packaging materials, sustainable transportation and logistics solutions, carbon footprint reduction

3. How would you **rate skills and knowledge** about circular economy in your enterprise?

- 1 - Poor
- 2 - Limited
- 3 - Acceptable
- 4 - Good
- 5 - Excellent



4. According to your opinion, which **skills** are most significant in the olive oil sector regarding circular economy?
- For e.g. knowledge of sustainable farming practices, knowledge of water and soil protection, organic farming and pest control techniques, understanding of food policies and regulations, waste and by-product management, energy efficiency in production, supply chain management, digital skills

Part 3. Factors Shaping Skills Demand

5. In your opinion, which **factors** are influencing **the demand for new skills** in your enterprise the most?
- For e.g. pressure to improve sustainability performance, economic changes, adoption of circular economy models, environmental regulations and policies, consumer demand for sustainable products, industry competition and performance improvement pressures, development of new technologies and innovation, resource scarcity and waste management needs, global market demands and trade dynamics

Part 4. Skill Gaps

6. Are there any noticeable **skills gaps** in your enterprise that limit your ability to transition to a circular economy?
- For e.g. lack of technical skills for sustainable production methods, financial constraints, lack of regulatory incentives, limited knowledge of circular economy principles, lack of digital and data management skills, insufficient innovation skills, insufficient market demand for sustainable products, limited understanding of renewable energy technologies, shortage of marketing and communication skills related to sustainability, lack of entrepreneurial mindset, lack of deep tech knowledge (e.g. artificial intelligence, smart farming technologies...)
7. In the olive oil sector, which **occupations** do you think would need circular economy skills?
- o For e.g. agronomists, agricultural production managers, agricultural labourers, oil mill operators, quality control and safety officers, packaging production managers, sales and marketing managers, logistics and supply chain managers, researchers and scientists in circular economy

Part 5. Future Skill Needs and Occupation

8. In your opinion, which **skills** are most critical for your company's **future** success in adopting circular economy practices?



- For e.g. by-product and waste management, produce sustainable products, develop and coordinate waste management processes, develop recycling programs, renewable energy integration, product data management and digitalization, ensure compliance with environmental legislation, assess the life cycle of resources, entrepreneurial mindset, deep tech knowledge

9. What **emerging occupations** do you expect will become important in the **future** in the olive oil sector **for transition to circular economy**?

- For e.g. circular economy managers, sustainability consultants, renewable energy specialists, waste valorization engineers, environmental impact auditors, data analysts for sustainable agriculture, marketing professionals for eco-friendly products, supply chain specialists for green logistics, legal advisors on environmental regulations, professionals in the food/pharmaceutical industry for the development of new products

10. In your opinion, which **future skills**, regarding circular economy, will be critical for these emerging **occupations** in the olive oil sector?

- For e.g. knowledge of waste and by-product valorization, expertise in sustainable resource management, digital and precision agriculture skills, circular product design and eco-packaging, data science and analytics for optimizing production, renewable energy technology expertise, process innovation and automation, marketing and sales of green products, green finance and investment expertise, leadership in sustainability strategy, deep tech skills, innovative problem-solving skills

10.1.3. Annex 3 (D2.3) – Structured Interview with VET Providers about Current and Future Skills Needs for transition of the Olive Oil Sector to Circular Economy

Instructions for Structured interview

General information:

- useful tool of quantitative research and social surveys
- standardized interview schedule
- each interviewee gets the same questions, in the same way and order
- minimizes variation between interviews

Conducting structured interviews:

- Introduce the research - (identify yourself, general information about CIRCOLIVE project, purposes of research and procedure of interview)
- Ethical issues - (GDPR, recording interview) – need to be signed



ANNEX 3 (D2.3): Structured Interview with VET Providers about Current and Future Skills Needs for transition of the Olive Oil Sector to Circular Economy

In this interview definition of **Circular Economy** presents methods and possibilities of using olive by-products and waste in olive sector. **ESCO** (European Skills, Competences, Qualifications and Occupations), the European multilingual classification of Skills, Competences, Qualifications and Occupations, was used to identify and select existing occupations and skills relevant to circular economy in the olive oil sector.

Part 1. General Information

Date:

Location:

VET name:

VET email address (in case you want receive further information about the CIRCOLIVE project): _____

Interviewees' years:

Interviewees' educational level:

Type of Education/VET Institution:

1. University
2. Polytechnic
3. Institute
4. Public Open University
5. VET provider
6. Private VET provider
7. Other (specify): _____

Interviewees' role:

1. Executive
2. Manager
3. Lecturer
4. VET specialist
5. Other _____

Main information about educational/VET provider

- Length of business
- Number and type of employees by role (teaching, training, administrative...)
- Area of expertise/subject provided (agronomy, forestry, economy, other)
- Other information

Part 2. Current Skill Levels

11. According to your opinion, which **skills** are most significant in the olive oil sector regarding circular economy?

- For e.g. knowledge of sustainable farming practices, knowledge of water and soil protection, organic farming and pest control techniques, understanding of food



policies and regulations, waste and by-product management, energy efficiency in production, supply chain management, digital skills

Part 3. Factors Shaping Skills Demand

12. In your opinion, which **factors** are influencing **the demand for new skills** in the olive oil sector?
- For e.g. pressure to improve sustainability performance, economic changes, adoption of circular economy models, environmental regulations and policies, consumer demand for sustainable products, industry competition and performance improvement pressures, development of new technologies and innovation, resource scarcity and waste management needs, global market demands and trade dynamics

Part 4. Skill Gaps

13. In the olive oil sector, which **occupations** do you think **would need** circular economy skills?
- For e.g. agronomists, agricultural production managers, agricultural labourers, oil mill operators, quality control and safety officers, packaging production managers, sales and marketing managers, logistics and supply chain managers, researchers and scientists

Part 5. Future Skill Needs and Occupation

14. In your opinion, which **skills** are generally most critical for **future** success in adopting circular economy practices in the olive oil sector?
- For e.g. by-product and waste management, produce sustainable products, develop and coordinate waste management processes, develop recycling programs, renewable energy integration, product data management and digitalization, ensure compliance with environmental legislation, assess the life cycle of resources, entrepreneurial mindset, deep tech knowledge
15. What **emerging occupations** do you expect will become important in the **future** in the olive oil sector **for transition to circular economy**?
- For e.g. circular economy managers, sustainability consultants, renewable energy specialists, waste valorization engineers, environmental impact auditors, data analysts for sustainable agriculture, marketing professionals for eco-friendly products, supply chain specialists for green logistics, legal advisors on environmental regulations, professionals in the food/pharmaceutical industry for the development of new products



16. In your opinion, which **future skills**, regarding circular economy, will be critical for these **emerging occupations** in the olive oil sector?
- For e.g. knowledge of waste and by-product valorization, expertise in sustainable resource management, digital and precision agriculture skills, circular product design and eco-packaging, data science and analytics for optimizing production, renewable energy technology expertise, process innovation and automation, marketing and sales of green products, green finance and investment expertise, leadership in sustainability strategy, deep tech skills, innovative problem-solving skills

Part 6. Education

17. Does your institution currently provide courses on circular economy practices in the olive oil sector?
- If YES, in what format? If NO, go to question 8.
18. In your opinion, do you think your institution could implement courses on circular economy practices in the olive oil sector?
- If YES, in what format?
19. In your opinion, which competences should the participant/student have before attending a course about circular economy?



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