



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

- SPAIN -

February 2025



Project  
management



Identification  
of olive sector



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business



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

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## 1. Executive Summary

The Spanish olive oil sector faces both challenges and opportunities in its transition to a circular economy, requiring new skills, workforce development, and industry adaptation. This report examines current skill levels, gaps, and future training needs based on survey data and experts and training providers' interviews.

Findings indicate growing awareness of circular economy principles, but significant skill gaps persist, particularly in regulatory compliance, waste valorization, digitalization, and sustainability marketing. While many producers already implement resource-saving practices, these efforts are largely informal, and training providers lack structured programs. A key challenge is the declining interest of young people in agricultural careers, which may hinder skill development.

Climate change, stricter regulations, consumer demand for sustainability, and resource scarcity are driving the need for expertise in sustainable water management, precision agriculture, and circular production models. Experts highlight the emergence of new professions, such as sustainability consultants, circular economy managers, and waste valorization engineers, as essential for the sector's transformation.

To address these challenges, the report recommends the implementation of structured training programs and awareness campaigns to shift the perception of circular economy practices from a regulatory burden to a business opportunity. By prioritizing education, innovation, and policy adaptation, Spain's olive oil sector can enhance competitiveness, sustainability, and long-term economic viability.

## 2. Introduction

The global economy is undergoing a fundamental shift towards sustainability, driven by concerns over climate change, resource depletion, and environmental degradation. The circular economy model has emerged as a key strategy to reduce waste, improve resource efficiency, and promote sustainable production practices across industries. According to the European Commission (2020), circular economy principles will play a central role in achieving the objectives of the European Green Deal, which aims to make Europe the first climate-neutral continent by 2050. The agriculture and food production sectors are particularly affected by these changes, as they are significant contributors to global environmental impacts, including water consumption, greenhouse gas emissions, and soil degradation (FAO, 2021).

Within this context, the olive oil sector—a pillar of Mediterranean agriculture—faces both challenges and opportunities in adapting to circular economy principles. The olive oil production process generates large quantities of by-products, including olive pomace, wastewater, and pruning residues, which have traditionally been considered waste (International Olive Council, 2022). However, recent advancements in waste valorization technologies and bio-economy strategies suggest that these by-products can be repurposed into biofuels, animal feed, organic fertilizers, and even cosmetic and pharmaceutical ingredients (UNEP, 2022). In addition to environmental benefits, circular economy practices offer economic advantages, as they can reduce operational



costs, create new revenue streams, and improve the competitiveness of olive oil producers (OECD, 2021).

Despite these opportunities, many olive oil producers struggle to implement circular economy practices due to skill gaps, financial constraints, and regulatory complexities. The Food and Agriculture Organization (FAO, 2021) highlights that technical knowledge, digital competencies, and regulatory compliance skills are among the most critical barriers preventing the widespread adoption of sustainable practices in agriculture. Similarly, the International Labour Organization (ILO, 2020) emphasizes that the transition to a green economy requires significant investment in workforce training and education, particularly in traditional industries such as agriculture and food processing.

This report seeks to explore the current state of circular economy skills in the olive oil sector in Spain by addressing three key questions:

1. What are the current skill levels in the olive oil sector regarding circular economy practices?
2. What are the main skill gaps limiting the transition to circular economy models?
3. What future competencies and emerging occupations will be necessary for the sector's transformation?

To answer these questions, the study draws on survey data from olive oil producers, as well as in-depth interviews with industry experts and training providers.

## 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 Spain. 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- Spain).

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 Spain, 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 Spain.

## 2.2. Key Findings



The results indicate that while awareness of circular economy principles is increasing, skill levels remain relatively low. Many producers are already implementing basic sustainability practices, such as water recycling, organic waste repurposing, and renewable energy integration, but these efforts are often based on experience rather than structured training. Training providers recognize this gap and express a strong commitment to including circular economy topics in their programs. However, a major challenge they face is the declining interest of young people in agricultural careers, which may impact the future adoption of sustainability-focused training.

Significant gaps in technical knowledge, regulatory compliance, digitalization, and sustainability marketing are preventing a full transition to circular economy practices. Producers lack formal training in waste valorization, digital monitoring tools, and sustainability reporting, which are crucial for effective implementation. Financial constraints and complex regulations further hinder innovation, making it difficult for producers to invest in new technologies and sustainable practices. Some experts also highlight a mental shift is needed—many in the sector see sustainability regulations as a burden rather than an opportunity, limiting their willingness to adopt circular strategies.

The study identifies a set of critical future competencies for the sector's transformation. These include expertise in waste valorization, digital agriculture, regulatory compliance, and sustainable supply chain management. Additionally, new emerging professions such as sustainability consultants, circular economy managers, digital agriculture specialists, and waste valorization engineers will be key in guiding the sector through this transition. Experts also emphasize the need for improved sustainability communication and marketing strategies to ensure that producers can effectively convey their environmental efforts without falling into greenwashing practices.

### 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          | <a href="http://data.europa.eu/esco/skill/a992f345-7c06-4982-8fc9-5fab55e316af">http://data.europa.eu/esco/skill/a992f345-7c06-4982-8fc9-5fab55e316af</a>                                                                                                                                                              |
| Knowledge of water and soil protection                       | Advise on soil and water protection                        | <a href="http://data.europa.eu/esco/skill/3e25fd3e-2bcd-4320-9587-0aadf7fb93b1">http://data.europa.eu/esco/skill/3e25fd3e-2bcd-4320-9587-0aadf7fb93b1</a>                                                                                                                                                              |
| Organic farming and pest control techniques                  | Organic farming<br>Perform pest control                    | <a href="http://data.europa.eu/esco/skill/186da517-9a3e-41cd-9158-4001e3694459">http://data.europa.eu/esco/skill/186da517-9a3e-41cd-9158-4001e3694459</a><br><a href="http://data.europa.eu/esco/skill/08881cb7-5331-4b11-9442-4d7c9fce749e">http://data.europa.eu/esco/skill/08881cb7-5331-4b11-9442-4d7c9fce749e</a> |
| Understanding of food policies and regulations               | Food policy<br>Control food safety regulations             | <a href="http://data.europa.eu/esco/skill/e591f458-93c4-4cc7-a441-2340545c33f3">http://data.europa.eu/esco/skill/e591f458-93c4-4cc7-a441-2340545c33f3</a><br><a href="http://data.europa.eu/esco/skill/4d7410df-51a9-42bc-83ec-363c201ee631">http://data.europa.eu/esco/skill/4d7410df-51a9-42bc-83ec-363c201ee631</a> |
| Waste and by-product management                              | Waste management<br>By-products                            | <a href="http://data.europa.eu/esco/skill/40f65a56-ccbe-4601-9f32-1cc6cdd24f28">http://data.europa.eu/esco/skill/40f65a56-ccbe-4601-9f32-1cc6cdd24f28</a><br><a href="http://data.europa.eu/esco/skill/f2412a5c-8072-4cd7-8fa1-806864f91276">http://data.europa.eu/esco/skill/f2412a5c-8072-4cd7-8fa1-806864f91276</a> |
| Energy efficiency in production                              | Energy efficiency                                          | <a href="http://data.europa.eu/esco/skill/83fc0b2b-6cd2-46af-b1ff-d3fc83604c26">http://data.europa.eu/esco/skill/83fc0b2b-6cd2-46af-b1ff-d3fc83604c26</a>                                                                                                                                                              |
| Supply chain management                                      | Supply chain management                                    | <a href="http://data.europa.eu/esco/skill/f929c89e-c363-4132-a918-e021d57b307c">http://data.europa.eu/esco/skill/f929c89e-c363-4132-a918-e021d57b307c</a>                                                                                                                                                              |
| Digital skills (e.g. data management, precision agriculture) | Product data management<br>Agriculture not further defined | <a href="http://data.europa.eu/esco/skill/e2d0daae-2aa1-40cc-99e2-b340b02f97d3">http://data.europa.eu/esco/skill/e2d0daae-2aa1-40cc-99e2-b340b02f97d3</a><br><a href="http://data.europa.eu/esco/iscdf/0810">http://data.europa.eu/esco/iscdf/0810</a>                                                                 |



|                                                   |                                                  |                                                                                                                                                           |
|---------------------------------------------------|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Produce sustainable products                      | Produce sustainable products                     | <a href="http://data.europa.eu/esco/skill/97725325-5287-4ebb-9f83-1ba2c38f465c">http://data.europa.eu/esco/skill/97725325-5287-4ebb-9f83-1ba2c38f465c</a> |
| Develop and coordinate waste management processes | Develop waste management processes               | <a href="http://data.europa.eu/esco/skill/114a79ef-1e62-475b-a862-954f5b4cca20">http://data.europa.eu/esco/skill/114a79ef-1e62-475b-a862-954f5b4cca20</a> |
| Develop recycling programs                        | Develop recycling programs                       | <a href="http://data.europa.eu/esco/skill/862920c8-f2d0-4058-8fb8-9f06fbfc2446">http://data.europa.eu/esco/skill/862920c8-f2d0-4058-8fb8-9f06fbfc2446</a> |
| Renewable energy integration                      | Renewable energy                                 | <a href="http://data.europa.eu/esco/skill/f8413360-6114-40de-a276-c59b764b9913">http://data.europa.eu/esco/skill/f8413360-6114-40de-a276-c59b764b9913</a> |
| Product data management and digitalization        | Product data management                          | <a href="http://data.europa.eu/esco/skill/e2d0daae-2aa1-40cc-99e2-b340b02f97d3">http://data.europa.eu/esco/skill/e2d0daae-2aa1-40cc-99e2-b340b02f97d3</a> |
| Ensure compliance with environmental legislation  | Ensure compliance with environmental legislation | <a href="http://data.europa.eu/esco/skill/089ee650-297e-4716-87d1-440743b70a0d">http://data.europa.eu/esco/skill/089ee650-297e-4716-87d1-440743b70a0d</a> |
| Asses the life cycle of resources                 | Asses the life cycle of resources                | <a href="http://data.europa.eu/esco/skill/4e87c852-602a-4a0e-b8d8-20709ce14ac5">http://data.europa.eu/esco/skill/4e87c852-602a-4a0e-b8d8-20709ce14ac5</a> |
| Develop new food products                         | Develop new food products                        | <a href="http://data.europa.eu/esco/skill/090ae6b3-12ab-4c72-b98a-17b790cf416e">http://data.europa.eu/esco/skill/090ae6b3-12ab-4c72-b98a-17b790cf416e</a> |
| Plan digital marketing/digital skills             | Plan digital marketing                           | <a href="http://data.europa.eu/esco/skill/736ef286-fbd3-4e5c-a4b4-d1e2008c9898">http://data.europa.eu/esco/skill/736ef286-fbd3-4e5c-a4b4-d1e2008c9898</a> |
| Implement marketing strategies                    | Implement marketing strategies                   | <a href="http://data.europa.eu/esco/skill/13e2378e-0d10-450d-843a-b3592575826e">http://data.europa.eu/esco/skill/13e2378e-0d10-450d-843a-b3592575826e</a> |
| Green marketing                                   | Marketing principles                             | <a href="http://data.europa.eu/esco/skill/de03f4fd-c147-4477-a048-7109e5ba2d6f">http://data.europa.eu/esco/skill/de03f4fd-c147-4477-a048-7109e5ba2d6f</a> |
| Thinking creatively and innovatively              | Thinking creatively and innovatively             | <a href="http://data.europa.eu/esco/skill/e84d080a-ff6d-41a7-b7b9-133e97c7bf00">http://data.europa.eu/esco/skill/e84d080a-ff6d-41a7-b7b9-133e97c7bf00</a> |



|                         |                                       |                                                                                                                                                           |
|-------------------------|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Entrepreneurial mindset | Show entrepreneurial spirit           | <a href="http://data.europa.eu/esco/skill/bd429c-5ccf-4c3d-bb61-4c987573a35e">http://data.europa.eu/esco/skill/bd429c-5ccf-4c3d-bb61-4c987573a35e</a>     |
| Deep tech knowledge     | Principles of artificial intelligence | <a href="http://data.europa.eu/esco/skill/e465a154-93f7-4973-9ce1-31659fe16dd2">http://data.europa.eu/esco/skill/e465a154-93f7-4973-9ce1-31659fe16dd2</a> |
|                         | Principles of artificial intelligence | <a href="http://data.europa.eu/esco/skill/f049d050-12da-4e40-813a-2b5eb6df6b51">http://data.europa.eu/esco/skill/f049d050-12da-4e40-813a-2b5eb6df6b51</a> |

The planned sample size was 30 respondents, but data was collected from 32 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=32)

| Variable                      | N         | Percentage (%) |
|-------------------------------|-----------|----------------|
| <b>Gender</b>                 |           |                |
| Male                          | <b>24</b> | <b>75%</b>     |
| Female                        | <b>6</b>  | <b>18.75%</b>  |
| No response                   | <b>2</b>  | <b>6.25%</b>   |
| <b>Age</b>                    |           |                |
| Up to 36                      | <b>5</b>  | <b>15,6%</b>   |
| 37 - 56                       | <b>19</b> | <b>59.3%</b>   |
| 57 and more                   | <b>8</b>  | <b>18.75%</b>  |
| <b>Education</b>              |           |                |
| High school and lower         | <b>7</b>  | <b>21.88%</b>  |
| Bachelor's degree             | <b>12</b> | <b>37.50%</b>  |
| VET                           | <b>8</b>  | <b>25%</b>     |
| Master's degree               | <b>5</b>  | <b>15.63%</b>  |
| PhD                           | <b>0</b>  | <b>0</b>       |
| <b>Enterprise size</b>        |           |                |
| Micro (<10 employees)         | <b>27</b> | <b>84.4%</b>   |
| Small (<50 employees)         | <b>5</b>  | <b>15.6%</b>   |
| Medium sized (<250 employees) | <b>0</b>  | <b>0</b>       |

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 skills needs for transition of the olive oil sector to circular economy).



The other one for providers of education in Spain (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). 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. Interviews were conducted face-to-face with respondents and through an online meeting. 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 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

### **Current occupations in the olive oil sector**

The results highlight that the olive oil sector is predominantly staffed by agricultural workers and managers, with specialized roles in sustainability, technology, and food safety being less represented but still important to the broader ecosystem of the industry. This insight emphasizes the need to focus on upskilling the agricultural workforce in areas like circular economic practices, while also recognizing the importance of specialized roles in pushing for sustainability and innovation.

Figure 1 provides an overview of the current occupations or professions of olive oil producers, helping us understand the distribution of workforce roles within the sector regarding the circular economy.

A significant 53.1% of respondents identify themselves as agricultural workers, indicating that this occupation is the most common in the sector. This aligns with the essential role that agriculture plays in olive oil production, particularly when considering the manual and field-intensive nature of the work.

Following that, 18.8% of respondents are agricultural production managers, which



suggests that a portion of the workforce is involved in higher-level production oversight and management. This group likely contributes to decision-making processes related to production efficiency and sustainability practices.

Smaller percentages of respondents belong to other roles, such as agronomists (5%), food technologists (5%), and environmental engineers (5%), indicating that these specialized roles are less common but still present in the sector. Other positions, such as mill operators, quality control managers, and packaging production managers, account for small proportions, suggesting that these roles are either less widespread or potentially less critical at the current stage of the industry's development.

**Which of the following options best describes your current occupation/profession in the olive oil sector?  
32 Responses**

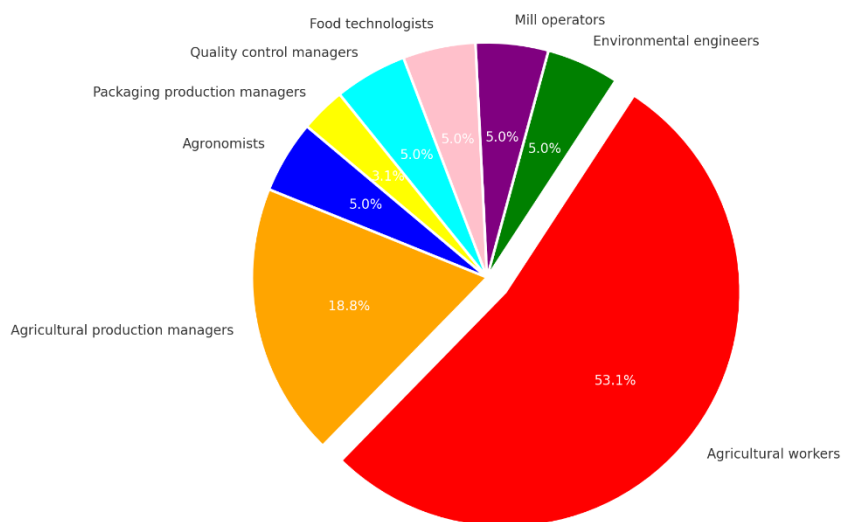


Fig 1. Current occupations in the olive oil sector

### Circular economy practices implemented

Also, data obtained show that in general terms, the olive oil sector is actively incorporating circular economy principles, particularly in waste reduction, water management, and renewable energy use. However, there is still room for improvement, especially in areas like sustainable transportation and carbon footprint reduction. Encouraging broader adoption of these practices through incentives, education, and regulatory support could further enhance sustainability in the industry.

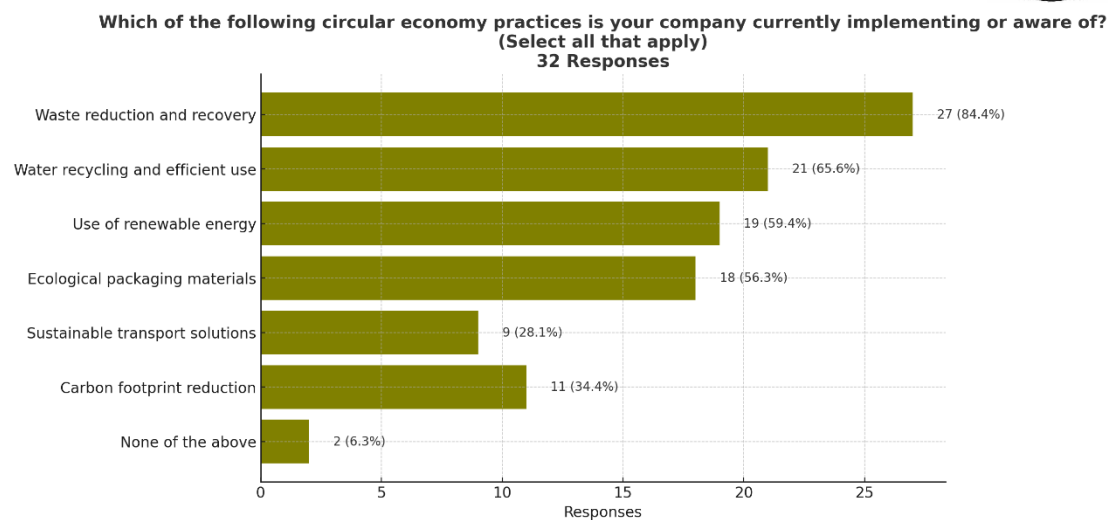


Fig. 2. Circular economy practices implemented

Figure 2. provides an overview of circular economy practices that olive oil producers are currently implementing or are aware of. These insights help in understanding the industry's engagement with sustainability and resource efficiency.

The most widely adopted practice, according to 84.4% of respondents, is waste reduction and recovery. This indicates that the olive oil sector has already taken significant steps toward minimizing waste and maximizing the value of by-products. Given the large volume of organic waste generated in olive oil production, such as olive pomace and wastewater, this finding suggests that companies are prioritizing resource recovery as a key sustainability strategy.

Water recycling and efficient use ranks as the second most implemented practice, with 65.6% of respondents reporting its adoption. Water use is a critical factor in agriculture and olive oil processing, and the high engagement in water conservation efforts suggests a growing awareness of the importance of sustainable water management.

The use of renewable energy is another widely implemented practice, with 59.4% of respondents indicating its presence in their operations. This suggests a shift toward reducing dependency on fossil fuels and integrating alternative energy sources such as solar or biomass energy, which are particularly relevant for agricultural and rural industries.

Ecological packaging materials are being used by 56.3% of respondents, showing a growing interest in sustainable product presentation and reducing plastic waste. This could reflect industry efforts to meet consumer demand for environmentally friendly products and align with regulations on packaging sustainability.

Other circular economy practices, such as sustainable transport solutions (28.1%) and carbon footprint reduction (34.4%), have a lower but still notable adoption rate. These areas may require further incentives or technological advancements to gain wider industry engagement.

Interestingly, 6.3% of respondents indicated that their company is not currently implementing or aware of any circular economy practices. This suggests that while the

majority of businesses are engaging with sustainability efforts, there remains a small segment that has yet to integrate these principles into their operations.

Results also show that olive oil producers acknowledge the importance of sustainability-related competencies, particularly in waste management, water conservation, organic farming, and digitalization. The high emphasis on digital skills also indicates a shift towards more technology-driven approaches in modern agriculture, including precision farming and data analytics.

### Most significant competences regarding circular economy

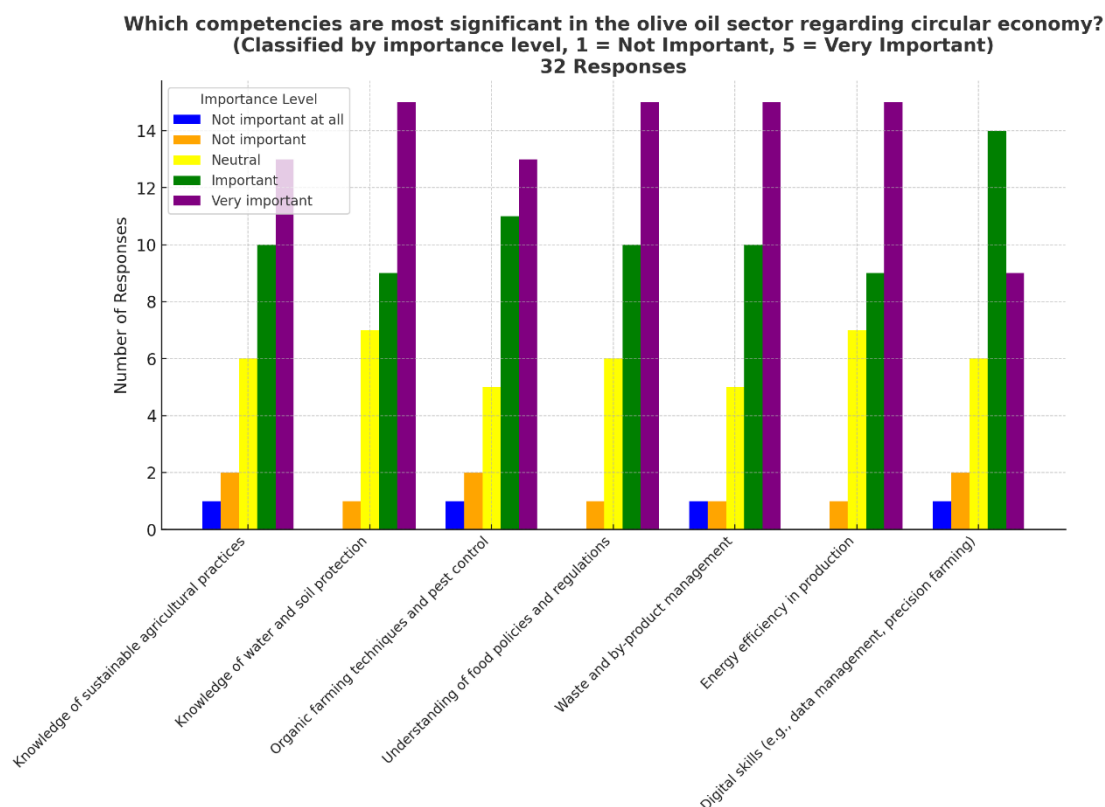


Fig 3. Most significant competences regarding circular economy

Figure 3 presents an evaluation of the most significant competencies in the olive oil sector regarding the transition to a circular economy. It classifies skills based on their perceived importance, with responses ranging from "Not Important at All" to "Very Important."

The findings indicate that most competencies are rated as either "Important" or "Very Important," emphasizing the sector's recognition of the skills required to implement circular economy principles effectively. The categories receiving the highest "Very Important" ratings are "Waste & By-Product Management," "Knowledge of water and soil protection," and "understanding of food policies and regulations". This highlights that professionals in the olive oil industry consider efficient waste utilization, sustainable farming methods, and technological adaptation as crucial for future success.



Similarly, "Knowledge of Water & Soil Protection," "Organic Farming Techniques & Pest Control," and "Energy Efficiency in Production" are also highly rated, with strong support for their importance. This reflects the growing awareness of environmental sustainability and the need to optimize resource use while reducing environmental impact.

On the other hand, very few respondents rated any competency as "Not Important" or "Not Important at All," indicating that most skills are deemed relevant to some extent. However, the lowest-rated categories still received a mix of responses, suggesting that while all competencies are valued, some may require more emphasis depending on the specific needs of different companies within the sector.

### Factors that are influencing the demand for new skills in the olive oil sector

Regarding the factors that are influencing the demand for new skills in the olive oil sector, figure 4 illustrates the key factors influencing the demand for new skills in the olive oil sector, particularly in relation to the transition toward a circular economy. Respondents were asked to select multiple factors that they believe are driving the need for upskilling in their companies.

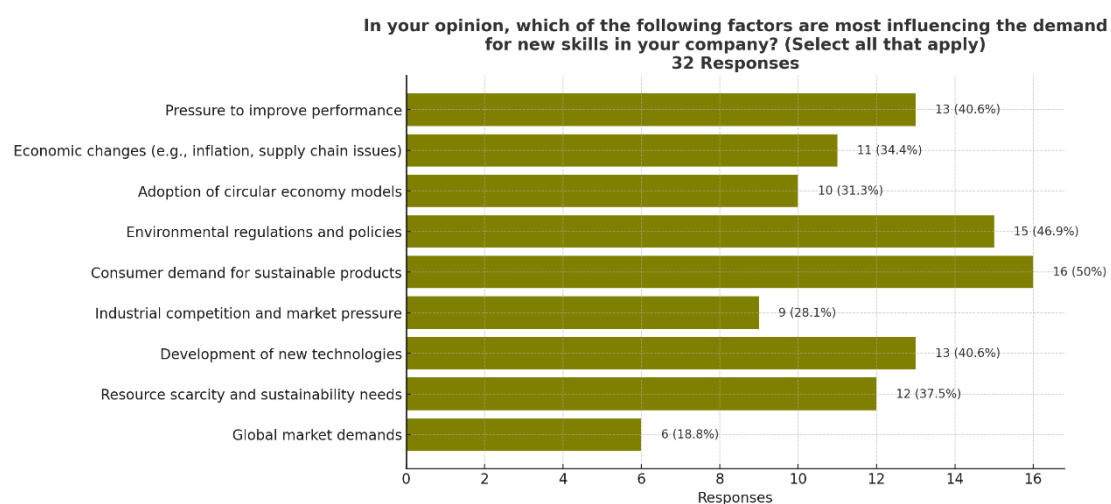


Fig. 4 Factors that are influencing the demand for new skills in the olive oil

The most significant factor, with 50% of respondents selecting it, is "Consumer Demand for Sustainable Products." This result indicates that market pressures are playing a central role in shaping skill development, as consumers increasingly prefer environmentally friendly and sustainable products. As sustainability becomes a stronger purchasing driver, businesses in the olive oil sector must adapt by equipping their workforce with the necessary knowledge to meet these demands.

"Environmental Regulations and Policies" follow closely, with 46.9% of respondents recognizing their influence. This suggests that compliance with sustainability-related laws and standards is a major concern for businesses, requiring employees to stay informed about evolving regulations and best practices in environmental management.

Another key factor is "Pressure to Improve Performance," which was selected by 40.6%



of respondents. This implies that companies are seeking to enhance efficiency, reduce waste, and improve overall sustainability performance. Similarly, "Development of New Technologies" (40.6%) signals the increasing role of innovation in the sector, pushing companies to train employees on new tools, equipment, and digital solutions.

Economic challenges also play a role in shaping skill demand. For instance, 34.4% of respondents identified "Economic Changes (e.g., inflation, supply chain issues)" as a significant factor, highlighting the impact of financial uncertainties on business operations. Likewise, 31.3% of respondents cited "Adoption of Circular Economy Models," indicating that companies are recognizing the need to implement sustainability frameworks but require additional knowledge and expertise to do so effectively.

Other factors such as "Resource Scarcity and Sustainability Needs" (37.5%) and "Industrial Competition and Market Pressure" (28.1%) suggest that companies are facing external pressures that necessitate workforce adaptation. Finally, "Global Market Demands" (18.8%) was the least selected factor, indicating that while international markets may influence skill requirements, local and regional factors play a more dominant role.

The findings highlight that consumer expectations, regulatory frameworks, technological advancements, and economic shifts are the primary drivers behind the need for new skills in the olive oil industry.

### **Results from the Interviews**

Based on insights from training providers and survey results, it is evident that the current level of circular economy knowledge in the olive oil sector is mixed. While there is growing awareness of sustainability practices, there are still notable skill gaps that must be addressed for a full transition to a circular economy.

Training providers confirm this inconsistent knowledge base in their interviews. They highlight that many agricultural workers and production managers recognize the impact of climate change and resource scarcity on olive oil production. However, there is limited structured knowledge on how to implement circular economy strategies effectively. While farmers experience water shortages, changing weather patterns, and soil degradation firsthand, there is a lack of training on precision irrigation, water efficiency, and sustainable soil management techniques to mitigate these challenges.

Insights from olive oil producers and cultivators reveal that while some sustainability practices are already in place, the overall level of circular economy knowledge remains limited or inconsistent across the sector. Producers tend to learn by experience, applying practical solutions based on trial and error rather than formal education or training.

Several producers have implemented water-saving techniques, such as reusing wastewater from mills for irrigation, but recognize that more can be done. One farmer described how they experimented with olive pits as a moisture-retention method, reducing water loss and acting as a natural herbicide. While these practices show a growing awareness of sustainability, producers acknowledge that their understanding of circular economy principles is mostly informal, with little structured training or



research backing their efforts.

Regarding self-assessment of circular economy knowledge, responses were mixed. Some producers rated their knowledge as “acceptable” due to their hands-on experience in waste minimization and resource efficiency. However, one interviewee described their company’s knowledge as “mediocre” since they have not undergone formal training or engaged in structured research on circular economy practices. Another producer highlighted that while they personally have a strong background in sustainability, most of their team lacks awareness or engagement in circular economy principles.

The main skills currently applied in the sector include sustainable agricultural practices, water conservation, and some forms of waste valorization. However, producers agree that certain knowledge areas, such as digital skills, precision farming, and understanding of circular economy regulations, remain underdeveloped.

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

### Current skills and knowledge in circular economy

The data highlights that while some businesses have a solid grasp of circular economy concepts, many still require additional training and resources to fully optimize their practices.

How do you rate your company's skills and knowledge in circular economy (Methods and possibilities for using by-products and waste in the olive oil sector)?  
32 Responses

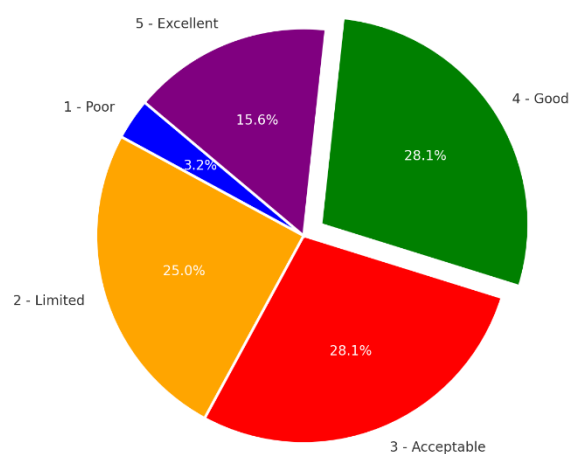


Fig.5. Current skills and knowledge in circular economy

Figure 5 provides insight into the current skill gaps regarding circular economy practices in the olive oil sector by evaluating how companies rate their own knowledge and abilities in this area. The results reflect a mixed level of expertise, with responses spread across different competency levels.

The most common responses indicate a moderate level of knowledge, with 28.1% of



respondents rating their skills as "Good" and another 28.1% rating them as "Acceptable." This suggests that while a significant portion of businesses have some familiarity with circular economy concepts, there is still considerable room for improvement in their understanding and application.

However, a notable portion of respondents (25%) rated their knowledge as "Limited," indicating that one in four companies feels they lack sufficient expertise in circular economy methods and by-product utilization. This highlights an area where further training, capacity building, and knowledge-sharing initiatives could be beneficial to improve sustainability practices in the sector.

On the higher end of the scale, 15.6% of respondents consider their knowledge to be "Excellent," showing that a smaller percentage of companies have achieved a high level of proficiency in implementing circular economy principles. These companies could potentially serve as leaders or mentors within the industry, sharing best practices and innovative approaches with others.

Conversely, 3.2% of respondents rated their knowledge as "Poor," representing a small but significant group of businesses that may struggle with integrating circular economy principles into their operations. Addressing this knowledge gap should be a priority, as a lack of understanding can hinder the industry's overall progress toward sustainability.

### Skill gaps limiting the transition to a circular economy

In relation to the significant skill gaps that limit companies in the olive oil sector from fully transitioning to a circular economy, the responses provide valuable insights into the primary barriers preventing businesses from implementing more sustainable practices.

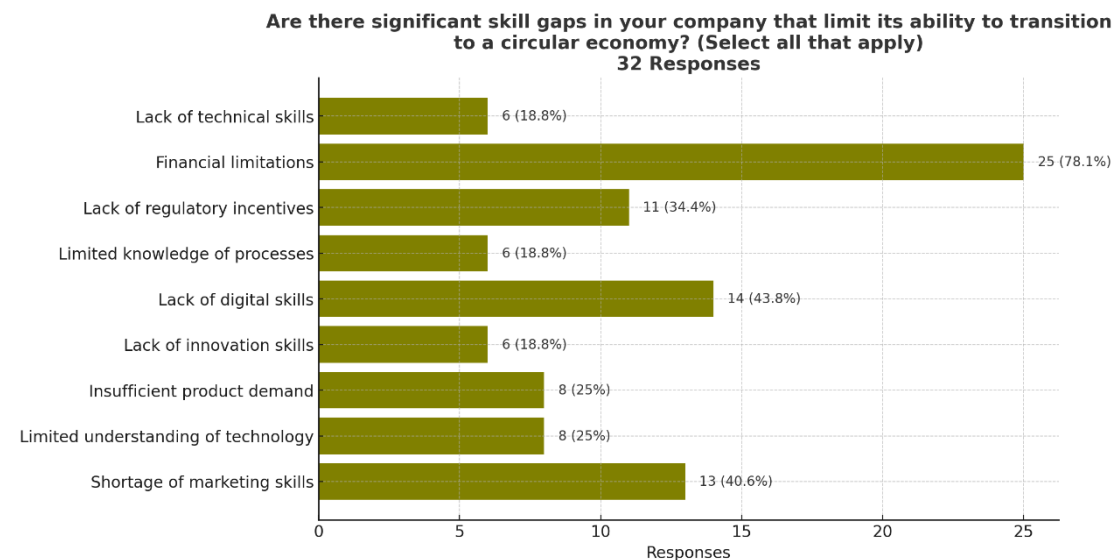


Fig 6. Skill gaps limiting the transition to a circular economy

As can be observed in figure 6, the most pressing limitation identified by respondents is financial constraints, with 78.1% of companies citing this as a barrier. This suggests that while companies may recognize the importance of circular economy practices, the cost of implementation, investment in new technologies, and operational changes remain significant hurdles. Without adequate funding, businesses may struggle to



adopt sustainability initiatives, making financial support or incentives critical for accelerating the transition.

Digital skills emerge as another major gap, with 43.8% of respondents identifying it as a challenge. This indicates that many companies lack the expertise to integrate digital tools, data management, and precision farming techniques that could improve efficiency and sustainability. Given the increasing role of smart agriculture and digital monitoring systems, addressing this gap could be crucial for the industry's long-term competitiveness.

Another notable challenge is the shortage of marketing skills, reported by 40.6% of respondents. This suggests that businesses struggle to effectively promote sustainable products and communicate the value of circular economy practices to consumers. Strengthening marketing capabilities could help companies differentiate their products, reach eco-conscious consumers, and increase demand for sustainably produced olive oil.

Regulatory challenges also play a role, with 34.4% of companies citing a lack of incentives as a barrier. This indicates that some businesses feel constrained by the absence of policy-driven support, subsidies, or incentives that could facilitate the transition. A clearer regulatory framework with financial or logistical backing may be needed to encourage widespread adoption of sustainability measures.

Several other areas, such as limited knowledge of processes (18.8%), lack of innovation skills (18.8%), and insufficient product demand (25%), also highlight underlying challenges. These responses suggest that some companies may need better access to information, training programs, and market development strategies to successfully implement circular economy principles.

The results reveal that the biggest obstacles are financial, technological, and marketing-related.

### **Most critical skills for companies in the olive oil sector to successfully adopt circular economy practices**

Moving to the most critical skills for companies in the olive oil sector to successfully adopt circular economy practices, the responses highlight which competencies businesses consider essential for long-term sustainability and innovation as can be observed in figure 7.

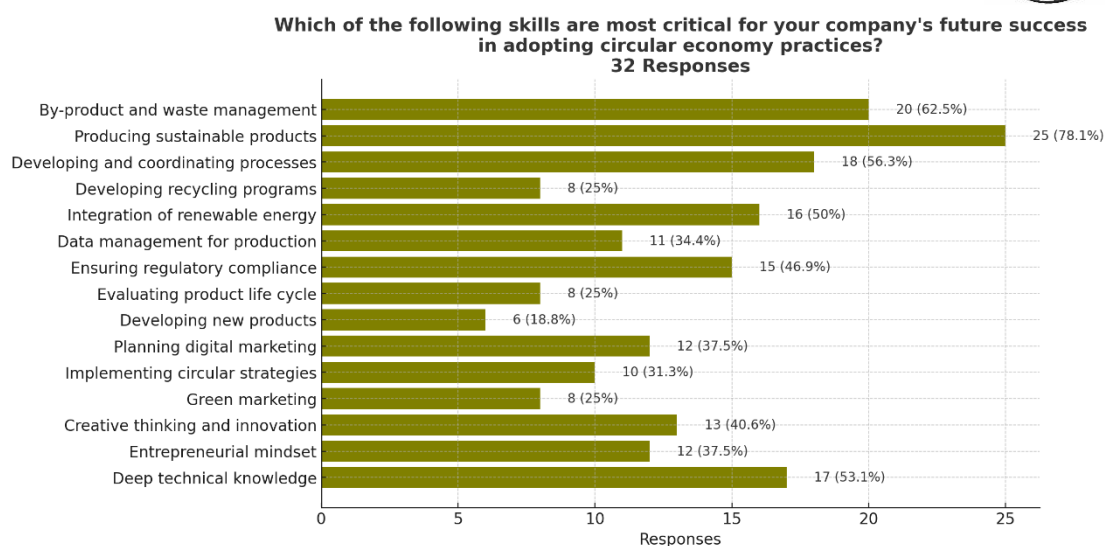


Figure 7. Most critical skills for companies in the olive oil sector to successfully adopt circular economy practices.

The responses highlight which competencies businesses consider essential for long-term sustainability and innovation.

The most highly rated skill, selected by 78.1% of respondents, is "Producing Sustainable Products." This emphasizes that companies recognize the importance of developing environmentally friendly products and implementing processes that reduce waste and environmental impact. The strong focus on sustainable production suggests a shift toward more responsible and eco-conscious business models, driven by both regulatory pressures and consumer demand.

"By-Product and Waste Management" follows closely, with 62.5% of respondents considering it a crucial skill. This highlights the sector's awareness of the importance of efficiently utilizing waste materials and by-products, such as olive pomace and wastewater, which are byproducts of olive oil production. Improving waste management strategies can lead to cost savings, environmental benefits, and the creation of new value-added products.

"Developing and Coordinating Processes" (56.3%) and "Ensuring Regulatory Compliance" (46.9%) are also rated highly, suggesting that many companies recognize the need for efficient operational management and adherence to environmental laws and regulations. The strong emphasis on compliance indicates that navigating sustainability-related policies is a critical challenge for businesses, reinforcing the need for regulatory knowledge and adaptation strategies.

Another key area is "Integration of Renewable Energy" (50%), showing that many companies see the shift to clean energy sources as a priority for circular economy success. As the industry seeks to reduce its carbon footprint, renewable energy solutions such as solar power, biomass, and energy efficiency improvements will play a crucial role.

Several other skills are also considered valuable, including "Deep Technical Knowledge" (53.1%), "Creative Thinking & Innovation" (40.6%), and "Entrepreneurial Mindset" (37.5%). These responses suggest that businesses are looking for a combination of technical expertise, innovative problem-solving skills, and an entrepreneurial approach to drive circular economy initiatives forward.



Interestingly, "Planning Digital Marketing" (37.5%) and "Implementing Circular Strategies" (31.3%) are also recognized as important, indicating that companies understand the need to effectively communicate their sustainability efforts to consumers and integrate circular economy principles into their overall business strategy.

At the lower end of the scale, "Developing Recycling Programs" (25%), "Evaluating Product Life Cycle" (25%), and "Green Marketing" (25%) received fewer responses. While these areas are still relevant, they may be seen as secondary priorities compared to the more immediate concerns of production sustainability, waste management, and regulatory compliance.

The results indicate that businesses in the olive oil sector prioritize skills related to sustainable production, waste management, process optimization, and renewable energy integration. At the same time, regulatory compliance, technical knowledge, and innovation are also viewed as key drivers of success.

### Results from the interviews

The interviews with training providers highlight several critical gaps in the sector's current skill set:

- **Regulatory Compliance and Policy Awareness:** One of the most significant gaps identified is the ability to navigate environmental policies and sustainability regulations. Given that the olive oil industry is highly regulated, professionals must understand how environmental laws, certification requirements, and financial incentives impact their businesses. Training providers stress that companies need better knowledge of funding opportunities, sustainability reporting, and legal requirements to integrate circular economy practices effectively.
- **Digitalization and Data Management:** Another crucial skill gap is digital agriculture and data-driven decision-making. The survey revealed that 43.8% of respondents identified a lack of digital skills as a major barrier. Training providers emphasize the growing importance of traceability systems, precision farming technologies, and digital tools for sustainability reporting. This lack of digital knowledge prevents businesses from effectively monitoring resource use, optimizing production, and proving their sustainability credentials to regulators and consumers.
- **Marketing and Consumer Communication:** Training providers also highlight that many olive oil producers struggle with marketing sustainable products effectively. While circular economy practices add value to olive oil production, producers often lack the skills to communicate these benefits clearly to consumers. There is a risk of greenwashing or misrepresentation of environmental benefits, which could lead to miscommunication and potential reputational damage. Proper training is needed in sustainability branding, eco-labeling, and transparency in sustainability claims.

Interviews with experts producers show that despite a clear willingness to adopt sustainable practices, producers face significant barriers that limit their full transition to a circular economy. One of the most frequently cited challenges is financial limitations, with many producers stating that they lack the capital to invest in



technologies that would make their operations more sustainable.

For example, one producer mentioned that recovering olive pulp for reuse would require costly investments in filtering and drying equipment, as well as increased energy consumption. Without external support or financial incentives, these upgrades remain out of reach for many small and medium-sized producers.

Another major barrier is regulatory uncertainty. Producers expressed frustration over the lack of clear guidelines or research on the feasibility of certain circular economy practices. One farmer noted that if they wanted to treat wastewater with enzymes to make it safe for reuse, they wouldn't know if the method is legally permitted or environmentally sound due to a lack of accessible research and regulatory guidance.

Beyond financial and regulatory constraints, technical knowledge gaps were also identified. Several interviewees admitted that they do not fully understand circular economy regulations or how to access funding opportunities and subsidies for sustainability projects. Digitalization was another critical weakness, with producers stating that they lack the necessary digital skills to track sustainability indicators, measure performance, and optimize production processes. Without proper monitoring systems or data analytics tools, producers struggle to evaluate whether their circular economy efforts are actually maximizing efficiency and reducing waste.

Marketing and communication were also highlighted as a skill gap. Many producers emphasized that while they engage in sustainable practices, they do not have the expertise to effectively communicate these efforts to consumers. One interviewee stressed the importance of avoiding greenwashing while still promoting the environmental benefits of their products but admitted that their company lacks the skills to do this properly.

Finally, producers recognized the importance of sustainability leadership but were unsure of how to integrate this into their existing business structures. Larger companies might have the resources to employ a dedicated sustainability manager, but small and medium-sized producers would need to assign sustainability responsibilities to existing team members, which they see as a challenge due to limited time and expertise.

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

### **Emerging occupations**

Regarding the emerging occupations important for the transition of the olive oil sector to a circular economy, results show which professions industry stakeholders believe will be critical in driving sustainability and innovation in the coming years as can be observed in figure 8.

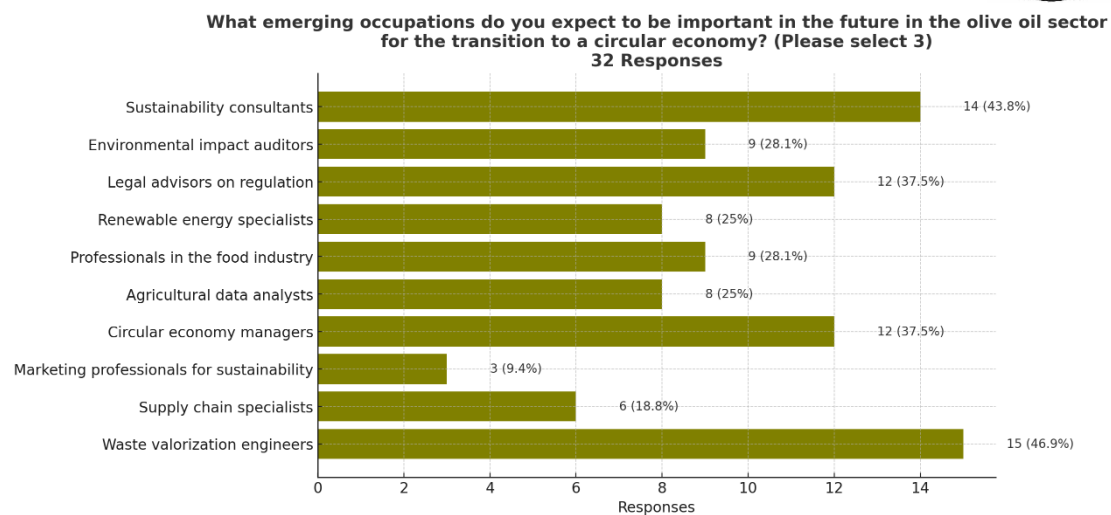


Fig 8. Emerging occupations that are expected to be important for the transition of the olive oil sector to a circular economy.

The most highly anticipated profession is "Waste Valorization Engineers," selected by 46.9% of respondents. This reflects a strong recognition of the need for expertise in developing methods to repurpose waste and by-products from olive oil production. Given the sector's significant organic waste output, professionals who can find innovative ways to convert waste into valuable secondary products (such as biofuels, fertilizers, or animal feed) will be essential in maximizing resource efficiency.

"Sustainability Consultants" are also viewed as a crucial role, with 43.8% of respondents recognizing their importance. This suggests that businesses see a need for specialized advisors who can guide companies in implementing sustainable practices, optimizing resource use, and ensuring compliance with environmental regulations. These professionals will likely help businesses navigate the complexities of circular economy models, supply chain sustainability, and carbon footprint reduction.

Another key emerging profession is "Circular Economy Managers," selected by 37.5% of respondents. This indicates an increasing demand for dedicated professionals who can oversee the strategic planning and implementation of circular economy initiatives within companies. These roles will likely involve coordinating sustainability projects, optimizing production processes, and integrating innovative business models that reduce waste and improve efficiency.

Additionally, "Legal Advisors on Regulation" (37.5%) and "Environmental Impact Auditors" (28.1%) are recognized as important roles, highlighting the increasing importance of regulatory compliance and environmental monitoring. As governments introduce stricter environmental policies, companies will require legal expertise to navigate regulations, secure certifications, and ensure compliance with sustainability standards. Environmental auditors will play a crucial role in assessing the impact of business operations and helping companies improve their environmental performance.



Other significant professions include "Renewable Energy Specialists" (25%) and "Agricultural Data Analysts" (25%). The recognition of these roles indicates a growing need for technical expertise in sustainable energy solutions and data-driven decision-making in agriculture. With the rise of precision farming and digital monitoring technologies, data specialists will be essential in optimizing resource efficiency and improving production sustainability.

Interestingly, "Marketing Professionals for Sustainability" received the lowest percentage (9.4%). This suggests that while sustainability communication is important, businesses currently prioritize technical, regulatory, and process-oriented roles over marketing. However, as consumer awareness of sustainability grows, demand for marketing experts in this field may increase.

The data suggests that the olive oil sector is shifting toward a workforce that is more specialized in sustainability, waste valorization, regulatory compliance, and renewable energy. The industry is recognizing that transitioning to a circular economy requires new expertise, strategic planning, and technical innovation.

### **Critical future skills essential for emerging occupations in the olive oil sector**

In terms of the most critical future skills that will be essential for emerging occupations in the olive oil sector as it transitions to a circular economy, the responses provide insight into which competencies will be most in demand as the industry evolves toward more sustainable practices. The results suggest that the olive oil sector's future workforce will need a strong combination of technical knowledge, digital capabilities, and strategic management skills to drive the transition to a circular economy.

Figure 9 shows that the most highly rated skill is "Knowledge in Waste Valorization", selected by 50% of respondents. This reflects the industry's increasing focus on finding innovative ways to repurpose waste and by-products from olive oil production. Developing expertise in waste valorization will allow companies to convert by-products into biofuels, animal feed, organic fertilizers, or other secondary products, improving both environmental sustainability and business profitability.

"Specialization in Sustainable Management", "Skills in Digital Agriculture", "Data Science and Predictive Analysis", and "Specialization in Sustainable Technology" were each selected by 31.3% of respondents. This indicates a growing need for data-driven, technology-enhanced, and strategically managed approaches to sustainability in the sector.

- Sustainable management specialization will help businesses optimize operations and resource use while ensuring compliance with environmental regulations.
- Digital agriculture skills are becoming increasingly important, as precision farming, sensor-based monitoring, and data-driven decision-making enhance efficiency and sustainability in olive cultivation.
- Data science and predictive analysis will allow companies to better manage agricultural cycles, predict yields, and optimize resource use, reducing waste and improving productivity.
- Sustainable technology specialization will be essential for developing and integrating new eco-friendly technologies into production, from energy efficiency systems to circular economy-based processing methods.



Several other skills were identified as crucial, including "Sustainable Agricultural Planning" (21.9%), emphasizing the need for expertise in developing farming strategies that align with sustainability goals. Similarly, "Technology-Related Skills" (18.8%) suggests that businesses recognize the role of digital tools and automation in streamlining processes and reducing environmental impact.

Other competencies, such as "Process Innovation and Automation," "Marketing and Sustainable Product Sales," and "Integrated Biodiversity Management" (all at 12.5%), indicate that while technical and management skills dominate priorities, there is still recognition of the importance of marketing, biodiversity conservation, and automation in future industry practices. Interestingly, "Leadership in Circular Strategies" (6.3%) and "Specialization in Finance" (3.1%) were ranked among the lowest, suggesting that while these skills may still be important, they are not currently perceived as urgent compared to technical and operational expertise.

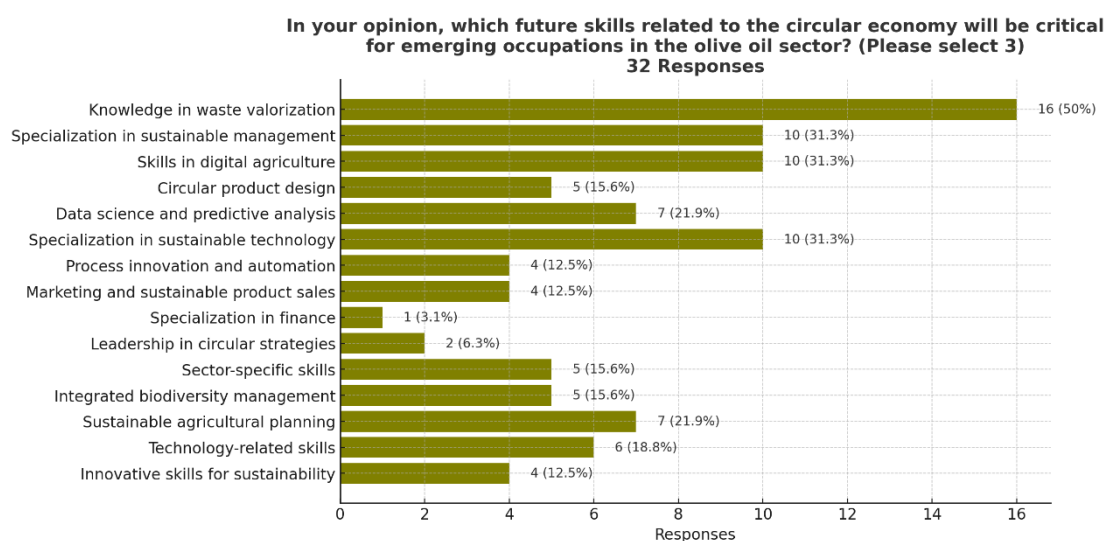


Fig. 9. Most critical future skills essential for emerging occupations in the olive oil sector.

### Results from the interviews

Training providers highlight several key factors driving the demand for new skills in the olive oil sector. Climate change adaptation is becoming increasingly critical as rising temperatures, water scarcity, and soil degradation impact olive oil production. To mitigate these challenges, training in sustainable water use, efficient irrigation systems, and carbon footprint reduction is essential. At the same time, stricter environmental regulations and sustainability laws are pushing the industry toward more eco-friendly practices, making regulatory compliance knowledge a necessity for producers. Additionally, consumer demand for sustainably produced olive oil continues to grow, reinforcing the need for professionals who can align production processes with sustainability certifications and market expectations. Furthermore, economic pressures and resource scarcity, including the rising costs of fertilizers, water, and energy, are making waste valorization and alternative production methods crucial for cost-effective operations. Given these skill gaps, education and training initiatives must be prioritized to enhance the sector's capacity for circular economy practices. This includes developing structured training programs focused on regulatory



compliance, digital agriculture, and sustainability reporting, as well as encouraging knowledge-sharing among industry leaders, training providers, and producers to promote best practices. Additionally, integrating sustainability education into primary and secondary school curricula will help create a long-term cultural shift in consumer awareness and industry standards. Finally, investing in digital upskilling will ensure that producers can leverage technology for sustainability monitoring, precision agriculture, and resource optimization, ultimately facilitating the industry's transition to a circular economy.

Looking ahead, producers identified several skills that will be crucial for successfully implementing circular economy practices in the olive oil sector.

One of the most frequently mentioned needs is expertise in waste valorization. Producers agree that finding innovative ways to repurpose by-products such as olive pits, pulp, and wastewater will be key to increasing sustainability and profitability. They emphasize the need for technical specialists who can develop new solutions for waste utilization and integrate them into existing production processes.

Digital skills are also seen as a top priority. Several interviewees stressed the growing need for data-driven decision-making, precision farming, and traceability technologies. They believe that future professionals in the olive oil sector must be able to manage sustainability indicators, measure environmental impact, and optimize operations using digital tools. One producer highlighted that without proper data tracking, it is difficult to know whether their circular economy efforts are reaching their full potential.

Regulatory knowledge was another critical skill gap identified. Producers expressed concerns about the increasing complexity of environmental laws and sustainability certifications, noting that professionals with expertise in legal compliance and policy adaptation will become more essential. Understanding these regulations will be crucial not only for ensuring compliance but also for accessing financial incentives and grants that could help fund circular economy initiatives.

Another important area is packaging innovation. Producers observed that consumers are increasingly demanding sustainable packaging solutions, yet many companies lack the expertise to develop eco-friendly packaging options that align with circular economy principles. Some mentioned that the ability to design and implement sustainable packaging strategies will become a key skill for businesses in the sector.

In terms of emerging professions, producers foresee an increasing need for sustainability consultants, waste valorization engineers, digital agriculture specialists, and policy advisors. They also believe that there will be a rise in demand for field technicians who can advise on sustainable farming practices and help optimize production processes in a circular economy framework.

Lastly, producers noted that sustainability education should extend beyond just businesses and include consumer awareness initiatives. One interviewee suggested that teaching circular economy principles in primary and secondary schools could help create a long-term cultural shift in sustainability practices and consumer expectations.

## 7. Conclusions

The findings from both training providers and olive oil producers confirm that while



there is growing awareness of circular economy principles in the olive oil sector, significant skill gaps remain. The transition to a more sustainable and circular production model will require a combination of technical, regulatory, digital, and managerial expertise, as well as financial and institutional support.

The current skill levels in circular economy vary significantly. Some producers have developed practical experience in resource efficiency, water conservation, and by-product utilization through trial and error, but lack formal training, structured research, and a deep understanding of sustainability frameworks. While some professionals rate their knowledge as “Good” or “Acceptable,” a large portion considers it “Limited.” Training providers highlight that formal education programs remain scarce, and many agricultural workers and production managers rely on experiential learning rather than structured training.

The main skill gaps identified include regulatory knowledge, digitalization, marketing and sustainability communication, and financial constraints. Many producers struggle to navigate environmental regulations, sustainability certifications, and funding opportunities, which limits their ability to integrate circular economy practices effectively. Digital skills are also underdeveloped, making it difficult for businesses to implement precision farming, sustainability tracking, and data-driven decision-making. Without proper data tracking and analysis, companies cannot measure or optimize their circular economy efforts. Marketing and consumer communication were also cited as weaknesses, as many businesses lack the expertise to effectively promote their sustainability efforts while avoiding greenwashing.

Another major limitation is financial constraints. Many sustainability improvements, such as waste valorization, renewable energy integration, and sustainable packaging solutions, require substantial investments that are often out of reach for small and medium-sized producers. Without external support or policy incentives, large-scale adoption of circular practices remains a challenge.

The demand for circular economy skills is being driven by several external factors. Climate change adaptation has become a priority as olive oil producers face rising temperatures, water scarcity, and soil degradation. There is a growing need for skills in sustainable water use, efficient irrigation, and carbon footprint reduction to mitigate these environmental threats. Stricter environmental regulations are also shaping the industry, requiring companies to develop compliance knowledge to meet evolving policies and sustainability laws. Additionally, consumer demand for sustainable products is increasing, forcing companies to adapt their production processes to meet sustainability certifications and market expectations. Economic pressures and resource scarcity, particularly the rising costs of fertilizers, water, and energy, further highlight the need for waste valorization, alternative production methods, and efficiency improvements.

The future skill needs for the olive oil sector will focus on sustainability expertise, innovation, and digital transformation. The most critical skills include waste valorization and by-product management, digital skills and data analytics, regulatory compliance, and sustainable packaging innovation. Companies will require technical specialists in waste management, regulatory advisors, sustainability consultants, and digital agriculture experts to drive the transition toward a circular economy. Additionally, the demand for sustainability-focused marketing professionals is expected to grow, as businesses will need to improve how they communicate their



environmental efforts to consumers.

The emergence of new professions is expected to further shape the sector. These include sustainability consultants to help companies integrate circular economy principles, waste valorization engineers to develop alternative uses for olive oil by-products, and digital agriculture specialists to improve resource efficiency. Additionally, circular economy managers will oversee sustainability initiatives within organizations, while policy and compliance advisors will guide companies in adapting to changing environmental regulations and certifications.

The olive oil sector has strong potential for circular economy transformation, as many by-products can be repurposed, and sustainable practices can improve efficiency. However, significant skill gaps, financial constraints, and regulatory challenges remain major obstacles to large-scale adoption. Addressing these gaps will be essential to ensuring a successful transition to a circular economy framework.

A crucial finding from this research in Spain is that olive oil producers need to shift their perception of circular economy practices—not as regulatory burdens, but as business opportunities that can improve profitability, sustainability, and competitiveness. By integrating digital technologies, sustainable resource management strategies, and waste valorization techniques, the sector can create new business models that align with emerging market trends and consumer expectations.

The majority of training centers surveyed indicated that they plan to include circular economy education in their future training offerings, as it is currently not a structured part of their curricula. However, while there is a clear intention to integrate these sustainability principles, some training providers highlighted a key challenge: the difficulty of attracting young people to study and work in agricultural-related fields. This concern suggests that, beyond developing specialized training programs, there is also a need for broader efforts to make the agricultural sector more appealing to younger generations. Encouraging interest in sustainability, innovation, and digital transformation within agriculture will be crucial for ensuring a future workforce capable of driving the sector's transition to a circular economy.

## 8. Recommendations

To accelerate the olive oil sector's transition to a circular economy, targeted investments in education, training, and capacity-building initiatives must be made. A key step is developing structured training programs that focus on regulatory compliance, digital agriculture, waste valorization, and sustainability management. These programs should be made widely accessible to farmers, production managers, and agribusiness professionals to ensure that the workforce is equipped with the necessary skills to implement sustainable practices effectively.

Collaboration between industry leaders, training providers, and policymakers should be encouraged to promote knowledge-sharing, best practices, and innovation in circular economy applications. Strengthening partnerships between academic institutions and olive oil producers will help create practical training programs that bridge the gap between theoretical knowledge and real-world applications. At the same time, sustainability education should be integrated into primary and secondary school curricula to foster long-term consumer awareness and industry-wide adoption of circular economy principles. Early education initiatives will help build a future



workforce equipped with sustainability knowledge.

Additionally, investing in digital upskilling is essential to ensure that professionals can leverage technology for sustainability monitoring, precision agriculture, and supply chain optimization. Digital tools should be widely adopted to help companies track resource efficiency, waste reduction, and production sustainability effectively. Governments and industry organizations should provide financial incentives and policy support to help businesses overcome economic barriers and invest in circular economy practices.

Developing clear guidelines, training programs, and consulting services will help businesses navigate sustainability regulations and funding opportunities with greater ease. Governments and industry associations should work together to improve access to compliance resources and financial aid. In parallel, workforce development initiatives should focus on preparing professionals for emerging roles in sustainability. Job roles such as sustainability consultants, circular economy managers, and waste valorization specialists should be incorporated into existing training and education programs to ensure that new industry demands are met with qualified professionals. Lastly, improving sustainability communication and marketing strategies is necessary to ensure that companies can effectively promote their environmental efforts while maintaining consumer trust. Training in ethical marketing, transparency, and sustainability branding will help businesses differentiate themselves in the market while avoiding misleading sustainability claims. By prioritizing education, innovation, and policy adaptation, the olive oil sector can build a more sustainable and competitive future. The demand for technical experts, sustainability leaders, and digital specialists will continue to grow, making upskilling and workforce development essential for ensuring that the olive oil sector thrives in a circular economy framework.



## 9. References

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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:

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## 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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