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**PR2- Expert profile in by-products and
wastes valorization in agri-food
sector. ECVET Model**

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Table of Contents

1	Introduction	3
2	European Framework	4
2.1	The European Qualification Framework	4
2.2	European Credit System for Vocational Education and Training	6
2.3	European Quality Assurance Reference Framework	7
3	National Framework	8
3.1	Qualification system in Spain	8
3.2	Qualification system in Finland	9
3.3	Qualification system in Greece	10
3.4	Qualification system in Latvia	10
3.5	Qualification system in Portugal	11
4	Target Groups & Training path	13
4.1	Byp4Dev target group	13
4.2	Training paths	14
4.3	Background recommendations	16
5	Learning Outcomes:	17
5.1	Learning outcomes definition	17
5.2	From survey results to Learning Outcomes	21
5.3	BypDev Learning Outcomes	22
6	Training Structure	31
7	ECVET Points	54
8	Methodology and Platform	57
8.1	Methodology	57
8.2	Platform	57
9	Evaluation	60
10	Memorandum of Understanding	61

1 Introduction

Byp4Dev project main objective is related to improve the development of bio-based sector through the creation of a new professional profile, the by-products and wastes valorisation in agri-food sector expert, thus, the design of a common curriculum and a learning approach that will allow professionals from this sector to meet the needs and opportunities that bio-based labour market offers is at the core of this project.

In order to develop the **Vocational Education and Training (VET)** online training course, **Byp4Dev** follows the recommendations of the European Commission to adopt **ECVET** as a framework that facilitates the validation, recognition and accumulation of work-related skills and knowledge acquired from one country to another and promotes transnational mobility and access to lifelong learning by making it easier for EU citizens to gain recognition for their training, skills and knowledge in another EU country.

This document describes the **European Framework for VET**, and provides an overview on the national education framework for the partners' countries, as well as a complete explanation about how ECVET works.

Moreover, the document focuses on the specifications of the training course by **defining Learning Outcomes, Modules and Training Units**, alongside with their duration and weight for the future acquisition of **ECVET points**.

Based on the defined **Training Path**, the contents of **Byp4Dev** training course will be then developed and shaped accordingly by taking into account the opinion from target groups gather in PR1 of the project (Methodological Guideline and Framework), adapting the contents to real needs.

The objective of this document is to prepare the **Byp4Dev** training course to the future implementation of ECVET system in all of the EU countries. It therefore aims at facilitating the transnational recognition, the transfer to countries and organizations, as well as being ready for a formal validation at European level.

2 European Framework

2.1 The European Qualification Framework

The European Qualifications Framework¹ (EQF) is aimed at contributing to improve the transparency, comparability and portability qualifications across EU countries and systems. The EQF was set up in 2008 as a common reference framework of qualifications, expressed as learning outcomes at increasing levels of proficiency.

The framework serves as a bridge between different national qualifications systems and their levels in EU country. It is intended to benefit learners, workers, job-seekers, employers, trade unions, education and training providers, qualification recognition bodies, government authorities and international organizations. There are three categories that define the learning outcomes:

- **Knowledge** is defined as the result of learning and the assimilation of concepts, principles, theories and practices. Acquisition of knowledge takes place in various settings: in the educational process, at work and in the context of private and social life.
- **Skills** may be cognitive or practical.
- **Competences** are classified in terms of complexity, autonomy and responsibility and it is about the ability of putting in practice the skills and knowledge acquired.

Below are described the knowledge, skills and competences of all 8 levels by which the EQF is composed (Table 1):

Table 1: EQF levels

Level	Knowledge	Skills	Competences
Level 8	Knowledge at the most advanced frontier of a field of work or study and at the interface between fields	The most advanced and specialised skills and techniques, including synthesis and evaluation, required to solve critical problems in research and/or innovation and to extend and redefine existing knowledge or professional practice	Demonstrate substantial authority, innovation, autonomy, scholarly and professional integrity and sustained commitment to the development of new ideas or processes at the forefront of work or study contexts including research
Level 7	Highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study, as the basis for original thinking and/or research	Specialised problem-solving skills required in research and/or innovation in order to develop new knowledge and procedures and to	Manage and transform work or study contexts that are complex, unpredictable and require new strategic approaches; take responsibility for contributing to

¹ <https://europa.eu/europass/en/europass-tools/european-qualifications-framework>

	Critical awareness of knowledge issues in a field and at the interface between different fields	integrate knowledge from different fields	professional knowledge and practice and/or for reviewing the strategic performance of teams
Level 6	Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles	Advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialised field of work or study	Manage complex technical or professional activities or projects, taking responsibility for decision-making in unpredictable work or study contexts; take responsibility for managing professional development of individuals and groups
Level 5	Comprehensive, specialised, factual and theoretical knowledge within a field of work or study and an awareness of the boundaries of that knowledge	A comprehensive range of cognitive and practical skills required to develop creative solutions to abstract problems	Exercise management and supervision in contexts of work or study activities where there is unpredictable change; review and develop performance of self and others
Level 4	Factual and theoretical knowledge in broad contexts within a field of work or study	A range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study	Exercise self-management within the guidelines of work or study contexts that are usually predictable, but are subject to change; supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities
Level 3	Knowledge of facts, principles, processes and general concepts, in a field of work or study	A range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information	Take responsibility for completion of tasks in work or study; adapt own behaviour to circumstances in solving problems
Level 2	Basic factual knowledge of a field of work or study	Basic cognitive and practical skills required to use relevant information in order to carry out tasks and to solve routine problems using simple rules and tools	Work or study under supervision with some autonomy
Level 1	Basic general knowledge	Basic skills required to carry out simple tasks	Work or study under direct supervision in a structured context

Thus, the **EQF** is extremely important for the development of more homogenous national qualification frameworks considering that each Member State has its own framework.

The **Byp4Dev** partners have agreed that **EQF level 5** best reflects the knowledge, skills and competences, which are to be acquired by the future expert in by-product valorization and waste in agri-food sector.

2.2 European Credit System for Vocational Education and Training

The **European Credit system for Vocational Education and Training (ECVET)** aims to give people greater control over their individual learning experiences and make it more attractive to move between different countries and different learning environments.

The system aims to facilitate the validation, recognition and accumulation of work-related skills and knowledge acquired during a stay in another country or in different situations. It should ensure that these experiences contribute to vocational qualifications.

ECVET aims for better compatibility between the different vocational education and training (VET) systems in place across Europe and their qualifications.

It aims to create a technical framework to describe qualifications in terms of units of learning outcomes, and it includes assessment, transfer, accumulation and recognition procedures. The main characteristics of the ECVET are the following:

Flexibility

In ECVET, an individual's learning outcomes are assessed and validated in order to transfer credits from one qualification system to another or from one learning pathway to another. According to this approach, learners can accumulate the required learning outcomes for a given qualification over time, in different countries or in different situations.

The system also allows the possibility to develop common references for VET qualifications and is fully compatible with the **European Credit Transfer and Accumulation System (ECTS)**.

ECVET is based on:

- Learning outcomes – statements of knowledge, skills and competence that can be achieved in a variety of learning contexts.
- Units of learning outcomes that are components of qualifications. Units can be evaluated, validated and recognized.
- ECVET points, which provide additional information about units and qualifications in a numerical form.
- Credit for evaluated Units. Credit can be transferred and accumulated to achieve a qualification.
- Mutual trust and partnership among participating organizations are expressed in memoranda of understanding and learning agreements.

Although ECVET is underpinned by European legislation, participation is voluntary and national protocols are respected.

ECVET testing and implementation

According to a 2019 study on EU VET instruments ECVET and EQAVET² ECVET widely contributed to the development of a better-quality mobility experience, through more effective agreement on, and documentation, of learning outcomes and their recognition being adopted within all Member States. A total, in parallel with the generalised adoption of a learning outcomes-based approach, 21 countries introduced modules or units in initial vocational education and training and four others had some qualifications or parts of qualifications modularised. On the other hand, credit systems were introduced in 17 countries though very few applying the concept of ECVET points.

The use of peer learning activities (PLAs) and other events (Annual Fora, Users' Group and Network Meetings) for mutual learning and exchange of experience were widely believed to have sustained implementation of ECVET principles.

ECVET and validation of Non-Formal and Informal Learning

Countries around Europe are increasingly emphasizing the need to take account of the full range of an individual's knowledge, skills and competences – not only those acquired at schools, universities or other formal education and training institutions. Recognizing all forms of learning is therefore a priority of EU action in education and training.

Learning that takes place in formal education and training systems is traditionally the most visible and recognized in the labour market and by society in general. In recent years, however, there has been a growing appreciation of the importance of learning in non-formal and informal settings. New approaches are needed to identify and assess and validate these 'invisible' learning experiences within the context of qualifications.

2.3 European Quality Assurance Reference Framework

The creation of the **European Qualifications Framework** and the **European Credit System for VET**³ needed the development of a system to ensure the quality of the VET systems. The **European Quality Assurance Reference Framework (EQAVET)**, created following a 2009 Recommendation, is a voluntary system made for the use of public institutions and other bodies. Its goals are the promotion and monitoring of the continuous improvement of VET systems. It also offers VET providers a simple and straightforward way to improve their systems.

² <https://op.europa.eu/en/publication-detail/-/publication/205aa0ac-460d-11e9-a8ed-01aa75ed71a1/language-en>

³ <https://ec.europa.eu/social/main.jsp?catId=1536&langId=en>

EQAVET is based on a four-stage cycle:

1. Purpose and plan: set up clear, appropriate and measurable goals.
2. Implementation: establish procedures to achieve the goals.
3. Assessment and Evaluation: design mechanisms to evaluate the data collected about the activities that have been done in order to achieve the goals.
4. Review: after processing feedbacks, the stakeholders conduct analysis to comprehend how to improve the stages.

3 National Framework

Currently, all the countries that integrate **Byp4Dev** partnership already have a National Qualifications Framework aligned with the European Qualifications Framework, despite the fact that countries have different stages of development and there are small variations in level descriptors.

A brief description of the qualification system in the project partners countries is described below.

3.1 Qualification system in Spain

The Spanish Qualifications Framework (SQF)⁴ is the national qualifications framework that covers general and adult education, vocational education and training, and higher education. It also includes qualifications obtained outside the education system through in-service training, work activity, collaboration with NGOs, etc., and the ones obtained in the education system.

It has eight levels and the level descriptors are defined in terms of knowledge, skills and competences. The main objective of the Spanish Qualifications Framework is to correlate and coordinate the different subsystems of education and training and include the qualifications obtained in compulsory, post-secondary and higher education, as well as integrate the validation of non-formal and informal learning. This objective aims to:

- Make qualifications more understandable by describing them in terms of learning outcomes
- Improve citizens' information on national qualifications, as well as facilitate and promote mobility

⁴ <https://eurydice.eacea.ec.europa.eu/national-education-systems/spain/national-qualifications-framework>
[k](#)

- Support lifelong learning and correlate initial vocational training and vocational training for employment, as well as improve access and participation in this type of training, especially of people with disability
- Facilitate the identification, validation and recognition of all types of learning outcomes, including those related to non-formal and informal learning
- Facilitate transition and progression between the different training subsystems
- Develop procedures for the recognition of non-formal learning
- Reduce early school leaving

3.2 Qualification system in Finland

The Finnish National Qualifications Framework⁵ (FNQF) covers the entire education system. It is seen as a tool for transparency and facilitates the examination of the Finnish education and qualifications system by describing the required learning outcomes and competence modules in a comprehensive and comparable manner and defines their interrelations.

The FNQF adds the lifelong learning opportunities both by describing learning outcomes on the eight levels of education and by making recognition of prior learning easier. The framework increases national and international transparency and comparability of qualifications. It promotes international mobility, recognition of qualifications and supports educational co-operation and education export.

The FNQF is compatible with the European Qualifications Framework for Lifelong Learning (EQF) and the Qualifications Framework for the European Higher Education Area. The learning outcomes approach is well-established and generally accepted in the vocational education and training, it also has a long history in this sector of education.

Also, higher education institutions, are moving towards learning outcomes-based qualifications. In the level descriptors, a distinction is not made between knowledge, skills and competences. Instead, the learning outcomes are described in a holistic way, as one unified descriptor.

The Finnish National Qualifications Framework will be further developed towards a wider framework for learning, by incorporating for example certain extensive competence modules which are a qualification requirement for a certain position, or relate to the improvement of professional skills and competence.

⁵ <https://eurydice.eacea.ec.europa.eu/national-education-systems/finland/national-qualifications-framework>

3.3 Qualification system in Greece

The Hellenic Qualifications Framework (HQF)⁶ is the national qualifications framework for improving lifelong learning policies and practices, which allow recognition and certification of all kinds of education, training and learning, in general.

The main objective of HQF is to create a coherent and comprehensive system of classification of all qualifications obtained from formal, non-formal education and informal learning in Greece. This objective aims to improve transparency of quality procedures for qualifications and qualification titles, increase horizontal mobility (within and outside the country), as well as vertical mobility (showing pathways that a person can follow to move from one level to another) and support lifelong learning.

HQF is aimed at everyone who can make use of its benefits; people in training, people in or out of employment, employers, education and training providers, awarding bodies, career counselors, professional sectors, social partners and every citizen holding a title of study. People in training and in employment, who wish to change field of study, job or country of employment, have a tool for “translating” and comparing their qualifications. Employers, on the other hand, have a tool for identifying the knowledge, skills and competences hidden behind qualifications (degrees, diplomas, certificates, certificates of competency).

The eight-level structure reflects the existing formal education and initial vocational training system in Greece. Levels are defined in terms of knowledge, skills and competencies. Work on level descriptors for HQF and on a qualifications framework for higher education has taken place separately, but the final objective is to have a comprehensive framework, covering all levels and types of qualification.

3.4 Qualification system in Latvia

The Latvian Qualification Framework⁷ aims at setting a united scale of levels for all qualifications - a scale, which is comparable with the qualifications of other countries via EQF. It expands the inhabitants’ opportunities for mobility not only between countries, but, which is more important, between various institutions and education levels. It is facilitated by a process taking place parallel to the qualifications framework – recognition of knowledge and skills acquired outside formal education, which is based upon a simple principle – all knowledge and skills are valuable, irrespective of the way and form of their acquisition.

The Latvian Qualifications Framework, similarly to the EQF, consists of eight reference levels and imparts all stages (basic, secondary and higher education) and types of education

⁶ <https://eurydice.eacea.ec.europa.eu/national-education-systems/greece/national-qualifications-framework>
[k](#)

⁷ <https://eurydice.eacea.ec.europa.eu/national-education-systems/latvia/national-qualifications-framework>

(general, vocational, academic and professional), as well as professional qualifications acquired outside of formal education.

LQF levels are described by learning outcomes to be attained on each level. Each level comprised the knowledge, skills and competences of the previous levels.

3.5 Qualification system in Portugal

The Portuguese Qualifications Framework⁸ (PQF) is aimed to integrate and articulate, within a single framework, the qualifications produced within the different subsystems of education and training - basic, secondary and higher education, and regardless of the access routes, to value and consider skills acquired in non-formal and informal learning contexts and to improve the readability, transparency and comparability of qualifications in the education and training system and in the labour market.

PQF is guided by the principles of the European Qualifications Framework (EQF), in which national qualifications are described in terms of learning outcomes. The options taken regarding the design and structure of the NQF are in response to the following aspects:

- The PQF includes qualifications at various levels of the education and training system, regardless of entry points (primary, upper-secondary, higher education, vocational education and training and processes of recognition, validation and certification of competences, acquired both formally and informally);
- It is divided into 8 qualification levels that include all the qualifications currently produced in the Portuguese education and training system.
- The adoption of a methodology is based on learning outcomes that describes each qualification level: the use of learning outcomes in defining qualification levels reflects a major change in the way qualifications are conceptualized and described, making comparability possible according to competences and not learning processes;
- the adoption of the “knowledge, aptitudes and attitudes” fields for the definition of learning outcomes for each qualification level;
- the adoption of descriptors of learning outcomes found in the EQF.

The following table (Table 2) collects the scopes, levels, description and stages of the development of the Qualification System of the participant countries.

⁸ <https://eurydice.eacea.ec.europa.eu/national-education-systems/portugal/national-qualifications-framework>

Table 2: Summary of the Qualification System of the participant countries

Country	Scope of the framework	Number of Levels	Level Descriptors	Stage of Development	NQF linked to EQF
Spain	Designed as a comprehensive NQF for lifelong learning; will include all levels and types of qualification from formal education and training.	Eight proposed	<ul style="list-style-type: none"> – Knowledge – Skills and abilities – Competence 	Advanced development stage	In process
Finland	Comprehensive framework including all State-recognised qualifications. No qualification linked to EQF level 1.	Eight	<ul style="list-style-type: none"> – Integrated level descriptors include knowledge, skills and key competences 	Operational	2017
Greece	Comprehensive NQF including all levels and types of qualification from formal education and training.	Eight	<ul style="list-style-type: none"> – Knowledge – Skills – Competence 	Activation stage	2015
Latvia	Comprehensive NQF including all levels and types of qualification from formal education and training.	Eight	<ul style="list-style-type: none"> – Knowledge – Skills – Competence 	Operational	2011
Portugal	Comprehensive NQF including all levels and types of qualification from formal education and training and from the national system for the recognition, validation and certification of competences.	Eight	<ul style="list-style-type: none"> – Knowledge – Skills – Attitudes 	Operational	2011

Source: https://www.cedefop.europa.eu/files/8611_en.pdf

Despite the small variations in EQF level descriptors found between countries, within the context of the **Byp4Dev project**, learning outcomes are described in terms of “knowledge”, “skills” and “competence”.

4 Target Groups & Training path

4.1 Byp4Dev target group

As defined in the project proposal, the target group which **Byp4Dev** is addressing consists of VET students, businesses (especially professionals of agri-food sector (technical profiles)) and agro-industrial entrepreneurs.

Byp4Dev aims at providing participants with suitable training tools, which will facilitate the transition and acceleration to the bio-based society and the primary sector development through a generation of more added value products and processes.

Other important target public are policymakers related to vocational training and the agro-industry sector. Policymakers and agro-industry are crucial actors as the connectors as facilitators of this new expert profiles integration and promotion.

These different target groups are listed below:

Direct target group:

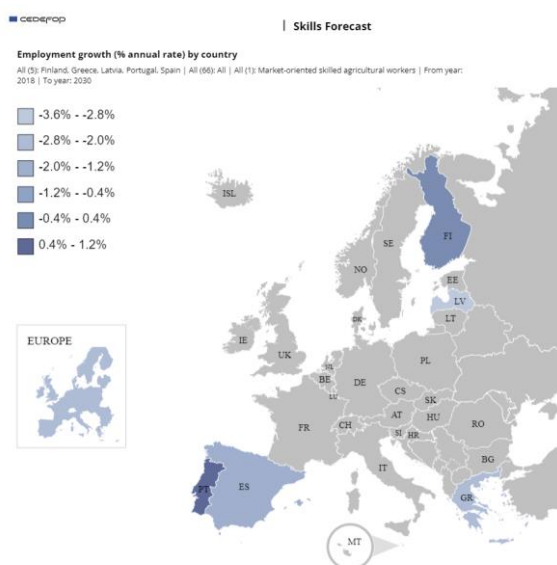
- Professionals of agri-food sector (technical profiles).
- Vocational training students, graduates, masters in the agro-industrial and forestry sector.
- Agro industrial entrepreneurs

Indirect target public:

- The agro-industry sector (including forestry sector): SME associations, business organizations and Clusters.
- The Educational sector: vocational training centres, organizations involved in adult education, universities - the Regional supporting services: business incubators and accelerators, Regional development agencies
- Policy-makers: local, national and European public authorities responsible for the definition of policies for employment and training

4.2 Training paths

According the skills forecast platform of **CEDEFOP**, the “market-oriented skilled agricultural workers” employment growth rate of the countries project partners will decrease with different rates during the next years⁹.



According the point “4.3. Focus Groups results” included in the **Methodological Guideline and Framework (PR1)**, the transition from “market-oriented skilled agricultural workers” to “circular economy-oriented skilled agricultural workers” will require different profiles with different skills and responsibilities.

Focus on design Vs Focus on implement

These new profiles can differentiate between expert profiles focused on a global design of valorisation processes (**Focus on design**), where concepts as regulations, trends, market, business models, etc., will provide a global map about the by-product valorisation process.

These "focus on design" expert will be general managers, sustainability or innovation managers who will understand the need of a transition process, the opportunities that this transition process can provide for the company and which is the path to achieve it. These "focus on design" expert will have level close to 6-7 of the European Qualification Framework.

These focus on design profiles will be completed with other expert profiles more focused on implementation process (**Focus on implement**). This profile, instead of focus on having a global

⁹ <https://www.cedefop.europa.eu/en/tools/skills-forecast>

vision of the process, will focus in by-products typologies, main bioactive compounds, and the main processes and technologies.

The knowledge, capabilities and skills linked to the implementation processes will be complemented with general knowledge about trends, market, business and design and with other soft skills needed to carry out implementation processes correctly.

Generalist Vs Specialist

Due to the amplitude of this new sector, with a large number of by-products, biocompounds, technologies, etc., other vision about these new profiles can vary from more generalist profiles to more specialist ones.

On the one hand, the **generalist** profiles should include a wide range of knowledge (by-products, technologies, biocompounds, etc.), capabilities and skills, with a limited depth and with an extensive development possibility.

On the other hand, **specialist** profiles should have a wide and depth knowledges, capabilities and skills about a specific by-product, biocompound or about a concrete technology, but with a limited vision of the global by-product valorisation process.

We have defined this dichotomy as **Generalist** versus **Specialist**.

This project will focus on a “**generalist**” training course for “**focus on implement**” experts. During the last project result (blueprint/roadmap) development, these different options will be considered, trying to integrate it the existing structure or considering the industry requirements and needs.

Besides, the created structure in this project will be versatile and it will structure the basis for future by-product valorisation expert profiles as focus on design as focus on implement or if are directed toward a concrete by-product or toward an acquire a global vision about this transition process.

Due to this is an incipient sector with a number of possibilities yet to be exploited, the industry requirement will play an important role to the design of future and more adapted training path according to the concrete and specific needs.

4.3 Background recommendations

Basic recommendations for future students (Table 3)

Table 3: Basic recommendations

Accreditations/ qualifications	There is not any requirement to access to this expert profile, but basic knowledge about agro-industry, circular economy or industry processes are recommended.
Professional experience	There is not required professional experience

5 Learning Outcomes:

5.1 Learning outcomes definition

What are the Learning Outcomes?

Learning Outcomes are defined as statements of what a learner knows, understands and is able to do on completion of a learning process, which are defined in terms of knowledge (knows), skills (understands) and competence (is able to do).

- **Knowledge** means the outcome of the assimilation of information through learning. Knowledge is the body of facts, principles, theories and practices related to a field of work or study. In the context of the European Qualifications Framework, knowledge is described as theoretical and/or factual.
- **Skills** mean the ability to apply knowledge and use know-how to complete tasks and solve problems. In the context of the European Qualifications Framework, skills are described as cognitive or practical skills.
- **Competence** means the proven ability to use knowledge, skills and personal, social and methodological abilities in work or study situations and in professional and/or personal development. In the context of the European Qualifications Framework, competence is described in terms of responsibility and autonomy.

A unit of learning outcomes (also called “unit” or “module”) is a component of a professional profile consisting of a coherent set of knowledge, skills and competence that can be assessed and validated. This presupposes that the units of learning outcomes are structured comprehensively and logically and that they can be examined. Units of learning outcomes can be specific to a single professional profile or common to several.

Following the definition gave by EQF a learning outcome means statements of what a learner knows, understands and is able to do on completion of a learning process, which are defined in terms of knowledge, skills and competence.

Trying to be more concise that the EQF’s definition a Learning Outcome must express the finality of the training, so, it must be the final objective of the learning process expressed as an achievement.

This objective must be formulated in a formal way following this **Math formula** (Table 4):

Figure 1: Math formula for Learning Outcomes

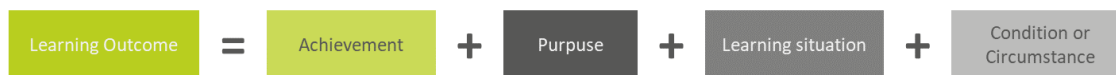


Table 4: Math formula for Learning Outcomes description

Achievement	It must express the action that must be performed with the content. It is formulated with an action verb in infinitive or substantive
Purpose	It must express the content with which the achievement will be obtained. It is therefore, the object of the achievement
Learning Situation	It must describe the situation through the trainer/teacher is going to structure and work his teaching/learning process to get the achievement. It is built asking: how? With what? or by what are we going to get the Achievement + Purpose . It is formulated using gerund verbs that described that learning situation.
Condition or Circumstance (if we have it)	It is a part that has not to be necessary, only just in the case that some specific element needs to be expressed directly. It is not expressed by a previously define grammatical formula, but must be expressed freely.

We recommend to follow this formula to describe the general definition of each **By4Dev Learning Outcome**.

Characteristics of Learning Outcomes and Units of Learning Outcomes

To make a correct description of the Learning Outcomes, it is necessary to take into consideration some characteristics of them:

- Learning outcomes principally refer to vocational qualifications and not to individual learners. The learning outcomes do not describe the learning target or the learning path, but the results following the complexation of the learning process.
- Learning outcomes will always be described from the perspective of the learner (outcome) and not from the perspective of the teacher, instructor.
- The optimal number of learning outcomes is dependent on the complexity of the educational programme. It is advisable to formulate neither too many, nor too few learning outcomes. Too many could cause a lack of transparency, while on the other hand too few would not be conducive to transparency.
- Learning outcomes should be externally verifiable. The formulations are to be chosen such that it can be determined during an evaluation process if the learner has achieved the learning outcomes.

- The manner in which the learning outcomes are acquired is not relevant for the learning outcome description. This means that it does not matter if the contents have been acquired through an e-learning programme, classroom instruction, at the workplace, at school or through self-study.

The characteristics of the units of **Learning Outcomes** are:

- Units should be designed in such a way that they can be completed as independently as possible of other units of learning outcomes.
- Units should include all necessary learning outcomes, i.e. they should describe the intended professional competences as well as the necessary social and personal competences in this context.
- Units should be structured and dimensioned in such a way that the relevant learning outcomes can actually be achieved in the given time. Units of learning outcomes should therefore not be too extensive.
- Units should be assessable. Orienting units of learning outcomes towards occupational activities and tasks make it easier to determine assessment criteria.

Elements of a **LEARNING OUTCOME**

Each Learning Outcome must be composed by 3 different parts:

- **Knowledge.** In the context of EQF, Knowledge is described as theoretical and/or factual knowledge. Knowledge could be WHAT IS IT?
In terms of verbs: **KNOWS**.
- **Skills.** In the context of EQF, Skills is described as cognitive (involving the use of logical, intuitive and creative thinking) and practical skills (involving manual dexterity and the use of methods, material tools and instruments). Skills could be: HOW CAN BE DONE.
In terms of verbs: **UNDERSTANDS**.
- **Competence.** In the context of EQF, Competence is described in terms of responsibility and autonomy. Competence it could be the APPLICATION OF KNOWLEDGE & SKILLS.
In terms of verbs: **APPLIES / DEVELOPS**.

- Cognitive could be linked to **KNOWLEDGE**.
- Psychomotor could be linked to **SKILLS**.
- Affective could be linked to **COMPETENCES**.

Having in mind this taxonomy, an example of what kind of verbs we can use to describe the different elements of a **Learning Outcome** could be like following:

Table 5: Verbs to be used for describing the different elements of a Learning Outcome

KNOWLEDGE (it could be linked to)	SKILLS	COMPETENCES
Select, recognize, mention, identify, name, place, define, describe, etc.	Explain, design, express, interpret, distinguish, classify, give, priority, analyze, judge, relate, etc.	Lead a team, instruct trainees, act independently, monitor work processes, assume responsibility

How the Learning Outcomes and Learning Units are described

Some principles must be taken into consideration for describing the Learning Outcomes:

- Use of active, clearly understandable verbs. Verbs should describe measurable or observable actions, e.g. "explain", "represent", "apply", "analyse", "develop", etc. Learning outcomes must be specified and contextualized. Therefore, it is essential to provide an indication as to what the knowledge and skills of the graduates refer to, and as to what kind of performance is concerned.
- Avoiding vague, open formulations. Learning outcomes should be described briefly and precisely, complicated sentences should be avoided, learning outcomes should not be formulated in too general or in too concrete terms; clear (simple and unambiguous) terminology should be used as far as possible.
- Orientation towards minimum demands for achieving learning outcomes. Learning outcomes should comprehensibly describe the minimum demands for achieving/validating a unit of learning outcomes, i.e. all learning outcomes which are necessary for fulfilling the tasks in the sense of a complete vocational activity should be listed.
- Qualifications-/competence level is described comprehensibly. Formulations, particularly verbs and adjectives should reflect the level of qualification/competence (EQF or sectoral framework) of a unit of learning outcomes.

5.2 From survey results to Learning Outcomes

During PR1 and through interviews with more than 100 stakeholders, a large number of valuable inputs have been gathered and converted into the learning outcomes.

These inputs provided from educative organisations, policymakers and agro-industry sector. Their answers have determined the modules and training units which integrate the training structure (knowledge, competences and skills).

Among barriers detected to promote the development of by-product valorisation sector are the need to know more about the opportunities of by-products and waste valorisation (trends and market) and the main bioproducts and technologies and processes.

A concept that was not taken into account at the beginning of the project and which the interviews have revealed to be a key area for the project is the knowledge about regional support to by-products valorisation processes.

This concept detected as barrier is reinforced in the question about the “Priorization of the knowledge area which should have the by-products and waste valorisation experts from agroindustry sector”.

This question provided us with another two important areas of knowledge to be integrated into the training structure. Green technologies and the potential applications of by-products.

The use of green technologies will strengthen, as well as the by-product valorisation, the fight against climate change, and the need to know the potential uses of by-products provided us the signal that this is an emerging sector that basic pillars are needed to achieve robust and consistent growth.

Other question considered in the design of the expert profile is the “Main sectors that by-products valorisation processes should go”. The answers prioritise the energy as the main sector that by-products valorisation processes should go.

This project will consolidate the energy was a result of by-products valorisation processes, but it will prioritise other more added value biocompounds directed toward food, feed and cosmetic, and promoting the concept of chained processes which can give us a waterfall of different biocompounds (biorefinery concept).

The last two questions which have provided us important inputs are the “Technologies do you consider the most important to know about related to by-products and waste valorisations processes from agro-industry sector” and the “the main crops/agroindustry sector in your region”.

The answers about the technologies provided us valuable information about the main technologies to include in the training structure and the main crops will give us information not only for this expert profile but also future and more specific expert profiles

5.3 BypDev Learning Outcomes

According to the survey and focus groups results by the project's participants, and considering the trends and needs found during the first phase of the project, the following learning outcomes have been developed.

These learning outcomes will make up the expert profile in by-products and wastes valorization in the agri-food sector, that will be distributed in the designed modules described below.

Learning outcomes Module 0 – Introductory Module

Table 6: Learning outcomes Module 0

Knowledge	Skills	Competences
<ul style="list-style-type: none"> Identifying, describing and defining concepts related to bioeconomy, circular economy, biomass and by-products and waste. Recognising the by-products valorization opportunities a general level. 	<ul style="list-style-type: none"> Distinguish among the main concepts related to bioeconomy / Circular Economy. 	<ul style="list-style-type: none"> Applying the learnt concepts for the determination of opportunities of by-products to be valorized.
<ul style="list-style-type: none"> Mentioning and describing the most important environmental-oriented agreements (Paris Agreement Sustainable development – ODS). Mentioning, naming and defining concepts and footprints related to environmental (Carbon footprint concept, water footprint, etc.). 	<ul style="list-style-type: none"> Ability to distinguish and classify the carbon footprint (or other environmental footprint) analysis tools. Ability to analyse and classify the activities of the company with the ODS. 	<ul style="list-style-type: none"> Using and applying of environmental analysis tools.
<ul style="list-style-type: none"> Defining the most relevant knowledge and tools 	<ul style="list-style-type: none"> Interpreting by-products valorization processes into 	<ul style="list-style-type: none"> Applying bioeconomy concepts into the by-

regarding circular economy processes and approaches related with agroindustry (the butterfly diagram, bio-based society, waste hierarchy, biomass value pyramid and biorefinery concept).	the global circular economy transition of agro-industry sector.	products valorization processes.
<ul style="list-style-type: none"> Identifying, describing and defining circular design concepts and system thinking. Recognise, defining and selecting circular design resources. 	<ul style="list-style-type: none"> Understanding circular design approaches, prioritizing the best options and designing circular processes. 	<ul style="list-style-type: none"> Using circular mindset (RE:THINK, RE:DUCE, RE:USE, RE:CYCLE) and circular design tools in the definition and implementation of by-products valorization processes.

Learning outcomes Module 1 – Trends and Markets

Table 7: Learning outcomes Module 1

Knowledge	Skills	Competences
<ul style="list-style-type: none"> Recognizing and Identifying the key facts, global trends and projections of global by-products resources and use. Describing the contribution of by-product valorization processes in UN SDG. 	<ul style="list-style-type: none"> Interpreting global facts, market and trends concepts about possibilities of by-products valorisation processes. Explaining the sustainable use of biomass in by-products valorisation processes. Analysing the contribution of by-product valorization processes in UN SDG.. 	<ul style="list-style-type: none"> Ability to translate the biomass/by-products application into market opportunities.
<ul style="list-style-type: none"> Recognizing the most relevant European, national and regional Strategies, Policies and instruments related to bioeconomy 	<ul style="list-style-type: none"> Analyzing the European Strategies and Policies related to development of by product valorization industries. 	<ul style="list-style-type: none"> Ability to contextualize by-products valorisation processes, designing and monitoring the impact of those ones into the

<ul style="list-style-type: none"> – Understanding bioeconomy growth opportunities 	<ul style="list-style-type: none"> – Interpreting and prioritizing the most relevant Strategies and Policies for by-product valorization processes. 	<p>European Policies and Strategies.</p> <ul style="list-style-type: none"> – Capacity to integrate knowledge processes on policies, instruments to support deeper, complete, and efficient processing of products that raise their value added.
<ul style="list-style-type: none"> – Defining the biomass supply chain and biomass value chain. – Describing the differences between traditional biomass supply chain and value chain. – Recognizing novel, innovative biobased value chains and products, allowing map and assess local biobased value chains comprehensively. 	<ul style="list-style-type: none"> – Distinguishing between traditional biomass supply chain and value chain (creating value of biomass in the chain) as well as the biomass flows in the economy. – Assessing and mapping novel, innovative biobased value chains and products. – Identifying good examples from involved countries. 	<ul style="list-style-type: none"> – Assuming the responsibility to determinate key points in the biomass value chain in by-products valorization processes.
<ul style="list-style-type: none"> – Understanding of the importance of science and innovation in the sustainable development of the by-product valorization in agroindustry. – Knowing the role of the different stakeholders of science and innovation system. – Identifying financial opportunities for the development of innovative by-product valorization projects 	<ul style="list-style-type: none"> – Understanding of the importance of R&D in the development of enterprises. – Distinguish the competences of the stakeholders in the different by-product valorization stages. 	<ul style="list-style-type: none"> – Ability to integrate and use new findings to create original solutions for using of agroindustry by-products and wastes.

Learning outcomes Module 2 - By-products and wastes likely to be re- valuated

Table 8: Learning outcomes Module 2

Knowledge	Skills	Competences
<ul style="list-style-type: none"> – Recognizing the importance of learning more about processing side streams and by-products in agriculture and food production globally, locally and in person. – Describing the sustainability production concepts and the use wisely of economic and ecologic resources. 	<ul style="list-style-type: none"> – Questioning the sustainability in production processes. – Interpreting the food production and being able to analyse things in a larger scale. – Opening mind and positive attitude to new processes. 	<ul style="list-style-type: none"> – Leading the valuation of local food productions and its by-products.
<ul style="list-style-type: none"> – Describing different by products from domestic animal productions and crops. – Understanding how the number of by-products or wastes depends on different conditions. – Identifying challenges to find ways utilizing these by-products and wastes. – Identifying how the composition and amount of waste biomasses affects to processes needed. 	<ul style="list-style-type: none"> – Distinguishing and classifying by-products from different crops. – Analyzing the best use of the by product. 	<ul style="list-style-type: none"> – Ability to find out what kind of side-streams can be formed in local open field and greenhouse production.
<ul style="list-style-type: none"> – Defining and describing by-products and side streams in food production. Amounts and 	<ul style="list-style-type: none"> – Distinguishing and classifying by-products from different agroindustry type. 	<ul style="list-style-type: none"> – Leading analysis processes about concerning by-products and side streams in food production

<p>causes in different sectors.</p> <ul style="list-style-type: none"> Identifying the principles of laws and orders related to food-based wastes 		
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Learning outcomes Module 3 – Main Technologies

Table 9: Learning outcomes Module 3

Knowledge	Skills	Competences
<ul style="list-style-type: none"> Defining the concepts of the overall process and unit operation, and describing the basics of classifying unit operations 	<ul style="list-style-type: none"> Analyzing the valorisation/processing methods. Interpreting and adapting existing cases to local needs. 	<ul style="list-style-type: none"> Ability to determine suitable method for different purposes and scales
<ul style="list-style-type: none"> Defining the operating principles and requirements of key bioprocesses. Knowing the possibilities of different bioprocesses as a treatment solution for different side streams. Identifying the products obtained through different bioprocesses and their utilization possibilities 	<ul style="list-style-type: none"> Explaining the different bioprocesses and existing solutions. Interpreting and adapting the best bioprocess depending on the by-product. 	<ul style="list-style-type: none"> Ability to determine bioprocesses for different purposes and scales
<ul style="list-style-type: none"> Knowing drying as a usual method when preserving bio-based by-products, describing different thermal drying equipment (air-dryer, IR-dryer, freeze dryer). 	<ul style="list-style-type: none"> Explaining the Thermal methods. Determining the best Thermo-Chemical valorization method for each side stream. 	<ul style="list-style-type: none"> Ability to determine suitable thermo-chemical method for different purposes and scales.

<ul style="list-style-type: none"> – Defining biomass combustion concept (energy use) as the final (not primary) use of material. – Defining principles of dry distillation methods (torrefaction, pyrolysis, gasification), identifying their associated products: biochar, bio-oil, syngas. specially biochar. 		
<ul style="list-style-type: none"> – Understanding the operating principles and requirements of different extraction and distillation methods. – Knowing the possibilities of different techniques as a separation and recovery method for different biocompounds 	<ul style="list-style-type: none"> – Analyzing and interpreting the extraction and distillation methods – Determining the best Thermo-Chemical valorization method for each side stream 	<ul style="list-style-type: none"> – Ability to determine suitable extraction and distillation methods for different purposes and scales
<ul style="list-style-type: none"> – Describing the operating principles of mechanical separation methods – Describing the possibilities of using mechanical methods for different separation needs 	<ul style="list-style-type: none"> – Interpreting the mechanical separation methods. – Determining the best mechanical separation methods for each side stream 	<ul style="list-style-type: none"> – Ability to determine suitable mechanical separation method for different purposes and scales

Learning outcomes Module 4 - Main biocompounds and holistic (overall) solutions for utilisation

Table 10: Learning outcomes Module 4

Knowledge	Skills	Competences
<ul style="list-style-type: none"> Identifying and describing some of the most important and valuable biocompounds and their application possibilities extensively. Understanding the importance of the overall utilization of the side stream in accordance with the requirements of the circular bioeconomy 	<ul style="list-style-type: none"> Analyzing most important and valuable biocompounds. Assessing and mapping different uses of biocompounds depending on the industrial sector to be used 	<ul style="list-style-type: none"> Ability to see determine the added value of using biocompounds
<ul style="list-style-type: none"> Identifying good biorefineries examples, transferring the lesson learnt to other cases or transforming it in new ideas. 	<ul style="list-style-type: none"> Analyzing different types of Biorefineries. 	<ul style="list-style-type: none"> Ability to transform the problem into the right and best, holistic solution.

Learning outcomes Module 5 – Business Strategies

Table 11: Learning outcomes Module 5

Knowledge	Skills	Competences
<ul style="list-style-type: none"> Identifying, describing and defining concepts about business model design and the specific circular model canvas. 	<ul style="list-style-type: none"> Interpreting the circular model canvas and its value proposition. 	<ul style="list-style-type: none"> Ability to elaborate a circular model canvas for different kind of by-products valorization projects.
<ul style="list-style-type: none"> Naming, defining and describing the steps in developing efficient marketing communication for a bio-based product: strategy; objectives; 	<ul style="list-style-type: none"> Designing marketing strategies for by-products valorization projects. Analysing and prioritizing the elements of the marketing mix. 	<ul style="list-style-type: none"> Leading the developing and implementing of a marketing strategy for a bio-based product: situation analysis; formulation of marketing objectives, defining marketing strategies for

<p>industry; evaluation and metrics.</p> <ul style="list-style-type: none"> Identifying and selecting the elements of the communication mix: advertising; digital marketing (content marketing, social media marketing); public relations; direct marketing; sales promotions; personal selling; events and exhibitions. Recognizing the importance of sociocultural environment in national and international marketing: layers and elements of culture; high and low context cultures. Cross-cultural sales negotiations: effects of cultural dimensions on decision making. Issues of marketing ethics. 		<p>marketing mix elements; implementation process; measurement and control.</p>
<ul style="list-style-type: none"> Describing and defining concepts about the structure of a business plan. 	<ul style="list-style-type: none"> Interpreting the main blocks of the business and financial plan 	<ul style="list-style-type: none"> Ability to elaborate a basic business plan
<ul style="list-style-type: none"> Identifying and describing by-product valorization project "scale-up" potential, selecting the best timing to "scale-up" and defining the "scale-up" structure, processes and timing. 	<ul style="list-style-type: none"> Distinguish among the scale-ups process. Analysing the barriers and prioritizing the steps to follow. 	<ul style="list-style-type: none"> Ability to detect the main risks and mismatches (financial and processes) related to scale-up process.
<ul style="list-style-type: none"> Identifying and defining the necessary profiles in by-products valorization project and start-ups teams, and their roles. 	<ul style="list-style-type: none"> Designing high-performance equipment for by-product valorization processes 	<ul style="list-style-type: none"> Ability to design high-performance equipment for by-product valorization processes.
<ul style="list-style-type: none"> Defining and describing the different stages of the "start-up", its characteristics and its advantages and risks. 	<ul style="list-style-type: none"> Analysing start-up value proposition, distinguishing among the different stages. Design start-ups processes, including human resources team. 	<ul style="list-style-type: none"> Ability to lead start-ups processes, acting independently and Assuming the responsibility.

<ul style="list-style-type: none"> – Knowing the different options related to Intellectual, industrial and commercial properties. – Understanding the importance of Strategic surveillance to achieve business competitive advantages. 	<ul style="list-style-type: none"> – Distinguishing the best options for protecting ideas, process or business. 	<ul style="list-style-type: none"> – Ability to carry out searching of “State of the art” processes. – Leading registration processes of invention, articles, knowledge, etc.
<ul style="list-style-type: none"> – Recognising the different actors and profiles that make up an ecosystem of support for entrepreneurship and innovation (Regional Innovation Agency, Clusters, Technological Parks). – Defining basic Industrial Symbiosis concept and its relevance to by-product valorisation processes 	<ul style="list-style-type: none"> – Understanding the role of the different actors and profiles of an ecosystem of support for entrepreneurship and innovation, distinguishing the best roles for supporting our by-product valorisation processes. 	<ul style="list-style-type: none"> – Having the ability to design and create an ecosystem of support for entrepreneurship and innovation map for different by-product valorisation process

6 Training Structure

For designing ECVET model structure, the recommendations obtained during the gathering process generated in PR1 - Methodological Guideline and Framework have been followed. Moreover, a logical sequence of thought and action, have guided the training structure: from the most general, to the most particular and from the first stages of the processes of valorization, until the conversion of an idea that reaches the market.

The course begins with the acquisition of the basic concepts of bioeconomy, circular economy and environmental impact, trying to achieve opened minds students.

The first module presents the current state of the situation, both at the level of markets and trends, as well as at the legal and political level, reflecting different areas of influence, passing through the R + D state of the art.

The second module focuses on the identification and analysis of by-products and waste from the agri-food sector that have the possibility of being valued.

The third module shows the main technologies and existing methods used in the process of valorization of by-products.

The fourth module describes the main biocompounds that can be obtained in the valuation of byproducts of the agroindustrial sector, as well as their main applications and uses in diverse fields.

Finally, in the fifth module business strategies applied to Circular businesses will be presented.

Table 12: Module 0

MODULE 0					
INTRODUCTION MODULE					
Training Unit	Objective	Learning outcomes		Pedagogical approach	Assessment methodology
Unit 0.1: Basic Introduction	Introducing the concept of by-product valorization in (side-streams) in agroindustry, its opportunities and its evolution.	Knowledge	<ul style="list-style-type: none"> Identifying, describing and defining concepts related to bioeconomy, circular economy, biomass and by-products and waste. Recognising the by-products valorization opportunities a general level. 	Text Presentation Video Case studies Best practices External links	Quiz
		Skills	<ul style="list-style-type: none"> Distinguish among the main concepts related to bioeconomy / Circular Economy. 		
		Competences	<ul style="list-style-type: none"> Applying the learnt concepts for the determination of opportunities of by-products to be valorized. 		
Unit 0.2: Environmental Impact	Introducing to state of the art related to Climate Change, sustainable development, agroindustry impact, and the organisations, global agreements, measurement	Knowledge	<ul style="list-style-type: none"> Mentioning and describing the most important environmental- oriented agreements (Paris Agreement Sustainable development – ODS). Mentioning, naming and defining concepts and footprints related to environmental (Carbon footprint concept, water footprint, etc.). 	Text Presentation Video Case studies Best practices External links	

	tools and actions carried out to fight against it.	Skills	<ul style="list-style-type: none"> – Ability to distinguish and classify the carbon footprint (or other environmental footprint) analysis tools. – Ability to analyse and classify the activities of the company with the ODS. 		
		Competences	<ul style="list-style-type: none"> – Using and applying of environmental analysis tools. 		
Unit 0.3: Circular Economy (Bioeconomy)	Understanding the Circular Economy process, its evolution, approaches and specific concepts related to agro-industry.	Knowledge	<ul style="list-style-type: none"> – Defining the most relevant knowledge and tools regarding circular economy processes and approaches related with agroindustry (the butterfly diagram, bio-based society, waste hierarchy, biomass value pyramid and biorefinery concept). 	Text Presentation Video Case studies Best practices External links	
		Skills	<ul style="list-style-type: none"> – Interpreting by-products valorization processes into the global circular economy transition of agro-industry sector. 		
		Competences	<ul style="list-style-type: none"> – Applying bioeconomy concepts into the by-products valorization processes. 		
Unit 0.4: Circular Mindset	Describing System thinking and the Circular Design approaches.	Knowledge	<ul style="list-style-type: none"> – Identifying, describing and defining circular design concepts and system thinking – Recognise, defining and selecting circular design resources 	Text Presentation Video Case studies Best practices	

		Skills	– Understanding circular design approaches, prioritizing the best options and designing circular processes.	External links	
		Competences	– Using circular mindsets (RE:THINK, RE:DUCE, RE:USE, RE:CYCLE) and circular design tools in the definition and implementation of by-products valorization processes		

Table 13: Module 1

MODULE 1					
Trends & Markets					
Training Unit	Objective	Learning outcomes		Pedagogical approach	Assessment methodology
Unit 1.1: Global facts, market & trends in by-products	Understanding the main global facts and trends related to by-products by categories, origin and potential valorisation uses and its contribution in achieving United Nations' Sustainable Development Goals.	Knowledge	<ul style="list-style-type: none"> Recognizing and Identifying the key facts, global trends and projections of global by-products resources and use. Describing the contribution of by-product valorization processes in UN SDG. 	Text Presentation Video Case studies Best practices External links	Quiz
		Skills	<ul style="list-style-type: none"> Interpreting global facts, market and trends concepts about possibilities of by-products valorisation processes. Explaining the sustainable use of biomass in by-products valorisation processes. Analysing the contribution of by-product valorization processes in UN SDG. 		
		Competences	<ul style="list-style-type: none"> Ability to translate the biomass/by-products application into market opportunities. 		

Unit 1.2: European, National and Regional legal frame, Strategies and Policies	Introducing to the European, national and regional legal frame, Strategies, Policies and instruments for bioeconomy (agroindustry by-products).	Knowledge	<ul style="list-style-type: none"> – Recognizing the most relevant European, national and regional Strategies, Policies and instruments related to bioeconomy – Understanding bioeconomy growth opportunities. 	Text Presentation Video Case studies Best practices External links	
		Skills	<ul style="list-style-type: none"> – Analyzing the European Strategies and Policies related to development of by product valorization industries. – Interpreting and prioritizing the most relevant Strategies and Policies for by-product valorization processes. 		
		Competences	<ul style="list-style-type: none"> – Ability to contextualize by-products valorisation processes, designing and monitoring the impact of those ones into the European Policies and Strategies. – Capacity to integrate knowledge processes on policies, instruments to support deeper, complete, and efficient processing of products that raise their value added. 		

Unit 1.3: Supply chains and value added of biomass and by-products	Introducing the by-products supply chain and the value creation concept in this area.	Knowledge	<ul style="list-style-type: none"> – Defining the biomass supply chain and biomass value chain. – Describing the differences between traditional biomass supply chain and value chain. – Recognizing novel, innovative biobased value chains and products, allowing map and assess local biobased value chains comprehensively. 	Text Presentation Video Case studies Best practices External links	
		Skills	<ul style="list-style-type: none"> – Distinguishing between traditional biomass supply chain and value chain (creating value of biomass in the chain) as well as the biomass flows in the economy. – Assessing and mapping novel, innovative biobased value chains and products. – Identifying good examples from involved countries. 		
		Competences	<ul style="list-style-type: none"> – Assuming the responsibility to determinate key points in the biomass 		

			value chain in by-products valorization processes.		
Unit 1.4: RD&i in Bioeconomy and by-products valorisation	Knowing and internalizing research, development and innovations contribution in by-product valorization.	Knowledge	<ul style="list-style-type: none"> – Understanding of the importance of science and innovation in the sustainable development of the by-product valorization in agroindustry. – Knowing the role of the different stakeholders of science and innovation system. – Identifying financial opportunities for the development of innovative by-product valorization projects 	Text Presentation Video Case studies Best practices External links	
		Skills	<ul style="list-style-type: none"> – Understanding of the importance of R&D in the development of enterprises. – Distinguish the competences of the stakeholders in the different by-product valorization stages. 		
		Competences	<ul style="list-style-type: none"> – Ability to integrate and use new findings to create original solutions for using of agroindustry by-products and wastes. 		

Table 14: Module 2

MODULE 2					
By-products and wastes likely to be re-valuated					
Training Unit	Objective	Learning outcomes		Pedagogical approach	Assessment methodology
Unit 2.1: Introduction	Acquiring and global vision about food production and by-products in it.	Knowledge	<ul style="list-style-type: none"> – Recognizing the importance of learning more about processing side streams and by-products in agriculture and food production globally, locally and in person. – Describing the sustainability production concepts and the use wisely of economic and ecologic resources. 	Text Presentation Video Case studies Best practices External links	Quiz
		Skills	<ul style="list-style-type: none"> – Questioning the sustainability in production processes. – Interpreting the food production and being able to analyse things in a larger scale. – Opening mind and positive attitude to new processes. 		
		Competences	<ul style="list-style-type: none"> – Leading the valuation of local food productions and its by-products. 		

Unit 2.2: Open field and greenhouse cultivation and domestic animals	Recognizing and identifying side streams and by-products different crops form (open field cultivations, greenhouse production of vegetables and domestic animals), how much (significant amounts), periodicity, special composition/properties. Factors affecting the quantity and quality.	Knowledge	<ul style="list-style-type: none"> Describing side streams of different domestic animal productions and crops, understanding how the number of by-products or wastes depends on different conditions. Identifying challenges to win to find ways utilizing these by-products and wastes. Recognizing some reasons that may turn products to be a waste and what processes may cause side-streams (cause and effect). Identifying how the composition and amount of waste biomasses affects to processes needed. 	Text Presentation Video Case studies Best practices External links	
		Skills	<ul style="list-style-type: none"> Distinguishing and classifying by-products from different crops. Analyzing the best use of the by product. 		
		Competences	<ul style="list-style-type: none"> Ability to find out what kind of side-streams can be formed in local open field and greenhouse production. 		

Unit 2.3: Food production: animal-based products and plant-based products	Recognizing and identifying food production by-products and side streams from different type of industries	Knowledge	<ul style="list-style-type: none"> – Defining and describing by-products and side streams in food production. Amounts and causes in different sectors. – Identifying the principles of laws and orders related to food-based wastes. 	Text Presentation Video Case studies Best practices External links
		Skills	<ul style="list-style-type: none"> – Distinguishing and classifying by-products from different agroindustry type. 	
		Competences	<ul style="list-style-type: none"> – Leading analysis processes about concerning by-products and side streams in food production. 	

Table 15; Module 3

MODULE 3					
Main valorization technologies					
Training Unit	Objective	Learning outcomes		Pedagogical approach	Assessment methodology
Unit 3.1: Introduction	Describing different valorisation/processing methods and their classification, as well as knowing several examples of a few overall biorefinery processes with unit operations.	Knowledge	– Defining the concepts of the overall process and unit operation, and describing the basics of classifying unit operations.	Text Presentation Video Case studies Best practices External links	Quiz
		Skills	– Analyzing the valorisation/processing methods. – Interpreting and adapting existing cases to local needs.		
		Competences	Ability to determine suitable method for different purposes and scales		
Unit 3.2: Bioprocesses	Describing of the key valorization methods based on bioprocesses: Biogas and bioethanol production (biofuels); micro algae cultivation; insects' production; mushroom production; fermentation, etc.	Knowledge	– Defining the operating principles and requirements of key bioprocesses. – Knowing the possibilities of different bioprocesses as a treatment solution for different side streams. – Identifying the products obtained through different bioprocesses and their utilization possibilities	Text Presentation Video Case studies Best practices External links	

		Skills	<ul style="list-style-type: none"> Explaining the different bioprocesses and existing solutions. Interpreting and adapting the best bioprocess depending on the by-product. 		
		Competences	<ul style="list-style-type: none"> Ability to determine bioprocesses for different purposes and scales 		
Unit 3.3: Thermal methods	Describing of the key thermo-chemical valorisation methods: Drying, Biomass combustion, torrefaction, Pyrolysis (biochar manufacturing and use), Gasification.	Knowledge	<ul style="list-style-type: none"> Knowing drying as a usual method when preserving bio-based by-products, describing different thermal drying equipment (air-dryer, IR-dryer, freeze dryer). Defining biomass combustion concept (energy use) as the final (not primary) use of material. Defining principles of dry distillation methods (torrefaction, pyrolysis, gasification), identifying their associated products: biochar, bio-oil, syngas. specially biochar. 	Text Presentation Video Case studies Best practices External links	
		Skills	<ul style="list-style-type: none"> Explaining the Thermal methods. 		

			<ul style="list-style-type: none"> – Determining the best Thermo-Chemical valorization method for each side stream. 		
		Competences	<ul style="list-style-type: none"> – Ability to determine suitable thermo-chemical method for different purposes and scales. 		
Unit 3.4: Extraction and distillation methods	Describing of different extraction and distillation methods, incl. enhanced green extraction methods, microwave extraction, supercritical extraction etc. for the production of added value components (biocompounds)	Knowledge	<ul style="list-style-type: none"> – Understanding the operating principles and requirements of different extraction and distillation methods – knowing the possibilities of different techniques as a separation and recovery method for different biocompounds 	Text Presentation Video Case studies Best practices External links	
		Skills	<ul style="list-style-type: none"> – Analyzing and interpreting the extraction and distillation methods – Determining the best Thermo-Chemical valorization method for each side stream 		
		Competences	<ul style="list-style-type: none"> – Ability to determine suitable extraction and distillation methods for different purposes and scales 		

Unit 3.5: Mechanical separation methods	Describing of mechanical separation methods: liquid/solid separation like filtration, centrifugal separation, sieving, pressing, etc.	Knowledge	<ul style="list-style-type: none"> – Describing the operating principles of mechanical separation methods – Describing the possibilities of using mechanical methods for different separation needs 	Text Presentation Video Case studies Best practices External links
		Skills	<ul style="list-style-type: none"> – Interpreting the mechanical separation methods. – Determining the best mechanical separation methods for each side stream 	
		Competences	<ul style="list-style-type: none"> – Ability to determine suitable mechanical separation method for different purposes and scales 	

Table 16: Module 4

MODULE 4					
Main biocompounds and holistic (overall) solutions for utilisation					
Training Unit	Objective	Learning outcomes		Pedagogical approach	Assessment methodology
Unit 4.1: Introduction	Describing the separation processes and applications of a few key biocompounds. Describing the overall utilization process from the perspective of different side streams containing the biocompound in question.	Knowledge	<ul style="list-style-type: none"> Identifying and describing some of the most important and valuable biocompounds and their application possibilities extensively. Describing the importance of the overall utilization of the side stream in accordance with the requirements of the circular bioeconomy. 	Text Presentation Video Case studies Best practices External links	Quiz
		Skills	<ul style="list-style-type: none"> Analyzing most important and valuable biocompounds. Assessing and mapping different uses of biocompounds depending on the industrial sector to be used 		
		Competences	<ul style="list-style-type: none"> Ability to see determine the added value of using biocompounds 		
Unit 4.2: Good practices	Identifying and describing different types of Biorefinery (case examples)	Knowledge	<ul style="list-style-type: none"> Identifying good biorefineries examples, transferring the lesson learnt to other cases or transforming it in new ideas. 	Text Presentation Video Case studies	

		Skills	– Analyzing different types of Biorefineries.	Best practices Interviews External links	
		Competences	– Ability to transform the problem into the right and best, holistic solution.		

Table 17: Module 5

MODULE 5					
Business strategies					
Training Unit	Objective	Learning outcomes		Pedagogical approach	Assessment methodology
Unit 5.1: From Business model to Circular Business model	Learning what a "circular model canvas" is based on "business model canvas", its different elements, from the value proposition to the cost structure and how to build it.	Knowledge	– Identifying, describing and defining concepts about business model design and the specific circular model canvas.	Text Presentation Video Case studies Best practices External links	Quiz
		Skills	– Interpreting the circular model canvas and its value proposition.		
		Competences	– Ability to elaborate a circular model canvas for different kind of by-products valorization projects.		
Unit 5.2: Marketing for Circular models	Learning how to adapt Marketing strategies to Circular models	Knowledge	– Naming, defining and describing the steps in developing efficient marketing communication for a bio-based product: strategy; objectives; industry; evaluation and metrics. – Identifying and selecting the elements of the communication mix: advertising; digital marketing (content marketing, social media marketing); public relations; direct marketing;	Text Presentation Video Case studies Best practices External links	

			<p>sales promotions; personal selling; events and exhibitions.</p> <ul style="list-style-type: none"> – Recognizing the importance of sociocultural environment in national and international marketing: layers and elements of culture; high and low context cultures. Cross-cultural sales negotiations: effects of cultural dimensions on decision making. Issues of marketing ethics. 		
		Skills	<ul style="list-style-type: none"> – Designing marketing strategies for by-products valorization projects. – Analysing and prioritizing the elements of the communication mix. 		
		Competences	<ul style="list-style-type: none"> – Leading the developing and implementing of a marketing strategies for a bio-based product: situation analysis; formulation of marketing objectives, defining marketing strategies for marketing mix elements; implementation process; measurement and control. 		

Unit 5.3: Business Plan & Financial Planification	Understanding the structure of a business plan and the elaboration of financial planification	Knowledge	– Describing and defining concepts about the structure of a business plan.	Text Presentation Video Case studies Best practices External links	
		Skills	– Interpreting the main blocks of the business and financial plan.		
		Competences	– Ability to elaborate a basic business plan		
Unit 5.4: Scale-up	Knowing the stages, processes and barriers to "scale up" a by-product valorisation process	Knowledge	– Identifying and describing by-product valorization project "scale-up" potential, selecting the best timing to "scale-up" and defining the "scale-up" structure, processes and timing.	Text Presentation Video Case studies Best practices External links	
		Skills	– Distinguish among the scale-ups process. – Analysing the barriers and prioritizing the steps to follow.		
		Competences	– Ability to detect the main risks and mismatches (financial and processes) related to scale-up process.		
Unit 5.5: Project Team	Knowing and understanding the	Knowledge	– Identifying and defining the necessary profiles in by-products	Text Presentation	

	different required profiles in companies and start-ups related to bio-product valorisation		valorization project and start-ups teams, and their roles.	Video Case studies Best practices External links	
		Skills	– Designing high-performance equipment for by-product valorization processes		
		Competences	– Ability to design high-performance equipment for by-product valorization processes.		
Unit 5.6: Start-up	Learning the definition of start-ups and to know its special characteristics	Knowledge	– Defining and describing the different stages of the "start-up", its characteristics and its advantages and risks.	Text Presentation Video Case studies Best practices External links	
		Skills	– Analysing start-up value proposition, distinguishing among the different stages. – Design start-ups processes, including human resources team.		
		Competences	– Ability to lead start-ups processes, acting independently and – Assuming the responsibility.		

Unit 5.7: Industrial Property and Patents	Understanding the concepts and tools of innovation management.	Knowledge	<ul style="list-style-type: none"> – Knowing the different options related to Intellectual, industrial and commercial properties. – Understanding the importance of Strategic surveillance to achieve business competitive advantages. 	Text Presentation Video Case studies Best practices External links	
		Skills	<ul style="list-style-type: none"> – Distinguishing the best options for protecting ideas, process or business. 		
		Competences	<ul style="list-style-type: none"> – Ability to carry out searching of “State of the art” processes. – Leading registration processes of invention, articles, knowledge, etc. 		
Unit 5.8: Circular Ecosystem	Understanding the importance of the support ecosystems to development biocompounds from by-products of agroindustry	Knowledge	<ul style="list-style-type: none"> – Recognising the different actors and profiles that make up an ecosystem of support for entrepreneurship and innovation (Regional Innovation Agency, Clusters, Technological Parks). – Defining basic Industrial Symbiosis concept and its relevance to by-product valorisation processes 	Text Presentation Video Case studies Best practices External links	
		Skills	<ul style="list-style-type: none"> – Understanding the role of the different actors and profiles of an 		

			ecosystem of support for entrepreneurship and innovation, distinguishing the best roles for supporting our by-product valorisation processes.		
		Competences	– Having the ability to design and create an ecosystem of support for entrepreneurship and innovation map for different by-product valorisation process		

7 ECVET Points

According the Recommendation of the European Parliament and of the Council of 18 June 2009 on the establishment of a **European Credit System for Vocational Education and Training (ECVET)**¹⁰, the allocation of **ECVET** points usually has two phases: **ECVET** points are allocated first to a qualification as a whole and then to its units. For a given qualification, one formal learning context is taken as a reference and, on the basis of the convention the total number of points is assigned for that qualification. From this total, **ECVET** points are then allocated to each unit according to their relative weight within the qualification.

Allocations of **ECVET** points are normally part of the design of qualifications and units. They are produced by the competent institution responsible for the design and maintenance of the qualification or specifically empowered for this task. In countries where there is already a national system of points, the relevant competent institutions establish arrangements for the conversion of national credit points to **ECVET** points.

Table 18: ECVET points of BypDev Training course

TRAINING COURSE			
	Duration (hours)	Relevance (%)	Nº of ECVET points
Module 0. Introduction	5,50	10%	0,22
Module 1. Trends and Markets	8,50	15%	0,34
Module 2. By- products and wastes likely to be re-valuated	10,00	18%	0,40
Module 3. Main technologies	17,00	31%	0,68
Module 4. Main biocompounds and holistic (overall) solutions for utilisation	6,00	11%	0,24
Module 5. Business Strategies	8,00	15%	0,32
TOTAL	55	100%	2,20

¹⁰ [https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009H0708\(02\)&from=EN](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009H0708(02)&from=EN)

Table 19: Module 0 (ECVET points)

Module 0. Introduction			
Training units	Duration (hours)	Relevance (%)	Nº of ECVET points
Unit 0.1: Basic Introduction	1,50	27%	0,06
Unit 0.2: Environmental Impact	1,00	18%	0,04
Unit 0.3: Circular Economy (Bioeconomy)	2,00	36%	0,08
Unit 0.4: Circular Mindset	1,00	18%	0,04
TOTAL	5,50	100%	0,22

Table 20: Module 1 (ECVET points)

Module 1. Trends and Markets			
Training units	Duration (hours)	Relevance (%)	Nº of ECVET points
Unit 1.1: Global facts, markets & trends in by-products	2,50	29%	0,10
Unit 1.2: European, National and Regional legal frame, Strategies and Policies	2,00	24%	0,08
Unit 1.3: Supply chains and value added of biomass & by-products	2,50	29%	0,10
Unit 1.4: RD&i in Bioeconomy and by-products valorisation	1,50	18%	0,06
TOTAL	8,50	100%	0,34

Table 21: Module 2 (ECVET points)

Module 2. By- products and wastes likely to be re-valuated			
Training units	Duration (hours)	Relevance (%)	Nº of ECVET points
Unit 2.1: Introduction	2,00	20%	0,08
Unit 2.2: Open field and greenhouse cultivation and domestic animals	4,00	40%	0,16
Unit 2.3: Food production: animal-based products and plant-based products	4,00	40%	0,16
TOTAL	10	100%	0,40

Table 22: Module 3 (ECVET points)

Module 3. Main technologies			
Training units	Duration (hours)	Relevance (%)	Nº of ECVET points
Unit 3.1: Introduction	1,00	6%	0,04
Unit 3.2: Bioprocesses	5,00	29%	0,20
Unit 3.3: Thermal methods	5,00	29%	0,02
Unit 3.4: Extraction and distillation methods	3,00	18%	0,12
Unit 3.5: Mechanical separation methods	3,00	18%	0,12
TOTAL	17	100%	0,68

Table 23: Module 4 (ECVET points)

Módulo 4. Main biocompounds and holistic (overall) solutions for utilisation			
Training units	Duration (hours)	Relevance (%)	Nº of ECVET points
Unit 4.1: Introduction	2,00	33%	0,08
Unit 4.2: Good practices	4,00	67%	0,16
TOTAL	6	100%	0,24

Table 24: Module 5 (ECVET points)

Module 5. Business Strategies			
Training units	Duration (hours)	Relevance (%)	Nº of ECVET points
Unit 5.1: From Business model to Circular Business model	1,50	19%	0,06
Unit 5.2: Marketing for Circular models	1,00	13%	0,04
Unit 5.3: Business Plan & Financial Planification	0,50	6%	0,02
Unit 5.4: Scale-up	1,00	13%	0,04
Unit 5.5: Project Team	1,00	13%	0,04
Unit 5.6: Start-up	1,50	19%	0,06
Unit 5.7: Industrial Property and Patents	0,50	6%	0,02
Unit 5.8: Circular Ecosystem	1,00	13%	0,04
TOTAL	8,00	100%	0,32

8 Methodology and Platform

8.1 Methodology

The methodology that will guide the expert profile in by-products and wastes valorization in the agri-food sector training course will be a methodology based on **MOOC** (Massive Open Online Course). This methodology will allow bringing this new expert profile to any interested person, regardless of their location.

This methodology will also allow to adapt the learning/teaching process to the real possibilities of the target public.

The total duration of the course will be 55 hours, distributed in 6 modules. A training planification has been developed, where the duration of each modules and units have been included, with the aim to support the target public to acquire the contents in the best possible way.

The training course will be composed by different content formats, from text documents to videos, good practices, online tools or external links in order to complete the contents included in the platform.

Each module will be completed with a final evaluation, which will allow to analyze the acquisition of the contents by the participants.

Finally, a collaborative communication tool will be included,

Finally, a collaborative communication tool will be included, which will allow the sharing of ideas, new approaches or reflections on the subject.

8.2 Platform

Massive Open Online Courses (MOOCs) are online courses in different disciplines and fields of study, organised around an open, publicly-shared curriculum, available for anyone to enrol. MOOCs provide an affordable and flexible way to acquire new skills, foster personal development and career advancement through informal quality educational experiences at scale.

Typically, **MOOCs** integrate social networking, accessible online resources, and are either self-paced or facilitated by experienced trainers in the field of study. MOOCs build on the engagement of learners who are at the centre of the learning process and self-organize their participation according to their own learning goals and skill development needs, prior knowledge and educational background, and available time and resources.

A **VOOC** (Vocational Open Online Courses), as compared to MOOCs, has a vocational focus. It provides targeted, bit-size training opportunities to particular occupational groups that need to upgrade their skills and keep pace with the developments in their field (such as ICT professionals). VOOCs are designed to fill occupational skills needs/gaps with flexible, modular and interactive e-learning offerings that take into account VET teaching and learning particularities, and can be adapted to participants' individual needs and training priorities. The term "VOOC" was first coined by the European Commission within the call for sector skills alliances (Applicants' guidelines - 04/2017)

The main characteristics of these kind of training course are the following:

Table 25: Main characteristics of MOOC

Course	A MOOC/VOOC supports the attainment of learning outcomes after certain activities within in a given period of time. It comprises learning materials and some kind of formative evaluation method to assess the knowledge acquired by learners. It involves facilitators and learners, and enables the interaction among students and between students and facilitators.
Open	On one hand, a MOOC/VOOC should provide open and free access to educational resources and learning activities, which means that learners can enrol and attend the course. On the other hand, a MOOC/VOOC should be open to anyone without prerequisites such as country of origin, previous qualifications, or specific grades
Online	Course content is always available, over the internet, and through different devices. A MOOC/VOOC does not require the physical attendance of learners at a classroom
Massive	A MOOC/VOOC has no limitation on the number of participants, supporting the participation of thousands of learners from around the globe. Learners become part of the course by engaging with other people's work, and everybody learns from the work of the other participants

Pedagogical Principles

The **Byp4dev Vocational Open Online Course** is founded on the following pedagogical principles:

- **Learner-centeredness:** Learners are at the heart of the learning process, being able to establish individuals learning goals and a personal learning path based on available content and materials.
- **Flexibility:** Learners are able to arrange their own learning schedule according to their resources within the lifecycle of the course and decide their level of engagement.
- **Interactivity:** The **Byp4dev VOOC** makes explicit mention on the value of interactivity and the multiplying effects it has on learning and capacity building. Learners are encouraged throughout the course to discuss with their peers, provide feedback on each other's work, and participate in joint activities, where possible.

- **Ubiquitous learning:** Learners are able to experience learning activities and content in any context and situation 24 hours 7 days per week through mobile devices such as laptops, tablets and smart phones.
- **Teacher as facilitator:** In MOOCs/VOOCs, trainers should abandon their traditional role which is to convey information to learners and now act as facilitators, motivating learners to engage in course activities and providing feedback and assistance with their tasks.
- **Blended evaluation scheme:** One of the greatest challenges for a Massive Open Online Course is to establish an assessment model that works at a much larger scale, with potentially thousands of learners participating in the course.

9 Evaluation

Training evaluation can be defined as any attempt to obtain information (feedback) on the effects of training program and to assess the value of training in the light of that information for improving further training.

Evaluation of training can be viewed as a method of measuring change in knowledge, skills, and competences. A major reason to evaluate training programs is to determine whether the training programs are accomplishing their specific training objectives.

The evaluation of the training modules will be carried out through a test at the end of each of the modules carried out (6 tests in total). Each questionnaire will be made up of 10 questions related to the knowledge presented in the training programme. This questionnaire will be available in the virtual platform.

To obtain the certificate of completion of the course of expert in by-products and wastes valorization in the agri-food sector, it will be necessary to have passed the tests of the six modules of the training programme with more than 80% of the questions of each module answered adequately. The final grade for the course is established as pass or fail, with no graduation rank.

10 Memorandum of Understanding

A **Memorandum of Understanding (MoU)** is an agreement between competent institutions, which sets the framework for credit transfer. It formalises the **ECVET** partnership by stating the mutual acceptance of the status and procedures of competent institutions involved. It also establishes partnership's procedures for cooperation. Credit transfer is supported by mutual trust between the competent institutions involved.

In order to recognise credit, outcomes have to be assessed in a reliable and valid manner by the competent institution in charge. It also needs to trust that learners' credit does concern the learning outcomes expected and that these are at the appropriate level. By setting up a **MoU**, competent institutions should acknowledge their partners' approaches to designing units, assessment, validation, and recognition as well as quality assurance. Through this process, they make informed judgements about the conditions under which they can recognise credit achieved in partner systems. MoUs are concluded by competent institutions, each of which is empowered, in their own setting, to award qualifications or units or to give credit for achieved learning outcomes for transfer and validation.

The **Byp4Dev Memorandum of Understanding** can be found in **Annex I**.