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Relief
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RELIEF Curriculum

Deliverable D2.2

TERINOV
UNIFI

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VER 0	10 May 2023	Partnership	Partnership	First version of the course structure discussed during first project meeting (annexes)
VER 0.1	24 May 2023	Partnership	Partnership	First version of Syllabi and structure. Compliance with D2.1 results (annexes)
VER 0.2	5 June 2023	Partnership	Partnership	Revised Syllabi (annexes)
VER 1	6 June 2023	UNIFI	TERINOV	First draft of final document
VER 2	8 June 2023	UNIFI	TERINOV Partnership	Second draft
VER Final	9 June 2023	UNIFI	UoP for E+ Portal	The corrections and feedback from the partnership following previous shared draft are included.

Content

Executive summary

The goal of Deliverable 2.2 is to provide the first version of the RELIEF course curricula. These have been developed starting from the draft structure as from the proposal stage, combined and adjusted based on the results of Tasks T2.2 and T2.3 as summarised in Deliverable 2.1 “Analysis of training in Bioeconomy in farming sector”.

The structure of both the courses for Higher Education Institutions (HEI) and the vocational Education and Training (VET) are here presented.

The proposed structures will serve as the foundation for the implementation of the course material. Additionally, the external evaluator (task 6.1) will assess the proposed structured and provide feedback. Based on their evaluation, any necessary elaborations or adjustments will be considered and implemented accordingly.

Keywords: bioeconomy; education; training: VET; secondary education; tertiary education.

Introduction

Bioeconomy is the production, utilization, conservation, and regeneration of biological resources, including related knowledge, science, technology, and innovation, to provide sustainable solutions (information, products, processes, and services) within and across all economic sectors and enable a transformation to a sustainable economy. Bioeconomy corresponds to a complex, hybrid subfield of knowledge, stemming from the inputs of several scientific fields. It is also a sector strongly informed by major driving forces of current societies and economies. The dual transition, namely the green transition, and digitalization are certainly among some of these drivers that help shape the bioeconomy's present and future.

In this context, the future of bioeconomy strongly relies on the adaptability of education and training programs to effectively address the complex intersections of knowledge expansion, multidisciplinary approaches, and important societal transformations. Bearing this in mind, this report issued by the RELIEF project aims at presenting the structure of the RELIEF courses, as developed during Task 2.4.

The first part of the report presents the path followed for the elaboration of the two curricula (HEI and VET), and the second part presents how the developed curricula comply with the results of the work performed in the previous tasks of WP2, summarised within Deliverable 2.1 "Analysis of training in Bioeconomy in farming sector". The structure of the courses, including the syllabi of each learning unit composing the modules of the courses are then presented in detail in the Deliverable Annexes.

Building the Course structure

The course structure was set during the First Project meeting, held in Florence in May 2023 based on a draft structure prepared by UNIFI and presented during the in-person meeting. In fact, the second day of the meeting (10 May 2023) was almost fully devoted to Work Package 2.

The work followed the presentation of the first results of tasks 2.2 and 2.3, devoted to the analysis of the training needs. The results were made available by means of the first draft of Deliverable 2.1 “Analysis of training in Bioeconomy in farming sector”.

The brainstorming work “in presence” has been coordinated by UNIFI, leader of Task 2.4. The team worked directly on an excel file, making real-time modifications. Prior to the meeting, data on the competencies of each partner in the main fields related to bioeconomy had already been collected and incorporated into the excel file.

The main structure of each of the two courses (1 HEI and 1 VET) is agreed as in the following.

- **HEI**; the course is composed by 5 Modules, each consisting of 4 Learning Units (LUs); 4 modules devoted to bioeconomy related topics, 1 module devoted to Horizontal Issues. Each LUs is equivalent to 3 ECTS.
- **VET**; the course mirrors the HEI course structure, but it adopts a VET approach. It is composed by 5 Modules, each consisting of 4 Learning Units (LUs); 4 modules devoted to bioeconomy related topics, 1 module devoted to Horizontal Issues. Each LUs is here equivalent to 1 ECTS.

The first step was to define the 20 LUs and assign each of these LUs to a partner that has the role to coordinate the syllabus implementation, supported in some cases by a second partner. The distribution of assignments is presented in Annex 1.

Each contributor (coordinator and supporter) was then assigned to prepare, after the meeting, a list of specific arguments (topics) for each learning unit. This information has been included in a common template for the LU’s syllabus, together with a Short Description, the learning outcomes, and the training and assessment methodologies. The common template was shared on the project repository, together with a document clearly depicting how to compile the description of Learning Outcomes, to be compatible with the Framework for Qualifications of the European Higher Education Area. Particular attention was devoted to how to describe the expected learning outcomes and learning progression following Bloom’s taxonomy, and which verbs and words to use to show the expected learning outcomes.

As a starting point, the LUs were initially given identical titles in both HEI and VET courses, so to establish a common framework. However, during the subsequent elaboration and development process, the developers were encouraged to develop a more specific structure for VET with the aim to propose, when possible and/or necessary, more engaging and appealing titles targeting the VET audience.

The final course structure was determined after the approval of Deliverable D2.1. by all partners.

The main structure of the two courses is presented in Annex 2. The detailed list of each module including the main topics/arguments of each Learning Unit is presented in Annex 3, while the syllabus of each Learning Unit is available in Annex 4.

Compliance with D2.1 recommendations

The structure of the developed courses has been elaborated in order to comply with the outcomes of the recommendations resulting from the "Analysis of Training in Bioeconomy in farming sector" (Deliverable D2.1). The recommendations for further supporting the development of the bioeconomy education and training are listed below, presented in no order of importance, together with an explanation of the link with the developed RELIEF curricula.

Balancing sustainability with economic dimensions in training and education: *matching the economic dimensions of the training programs with the sustainable environment principles, particularly to respond to the practical management needs that seem to be required by learners, especially by farmers in the bioeconomy-driven or bioeconomy-related education and training programs.*

- The structure of the learning units more directly linked to the bioeconomy, have been developed by balancing the two dimensions, sustainability and economics. This approach will be followed as a general guideline also in the phase of course material development, that will be carried out within Work Package 3 activities.

Complexity is and add-on for bioeconomy training packages, but also a challenge for selecting and updating technical skills of the teaching staff: *the complexity of bioeconomy education and training with increasing overlaps between different scientific fields and multiple methodological approaches to programs delivery entails the need for training providers further supporting the development (upskilling and reskilling) of the technical skills of teachers and trainers.*

- Although the RELIEF curricula, both for HEIs and VET, are more focussed on the agricultural dimension, the whole complexity of the bioeconomy is included in the planned Learning Units. In fact, the modules are not limited to the specific Bioeconomy, circular economy and bio-based products topics. They also include the Water-Energy-Food and Ecosystems nexus, with an additional focus on the Climate Change issue and the role of renewables. In addition, the curricula cover the challenge and opportunities of controlled environment agriculture and includes a dedicated module on Digital technologies and artificial intelligence solutions applied to agriculture and farm management. Furthermore, the module for horizontal learning units includes soft, green, entrepreneurial, and digital skills. Their

importance is relevant because horizontal skills and soft skills complement the technical knowledge of agriculture and enable agricultural entrepreneurs and farmers to thrive in a rapidly changing and interconnected world, empowering individuals to effectively manage their businesses, build relationships, adapt to new challenges, and contribute to sustainable agricultural practices, that is strictly related to the bioeconomy issues, indeed.

Digitalization is not everything: *training providers must avoid an excessive techno-optimism. By this we mean that making bioeconomy training available online or using blended methods will not increase per se outreach and efficiency in delivering training programs. To avoid the problems associate to the digital divide that may affect potential learners in remote areas, especially farmers with lower digital skills, training providers must assess digital skills and literacy levels ahead of implementing any curricula. Training providers must also adjust content and structure to the targeted digital proficiency level.*

- Learning units will be developed, and further offered, in a blended format. By the way, online (asynchronous) learning will only partially cover the educational offer implementation, being predominant the other learning methodologies adopted. In the case of VET, whose learners could be the most affected by the digital divide issues, online learning is limited to few hours. The parallel development of digital skills by means of Horizontal skills module, will furthermore train the learners to the correct and proficient use and fruition of the asynchronous learning units.

English teaching is great, but it is not always good or better: *choosing the teaching language is an important aspect of setting an educational and training program in bioeconomy. Our results show that advanced courses are adopting English as the main teaching language as a standard. A continued effort to make advanced education and training in this area more international is required, to increase cross-borders cooperation and knowledge exchange. However, at secondary education levels and even at some intermediate training levels (EQF5), native language programs will continue to be needed, in order to increase the number of intermediate professionals in the field of bioeconomy, especially at the local/regional level.*

- During the VET courses' implementation phase, the material will be shared in English within the partnership, being this language the common communication language of all the partners. Once the basis material is available, courses will be

translated and provided in the national language, in order to make them accessible to all the target groups.

Creating logical and linear education and training pathways, promoting coordination between the VET sector and higher education institutions: *the development of bioeconomy-related education and training programs must look for a match between the learning of basic knowledge and skills at the secondary education level (especially in VET programs) and undergraduate levels that can, later one, be linked with advanced training courses on bioeconomy or in bioeconomy related fields. To achieve that, it is important that national training catalogues are reviewed and that a greater coordination between the VET sector and universities is achieved in terms of the curricular pathways offer.*

- The curricula development followed a "parallel paths approach". As a first step, the main structure of the RELIEF HEI curriculum has been developed and discussed, by including all the most important and relevant arguments composing each selected learning units. Once the HEI learning unit was developed, the same unit has been adapted to the learning level and needs that are relevant for VET, by focussing on the topics that are "nearer" to the operators' (e.g. the farmers) demand, by "cherry-picking" the most appropriate topics. This ensures a direct link between HEI and VET courses, by maintaining at the same time a difference in the topics and approach. In some cases, while passing from HEI to VET, the topics' or even the Learning Units' titles have been reformulated in order to make them more attractive for the different audience.

The inclusion of bioeconomy in VET programs must be a priority: *bioeconomy is still far from being a relevant topic in EQF4 programs curricula. EQF5 programs specifically focusing on bioeconomy seem to be missing as well. Stakeholders must consider the dimension of VET bioeconomy curricula and curricular units as major priority for the sector.*

- In both Curricula. HEI and VET, an entire module in "Bio-economy, circular economy and bio-based products" is planned.

Curricula (particular, non-standard ones) must adopt a person-centred approach: *our data shows suggests that curricula must adjust to different learners' profiles. This is a common place in education and training literature. It is, however, important to emphasize*

that curricula, particularly, non-standard ones which often have greater flexibility (e.g., MOOC courses, short-term courses) may benefit from co-creation design, putting potential learners at the centre stage of the process and, thus, ensuring the implementation of programs which are attuned with their expectations and needs. These approaches may more easily stream into the curricula the entrepreneurial and digital skills.

- This recommendation will be important for the implementation phase rather than for the course structure. However, having planned to have part of the course provided as asynchronous learning it facilitates the following development in this direction.

Following Steps

This activity is strictly related to Work Package 3 “Development of the RELIEF training material, methodology, assessment and accreditation” and Work Package 6 “Quality assurance, evaluation and impact analysis”.

Link with Work Package 3

The aim of WP3 is to develop the training material as well as training methodology and assessment based on the learning outcomes and findings in WP2. The starting point of WP3 activities will be the structure of the Courses as elaborated in Wp2 and available in the present deliverable.

Link with Work Package 6

The project progress will be evaluated by an independent External Evaluator at the mid-term and at the end of its duration, as foreseen in Task 6.1.

This evaluation will also focus on both the quality of project activities and its outputs. The mid-term evaluation (Deliverable D6.3) could also provide feedback on the project outputs available at that moment, theoretically including the proposed RELIEF curricula. For this reason, it cannot be excluded that the evaluator will request to make some changes either to the course structure or to some of the Learning Units. For this reason, the final structure and contents of the courses that will be piloted within the activities of Work Package 5 could result different from what presented in the present Deliverable. In fact, a process of Fine Tuning could be performed as a follow up of the feedback from the External Evaluator received at Month 18.

Annexes

Annex 1 - distribution of assignments for syllabus implementation

	Title	Coordinator	Supporter 1
	Agricultural sustainability, management of natural resources and climate action		
A1	Renewable energy and its application as green agricultural energy source	UNIFI	MDU
A2	Climate change	UAZORES/MDU	ReadLab
A3	Water, Energy, and Food (WEF) Nexus security, Drip Irrigation, and Desalination	UAZORES	UNIFI
A4	Agricultural reuse of organic residuals	UNIFI	CERTH
	Digital technologies and artificial intelligence		
B1	Precision technology and Big Data	TERINOV	DREAM
B2	Remote sensing in Farming	UAZORES	MDU
B3	Farm management	MDU	
B4	Automation Technologies	CERTH	UoP
	Bio-economy, circular economy and bio-based products		
C1	Circular Economy	UoP	SWIDEAS
C2	The concept of biorefinery	MDU	UNIFI
C3	Bioenergy and energy crops	UNIFI	MDU
C4	Innovation, Economics and Strategic Management in the Bioeconomy	OTC	TERINOV
	Controlled environment agriculture		
D1	Controlled environment agriculture infrastructure	MDU	
D2	Soilless: Hydroponics, substrates, aquaponics	MDU	
D3	Pest Management in Controlled environment	MDU	
D4	Crop selection for controlled agriculture	MDU	
	Horizontal		
E1	soft skills	OTC	CESIE
E2	green skills	OTC	CESIE
E3	entrepreneurial skills	ReadLab	CESIE
E4	digital skills	ReadLab	OTC

Annex 2 - Main structure of RELIEF courses

RELIEF for Higher Education Institutes	RELIEF for Vocational Education and training
Agricultural sustainability, management of natural resources and climate action	**Agricultural sustainability, management of natural resources and climate action**
Renewable energy and its application as green agricultural energy source (HEI-A1)	Renewable energy solutions for agriculture (VET-A1)
Climate change (HEI-A2)	Understanding climate change (VET-A2)
Water, Energy, and Food (WEF) Nexus security, Drip Irrigation, and Desalination (HEI-A3)	Water, Energy, and Food (WEF) Nexus security, Drip Irrigation, and Desalination (VET-A3)
Agricultural reuse of organic residuals (HEI-A4)	Agricultural reuse of organic residuals (VET-A4)
Digital technologies and artificial intelligence	**Digital technologies and artificial intelligence**
Precision technology and Big Data (HEI-B1)	Data Science and Precision Technologies (VET-B1)
Remote sensing in Farming (HEI-B2)	Exploring precision farming using remote sensing (VET-B2)
Integration of digital technologies for effective farm management (HEI-B3)	Smart farming solutions (VET-B3)
Automation Technologies (HEI-B4)	Automation Technologies (VET-B4)
Bio-economy, circular economy and bio-based products	**Bio-economy, circular economy and bio-based products**
Circular Economy (HEI-C1)	Circular Economy (VET-C1)
The concept of biorefinery (HEI-C2)	Discovering the potential of biorefineries (VET-C2)
Bioenergy and energy crops (HEI-C3)	Bioenergy and energy crops (VET-C3)
Innovation, Economics and Strategic Management in the Bioeconomy (HEI-C4)	Introduction to bioeconomy - New value chains, Innovation and basic Economics in the Bioeconomy (VET-C4)
Controlled environment agriculture	**Controlled environment agriculture**
Controlled environment agriculture infrastructure (HEI-D1)	Basics of controlled environmental agriculture (VET-D1)
Soilless: Hydroponics, substrates, aquaponics (HEI-D2)	Mastering vertical farming (VET-D2)
Pest Management in Controlled environment (HEI-D3)	The business of vertical farming: from plants to profit (VET-D3)
Crop selection for controlled agriculture (HEI-D4)	Sustainable agriculture in controlled environments: Challenges, opportunities and solutions (VET-D4)
Horizontal	**Horizontal**
soft skills (HEI-E1)	soft skills (VET-E1)
green skills (HEI-E2)	green skills (VET-E2)
entrepreneurial skills (HEI-E3)	entrepreneurial skills (VET-E3)
digital skills (HEI-E4)	digital skills (VET-E4)

Annex 3 - Detailed description of each module

Agricultural sustainability, management of natural resources and climate action				
	Renewable energy and its application as green agricultural energy source (HEI-A1)	***Climate change (HEI-A2)***	***Water, Energy, and Food (WEF) Nexus security, Drip Irrigation, and Desalination (HEI-A3)***	***Agricultural reuse of organic residuals (HEI-A4)***
1	Introduction to Renewable Energy Sources and Efficiency	Climate Systems and climate change	Hydrologic Cycle	Typologies and characterization of agricoltural residues
2	Solar Energy	Climate models and predictive tools	Supply water systems	Biochar as a solution for sustainable agriculture
3	Wind Energy	Climate change impacts in agriculture	Water uses	Residues management and logistic
4	Biomass to Energy	Mitigation and adaptation strategies for agriculture	Water Management	Processes and treatments for successful reuse
5	Energy Storage	Climate policies and international agreements		Cost/benefit - from waste to opportunity
6	Agrivoltaics			European legislation on organic residuals reuse in agricolture
7	Other RES based solutions for agriculture			
8	Case studies of off-grid projects			
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Digital technologies and artificial intelligence				
	Precision technology and Big Data (HEI-B1)	***Remote sensing in Farming (HEI-B2)***	***Integration of digital technologies for effective farm management (HEI- B3)***	***Automation Technologies (HEI-B4)***
1	Introduction to data science	Fundamentals in Remote sensing	Introduction to smart farming	Introduction to Automation technology in agriculture.
2	Introduction to sensors and other monitoring devices in agriculture	Image characteristics	Monitoring systems	General information
3	Uses of precision technologies in agriculture	Orbitals of satellites	Modern farming methods	Applications in Agriculture
4	Applied cases in agriculture	Applications	Case studies	Case studies
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Bio-economy, circular economy and bio-based products				
	Circular Economy (HEI-C1)	***The concept of biorefinery (HEI-C2)***	***Bioenergy and energy crops (HEI-C3)***	***Innovation, Economics and Strategic Management in the***
1	Background and concept of the CE	The concept of biorefinery	Introduction on bioenergy production	Introduction to Bio-economy
2	Linear economy versus CE	Pathways of biorefinery	Sustainable biofuel production processes	Bio-based industry and Bio-economy in Europe, the EU and national policies in relation to bioeconomy, with focus on the agricultural sector
3	Principles, dimensions, benefits and challenges of CE	Case studies and world- case examples	Crops: feedstocks selection and pre- treatment	Biological Resources and Bioproducts
4	Strategic action plan for circular economy and product sustainability	Challenges for future development	Bioenergy and sustainability	Introduction of Economic fields of Bioeconomy micro and macro- economic level
5	System thinking and CE		European legislation on energy crops and biofuels	Strategic management in bioeconomy – the framework of principles and methods that define the decision making process in the agribusiness sector
6	Applying circularity to agriculture			Bio business, sustainable entrepreneurship and Business Plans
7	Agroecology and Regenerative Practices			The role of Innovation in bio based economy
8	Circular Farming Technologies			The Economics of Innovation and Sustainable Development
9	Circular Business models			
10	Resource reduction and waste management			
11	Agricultural Production of Bio-based Resources			
12				

Controlled environment agriculture				
	Controlled environment agriculture infrastructure (HEI-D1)	***Soilless: Hydroponics, substrates, aquaponics (HEI-D2)***	***Pest Management in Controlled environment (HEI-D3)***	***Crop selection for controlled agriculture (HEI-D4)***
1	Controlled environmental agriculture	LED lighting in vertical farming	Business models in vertical farming	Sustainable agriculture techniques and technologies
2	Factors affecting plant growth	Plant nutritional requirements in vertical farming	Financial planning	Challenges and opportunities
3	Environmental control systems	Modern tools in vertical farming	Markting strategies	Environmental control systems
4	Current market and potential economic and environmental beneffits	Emerging trends	Case studies	Case studies
5			Development of a business plan	
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Horizontal				
	soft skills (HEI-E1)	***green skills (HEI-E2)***	***entrepreneurial skills (HEI-E3)***	***digital skills (HEI-E4)***
1	Principles of effective communication	Introduction to Sustainability and the various related concepts (circular economy, bioeconomy, green economy)	Introduction to Entrepreneurship – Entrepreneur - GEM	Data Analysis for cost analysis
2	Effective negotiations	Getting familiar with International and European key directives such as SDGs and the Green New Deal	The Business Environment – PEST Analysis – Porter's 5 Forces	Digital Collaboration and Communication
3	Building effective Teams	Environmental management and green innovation	The Enterprise – Resource Based Theory – Value Chain Theory	E-Commerce and Digital Marketing
4	The importance of cultivating agile thinking	Waste management, Energy efficiency and savings, waste water and their relation to Life cycle Thinking	Business Concept Development - Business Model Canvas	Cloud Computing
5	The basic principles of Accountability and Ethical communication	Key elements for ensuring compliance with environmental legislation	Business Plan	On-line Security
6	The importance of Professional development and the enhancement of self-awareness and self-management of professionals	Assessment of the environmental impact derived from personal and professional activities	Classroom Workshop – Business Concept	
7		The importance of adopting a systems thinking approach	Financing - Alternative Funding Sources	
8			Spatial Positioning of Businesses – Clusters - Industrial Areas	
9			Agricultural Entrepreneurship	
10			Sustainable – Green – Circular Entrepreneurship	
11			Entrepreneurship in an International Environment	
12			e - Entrepreneurship	

Agricultural sustainability, management of natural resources and climate action				
	Renewable energy solutions for agriculture (VET-A1)	***Understanding climate change (VET-A2)***	***Water, Energy, and Food (WEF) Nexus security, Drip Irrigation, and Desalination (VET-A3)***	***Agricultural reuse of organic residuals (VET- A4)***
1	Introduction	Climate systems and climate change	Water basic concepts	Typologies and characterization of agricoltural residues
2	Solar Energy for farmers	Climate change impact in agriculture	Supply water systems	Biochar as a solution for sustainable agriculture
3	Biomass to Energy	Mitigation and adaptation strategies for agriculture	Water uses	Management of organic residues from agricultural activities: from production to storage
4	Other RES based solutions for agriculture		Water Management	Processes and treatments for successful reuse
5	Case studies of off-grid projects			Cost/benefit: does it really worth?
6				European legislation: restrictions and opportunities
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Digital technologies and artificial intelligence				
	Data Science and Precision Technologies (VET-B1)	***Exploring precision farming using remote sensing (VET-B2)***	***Smart farming solutions (VET-B3)***	***Automation Technologies (VET-B4)***
1	Introduction to data science	Fundamentals in Remote sensing	Introduction to smart farming	Introduction to Automation technology in agriculture.
2	Introduction to sensors and other monitoring devices in agriculture	Fundamentals of image characteristics	Monitoring systems	General information
3	Uses of precision technologies in agriculture	Some concepts of satellites used in remote sensing and farming	Modern farming methods	Applications in Agriculture
4	Applied cases in agriculture	Applications	Case studies	Case studies
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Bio-economy, circular economy and bio-based products				
	Circular Economy (VET-C1)	***Discovering the potential of biorefineries (VET-C2)***	***Bioenergy and energy crops (VET-C3)***	***Introduction to bioeconomy - New value chains, Innovation and basic Economics in the Bioeconomy (VET-C4)***
1	Circular Economy – principles, dimensions, benefits and challenges	The concept of biorefinery	Bioenergy: what is it and the production processes	Introduction about Bio-economy
2	Resource reduction and waste management	Case studies and world- case exemples	Crops: feedstocks selection and pre- treatment	Bio-based industry and Bio-economy in Europe with a focus on the agricultural sector
3	Agricultural Production of Bio-based Resources	Challenges for future development	Biofuels, are they sustainable?	Biological Resources and Bioproducts
4	Agroecology and Regenerative Practices		European legislation: restrictions and opportunities	Innovation in bio based economy
5	Circular Farming Technologies			Introduction of Economic aspects of Bioeconomy
6				Introduction to Strategic management in bioeconomy
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Controlled environment agriculture				
	Basics of controlled environmental agriculture (VET-D1)	***Mastering vertical farming (VET-D2)***	***The business of vertical farming: from plants to profit (VET-D3)***	***Sustainable agriculture in controlled environments: Challenges, opportunities and solutions (VET-D4)***
1	Controlled environment agriculture	LED lighting in vertical farming	Business models in vertical farming	Sustainable agriculture techniques and technologies
2	Environmental control systems	Plant nutritional requirements in vertical farming	Markting strategies	Challenges and opportunities
3	Current market and potential economic beneffits	Vertical farming techniques	Case studies	Case studies
4		Emerging trends	Development of a business plan	
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Horizontal				
	soft skills (VET-E1)	***green skills (VET-E2)***	***entrepreneurial skills (VET-E3)***	***digital skills (VET-E4)***
1	Principles and key elements of interpersonal communication	Introduction to Sustainability and Bioeconomy concepts	Introduction to Entrepreneurship – Entrepreneur	Digital Reasearch
2	Effective negotiations	Introduction to the Sustainable Development Goals as mentioned in the UN's 2030 Agenda, the European Green Deal and the GreenComp Framework and their application in practice	Agricultural Entrepreneurship	Digital Communication and Collaboration
3	Team working and collaboration skills	Key elements of waste management, energy efficiency, water and food waste practices	The Business Environment – PEST Analysis – Porter's 5 Forces	E-Commerce
4	Decision making and problem solving	Impact of human activity on the environment and tools to calculate this impact	The Enterprise – Resource Based Theory – Value Chain Theory	Digital Marketing
5	The importance of Resilience and Adaptability in transition to change	The need for all to adopt a systems thinking approach	Business Concept Development - Business Model Canvas	E-Learning
6	The basic principles of Accountability and Ethical behaviour		Business Plan	
7			Classroom Workshop – Business Concept	
8			Financing - Alternative Funding Sources	
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Annex 4 - Syllabi of Learning Units

HEI-A1

Module: Agricultural sustainability, management of natural resources and climate action
Learning Unit: Renewable energy and its application as green agricultural energy source
Total number of hours: 60 hours **ECTS: 3** **EQF level: 6**
2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***
This LU aims to provide the student with a complete view of the RES based technologies that are available and that can be used in the agricultural context. It also aims at providing the ability to determine the most appropriate solution to be adopted in a specific context, thus supporting the decision-making process.
3. Learning Outcomes *The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described*
Knowledge ***After the completion of this LU, the learner will:*** • describe the importance of Renewable Energies in the Global energy Consumption scenario, • recognise and discuss the state of the art of the most relevant RES technologies available for the agricultural environment, • identify the basic mechanisms and processes renewable underlying renewable energy sources discuss the Best presently Available Technologies • assess and discuss off-grid renewable energy solutions at diverse climate conditions. **Skills** ***After the completion of this LU, the learner will be able to:*** • identify the best renewable application(s) to be implemented based on each specific situation, • propose RES based solution for application, • recommend RES based solutions, in particular in the agricultural context. **Competences** ***After the completion of this LU, the learner will be competent to:*** • compare different RES based solutions, • examine RES based technical solutions proposed, • support the related decision process.

4. Content

- **Introduction to Renewable Energy Sources and Efficiency**: Energy potentials from Renewables; Reasons for shifting from Fossil Fuels to Renewables; Energy Efficiency
- **Solar Energy**: Solar radiation; Solar Heat; Photovoltaics; Concentrated Solar Energy; Economics; Design and Applications
- **Wind Energy**: Wind resource and measurements; Basic Theory; Wind generators; Components of a Wind Generator; Wind Park development; Wind Energy Production; Small Scale Applications
- **Biomass to Energy**: Biomass treatment; Logistics; Energy Conversion Technologies; Biomass to Heat; Cogeneration; Anaerobic Digestion
- **Energy Storage**: The Concept of Flexibility, Decoupling Production and Load; Thermal Storage; Electricity Storage
- **Agrivoltaics**: Concepts; Coupling with crops; modelling
- **Other RES based solutions for agriculture**: geothermal, and mini hydro.
- **Case studies of off-grid projects**: Off-grid applications of renewable energy solutions and evaluating their different technologies applied to different climate conditions

6. Training methodologies

- Face to Face: 24 hours
- Online learning (asynchronous): 20 hours
- WBL (through study visits and/or workshops): 16 Hours

7. Assessment methodologies

For Face to Face
Oral Exam
For Online learning
Self- assessment activities (quizzes, multiple choice, true -false), reflection questions
For WBL
Project based assessment

Module: Agricultural sustainability, management of natural resources and climate action

Learning Unit: Climate change

Total number of hours: 60 hours

ECTS: 3

EQF level: 6

2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***

In this LU, the student will study climate change and its effect on the different components of agriculture: weather, available water, etc. Learning how to control some of these changes, through a change in the type of culture carried out, other cultural techniques, among other alternatives.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge

After the completion of this LU, the learner will:

- Identify and discuss the fundamental concepts of climate system, including the drivers of climate change drivers
- Identify and assess the specific impacts of climate change in agriculture
- Describe the role of climate models
- Identify the effect of these climate changes on agriculture

Skills

After the completion of this LU, the learner will be able to:

- Analyse and debate mitigation strategies in agriculture to reduce greenhouse gas emissions
- Develop and propose adaptation strategies in agriculture

Competences

After the completion of this LU, the learner will be competent to:

- Assess and analyse specific effects of climate change on agriculture
- Formulate a plan of action to adapt agricultural practices to potential climate change impacts
- Identify climate-change induced impacts and changes within agricultural systems

4. Content

1. Climate Systems and climate change: Introduction to the Earth´s system and basic mechanisms of climate change
2. Climate models and predictive tools: Introduction to climate models and their role in understanding climate change
3. Climate change impacts in agriculture: Exploring the specific impacts of climate change on agriculture and their implications on e.g. crop yield, water availability, extreme weather events and precipitation patterns
4. Mitigation and adaptation strategies for agriculture: Discussing mitigation strategies to reduce greenhouse gas emissions and adaptation strategies to cope with climate change impacts.
5. Climate policies and international agreements: Overview of global and regional climate policies and analyze the specific policy framework related to agriculture.

6. Training methodologies
• Face to Face: 25 hours • Online learning (asynchronous): 20 hours • WBL (through study visits and/or workshops): 15 Hours
7. Assessment methodologies
For Face to Face E.g., Case study, practical activity (either individual or in groups), decision making scenarios **For Online learning** E.g., Self- assessment activities (quizzes, multiple choice , true -false), reflection questions **For WBL** Work/Monograph

Module: Agricultural sustainability, management of natural resources and climate action

Learning Unit: Water, Energy, and Food (WEF) Nexus security, Drip Irrigation, and Desalination

Total number of hours: 60 hours

ECTS: 3

EQF level: 6

2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***

This LU aims to develop good management of existing water, as well as identify how to use all possible sources of water available for agriculture and human consumption. At the same time, how to use remnant water used in agriculture for possible uses, will be also achieved.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge

After the completion of this LU, the learner will:

- Identify different sources of water
- Identify uses of water

Skills

After the completion of this LU, the learner will be able to:

- Ability to reuse water from different origins
- Water control and monitorization

Competences

After the completion of this LU, the learner will be competent to:

- Better sensibility to water use and waste
- Better understanding of the notion of the value of water and its quality

4. Content

- **Hydrologic Cycle**
  - **1.1. Water basic concepts**
    - 1.1.1. Surface and marine waters
    - 1.1.2. Groundwater
      - 1.1.2.1. Aquifers
  - **1.2. Hydrostratigraphy**
    - 1.2.1. Water at soil level
    - 1.2.2. Unsaturated zone
    - 1.2.3. Saturated zone

- **Supply water systems**
  - **2.1. Catchments**

        - 2.1.1. Rain catchment
        - 2.1.2. River catchments
        - 2.1.3. Springs
        - 2.1.4. Wells and boreholes
    - **2.2. Other sources of water**
        - 2.2.1. Desalinization
        - 2.2.2. Water reuse and recycling
    - **2.3. Reservoirs**
        - 2.3.1. Lakes
        - 2.3.2. Dams
        - 2.3.3. Artificials
    - **2.4. Distribution**
        - 2.4.1. Gravity
        - 2.4.2. Pumping
        - 2.4.3. Others

- **Water uses**
    - **3.1. Drinking water**
        - 3.1.1. Human
        - 3.1.2. Animals
    - **3.2. Irrigation**
        - 3.2.1. Surface irrigation
        - 3.2.2. Sprinkler irrigation
        - 3.2.3. Drip Irrigation
        - 3.2.3. Drainage systems
    - **3.3. Industrial uses**
        - 3.3.1. Processing and fabrication
        - 3.3.2. Washing and disinfection
        - 3.3.3. Cooling
    - **3.4. Energy production**

- **Water Management**
    - **4.1. Quality and Quantity**
        - 4.1.1. Norms and laws for quality
            - 4.1.2. Drinking water
            - 4.1.3. Agriculture
            - 4.1.4. Industrial
        - 4.1.2. Demands vs available equilibrium.
    - **4.2. Control and monitorization**
        - 4.2.1. Monitorization networks
        - 4.2.2. Control plans and reports
    - **4.3. Protection and security**
        - 4.3.1. Protection areas
        - 4.3.2. Safety and security for water
            - 4.3.2.1. Risks and conflicts
            - 4.3.2.2. Water scarcity
            - 4.3.2.3. Contamination and pollution

- 4.3.2.4. Other treats

- **4.4. Costs and values**
  - 4.4.1. Costs of water
    - 4.4.1.1. Production vs manutention vs uses
    - 4.4.1.2. Treatment of water
  - 4.4.2. Value of water
    - 4.4.2.1. Quantity and quality
    - 4.4.2.2. Relative value

6. Training methodologies

- Face to Face: 25 hours
- Online learning (asynchronous): 20 hours
- WBL (through study visits and/or workshops) : 15 Hours

7. Assessment methodologies

For Face to Face

E.g., Case study, practical activity (either individual or in groups), decision making scenarios

For Online learning

E.g., Self- assessment activities (quizzes, multiple choice , true -false), reflection questions

For WBL

Two field trips

1: Visit water catchments and reservoirs; watch water monitoring

2: Energy production – hydroelectric center; Industrial Processing and fabrication or washing and disinfection.

Module: Agricultural sustainability, management of natural resources and climate action

Learning Unit: Agricultural reuse of organic residuals

Total number of hours: 60 hours

ECTS: 3

EQF level: 6

2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***

This Lu aims to provide an overview of organic residues that can be reused in agricultural activities. This is through lessons aimed at the characterization of residues, description of storage and treatment processes to make them usable and an analysis of the costs and benefits of their use. LU concludes with a review of the pertinent European legislation.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge

After the completion of this LU, the learner will:

- Analyse types of organic residues that can be reused in agriculture.
- Compare the processes and treatments necessary to characterize organic residues and allow their proper use.

Skills

After the completion of this LU, the learner will be able to:

- Assess the characteristics that an organic waste must have in order to be reused.
- Examine the costs and benefits of reusing organic residues in agriculture.
- Design a simple workflow aimed at the recovery and utilization of organic residues in agriculture.

Competences

After the completion of this LU, the learner will be competent to:

- Apply knowledge and skills to participate actively in agricultural realities sensitive to sustainability topics.
- Distinguish processes required to transform a waste into something useful for the farm.
- Make and defend decisions in this area aware of European regulations in terms of limitations and funding opportunities.

4. Content

- **Typologies and characterization of agricoltural residues:** An overview of the types of organic residues that can be reused in agriculture and their characterization.
- **Biochar as a solution for sustainable agriculture:** What biochar is and how it is produced. How it can be successfully used in agriculture
- **Residues management and logistic:** A discussion of the chain of collection and management of organic residues aimed at reuse in agriculture.

- **Processes and treatments for successful reuse:** The analyses and treatments required to assess the quality of residues and their proper use.
- **Cost/benefit - from waste to opportunity:** A comparison between the costs to be faced for the management and treatment of organic residues and the benefits that can be obtained from their use.
- **European legislation on organic residuals reuses in agricolture:** An overview of European legislation on the subject: constraints and opportunities.

6. Training methodologies

- Face to Face: 24 hours
- Online learning (asynchronous): 20 hours
- WBL (through study visits and/or workshops) : 16 Hours

7. Assessment methodologies

For Face to Face

Written exam

For Online learning

Self-assessment activities (quizzes, multiple choice, true-false), reflection questions

For WBL

Project based assessment

Module: Digital technologies and artificial intelligence

Learning Unit: Precision technology and Big Data

Total number of hours: 75 hours

ECTS: 3

EQF level: 6

2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***

This LU aims to explore the best practices for using precision technologies and big data in farming. This unit starts with the fundamentals needed for data science, such as extracting, harmonizing, and storing data. In a more advanced stage, the application of artificial intelligence for different purposes will be explored, such as Remote Sensing and Predictions (finding diseases, harvest predictions, resource utilisation optimisation, etc.).

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge

After the completion of this LU, the learner will:

- Understand topics such as data lake and data warehouse, among other necessary concepts for creating a data pipeline.
- Understand the concept of remote sensing and the technology required for image processing.
- Understand how to install and connect IoT devices to extract data from the field.
- Understand how to install and use a computer vision-based system to collect images within the field and process those images to extract knowledge.
- Understand how to use historical data to create AI prediction models (i.e., regression models).

Skills

After the completion of this LU, the learner will be able to:

- Create, develop, and deploy a data pipeline, from installing sensors, data extraction and harmonization, and storage.
- Development of CNNs (Convolutional Neural Networks) models for image processing applied for remote sensing and in-site computer vision-based systems.
- Development of artificial intelligence regression models (Linear Regression, Polynomial Regression, Support Vector Machine, Gradient Boosting, etc.) to identify trends and future occurrences within the production, such as:
    - Forecast harvests consider the activities carried out and the conditions under which production occurs.
    - Predict the appearance of diseases considering the data extracted from production and atmospheric conditions.
    - Predict the harvest, considering the current state of production and the expected conditions until harvest.
    - Predict the optimal use of resources (chemicals, fertilizers, water, etc.) to avoid overuse.

Competences

After the completion of this LU, the learner will be competent to:

- Develop the capacity for synthesis and critical analysis of this type of systems.

- Work as a team and increase written and oral communication, necessary for the implementation of complex systems such as precision agriculture.
- Ability to manage time and meet deadlines.

4. Content

- Data science fundamentals
- Introduction to earth observation in agriculture
- Precision technology and big data for productivity and efficiency
- Applied cases in agriculture

6. Training methodologies

- Face to Face: 30 hours
- Online learning (asynchronous): 30 hours
- WBL (through study visits and/or workshops): 15 Hours

7. Assessment methodologies

For Face to Face

- 3 laboratorial projects:
  - Development of a data pipeline
  - Remote sensing and computer vision.
  - Artificial intelligence regression models for predicting.

For Online learning

- 3 Quizzes, each one composed by a group of multiple-choice questions and 1 exploratory question.

For WBL

- One project focused on the development of a fully integrated solution, composed by the technologies explored during the LU.

Module: Digital technologies and artificial intelligence

Learning Unit: Remote Sensing and Farming

Total number of hours: 60 hours

ECTS: 3

EQF level: 6

2. Short Description of the LU *[this should be short providing general information and objectives of the LU- max. 4 lines]*

This LU covers fundamental concepts in remote sensing, including system components, with various elements such as, atmosphere, vegetation, soil, rocks, water, and cartography. It also explores image characteristics like structure, resolution, and processing techniques. Orbitals of satellites, sensors, and specific satellites such as Landsat, SPOT, IRS, and Envisat, along with applications in the fields of environment, agriculture, and forests also belong to the main aims.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge
After the completion of this LU, the learner will:

- Identify remote sensing system components
- Describe the use of image characteristics like structure, resolution, and processing techniques
- Describe applications of specific satellites such as Landsat, SPOT, IRS, and Envisat

Skills
After the completion of this LU, the learner will be able to:

- Ability to identify various elements such as atmosphere, vegetation, soil, rocks and water
- Understand image characteristics like structure, resolution, and processing techniques
- Understanding of orbitals of satellites and sensors

Competences
After the completion of this LU, the learner will be competent to:

- Identify and understand the functioning of the different components of remote sensing
- Use of specific satellites such as Landsat, SPOT, IRS, and Envisat
- Ability to apply remote sensing in the fields of environment, agriculture, and forests

4. Content

1. Fundamentals in Remote sensing
1.1. System components
1.2. Behaviours with elements
1.2.1. Atmosphere

1.2.2. Vegetation
1.2.3. Soil and rocks
1.2.4. Water
1.3. Cartography with remote sensing
1.3.1. Topography
1.3.2. Geology
1.3.3. Floods
1.3.4. Wildfires
1.3.5. Farming
2. Image characteristics
2.1. Structure
2.1.1. photography
2.1.2. pixel
2.1.3. ND
2.2. Resolution
2.2.1. Spectral
2.2.2. spatial
2.2.3. temporal
2.2.4. radiometric
2.3. Processing
2.3.1. Concepts
2.3.2. Orthorectification
2.3.3. Corrections
2.3.4. Highlights
2.3.5. Classification
3. Orbitals of satellites
3.1. Remote sensing systems
3.2. Sensors
3.2.1. Characteristics
3.3. Satellites
3.3.1. Landsat
3.3.2. SPOT
3.3.3. IRS
3.3.4. Envisat
4. Applications
4.1. Environment
4.2. Agriculture
4.3. Forests

6. Training methodologies

- Face to Face: 25 hours
- Online learning (asynchronous): 20 hours
- WBL (through study visits and/or workshops) : 15Hours

7. Assessment methodologies
For Face to Face E.g., Case study, practical activity (either individual or in groups), decision making scenarios **For Online learning** E.g., Self- assessment activities (quizzes, multiple choice , true -false), reflection questions **For WBL** E.g., Project based assessment

Module: Digital technologies and artificial intelligence

Learning Unit: Integration of digital technologies for effective farm management

Total number of hours: 60 hours

ECTS: 3

EQF level: 6

2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***

This LU aims at providing students with a fundamental understanding of the applications of digital technologies and modern tools in agriculture, equipping them with the knowledge and skills to effectively monitor and manage relevant agricultural processes while improving productivity and sustainability in farming.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge

After the completion of this LU, the learner will:

- Describe the fundamental concepts and principles of digital technologies, including artificial intelligence, the internet of things and robotics as applied to agriculture.
- Recognise and describe the various monitoring systems and precision agriculture techniques for collecting and analysing essential information related to key agricultural factors.
- Identify and discuss real-world applications of smart farming, including the integration of digital technologies and their impact on farm management and sustainability

Skills

After the completion of this LU, the learner will be able to:

- Analyse and compare various monitoring systems and sensor technologies used to collect data on soil conditions, crop health, environmental factors and livestock.
- Analyse and evaluate modern tools and techniques used in precision agriculture, such as remote sensing, drones, satellite imagery and data analytics for optimizing agricultural practices.

Competences

After the completion of this LU, the learner will be competent to:

- Apply digital technologies in agricultural processes.
- implement and appraise sustainable farming practices using digital technologies.

4. Content

- **Introduction to smart farming:** Exploring artificial intelligence, the internet of things and robotics in agriculture.
- **Monitoring systems:** Introduction to sensors technologies to monitor soil conditions, crop health, environmental factors and cattle health.
- **Modern farming methods:** Overview on technologies and techniques used in precision agriculture.
- **Case studies:** Analysing and discussing real-world case studies of successful and innovative application of smart agricultural technologies.

6. Training methodologies
• Face to Face: 24 hours • Online learning (asynchronous): 20 hours • WBL (through study visits and/or workshops): 16 Hours
7. Assessment methodologies
For Face to Face Oral Exam **For Online learning** Self- assessment activities (quizzes, multiple choice, true -false), reflection questions **For WBL** Project based assessment

Module: Digital technologies and artificial intelligence

Learning Unit: Automation Technologies

Total number of hours: 60 hours

ECTS: 3

EQF level: 6

2. Short Description of the LU

This LU aims to develop an overview of the automation technologies in the agriculture sector. An overall course that contains knowledge and develops skills on automatic systems in agriculture and how these systems are used in different sector of agriculture. Also, this LU will provide important practical skills and competences through case studies in the fields.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge

After the completion of this LU, the learner will be:

- Able to accurately identify state and explain automation technologies in agriculture.
- Able to accurately identify state and explain automation systems in agriculture.
- Able to clearly state and explain control theory and logical programming.

Skills

After the completion of this LU, the learner will be able to:

- demonstrate how to run, manage systems in different sectors (crop production, livestock, irrigation, post-harvest)
- apply demonstrate how robotics and unmanned field machinery work and perform relevant tasks with these systems.

Competences

After the completion of this LU, the learner will be competent to:

- combine knowledge and skills to design, develop and create automation systems in early stages.
- assess and choose the most appropriate automation systems and technologies.

4. Content

- **Introduction to Automation technology in agriculture**. (An overview of the automation technologies, when did they started, etc)
- **General information** about systems, microcontrollers (Arduino-Raspberry), PID controller, sensor technologies, resistor wiring diagram,
- **Applications in Agriculture**
  1)Automation in field crop production
  2) Automation in Animal housing production
  3)Automation of pesticide application systems
  4)Automation irrigation systems and soil management

5)Post harvest automation

- **Case studies in the field**

6. Training methodologies

- Face to Face: 20 hours
- Online learning (asynchronous): 20 hours
- WBL (through study visits and/or workshops): 20 Hours

7. Assessment methodologies

For Face to Face

E.g., Case study, practical activity (either individual or in groups), decision making scenarios.

For Online learning

E.g., Self- assessment activities (quizzes, multiple choice, true -false), reflection questions

For WBL

E.g., Project based assessment

Module: [Bio-economy, circular economy and bio-based products – No.3]

Learning Unit: [Circular Economy - No.1]

Total number of hours: 60 hours

ECTS: 3

EQF level: 6

2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***

This LU aims to deepen learners' knowledge, understanding, and skills in the field of Circular Economy. It explores the advanced principles and practices of the circular economy and introduces learners to the fundamental concepts of circular economy, such as the concept of closing the loop, minimizing waste and designing for circularity.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge

After the completion of this LU, the learner will:

- Demonstrate a comprehensive understanding of the fundamental principles and concepts of circular economy.
- Explain the key elements and components of a circular economy system.
- Debate the relevant policies and regulations related to the circular economy.

Skills

After the completion of this LU, the learner will be able to:

- Analyse circular economy principles.
- Examine and evaluate circular economy strategies.
- Compare sustainable and circular solutions.
- Assess circular economy opportunities.

Competences

After the completion of this LU, the learner will be competent to:

- Use Sustainable Design.
- Demonstrate an innovative and entrepreneurial mindset in proposing circular economy solutions.
- Apply critical and system thinking in the context of circular economy challenges.

4. Content

- Background and concept of the CE
- Linear economy versus CE
- Principles, dimensions, benefits and challenges of CE
- Strategic action plan for circular economy and product sustainability
- System thinking and CE
- Applying circularity to agriculture
- Agroecology and Regenerative Practices

- Circular Farming Technologies
- Circular Business models
- Resource reduction and waste management
- Agricultural Production of Bio-based Resources

6. Training methodologies

- Face to Face: 20 hours
- Online learning (asynchronous): 20 hours
- WBL (through study visits and/or workshops) : 20 Hours

7. Assessment methodologies

For Face to Face

E.g., Case study, practical activity (either individual or in groups), decision making scenarios

For Online learning

E.g., Self- assessment activities (quizzes, multiple choice, true -false), reflection questions

For WBL

E.g., Project based assessment

Module: Bio-economy, circular economy and bio-based products

Learning Unit: The concept of biorefinery

ECTS: 3

EQF level: 6

2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***

This LU aims at providing the student with the fundamental understanding of the principles and technologies in biorefineries to obtain chemicals, fuels and other high added-value products from biomass feedstocks.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge

After the completion of this LU, the learner will:

- Describe the concept and principles of biorefineries.
- Identify various conversion processes and technologies used in biorefineries.
- Identify case studies and understand the sustainability considerations involved in the development and implementation of biorefinery systems.

Skills

After the completion of this LU, the learner will be able to:

- Analyse and assess the feasibility of different conversion processes and technologies within the biorefinery concept.
- Evaluate and select appropriate biomass feedstocks for the biorefinery process.

Competences

After the completion of this LU, the learner will be competent to:

- Design and develop sustainable biorefinery systems, considering technologies as well as feedstock availability and composition.
- Enumerate and discuss the challenges and integration needs involved in the development of biorefineries.

4 Content

- **The concept of biorefinery**: introduction to the biorefinery concept, where biomass feedstocks are converted into a range of valuable products
- **Pathways of biorefinery:** Exploration of the various conversion processes and technologies used in biorefineries.
- **Case studies and world-case examples:** Analyse and discuss successful and innovative biorefinery implementations.
- **Challenges for future development:** Examine the key challenges and barriers faced in the development and implementation of biorefineries.

5. Training methodologies

- Face to Face: 24 hours
- Online learning (asynchronous): 20 hours
- WBL (through study visits and/or workshops): 16 Hours

6. Assessment methodologies
For Face to Face Oral Exam **For Online learning** Self- assessment activities (quizzes, multiple choice, true -false), reflection questions **For WBL** Project based assessment

Module: Bio-economy, circular economy and bio-based products

Learning Unit: Bioenergy and energy crops

Total number of hours: 60 hours

ECTS: 3

EQF level: 6

2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***

This Lu aims to provide a detailed overview of the bioenergy and biofuel crop sector. This is through lessons focused on the different types of usable biomass (crops), transformation processes and the types of fuel that can be obtained. The LU also provides guidance on sustainability and concludes with a review of the pertinent European legislation.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge

After the completion of this LU, the learner will:

- Describe the bioenergy production sector, which raw materials can be used and the processes for processing them.
- Explain how this type of energy production can be considered as sustainable.

Skills

After the completion of this LU, the learner will be able to:

- Comprehend the characteristics that a biomass should have to be used for energy production.
- Identify transformation processes that provide a qualitatively better product based on biomass characteristics.
- Develop a draft of agricultural plan for bioenergy production crops.

Competences

After the completion of this LU, the learner will be competent to:

- Participate actively in the bioenergy and energy crops sector.
- Exhibit competence about processes required to transform biomass into fuel or energy directly.
- Make and defend choices in this area aware of European regulations in terms of limitations and funding opportunities.

4. Content

- **Introduction on bioenergy production:** An introductory overview of the topic and why it can be called a relevant field with future prospective.
- **Sustainable biofuel production processes:** State of the art on available technologies: biological, chemical and thermochemical biomass conversion processes
- **Crops: feedstocks selection and pre-treatment:** Overview on crops for production of biomass, biodiesel-oil, bioethanol and biogas. Evaluation of different feedstock options based on the availability, composition and growing requirements.
- **Bioenergy and sustainability:** Considerations regarding the sustainability of biomass energy production.

- **European legislation on energy crops and biofuels:** An overview of European legislation on the subject: constraints and opportunities.

6. Training methodologies

- Face to Face: 28 hours
- Online learning (asynchronous): 24 hours
- WBL (through study visits and/or workshops) : 8 Hours

7. Assessment methodologies

For Face to Face

Written exam

For Online learning

Self-assessment activities (quizzes, multiple choice, true-false), reflection questions

For WBL

Project based assessment

Module: Bio-economy, circular economy and bio-based products

Learning Unit: **Innovation, Economics and Strategic Management in the Bioeconomy**

Total number of hours: 60 hours

ECTS: 3

EQF level: 6

2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***

This LU will focus on the Innovation, Economics and strategic management aspects of bioeconomy aiming to provide specialized knowledge in order to cope with the economic challenges of bio-economy and circular economy, shading light on aspects such as how (new) biobased products are embedded in value chains from micro- and macroeconomic perspectives; on the establishment of cooperation among different stakeholders; on the development of sustainable innovation; and on the measurement of adoption and environmental benefits.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge

After the completion of this LU, the learner will:

- indicate the key concepts related to bioeconomy such as, economic principles and economics, social and environmental impacts of bioeconomy policies and management schemes.
- discuss about the economic aspects of bioeconomy
- outline current and future trends of bioeconomy innovation
- be aware of strategic management tools in the bioeconomy
- refer to financial models and indicators for the analysis of a bioeconomy business
- identify the features of a business plan of a bio based industry
- distinguish among the new technologies used in the bio-food sector (bioinformatics, bio preservation, sensing and biosensors, metagenomics, and proteomics)

Skills

After the completion of this LU, the learner will be able to:

- apply technologies-related data management, processing and analysis of a bioeconomy business
- apply innovation practices in agriculture management, data gathering, data analysis and decision making process including co-creation of Innovative agriculture management alternatives for bioeconomy
- Propose and develop service products in bioeconomy

Competences

After the completion of this LU, the learner will be competent to:

- adapt existing emerging technologies in the bio-based economy
- explore business ideas and evaluate them by using the features of a business plan
- explore and administer existing bioeconomy strategies

4. Content

- Introduction to Bio-economy
- Bio-based industry and Bio-economy in Europe, the EU and national policies in relation to bioeconomy, with focus on the agricultural sector
- Biological Resources and Bioproducts
- Introduction of Economic fields of Bioeconomy micro and macro-economic level
    - Environmental and Resource Economics
    - Environmental Accounting
    - Sustainability Sciences
- Strategic management in bioeconomy – the framework of principles and methods that define the decision making process in the agribusiness sector
- Bio business, sustainable entrepreneurship and Business Plans
- The role of Innovation in bio based economy (emerging technologies, Logistics, supply chain management and new sustainable biotechnology practices, Diversification in the natural resources and bio-economy sector)
- The Economics of Innovation and Sustainable Development

6. Training methodologies

- Face to Face: 24 hours
- Online learning (asynchronous): 20 hours
- WBL (through study visit and/or workshop) : 16 Hours

7. Assessment methodologies

For Face to Face

E.g., Case study, practical activity (either individual or in groups), decision making scenarios, problem-based group work activities

For Online learning

E.g., Self- assessment activities (quizzes , multiple choice, true -false), reflection questions

For WBL

E.g., Project based assessment

Module: Controlled environment agriculture

Learning Unit: Introduction to controlled environment agriculture: principles, techniques and innovations

Total number of hours: 60 hours

ECTS: 3

EQF level: 6

2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***

This LU aims to provide the student with an overview of the development of controlled environment agriculture. It covers the principles about how the plant grows in the controlled environment, the techniques that are commonly used for controlled environment agriculture, and the innovations in both technologies and business models.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge

After the completion of this LU, the learner will:

- recognize the key factors and how they can affect the plant growing,
- identify the basic elements in a controlled environment farm,
- describe the advantages and disadvantages of controlled environment agriculture
- name the technologies used for controlled environment agriculture,
- describe the market of controlled environment agriculture.

Skills

After the completion of this LU, the learner will be able to:

- develop plant growing procedure,
- analyze the energy balance for controlled environment agriculture
- select the technologies for controlling the environment in controlled environment farms,
- select plants that are appropriate for controlled environment agriculture.

Competences

After the completion of this LU, the learner will be competent to:

- evaluate the cost of the environmental control agriculture
- design and operate a controlled environment farm,
- support the related decision process.

4. Content

- **Introduction to controlled environment agriculture**: the state-of-the-art of the controlled environment agriculture, including greenhouses and vertical farming
- **Key factors affecting the growth of plants:** the principle of photosynthesis, the need of nutrients, the influence of the ambient conditions
- **Environmental control systems:** the design and layout of controlled environment farm, how to control lighting, air and nutrient, and the energy consumption of different processes

- **Current market of controlled environment agriculture**: the need of controlled environment agriculture, the potential benefits from economic and environmental perspectives, new business models

6. Training methodologies

- Face to Face: 24 hours
- Online learning (asynchronous): 20 hours
- WBL (through study visits and/or workshops): 16 Hours

7. Assessment methodologies

For Face to Face

Oral Exam

For Online learning

Self- assessment activities (quizzes, multiple choice, true -false), reflection questions

For WBL

Project based assessment

Module: Controlled environment agriculture

Learning Unit: Advanced techniques in vertical farming: From LED lighting to plant nutrition

Total number of hours: 60 hours

ECTS: 3

EQF level: 6

2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***

This LU aims to provide students with an in-depth understanding of advanced techniques in vertical farming, including LED lighting, hydroponics, and plant nutrition. It covers the application of practical skills in designing and optimizing vertical farming systems, evaluating the relationships between plant growth and environmental factors, and developing critical thinking and problem-solving skills related to vertical farming.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge

After the completion of this LU, the learner will:

- Describe the science and technology behind LED lighting systems and their effect on plant growth and development in vertical farming.
- Explain the nutritional requirements of plants and the strategies for delivering optimal nutrition in a vertical farming context.
- Identify and critically assess the latest advancements and research in the field of vertical farming.

Skills

After the completion of this LU, the learner will be able to:

- Apply theoretical knowledge of LED lighting and plant nutrition to the practical setup and management of a vertical farm.
- Analyse the effectiveness of different vertical farming techniques and propose improvements.

Competences

After the completion of this LU, the learner will be competent to:

- Demonstrate the capability to apply theoretical knowledge and skills to identify and solve complex problems in vertical farming, making responsible and innovative decisions.
- Demonstrate the ability to stay updated with evolving technologies and methods in vertical farming and the ability to incorporate these changes in a productive and ethical manner into practice.

4. Content

- **Exploration of LED lighting in vertical farming:** Its principles, design, efficacy, and impact on plant growth.
- **Investigation into plant nutritional requirements in vertical farming**: Understanding essential nutrients, soilless cultivation, and nutrient delivery systems.
- **Discussion on modern tools for vertical farming:** Use, benefits, and limitations in planning, monitoring, and management.
- **Examination of emerging trends and research in vertical farming:** Evaluating their potential and applicability in future vertical farming practices.

6. Training methodologies
• Face to Face: 24 hours • Online learning (asynchronous): 20 hours • WBL (through study visits and/or workshops): 16 Hours
7. Assessment methodologies
For Face to Face Written exam **For Online learning** Self-assessment activities (quizzes, multiple choice, true-false), reflection questions **For WBL** Project-based assessment

Module: Controlled environment agriculture

Learning Unit: Entrepreneurship in Vertical Farming: Business Models, Financial Planning and Marketing Strategies

Total number of hours: 60 hours

ECTS: 3

EQF level: 6

2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***

This LU aims to introduce the basics of entrepreneurship in the vertical farming industry. It covers the fundamentals of business models, financial planning, and marketing strategies specific to this field. Through real-world case studies, learners will understand and apply these concepts in the context of a vertical farming startup. Ideal for aspiring entrepreneurs or those interested in the dynamics of the vertical farming sector.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge

After the completion of this LU, the learner will:

- Describe business models utilized in vertical farming.
- Explain fundamental elements of financial planning in a vertical farming context.
- Identify essential marketing strategies suitable for promoting a vertical farming business.

Skills

After the completion of this LU, the learner will be able to:

- Comprehend and interpret essential marketing strategies suitable for promoting a vertical farming business.
- Develop the skills necessary to draft a simple financial plan for a vertical farming startup.
- Formulate a basic marketing strategy using tools and resources specific to the vertical farming industry.

Competences

After the completion of this LU, the learner will be competent to:

- Apply knowledge and skills to participate effectively in a startup vertical farming business.
- Exhibit competence in making basic financial decisions based on the understanding of financial planning principles.
- Demonstrate the ability to contribute to the marketing efforts of a vertical farming venture.

4. Content

- **Introduction to business models in vertical farming:** A look into their basic structures and operation.
- **Basics of financial planning for vertical farming:** Understanding cost structures and potential revenue streams.
- **Marketing strategies in vertical farming:** An overview of how to reach potential customers and build brand awareness.
- **Case studies of vertical farming:** Examining their business models, financial plans, and marketing efforts.

- **Developing a basic business plan:** A guided activity to apply what has been learned to create a basic business model and marketing strategy for a hypothetical vertical farming startup.

6. Training methodologies

- Face to Face: 24 hours
- Online learning (asynchronous): 20 hours
- WBL (through study visits and/or workshops): 16 Hours

7. Assessment methodologies

For Face to Face
Written exam
For Online learning
Self-assessment activities (quizzes, multiple choice, true-false), reflection questions
For WBL
Project-based assessment

HEI-D4

Module: Controlled environment agriculture

Learning Unit: **Sustainable agriculture in contolled environments: Challenges, opportunities and solutions**

Total number of hours: 60 hours

ECTS: 3

EQF level: 6

2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge

After the completion of this LU, the learner will:

- Recognise and analyse the key challenges and opportunities associated with implementing agricultural practices in controlled environments,
- Describe sustainable agriculture techniques and technologies applicable to controlled environment, including hydroponics, vertical farming, resource management and pest and disease management control.
- Analyse case studies and real-world examples.

Skills

After the completion of this LU, the learner will be able to:

- Analyse the needs and conditions to select appropriate technologies in controlled environmental agriculture
- Develop new controlled environmental systems.

Competences

After the completion of this LU, the learner will be competent to:

- Design and optimize sustainable controlled environmental systems.
- Evaluate and adapt emerging technologies in controlled environment agriculture.

4 Content

- **Sustainable agriculture techniques and technologies**: A brief introduction to the most relevant techniques and and strategies in controlled environment agriculture.
- **Challenges and opportunites:** identifying key challenges in implementing agricultural practices as well as exploring the opportunitieS asociated with controlled environmenta agriculture.
- **Environmental control systems:** An overview on the design and layout of vertical farming and how to control lighting, air and nutrientes.
- **Case studies and world-case exemples:** Analysing and discussing successfull and innovative practices and Technologies in controlled environment agriculture.

5. Training methodologies

- Face to Face: 24 hours
- Online learning (asynchronous): 20 hours
- WBL (through study visits and/or workshops): 16 Hours

6. Assessment methodologies
For Face to Face Oral Exam **For Online learning** Self- assessment activities (quizzes, multiple choice, true -false), reflection questions **For WBL** Project based assessment

Module: Horizontal Skills

Learning Unit: Soft Skills

Total number of hours: 60 hours

ECTS: 3

EQF level: 6

2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***

This LU aims to develop the learner's knowledge, skills and competences related to the field of soft skills focusing in the application of the effective communication principles; the management of different teams along with the use of conflict resolution tools and techniques; the critical points of effective and efficient leadership along with the correlation of emotional intelligence. Moreover, the learner will be introduced to the need for seeking constant professional development along with the adoption of accountability and ethical behaviour; as well as the cultivation of agile thinking skills and the related benefits that derive from this approach.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge

After the completion of this LU, the learner will:

- Identify the various forms of communication and principles of effective communication and active listening
- Define and analyze a conflict situation and the steps for overcoming it
- Recognize the principles and techniques to develop and manage effective teams
- Illustrate the principles and sources of professional development
- Relate the critical components for effective leadership
- Recognize the role of emotional intelligence and its correlation with leadership
- Recognize the benefits for cultivating agile thinking skills

Skills

After the completion of this LU, the learner will be able to:

- Explore, evaluate and resolve the complexities of managing teams, conflict and negotiation necessary in achieving project objectives
- Think out of the box when trying to provide solutions to social/ environmental problems
- Draft and perform responsible leadership towards building and sustaining trustful relations with all relevant stakeholders
- Demonstrate ethical decision-making and communication
- Assess his/her needs in terms of training for ensuring the provision of qualitative services

Competences

After the completion of this LU, the learner will be competent to:

- Support and motivate others around them and influence their decisions
- Improve the team's performance through teambuilding techniques
- Handle ethical and moral dilemmas
- Self manage his/her professional development focusing in providing qualitative services and support

4. Content
• Principles of effective communication: verbal-non-verbal, speaking-listening, active listening, barriers to communication • Effective negotiations: the main characteristics of a successful negotiator, how to analyse the situation, negotiation styles and strategies • Building effective Teams • The importance of cultivating agile thinking • The basic principles of Accountability and Ethical communication • The importance of Professional development and the enhancement of self-awareness and self-management of professionals
6. Training methodologies
• Face to Face: 25 hours • Online learning (asynchronous): 15 hours • WBL (through study visit and/or workshop): 20 hours
7. Assessment methodologies
For Face to Face • E.g. Case study, practical activity (either individual or in groups), decision making scenarios **For Online learning** • E.g. Self- assessment activities (quizzes, multiple choice, true -false), reflection questions **For WBL** • E.g. Project based assessment

Module: Horizontal Skills

Learning Unit: Green Skills

Total number of hours: 60 hours

ECTS: 3

EQF level: 6

2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***

This LU aims to develop the learner's knowledge, skills and competences related to the field of sustainable development by introducing him/her to key concepts and elements such as waste management, energy efficiency, water waste; presenting thoroughly the key directives that enhance sustainable development leading to a greener economy along with green innovation and environmental practices; promoting the need for cultivating system thinking and Life cycle thinking skills; and, illustrating ways that showcase the environmental impact of personal and professional activity.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge

After the completion of this LU, the learner will:

- Analyse the key European and International directives related to the sustainable development
- Distinguish the differences of the various concepts related to sustainability
- Associate the role of green innovation for applying effective environmental management practices
- Classify practices related to waste management, energy efficiency and water waste
- Recognize the importance of system thinking and Life cycle thinking in the transition to a greener economy
- Illustrate the different phases for ensuring compliance with environmental legislation

Skills

After the completion of this LU, the learner will be able to:

- Improve and upgrade facilities to be more efficient and less resource intensive particularly by reducing energy use, using renewable energy, and improving energy efficiencies
- Develop system thinking that fosters thinking about complex issues related to the application of bioeconomy in the farming sector
- Evaluate environmental impact that derives from their personal behaviour and professional activity
- Mitigate the waste of resources
- Evaluate Information to Determine Compliance with Standards as posed by the regulations for environmental protection

Competences

After the completion of this LU, the learner will be competent to:

- Embrace new technologies and innovations that lead to a greener economy
- Apply ethical and sustainable thinking within his/her personal and professional practices
- Implement and monitor environmental organizational practices
- Develop a responsible attitude towards the environment also inspiring his/her peers

4. Content
• Introduction to Sustainability and the various related concepts (circular economy, bioeconomy, green economy) • Getting familiar with International and European key directives such as SDGs and the Green New Deal • Environmental management and green innovation • Waste management, Energy efficiency and savings, waste water and their relation to Life cycle Thinking • Key elements for ensuring compliance with environmental legislation • Assessment of the environmental impact derived from personal and professional activities • The importance of adopting a systems thinking approach
6. Training methodologies
• Face to Face: 25 hours • Online learning (asynchronous): 15 hours • WBL (through study visit and/or workshop): 20 Hours
7. Assessment methodologies
For Face to Face • E.g., Case study, practical activity (either individual or in groups), decision making scenarios **For Online learning** • E.g., Self- assessment activities (quizzes, multiple choice, true -false), reflection questions **For WBL** • E.g., Project based assessment

Module: ENTREPRENEURIAL SKILLS

Learning Unit:

Total number of hours: 40 hours

ECTS: 3

EQF level: 6

2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***

This LU tries to develop all the methodological tools for analysing the internal and external environment of a business and for designing a new business model. In addition, it presents all the dimensions of entrepreneurship that can strengthen the agricultural economy.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Upon successful completion of the course, students are expected to have the:

Knowledge so that they can:
o Understand the importance and complexity of modern entrepreneurship
o Realize the necessary connection between entrepreneurship and innovation
o They choose sustainable business models through critical and analytical thinking based on innovation.
o Recognize and describe points that can be improved in business processes when developing new products and services.

Skills to be able to:
o Support or develop innovation and entrepreneurship
o They examine the influence of a range of factors (external and internal) which affect entrepreneurship
o Prepare comprehensive business plans
o Seek and obtain funding

Competences to be able to:
o They recognize investment and development incentives
o Take advantage of professional opportunities by presenting integrated tasks in a wide professional range.
o Cooperate, coordinate and control the parties involved so that innovative business ventures are designed and implemented.

4. Content

- Introduction to Entrepreneurship – Entrepreneur - GEM
- The Business Environment – PEST Analysis – Porter's 5 Forces
- The Enterprise – Resource Based Theory – Value Chain Theory
- Business Concept Development - Business Model Canvas
- Business Plan
- Classroom Workshop – Business Concept
- Financing - Alternative Funding Sources
- Spatial Positioning of Businesses – Clusters - Industrial Areas
- Agricultural Entrepreneurship

- Sustainable – Green – Circular Entrepreneurship
- Entrepreneurship in an International Environment
- e - Entrepreneurship

6. Training methodologies

- Face to Face: 40 hours
- WBL (workshops) : 4 Hours

7. Assessment methodologies

For Face to Face
Exams,
Case studies,
Projects in Business Concept Development (in groups) with final evaluation in internal competition.

Module: Horizontal Skills

Learning Unit: Digital Skills

Total number of hours: 60 hours

ECTS: 3

EQF level: 6

2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***

This Learning Unit is designed to enable learners to leverage digital technologies for improved decision-making, productivity, and sustainability in agriculture. It provides comprehensive coverage of key areas such as data analysis, e-commerce, cloud computing, online security.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge

After the completion of this LU, the learner will:

- identify appropriate data analysis techniques to real-world agricultural datasets,
- recognize how an e-commerce platform operates,
- identify tools for online communication and collaboration,
- identify how an e-learning platform can be used to reach personal learning goals,
- Identify cloud-based tools for data storage and analysis in agricultural contexts.

Skills

After the completion of this LU, the learner will be able to:

- synthesize results from various data analysis techniques to inform decision-making in agricultural contexts,
- explain how to effectively use an e e-commerce platform and a digital marketing strategy for the promotion and sale of agricultural products,
- use tools for online communication and collaboration,
- use an e-learning platform to reach personal learning goals,
- apply cloud-based tools for efficient data storage, analysis, and collaboration in agricultural contexts.

Competences

After the completion of this LU, the learner will be competent to:

- interpret and utilize agricultural data, applying statistical and analytical techniques to inform decision-making processes,
- manage an e-commerce platform, effectively employing digital marketing strategies for the promotion and sale of agricultural products,
- assess which tools for online communication and collaboration are the most appropriate depending in the given context,
- critically analyse the most important functions of an e-learning platform to effectively achieve learning objectives,
- leverage cloud-based tools for efficient data storage, analysis, and collaboration in agricultural contexts.

4. Content
• Data Analysis for cost analysis • Digital Collaboration and Communication • E-Commerce and Digital Marketing • Cloud Computing • On-line Security
6. Training methodologies
• Face to Face: 36 hours • Online learning (asynchronous): 18 hours • WBL (through study visits and/or workshops) : 6 Hours
7. Assessment methodologies
For Face to Face • Case study/ demonstration **For Online learning** • Multiple choice questions **For WBL** • Project based assessment

Module: Agricultural sustainability, management of natural resources and climate action

Learning Unit: Renewable energy solutions for agriculture

Total number of hours: 20 hours

ECTS: 1

EQF level: 5

2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***

This LU aims to provide the student with a complete view of the main renewable energy-based technologies currently available on the market and that can be used in the agricultural context.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge

After the completion of this LU, the learner will:

- Identify the most relevant RES technologies available that are most relevant and applicable to the agricultural environment,
- identify their basic mechanisms and processes.
- assess and discuss off-grid renewable energy solutions at diverse climate conditions

Skills

After the completion of this LU, the learner will be able to:

- identify the most appropriate renewable application(s) to be implemented in that particular agricultural context.

Competences

After the completion of this LU, the learner will be competent to:

- compare different RES based solutions,
- examine RES based technical solutions proposed.

4. Content

- **Introduction**: Renewable Energy Sources and Efficient use of Energy
- **Solar Energy for farmers**: Stand-alone PV and agrivoltaics
- **Biomass to Energy**: Energy Conversion Technologies
- **Other RES based solutions for agriculture**: geothermal, micro wind, and mini hydro.
- **Case studies of off-grid projects**: Off-grid applications of renewable energy solutions and evaluating their different technologies applied to different climate conditions

6. Training methodologies

- Face to Face: 8 hours
- Online learning (asynchronous): 6 hours
- WBL (through study visits and/or workshops): 6 Hours

7. Assessment methodologies
For Face to Face Written test **For Online learning** Self- assessment activities (quizzes, multiple choice, true -false), reflection questions **For WBL** Project based assessment

Module: Agricultural sustainability, management of natural resources and climate action

Learning Unit: Understanding climate change

Total number of hours: 20 hours

ECTS: 1

EQF level: 5

2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***

This LU aims to provide the student with an overview of climate system, climate change impact on agriculture and strategies of mitigation, adaptation and policy responses.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge

After the completion of this LU, the learner will:

- Outline the fundamental concepts of climate system and climate change
- Identify the specific impacts of climate change in agriculture
- State the role of climate models

Skills

After the completion of this LU, the learner will be able to:

- Identify mitigation strategies in agriculture to reduce greenhouse gas emissions
- Outline adaptation strategies for climate change in agriculture

Competences

After the completion of this LU, the learner will be competent to:

- Identify specific effects of climate change in agriculture
- Outline a plan of action to adapt agricultural practices to potential climate change impacts.

4. Content

- **Climate systems and climate change**: Earth´s system, basic mechanisms of climate change and climate models
- **Climate change impact in agriculture**: exploring specific impacts of climate change on agriculture and their implications on e.g. crop yield, extreme weather events and precipitation patterns
- **Mitigation and adaptation strategies for agriculture:** Strategies to reduce greenhouse gas emissions or cope with climate change impacts in agriculture

6. Training methodologies

- Face to Face: 8 hours
- Online learning (asynchronous): 6 hours
- WBL (through study visits and/or workshops): 6 Hours

7. Assessment methodologies

For Face to Face

Written test

For Online learning

Self- assessment activities (quizzes, multiple choice, true -false), reflection questions

For WBL

Project based assessment

Module: Agricultural sustainability, management of natural resources and climate action

Learning Unit: Water, Energy, and Food (WEF) Nexus security, Drip Irrigation, and Desalination

Total number of hours: 20 hours

ECTS: 1

EQF level: 5

2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***

This LU aims to develop good management of existing water, as well as identify how to use all possible sources of water available for agriculture. At the same time, how to use remnant water used in agriculture for possible uses, will be also achieved.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge

After the completion of this LU, the learner will:

- Identify different sources of water
- Identify uses of water

Skills

After the completion of this LU, the learner will be able to:

- Ability to reuse water from different origins
- Water control and monitorization

Competences

After the completion of this LU, the learner will be competent to:

- Better sensibility to water uses and waste
- Better understanding of the notion of the value of water and its quality

4. Content

- **Water basic concepts**
- **Supply water systems**
  - **2.1. Catchments**
    - 2.1.1. Rain catchment
    - 2.1.2. River catchments
    - 2.1.3. Springs
    - 2.1.4. Wells and boreholes
  - **2.2. Other sources of water**
    - 2.2.1. Desalinization
    - 2.2.2. Water reuse and recycling
  - **2.3. Reservoirs**
    - 2.3.1. Lakes

        - 2.3.2. Dams
        - 2.3.3. Artificials
    - **2.4. Distribution**
        - 2.4.1. Gravity
        - 2.4.2. Pumping
        - 2.4.3. Others

- **Water uses**
    - **3.1. Drinking**
    - **3.2. Irrigation**
    - **3.3. Energy production**

- **Water Management**
    - **4.1. Quality and Quantity**
        - 4.1.1. Demands vs available equilibrium.
    - **4.2. Control and monitorization**
        - 4.2.1. Monitorization networks
        - 4.2.2. Control plans and reports
    - **4.3. Costs and values**

6. Training methodologies

- Face to Face: 8 hours
- Online learning (asynchronous): 6 hours
- WBL (through study visits and/or workshops): 6 Hours

7. Assessment methodologies

For Face to Face

E.g., Case study, practical activity (either individual or in groups), decision making scenarios

For Online learning

E.g., Self- assessment activities (quizzes, multiple choice, true -false), reflection questions

For WBL

Project based assessment

Module: Agricultural sustainability, management of natural resources and climate action

Learning Unit: Agricultural reuse of organic residuals

Total number of hours: 20 hours

ECTS: 1

EQF level: 5

2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***

This Lu aims to provide an overview of organic residues that can be reused in agricultural activities. The course is based on lessons regarding residues characterization, description of storage and treatment processes to make them usable and an analysis of the costs and benefits related to their use. The course further focuses on pertinent European legislation.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge

After the completion of this LU, the learner will:

- Identify the types of organic residues that can be reused in agriculture.
- Recognize the processes and treatments necessary to characterize organic residues and allow their proper use.

Skills

After the completion of this LU, the learner will be able to:

- Analyse the characteristics that an organic waste must have to be reused.
- Predict costs and benefits of reusing organic residues in agriculture.
- Develop and organize a simple workflow aimed at the recovery and utilization of organic residues in agriculture.

Competences

After the completion of this LU, the learner will be competent to:

- Act consciously in agricultural realities operating with sustainability vision.
- Define and choose processes required to transform a waste into something useful for the farm.
- Make decisions in this field aware of European regulations in terms of limitations and funding opportunities.

4. Content

- **Typologies and characterization of agricultural residues:** An overview of the types of organic residues that can be reused in agriculture and their characterization.
- **Biochar as a solution for sustainable agriculture:** What biochar is and how it is produced. How it can be successfully used in agriculture
- **Management of organic residues from agricultural activities: from production to storage:** the chain of collection and management of organic residues aimed at reuse in agriculture.
- **Processes and treatments for successful reuse:** The analyses and treatments required to assess the quality of residues and their proper use.

- **Cost/benefit: does it really worth?:** A comparison between the costs to be faced for the management and treatment of organic residues and the benefits that can be obtained from their use.
- **European legislation: restrictions and opportunities:** An overview of European legislation on the subject focusing on constraints and opportunities for farmers and sector operators.

6. Training methodologies

- Face to Face: 8 hours
- Online learning (asynchronous): 4 hours
- WBL (through study visits and/or workshops): 8 Hours

7. Assessment methodologies

For Face to Face

Written test

For Online learning

Self-assessment activities (quizzes, multiple choice, true-false), reflection questions

For WBL

Project based assessment

Module: Digital technologies and artificial intelligence

Learning Unit: Data Science and Precision Technologies

Total number of hours: 25 hours

ECTS: 1

EQF level: 5

2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***

This LU aims to introduce and explore practices for using data science and precision technologies in agriculture. This unit starts with the basis of data science, applications and its role in industry and research. Learners will then explore the basis of precision technologies and its applications. In a more advanced stage, the leaners will have the opportunity to understand how to install, connect and maintain sensors and other monitoring devices and how to extract and analyse the data provided by these systems.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge

After the completion of this LU, the learner will:

- Understand the basis of data science and its applications and its role in industry and research.
- Understand the basis of precision technologies and its applications.
- Understand how to install, connect, and maintain sensors and other monitoring devices.
- Understand how to extract and analyse data from sensors and other monitoring devices installed in the field.

Skills

After the completion of this LU, the learner will be able to:

- Perform descriptive statistics, data visualization, and data profiling to understand and gain insights from agricultural datasets.
- Identify and operate different types of sensors used in precision agriculture, such as soil moisture sensors, weather sensors, and crop health sensors.
- Install and maintain sensors and other devices for remote monitoring and control of agricultural processes to improve efficiency and productivity.
- Analyse and critically interpret data from sensors and other devices installed in the field.

Competences

After the completion of this LU, the learner will be competent to:

- Integrate data from various sources, such as sensors, weather stations, and historical records, and use it to make data-driven decisions in agriculture.
- Install, connect, and maintain sensors and other monitoring devices.
- Extract relevant features from agricultural data and select the most informative ones for building predictive models.
- Use decision support systems to improve the optimization of farming operations.

4. Content

- Introduction to data science
- Introduction to sensors and other monitoring devices in agriculture

- Uses of precision technologies in agriculture
- Applied cases in agriculture

6. Training methodologies

- Face to Face: 10 hours
- Online learning (asynchronous): 10 hours
- WBL (through study visits and/or workshops): 5 Hours

7. Assessment methodologies

For Face to Face

- E.g. Case study, practical activity (either individual or in groups), decision making scenarios

For Online learning

- E.g. Self- assessment activities (quizzes, multiple choice, true -false), reflection questions

For WBL

- E.g. Project based assessment

Module: Digital technologies and artificial intelligence

Learning Unit: Remote Sensing and Farming

Total number of hours: 20 hours

ECTS: 1

EQF level: 5

2. Short Description of the LU *[this should be short providing general information and objectives of the LU- max. 4 lines]*

This LU covers fundamental concepts in remote sensing in various elements such as atmosphere, vegetation, soil, rocks, water, and cartography. It also explores image characteristics in the fields of environment, agriculture, and forests.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge
After the completion of this LU, the learner will:

- Identify the advantage of a remote sensing system in farming
- Identify applications of specific satellites in farming

Skills
After the completion of this LU, the learner will be able to:

- Ability to use remote sensing systems in agriculture
- Understand image characteristics

Competences
After the completion of this LU, the learner will be competent to:

- Ability to identify and understand the system of remote sensing
- Ability to apply remote sensing in the fields of environment, agriculture, and forests

4. Content

1. Fundamentals in Remote sensing
2. Fundamentals of image characteristics
3. Some concepts of satellites used in remote sensing and farming
4. Applications
4.1. Environment
4.2. Agriculture
4.3. Forests

6. Training methodologies
• Face to Face: 8 hours • Online learning (asynchronous): 6 hours • WBL (through study visits and/or workshops): 6 Hours
7. Assessment methodologies
For Face to Face E.g., Case study, practical activity (either individual or in groups), decision making scenarios **For Online learning** E.g., Self- assessment activities (quizzes, multiple choice, true-false), reflection questions **For WBL** E.g., Project-based assessment

Module: Digital technologies and artificial intelligence No.2

Learning Unit: Smart farming solutions No.3

Total number of hours: 20 hours

ECTS: 1

EQF level: 5

2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***

This LU aims at providing students with a general understanding of the applications of digital technologies and modern tools in agriculture, equipping them with the understanding to monitor, manage and make informed decisions to improve productivity and sustainability in farming.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge

After the completion of this LU, the learner will:

- Identify the concepts of digital technologies, including artificial intelligence, the internet of things and robotics as applied to agriculture.
- Name various monitoring systems and precision agriculture techniques for collecting and analysing essential information related to key agricultural factors.
- Identify real-world applications of smart farming, including the integration of digital technologies and their impact on farm management and sustainability.

Skills

After the completion of this LU, the learner will be able to:

- Identify various monitoring systems and sensor technologies used to collect data on soil conditions, crop health, environmental factors and livestock.
- Analyse modern tools and techniques used in precision agriculture, such as remote sensing, drones, satellite imagery and data analytics for optimizing agricultural practices.

Competences

After the completion of this LU, the learner will be competent to:

- Understand digital technologies in agricultural processes.
- Appraise sustainable farming practices using digital technologies.

4. Content

- **Introduction to smart farming:** A look into the basics of artificial intelligence, the internet of things and robotics in agriculture
- **Monitoring systems:** Brief introduction to sensor technologies to monitor soil conditions, crop health, environmental factors and cattle health.
- **Modern farming methods:** A overview of the technologies and techniques used in precision agriculture.
- **Case studies:** Examine real-world case studies of successful and innovative application of smart agricultural technologies

6. Training methodologies

- Face to Face: 8 hours
- Online learning (asynchronous): 6 hours

- WBL (through study visits and/or workshops): 6 Hours

7. Assessment methodologies

For Face to Face

Written test

For Online learning

Self-assessment activities (quizzes, multiple choice, true-false), reflection questions

For WBL

Project based assessment

Module: Digital technologies and artificial intelligence

Learning Unit: Automation Technologies

Total number of hours: 20 hours

ECTS: 1

EQF level: 5

2. Short Description of the LU

This LU aims to develop an overview of the automation technologies in the agriculture sector. An overall course that contains knowledge and develops skills on automatic systems in agriculture and how these systems are used in different sector of agriculture. Also, this LU will provide important practical skills and competences through case studies in the fields.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge

After the completion of this LU, the learner will:

- be able to accurately identify state and explain automation technologies in agriculture.
- beable to accurately identify state and explain automation systems in agriculture.
- be able to clearly state and explain control theory and logical programming.

Skills

After the completion of this LU, the learner will be able to:

- demonstrate how to run, manage systems in different sectors (crop production, livestock, irrigation, post-harvest)
- apply demonstrate how robotics and unmanned field machinery work and perform relevant tasks with these systems.

Competences

After the completion of this LU, the learner will be competent to:

- combine knowledge and skills to design, develop and create automation systems in early stages.
- assess and choose the most appropriate automation systems and technologies.

4. Content

- **Introduction to Automation technology in agriculture**. (An overview of the automation technologies, when did they started, etc)
- **General information** about systems, microcontrollers (Arduino-Raspberry), PID controller, sensor technologies, resistor wiring diagram,
- **Applications in Agriculture** (in the field, for practical knowledge)
  1)Automation in field crop production
  2) Automation in Animal housing production

3)Automation of pesticide application systems
4)Automation irrigation systems and soil management
5)Post harvest automation

- **Case studies and in situ education**

6. Training methodologies

- Face to Face: 5 hours
- Online learning (asynchronous): 5 hours
- WBL (through study visits and/or workshops): 10 Hours

7. Assessment methodologies

For Face to Face

E.g., Case study, practical activity (either individual or in groups), decision making scenarios.

For Online learning

E.g., Self- assessment activities (quizzes, multiple choice, true -false), reflection questions

For WBL

E.g., Project based assessment

Module: Bio-economy, circular economy and bio-based products

Learning Unit: Circular Economy

Total number of hours: 20 hours

ECTS: 1

EQF level: 5

2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***

This LU aims to provide learners with the necessary knowledge, understanding, and skills to effectively apply the principles and practices of the circular economy in practical contexts. It introduces learners to the fundamental concepts of circular economy, such as the concept of closing the loop, minimizing waste and designing for circularity.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge

After the completion of this LU, the learner will:

- Understand the basic principles and concepts of the circular economy.
- Discuss relevant policies and regulations related to the circular economy.

Skills

After the completion of this LU, the learner will be able to:

- Apply circular economy principles in practical scenarios.
- Identify circular economy opportunities.
- Execute circular economy practices.

Competences

After the completion of this LU, the learner will be competent to:

- Apply critical thinking in the context of circular economy challenges.
- Demonstrate system thinking in the context of the circular economy.

4. Content

- Circular Economy – principles, dimensions, benefits and challenges
- Resource reduction and waste management
- Agricultural Production of Bio-based Resources
- Agroecology and Regenerative Practices
- Circular Farming Technologies

6. Training methodologies

- Face to Face: 10 hours
- Online learning (asynchronous): 5 hours
- WBL (through study visits and/or workshops) : 5 Hours

7. Assessment methodologies
For Face to Face E.g., Case study, practical activity (either individual or in groups), decision making scenarios **For Online learning** E.g., Self- assessment activities (quizzes, multiple choice , true -false), reflection questions **For WBL** E.g., Project based assessment

Module: Bio-economy, circular economy and bio-based products

Learning Unit: Discovering the potential of biorefineries

Total number of hours: 20 hours

ECTS: 1

EQF level: 5

2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***

This LU aims at providing the student with an overview about the principles and technologies in biorefineries to obtain chemicals, fuels and other high added-value products from biomass feedstocks.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge

After the completion of this LU, the learner will:

- State the concept and principles of biorefineries.
- Identify various conversion processes of conversion processes and technologies used in biorefineries.
- Refer to case studies and real-world examples of biorefineries and recognise the challenges associated with their development.

Skills

After the completion of this LU, the learner will be able to:

- Identify different biorefinery concepts based on the characteristics of the feedstock

Competences

After the completion of this LU, the learner will be competent to:

- Identify and describe important factors when designing biorefinery systems

4 Content

- **The concept of biorefinery**: introduction to the biorefinery concept, where biomass feedstocks are converted into a range of valuable products
- **Case studies and world-case examples:** Analyse successful and innovative biorefinery implementations.
- **Challenges for future development:** Identify the key challenges and barriers faced in the development and implementation of biorefineries.

5. Training methodologies

- Face to Face: 8 hours
- Online learning (asynchronous): 6 hours
- WBL (through study visits and/or workshops): 6 Hours

6. Assessment methodologies

For Face to Face

Written Exam

For Online learning

Self- assessment activities (quizzes, multiple choice, true -false), reflection questions

For WBL

Project based assessment

Module: Bio-economy, circular economy and bio-based products

Learning Unit: Bioenergy and energy crops

Total number of hours: 20 hours

ECTS: 1

EQF level: 5

2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***

This Lu aims to provide an overview on the bioenergy and biofuel crop sector. Lessons will be focused on the different types of usable biomass (crops), transformation processes and the types of fuel that can be obtained. The course also provides guidance on sustainability and concludes with a review of the pertinent European legislation.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge

After the completion of this LU, the learner will:

- Describe the bioenergy production sector, which raw materials can be used and the processes for processing them.
- Discuss which aspects make bioenergy sustainable.

Skills

After the completion of this LU, the learner will be able to:

- Identify the characteristics that a biomass should have to be used for energy production.
- Distinguish the transformation processes that provide a qualitatively better product based on biomass characteristics.
- Develop a simple agricultural plan for bioenergy production crops.

Competences

After the completion of this LU, the learner will be competent to:

- Participate actively in the bioenergy and energy crops sector.
- Exhibit competence about processes required to transform biomass into fuel or energy directly.
- Make choices in this area aware of European regulations in terms of limitations and funding opportunities.

4. Content

- **Bioenergy: what is it and the production processes:** An introductory overview of the topic, why it can be called a relevant field with future prospective and the processes involved
- **Crops: feedstocks selection and pre-treatment:** Overview on crops for production of biomass, biodiesel-oil, bioethanol and biogas. Evaluation of different feedstock options based on the availability, composition and growing requirements.
- **Biofuels, are they sustainable? :** Considerations regarding the sustainability of biomass energy production.
- **European legislation: restrictions and opportunities:** An overview of European legislation on the subject: constraints and opportunities.

6. Training methodologies
• Face to Face: 8 hours • Online learning (asynchronous): 4 hours • WBL (through study visits and/or workshops): 8 Hours
7. Assessment methodologies
For Face to Face Written test **For Online learning** Self-assessment activities (quizzes, multiple choice, true-false), reflection questions **For WBL** Project based assessment

Module: Bio-economy, circular economy and bio-based products

Learning Unit: **Introduction to bioeconomy - New value chains, Innovation and basic Economics in the Bioeconomy**

Total number of hours: 20 hours

ECTS: 1

EQF level: 5

2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***

This LU will offer a basic understanding of the transformation required in order to implement the bioeconomy practices in the agribusienss sector. The focus will be placed on the importance of forming new value chains and identifying new connections, networks or convergences with other industries, while highlighting the importance of being innovative or adopting open innovation practices in this process. The principles and characteristics of bioeconomy will also be discussed.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge

After the completion of this LU, the learner will:

- Indicate the key concepts related to bioeconomy.
- Make distinctions between conventional and bio based agribusinesses
- Identify the bio-based value chains and recognise potential convergences between industries and processes
- Discuss about the economic aspects of bioeconomy in the agribusiness sector
- Outline current and future trends for bioeconomy innovation
- Recognise strategic management as a tool for viable and efficient decision-making

Skills

After the completion of this LU, the learner will be able to:

- contrast conventional and bio based agribusinesses
- compare open innovation practices of bio based economy
- discover value chain networks that are compatible to his/her activities
- use tools that allow the calculation processing and analysis of economic aspects of bioeconomy
- propose and develop service products in bioeconomy

Competences

After the completion of this LU, the learner will be competent to:

- adapt existing emerging technologies in the bio-based economy
- administer existing bioeconomy strategies
- review open innovation practices and develop own strategic plans

4. Content

- Introduction to Bio-economy
- Bio-based industry and Bio-economy in Europe with a focus on the agricultural sector
- Biological Resources and Bioproducts

- Innovation in bio based economy (definitions, creativity and innovation, introduction of innovation models and systems, innovation tools, innovation diffusion)
- Introduction of Economic aspects of Bioeconomy (Indicators and criteria for certification of organic products, Processes for the development of bioeconomy products, Processes for the adoption of bioeconomy by enterprises, Inventions and their protection, the economics of patents)
- Introduction to Strategic management in bioeconomy (strategic management components, frameworks and processes)

6. Training methodologies

- Face to Face: 8 hours
- Online learning (asynchronous): 6 hours
- WBL (through study visit and/or workshop) : 6 Hours

7. Assessment methodologies

For Face to Face

E.g., Case study, practical activity (either individual or in groups), decision making scenarios, problem-based group work activities

For Online learning

E.g., Self- assessment activities (quizzes , multiple choice, true -false), reflection questions

For WBL

E.g., Project based assessment

Module: Controlled environment agriculture

Learning Unit: Basics of controlled environment agriculture

Total number of hours: 20 hours

ECTS: 1

EQF level: 5

2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***

This LU aims to provide the student with an overview about the controlled environment agriculture. It covers the techniques that are commonly used for controlled environment agriculture, and the current market.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge

After the completion of this LU, the learner will:

- name the environmental factors which affect the growth and yield of plants
- identify the basic elements for a controlled environment farm,
- recognise the differences between greenhouses and plant factories
- name the available technologies used for controlled environment agriculture,
- record the advantages and disadvantages of controlled environment agriculture

Skills

After the completion of this LU, the learner will be able to:

- identify the technologies needed by controlling the environment,
- use suitable equipment to control greenhouse environment
- manipulate the environmental factors of a greenhouse
- calculate the energy need of a greenhouse

Competences

After the completion of this LU, the learner will be competent to:

- design and operate a controlled environment farm
- evaluate the cost of the environmental control in a greenhouse or in a plant factory

4. Content

- **Introduction to controlled environment agriculture**: the state-of-the-art of the controlled environment agriculture
- **Environmental control systems:** the design and layout of controlled environment farms, how to control lighting, air and nutrient, the energy consumption
- **Current market of controlled environment agriculture**: the potential economic benefits

6. Training methodologies

- Face to Face: 8 hours
- Online learning (asynchronous): 6 hours
- WBL (through study visits and/or workshops): 6 Hours

7. Assessment methodologies
For Face to Face Written test **For Online learning** Self- assessment activities (quizzes, multiple choice, true -false), reflection questions **For WBL** Project based assessment

Module: Controlled environment agriculture

Learning Unit: Mastering vertical farming-

Total number of hours:20 hours

ECTS: 1

EQF level: 5

2. Short Description of the LU*[this should be short providing general information and objectives of the LU- max. 4 lines]*

This LU aims to advance knowledge of vertical farming techniques, focusing on LED lighting and plant nutrition. Learners will gain knowledge of the key components, develop relevant skills for practical application, and develop competencies to address challenges in vertical farming. The course further focuses on emerging trends and technologies in the field.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge

After the completion of this LU, the learner will:

- Explain the role of LED lighting systems in promoting plant growth and development in vertical farming.
- Name the basic nutritional requirements of plants in a vertical farming setting.

Skills

After the completion of this LU, the learner will be able to:

- Use LED lighting in the basic setup of a vertical farm.
- Prepare a nutrient solution for soilless cultures.
- Predict the effectiveness of different vertical farming techniques.

Competences

After the completion of this LU, the learner will be competent to:

- Estimate vertical farm efficiency.
- Defend the new technologies and advancements in the field of vertical farming.

4. Content

- **Understanding LED lighting in vertical farming:** Its importance and impact on plant growth.
- **Basics of plant nutritional requirements in vertical farming:** Essential nutrients and their delivery.
- **Overview of vertical farming techniques:** Evaluation and effectiveness.
- **Introduction to emerging trends in vertical farming:** Keeping up with technology and research.

6. Training methodologies

- Face to Face: 8 hours
- Online learning (asynchronous): 6 hours
- WBL (through study visits and/or workshops):6 Hours

7. Assessment methodologies
For Face to Face Written test **For Online learning** Self-assessment activities (quizzes, multiple choice,true-false), reflection questions **For WBL** Project-based assessment

Module: Controlled environment agriculture

Learning Unit: The business of vertical farming: from plants to profit

Total number of hours: 20 hours

ECTS: 1

EQF level: 5

2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***

This LU introduces entrepreneurship in vertical farming, focusing on understanding business models and marketing strategies. Learners will explore basic business models and marketing techniques within the vertical farming industry through practical examples and case studies. Learners will interpret simple business models and understand fundamental marketing strategies in the context of vertical farming and develop their own basic business plan.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge

After the completion of this LU, the learner will be able to:

- Describe what a business model is and how it applies to vertical farming.
- Discuss fundamentals of marketing strategies in the context of vertical farming

Skills

After the completion of this LU, the learner will be able to:

- Perform a simple business model related to vertical farming
- Apply marketing techniques suitable for a vertical farming business

Competences

After the completion of this LU, the learner will be competent to:

- Criticize in business models of vertical farming.
- Compare marketing strategies used in the vertical farming industry.

4. Content

- **Understanding business models:** A brief introduction to what business models are and how they apply to vertical farming.
- **Marketing in vertical farming:** A simple overview of the basic marketing strategies that can be used in the vertical farming industry.
- **Case study of a vertical farming startup:** A look into its business model and marketing strategy.
- **Developing a basic business plan:** A guided activity to apply what has been learned to create a basic business model and marketing strategy for a hypothetical vertical farming startup.

6. Training methodologies

- Face to Face: 8 hours
- Online learning (asynchronous): 6 hours
- WBL (through study visits and/or workshops): 6 Hours

7. Assessment methodologies
For Face to Face Written Exam **For Online learning** Self-assessment activities (quizzes, multiple choice, true-false), reflection questions **For WBL** Project-based assessment

VET-D4

Module: Controlled environment agriculture
Learning Unit: Sustainable agriculture in controlled environments: Challenges, opportunities and solutions
Total number of hours: 20 hours **ECTS:** 1 **EQF level: 5**
2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***
This LU aims at providing the student with an overview about the challenges, opportunities and solutions in sustainable agriculture in controlled environments.
3. Learning Outcomes *The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described*
Knowledge ***After the completion of this LU, the learner will:*** • Identify and analyse the key challenges and opportunities associated with implementing agricultural practices in controlled environments, • List sustainable agriculture techniques and technologies applicable to controlled environment, including hydroponics, vertical farming, resource management and pest and disease management control. • Analyse case studies and real-world examples. **Skills** ***After the completion of this LU, the learner will be able to:*** • Identify needs and conditions to select appropriate technologies in controlled environmental agriculture. **Competences** ***After the completion of this LU, the learner will be competent to:*** • Demonstrate the ability to design and operate sustainable controlled environmental systems.
4 Content
• **Sustainable agriculture techniques and technologies**: A look into the most relevant techniques and strategies in controlled environment agriculture • **Challenges and opportunites:** identifying key challenges in implementing agricultural practices as well as exploring the opportunitieS asociated with controlled environmenta agriculture. • **Case studies and world-case exemples:** Examining successfull and innovative practices and Technologies in controlled environment agriculture.
5. Training methodologies
• Face to Face: 8 hours • Online learning (asynchronous): 6 hours • WBL (through study visits and/or workshops): 6 Hours

6. Assessment methodologies
For Face to Face Written Exam **For Online learning** Self- assessment activities (quizzes, multiple choice, true -false), reflection questions **For WBL** Project based assessment

Module: Horizontal Skills

Learning Unit: Soft Skills

Total number of hours: 20 hours

ECTS: 1

EQF level: 5

2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***

This LU aims to develop the learner's soft skills needed to communicate effectively and ethically with different stakeholders within their environments, be flexible, work well with others, perform well and achieve their goals through creative problem solving thus creating additional value for their business.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge

After the completion of this LU, the learner will:

- Identify the various forms of interpersonal communication and the related principles
- Distinguish and analyze the factors that contribute to successful negotiation procedures
- Indicate the basic principles and advantages of collaboration and team working
- Recognize principles, phases and tools of creative problem-solving procedures
- Recognize the factors and barriers that affect the decision making process
- Illustrate the key principles of ethical behaviour

Skills

After the completion of this LU, the learner will be able to:

- Communicate with clarity and conviction and tailor their communication strategy according to the specificities of each context
- Identify the other party's perspective before starting the negotiation process and come up with a specific negotiation plan
- Create effective, flexible and resilient teams by motivating the team members and handling common conflicts that arise within teams
- Gather information about a problem, identify and analyze problems and use techniques in order to come up with a decision
- Develop ideas into valuable and creative solutions to the problem

Competences

After the completion of this LU, the learner will be competent to:

- Incorporate various forms of communication into the interaction with different actors and stakeholders
- Think more widely and creatively when it comes to decision making and problem solving
- Create an agri business environment and culture where change is accepted and embraced, and develop flexibility and optimism

4. Content
• Principles and key elements of interpersonal communication • Effective negotiations: the main characteristics of a successful negotiator, how to analyse the situation, negotiation styles and strategies • Team working and collaboration skills: their role in business success, how to build effective teams and their characteristics, setting common goals, resolution of conflicts • Decision making and problem solving: the decision making process, barriers, phases of creative problem-solving procedures • The importance of Resilience and Adaptability in transition to change • The basic principles of Accountability and Ethical behaviour
6. Training methodologies
• Face to Face: 8hours • Online learning (asynchronous): 6 hours • WBL (through study visit and/or workshop): 6 hours
7. Assessment methodologies
For Face to Face • E.g. Case study, practical activity (either individual or in groups), decision making scenarios **For Online learning** • E.g. Self- assessment activities (quizzes, multiple choice, true -false), reflection questions **For WBL** • E.g. Project based assessment

Module: Horizontal Skills

Learning Unit: Green Skills

Total number of hours: 20 hours

ECTS: 1

EQF level: 5

2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***

This LU aims to develop the learners' knowledge, skills and competences related to the fields of bioeconomy and sustainable development by introducing them to practices such as waste management, energy efficiency, water waste, food waste; presenting the European agreements that enhance sustainable development leading to a greener economy; promoting the need for cultivating system thinking; and, illustrating ways to measure the impact of human activity on the environment.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge

After the completion of this LU, the learner will:

- Interpret the key European and International directives and frameworks related to the sustainable development and the green transition
- Identify the fundamentals of the various concepts related to sustainability
- Recognize the impact of the human activity on the environment
- Identify the elements of waste management, energy efficiency, water and food waste practices
- Recognize the importance of system thinking and Life cycle thinking in the transition to a greener economy

Skills

After the completion of this LU, the learner will be able to:

- Measure his/her impact on the environment that derive from his /her activities
- Organize his/her professional and personal activities taking into account the European key directives
- Develop system thinking as a holistically approach related to the application of bioeconomy in the farming sector
- Mitigate the waste of resources

Competences

After the completion of this LU, the learner will be competent to:

- Apply ethical and sustainable thinking within his/her personal and professional practices
- Develop a responsible attitude towards the environment also inspiring his/her peers

4. Content

- Introduction to Sustainability and Bioeconomy concepts
- Introduction to the Sustainable Development Goals as mentioned in the UN's 2030 Agenda, the European Green Deal and the GreenComp Framework and their application in practice
- Key elements of waste management, energy efficiency, water and food waste practices

- Impact of human activity on the environment and tools to calculate this impact (e.g. carbon footprint and ecological footprint)
- The need for all to adopt a systems thinking approach

6. Training methodologies

- Face to Face: 8 hours
- Online learning (asynchronous): 6 hours
- WBL (through study visit and/or workshop): 6 Hours

7. Assessment methodologies

For Face to Face

- E.g. Case study, practical activity (either individual or in groups), decision making scenarios

For Online learning

- E.g. Self- assessment activities (quizzes, multiple choice, true-false), reflection questions

For WBL

- E.g. Project based assessment

Module: ENTREPRENEURIAL SKILLS

Learning Unit:

Total number of hours: 20 hours

ECTS:

EQF level: 5

2. Short Description of the LU ***[this should be short providing general information and objectives of the LU- max. 4 lines]***

This LU tries to develop all the methodological tools for analysing the internal and external environment of a business and for designing a new business model, in order to strengthen the agricultural economy.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Upon successful completion of the course, students are expected to have the:

Knowledge so that they can:
o Understand the importance and complexity of modern entrepreneurship
o They choose sustainable business models through critical and analytical thinking based on innovation.
o Recognize and describe points that can be improved in business processes when developing new products and services.

Skills to be able to:
o They examine the influence of a range of factors (external and internal) which affect entrepreneurship
o Prepare comprehensive business plans
o Seek and obtain funding

Competences to be able to:
o They recognize investment and development incentives
o Cooperate, coordinate and control the parties involved so that innovative business ventures are designed and implemented.

4. Content

- Introduction to Entrepreneurship – Entrepreneur
- Agricultural Entrepreneurship
- The Business Environment – PEST Analysis – Porter's 5 Forces
- The Enterprise – Resource Based Theory – Value Chain Theory
- Business Concept Development - Business Model Canvas
- Business Plan
- Classroom Workshop – Business Concept
- Financing - Alternative Funding Sources

6. Training methodologies
Online learning (asynchronous): 20 hours WBL (workshops) : 4 Hours
7. Assessment methodologies
For Online learning Self- assessment activities (quizzes, multiple choice), reflection questions **For WBL** Assessment through Projects in Business Concept Development.

Module: Horizontal Skills

Learning Unit: Digital Skills

Total number of hours: 20 hours

ECTS: 1

EQF level: 5

2. Short Description of the LU *[this should be short providing general information and objectives of the LU- max. 4 lines]*

This learning unit is designed to empower learners with a broad spectrum of horizontal digital skills, essential for navigating the contemporary agricultural environment and to flourish in an increasingly digital era. It encompasses a variety of areas, from harnessing online resources and safeguarding digital information to fostering collaboration and exploiting digital tools.

3. Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the learners will acquire with the successful completion of the course are described

Knowledge
After the completion of this LU, the learner will:

- identify reliable online sources and recall the process of evaluating online information.
- describe common digital threats and explain the basic measures for safeguarding sensitive data.
- summarize the principles of online trading and digital business strategies.
- list the main strategies for promoting products and services online.
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Skills
After the completion of this LU, the learner will be able to:

- apply digital tools to facilitate effective communication and teamwork
- demonstrate the use of these tools in collaborative scenarios.
- implement strategies for utilizing social platforms for business growth and community engagement.

Competences
After the completion of this LU, the learner will be competent to:

- evaluate the relevance and reliability of online information and synthesize this knowledge to make informed decisions in farming.
- exploit the e-commerce environment for their business
- use e-learning platforms for continuous self-directed learning and monitor their learning progress.

4. Content

- Digital Research (an introductory element of cybersecurity could be included here)
- Digital Communication and Collaboration (including Social Media Management)
- E-commerce
- Digital Marketing
- E-Learning

6. Training methodologies
• Face to Face: 10 hours • Online learning (asynchronous): 6 hours • WBL (through study visits and/or workshops) : 4 Hours
7. Assessment methodologies
For Face to Face • Case study/ demonstration **For Online learning** • Multiple choice questions **For WBL** • Project based assessment

Relief

euRopean bio-Economy aLliancE in Farming

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