EQVEGAN
European Qualifications & Competences for the Vegan Food Industry
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Deliverable 2.4

Innovative training for the vegan food industry technologist/engineer EQF7

Workpackage 2	Design of innovative trainings
Task 2.1	Design learning outcomes-based VET training using ECTS credits for EQF 7
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Foreword

The work described in this guideline was developed under the project EQVEGAN: European Qualifications & Competences for the Vegan Food Industry (621581-EPP-1-2020-1-PT-EPPKA2-SS). If you wish any other information related to this report or the EQVEGAN project please visit the project web-site (www.eqvegan.eu) or contact:

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Dissemination Level		
PU	Public (from 30/11/2024)	√
PP	Restricted to other programme participants (including Commission services and projects reviewers)	
CO	Confidential, only for members of the consortium (including EACEA and Commission services and projects reviewers)	

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Content

1. Summary

EQVEGAN project will provide updated trainings to vegan food industry professionals in order to improve their technical and soft skills in the fast-changing industry. The training materials are prepared for four European Qualifications Framework (EQF) levels, from level 4 to level 7. The occupational profiles tackled by EQVEGAN are the "Fruit, vegetable and related preserver" (EQF4, ISCO-08 code, ESCO 7514), "Food Production Operator" (EQF 4), the "Food technician" (EQF 5), the Food Technologist/Engineer (EQF 6 and 7).

Another level for the training materials is the trainer level which is the subject of this deliverable. The aim of this deliverable is to guide the trainers who will use the training materials prepared by EQVEGAN project on how they need to conduct the trainings and use the materials. It contains information about the trainings including modules, teaching topics, learning outcomes and the content of trainings.

2. Trainings in EQVEGAN

Trainings were designed into four modules:

1- Plant-based processing technology,
2- Green skills,
3- Digitalization and automation,
4- Soft skills

The modules are composed of units. In training materials, the aim and description of the units are provided, the teaching topics and learning outcomes are defined and the whole content is given. The assessment, reading list and resources for unit are explained as well.

The stakeholders of the EQVEGAN were identified and professional's profiles were defined in the first work package of the projects, which constituted the objectives to the design of training. These results are available on the Food Skills portal (food-skills.eu).

The quality of trainings will be assessed for validation and further improvement. Learning outcomes, ECVET and ECTS credits will be validated across the different countries to facilitate the design of a reliable European certification scheme. The certification scheme will be designed to include recognition of prior non-formal and informal learning and guidelines will be issued for guidance by the training organizations.

3. Training for the vegan food industry technologist/engineering

The trainings for the vegan food industry technologist/engineer (EQF 7) should consist of lectures, and practicals and site visits. The training modules on plant-based processing technology, soft skills, digitalization and automation and green skills.
The following sections identify the aim of the respective module in EQF 7, a short description of the module, the contents being explored, the suggested reading and link to training materials that the trainers can use.

3.1. Plant-Based Processing Technology

On a total of 7 ECTS credits, this module covers:

- Technologies
- Nutrition
- Food safety
- Analysis

3.1.1. Technologies

Aim of Unit: Design of innovative trainings

Unit aims to bring to the students` knowledge of vegan food production.
Students will gain knowledge of the basic raw materials for vegan food production and the modern technological processes used in the food industry. Technologies for the production of food analogues of animal origin and the use of fermentation processes will be presented in detail. Special attention will be paid to the production of safe food and the potential for adulteration.

Description of Unit:

In the Technology unit, students will learn about methods and strategies used in vegan food production. The aim of the unit is to provide students with knowledge of the quality requirements of plant raw materials used in the production of vegan food, modern methods of producing plant protein as a substitute for animal protein in the vegan diet, technological processes and operations used in the production of plant analogues of animal products. Students will learn about food preservation methods and become familiar with current fermented food production strategies. The effects of thermal and non-thermal processes on the sensory quality of finished products will be presented.

Teaching Topics:

EQF7
Contact hours: 78h in class/on-line; 28h practice. Non-contact hours: 14 hours
1. Leguminous products (10h in class/on-line; 4h practice)
2. Production of plant proteins (10h in class/on-line; 4h practice)
3. Thermal and non-thermal food processing (16h in class/on-line; 10h practice)
4. Technologies of fungi & yeasts products (8h in class/on-line; 2h practice)
5. Technologies of meat analogues (8h in class/on-line; 2h practice)
6. Technologies of dairy analogues (10h in class/on-line; 2h practice)
7. Technologies of eggs analogues (6h in class/on-line; 2h practice)
8. Technologies of fermented and non-fermented beverages (10h in class/on-line; 2h practice)

Learning Outcomes:

- In-depth theoretical foundations in the field of vegan food technology and keeps track of current trends, innovations and research directions in this field
- The health risks associated with contamination and adulteration of vegan foods and its estimation and reduction
- Analyze situations related to the vegan food technology, storage and manage activities to improve the quality and efficiency of production, and sustainability of the natural environment
- Analyze in detail and critically evaluate various technical and technological solutions
- Evaluate and put into practice the standards of the food sector (e.g., EC, ISO, BRC, IFS) as well as the production and safety of vegan food
- Develop and design a food product, technological process and packaging in accordance with the technical knowledge and market requirements

Content of Unit:

1.1. Legume-based products
1.2. Legumes as components of food products
2.1. PLANT PROTEIN EXTRACTION METHODS
2.2. PLANT PROTEIN EXTRUSION
2.3. COMPARISON OF PLANT BASED PROTEINS FROM DIFFERENT SOURCES
3.1. THERMAL FOOD PROCESSING
3.2. Non-THERMAL FOOD PROCESSING
4.1. The use of fungi and yeast in the production of vegan food
2. Technological treatment of fungi and yeasts
3. Biotechnological treatment of fungi and yeast
5.1. Basics of the production of meat analogues
5.2. Technologies in the production of meat analogues
5.3. Design and manufacture of meat analogues
6.1. Liquid dairy analogues
6.2. Fermented dairy analogues.
6.3. Quark analogues
6.4. Cheese analogues
6.5. Spread analogues.
7.1. Basics of the production of egg analogues
7.2. Ingredients and technologies in the production of egg analogues
7.3. Design and manufacture of egg analogues
8.1. Fermented beverages
8.2. Non-fermented beverages

Assessment for Unit:

1. Explain and discuss raw materials used for protein production.

2. Discuss and compare technics used for protein production. Show differences between proteins from different sources.
3. Discuss meat analogues and main methods for their production.
4. Discuss dairy analogues and main methods for their production.
5. Discuss eggs analogues and main methods for their production.
6. Explain the role of fermented food in vegan diet and describe some examples.
7. Explain and discuss the using of microbiota in production of vegan food. Describe functional properties of these products.

Reading List for Unit:

1. Abu-Ghannam, N., & Gowen, A. (2011). Pulse-based food products. Pulse Foods: Processing, Quality and Nutraceutical Applications, 249-278.
2. Chang, A. S., Sreedharan, A., & Schneider, K. R. (2013). Peanut and peanut products: A food safety perspective. Food Control, 32(1), 296-303.
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11. https://www.foodnavigator-usa.com/News/Promotional-Features/Legume-based-snacks-a-great-alternative-to-industrial-products
12. https://www.shutterstock.com
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19. Zhu H.-G., Tang H.Q. Cheng Y.-Q., Li Z.-G. Tong L.T. (2021) Electrostatic separation technology for obtaining plant protein concentrates: A review. Trends Food Sci Tech 113:66-76.
20. Erdogdu, F., Karatas, O. and Sarghini, F. 2018. A short update on heat transfer modelling for computational food processing in conventional and innovative processing. Current Opinion in Food Science. 23: 113-119.
21. Erdogdu, F., Sarghini, F. and Marra, F. 2017. Mathematical modeling for virtualization in food processing. Food Engineering Reviews. 9: 295-313.
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39. Lafarga T. Alvarez C., Villaro S. Bobo G., Aguilo-Aguayo I. (2020) Potential of pulse-derived proteins for developing novel vegan edible foams and emulsions. Int J Food Sci Technol 55:475-481.
40. Raikos V., Hayes H., Ni H. (2019) Aquafaba from commercially canned chickpeas as potential egg replacer for the development of vegan mayonnaise: recipe optimisation and storage stability. Int J Food Sci Technol 55:1935-1942.

Resources for Unit:

- A fully equipped classroom
- Hardware and software for online teaching
- Whiteboard
- Projector

3.1.2. Nutrition

Aim of Unit:

The unit aims to bring students knowledge about the topic about types of vegetarian diets, risk of nutritional deficiencies and possibilities to supplement. Students learn about health-related aspects of plant diets consumption. They will find out about differences between bioavailability and bioaccessibility of some nutrients in vegetarian diets. Students will gain knowledge how increase and avoid low bioavailability of nutrients on plant based diets. They also get acquainted with the rules of proteins supplementation to increase nutritional value of plant diets in relation to level of animal food limitations in diet.

Description of Unit:

In unit Nutrition, students will become familiar with vegetarian diets categorization. The unit aims to deliver to students knowledge concerning nutritional value of vegan diets in relation to type/restrictivness. Students will learn how to distinguish/analyse deficiencies, identify and avoid them on vegetarian diets in human nutrition. They get acquainted with the bioavailability and bioaccessibility evaluation and modifications on plant diets. Liebig law development in relation to proteins complementation in vegan nutrition will be presented and discussed.
Methods of the diet supplementation and complementation of vegan diet will be presented (training will be performed).
Health-related benefits and threats of plant diets consumption will be analysed basing on population studies will be (4h)
Unit is composed of teaching topics:

- Plant diets – categorization and definition
- Macro- and micronutrients in vegetarian diets (Nutritional value)
- Nutrient's bioavailability and bioaccessibility of vegan diets
- Protein complementation in vegan diets.
- Health-related benefits and threats of plant diets consumption.
- Assessment

Teaching Topics:

EQF4
Contact hours: 7.5 hours. Non-contact hours: 11 hours
1. Plant diets – categorization and definition
2. Macro- and micronutrients in vegetarian diets (Nutritional value)
3. Nutrient's bioavailability and bioaccessibility of vegan diets
4. Protein complementation in vegan diets
5. Health-related benefits and threats of plant diets consumption

Learning Outcomes:

- Name and explain basics types of vegetarian diets, descriptions and rules of their application. Foods proportions in diets.

- Name and explain nutritional value vegan diets, with distinguishing sources of nutrients and anti-nutritional compounds
- Name and understand rules of bioavailability and bioaccessibility nutrients in plant diets.
- Name and understand basics roles of protein's complementation on vegetarian's dietary patterns.
- Use a roles of increase bioavailability and protein complementation for vegan diet planning
- Name and understand risks and benefits in terms of health and moncommunicable diseases.

Content of Unit:

1. Plant diets – categorization and definition
2. Macro- and micronutrients in vegetarian diets
3. Nutrient's bioavailability and bioaccessibility of vegan diets
4. Protein complementation in vegan diets
5. Health-related benefits and threats of plant diets consumption

Assessment for Unit:

2h Student seminar preparation

Reading List for Unit:

1. Rizzo, N. S., Jaceldo-Siegl, K., Sabate, J., & Fraser, G. E. (2013). Nutrient profiles of vegetarian and nonvegetarian dietary patterns. Journal of the Academy of Nutrition and Dietetics, 113(12), 1610–1619. https://doi.org/10.1016/j.jand.2013.06.349
2. Clarys, P., Deliens, T., Huybrechts, I., Deriemaeker, P., Vanaelst, B., De Keyzer, W., Hebbelinck, M., & Mullie, P. (2014). Comparison of nutritional quality of the vegan, vegetarian, semi-vegetarian, pesco-vegetarian and omnivorous diet. Nutrients, 6(3), 1318–1332. https://doi.org/10.3390/nu6031318
3. Dinu, M., et al. (2017). Vegetarian, vegan diets and multiple health outcomes: A systematic review with meta-analysis of observational studies [Abstract]. https://www.tandfonline.com/doi/abs/10.1080/10408398.2016.1138447?journalCode=bfsn20
4. Kim, H., et al. (2019). Plant-based diets are associated with a lower risk of incident cardiovascular disease, cardiovascular disease mortality, and all-cause mortality in a general population of middle-aged adults. https://www.ahajournals.org/doi/10.1161/JAHA.119.012865
5. Qian, F., et al. (2019). Association between plant-based dietary patterns and risk of type 2 diabetes:A systematic review and meta-analysis [Abstract]. https://jamanetwork.com/journals/jamainternalmedicine/article-abstract/2738784?guestAccessKey=5e8aaedb-e77d-4bc1-9d52-b626e406138e&utm_source=For_The_Media&utm_medium=referral&utm_campaign=ftm_links&utm_content=tfl&utm_term=072219

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10. World Health Organization. (2015). IARC Monographs evaluate consumption of red meat and processed meat [Press release]. https://www.iarc.fr/wp-content/uploads/2018/07/pr240_E.pdf
11. https://www.eatrightpro.org/-/media/eatrightpro-files/practice/position-and-practice-papers/position-papers/vegetarian-diet.pdf
12. Mariotti, François, and Christopher D. Gardner 2019. "Dietary Protein and Amino Acids in Vegetarian Diets—A Review" Nutrients 11, no. 11: 2661. https://doi.org/10.3390/nu11112661
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14. https://openbiotechnologyjournal.com/VOLUME/13/PAGE/68/FULLTEXT/
15. https://academic.oup.com/nutritionreviews/article/76/11/793/5053734
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17. https://www.tandfonline.com/doi/abs/10.1080/10408398.2013.781011?tab=permissions&scroll=top
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25. https://www.vegansociety.com/sites/default/files/uploads/downloads/Zinc%20PDF_0.pdf

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Resources for Unit:

- A fully equipped classroom
- hardware and software for online teaching
- Whiteboard
- Projector

3.1.3. Food Safety

Aim of Unit:

The unit aims to provide knowledge on hygiene control requirements at the vegan food industry level (e.g. prerequisite program requirements and the HACPP system) with the focus to the practical assignments.

Description of Unit:

The unit Safety is practice oriented unit where students will get acquainted with the hygiene requirements for the food premises (outer and inner building requirements); water, air, equipment and surfaces; temperature control; food handling and health of food operators; control of raw materials and food suppliers as well as sanitation protocols, and will learn how to design and complete the mandatory checklists. The subunit on HACCP will include concrete information and practical assignments how to perform necessary steps to develop a HACCP plan in vegan food industry.
Unit is composed of the following teaching topics:

- Prerequisite programs (GMP, GHP, premises, people, product)
- HACCP system

The practical assignments include:

- Prerequisite programs: 1. laboratory exercise on surface hygiene or allergen testing; 2. identification of potential risks in a vegan food processing plant; 3. listing all prerequisite program requirements for vegan food industry (example) with required control plans and checklists
- HACCP: 1. Flow diagram; 2. Hazard analysis and CCPs determination; 3. Establishing critical critical limits, monitoring procedures and corrective actions; 4. a HACCP plan generation

Teaching Topics:

EQF7
Contact hours: 18 hours. Non-contact hours: 12 hours
1. Prerequisite programs (GMP, GHP, premises, people, product)
2. HACCP
3. Assessment

Learning Outcomes:

- Propose hygienic solutions in vegan food processing and methods for cleaning validation
    - Conduct a hazard analysis and determine critical control points
    - Explain the significance of critical limits and corrective action

- Develop a HACCP plan

- Assessment:
  - Project presentation

Content of Unit:

1. Prerequisite programs (GMP, GHP, premises, people, product)
   - Elements of prerequisite program: EC (852/2004): building, zoning, construction, water, air, equipment, surfaces, temperature control, food handlers health and practices, food suppliers, cleaning, disinfection, pest control
   - Control plans
   - Checklists and verification

   Practical: 1. Surface hygiene exercise in a laboratory / allergen testing; laboratory exercise on surface hygiene or allergen testing; 2. identification of potential risks in a vegan food processing plant; 3. listing all prerequisite program requirements for vegan food industry (example) with required control plans and checklists
2. HACCP
   - Preparatory steps
   - Hazard analysis and determining CCPs
   - Establishing critical limits, monitoring CCPs and establishing corrective actions
   - Validation and verification of the system
   - Documentation and records

   Practical: Case study- assessment of the HACCP plan

   1. Flow diagram; 2. Hazard analysis and CCPs determination; 3. Establishing critical critical limits, monitoring procedures and corrective actions; 4. a HACCP plan generation
3. Assessment:
   - Project presentation

Assessment for Unit:

Project presentation

Reading List for Unit:

1. Australian Institute of Food Safety. 2022. Can Vegans Get Food Poisoning? Retrieved from https://www.foodsafety.com.au/blog/can-vegans-get-food-poisoning on January 28, 2022.
2. EHEDG Doc. 44Hygienic Design Principles for Food Factories https://www.ehedg.org/guidelines/
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4. Implementation of HACCP plan for blue-mould tofu with focus on microbial hazards https://stud.epsilon.slu.se/10477/1/sapieja_a_171019.pdf
5. Regulation (EC) No 178/2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A32002R0178
6. Regulation (EC) No 852/2004 on the hygiene of foodstuffs https://eur-lex.europa.eu/eli/reg/2004/852/oj

7. Regulation (EC) No 2073/2005 on microbiological criteria for foodstuffs https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32005R2073
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10. Vegetarian guide to food hygiene https://www.rbkc.gov.uk/business-and-enterprise/food-safety/vegetarian-guide-food-hygiene#vegetarian-guide-to-food-hygiene

Resources for Unit:

- A fully equipped classroom
- Hardware and software for online teaching
- Laboratory and materials for microbial surface testing/allergen testing

3.1.4. Analysis

Aim of Unit:

Unit aims to bring to students knowledge of topic about food analysis. Students learn about the methods of analyzing food compounds, contaminants and physical properties, which are important from vegan food quality point of view. They will find out about strategies for determining allergenicity of new plant raw materials and plant based food. Students will gain knowledge on the analysis of the organoleptic properties of vegan food, both by instrumental and sensory methods. They also get acquainted with the basic methods of determining the authenticity of raw materials and food products.

Description of Unit:

In unit Analysis, students will become familiar with methods and strategies used in food analysis. The unit aims to deliver to students knowledge concerning proteins nutritional quality, methods of bioactive compounds and antioxidant activity determination, methods of food contaminants and residues determination and analysis of natural compounds with adverse health effects. Students will learn methods of analysis of rheological properties and texture of vegan food. They get acquainted with the current strategies for determining allergenicity of new plant raw materials and plant based food. Instrumental methods of the organoleptic characteristics of vegan food will be presented (color analysis, aroma analysis, food acoustic analysis, particle characteristics and oral processing analysis). Students will learn sensory techniques used in the analysis of plant products and will be able to design research in order to determine the preferences of vegan consumers (preference mapping) and to indicate possible sensory optimization options for the product intended for them. Intentional and unintentional food adulteration and their implications, the health risks associated with food adulteration, genomic and proteomic-based methods of fraud detection as well as professional and ethical aspects of responsibility for the production of authentic/high-quality food will also be presented.
Unit is composed of teaching topics:

- Food compounds, contaminants and physical properties analysis
- Strategy for determining allergenicity of new plant raw materials and plant based food
- Instrumental studies of the organoleptic characteristics of vegan food
- Food authenticity
- Sensory analysis in vegan product designing
- Assessment

Teaching Topics:

EQF7
Contact hours: 18 hours. Non-contact hours: 12 hours
1. Food compounds, contaminants and physical properties analysis (3h)
2. Strategy for determining allergenicity of new plant raw materials and plant based food (3h)
3. Instrumental studies of the organoleptic characteristics of vegan food (3h)
4. Food authenticity (3h)

5.	Sensory analysis in vegan product designing (4h on-line)
6.	Assessment (2h assessment)

Learning Outcomes:

- Discuss specialized methods of vegan food compounds and physical properties analysis
- Evaluate potential allergenicity of new raw materials
- Discuss instrumental methods of organoleptic characteristics and design their applications in solving technological problems
- Explain intentional and unintentional food adulteration and their implications
- Assess the health risks associated with food adulteration
- Distinguish between genomic and proteomic-based methods of fraud detection
- Evaluate the importance of the analysis of food origin and authenticity
- Appraise the importance of professional and ethical responsibility for the production of authentic/high-quality food
- Plan sensory techniques used in the analysis of plant products.
- Design research in order to determine the preferences of vegan consumers (preference mapping) and to indicate possible sensory optimization options for the product intended for them.

Content of Unit:

1. Protein nutritional quality tests
2. Determination of bioactive compounds
3. Analysis of antioxidant activity of vegan food
4. Analysis of food contaminant and residues
5. Analysis of natural compounds with adverse health effects and undesirable compounds
6. Physical properties of vegan food measurements methods
7. Strategy for determining allergenicity of new plant raw material and plant based food
8. Instrumental studies of the organoleptic characteristics of vegan food
   - 8.1. Color analysis
   - 8.2. Aroma analysis
   - 8.3. Food acoustic analysis
   - 8.4. Particle characteristics
   - 8.5. Oral processing analysis
   - 8.6. Food Authenticity
   - 8.7. Sensory analysis in vegan product designing

Assessment for Unit:

1. Explain and discuss methods of vegan food compounds and physical properties analysis
2. Explain how to evaluate allergenicity of raw materials

3. Discuss instrumental methods of organoleptic characteristics of vegan food
4. Discuss methods of vegan food fraud detection
5. Plan sensory techniques used in the analysis of plant products and design research in order to determine the preferences of vegan consumers (preference mapping) and to indicate possible sensory optimization options for the product intended for them.

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Resources for Unit:

- A fully equipped classroom
- hardware and software for online teaching
- Whiteboard
- Projector.

3.2. Green Skills

Even though food waste is primarily the responsibility of agriculture and consumers, the food industry seeks to improve its performance in order to minimize food waste even further, both for sustainability and profitability. Therefore, 'GREEN SKILLS' assists in building skills in energy and water management.

With suggested 6 ECTS credits, it covers:

- Sustainability,
- Vegan food processing,
- Economy and marketing,
- Society and visibility.

3.2.1. Sustainability

Aim of Unit:

Unit aims to bring to students knowledge of topics about sustainability, general definition and parameters that stand in terms of sustainable development. The unit aims to deliver to students what sustainable vegan processing and plant-based processing is. Another is to explain energy/water/waste critical points in processing and how food waste in processing can be reduced. Also, observation regarding food waste, would be oriented towards, how to educate consumers how to treat plant-based products, how to reduce, reuse and recycle plant-based products. Through the unit, there will be focus on food by-products and effective usage of by-products in extraction processing and further incorporation of output products. In waste management, it is necessary to establish critical thinking and skills toward future lead in vegan food processing technology.

Description of Unit:

In unit Sustainability, students will become familiar with general definitions and parameters that stand in terms of sustainable development. The unit aims to deliver to students what sustainable vegan processing and plant-based processing is. Another is to explain energy/water/waste critical points in processing and how food waste in processing can be reduced. Students will compare conventional and vegan food processing technologies. Also, students will be trained to prepare plans for food waste reduction in vegan food processing. There will be education regarding food waste, how to educate consumers how to treat plant-based products, how to reduce, reuse and recycle plant-based products. Through the unit, there will be focus on food by-products and effective usage of by-products in extraction processing and further incorporation of output products. In waste management, it is necessary to establish critical thinking and skills toward future lead in vegan food processing technology. There will be usage of software to understand, collect and analyze data from vegan food processing plants and analyze data in terms of sustainable parameters.
Unit is composed of teaching topics:

- Introduction to Sustainability
- Energy/water/waste critical points
- Food waste – targeting consumers
- Food by-products
- Waste management
- Assessment

Teaching Topics:

EQF7
Contact hours: 30 hours. Non-contact hours: 3 hours
1. Introduction to sustainability - Sustainable food production - Sustainable food sources - Protein sources - Traditional and emerging technologies and approaches used along the food chain - Challenges for sustainable food value chains - Strategies for improving the sustainability of food systems - Sustainable development goals - Food technology sustainable techniques - Nutrition - Future Efforts
2. Energy/water/waste critical points - Mapping of Energy/water/waste critical points - Sustainable production - Carbon cycle - Actions to make food production more sustainable - Food classification systems - Footprint
3. Food waste – targeting consumers - Vegan food processing and waste - Comparison with standard technologies information on waste generation - Comparison of available technologies and waste generation - Waste utilization
4. Food by-products - Visit to processing plant (3h) - Sustainable Development Goals - Sustainable Food Systems - Plant food by – products and reusage - Lean, green and digitalization towards smart, sustainable and energy efficient processing with low emission technologies
5. Waste management - Visit to processing plant (2h) - Food waste - Footprints - Life cycle assessment and digitalization- waste prevention - Climate Protection

Learning Outcomes:

- Identify primary and secondary sustainable parameters

- Explain vegan food processing in terms of sustainability
- Compare vegan food processing in terms of sustainability with conventional meat processing
- Plan management of mapping energy/water/waste critical points in conventional technologies with VFP
- Measure efficiency in energy/water/waste requirements in VFP (usage of life cycle assessment software)
- Create a plan for food waste reduction in VFP
- Evaluate most effective plan for waste reduction in VFP
- Manage education for consumers regarding sustainability in VFP
- Score the consumers knowledge in sustainable indicators and societal impact (usage of life cycle assessment software)
- Estimate by-products in VFP
- Rate most valuable by-product from VFP (in terms of nutraceuticals/energy/proteins)
- age of life cycle assessment software)
- Analyze data obtained from sustainability evaluation in VFP. On-site case study (visiting to processing plant) and collected data
- Justify sustainability evaluation in VFP in complete value chain (case study) – impact to ecology, environment and society. On-site case study (visiting to processing plant) and collected data

Content of Unit:

1. Identify primary and secondary sustainable parameters
2. Explain vegan food processing in terms of sustainability
3. Compare vegan food processing in terms of sustainability with conventional meat processing
4. Plan management of mapping energy/water/waste critical points in conventional technologies with VFP
5. Measure efficiency in energy/water/waste requirements in VFP (usage of life cycle assessment software)
6. Create a plan for food waste reduction in VFP
7. Evaluate most effective plan for waste reduction in VFP
8. Manage education for consumers regarding sustainability in VFP
9. Score the consumers knowledge in sustainable indicators and societal impact (usage of life cycle assessment software)
10. Estimate by-products in VFP
11. Rate most valuable by-product from VFP (in terms of nutraceuticals/energy/proteins) age of life cycle assessment software)
12. Analyze data obtained from sustainability evaluation in VFP. On-site case study (visiting to processing plant) and collected data

13. Justify sustainability evaluation in VFP in complete value chain (case study) – impact to ecology, environment and society. On-site case study (visiting to processing plant) and collected data

Assessment for Unit:

Quantified sustainability values using software tools for calculations in VFP chain (usage of life cycle assessment software) (collected reports).
Developed plan for food waste consumer education Interpret survey analysis results of consumers knowledge of indicators and societal impact.

Reading List for Unit:

1. Sustainable Food Processing 1st Edition; by Brijesh K. Tiwari (Editor), Tomas Norton (Editor); Nicholas M. Holden (Editor); Elsevier (2013)
2. Sustainable Food Processing and Engineering Challenges; by Charis Michel Galanakis (Editor); Academic Press; 2021
3. Sustainable Food Systems from Agriculture to Industry, by Charis M. Galanakis (Editor); Academic Press; 2018
4. Sustainable Food Waste Management: Concepts and Innovations, by Monika Thakur, V. K. Modi, Renu Khedkar (Editors); Springer; 2021
5. Valorization of Food Processing By-Products; by M. Chandrasekaran (Editor), CRC, 2012
6. Sustainability of the Food System, by Noelia Betoret, Ester Betoret (Editors); Academic Press; 2020
7. Sustainable Production in Food and Agriculture, by Jolanta B. Królczyk, Pawel Sobczak, Wioletta Żukiewicz-Sobczak (Editors), MDPI Books;· 2020

Resources for Unit:

A fully equipped classroom; hardware and software for online teaching; Whiteboard; Projector, Software for calculations of sustainable parameters. Special time and organization for on-site visit to vegan food processing plants.

3.2.2. Vegan Food Processing

Aim of Unit:

Unit aims to bring to students knowledge of topics about what a traceability system is and why it is necessary. The unit aims to deliver to students knowledge about the main rules in developing and labeling standards in VFP. In assessment of quality of vegan food products topics students will know how to evaluate production processes in terms of quality assurance in VFP.

Description of Unit:

In unit Traceability, students will try to apply basic tools for traceability systems in VFP. Another is to explain main factors affecting vegan food quality. Students will compare conventional and vegan food processing technologies. Also, students will be trained to design and prepare new vegan food products.

Unit is composed of teaching topics:

1. Traceability
2. Assessment of quality of VFP by QACP
3. Labeling of VFP
4. Developing new VFP

Teaching Topics:

EQF7
Contact hours: 18 hours. Non-contact hours: 2 hours
1. Introduction to vegan processing technology (6h) - Why veganism is key to zero-waste eating ? - What is veganism? - What is zero waste? - Why is veganism the key to zero-waste eating? - Is veganism healthy? - What Are Vegan Meat Alternatives Made Of? - Meat Alternatives, their economical and environmental effects - Meat Alternative Technology - Ingredients for Plant-Based Meats and Seafood - Good Manufacturing guidelines for Vegan Products - Industry Standards - Prerequisite Programmes
2. Mapping of critical points in sustainable vegan food production (raw material, processing, packaging) (12h) - The relationship between health and diet - The relationship between environment and plant-based diet

Learning Outcomes:

- Apply tools for traceability of VFP.
- Evaluation of production processes in terms of quality assurance in VFP.
- Choose the type of packaging and information for the label of VFP.
- Formulate the main rules in the developing and designing process of VFP and create a new VFP.
- Preparation of documents for the system & Test

Content of Unit:

1. Traceability
2. Assessment of quality of VFP by QACP
3. Labeling of VFP
4. Developing new VFP

Reading List for Unit:

1. Sikora, T., Strada, A. (2003). Safety and Quality Assurance and Management Systems in Food Industry: An Overview, available on line at http://www.ip.aua.gr/Studies/Sikora-Strada_final.pdf.
2. Van der Spiegel, M, Luning, P.A., Yiggers, G.W., Jongen, W.M.F. (2003), Towards a conceptual model to measure effectiveness of food quality systems, Trends in Food Science and Technology, 14, 424-431.
3. Boom, R. M., Dekker, M., & Esveld, D. C. (2005). Food production: trends in system innovation. In W. M. F. Jongen, &M. T. G. Meulenberg (Eds.), Innovation in agri-food systems (pp. 173e206). Wageningen: Wageningen Academic Publishers.
4. Luning, P.A., Marcelis, W.J. and Jongen, W.M.F. (2005) Food quality management: a techno-managerial approach. WNT, Warszawa
5. Hadi, J.; Brightwell, G. Safety of Alternative Proteins: Technological, Environmental and Regulatory Aspects of Cultured Meat, Plant-Based Meat, Insect Protein and Single-Cell Protein. Foods 2021, 10, 1226.
6. Fu, Y.; Chen, T.; Chen, S.H.Y.; Liu, B.; Sun, P.; Sun, H.; Chen, F. The potentials and challenges of using microalgae as an ingredient to produce meat analogues. Trends Food Sci. Technol. 2021, 112, 188–200.
7. Ramachandraiah, K. Potential Development of Sustainable 3D-Printed Meat Analogues: A Review. Sustainability 2021, 13, 938.
8. Wittek, P.; Karbstein, H.P.; Emin, M.A. Blending proteins in high moisture extrusion to design meat analogues: Rheological properties, morphology development and product properties. Foods 2021, 10, 1509.

Resources for Unit:

A fully equipped classroom; hardware and software for online teaching; Whiteboard; Projector, basics equipment and ingredients to VFP preparation.

3.2.3. Economy and Marketing

Aim of Unit:

This unit is aimed to delve deeper into the interwinding principles of economy, marketing and entrepreneurship. Throughout this unit the learner should be guided to appreciate the long term impact of research and development on business activities. Encouraging learners to be creative, innovative and ethical towards both shareholders and stakeholders. This should be in support of their ability to plan and manage projects in order to achieve objectives.
Being in touch with today's essential requirements dictates that any process embarked upon should rely on a circular economy concept and to be sensitive to the multidisciplinary view of the ecosystem of ideas, legislation and stakeholders at play in such scenarios. It is not enough to produce without taking into consideration the future outcomes of such production. Learners should not only be familiar with the concepts of the green economy, but also be able to identify areas where such activities can be implemented successfully.
Food safety is of paramount importance and reflecting this reality, the learners will be able to analyse a production supply chain identifying its hazards and to design a traceability system for the management of food safety problems.

Description of Unit:

Throughout this unit learners will become intrinsically familiar with assessing formal economic approaches and translate them into circular designs, based on concepts of sustainability and productivity. Learners will be exposed to theories that are proved to assist in shifting from linear to circular economy. Importance should also be given to the concepts of green economy. Learners should be familiar with the concept of global environmental concerns, that is, serious environmental issues of immediate global relevance and therefore considered to be of common interest; both in national and international scales.
In traceability the learners are required to master the correct terminology to express concepts relating to traceability, food safety and food quality. Learners must know principles of food safety legislation, food traceability and labeling. Moreover learners are to be exposed to blockchain technologies in order to be able to understand how such technologies can assist in food traceability. Blockchain's properties are to be discussed and applied to a food traceability scenario.
Learners will finally become familiar not only with the main theories related to entrepreneurship and business start-ups but will have the opportunity to explore, interact and learn from a number of first-hand situations. The challenges of working with diverse team members will provide the learners not only with the possibility to look at entrepreneurship ideas from different perspectives, but also to come up with more creative, original and feasible solutions to challenges that will arise.

This unit is composed of teaching topics:

- Circular economy
- Green economy concept
- Traceability (over Blockchain)
- Introduction to Entrepreneurship
- Assessment

Teaching Topics:

EQF7
Contact hours: 14 hours. Non-contact hours: 4 hours
1. Economics – economics of food (presentation pptx) – 1 h
2. Marketing (presentation pptx) – 3 h
3. Law (presentation pptx) – 5 h
4. Labelling and packaging (presentation pptx) – 5 h

Learning Outcomes:

- Construct a multidisciplinary view of the ecosystem of ideas, legislation and stakeholders at play in the Circular Economy.
- Evaluate Circular Economy opportunities and solutions in an food related organization sector
- Support an outlook for the green economy
- Examine Bio-diversity and ecosystem services
- Analyse a production supply chain and design a traceability system
- Assess the implications involved in product recalls and food fraud
- Appraise the value of research and development as an essential tool in the development and progress of business activity.
- Manage a market strategy, taking into consideration the ethical aspects that a business must take into consideration

Content of Unit:

1. Construct a multidisciplinary view of the ecosystem of ideas, legislation and stakeholders at play in the Circular Economy.
2. Evaluate Circular Economy opportunities and solutions in an food related organization sector
3. Support an outlook for the green economy
4. Examine Bio-diversity and ecosystem services
5. Analyse a production supply chain and design a traceability system
6. Assess the implications involved in product recalls and food fraud
7. Appraise the value of research and development as an essential tool in the development and progress of business activity.
8. Manage a market strategy, taking into consideration the ethical aspects that a business must take into consideration

Assessment for Unit:

Develop circular business plan for a food industry

Develop plan for blockchain implementation for food traceability

Reading List for Unit:

1. Barrow C., Barrow P., Brow R. (2012) The Business Plan Workbook
2. BURNS, P (2011) Entrepreneurship and Small Business. 3rd Ed. Basingstoke: Palgrave MacMillan.
3. CARTER, S. and JONES-EVANS, D. (2012) Enterprise and Small Business: Principles, Practice and Policy. London: Pearson.
4. CHARTER, M. (2018) Designing for the Circular Economy
5. DOWN, S. (2010) Enterprise, Entrepreneurship and Small Business. London: Sage.
6. DRESCHER, D. (2017) Blockchain Basics: A Non-Technical Introduction in 25 Steps
7. Evans, V., Tracy, B. (2014) The Standout Business Plan: Make It Irresistible and Get the Funds You Need for Your Startup or Growing Business
8. Griffin, M.P., (2015), How to Write a Business Plan: A Step-by-Step Guide to Creating a Plan That Gets Results, Fifth Edition
9. Hudson, K (2007), The Idea Generator: Tools for Business Growth
10. NEWTON, A. (2014) An Introduction to the Green Economy: Science, Systems and Sustainability
11. Svane, M., Adler, C. (2015) Startupland: How Three Guys Risked Everything to Turn an Idea into a Global Business
12. Tay, F. (2015), Turning Good Ideas Into Small Businesses
13. WEETMAN, C. (2020) A Circular Economy Handbook: How to Build a More Resilient, Competitive and Sustainable Business

Resources for Unit:

A fully equipped classroom; hardware and software for online teaching; Whiteboard; Projector.

3.2.4. Society and Visibility

Aim of Unit:

This unit aims to explore the links between the environment and food systems. Students should be guided to develop concern with the protection of natural resources and ecosystem services. Food systems and also food processing should contribute to the preservation and enhancement of environmental integrity, and contribute more broadly to the Sustainable Development Goals. They also must discuss the cause-effect relationships between environmental and food systems and to know which are the environmental performance indicators and tools to analyze the environmental impacts of different dietary options. Is also important to know how to communicate environmental issues to consumers. They should identify opportunities for rationalization of resources and new practices to improve environmental performance and formulate critical environmental thinking associated with processing and vegan diets.

Description of Unit:

In this unit, students will become familiar with the definition of food systems, with their contributions to the Sustainable Development Goals. The unit aims to develop students' understanding of the environmental impacts associated with food systems and diets in a context of respect for sustainability principles. It aims to lead students to understand and compare the effects of environmental changes, such as climate change, biodiversity loss, depending on the various food systems and diets, including veganism. It will permit to understand the importance of approaches to help integrate environmental concerns into food systems and diets and develop simple consumer information tools. Students will be engaged with the concept of the environment footprint and associated tools. They will compare the environmental performance of conventional and vegan food systems. They also will analyze and interpret data, synthesize information in order to validate conclusions and propose actions for environmental improvement in vegan processing.

Unit is composed of teaching topics:

- Food systems concepts
- Environment and food systems
- Environmental footprint
- Assessment

Teaching Topics:

EQF7
Contact hours: 30 hours. Non-contact hours: 2 hours
1. Food systems concepts (presentation pptx) – 8 h
2. Environment and food systems (presentation pptx) - 8h (2h online)
3. Environmental footprints (presentation pptx) - 12h (4h online + 4h visit)
4. Student seminar preparation + Test – 2 h

Learning Outcomes:

- Distinguish between food systems, sustainable and vegan food systems
- Discuss, from an environmental perspective, the differences between sustainable and vegan food systems
- Explain the contribution of vegan food systems to SDG 2030
- Explore the broad tools that can be used to make food systems sustainable
- Develop strategies for communicating about vegan food systems
- Compare the impact of food systems (including vegan food systems) on natural resources and ecosystems services
- Discuss the influence of effects of environmental issues into the vegan food systems (including land use, climate change and biodiversity loss)
- Explore some tools used to collect information about the impact of vegan diet in environmental issues (such as the use of big data, modeling and behavior change models)
- Propose food systems changes to achieve an environmental integrity
- Explore the environmental performance indicators associated with sustainable and vegan diet
- Discuss the how we collect data from individuals and how to translate that into a measure of impact
- Use some tools to collect information about environmental impacts of food systems and diets
- Use software tools to evaluate footprints diets, including vegan diet
- Discuss appropriate measures of environmental performance of the vegan food processing
- Calculate the environmental footprint of vegan diet
- Propose strategies to reduce environmental footprint
- Communicate the environmental footprint of vegan diet
- Public presentation of documents elaborated during classes

Content of Unit:

1. Distinguish between food systems, sustainable and vegan food systems
2. Discuss, from an environmental perspective, the differences between sustainable and vegan food systems
3. Explain the contribution of vegan food systems to SDG 2030
4. Explore the broad tools that can be used to make food systems sustainable
5. Develop strategies for communicating about vegan food systems
6. Compare the impact of food systems (including vegan food systems) on natural resources and ecosystems services
7. Discuss the influence of effects of environmental issues into the vegan food systems (including land use, climate change and biodiversity loss)
8. Explore some tools used to collect information about the impact of vegan diet in environmental issues (such as the use of big data, modeling and behavior change models)

9. Propose food systems changes to achieve an environmental integrity
10. Explore the environmental performance indicators associated with sustainable and vegan diet
11. Discuss the how we collect data from individuals and how to translate that into a measure of impact
12. Use some tools to collect information about environmental impacts of food systems and diets
13. Use software tools to evaluate footprints diets, including vegan diet
14. Discuss appropriate measures of environmental performance of the vegan food processing
15. Calculate the environmental footprint of vegan diet (using life-cycle assessment)
16. Propose strategies to reduce environmental footprint
17. Communicate the environmental footprint of vegan diet
18. Public presentation of documents elaborated during classes

Assessment for Unit:

Final test

Reading List for Unit:

1. Tim G. Benton et al, 2021. Food system impacts on biodiversity loss, Energy, Environment and Resources Programme.
2. McLaren, S., et al., 2021. Integration of environment and nutrition in life cycle assessment of food items: opportunities and challenges. Rome, FAO.
3. Dury, S., et al. eds. 2019. Food Systems at risk: new trends and challenges. Rome, Montpellier, Brussels, FAO, CIRAD and European Commission.
4. Environmental Footprints, by Kai Fang (Editor); Springer (2021)
5. Environmental Water Footprints; by Subramanian Senthilkannan Muthu (Editor); Springer (2019)

Resources for Unit:

A fully equipped classroom; hardware and software for online teaching; Whiteboard; Projector, Software for calculations of environmental footprints. Special time and organization for on-site visit to a vegan food processing plant.

3.3. Digitalization and Automatization

Digitalization and automatization is important in food industry to keep advanced, safe, high technology processing. With the introduction of Industry 4.0, smart factories, there are new opportunities to implement elements of industry 4.0 in vegan food processing.

This module provides detailed information about digitalization and automatization under below topics with suggested 12 ECTS credits:

- Automation
- ICT
- Robotics
- Electives

3.3.1. Automation

Aim of Unit:

Students will be able to differentiate between various automation systems and identify the components used in them. They will understand how automation systems work. Students will be knowledgeable of the structure, function and connections of relays and PLC drivers and the more common types of sensors and actuators. They will learn the idea behind the logic needed in automation technology.

Description of Unit:

In the Automation course, students will become familiar with automated systems. Unit is composed of teaching topics:

1. Introduction to Automation
2. Effective cooperation with automation specialists
3. Manual controlling of machines and processes
4. Programmable Logic Controllers (PLC)
5. PLC - Hardware
6. PLC - Software
7. Vegan Food Process Sensoring
8. Thermal Processing Control
9. Assessments

Teaching Topics:

EQF7
Contact hours: 40 hours. Non-contact hours: 69 hours
1. Introduction to Automation (3h in class/on-line)
2. Effective cooperation with automation specialists (1h in class/on-line)
3. Manual controlling of machines and processes (1h in class/on-line)
4. Programmable Logic Controllers (PLC) (2h in class/on-line)
5. PLC - Hardware (3h in class/on-line)
6. PLC - Software (3h in class/on-line; 20h practice)

7.	Vegan Food Process Sensoring (2h in class/on-line)
8.	Thermal Processing Control (2h in class/on-line)
9.	Assessments (3h)

Learning Outcomes:

- Operate effective cooperation with automation specialists
- Explain basic understanding of automated systems
- Identify common sensors in the automation of components and use cases for sensors
- Organize PLC and how it can be used in systems control units
- Design sensoring for specific vegan food processes
- Identify online offline need of sensoring
- Identify instruments and systems used in process automation, such as control rooms, control instruments and field buses in the process industry

Content of Unit:

1. Introduction to Automation
2. Effective cooperation with automation specialists
3. Manual controlling of machines and processes
4. Programmable Logic Controllers (PLC)
5. Vegan Food Process Sensoring
6. Thermal Processing Control

Assessment for Unit:

Project and exam

Reading List for Unit:

1. Edgar, T. F., Smith, C. L., Shinskey, F. G., Gassman, G. W., Waite A. W. R., McAvoy, T. J. & Seborg, D. E. (2007). Process control, in Perry's Chemical Engineers' Handbook 8th ed. R. H. Perry, and D. W. Green, eds. McGraw-Hill, New York, NY, US.
2. EN 1672-2:2020 Food processing machinery – Basic concepts – Part 2: Hygiene and cleanability requirements.
3. Fellows, P. J. (2017). Food Processing Technology: Principles and Practice. 4th edition. London: Woodhead Publishing Group.
4. Habib, Maki K. (2020). Advanced Robotics and Intelligent Automation in Manufacturing. IGI Global. Retrieved from
5. https://app.knovel.com/hotlink/toc/id:kpARIAM001/advanced-robotics-intelligent/advanced-robotics-intelligent
6. Kress-Rogers, E. Brimelow, C.J.B.. (2001). Instrumentation and Sensors for the Food Industry (2nd Edition). Woodhead Publishing. Retrieved from
7. https://app.knovel.com/hotlink/toc/id:kpISFIE008/instrumentation-sensors/instrumentation-sensors

8. Morgan, M. T. & Haley, T. A. (2019). Design of food process controls system. In M. Kutz (ed.) Handbook of Farm, Dairy and Food Machinery Engineering. 3rd ed. Amsterdam: Academic Press. https://doi.org/10.1016/B978-0-12-814803-7.00022-1

Thermal Processing Control

1. J. Castleman, in Coal Combustion Products (CCP's), 2017
2. Gregory W. O'Neil, ... Christopher M. Reddy, in Biofuels from Algae (Second Edition), 2019
3. Z. Boz, ... F. Erdoğdu, in Encyclopedia of Food Microbiology (Second Edition), 2014
4. Petr Stehlík, in Handbook of Process Integration (PI), 2013
5. P.E.D. Augusto, ... M. Cristianini, in Encyclopedia of Food Microbiology (Second E)

Resources for Unit:

1. A fully equipped classroom; hardware and software for online teaching;
2. Suggestions on software:
   - https://factoryio.com/ 30 day free trial available
   - https://www.plcfiddle.com/ ladder logic simulator - free.
   - Siemens Tia Portal - Siemens software
   - others

3.3.2. ICT

Aim of Unit:

The students are familiar with the digital transformation that faces the vegan food industry. They are able to use the current softwares, different online services and online learning environment. The student is able to apply basic information technology skills in new hardware and software environments.

Description of Unit:

In ICT courses, students will become familiar with information technology systems. Unit is composed of teaching topics:

- Industry 4.0 (3h in class/on-line; 5h practice)
- ICT unit (3h in class/on-line; 8h practice)
- Production function, data analysis using BI and Excel (6h in class/on-line; 12h practice)
- Assessments (3h)

Teaching Topics:

1. Industry 4.0
2. ICT unit

EQF7
Contact hours:15 hours. Non-contact hours: 60 hours
1. Industry 4.0 (3h in class/on-line; 5h practice
2. ICT unit (3h in class/on-line; 8h practice
3. Production function, data analysis using BI and Excel (6h in class/on-line; 12h practice)

Learning Outcomes:

- Arrange version control for natural origin raw material changes and properties
- Operate with basic ICT (working with human-machine interface; use different software, like traceability, IoT)
- Apply Manufacturing Enterprise System software for documentation

Content of Unit:

1. Industry 4.0
   - Internet of Things (IoT) and cloud computing
   - Additive production and 3D printing
   - Big Data
   - Visual technologies (augmented reality / virtual reality / computer vision)
   - Automation and intelligent robotics
   - Cybersecurity
2. ICT unit
   - Human-Machine Interface

- IoT Remote Monitoring
- AI
- Traceability Software

Assessment for Unit:

Project and exam

Reading List for Unit:

1. Bai, C., P. Dallasega, G. Orzes, and J. Sarkis. 2020. Industry 4.0 technologies assessment: A sustainability perspective. International Journal of Production Economics 229:107776. doi: 10.1016/j. ijpe.2020.107776.
2. Barbut, S. 2020. Meat industry 4.0: A distant future? Animal Frontiers: The Review Magazine of Animal Agriculture 10 (4):38–47. doi: 10.1093/af/vfaa038.
3. Bottani, E., Vignali, G., & Carlo Tancredi, G. P. (2020). A digital twin model of a pasteurization system for food beverages: Tools and architecture. 2020 IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC), 1–8. https://doi.org/10.1109/ICE/ITMC49519.2020.9198625
4. Da, X. L., E. L. Xu, and L. Li. 2018. Industry 4.0: State of the art and future trends. International Journal of Production Research 56 (8):2941–2962. doi: 10.1080/00207543.2018.1444806
5. Dalzochio, J., R. Kunst, E. Pignaton, A. Binotto, S. Sanyal, J. Favilla, and J. Barbosa. 2020. Machine learning and reasoning for predictive maintenance in Industry 4.0: Current status and challenges. Computers in Industry 123:103298. doi: 10.1016/j.compind.2020.103298.
6. Garg, D., Luthra, S., & Mangla, S. K. (ei pvm.). 9.3 Functional Roles of it in SCM. Teoksessa Supply Chain and Logistics Management. New Academic Science. https://app.knovel.com/hotlink/pdf/id:kt012NVIU1/supply-chain-logistics/functional-roles-it-in
7. Hassoun, A., Aït-Kaddour, A., Abu-Mahfouz, A. M., Rathod, N. B., Bader, F., Barba, F. J., Biancolillo, A., Cropotova, J., Galanakis, C. M., Jambrak, A. R., Lorenzo, J. M., Måge, I., Ozogul, F., & Regenstein, J. (2022). The fourth industrial revolution in the food industry—Part I: Industry 4.0 technologies. Critical Reviews in Food Science and Nutrition, 0(0), 1–17. https://doi.org/10.1080/10408398.2022.2034735
8. Hugos, M. (ei pvm.). 4.2.5 Enterprise Resource Planning (ERP). Teoksessa Essentials of Supply Chain Management (4th Edition). John Wiley & Sons. https://app.knovel.com/hotlink/pdf/id:kt0127YA81/essentials-supply-chain/enterprise-resource-planning
9. Jambrak, A. R., M. Nutrizio, I. Djekić, S. Pleslić, and F. Chemat. 2021. Internet of nonthermal food processing technologies (Iontp): Food industry 4.0 and sustainability. Applied Sciences 11:1–20.
10. Kayikci, Y., N. Subramanian, M. Dora, and M. S. Bhatia. 2020. Food supply chain in the era of Industry 4.0: Blockchain technology implementation opportunities and impediments from the perspective of people, process, performance, and technology. Prod Plan Control 33:301–321. doi: 10.1080/09537287.2020.1810757.
11. Khan, P. W., Y. C. Byun, and N. Park. 2020. IoT-blockchain enabled optimized provenance system for Food Industry 4.0 using advanced deep learning. Sensors 20 (10):2990. doi: 10.3390/s20102990.

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13. Lennon Olsen, T., and B. Tomlin. 2020. Industry 4.0: Opportunities and challenges for operations management. Manufacturing & Service Operations Management 22 (1):113–122. doi: 10.1287/ msom.2019.0796.
14. Scholten, B. (ei pvm.). MES Guide for Executives—Why and How to Select, Implement, and Maintain a Manufacturing Execution System. https://app.knovel.com/hotlink/toc/id:kpMESGEWH2/mes-guide-executives/mes-guide-executives
15. Soroush, M., Baldea, M., & Edgar, T. F. (ei pvm.). Smart Manufacturing—Concepts and Methods. https://app.knovel.com/hotlink/toc/id:kpSMCM0003/smart-manufacturing-concepts/smart-manufacturing-concepts

Resources for Unit:

A fully equipped classroom; hardware and software for online teaching;

3.3.3. Robotics

Aim of Unit:

Students will learn about various types of robots and examine robots and how to use them in factory automation and other areas where robots are needed. They will know the structure, features and coordinate systems of robots as well as the periphery devices used in robotics. Students will be competent in handling and programming industrial robots on- and offline. The course provides fundamental knowledge of robotics and an ability to design and select equipment for the automatic handling of products.

Description of Unit:

In the Robotics course, students will become familiar with robotic systems. Unit is composed of teaching topics:

- Introduction to Robotic Systems
- Industrial Manipulator Robots
- Robot Programming Languages and Techniques
- Collaborative Robotic Systems
- Assessments

Teaching Topics:

EQF7
Contact hours: 22 hours. Non-contact hours: 80 hours
1. Introduction to Robotic Systems (4h in class/on-line)
2. Industrial Manipulator Robots (10h in class/on-line)
3. Robot Programming Languages and Techniques (6h in class/on-line; 30h practice)
4. Collaborative Robotic Systems (6h in class/on-line)

5. Assessments (4h)

Learning Outcomes:

- Identify various types of robots
- Operate fault diagnostic of robots
- Recognise the structure, properties, co-ordinations of robots, as well as the additional devices used in robots
- Operate in handling and programming industrial robots using online and offline methods of programming
- Select devices for the automatic handling of products.
- Integrate devices for the automatic handling of products.

Content of Unit:

1. Introduction to Robotic Systems
2. Industrial Manipulator Robots
3. Robot Programming Languages and Techniques
4. Collaborative Robotic Systems

Assessment for Unit:

Exam

Reading List for Unit:

1. Gupta, A.K. Arora, S.K. Westcott, Jean Riescher. (2017). Industrial Automation and Robotics. Mercury Learning and Information. Retrieved from
2. https://app.knovel.com/hotlink/toc/id:kpIAR00001/industrial-automation/industrial-automation
3. Habib, Maki K.. (2020). Advanced Robotics and Intelligent Automation in Manufacturing. IGI Global. Retrieved from
4. https://app.knovel.com/hotlink/toc/id:kpARIAM001/advanced-robotics-intelligent/advanced-robotics-intelligent
5. Jaulin, Luc. (2019). Mobile Robotics (2nd Edition). John Wiley & Sons. Retrieved from
6. https://app.knovel.com/hotlink/toc/id:kpMRE00014/mobile-robotics-2nd-edition/mobile-robotics-2nd-edition
7. Mullakara, Nandan Asokan, Arun Kumar. (2020). *Robotic Process Automation Projects.* Packt Publishing. Retrieved from
8. https://app.knovel.com/hotlink/toc/id:kpRPAP0001/robotic-process-automation/robotic-process-automation

Resources for Unit:

A fully equipped classroom; hardware and software for online teaching: RokoDK, KUKA, ABB, Yaskawa…**https://robodk.com/**

3.4. Soft Skills

On a total of 4 ECTS credits, this training covers:

- Critical and innovative thinking,
- Ethical understanding,
- Intrapersonal and interpersonal skills
- Active listening
- Teamwork
- Leadership and team building

The Soft Skills trainings are presented differently from the trainings on Plant-based Processing, Green Skills and Digital and Automatization Skills.

They are described here as suggested to be delivered on EQF 4 to 7 trainings. The duration of activities is the suugested duration for trainings with the students. It is recommended that at the implementation of trainings on EQF 4 to 7, the Soft Skills trainnings are embedded in the other modules.

3.4.1. Critical and Innovative Thinking

Aim of Unit:

After this unit, students will recognize that decision-making and problem solving are competences that can and should be trained and developed; they will have gathered a few strategies to develop their mental plasticity and ability to decide and solve problems in various personal and professional domains.

Description of Unit:

In this unit students will become familiar with a range of strategies used for wise decision making and effective problem solving. The aims are to be accomplished through group dynamics; case studies; readings; metacognition and video watching. The unit is composed of teaching topics:

Teaching Topics:

EQF 4 to 7
Contact hours: 6 hours. Non-contact hours: 17 hours
1. Strategies used for wise decision making and effective problem solving
2. Learning from failure, thinking out of the box
3. Innovative solutions, thinking out of the box
4. Cooperative problem solving: The marshmallow challenge
5. Reflection and metacognition
6. Assessment (Student written essay and debate) (2h)
7. Self-Study (Non-Guided Learning) (10h): Novel literature update

Learning Outcomes:

- Understand the problem before making decisions and taking action.
- Evaluate available information for problem solving.
- Identify the reasonableness of the decision and find out alternatives.
- Take into account the consequences of the decision.
- Choose problem solving methods and procedure
- Apply relevant knowledge
- Evaluate the results of the decision.

Content of Unit:

1. Strategies used for wise decision making and effective problem solving
2. Learning from failure
3. Innovative solutions, thinking out of the box
4. Cooperative problem solving: The marshmallow challenge
5. Reflection and metacognition

Assessment for Unit:

Student written essay and debate

Reading List for Unit:

1. https://www.itseducation.asia/article/the-road-to-a-solution-generating-ideas
2. *https://www.itseducation.asia/article/finding-possible-solutions*
3. https://simplicable.com/new/decision-making
4. https://simplicable.com/new/problem-solving
5. *https://www.marshmallowchallenge.com/*
6. *https://www.youtube.com/watch?v=H0_yKBitO8M ted talk by Tom Wujec 'Build a tower, build a team'*

Resources for Unit:

A fully equipped classroom; hardware and software for online teaching; Whiteboard; Projector.

3.4.2. Ethical Understanding

Aim of Unit:

To support student to develop an understanding of the breadth of ethical judgements and factors that affect it.

Description of Unit:

In this unit the student will review the ethics principles, ethical judgment development and which factors can affect ethics judgments. Food ethics issues will be analyzed and discussed in a role play so students can understand the different possible ethical views on a single issue. Students will learn how to use the ethical matrix for decision making on ethics issues.

Teaching Topics:

EQF 4 to 7
Contact hours: 7 hours. Non-contact hours: 17 hours
1. Ethics principles 2. Stages of moral development 3. Factors that affects moral judgements Overview of ethics issues (food fraud, etc.) and what affects moral judgements (ethics principles, stages of moral development, factors that affect moral judgements). Give an overview to students of ethics issues in food (2h)
4. Food ethics issues Divide students in groups, assign to each group an issue and to each student a role according to the stakeholders (representatives of food industry, consumers association, policy maker, animal protection association, etc.). (1.5h)
5. Ethical matrix of Ben Mepham Explain the ethical matrix of Ben Mepham. Divide students in groups and assign an issue to each group. (0.5h)
6. Assessment (2h) Role playing (1.5h) Presentation of the ethical matrix (0.5h)
7. Self-Study (Non-Guided Learning) (14h): Search on an ethics issue, reflection on the ethical judgments of a given stakeholder (7h) Search on an ethics issue, reflection on the ethical judgments of all the stakeholders involved, and structure an ethics matrix (7h)

Learning Outcomes:

After this unit, students will be recognizing the breadth of ethical judgements and factors that affect it; they will be able to reflect on an ethical issue and to produce sound decisions considering the judgements of different stakeholders.

Content of Unit:

1. Ethics principles
2. Stages of moral development
3. Factors that affect moral judgements
4. Food ethics issues
5. Ethical matrix of Ben Mepham

Assessment for Unit:

- Role playing (1.5 h)
- Presentation of the ethical matrix (0.5 h)

Reading List for Unit:

1. Costa, R., Pittia, P. eds: Food ethics education. Springer International Publishing (2017)
2. Behave: The biology of humans at our best and worst, Sapolsky, Robert M. Penguin Press: New York, NY. 2017
3. FAO. 2021. Food fraud – Intention, detection and management. Food safety technical toolkit for Asia and the Pacific No. 5. Bangkok, https://www.fao.org/3/cb2863en/cb2863en.pdf

Resources for Unit:

- Classroom with projector
- Students with access to WWW.

3.4.3. Intrapersonal and Interpersonal Skills

Aim of Skills:

The aim of this unit is to highlight the importance of intrapersonal skills to enhance the student's self-awareness, self-discipline and self-management.

Description of Unit:

In this unit the students will be introduced to the difference between intrapersonal and interpersonal skills, and their importance for their personal and professional lives. Following that, students will work on their self-awareness and learn how a journey of self-awareness helps them to become more self-disciplined and organized. The unit is highly practical, although students will be expected to continue reflecting on topics discussed during their free time.

Teaching Topics:

EQF 4 to 7
Contact hours: 6 hours. Non-contact hours: 17 hours
1. Intrapersonal and Interpersonal Skills Greeting students; Expectations of students; Introduction of students; Observing different types of skills; Defining intrapersonal and interpersonal skills; Discussing the importance of

the different skills; Giving equal importance to intrapersonal and interpersonal skills; Sharing experiences where skills have improved. (2h)
2. Self-awareness Defining self-awareness; Activity - Who am I?; Activity - How I see myself and how I think others see me?; Activity - How others' perceptions affect me?; Different types of personalities; Myers-Brigss Test; Working in a team; Activity - Believing in myself. (2h)
3. Managing time, stress and organization Defining self-discipline and self-control; Activity - Resisting my mobile phone; Strategies to manage time better; Strategies to be more organised; Self-care assessment; Strategies to manage time better; Strategies to be more organized
4. Assessment (4h) Reflection on self-awareness and plans to address areas that require improvement
5. Self-Study (Non-Guided Learning) (15h): Further reading on intrapersonal and interpersonal skills (4h) Further reading on self-awareness; Mysers-Briggs Test and reflection (8h) Further reading on self-care (3h)

Learning Outcomes:

By the end of the unit, students will be able to:

- differentiate between intrapersonal and interpersonal skills
- understand that intrapersonal and interpersonal skills can be practiced and improved
- use different techniques to enhance self-awareness
- use different techniques to enhance self-discipline
- organise better their personal and professional lives

Content of Unit:

1. Intrapersonal and Interpersonal Skills
2. Self-awareness
3. Managing time, stress and organization

Assessmen for Unit:

Reflection on self-awareness and plans to address areas that require improvement

Reading List for Unit:

1. What self-awareness really is (and how to cultivate it), Harvard Business Review, 2018 https://hbr.org/2018/01/what-self-awareness-really-is-and-how-to-cultivate-it
2. An Overview of the Myers-Briggs Type Indicator https://www.verywellmind.com/the-myers-briggs-type-indicator-2795583
3. Maximizing Your Working Style – How to Identify and Develop your Work Style Type https://www.tonyrobbins.com/career-business/whats-working-style/
4. Manipulate Time With These Powerful 20 Time Management Tips

https://www.forbes.com/sites/johnrampton/2018/05/01/manipulate-time-with-these-powerful-20-time-management-tips/?sh=392bf44a57ab
5. Time Management Won't Save You, Harvard Business Review, 2021 https://hbr.org/2021/06/time-management-wont-save-you
6. Time Management is About More than Life Hacks, Harvard Business Review, 2020 https://hbr.org/2020/01/time-management-is-about-more-than-life-hacks

Resources for Unit:

- Classroom with projector and speakers
- Students with access to internet

3.4.4. Active Listening

Aim of Unit:

The aim of this unit is to call students attention to the importance of practicing active listening, give them the opportunity to learn a few techniques to improve it and use it to gain control over their teaching-learning process.

Description of Unit:

Active Listening is probably the most critical of interpersonal communication skills because it reinforces open communication, being an effective way for the students to gain self-understanding, feel understood, make the learning-teaching process easier, which is indeed basic and critical for any kind of apprenticeship. Thus, this Unit aims at making students understand that and help them in learning a few techniques to improve active listening in a way that will contribute to their successful autonomous learning.

Teaching Topics:

EQF 4 to 7
Contact hours: 8 hours. Non-contact hours: 17 hours
1. The meaning of Active Listening (2h) List situations when active listening is very important – classroom, workplace, interaction with professors, colleagues, clients, team leaders, etc. It is the most critical of interpersonal communication skills because it reinforces open communication, being an effective way for the students to gain self-understanding, feel understood, make the learning-teaching process easier.
2. Paying attention (2h) Paying attention Learn some techniques to improve active listening.
3. Managing time, stress and organization (2h) Defining self-discipline and self-control; Activity - Resisting my mobile phone; Strategies to manage time better; Strategies to be more organised; Self-care assessment; Strategies to manage time better; Strategies to be more organised

4. Show attentiveness and provide feedback (2h) Learn ways of showing they are listening by using body language and by providing feedback.
5. Appropriate responsiveness (2h) Learn how to respond appropriately through practice.
6. Assessment Continuous assessment is carried out throughout the delivery sessions.
7. Self-Study (Non-Guided Learning) (4h): Students are asked to find out websites and materials about active listening for further learning on these topics.

Learning Outcomes:

By the end of the unit, students will be able to:

- Understand what it takes to be a good listener.
- Understand the importance of paying attention.
- Know a few techniques to practice and improve active listening.
- Use body language (non-verbal communication through gestures, tone of voice, etc.).
- Provide feedback by questioning or asking for clarification.
- Show appropriate responsiveness.
- Show assertiveness with respect.
- Hold judgement.
- Paraphrase.

Content of Unit:

1. The meaning of Active Listening
2. Paying attention
3. Show attentiveness and provide feedback
4. Appropriate responsiveness

Assessment for Unit:

Continuous assessment is carried out throughout the delivery sessions.

Reading List for Unit:

1. https://www.youtube.com/watch?app=desktop&v=t2z9mdX1j4A&feature=youtu.be
2. http://files.teachingjedi.webnode.com/200000004-6f61f705bf/ActiveListening_RogersFarson.pdf
3. http://www.elanica.com/collaboratory/ActiveListening2020-spreads.pdf

Resources for Unit:

- Classroom with projector and speakers
- Access to internet
- Two texts, pen and paper

3.4.5. Teamwork

Aim of Unit:

The aim of this unit is to introduce the students to teamwork i.e. how to build up a team and how to empower employee based on the employees' competencies.

Description of Unit:

In this unit, a systematic team-building training is drawn up to teach the students to fill the skill gaps based on various cases. This action prepares the students to better understanding the need of various skills to enable employees to learn new skills needed in the team and to engage new workers employed. The teambuilding skills also enable the student how to act when applying for employment in a company and how to act as a team member in his/her tasks in the future. The team-building training will be based on theoretical classes and improvising in class in which the students are trained in various phases in the team development process. Here the teamwork skills are developed. Limitations and future research directions will also be discussed at EQF-level 7.

Teaching Topics:

EQF 4 to 7
Contact hours: 9 hours. Non-contact hours: 17 hours
1. Building blocks in teamwork principles (3h)
2. How to use the diversity of members' knowledge, when building a team (3h)
3. Steps on how to advance jointly, to persuade and to manage changes in teams (3h)
4. Assessment (3h) team-building exercise on a given case (0.5h) evaluation of the above-mentioned case performed in a group of 3-4 students (2h) oral exam on theory (2-3 tasks to explain individually) (0.5h)
5. Self-Study (Non-Guided Learning) (13h): reading literature (both found in the literature search and material given to the class), individual effort compiling a case presentation as a team to the class; individual effort.

Learning Outcomes:

By the end of the unit, students will be able to:

- is able to learn proper team habits
- is aware of the team structure
- understands how to create a team
- knows how to manage a team
- is able to empower both already available and new members in the team

Content of Unit:

1. Understanding of teamwork principles
2. Usage of the diversity of members' knowledge in building a team
3. Information on steps how to advance jointly, persuade and manage changes in the team

Assessment for Unit:

- team-building exercise on a given case
- evaluation of the above-mentioned case performed in a group of 3-4 students
- oral exam on theory (2-3 tasks to explain individually)

Reading List for Unit:

1. Bird. A., Mendenhall, M., Stevens, M.J. & Oddou, G. 2010. Defining the content domain of intercultural competence for global leaders. Journal of Managerial Psychology, 25, 810-828. DOI 10.1108/02683941011089107.
2. Brinck, L & Tanggaard., L. 2016. Embracing the unpredictable. Leadership, learning, changing practice. Human Resource Development International, 19, 374–387, http://dx.doi.org/10.1080/ 13678868.2016.1141607.
3. Bartel, j. 2018. Teaching soft skills for employability. ESL Canada Journal, 2018, 35, 78–92, http://dx.doi.org/10.18806/tesl.v35i1.1285.
4. Marasi, S. 2019. Team-building: Developing teamwork skills in college students using experiential activities in a classroom setting. Organization Management Journal, 16, 324-337, DOI: 10.1080/15416518.2019.1662761.
5. Paros, A., Taylor, M. & Yawson, R.M. 2020. Enhancing student understanding of networks using experiential learning. Organization Management Journal, 17, 173-183, DOI 10.1108/OMJ-05-2020-0930
6. Volkova, N., Lebid, O., Hrom, O., Zinukova, N. & Korobeinikova, T. 2021. Teamwork as an interactive educational technology at pedagogical universities. SHS Web of Conferences, 104, 03003. https://doi.org/10.1051/shsconf/202110403003.

Resources for Unit:

- Classroom with projector and speakers
- Access to internet
- Two texts, pen and paper

3.4.6. Leadership

Aim of Unit:

The aim of this unit is to introduce the students to the concept of leadership and help them understand how to develop and apply the basic principles of effective leadership.

Description of Unit:

In this unit, students will analyze the concept of leadership, different leadership styles, their characteristics and influence on the performance of groups and work teams.

Teaching Topics:

EQF 4 to 7
Contact hours: 16 hours. Non-contact hours: 17 hours
1. Defining leadership (1h)
2. Storytelling and Case studies (group work) (2h)
3. The elements of leadership (1h)
4. Role play – the good and the bad leaders (1h)
5. Self-Assessment and peer assessment (10h)
6. Project based learning (min 10h)
7. Readings (min 4h)
8. Assessment (2h) Self-Assessment and peer assessment (1h) Project based learning (results – group presentation) (1h)
9. Self-Study (Non-Guided Learning) (min 4h): Reading literature

Learning Outcomes:

By the end of the unit, students will be able to:

- Define leadership.
- Understand and explain how leadership operates in organizations.
- Identify his own strengths and development needs as a leader.
- Describe qualities and behaviours of effective leaders.
- Work effectively with other people, by applying leadership techniques related to specific situations.

Content of Unit:

1. Understanding the concept and principles of leadership
2. Recognize effective leadership styles through real examples.
3. Recognize effective leadership styles through real examples.
4. Participate in situations that make use of leadership qualities.

Assessment for Unit:

- Self-Assessment and peer assessment
- Project based learning (results – group presentation)

Resources for Unit:

Classroom; Library; readings.