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Methodological Handbook in Food Sustainability through Service-learning

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Methodological Handbook in Food Sustainability through Service-learning
Cantalejo, M.J.*, Aldaya, M.M., Vilches, C., Navarlaz, I., Murkovic, M., Siegmund, B., Pfeiffer, L., Ghnimi, S., Chriki, S., Dunne, J., Barry-Ryan, C., McMahon, C., Tomasi, S., Ferrara, A., Cavicchi, A., Toccoli, F.
NEMOS Erasmus+ Project 2021-1-ES01-KA220-HED-000027570: A new educational model for acquisition of sustainability competences through Service-learning.
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This work shall be cited as follows
CANTALEJO, María J.; Maite M. ALDAYA; Carlos VILCHES, Isabel NAVARLAZ; Michael MURKOVIC et.al. Methodological Handbook in Food Sustainability through Service-learning. Graz: Verlag der Technischen Universität Graz, 2024. Available from: Verlag der Technischen Universität Graz (distributor), https://doi.org/10.3217/978-3-85125-988-9.

Editorial author: Barbara Siegmund
Proofreading: NEMOS consortium
Layout: Xabi Angós
Pictures: Images were generated by Midjourney
Print: Buchschmiede (Dataform Media GmbH)

2024 Verlag der Technischen Universität Graz
www.tugraz-verlag.at

ISBN print 978-3-85125-988-9
ISBN e-book 978-3-85125-989-6
DOI 10.3217/978-3-85125-988-9

www.nemosproject.com

This publication is the outcome of in-depth consultations undertaken by the Erasmus+ NEMOS project consortium:

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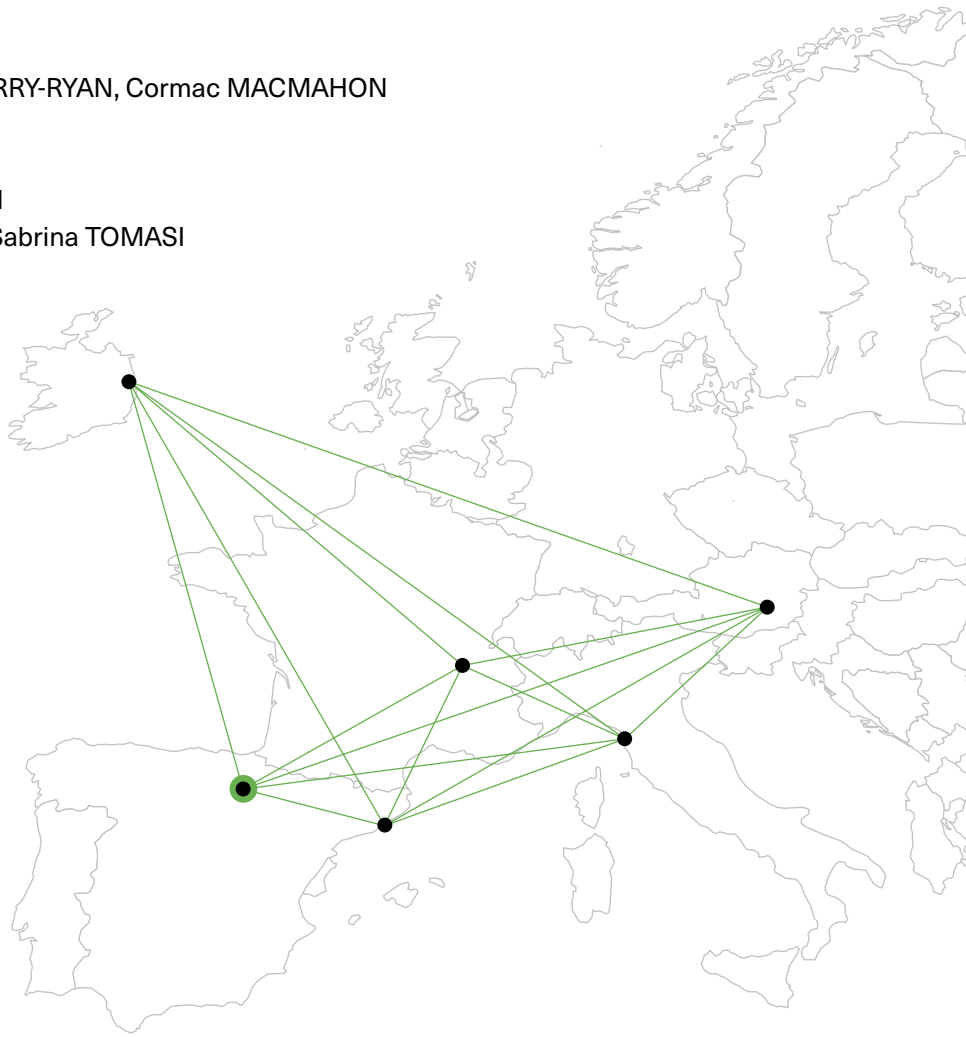

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"Tell me and I forget.
Teach me and I may remember.
Involve me and I will learn."

Benjamin Franklin

Acknowledgements

The NEMOS project -A New Educational Model for acquisition Of Sustainability competences through Service-learning- has been co-funded by the Erasmus+ programme of the European Union.

The Public University of Navarre (UPNA) is grateful to professors Carmen Almansa, Nerea Iturmendi, Montserrat Navarro, María Victoria Sarriés and Débora Villaño, for implementing the pilot projects in subject areas of the degree in Innovation in Food Processes and Products (GIPPA); to professor Natxo Irigoyen for his support and very useful advice.

The Technological University Dublin would like to thank the NEMOS fellows Orla Cahill, Fintan Moran, Azza Naik Silotry, Greg Burke, Ciara Walsh, David O'Connor, Michelle Giltrap and Sara Boyd for implementing the pilot projects in subject areas of the degree in Food Innovation, and to Graham O'Neill and to the Students Learning with Communities Unit for their support and useful advice.

The University of Pisa (UNIPI) sincerely acknowledges the professors of the Bachelor's and Master's degrees from the Department of Agriculture, Food and Environment who supported and participated in the implementation of the pilot activities: professors Marcello Mele, Lucia Guidi, Andrea Lucchi, Silvia Tavarini, Andrea Serra, Marco Landi, Giovanni Benelli, Claudio D'Onofrio and Giuseppe Conte.

1. Introduction

1.1 Introduction to the handbook

In 2022, the NEMOS project -A New Educational Model for acquisition Of Sustainability competences through Service-learning- was launched. This EU-funded project has been implemented in collaboration and partnership with five higher education institutions in Austria (TU Graz), Ireland (TU Dublin), Italy (UNIPI), France (ISARA-Lyon) and Spain (UPNA) and aims to take a step forward in the transition towards education for sustainability through practical and innovative educational approaches and interventions.

Within the framework of the project, a collaborative process has been initiated to pool the knowledge and experience of the five higher education institutions working together to implement in practice new educational models to effectively acquire sustainability competences through Service-learning in food-based degrees. Each institution had a different educational food-based programme and started from a different baseline in terms of experience and practice in implementing sustainability through Service-learning.

This handbook is the result of this joint work. It aims to bring together the key lessons learned, and the recommendations gathered throughout the process, with the objective of facilitating decision-making for teachers and higher-level educational institutions that want to start integrating or continuing to integrate and promote sustainability competences in the curricula and classroom daily practice.

There is no single way to use this handbook, depending on the interest of the reader, one can focus on its different parts.

Section 2 and 3	Address the definitions of key terms used in this handbook: sustainability and Service-learning. The latter, Section 3, also contains methods for the Service-learning educational approach.
Section 4	Describes the competencies and skills required by students to be knowledgeable of sustainability, including the definition of the Food Sustainability Profile for students and the soft and technical skills.
Section 5	Offers a collection of case studies of the 5 higher education institutions of the NEMOS project (ISARA-Lyon, TU Dublin, TU Graz, UNIPI and UPNA) as a means to illustrate the different ways for the implementation of sustainability competences through Service-learning in food degrees in different contexts.
Section 6	Summarizes the assessment methods that can be used to track progress and evaluate the effectiveness of the approach.

Another helpful section in the handbook are the **Appendixes**, which show examples of incorporation of sustainability competences through Service-learning in food-related courses and ideas for community service in the food sector.

The handbook contains new insights and possibilities through a range of Service-learning approaches and methodological suggestions that can be helpful for making teaching more transformational and engaging. However, there is still a great deal to be done to ensure that sustainability becomes an integral part of the educational path.

1.2 The NEMOS project

Sustainability is one of the main challenges set by the UN 2030 Agenda and food lies at the heart of this Agenda as sustainable consumption and production patterns greatly depend upon achieving sustainable food systems. Within this framework, the NEMOS project -A New Educational Model for acquisition Of Sustainability competences through Service-learning- links sustainability, Service-learning and food to demonstrate how the Sustainable Development Goals (SDGs) can be achieved through the training of university students.

The main objective of the NEMOS project is to design a new educational model based on the effective acquisition of sustainability specific and transversal competencies through the teaching methodology known as Service-learning, firstly in the field of food-related degrees. This may serve as a basis for application in other degree programmes and at other educational levels.

In summary, the main strategic milestones of the NEMOS project are the following ones (Figure 1):

1. Definition of a **food sustainability profile (FSP)** through a collaborative methodology between the different agents involved: educational community, social agents, companies and professionals.

2. Elaboration of a **methodological handbook (MH)** on food sustainability through Service-learning.

3. Construction of **evaluation tools** for the FSP and the MH through co-creation practices in Service-learning.

4. Rethinking a **new educational model** suitable for the acquisition of sustainability competences through green pedagogies and Service-learning.

The consortium of the project is composed of five European higher education institutions:

- Public University of Navarre (UPNA, Spain), coordinator of the project
- University of Pisa (UNIPI, Italy)
- Graz University of Technology (TU GRAZ, Austria)
- Technological University Dublin (TU DUBLIN, Ireland)
- Higher Institute of Agriculture Rhone Alpes I.S.A.R.A.-University of Lyon (ISARA-Lyon, France)

Also, the International Institute of Gastronomy, Culture, Arts and Tourism (IG-CAT, Spain), an EU-wide network, is one of the NEMOS partners and acts as a responsible for the dissemination of the project results.

This document, the methodological handbook on food sustainability through Service-learning developed in the context of the NEMOS project, is intended to be a practical tool for teachers helping them to provide students with the skills necessary for addressing sustainability within the curricula.

PR1 Defining a food sustainability profile through a community building methodology

State-of-the-art
Analysis of the sustainability embeddedness within the curricula.

Qualitative analysis
Focus groups/Interviews: students, lecturers, stakeholders.

Quantitative analysis
Questionnaires based on the qualitative analysis results.

OUTPUTS

Food sustainability profile

- Definition
- Soft and technical competences

PR2 Defining a methodological handbook in food sustainability through Service-learning

- Election of core and compulsory subject areas from each course of the food degree representative and aligned with sustainability goals.
- Engaging and training the academic staff on sustainability and Service-learning experiences.
- Identification and planning of pilot case studies by each lecturer for each subject area.
- Implementation of pilot case studies for the acquisition of sustainability competences through Service-learning in subject areas.

OUTPUTS

Case studies

- Title of the degree.
- Academic year.
- Credits: staff and participants involved.
- Method.
- Short description of the pilot cases: Methodology, Learning outcomes, Service.

PR3 Defining assessment tools of Food Sustainability Profile and Methodological Handbook by co-creation practices in Service-learning

- Identifying indicators, criteria and assessment tools for the validation of the incorporation of the sustainability competences within the subject areas of the degree.
- Definition of rubrics for assessment of the competences in sustainability.

OUTPUTS

Assessments tools

- Questionnaires to students,lecturers and social entities.
- Pre- and post-service questionnaires to students.
- Reflective journals.
- Examinations.
- Written reports.
- Oral presentations.
- Rubrics.

PR4 Defining a new educational model suitable for the acquisition of sustainability competences through green pedagogies and Service-learning

Transferability to other degrees and levels of education

- Engaging academic staff for interdisciplinary feedback collection for the transferability to other degrees and levels of education.
- Consolidating and synthesizing the learnings gained using green pedagogies in the context of University Strategic Plans, Quality Assurance, Curriculum design, and others, both for food and other disciplines.
- Developing guidelines for a pedagogical strategy with transferable recommendations and building capacity in higher education.

OUTPUTS

Guidelines for a pedagogical strategy of higher education

Figure 1. NEMOS quick guide for integrating sustainability competences through Service-learning in a systematic way throughout the degree. (PR: Project results).

2. Definition of sustainability and the agri-food sector

In 1987, the United Nations Brundtland Commission defined sustainability as "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987). Today, there are almost 140 developing countries in the world seeking ways of meeting their development needs, with the increasing threat of climate change. Concrete efforts must be made to ensure that current development does not negatively affect future generations. It seeks to reconcile economic development with the protection of social and environmental balance (EU, 2023).

2 billion adults are overweight or obese

In the context of the agri-food sector, the food industry has significant environmental, social, and economic impacts. Currently, the global food system is the largest freshwater user: agriculture alone accounts for 70% of freshwater withdrawn in the world (FAO, 2018). Agriculture is also responsible for 21–37% of total greenhouse gas (GHG) emissions (Crippa et al., 2021) and covers approximately 49–51% of global ice-free land surface (IPCC, 2019). Intensive and unsustainable agricultural practices and pollution can also trigger biodiversity loss (IPBES, 2019). On the other hand, an estimated 821 million people are undernourished, 151 million children under five years of age have stunted growth, 613 million women and girls aged 15 to 49 suffer from iron deficiency, and, on the other side, 2 billion adults are overweight or obese (Crippa et al., 2021).

Agriculture alone accounts for **70% of freshwater**

Agriculture is responsible for **21-37% of GHG emissions**

821 million people are undernourished

In the educational context, by developing a food sustainability profile for students addressing the three dimensions of sustainability, environmental, social and economic, universities can prepare students to tackle these challenges and contribute to the transition towards more sustainable food systems.

3. Service-learning

3.1 What is Service-learning

Service-learning is a teaching and learning method with the aim of combining commitment to society (**service**) with training in professional and social skills (**learning**). Service-learning is a process whereby students learn and develop through active participation in organised service experiences that meet community needs.

Within the framework of Service-learning projects, students engage in activities for the common good, linking the practical learning experience with theoretical training content and reflecting on it. An essential criterion is that the projects offer added value for the (partner) organisations involved, the participating students, university teaching and society as a whole. Service-learning thus combines educational goals with the assumption of social responsibility (Berthold et al., 2010).

Successful involvement in community-based service experiences not only enhance the academic experience, but also provide opportunities for students to develop leadership, project management and communication skills. A faculty can integrate Service-learning into a course in many ways, some are extensive and others not (Bartsch and Reiß, 2009).

Service-learning principles and core values

The Service-learning principles and core values, based on the AISA Service-learning Handbook (AISA, 2016) are included below:

1. Students learn from, and are enriched by, the **perspectives of others.**
2. We have a **responsibility to the community** in which we live.
3. Meaningful service is best achieved through **sustained reciprocal partnerships.**
4. Service has deeper meaning and consequences when **integrated into curriculum.**
5. Meaningful service is achieved through the **five stages/standards** of Service-learning: 1. Investigation, 2. Preparation, 3. Action, 4. Reflection and 5. Demonstration.
6. **Leadership, teamwork, communication and mutual respect** are fundamental for successful service experiences.

Service-learning related terms

There are different terms related to Service-learning that share a common thread of promoting active engagement, collaboration, and community involvement as part of the educational process. They encourage students to apply their knowledge and skills in real-world situations, deepen their understanding of social issues, and make a positive impact on their communities.

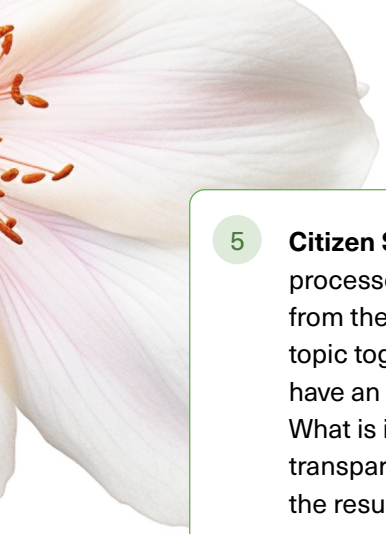
These terms place an emphasis on different dimensions of the approach, some highlight the centrality of civic learning, while others focus on the necessity of capacity building and reciprocal partnerships, and others focus on learning and knowledge acquired (CampusEngage, 2018a). Thus, the specific terminology used may vary based on the focus and objectives of the educational programme or research project, for example:

1. **Students Learning with Communities (SLWC):** In SLWC lecturer and community partners collaboratively design real-world projects for students to work on, as part of their studies, for mutual benefit. This is also known and Community Engaged Research and Learning (CERL) (TU Dublin, 2023).

2. **Community Engaged Research and Learning (CERL):** CERL aims to facilitate mutually beneficial collaborations between community partners, educators and students through small scale applied research projects that address community goals and enhance student learning (CIRCLET, 2023).

3. **Community-Based Learning (CBL):** is essentially a form of experiential education with a civic underpinning. The aspiration is that mutually beneficial relationships and partnerships develop between the community and those within the higher education institution. The ultimate goal is to develop graduates who have a wide and deep sense of their role as active citizens both personally and professionally (CampusEngage, 2018b).

4. **Community and Civic Engagement:** is a broad umbrella term used to signify the relationship between higher education and the wider society and signifies how the Higher Education Institution contributes to society in multiple ways, including economic, democratic, social and cultural (CampusEngage, 2018b).



5 **Citizen Science:** Citizen Science describes the participation of persons in scientific processes who are not institutionally bound in this scientific field. Participation can range from the short-term collection of data to intensive use of leisure time to delve into a research topic together with scientists and/or other volunteers. Although many volunteer researchers have an academic education, this is not a prerequisite for participation in research projects. What is important, however, is the adherence to scientific standards, which includes above all transparency with regard to the methodology of data collection and the public discussion of the results (OEAD, 2023).

6 **Participatory Action Research (PAR):** PAR is an approach to research that prioritises the value of experiential knowledge for tackling problems caused by unequal and harmful social systems, and for envisioning and implementing alternatives. PAR involves the participation and leadership of those people experiencing issues, who take action to produce emancipatory social change, through conducting systematic research to generate new knowledge (Cornish et al., 2023).

3.2 The goals of Service-learning

The main goal of Service-learning is to create a connection between community and campus assets for building strong, reciprocal, learning partnerships that meet societies needs and advance academic goals in a way that results in better understanding and learning for students. At the same time, Service-learning promotes service delivery for community partners, and it improves teaching for faculty. Service-learning requires students to recognise the relevance of an academic subject by applying classroom theories, perspectives, and ideas in a community setting. Students develop the ability to think critically and analyse complex social issues when they apply their coursework to a tangible community project.

Through direct experience, students personalise their relationship to social responsibility and civic engagement in the society. Service-learning also provides the opportunity for students to encounter the many ways that social structures contribute to or undermine the common good (Fahlberg and Fuller, 2014).

3.3 The benefits of Service-learning

The benefits to students, academic staff and community of engaging in Service-learning activities are presented in Table 1.

Table 1. Benefits to students, academic staff and community of engaging in Service-learning activities. Source: Berman (2015), CampusEngage (2018b).

Benefits to academic staff	Benefits to students	Benefits to the community
• Increased awareness of community issues related to a discipline and opportunities to connect teaching and research. • New perspectives and understanding of how learning takes place. • Facilitates multidisciplinary projects and networking with colleagues in other subject areas. • Opportunities for scholarship and publication. • Opportunities for learning (from community partners, peers and mentoring of students), sharing knowledge and ideas, and personal growth. • The identification of new research streams and highlighting the societal benefit of research. • Increased quality and attractiveness of their teaching.	• Application of academic knowledge and skills to the complexity of a real-world situation. • Exploration of future role as a professional and how they can contribute to the community. • Development of collaboration, critical-thinking, problem-solving, organisation and communication skills. • Improved self-confidence and self-efficacy. • Opportunities for learning (from community partners, peers, academic staff and own reflections), sharing knowledge and ideas and personal growth. • Opportunities for engagement in authentic research projects addressing real world problems and developing research skills.	• Development of projects that could not be realized due to cost-cutting measures or low funding. • Identification of problems and development of solutions. • Advances in science reach society directly and vice versa • Access to university resources. • Affordable access to professional development. • Exchange occurs that creates an important cycle for identifying social needs and developing targeted solutions.
Benefits to academic staff and students • No need to try to find time outside of work or college studies for civic engagement and meaningful involvement with communities. • The positive effects on student learning and retention associated with Service-learning contribute to greater satisfaction among staff and students. • Involvement in a more engaging and interesting learning experience for staff and students and reinvigoration of the curricula. • Working towards a common goal means that interactions between students and staff (and among students) are generally positive and an effective rapport develops. • Better understanding of social and civic responsibility.		

3.4 Ideas for community service in the food industry

This section delves into the practical avenues for community service opportunities that promote sustainable practices within the food sector. The examples presented here serve as a springboard for action, illustrating diverse ways in which Service-learning can be integrated into food degree programs, providing ideas to educators, students, and practitioners (Lions Club International, 2017; own elaboration). The examples are included below:

- Support the local food bank by donating time, equipment, or food.
- Host a healthy eating event at your school, community centre etc. invite a nutritionist as a keynote speaker.
- Deliver nutritious, prepared meals to the elderly, disabled or ill community members.
- Serve meals at a soup kitchen or homeless shelter.
- Bring a variety of fruits and vegetables to an elementary school class. Maybe explain to the students where the food comes from and what the health benefits are.
- Start a group to harvest unpicked fruits and vegetables from farms and donate them.
- Organise a community food drive, maybe focusing on collection items most needed in your area.
- Gather ideas for healthy, cheap, and sustainable recipes for a cookbook.
- Establish a community or school vegetable garden (urban gardening).
- Create a volunteer transportation programme to help individuals and families to get to grocery stores, food banks and soup kitchens.
- Help at your local farmers' market.
- Expanding farm-to-school programmes beyond lunch to bring local or regional food products into the School Breakfast programme.
- Readying producers to participate in school food service by providing training on Good Agricultural Practices (GAP) and other food safety-related topics.
- Encouraging increased consumption of fruits and vegetables through promotional activities, taste tests, and other activities.
- Inform children in public institutions about traditional and modern food processing.
- Get involved in urban gardening or sustainable/resilient food production projects.
- Develop sustainable food concepts for the community (short transport, reduce food waste/loss, acquaint local food producers).
- Disseminate knowledge on "sustainable" eating habits (e.g., less meat, more vegetable) in the local community.

3.5 Service-learning: models and methods

While there are a number of models of Service-learning, most Service-learning experiences can be described in the following five categories (Heffernan, 2002):

1 **"Pure" Service-learning**
Students are sent out into the community to serve, the goal is the service to communities by students, volunteers or engaged citizens. Not typically lodged in any one discipline.

2 **Discipline-Based Service-learning**
Students are expected to have a presence in the community throughout the semester and reflect on their experiences regularly throughout the semester.

3 **Problem-Based Service-learning**
Students work with community members to understand a particular problem or need. Students will have some knowledge beforehand they can use to make recommendations to the community or develop a solution to the problem.

4 **Capstone Courses**
These courses ask students to draw upon the knowledge they have obtained throughout their coursework and combine it with relevant service work in the community. The goal is to explore a new topic or to synthesize students' understanding of their discipline. It is a way to help students make the transition from the world of theory to the world of practice. Usually, these capstone courses are offered to students in their final year.

5 **Service Internships**
Service Internships are more intense than a typical Service-learning course, with students working as many as 10 to 20 hours a week in a community setting. Students are charged with producing a body of work that is of value to the community. The difference between traditional internships and service internships is that service internships offer regular and ongoing reflective opportunities that help students analyse their new experiences. Also the focus of service internships differs from the traditional internship: the students and the community should benefit equally from the experience.

Furthermore, Service-learning can either be integrated as an optional component or as a required course component.

A - Optional Course Component:
Service and accompanying reflection are offered as an alternative to a quiz, particular readings, other experiential learning activity, or a research assignment.

B - Required Course Component:
A course requires students to engage in some form of community service (one-time or ongoing, individually or with a group) and complete one or more reflective essays or other activities related to the service experience.

Both strategies can be effective, and each has advantages and disadvantages. If Service-learning is optional, you would give them the choice to do another project, like a research article. All students will have a common experience to draw on during class discussions if Service-learning is necessary. Facilitating student reflection and discussion on Service-learning will be made simpler as a result. There is a risk of sending students into the community who do not want to be there when Service-learning is necessary (Furco, 2002).

Implemented in over **1000 colleges and universities**

Implementation of Service-learning

Service-learning has been already implemented successfully in over 1000 colleges and universities across the globe, especially in the United States and Canada. When Service-learning is well designed and managed, it can contribute to the learning and growth of students. According to Bringle and Hatcher (1996) and Jenkins and Sheehey (2011) the implementation of Service-learning follows a four-stage scheme. The essential steps are:

1 Preparation — 2 Implementation — 3 Assessment/Reflection — 4 Demonstration

Detailed steps:

1 Preparation

First, a need in a community must be identified and the goals/objective for the Service-learning project established. The preparation includes:

- Course description.
- Integration of Service-learning projects into the course content.
- Project description and requirements.

2 Implementation - Performing the service

Implementation of Service-learning should include frequent connections of the project to academic content. The Service-learning project should facilitate a learning relationship whereby the service experience enhances the academic understanding and a better understanding enhances the service experience.

- Prior to allowing students to begin a project, provide a foundation for Service-learning as a philosophy and as pedagogy.
- Student support and feedback throughout the project.

3 Assessment/Reflection

A crucial part of Service-learning is reflection, and it is reflection that sets Service-learning apart from volunteerism. Reflection gives teachers the tools to evaluate the experiential learning that takes place when students engage in volunteer work outside of the classroom. Additionally, reflection enables students to link newly learned information with the formal knowledge acquired from class activities and resources by synthesising the facts seen during service activities.
Some ideas for reflection are (Kiely, 2015):

Group discussions
Throughout the semester, students engage in group discussions to reflect on their Service-learning experiences. Initially, they delve into the identified problem and how their organisation addresses it, pondering their role and preconceptions. As the term progresses, they assess how their Service-learning aligns with course goals, sharing their experiences and evaluating effectiveness. Towards the end, the focus turns to personal growth, changed beliefs, and their impact on the community, as they consider how others can address the issue. These discussions encourage comprehensive learning and meaningful community involvement.

Journaling
Journaling provides students with a chance to hone their writing skills, express and dissect their service encounters, and chronicle their advancements in achieving their educational goals.

Papers
Alternative to the journal students can deliver a final paper on the course at the end of the semester.

Portfolios

Presentations

Appendix III is a guide for reflective practice which has been compiled as part of the NEMOS project. It includes resources to assist students with reflective writing, and to support academic staff in conducting reflective assessments as part of sustainability-related service-learning activities, including guidance with designing and grading reflective assessments.

4 Demonstration

Demonstration allows students to discuss and openly exhibit their work through different formats such as displays, performances, and presentations where they validate what they learning through the project and how they learned it, as well as to share the learning with others.

4. Sustainability competences for food degrees

4.1 Development of a Food Sustainability Profile for Students

To develop the Food Sustainability Profile (FSP) for Students an in-depth analysis of the competences of sustainability and their embeddedness within food curricula was performed through the community building method by the 5 universities involved in the NEMOS project. All the partners reviewed the existing food-related degrees curricula and courses. This analysis integrated the following tasks:

A **Experts curricula analysis in every university.** A food degree lecturers' team reviewed every subject offered in the existing curricula, with special attention to the technical skills pursued, their link with SDGs and sustainability and the way to really improve or integrate this skill in them.

B **Lecturers, students and stakeholders (local food industries and civil society organisations related to food and sustainability) SDGs and sustainability survey.** The objective of this survey was to find out how lecturers and students feel about sustainability in the degrees they are teaching or studying in, if they considered that these degrees answer to the actual sector needs in terms of sustainability, if they felt that the students would be prepared to integrate in their future work skills and know-how in topics like climate change, preserve biodiversity, culture of food and local awareness, water and energy, what development means, responsible consumption and production, etc. In the case of stakeholders, the aim of this survey was to find out the skills and technical capacities they would ask for future professionals involved in sustainability. In order to get a significant sample of the survey, the partners tried to get at least 50% of the students and 75% of teachers involved in food-related degrees participation. In the case of stakeholders, relevant companies, and organisations, including regional and local governments departments, answered the survey. The student, lecturer and stakeholder questionnaires for quantitative research can be found in Appendix II.

C **Multidisciplinary experts focus groups in every university and country involved in the project.** The objective of this activity was to obtain a more expert opinion on the incorporation of the 2030 Agenda and SDGs in food-related degrees. A multidisciplinary, bottom-up approach in sustainability was the common thread of the sessions. Every university organised at least four focus groups of 4 to 6 experts coming from different backgrounds, including social and economic ones. In addition to aspects related to technical training in food degrees, other aspects such as social and cultural importance of local identity were considered. Experts, local stakeholders, such as small local companies, social and solidarity economy companies, consumer associations, local food producers, food quality control organisations as well as teachers and students participated in the focus groups.

Based on the data generated during the three processes of the review above, through a quantitative and qualitative social research analysis, the main challenges and needs to be implemented in the existing curricula were identified, in order to get a real bottom-up approach of sustainability in food-related degrees. The questions used for the student, lecturer and stakeholder interviews and focus group qualitative research are included in Appendix I.

A Food Sustainable Profile was designed including the different attributes pursued in a food graduated student, including technical, social and transversal skills.

4.2 Definition of a Food Sustainability Profile for Students

The NEMOS partners collected a series of insights about the ideal competencies and skills of a food graduated student from the qualitative and quantitative analysis involving interactions with students, teachers and stakeholders, which were summarised in the definition of a Food Sustainability Profile.

In the frame of the NEMOS project, the definition of the FSP for students is the following:

- Undergraduate students have received transversal training, throughout the whole curriculum and with different levels of deepening, in social, economic and environmental sustainability.

- Different aspects related to sustainability appear throughout the entire degree (or Master's degree) in the scientific and theoretical parts as well as in the projects. The Service-learning methodology supports and reinforces the acquisition of these competencies and skills on sustainability that the students receive, and this also leads to a change in their personal attitudes and way of life.

- There is a close relationship between the university and the entrepreneurial network and social agents to develop Service-learning projects on sustainability.

The main transversal competences and technical and scientific competences in relation to food sustainability are summarised below.

4.3 Competences of Students for Sustainable Food Systems

The competences and skills required by students to be knowledgeable of sustainability are both soft skills, applicable to all professions, and technical or hard skills, which are specific to individual professions.

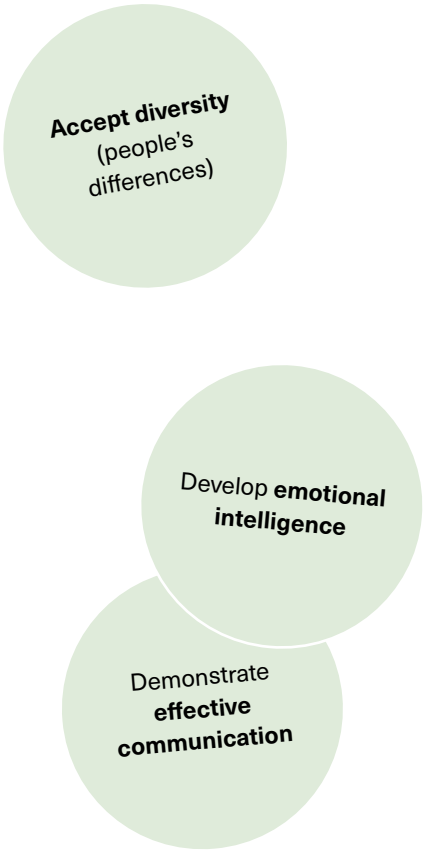
4.3.1 Soft skills

According to the NEMOS questionnaires to students, lecturers and stakeholders, the four fundamental pillars that the student body should acquire are:

1. Transversal and systemic vision to provide sustainability in all three aspects: social, environmental and economic.
2. Interaction with future changes (enthusiastic, digital, social, etc.) with reactivity, adaptation and curiosity.
3. Critical thinking and problem solving.
4. Methodological rigour.

The main transversal competences and skills that develop sustainability are:

1. Ability to adapt to change.
2. Teamwork and collaboration skills.
3. Systems thinking and holistic vision.
4. Relational skills and listening skills (empathy).
5. Problem solving.
6. Critical thinking.
7. Leadership and ability to set priorities.



The identified soft competences that foster a sustainability mindset, promoting ways to think, plan and act with empathy, responsibility, and care for our planet and for public health, are similar to those suggested by the by the European Commission GreenComp competence framework for sustainability (Bianchi et al., 2022) but also include the teamwork and communication skills. In line with the European Entrepreneurship Competence Framework (EntreComp) (Bacigalupo et al., 2016; McCallum et al., 2018), teamwork, so-called "working with others", is defined as a team up, work together, and network: work together and cooperate with others to develop ideas and turn them into action and; Solve conflicts and face up to competition positively when necessary. This can include the following threads: accept diversity (people's differences), develop emotional intelligence, listen actively, team up, work together or expand your network. While communication, so-called "Mobilising others", is defined to inspire, engage and get others on board: Inspire and enthuse relevant stakeholders; Get the support needed to achieve valuable outcomes and; Demonstrate effective communication, persuasion, negotiation and leadership

(Bacigalupo et al., 2016; McCallum et al., 2018). Table 2 summarises the main 14 soft skills that ideally students should acquire.

Table 2. Areas, competences, and descriptors of the soft skills required by students to be knowledgeable of sustainability. Source: adapted from Bianchi et al. (2022).

Area	Competence	Descriptor
1. Embodying sustainability values	1.1. Valuing sustainability	To reflect on personal values; identify and explain how values vary among people and over time, while critically evaluating how they align with sustainability values.
	1.2. Supporting fairness	To support equity and justice for current and future generations and learn from previous generations for sustainability.
	1.3. Promoting nature	To acknowledge that humans are part of nature; and to respect the needs and rights of other species and of nature itself in order to restore and regenerate healthy and resilient ecosystems.
2. Embracing complexity in sustainability	2.1. Systems thinking	To approach a sustainability problem from all sides with methodological rigor; to consider time, space and context in order to understand how elements interact within and between systems.
	2.2. Critical thinking	To assess information and arguments, identify assumptions, challenge the status quo, and reflect on how personal, social and cultural backgrounds influence thinking and conclusions with methodological rigor.
	2.3. Problem framing	To identify, analyse and define current or potential challenges as a sustainability problem in terms of difficulty, people involved, time and geographical scope, in order to identify suitable approaches to anticipating and preventing problems, and to mitigating and adapting to already existing problems.
	2.4. Communication	To effectively convey and exchange ideas and findings, including both verbal and written skills.
	2.5. Teamwork	To effectively work in teams and collaborate with diverse stakeholders.
3. Envisioning sustainable futures	3.1 Futures literacy	To envision alternative sustainable futures by imagining and developing alternative scenarios and identifying the steps needed to achieve a preferred sustainable future.
	3.2 Adaptability	To manage transitions and challenges in complex sustainability situations and make decisions related to the future in the face of uncertainty, ambiguity and risk.
	3.3 Exploratory thinking	To adopt a relational way of thinking by exploring and linking different disciplines, using creativity and experimentation with novel ideas or methods.
4. Acting for sustainability	4.1 Political agency	To navigate the political system, identify political responsibility and accountability for unsustainable behaviour, and demand effective policies for sustainability.
	4.2 Collective action	To act for change in collaboration with others.
	4.3 Individual initiative	To identify the own potential for sustainable actions and to actively contribute to improving prospects for the community and the planet.

4.3.2 Hard skills

Concerning the hard skills, the questionnaires highlighted that the main technical and scientific competences and skills that develop sustainability are:

1. Holistic and systemic approach to complex phenomena considering the 3 pillars of sustainability: social, environmental and economic.
2. Knowledge of sustainability tools in agri-food systems: life cycle assessment, techno-economic analysis, social life cycle assessment, food laws/ regulations, etc.
3. Energy, digital and social developments.
4. Knowledge based on experience.
5. Ability to link theory and practice.

Table 3 summarises the specific scientific and technical competences required by students to be knowledgeable of food sustainability in the context of food degrees. A comprehensive list is provided, but according to the different courses a selection could be made. As the understanding of sustainability and the challenges facing the food industry evolves, the topics and competences required by professionals in this field may also need to be modified in the future.

Table 3. Technical areas and competences required by students to be knowledgeable of food sustainability. Source: NEMOS partners.

Area	Competence
1. Agriculture and farming practices	1.1. Conventional and organic farming practices.
	1.2. Conservative and sustainable soil management techniques.
	1.3. Integrated pest management and natural pest control methods.
	1.4. Biodiversity and ecosystem health promotion in agriculture.
	1.5. Food plant varieties or animal breeds with lower environmental impact.
2. Sustainable sourcing and supply chain management	2.1. Sustainable sourcing practices for ingredients and raw materials.
	2.2. Ethical trade and ethical supply chain standards.
	2.3. Evaluation and selection of suppliers based on sustainability criteria.
	2.4. Optimising supply chains to reduce environmental impact.
3. Waste reduction and resource management	3.1. Implementation of waste reduction strategies in food production and processing in a circular economy context.
	3.2. Composting and recycling techniques for food waste.
	3.3. Water and energy conservation methods.
	3.4. Sustainable packaging alternatives and waste management practices.
4. Food product development	4.4. Processing methods to reduce waste and environmental impact.
	4.5. Development of products that need less resources and produce less waste.

Area	Competence
5. Sustainable food systems and policy	5.1. Agrifood circular bioeconomy frameworks and principles.
	5.2. Food policy and regulations related to sustainability.
	5.3. Food sovereignty and local food systems.
	5.4. Traceability, food safety, regulation, and compliance.
6. Life cycle assessment and environmental impact	6.1. Interconnections between food production, water, greenhouse gas emissions, climate change, and land use.
	6.2. Life cycle assessments of food products.
	6.3. Analysis and quantification of environmental impacts of food production and consumption (cradle to grave).
	6.4. Carbon footprint calculations and mitigation strategies.
	6.5. Identification and implementation of sustainable practices throughout the food life cycle.
	6.6. Importance of biodiversity in ecosystems and in sustainable food production.
7. Social impact assessment	7.1. Potential for positive and negative consequences of activities on communities, workers, and society as a whole.
	7.2. Principles and methodologies of social life cycle assessment to evaluate the social impacts of food systems. This includes identifying and analysing social hotspots, such as labour conditions, human rights, community health, and social inequalities, throughout the various stages of the food life cycle.
8. Consumer engagement and education for sustainable food consumption	8.1. Marketing strategies that promote sustainable food products and practices.
	8.2. Consumer behaviour and preferences related to sustainable food choices.
	8.3. Food ecolabelling and certification schemes related to sustainability.
	8.4. Consumer education and engagement on sustainable food choices.
	8.5. Sustainable nutrition principles and healthy eating patterns.
	8.6. Development of educational programmes and campaigns on sustainable food practices.

5. Case studies of Service-learning for food sustainability

This section offers a collection of case studies of the 5 higher education institutions of the NEMOS project: ISARA (Table 4), UPNA (Table 5), TU Dublin (Table 6), UNIPI (Table 7), TU Graz (Table 8), as a means to illustrate the different ways of implementation of sustainability competences through Service-learning in food degrees in different contexts and starting from different baselines.

Further examples of incorporation of sustainability competences through Service-learning in food-related courses are included in Appendix IV.

Table 4. Embedding sustainability competences through Service-learning at the Institut Supérieur d'Agriculture Rhône-Alpes in Lyon (ISARA-Lyon).

Embedding sustainability competences through Service-learning at ISARA

Title of the degree	Master's degree in Food, Agriculture and Environmental Sciences.
Academic year	2022-2023.
Subject areas	Diagnosis in agronomy and animal sciences, active project, transdisciplinary analysis of territories, management of agroecosystems, sustainable development in food industries.
Credits	42 ECTS in total.
Staff and participants involved	6 professors, social enterprises, farmers, social entities, technical centres, Master students.
Method	At ISARA, these activities are implemented for the acquisition of sustainability competences through Service-learning within 5 compulsory subject areas. A working group has been set up to define the pilot cases and refine the assessment tools.

	2022			2023										
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Sep	Oct	Nov	Dec
1. Launch of the project														
1.1. Regular meetings														
2. SL inclusion with students and professors														
3. MH in food sustainability through SL														
4. Implementation of sustainability through SL														
4.1. Definition of activities/assessment tools														
4.2. Implementation/assessment of SL activities														

Short description of the pilot cases

01 **Improving the economic, social and environmental sustainability of farming systems**
Subject area: diagnosis in agronomy and animal sciences

Methodology	Students work on a real case study of a local farm located in the Monts du Lyonnais region to implement a diagnostic approach based on technical, economic, social and environmental systemic approach.
Learning outcomes	Understand and analyse the running of a livestock farm, including the implementation of a diagnostic approach taking into account the economic, social and environmental pillars.

Service	Provide the farmer with the summary of the farm management, highlighting the technical, economic, social, and environmental determinants of breeding practices.

02 Sustainable development in food industry: how to implement and manage sustainable projects with social enterprises

Subject area: Sustainable development in food industries

Methodology	Applied projects with social enterprises are selected (carbon footprint, corporate social responsibility - CSR, sustainable food packaging, ecolabels, eco-score, R&D, etc.) and presented to the students to work for approximately 6 weeks full time on the topic. Students provide the social enterprise with a full diagnosis and solutions to the proposed problem based on the theoretical and practical knowledge gained during the 5 years programme.
Learning outcomes	The students understand the challenges that food sector is facing and acquire ability for a systemic approach to sustainability issues. They learn how to manage food industrial operations in a sustainable manner within a complex environment.
Service	Social enterprises received valuable inputs (technical, economic, environmental) on how to improve the sustainability of their operations (CSR, R&D, sourcing, packaging, carbon footprint, etc.).

03 How to engage students in the community?

Subject area: Active project

Methodology	Projects take the form of an associative, civic, or environmental responsibility. They must be attached to a structure hey must be recorded in the diploma supplement.
Learning outcomes	Develop students' soft skills such as initiative, creativity, autonomy, responsibility, leadership, openness, sense of dialogue, organisation, etc. and promote self-awareness and understanding of others. Students will be able to communicate concisely both orally and in writing.
Service	Provide support to seniors, sustainable projects through an organisation, help the visually impaired people, help child with academic difficulties to connect and motivate them to regain confidence in their ability to work and succeed, provide necessities for people in need (students, homeless people, etc.).

04 Management of sustainable agroecosystems

Subject area: Management of agroecosystems. Implications from policies and nature conservation

Methodology	Students will have to use the acquired knowledge to a) develop a topic related to agroecosystems management and present it in a poster session to the other students and b) actively debate taking a stakeholder role with other students/stakeholders on specified topics related to agroecosystem management.
Learning outcomes	Get familiar with different types of policies and regulations that are important for the management of agroecosystems and learn how they are used to influence management and allow sustainability transitions.
Service	Debate with stakeholders on selected topics and propose solutions.

05 **Agroecological innovations for more sustainable agricultural production**
Subject area: Agro-ecological transition in action

Methodology	Different projects are carried out in groups throughout the semester with technical centres, social companies, associations, farmers' organisations, and research institutes. Two three-week periods are made available during the semester to facilitate field work (surveys, experiments, etc.). At the end of the semester, each group delivers a written and oral presentation to the sponsors of the project.
Learning outcomes	The students will be able to respond to a request from a stakeholder concerning a specific issue linked to the agro-ecological transition of farming systems and territories and agro-ecological innovations for more sustainable agricultural production.
Service	Technical solution to improve the sustainability of the agricultural production.

Assessment tools

Students service reflection, questions to students, social entities, and lecturers.
Different rubrics are used for the assessment of the Service-learning experience.

Table 5. Embedding sustainability competences through Service-learning at the Public University of Navarre (UPNA).

Embedding sustainability competences through Service-learning at UPNA

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Universidad Pública de Navarra
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Title of the degree	Bachelor's degree in Innovation in Food Processes and Products.
Academic year	2022-2023
Subject areas	Business, entrepreneurship and innovation in the food business, nutrition and health, innovation in food products, quality control and management in the primary sector, food design and development I and II, quality, safety, and project management in the food industry.
Credits	48 ECTS in total.
Staff and participants involved	7 professors, 2 experts on sustainability and Service-learning, Bachelor students and social entities.
Method	The UPNA designed and implemented a model of activities for the acquisition of sustainability competences through Service-learning within 8 compulsory subject areas of the food degree. A working group with the academic staff responsible of these subjects and UPNA experts on sustainability and Service-learning collaborated in the design and implementation of the pilot activities. Two workshops were carried out to train the teachers on Service-learning and sustainability approaches and several meetings were held to programme and land the activities.

	2022			2023						
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July
1. UPNA roadmap of implementation of the pilot for the acquisition of food sustainability competences through service learning										
1.1. Launch of the UPNA teacher working group										
1.2. Training the teachers: • Service-learning approaches • Sustainability and environmental footprints										
1.3. Teacher working group meetings										
1.4. Implementation of sustainability through Service-learning in the UPNA food degree										
1.5. Paper publication										
2. Development of the "Methodological handbook in food sustainability through Service-learning" leaded by TU Graz										
2.1. Development of the methodological handbook										

Short description of the pilot cases

01 A more sustainable university canteen: Design Thinking

Subject area: Entrepreneurship and innovation in the food business

Methodology	The students looked for a theme and information on a specific subject (meat/veganism debate) (first awareness raising part). Then, they designed an innovation to be carried out at the university canteen in order to incorporate this aspect of sustainability, using Design Thinking.
Learning outcomes	Students learned to think critically, to obtain reliable information, less widespread, on farm practices and the food industry, for decision-making and became aware of healthy eating.
Service	Knowledge was disseminated among university students on the impact of meat consumption/ vegetarianism.

02 Evaluation of diet and lifestyle habits in university students

Subject area: Nutrition and health

Methodology	The students, distributed in working groups (5-6), brainstormed about the nutritional needs of student population, and developed of a food frequency questionnaire. Each group conducted interviews to a different degree along a three-week period and analysed the data. A summary-guide was developed for students.
Learning outcomes	The students acquired knowledge about the nutritional needs and recommended intakes of a specific population, management of dietary guides, management of food frequency questionnaires and qualitative evaluation of the diets.
Service	Information about dietary habits of the university population within the personal context of students was obtained. Students from other degrees became more conscious about their dietary habits and which are key points to improve.

03 Sustainable innovations in the food sector: breaking the gap between students and professionals

Subject area: Innovation in food products

Methodology	Talks in the classroom were given to students by food industry experts professionals with experience in sustainability in the sector. The students provided proposals to the industry. For instance, in the case of a zero-waste company, students proposed alternative uses to the by-products and residues. Visits to zero waste food companies were organised to learn how to reuse residues and by-products to give them added value.
Learning outcomes	The students acquired knowledge on innovative agri-food waste reduction and by-product use strategies and circular economy from a practical point of view.
Service	Sustainable agrifood companies received valuable inputs on innovative ideas to their activities.

04 Improving the economic and environmental sustainability of small producers in a disadvantaged situation in rural Pyrenees Mountain areas in the north of Spain: an insecticulture case

Subject area: Quality control and management in the primary sector

Methodology	A new producer dedicated to the rearing of worms/larvae as a new source of protein had concrete questions about marketing, legal questions (as there is no regulation on the topic in Spain) and conversion rate, among others. Different groups of students worked and answered each of the questions. They prepared a dossier and explained the answers to the farmer.
Learning outcomes	The students gained experience in problem solving, communicating and working in teams. The teacher acquired skills and criteria to be able to evaluate the students through Service-learning.
Service	The farmer solved technical uncertainties related to his business located in an area in risk of depopulation.

05 Sustainable food packaging in practice

Subject areas: Food design and development I and II

Methodology	The students designed a new food product with a sustainable food packaging (e.g., bread). The students analysed the life of the product (the food quality and aspect vary with or without different paper packaging options). After students were taught by a composting expert and analysed in practice which paper packaging composted better. They concluded whether the packaging was better to maintain the bread and the sustainability implications. The papers were produced by the social printing block of the Pamplona town hall, which are at risk of exclusion. The students wrote a short report, which was assessed and presented to the social printing block of the town hall.
Learning outcomes	The students and the Pamplona town hall were informed about sustainable food paper packaging in practice.
Service	The people at risk of social exclusion gained opportunities and resources.

Assessment tools

Multifocal assessments were developed. The teachers adopted, and adapted to the sustainability-related competences, the rubric for self-assessment and enhancement of Service-learning projects developed by the University of Barcelona (Puig et al., 2023). Each teacher developed different assessment surveys with questions to students, social entities, and teachers.

Table 6. Embedding sustainability competences through Service-learning at the Technological University Dublin (TU Dublin).

Embedding sustainability competences through Service-learning at Technological University Dublin (TU Dublin)

Title of the degree	BSc Food Innovation.
Academic year	2022-2023 and 2023-2024.
Subject areas	Food Science, Food Chemistry, Food Safety, Health and Safety, Work Placement, Research Project.
Credits	55 ECTS across the Programme.
Staff and participants involved	8 professors, 3 experts on sustainability and Service-learning, Bachelor students and social partners.
Method	TU Dublin took a formal quality assurance programmatic review approach to embedding sustainability. This was informed by consultation with all relevant stakeholders, and by the TU Dublin strategic plan for sustainability. With an ambition to embed sustainability at the programme learning outcome and graduate attributes level (FSP), the programme team revised all of the programme modules through the lens of sustainability. The module descriptors, including module learning outcomes and syllabi, were appropriately updated. As part of the curriculum review, a team of 'NEMOS Fellows' designed high-impact Service-learning activities aligned to sustainability learning outcomes across several stages of the programme. These are outlined in the specific cases hereafter.

	2022			2023											
	Q2	Q3	Q4	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1. NEMOS Project start															
2. Training the Lecturers: Educating for Food Sustainability CPD															
3. NEMOS Fellowships awarded															
4. Communication & Project meetings															
5. Research with stakeholders & Review of Curriculum															
6. Implementation of sustainability through Service-learning in the TU Dublin BSc Food Innovation degree															
7. Assessment of sustainability through Service-learning in the TU Dublin BSc Food Innovation degree															

Short description of the pilot cases

01 Priory Social Enterprise Brewery and Teagasc Agri-Food Development Authority: Brewers Spent Grain Valorisation

Subject Area: Final Year Research Project

Methodology	The students carried out research to find a higher value use for the BSG as part of a sustainable circular bioeconomy. Projects included Bioprocessing using enzymes and Fermentation of BSG to enrich animal feed.
Learning outcomes	Search, access, and ethically use information. Demonstrate an ability to think globally and consider issues and knowledge from a variety of perspectives.
Service	Research with Teagasc relating to fermentation of BSG to enrich animal feed and knowledge transfer to Priory Brewery for transformation of BSG previously used as animal feed to a higher value use as part of a sustainable circular bioeconomy.

02 Sustainability at Dublin Zoo

Subject Area: Final Year Research Project

Methodology	The students carried out practical research to address various sustainability challenges at Dublin Zoo in areas related to food quality, phytoremediation & food safety.
Learning outcomes	Search, access, and ethically use information. Demonstrate an ability to think globally and consider issues and knowledge from a variety of perspectives.
Service	Collaborative research with Dublin zoo on various projects involving consideration of key scientific questions which help the zoo provide optimal animal health and welfare for all their species. This in turn helps the zoo make a significant contribution to education and biodiversity conservation. including 'Sustainable sourcing of Sea Lion feed', 'Self-sufficient sustainable feed production for Meerkats & reptiles in Dublin Zoo', 'Phytoremediation of the flamingo lagoon', 'Food safety & sustainability in Dublin Zoo kitchens'.

03 Sustainability within Internships. Type 1 – Internship focused on sustainability action

Subject Area: Work placement (Internship)

Methodology	The students carried out work-based activities focused on specific sustainability objectives of the work placement organisation, for example working with the Irish Food Safety Authority Reformulation Taskforce.
Learning outcomes	Demonstrate the development of core competences relating to theoretical principles, sustainability competences, concepts and skills studied to a real working situation. Reflect on participation in and contribution to the successful operation of a production/research facility, as well as the use of greener technologies. Demonstrate a clearer understanding of structures in industry, the role of the technologist in those structures, and the relationship between theoretical modules, sustainability practices, and the workplace. Reflect on their professional development and learning through the work placement experience, relating it to programme aims, identify future goals and their impact with regard to sustainability. Develop employability skills, including successfully seeking employment. Evaluate food sustainability in a work environment and identify potential areas for improvement.

Service	Working with the Food Safety Authority 'Roadmap for Food Product Reformulation in Ireland' which sets out requirements for identifying priority food categories for food reformulation including foods which contribute most to energy (calories), saturated fat, sugar and salt intakes in the Irish diet.

04 Sustainability within Internships. Type 2 – Internship including host enterprise sustainability evaluation.

Subject Area: Work placement (Internship)

Methodology	Students carry out a sustainability evaluation with the placement organisation in areas of Sustainability Strategy, Packaging, Air Pollutants & Greenhouse Gas Emissions (GGE), Energy Use, Water and Discharge, Biodiversity Stewardship, Waste & Food Waste, Animal Sourced Food, Food Reformulation, Relationships with other organisations, Health, Safety & Sustainability. Training is provided before the student commences placement.
Learning outcomes	As for Type 1.
Service	Students provide a sustainability evaluation report. The then identify one key area of focus and develop a sustainability action plan for the organisation as part of the placement. Where feasible, the student also works on the actions identified as part of the placement.

05 Sustainability embedded in Food Safety Training and Auditing

Subject Area: Training and Auditing

Methodology	Students audit a commercial or not for profit food premises against an appropriate audit template amended to include sustainability, analyse, and report their results as a case study. The challenge is to maintain food safety, but to make sure that recommendations are as sustainable as possible. This is graded and feedback given. Aided by the feedback students then present their audit report to the class group where they are questioned on their recommendations.
Learning outcomes	Carry out a food safety audit on a food premises using an appropriate standard.
Service	Students provide a final food safety audit report including elements of sustainability.

Assessment tools

The approach involved a formal quality review of the curriculum, where sustainability learning outcomes were embedded in modules, and assessments aligned to the learning outcomes were developed. In the case of the work placement, sustainability has been included as part of a rubric developed for reflective assessment of work placement experiential learning (Dunne and Ryan, 2016; Dunne, 2021).

Table 7. Embedding sustainability competences through Service-learning at the University of Pisa (UNIPI).

Embedding sustainability competences through Service-learning at UNIPI

UNIVERSITÀ DI PISA

Title of the degrees	Bachelor's degrees in Agricultural Sciences, Viticulture and Oenology; Master's degrees in Plant and Microbial Biotechnology, Biosafety and Food Quality, Urban Green and Landscape Design and Management and Food Production and Agri-ecosystems Management.
Academic year	2022-2023.
Subject areas	Agricultural chemistry, Agricultural entomology; Agronomy and herbaceous crops, Business management and innovation in agribusiness, Zootechny, Viticulture, Animal foods and nutrition, Livestock management, Plant production and biotechnologies, Sustainable management of agricultural ecosystems.
Credits	Bachelor's degrees 71 ECTS; Master's degrees 45 ECTS.
Staff and participants involved	6 professors, 4 student tutors, 40 Bachelor's and Master's students, 6 local NGOs.
Method	A team of researchers at the Department of Agriculture, Food and Environment of the University of Pisa designed and implemented the II edition of an initiative titled "Quanto ne sai di sostenibilità?" ("How much do you know about sustainability?") to develop community Service-learning through challenge-based and project-based learning. This three-week-long initiative, transversal to the different degrees involved in the activities, has been carried out both in presence and online and consists of different phases. The research team invited the faculty members to engage several non-profit organisations to pose to students some practical challenges they face for the sustainability of the agri-food sector and help them find feasible solutions. Please, refer to the following table for an overview of the activities.

	2022			2023							
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug
UNIPI design and implementation, and analysis of "Quanto ne sai di sostenibilità?" activities											
1. First edition of "Quanto ne sai di sostenibilità?"											
2. Second edition of "Quanto ne sai di sostenibilità?"											
2.1. The research team invited faculity members and student tutors to join the organization of the II edition, and to set the objectives and dates											
2.2. The research team invited faculty members to decide the organizations to be involved in the initiative and proceeded with the invitation											
2.3. Implementation of the II edition of "Quanto ne sai di sostenibilità?", according to different phases:											
2.3.1. April, 14th and 21st: interdisciplinary seminars provided by no-profit organizations to students and teachers, related to the sustainability challenges faced in the agri-food sector											
2.3.2. April 21st - May 4th, students teambuilding and teamwork towards a project solution for the challenge proposed by the no-profit organizations											
2.3.3. May 5th, students, restitutions of projects solutions to local no-profit organizations											

	2022			2023							
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug
Research, data gathering and analysis from the II edition of "Quanto ne sai di sostenibilità?"											
1. Literature search to set up the activities of the II edition of "Quanto ne sai di sostenibilità?" (e.g., Design Thinking, assessment tools for sustainability competences)											
Data gathering from students (mixed methods, questionnaires and reflective journals)											
Data gathering from local no-profit organizations (reflective journals)											
Data gathering from teachers and student tutors (focus group)											
Data analysis (mixed methods: quantitative analysis - questionnaires, coding - reflective ournals, focus groups, rubrics)											

Short description of the pilot cases

01 **"Quanto ne sai di sostenibilità?": Design Thinking**
Subject area: Agricultural chemistry; Agricultural entomology; Agronomy and herbaceous crops; Business management and innovation in agribusiness

Methodology

Students addressed the sustainability challenges proposed by several NGOs active in Tuscany Region. Using Design Thinking principles and phases, students were able to define project-oriented solutions that combine their previous technical knowledge and skills with new ones deriving from dedicated seminars addressing practical cases, research activity and community service practical experience. Design Thinking phases are described as it follows:

Phase 1 – interdisciplinary seminars (empathise, define): two seminars with the aim to first explain the main objectives, activities and steps of the initiative, then to introduce the most relevant concepts for the purpose (e.g.: Design Thinking and its application to the initiative, sustainability competences – GreenComp, Service-learning as a pedagogy) and the tools for students to reflect upon the learning experience (questionnaires and reflective journals for each phase). Finally, representatives of the NGOs presented their organisations' activities and launched their sustainability challenges, while attending students could ask questions to deepen their case.

Phase 2 – team building (empathise, define, ideate): online meeting in which students, divided into teams according to their preference for one of the challenges launched (the case adopted), and supported by student tutors, started working by using a team canvas: a tool for discussing common goals and values, defining specific roles and potential individual contributions and skills made available to the rest of the team.

Phase 3 – teamwork (empathise, define, ideate, prototype): group work through which each team ran research on the specific topics related to the challenge adopted, asked their teachers for additional data and study materials, and had the opportunity to interview their key stakeholders (representatives of the respective NGOs) to acquire additional insights about the case and the potential solutions to be adopted. In this phase, teams formulated their solutions and prepared the presentation for the final pitch, through brainstorming, potential conflict management, decision-making, knowledge, and skills sharing.

	Phase 4 – final presentation (testing, empathise): teams presented their solutions to the chosen challenge to an "expert audience" formed by the NGOs and teachers in a specific time slot. A PowerPoint presentation, based on a template provided to students by the organisers, served as a reference point for students, to express their ideas. The contents of the template, similar to a project form, were: 1) case and challenge description, deepened through students' research; 2) objectives and target of the identified solution; 3) SDGs-related relevance of the solution; 4) description of punctual activities and necessary resources; 5) project's visibility and dissemination; 6) project's follow-up activities. Students received questions and feedback from local stakeholders about their proposals.
Learning outcomes	Students acquired different transversal skills through working in multidisciplinary teams to address context-based sustainability challenges in the agri-food sector.
Service	Community service resulted in giving back to the local stakeholders' specific projects developed to solve the sustainability challenges proposed at the beginning of the process. Knowledge was disseminated among participants of the Service-learning community created by the initiative (students, teachers, and local non-profit organisations).

Assessment tools

ADDRESSED TO:

- **Students:** pre-post initiative questionnaire about owing the GreenComp; reflective journals for each phase, where students had to express objective, personal and analytic reflections (combination of current and previous experience) about the initiative.
- **Tutors and teachers:** focus group to discuss organisational and learning outcomes of the initiative.
- **Stakeholders:** final reflective journal on the overall experience related to the initiative.

USED BY ORGANISERS:

- **For students:** a comparative analysis of the pre-post surveys' data; use of a rubric, based on the information contained in the students' reflective journals, in which assessing the learning level (from beginning to strong) for each phase's learning objective.
- **For tutors and teachers:** thematic content analysis of the focus group contents.
- **For stakeholders:** thematic content analysis of the reflective journals.

Table 8. Embedding sustainability competences through Service-learning at Graz University of Technology (TU Graz).

Embedding sustainability competences through Service-learning at TU Graz

Title of the degrees	Master's degree in biotechnology.
Academic year	2023-2024.
Subject areas	Food biotechnology, Enzymatic and microbial processes in food production, Food chemistry, Industrial biotechnology, Sensory analysis, Postharvest technology.
Credits	16 ECTS in total.
Staff and participants involved	4 professors, 1 expert on sustainability and Service-learning, Master students and social entities.
Method	At TU Graz the topic of sustainability is a general focus in teaching and research. The implementation of SL in the current curriculum of Biotechnology comprising the topics of food science will be implemented and tested for its applicability. A working group of the teachers has identified possible topics which could be addressed by SL. During the winter semester of 2023/24 a pilot run of the SL activities will be carried out. The students interested in this activity will be recruited in October 2023 and the SL project will be finished by the end of the semester.

	2022	2023				2024			
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1. Design and implementation of service learning at TU Graz									
2. Information of teachers about SL and how to implement it									
2.1. Recruiting of possible SL partners from outside the university and discussion about topics related to sustainability									
2.2. Information of students for possibilities of SL									
3. Courses and SL activities									
3.1. Discussion and reflection on the outcome of the SL activity									
3.2. Evaluation of SL activities in the courses									

Short description of the pilot cases

01 Development of a leaflet for waste reduction in urban households
Subject area: waste reduction, sustainability and logistics of food distribution and storage

Methodology	The students will analyse the behaviour of selected persons related to food shopping and consumption. The amount of waste from food preparation and food that is not consumed will be analysed and a concept for change of behaviour will be developed with the aim to reduce the waste.
Learning outcomes	Improved communications skills, students will learn to think critically.
Service	Knowledge on food waste in general and how this could be reduced will be distributed to the public.

02 **Information about expiration date, food quality, and food safety**
Subject area: Food safety

Methodology	Small groups of students will gather information which foods are normally stored in the households for prolonged periods. Information on the safety of prolonged storage will be combined with the legal requirements of safety and quality and a risk evaluation of prolonged storage will be carried out. From these results an information folder will be created.
Learning outcomes	The students will acquire knowledge of food safety and quality as well as on legal aspects.
Service	Information to the population will be provided which is related to food safety in relation to waste reduction. They will raise the awareness of the general population how quality and safety will be influenced by improper storage.

Assessment tools

The lectures will be assessed by the standards of TUG. The students will have the chance to respond specifically to Service-learning issues with this on-line tool.

6. Assessment tools

Effective assessment tools applied in a systematic way are essential for evaluating the impact of Service-learning experiences and ensuring that students are achieving learning objectives related to sustainability. The main assessment tools and criteria to evaluate Service-learning experiences are summarised in Table 9.

By using a combination of assessment tools, like self-reflection journals, surveys, presentations, and peer evaluations, adapted to each context, educators can effectively measure the impact of Service-learning experiences and guide students to address sustainability issues.

Examples of each of the assessment tools as implemented by the NEMOS consortium partners for incorporating sustainability competences through Service-learning in food-related courses are provided in Table 10 and Appendix V.

Table 9. Summary of Service-learning assessment tools.

Service-learning assessment tools	
A	**Questionnaires to students, lecturers and social entities:** questionnaires based on rubrics to gather feedback from students, lecturers, and social entities involved in the Service-learning initiative. These questionnaires help refine education programmes and better align them with learning objectives and community needs.
B	**Pre- and post-service questionnaires to students:** questionnaires (before and after the Service-learning experience) are made to gauge changes in students' knowledge, attitudes, and perceptions. The responses can be compared to identify shifts in understanding and awareness.
C	**Reflective journals:** students maintain a journal throughout the Service-learning experience, reflecting on their activities, challenges, and personal growth. Criteria for assessment could include the depth of the reflection, the connection between the service and sustainability concepts, and the evidence of critical thinking.
D	**Examinations:** written examinations are used to test students' understanding of sustainability concepts, theories, and principles linked to Service-learning.
E	**Written reports:** students write reflection reports that synthesize their Service-learning experience, its impact on their understanding of sustainability, and their personal growth. The depth of critical thinking and integration of sustainability concepts are evaluated.
F	**Oral presentations:** students present their Service-learning project to their peers and instructors, and social entities (if applicable). The clarity of their presentation, their ability to communicate sustainability goals and outcomes, and their capacity to engage the audience in the topic can be assessed.
The assessment is done based on different rubrics for reflective journals, oral and written skills.	

Table 10. Service-learning assessment tools implemented by the NEMOS consortium partners for incorporating sustainability competences through Service-learning in food-related courses.

NEMOS Service-learning assessment tools	
1. ISARA	**Questionnaires to students, lecturers, and partners** about the SL experience (added value to the partners, transversal competences gained, whole experience, etc.) **Reflective journals:** students document their learning journey and demonstrate their understanding of sustainability concepts. Assessments can be based on their ability to critically reflect on sustainability issues and articulate their thoughts and insights. **Examinations, written report, oral presentations:** traditional assessment methods like written examinations, reports and oral presentations are used to test students' understanding of sustainability concepts, theories, and principles linked to SL. The assessment is done based on different **rubrics** for reflective journals, oral and writing skills.
2. UPNA	**Questionnaires:** each teacher developed different assessment surveys with questions to students, social entities and teachers. The teachers adopted, and adapted to the sustainability-related competences, **the rubric for self-assessment and enhancement of Service-learning** projects developed by the University of Barcelona (Puig et al., 2023).
3. TU Dublin	**Reflective journal** which includes the sustainability reflection within the reflective blogs and the TU Dublin Experiential Learning Rubric. **Written report** for practical labs and internships. **Examinations, written reports, oral presentations:** Traditional assessment methods like written examinations, reports and oral presentations incorporate assessment of the students' understanding of sustainability concepts.
4. UNIPI	**Questionnaires both pre-post initiative.** The questionnaire is based on the GreenComp areas (Bianchi et al., 2022) and is aimed to assess students' sustainability competences before and after taking part in the Service-learning initiative. **Reflective journals.** The Service-learning initiative consists of 4 phases (namely, attending the seminars; team building; teamwork; presentation/pitch day based on the steps and principles of Design Thinking). For each phase, students filled in a reflective journal, which allowed to understand how each phase helped students to develop sustainability skills. UNIPI assessed it by analysing the reflective journals through a rubric. This **Rubric** provides the level of assessment from "beginner" to "proficient" according to the identified learning objectives. A specific section in the rubric reported the information related to the different GreenComp.
5. TU Graz	**Evaluation of lectures and courses is performed on a routine basis at TU Graz at the end of each course.** Questions are asked with respect to workload, content requirement, general satisfaction with the course, specific treatment of the students with respect to fairness and equal rights (e.g. learning style, gender, ethnicity) as well as personal involvement/engagement of the lecturers and their teaching capabilities. These questions are to be answered in terms of yes/no questions or rating on category scales (1 to 5). In addition, specific feedback on the lecturers and the courses may be given. **Prior to the evaluation, lecturers have the opportunities to implement specific questions regarding the course or the teaching aims of the aims.** For those courses with a specific impact in the context of food & sustainability, questions on sustainability as well as on a sustainable transfer of knowledge will be implemented. Depending on the question, the appropriate question style (yes/no), rating on category scales or specific written feedback are asked for. **Evaluation of lab courses with implementation of the Service-learning pedagogy.** Personal face to face discussion with specific focus on sustainability will be performed. This evaluation will be performed with (i) the students and (ii) with the organisations, which are involved in the project. **Evaluation of the sustainability and Service-learning goals in course protocols.** For Service-learning project/courses, students have to deliver a written report on their and achievements. In addition to the report on the (experimental) work and obtained results, a reflection of the benefits of Service-learning and sustainability will be requested.

7. Rethinking a new educational model suitable for the acquisition of sustainability competences through green pedagogies and Service-learning

The purpose of this final section is to synthesise the project learnings in the context of University Strategic plans, University Quality Assurance processes, Curriculum design, International Guidelines for incorporating sustainability through Service-learning in Higher Education degrees, Available Educational Research & Scholarship in curriculum review for sustainability, both for Food and other disciplines, and available Regulatory/Compliance guidelines.

The expected impact will be at several levels of the Higher Education system:

1. **At University level** in relation to policies and practices for staff development in sustainability through Service-learning for a meaningful achievement of sustainability competencies, and to bring meaning to strategic plan objectives for embedding SDGs in Higher Education.

2. **For Academic departments**, through providing evidence-based Curriculum review guidelines and exemplars for embedding sustainability competences based on Service-learning practices at Programme/degree Learning Outcome (PLO) level, as well as at specific module/course Learning Outcomes level, and linked, if possible, to common European Qualification Frameworks.

3. **For Academic lecturers**, for their own professional development, and in support of developing teaching and learning materials and resources to develop sustainability competencies in students.

The ultimate impact will be on student learning and, consequently, in their attitudes, behaviours, and knowledge which will inform their decisions as globally responsible employees, entrepreneurs and future leaders in the Food Industry.

Sustainability education invites thinking in other directions in order to allow for innovative approaches to solving problems for future challenges. The sustainability competences are reflected in “an ability to look ahead” in order to modify and model the future of societies in which one lives by active participation in the sense of sustainable development. Through Service-learning, students assume responsibility in their actions. The complex nature of sustain- ability questions means that it is useful to explore problems and their solutions in a holistic and non-linear way, in contrast to the reductionist approach increasingly seen in the scientific disciplines.

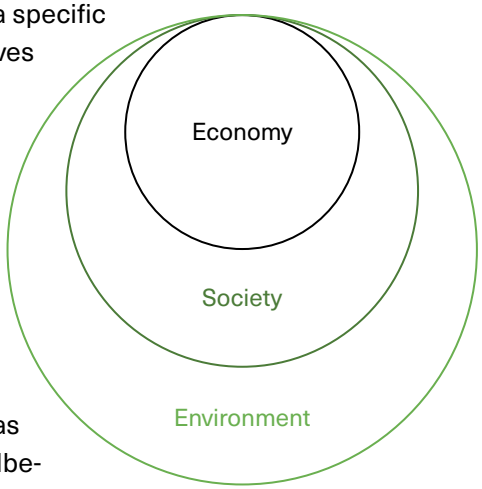
This aspect of the pedagogy is not only relevant to discussing existing situations but also relevant to the ability to conceive of different future scenarios as variables change. The teachers´ role would be to help students (as potential change-makers in society) to visualise their possibilities with a sustainable

approach. Green pedagogy can support transformative learning through the exploration and clarification of learners´ own values.

As Heike Freire states:

> "Learning to live in harmony with the Earth implies a profound change in our way of feeling, thinking, acting and relating that brings us health, fullness and gives us back our innate wisdom. We have to work so that education may play its proper role in this incredibly necessary transformation".

This is the basis of Green Pedagogy or how to be an acknowledged sustainability-engaged new generation of global citizens who can be truly engaged and active in the enterprise of sustainability. Breiting (2009) and Jóhannesson et al. (2011) argue that education should focus on empowerment for democratic engagement and on teachers becoming capable of handling controversial issues with students. Green Pedagogies offer a structured approach to lesson planning to achieve embedded sustainability competences within a specific vocational or academic field. The Green Pedagogy approach achieves sustainability competency through a controlled appeal to the emotions and the explicit uncovering of learner values to take on new ideas and new perspectives in a more sustainable direction. This approach is compatible with many recommended in Education for Sustainable Development (ESD).



This approach builds sustainability competence by automating a sustainability response in the learners; in other words, building a sustainable mindset by making visible the sustainability values upon which daily problem solving can be based. Green Pedagogy, as other sustainability approaches, is based on an onion model of wellbeing that assumes that economic wellbeing is dependent on social justice, which in turn is dependent on environmental wellbeing, the so-called strong sustainability model (Neumayer, 2013). The final goal is to achieve deep learning about sustainability based on a more conscious understanding of how actions support or negate existing values. In this way, sustainable practices based on Service-learning go beyond surface learning.

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Appendix I

Questions for the interviews and focus group with students, lecturers and stakeholders for qualitative research

Qualitative analysis focus groups' scripts

Organise at least 6 Focus Groups (Only FG6 and FG8 are optional)

- **FG1:** Regional and local administrations
- **FG2:** Associated partners, NGOs, NPOs.
- **FG3:** Food companies .
- **FG4:** Other stakeholders (you may use FG1, FG2 or FG3), i.e., use FG3 for other food companies.
- **FG5:** one with students from the chosen degree (undergraduates, postgraduates, MS students, PhD students from the same subject area). You may divide this FG into 2 (undergraduates and postgraduates).
- **FG6** (optional but recommended): one with students from different degree programmes (i.e., social work degree, sociology degree, teaching degree).
- Based on FG5 and adapted to the new degrees .
- **FG7:** one with teachers who actively work with sustainability as a competence included in their teaching guides of the chosen degree.
- **FG8** (optional but recommended): a second one with those lectures who do not integrate sustainability as a competence in their teaching of the chosen degree.

FG1 - Script for the experts focus group from the regional and local administration (4-6 persons)

Starting point: sustainability as a social and professional concept (attempt to reach a consensus on a general definition).

- Assessing the state of art in the regional and local administration. Debates and new lines of work (including the regulatory and legal framework).
- Presence and demand for training in sustainability required for work in the administrative and professional spheres: primary, secondary, and tertiary sectors.
- Sustainability in education in general, at the university and, in particular, in the chosen degree.
- Strengths and weaknesses for its presence at the university.
- Opportunities and threats for its presence at the university.
- Knowledge and skills in sustainability that the teaching staff should have.
- What knowledge, values and skills in sustainability should be transmitted to the students of the degree and the rest of the degrees of the university.
- Sustainability profile to be built in students for the professional future demanded by the market.
- Knowledge and attitudes towards Service-learning and its relationship with sustainability in teaching.
- Thematic proposals for a questionnaire for students and teaching staff.

FG2 & FG3 - Script for experts focus group from business and social institutions (4-6 persons)

Starting point: sustainability as a concept in the social, organisational, and professional spheres (attempt to reach a consensus on a general definition).

- Assessing the state of art in the business and/or organisational sphere. The current culture of sustainability and the desired future culture in their areas.
- Debates and new lines of work on the subject (including the regulatory and legal framework: both of the administrations and of the companies and/or organisations themselves).
- Professional and training profiles with sustainability required in their companies and/or organisations. Both for new workers and for the training of current staff.
- Training activities developed in relation to sustainability. New training needs (differentiate as far as possible by primary, secondary and tertiary sectors).
- Sustainability in the educational system, at the university and, in particular, in the chosen degree.
- Strengths and weaknesses for its presence at the university.
- Opportunities and threats for its presence at the university.
- Knowledge and skills in sustainability that university teaching staff should have/transmit.
- What knowledge, values and skills in sustainability should be transmitted to the students of the chosen degree and the rest of the degrees of the university with a view to their professional life.
- Sustainability profile to be built in students for the professional future demanded by the market.
- Knowledge and attitudes towards Service-learning and its relationship with sustainability in teaching. Possible company-organisations-university collaborative projects.
- Questions of final interest regarding sustainability in the social and business sphere that have not been dealt with in this script and that you would like to contribute as a conclusion to the session.

FG5 - Script for the students' focus groups (6-8 persons)

Starting point: sustainability as a social concept (attempt to agree on a general definition).

- Sustainability and its experience in everyday life: what knowledge do they have and what attitudes and behaviour do they develop in their daily lives? In the domestic/family sphere, waste, eating habits, consumption in general and in the purchase of clothes/footwear in particular, leisure and free time and mobility.
- Please, explain their experience of sustainability in their educational process in general and at this university in particular.
- Is sustainability integrated transversally in the education they receive at this university. In all subjects: What values and/or attitudes do they receive and what shortcomings do they identify?
- Do they think that this university, the faculties/schools, and departments and specifically the teaching staff transmit knowledge and training on this subject?
- What presence should Sustainability have at this university? Strengths and weaknesses for its current and future presence at the university and in the teaching of their degree.
- Training needs they have as students in this subject.
- What profile in sustainability do they think they will need to enter the labour market: administrations, companies, social organisations or for self-employment.
- Knowledge and attitudes towards Service-learning and its relation to sustainability in teaching. Have they had any experience and, if so, how do they evaluate the experience?
- Finally, talk about any questions that have not been included in this script and which you think would be interesting to include in the study.
- What questions would you ask in a questionnaire addressed to students and lecturers?

FG7 - Script for the lecturers' focus groups (6-8 persons)

Starting point: sustainability as a social concept.

- What does "Sustainability in education" mean in general and at (this) university level.
- What are the main challenges that agri-food sector is facing now and will face in the coming years? - What are the strengths and weaknesses of (this) university in providing sustainability competences in food related curricula degrees according to the current educational offer?
- What are the external opportunities and threats (in terms of macro-national-local trends) to consider in order to better promote sustainability competences in the university courses/ modules?
- How do you think universities can better improve their sustainability teaching in food-related curricula?

Personal position as lecturers:

- Which main competences and values should universities teach in order to support the sustainability of agri-food sector?
- How technical competencies can be implemented by sustainability competencies?
- Assuming that teaching sustainability implies an inner transformation, how teaching sustainability in the agri-food curricula can influence students in their:
  - › everyday food experiences?
  - › social relations?
  - › culture?
  - › sustainable lifestyles?
- Concerning their experiences: how do they incorporate them in their teaching?
- What type of pedagogies do you implement to teach sustainability in the agri-food sector?
  - › Active learning
  - › Project-based learning
  - › Gamification
  - › Role plays, experimental games and simulations
  - › Case-studies
  - › Blended and online learning
  - › Collaborative approaches (cooperation with external partners)
  - › Service-learning
- What lecturers specifically need to do?
- What training needs do lecturers and students have in terms of incorporating sustainability as a competence of the chosen degree?
- What attitudes towards the subject "sustainability in education" do they see among: teaching staff, students, the school or faculty and this university itself?
- Which 3 competencies would they highlight in themselves with respect to their teaching in the programme of the chosen degree?
- What sustainability values should be transmitted to students? define the sustainability profile to be built for students.
- How familiar are you with the Service-learning in terms of knowledge, attitudes, and experience?
- How do you think SL could help to teach sustainability in food related degrees?
- Thematic proposals for the students' and lecturers' questionnaires.

FG8 - Script for the lecturers' focus groups (6-8 persons)

Starting point: sustainability as a social concept.

- What does "Sustainability in education" mean in general and at (this) university level.
- What are the main challenges that agri-food sector is facing now and will face in the coming years? - What are the strengths and weaknesses of (this) university in providing sustainability competences in food related curricula degrees according to the current educational offer?
- What are the external opportunities and threats (in terms of macro-national-local trends) to consider in order to better promote sustainability competences in the university courses/ modules?
- How do you think universities can better improve their sustainability teaching in food-related curricula?

Personal position as lecturers:

- If they do not incorporate sustainability as a competency, why not?
- If they do not use innovative pedagogies, what are the main reasons to not using them?
- What training needs do lecturers and students have in terms of incorporating sustainability as a competence of the chosen degree?
- What attitudes towards the subject "Sustainability in education" do they see among: teaching staff, students, the school or faculty and this university itself?
- Which three competencies would they highlight in themselves with respect to their teaching in the programme of the chosen degree?
- What sustainability values should be transmitted to students? define the sustainability profile to be built for students.
- How familiar are you with the Service-learning (SL) in terms of knowledge, attitudes, and experience?
- How do you think SL could help to teach sustainability in food related degrees?
- Thematic proposals for the students' and lecturers' questionnaires.

Appendix II

Student, lecturer and stakeholder questionnaires for quantitative research

Survey for students

This questionnaire is part of the research carried out in the NEMOS project "A new educational model for acquisition of sustainability competences through Service-learning". Further information about the project is below and can be found on the project website www.nemosproject.com. The survey is anonymous, and data will be stored on a secure drive. By taking this survey you are agreeing to participate in this research project. If you would like to ask any questions before taking the survey, please contact @.

NEMOS: A new educational model for acquisition of sustainability competences through Service-learning.

Aim and objectives
The main aim of the project is to develop an educational model, complete with students´ toolkit and educational practices in order to integrate the acquisition of sustainability competences during curricular education in the Food Sciences.

The objectives of this project are:

1. Defining a food sustainability profile (FSP) through a community building methodology by developing a model of intervention common to all universities involved, focused on sustainability and pedagogical practices, included Service-learning (SL).
2. Defining a methodological handbook (MH) in Food sustainability through SL as a common framework of activities for acquisition of sustainability competences for SL and roadmaps of implementation.
3. Defining assessment tools of FSP and MH by co-creation practices in SL.
4. Defining a new educational model suitable for the acquisition of sustainability competences through green pedagogies and SL. The final results would be a new educational model that we propose as the catalyst for change in the current educational model.

1. Gender
   - ○ Woman
   - ○ Man
   - ○ Non-binary
   - ○ Prefer not to say

2. How old are you now?

3. What kind of course do you attend?
   - ○ Bachelor degree
   - ○ Master degree

4. Which is the title of the course you are attending?

5. In which programme academic year are you currently studying?
   - ○ 1
   - ○ 2
   - ○ 3
   - ○ 4
   - ○ 5
   - ○ 6

6. What was the main reason you decided to study this Bachelor's or Master's degree?
   - ○ Job opportunities
   - ○ Vocation
   - ○ I liked it
   - ○ Family tradition
   - ○ Guidance school/Institute

- ○ My choice
- ○ I wanted to study at this university
- ○ Interest in the agri-food world
- ○ Other

7. If 'other', please provide more details

8. What socio-economic class would you say you belong to?
   - ○ Upper class
   - ○ Upper-middle class
   - ○ Middle class
   - ○ Lower-middle class
   - ○ Lower class

9. Do you participate in any NGO or social, student, political, trade union or environmental organisation?
   - ○ No
   - ○ No, but I would like to be part of
   - ○ Yes, I do belong

10. Your interest in social, political, economic or environmental issues is:
    - ○ Very low
    - ○ Low
    - ○ Average
    - ○ High
    - ○ Very high

11. What media or sources do you turn to for information on these issues? (multiple answers possible)
    - ○ None
    - ○ Family members
    - ○ Friends
    - ○ Workshops, talks, courses...
    - ○ Personal experience
    - ○ Internet
    - ○ Social Media
    - ○ University lecturers
    - ○ Press and media
    - ○ Social organisations....
    - ○ Bibliography: books, journals
    - ○ Other

12. If 'other', please provide more details

13. Speaking now about the idea of sustainability, in general terms, could you define this concept briefly?

14. Your interest in sustainability would you say is:
    - ○ Very low
    - ○ Low
    - ○ Average
    - ○ High
    - ○ Very high

15. What issues, areas and disciplines do you relate to sustainability?

16. What personal and social behaviours do you relate to sustainability?

17. What media or sources do you use to inform yourself about sustainability? (multiple answers possible)

- ○ None
- ○ Family members
- ○ Friends
- ○ Workshops, talks, courses...
- ○ Personal experience
- ○ Internet
- ○ Social Media
- ○ University lecturers
- ○ Press and media
- ○ Social organisations....
- ○ Bibliography: books, journals
- ○ Other

18. If 'other', please provide more details

19. Are you aware of the Sustainable Development Goals (SDGs) of the 2030 Agenda?

- ○ Yes
- ○ No (if not, please skip to question n. 21)

20. If you are familiar with the SDGs, can you name any of them?

21. Have you been involved in any social, educational or professional project related to sustainability? (multiple answers possible)

- ○ Yes, social
- ○ Yes, educational
- ○ Yes, professional
- ○ No

22. Would you say that in your daily life you have a behaviour where you strive for sustainable behaviours and actions?

- ○ No (if not, please skip to question n. 25)
- ○ Yes
- ○ Sometimes

23. What actions do you take regularly to ensure greater sustainability in your immediate and distant environment (waste, energy, mobility, consumption, technology, social environment)?

- ○ None
- ○ Some

24. If 'some', please provide more details

25. When you buy products such as clothes, shoes, and food do you pay attention to the origin, whether it is organic or Fair Trade? (multiple answers possible)

- ○ Yes, at the origin
- ○ Yes, if it is organic
- ○ Yes, if it is Fair Trade
- ○ No

26. Do you see the need for specific knowledge and training in sustainability issues as a necessary part of your professional education?

- ○ Yes, I do
- ○ I do not know
- ○ No, I do not

27. How informed do you feel about climate change?

- ○ Not informed
- ○ Little informed
- ○ Somewhat informed
- ○ Fairly informed
- ○ Very informed

28. How much are you concerned for the climate change?

- ○ Extremely concerned
- ○ Moderately concerned
- ○ Somewhat concerned
- ○ Slightly concerned
- ○ Not at all concerned

29. To what extent would you say that sustainability is present in the education you receive in the Bachelor's or Master's degree?

- ○ Not present
- ○ Little present
- ○ Somewhat present
- ○ Fairly present
- ○ Very present

30. In what specific areas would you like to have more knowledge on this issue?

31. Which teaching and/or practical initiatives, carried out in this degree, have helped you to experience sustainability first-hand?

32. What teaching and/or practical initiatives would you like to see in this degree programme to experience sustainability first hand?

33. Would you like to participate in sustainable development projects or activities that take into account the relationship between environmental, social and economic factors.?

- ○ Yes
- ○ No

34. Do you think increased topics and actions related to sustainability in your Bachelor's or Master's degree is necessary?

- ○ Yes
- ○ No

35. How do you assess the involvement of your teaching staff in the issue of sustainability?

- ○ Very poor
- ○ Poor
- ○ Average
- ○ Good
- ○ Excellent

36. If companies were to convey to you in class the need for you to develop such a competency in sustainability, would you be encouraged to work on it more intensively during your studies?

- ○ Yes
- ○ No

37. In terms of career opportunities, do you think it would give you an advantage in terms of being selected for a job if you have integrated sustainability competency in your studies?

- ○ Yes
- ○ No

38. In which type of professional organisation would you prefer to work? Choose only one answer

- ○ Administration
- ○ Large company
- ○ Medium-sized enterprise
- ○ Small business
- ○ Cooperatives
- ○ Setting up my own company
- ○ Social organisations, NGOs...
- ○ Professional organisations, trade unions...
- ○ Research centres
- ○ University
- ○ Teaching in High School / Secondary School
- ○ Others

39. If 'others', please provide more details

40. Do your priorities include the possibility of working and/or living in a rural area?

- ○ Yes to work, but not to live
- ○ Yes to live, but not to work
- ○ Yes to live and work
- ○ No. Neither live nor work

41. In the case of your university, do you see the need for increased actions related to sustainability?

- ○ Yes
- ○ No

42. Do you know about any initiative or activity that might favor sustainability at your university?

- ○ Yes
- ○ No

43. If 'yes', please provide more details

44. Which kind of actions do you feel necessary to be implemented in order to make your organization a sustainable university?

45. Do you know about the pedagogical methodology called Service-leaning?

- ○ Yes
- ○ No

46. Service-learning is an educational approach that combines learning objectives with community service in order to provide a pragmatic, progressive learning experience while meeting societal needs. Are you interested in incorporating this type of training in your Bachelor's degree or Master's degree through internships in companies, social enterprises or in the final Degree Project (Practicum)?

- ○ Yes
- ○ No

47. Would you sign up for an internship at your university with this Service-learning model?

- ○ Yes
- ○ No

48. Would you sign up for an internship at your university with a social enterprise focused on food sustainability?

- ○ Yes
- ○ No
- ○ Maybe

49. Do you think it is necessary to create Service-learning processes with lecturers so that they can experience it first-hand and communicate it in an experiential way to students?

- ○ Yes
- ○ No

Thank you for your participation.

Survey for lecturers

This questionnaire if part of the research carried out in the NEMOS project "A new educational model for acquisition of sustainability competences through Service-learning". Further information about the project is below and can be found on the project website www.nemosproject.com. The survey is anonymous, and data will be stored on a secure drive. By taking this survey you are agreeing to participate in this research project. If you would like to ask any questions before taking the survey, please contact @.

NEMOS: A new educational model for acquisition of sustainability competences through Service-learning.

Aim and objectives
The main aim of the project is to develop an educational model, complete with students´ toolkit and educational practices in order to integrate the acquisition of sustainability competences during curricular education in the Food Sciences.

The objectives of this project are:

1. Defining a food sustainability profile (FSP) through a community building methodology by developing a model of intervention common to all universities involved, focused on sustainability and pedagogical practices, included Service-learning (SL).
2. Defining a methodological handbook (MH) in Food sustainability through SL as a common framework of activities for acquisition of sustainability competences for SL and roadmaps of implementation.
3. Defining assessment tools of FSP and MH by co-creation practices in SL.
4. Defining a new educational model suitable for the acquisition of sustainability competences through green pedagogies and SL. The final results would be a new educational model that we propose as the catalyst for change in the current educational model.

1. Gender
   - ○ Woman
   - ○ Man
   - ○ Non-binary
   - ○ Prefer not to say
2. How old are you now?
   - ○ Under 30
   - ○ 30-39
   - ○ 40-49
   - ○ Over 50
3. In your lecturing role, what levels do you teach? (check all that apply)
   - ○ Level 6
   - ○ Level 7/8
   - ○ Level 9

4. What Higher Education Studies have you yourself completed? Discipline area and level can be included

5. In what discipline area of knowledge do you mainly teach?

6. How many years have you been a University lecturer?
   - ○ 0-5 years (early career)
   - ○ 5-15 years (mid career)
   - ○ 15+ years

7. What is your current contractual relationship with your University?
   - ○ Senior Lecturer (SLI,II,III)
   - ○ Lecturer
   - ○ Assistant Lecturer
   - ○ Other

8. In addition to the university, do you work for any other public or private entity?
   - ○ No
   - ○ Yes, in the administration / civil service
   - ○ Yes, in a public company
   - ○ Yes, in a private company

9. Do you participate in any NGO or social, student, political, trade union or environmental organisation?
   - ○ No
   - ○ No, but I would like to be part of
   - ○ Yes, I do belong

10. Your interest in social, political, economic or environmental issues is:
   - ○ Very low
   - ○ Low
   - ○ Average
   - ○ High
   - ○ Very high

11. What media or sources do you turn to for information on these issues? (tick all that apply. Multiple answers possible)
   - ○ None
   - ○ Family members
   - ○ Friends
   - ○ Workshops, talks, courses...
   - ○ Personal experience
   - ○ Internet
   - ○ Social Media
   - ○ University colleagues and lecturers
   - ○ Press and media
   - ○ Social organisations
   - ○ Bibliography: books, journals, etc.
   - ○ Other

12. Speaking now about the idea of sustainability, in general terms, could you define this concept briefly?

13. What is your level of interest in sustainability?
   - ○ Very low
   - ○ Low
   - ○ Average
   - ○ High
   - ○ Very high

14. What issues, areas, and disciplines do you relate to sustainability?

15. What personal or social behaviours do you relate to sustainability?

16. What media or sources do you use to inform yourself about sustainability? (tick all that apply. Multiple answers possible)

- ○ None
- ○ Family members
- ○ Friends
- ○ Workshops, talks, courses...
- ○ Personal experience
- ○ Internet
- ○ Social Media
- ○ University colleagues and lecturers
- ○ Press and media
- ○ Social organisations
- ○ Bibliography: books, journals. Etc.
- ○ Other

17. Are you aware of the Sustainable Development Goals (SDGs) of the 2030 Agenda?

- ○ Yes
- ○ No (please go to question n.19)

18. If you are familiar with the SDGs, can you name any of them?

19. Have you been involved in any social, educational or professional project related to sustainability? (multiple answers possible)

- ○ Yes, social
- ○ Yes, educational
- ○ Yes, professional
- ○ No

20. Would you say that in your daily life you have behaviours and actions strive to be sustainable?

- ○ No (please, go to question n. 22)
- ○ Sometimes
- ○ Yes

21. What actions do you take regularly to ensure greater sustainability in your immediate and distant environment (waste, energy, mobility, consumption, technology, social environment)?

22. When you buy products such as clothes, shoes, and food do you pay attention to the origin, whether it is organic or Fair Trade? (multiple answers possible)

- ○ Yes, at the origin
- ○ Yes, if it is organic
- ○ Yes, if it is Fair Trade
- ○ No

23. In teaching, do you include sustainability-related content in the syllabus, lectures and or placements of your subject?

- ○ Yes, a lot
- ○ Somewhat
- ○ No, not at all

24. Do you encourage students to follow environmental, consumer and social “good practices” both at University and in their daily lives?

- ○ Yes, I do
- ○ No, I don’t

25. Do you and your students take care of waste production, excess consumption of materials and/or energy in the classroom, placements and/or laboratories?

- ○ Yes, I do
- ○ No, I don't

26. To what extent would you say that sustainability is present in the modules that you teach?

- ○ Not present
- ○ Somewhat present
- ○ Very present

27. Do you think there is a need for a greater emphasis on sustainability in the BSc Food Innovation?

- ○ Yes, I do
- ○ Maybe
- ○ No, I do not think so

28. How do you consider your own knowledge, skills and training in sustainability with a view to introducing it, as a competency, in your teaching and curriculum subjects and teaching projects?

- ○ Very low
- ○ Low
- ○ Fair
- ○ High
- ○ Very high

29. Have you taken formal professional development to increase your knowledge and skills in sustainability?

- ○ Yes
- ○ No

30. Do you see a need for further professional development in sustainability issues in your work as a lecturer?

- ○ Yes
- ○ No (please, go to question n. 33)

31. In what general areas would you like to have more knowledge and training in sustainability on this issue?

- ○ In my discipline area
- ○ In the general area of sustainability
- ○ In pedagogies to embed sustainability
- ○ Other

32. In what specific areas would you like to have more knowledge and training in sustainability?

33. What initiatives and/or activities do you carry out in your teaching to help students increase their knowledge and positive attitudes towards sustainability?

34. What teaching initiatives and/or activities would you like to see implemented in programmes for the education/training of students in sustainability in your area?

35. Would you like to participate in sustainable development projects or activities that take into account the relationship between environmental, social and economic factors?

- ○ No
- ○ Yes

36. What is your perception of the level of engagement of your students in sustainability related issues?

- ○ Very poor
- ○ Poor
- ○ Average
- ○ Good
- ○ Excellent

37. How do you assess the involvement of lecturing staff in general with the issue of sustainability?

- ○ Very low (please, go to question n. 38)
- ○ Low (please, go to question n. 38)
- ○ Average
- ○ Good
- ○ Excellent

38. If you think that lecturers' commitment to this issue is low, why do you think this is the case? (several answers possible)

- ○ Lack of training in the subject
- ○ Lack of time
- ○ No incentives from the University
- ○ Too much workload
- ○ Focused on professional career
- ○ Lack of University interest
- ○ No promotion
- ○ Other

39. What sustainability knowledge and attitudes do you think should be transmitted to students through university teaching?

40. In terms of career opportunities, do you think it would give your students an advantage in terms of being selected for a job if they have integrated sustainability competency in their education?

- ○ Yes
- ○ No
- ○ Maybe

41. In the case of your university, do you see the need increased training and actions related to sustainability?

- ○ Yes
- ○ No
- ○ Maybe

42. Do you know about any initiative or activity that promotes or enhances sustainability at your university?

- ○ No
- ○ Yes

43. If you selected "Yes" to the previous question, please provide some details

44. Which kind of actions do you feel necessary to be implemented in order to make your organization a sustainable university?

45. Do you know about the pedagogical methodology called "Service-learning"?

- ○ Yes
- ○ No

46. Service-learning is an educational approach that combines learning objectives with community service in order to provide a pragmatic, progressive learning experience while meeting societal needs. Do you support incorporating this type of training in the Bachelor's or Master's degree through work placement in companies, social entities or in the Final Year Project?

- ○ Yes
- ○ No

47. Would you include this Service-learning methodology in your teaching to embed sustainability?

- ○ Yes
- ○ No
- ○ Not sure

48. Do you think it is necessary to create sustainability related Service-learning opportunities for lecturers so that they can experience it first-hand and communicate it in an experiential way to students?

- ○ Yes
- ○ No
- ○ Not sure

49. Finally, would you attend professional development training in Service-learning methodology and its practical incorporation into your teaching for sustainability if was organized at the University?

- ○ Yes
- ○ No
- ○ Maybe

Thank you for your participation.

Survey for Stakeholders

We are interested to hear your perspective on sustainability!
This is important so that we can develop new training/education models based on real agri-food industry needs.
You are invited to take part in this 20-minute survey and share your valuable insight with us.
This questionnaire is part of the Erasmus+ project NEMOS - A new educational model for acquisition of sustainability competences through Service-learning. For more information please visit: www.nemosproject.com

The survey is anonymous, and data will be stored on a secure drive. By taking this survey you are agreeing to participate in this research project. For any questions please contact: @

Thank you for your help!
Your answers are important in designing education for a more sustainable global food.

1. Gender
   - ○ Woman
   - ○ Man
   - ○ Non-binary
   - ○ Prefer not to say
2. How old are you now?
   - ○ Under 30
   - ○ 30-39
   - ○ 40-49
   - ○ Over 50
3. Where do you work?
   - ○ Food company
   - ○ Research centre
   - ○ Regional or local government
   - ○ NGO
   - ○ Other
4. If 'other', please specify:
5. In the last 5 years, approximately how many graduates has your organisation recruited?

6. What type of employment has your organisation provided in recent years?
   - ○ Full-time
   - ○ Part-time
   - ○ Occasional
   - ○ Internship/Training

7. Speaking now about the idea of sustainability, in general terms, could you define this concept briefly?

8. What is your level of interest in sustainability?
   - ○ Very low
   - ○ Low
   - ○ Average
   - ○ High
   - ○ Very high

9. What issues, areas, and disciplines do you relate to sustainability?

10. What personal or social behaviours do you relate to sustainability?

11. What media or sources do you turn to for information on these issues? (tick all that apply)
   - ○ None
   - ○ Family members
   - ○ Friends
   - ○ Workshops, talks, courses...
   - ○ Personal experience
   - ○ Internet
   - ○ Social Media
   - ○ University colleagues
   - ○ Press and media
   - ○ Social organisations....
   - ○ Bibliography: books, journals
   - ○ Other

12. If 'other', please specify

13. Are you aware of the Sustainable Development Goals (SDGs) of the 2030 Agenda?
   - ○ Yes
   - ○ No (in this case, go to question n. 15)

14. If you are familiar with the SDGs, can you name any of them?

15. Have you been involved in any social, professional or institutional project related to sustainability? (multiple answers possible)
   - ○ Yes, social
   - ○ Yes, educational
   - ○ Yes, professional
   - ○ No

16. In your daily life do you strive for sustainable behaviours and actions?
   - ○ No (if not, skip to question n. 18)
   - ○ Sometimes
   - ○ Yes

17. What actions do you take regularly to ensure greater sustainability in your immediate and distant environment (waste, energy, mobility, consumption, technology, social environment)?

18. When you buy products such as clothes, shoes, food... do you pay attention to the origin, whether it is organic or Fair Trade? (several answers possible)

- ○ Yes, at the origin
- ○ Yes, if it is organic
- ○ Yes, if it is Fair Trade
- ○ No

19. Do you encourage your employees and/or colleagues to follow "good practices" in environmental, consumer, social, etc., both at company/organisation where you work and in their daily lives?

- ○ Yes
- ○ No

20. Do you and your employees and/or colleagues take care of waste production, excess consumption of materials and/or energy in the organisation where you work?

- ○ Yes
- ○ No

21. To what extent would you say that sustainability is present in your company/organisation?

- ○ Not present at all
- ○ Somewhat present
- ○ Fairly present
- ○ Very present

22. Do you think there is a need for a greater emphasis on sustainability in your organisation?

- ○ Yes
- ○ No

23. What issues hinder the further implementation of sustainability processes and actions in your organisation?

24. How do you consider your own knowledge, skills and training in sustainability with a view to introducing it in your work? Level of knowledge about sustainability:

- ○ Very low
- ○ Low
- ○ Average
- ○ High
- ○ Very high

25. Do you see a need for further professional development in sustainability issues in your work?

- ○ Yes
- ○ No (please, skip to question n. 27)

26. In what specific areas would you like to have more knowledge and training in sustainability?

27. How important are the following sustainability-related practices for your company/institution? Please, rate the level of importance of the following sustainability-related practices by using a scale between 1 and 6. (where 1= not at all important; 6= extremely important. Please, consider 0= I don't know)

- ○ Recycling (i.e., paper, cardboard, glass, plastic, or aluminium cans)
- ○ Contributing to community projects
- ○ Having family-friendly policies (i.e., flexitime)
- ○ Supporting local suppliers
- ○ Considering diversity inhering decisions
- ○ Promoting daily energy saving activities in offices (turning off computers, lights, air-conditioning, etc.)
- ○ Installing solar or other renewable energy source
- ○ Training of employees to raise their awareness of sustainability
- ○ Reporting social and environmental impacts in annual reports

- ○ Having eco-friendly merchandise or products
- ○ Setting targets for waste reduction
- ○ Setting targets for reducing electricity consumption
- ○ Using low-flow water devices
- ○ Using sustainability-related criteria in recruitment and selection
- ○ Obtaining environmental certification (i.e., ISO14001)
- ○ Appointing a Manager for Sustainability
- ○ Applying circular bioeconomy

28. What are the GENERAL COMPETENCIES that graduates should possess to work in your company/institution? Please, rate the level of importance of the following competencies by using a scale between 1 and 6 (where 1= not at all important; 6= extremely important. Please, consider 0= I don't know)

- ○ Effective oral and written communication
- ○ Interpersonal communication
- ○ Ability to follow through on tasks
- ○ Time management
- ○ Ability to work in a team/collaborate
- ○ Ability to adapt to change
- ○ Critical thinking
- ○ Ability to take initiative
- ○ Ability to set priorities
- ○ Ability to problem solve
- ○ Ability to think strategically
- ○ Ability to be empathetic
- ○ Awareness of cultural diversity
- ○ Leadership
- ○ Conflict resolution

29. How satisfied are you with the level of performance of recent graduates on the same skills? Please, rate the level of importance of the following competencies by using a scale between 1 and 6 (where 1= not at all satisfied; 6= extremely satisfied. Please, consider 0= I don't know)

- ○ Effective oral and written communication
- ○ Interpersonal communication
- ○ Ability to follow through on tasks
- ○ Time management
- ○ Ability to work in a team/collaborate
- ○ Ability to adapt to change
- ○ Critical thinking
- ○ Ability to take initiative
- ○ Ability to set priorities
- ○ Ability to problem solve
- ○ Ability to think strategically
- ○ Ability to be empathetic
- ○ Awareness of cultural diversity
- ○ Leadership
- ○ Conflict resolution

30. Please, reflect on your own personal values and worldview in terms of sustainability, equity and justice for current and future generations. Please, rate the level of importance of the following values by using a scale between 1 and 6 (where 1= not at all important; 6= extremely important. Please, consider 0=I don't know)

- ○ Valuing sustainability
- ○ Supporting equity and fairness
- ○ Protecting and promoting nature

31. What SUSTAINABILITY-RELATED VALUES should graduate students possess in order to work in your organisation? Please, rate the level of importance of the following values by using a scale between1 and 6 (where 1= not at all important; 6= extremely important. Please, consider 0=I don't know)

- ○ Valuing sustainability
- ○ Supporting equity and fairness
- ○ Protecting and promoting nature

32. What importance do you attribute to the following statements? Please, rate the level of importance of the following statements by using a scale between 1 and 6 (where 1= not at all important; 6= extremely important. Please, consider 0= I don't know)

- ○ Education should increase students knowledge of the role of renewable energy resources in helping to prevent climate change
- ○ Education should help students develop positive attitudes and values towards sustainability issues.
- ○ Sustainability is a key factor in the future success of business

33. Would you like to participate in sustainable development projects or activities that take into account the relationship between environmental, social and economic factors

- ○ Yes
- ○ No

34. Which kind of actions should be implemented in order to make your organization sustainable?

35. Do you know about the pedagogical methodology called Service-learning?

- ○ Yes
- ○ No

36. Service-learning is an educational approach that combines learning objectives with community service in order to provide a pragmatic, progressive learning experience while meeting societal needs. Do you think it would be of interest to incorporate this type of training for graduates recruited by your organisation?

- ○ Yes
- ○ No

37. Would you commit yourself to collaborate with this Service-learning model?

- ○ Yes
- ○ No

38. If yes, how? If you think there are already initiatives compatible with this approach, please describe them. We ask you to do the same should you wish to implement any.

Thank you for your participation.

Appendix III

NEMOS guide for reflective assessment of Service-learning experience

This guide, developed within the NEMOS project, provides the resources to assist students and academic staff in conducting reflective assessments as part of sustainability-related Service-learning activities. Reflective practice is a key part of turning high-impact experiences into learning. It allows students to participate actively in their learning process and fosters intellectual engagement. It helps with recognising and relating knowledge gained in theoretical activities to what they are learning through experiential activities such as Service-learning. It is a way of helping the student to become an active, aware, and critical learner.

However, the process of transforming tacit knowledge from Service-learning into a form they can verbalise or articulate in writing is important but can be challenging for students. This guide aims to provide resources to assist with this process. It also aims to provide guidance to academic staff with designing and grading reflective assessments.

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1. Trigger Questions for structuring Service-learning reflective writing

Research shows that students struggle with the process of reflective writing (Dunne, 2019). Structuring the process, including use of 'trigger questions' (#1), rubrics (#2), and models for reflection (#3), and reflective writing guides and supports (#4) will all help students in their critical reflection.

An example of a general set of trigger questions:

1. What was the purpose of the Service-learning experience and what specific outcome was expected by the community partner?
2. What prior learning from your course of study underpinned your ability to contribute to the development of a solution for the community partner? You should include both technical and transferable skills and knowledge.
3. Specifically, what sustainability knowledge enabled your contribution to the Service-learning experience? How does this relate to the UN SDGs?
4. How has your knowledge/skills been enhanced through participation in the Service-learning experience? You should include a discussion of the learning outcomes or objectives of the Service-learning agreement.
5. How has the Service-learning experience enhanced your sustainability competencies? This should include consideration of both technical and transferable competences (e.g. GreenComp competences).

2. Rubric for structuring and assessing Service-learning (based on Dunne and Ryan, 2016)

2.1. Content

Beginning	Developing	Proficient	Strong
Identifies some general ideas or issues from Service-learning experiences relevant to the purpose or topic. Experiences are poorly described or are not relevant to the course of study or profession .	Some detail explaining some specific ideas/issues from Service-learning experiences related to the purpose or topic. Makes general connections between Service-learning experiences and theory. Experiences are reasonably well described and somewhat relevant to the course of study, but not related well to specific theory .	Good detail explaining some specific aspects of Service-learning related to the topic or purpose. Makes some connections between what is learned from Service-learning experiences to college theory and profession.	In-depth synthesis and well described appropriate aspects of Service-learning experiences. Makes clear connections between what is learned from Service-learning experiences to college theory and future profession.

2.2. Sustainability in action

Beginning	Developing	Proficienty	Strong
Has not identified how the Service-learning experience relates to sustainability or to the UN SDGs.	Has identified how the Service-learning experience relates to sustainability and demonstrates some literacy to connect the experience to a UN SDG.	Clearly articulates the relationship between the Service-learning activity and how a process or product can be changed to enhance sustainability. Has well developed sustainability literacy and demonstrates the capacity to link the enhanced sustainability to one or more UN SDGs. Makes connections to related sustainability aspects of the course of study.	Evidence of significant expertise development to make informed and appropriate judgements relating to enhancing a process or product to improve sustainability, evidenced on relevant knowledge from related aspects of course of study and also including the context of UN SDG targets, indicators and relevant data.

2.3. Graduate Attributes (Transferable skills/employability skills) including sustainability related competencies

Beginning	Developing	Proficienty	Strong
No reference made to graduate attributes including specific sustainability competencies.	Some mention of graduate attributes including specific sustainability competencies but little evidence to support skill development.	Discussion on the development of an attribute (s) supported by evidence from Service-learning experience or a specific element or scenario to support.	Critical discussion on the development of an attribute based on evidence from the Service-learning experience or a specific element or scenario, and discussion on the impact or importance on professional development and future career.

2.4. Reflection

Beginning	Developing	Proficienty	Strong
No evidence of reflection on performance during the activity or personal response to experiences described.	No evidence of reflection on performance but some personal response to experiences described.	Evidence of reflection on performance and good personal response to experiences described.	Evidence of deep reflection on performance and clear personal response to experiences described, together with statement of learning achieved both from the experience and reflection.

2.5. Style

Beginning	Developing	Proficienty	Strong
Poor grammar and spelling, and poor general language usage makes submission difficult to read or follow. Incorrect length, word count or other requirement.	Spelling and grammar are good, but little thought out into construction of submission into a coherent piece. Incorrect length, word count or other requirement.	Good grammar and spelling, and correct language usage. Coherent and adhering to instructions of format, length and other requirements.	Good grammar and spelling, excellent language usage, demonstrating style and personal expression. Coherent and adhering to instructions of format, length and other requirements.

3. What? So What? Now What?

An example of a model for Reflection based on Rolfe et al. (2001) "Framework for reflexive practice"

Rolfe et al. (2001) propose a framework that uses Borton's (1970) developmental model. The questions What? So what? And now what? can stimulate reflection from novice to advanced levels. Firstly, the practitioner reflects on the situation in order to describe it. The second phase encourages the practitioner to construct personal theory and knowledge about the situation in order to learn from it. At the third level the practitioner reflects on action and considers ways of improving the situation and reflects on the consequences of his/her actions. Rolfe et al. (2001) consider this final stage as one, which can make the greatest contribution to practice.

Framework for reflexive practice:

Descriptive level of reflection **What ...**	Theory - and knowledge - building level of reflection **So what ...**	Action-orientated (reflexive) level of reflection **Now what ...**
• ... is the problem/difficulty/ reason for being stuck/reason for feeling bad/reason we don't get on? • ... was my role in the situation? • ... was I trying to achieve? • ... actions did I take? • ... was the response of others? • ... were the consequences for everyone involved? • ... feelings did it evoke in all those involved? • ... was good/bad about the experience?	• ... does this tell me/teach me/ imply/mean about me/my work/ others/our relationship/ /my attitudes/the community's attitudes • ... was going through my mind as I acted? • ... did I base my actions on? • ... other knowledge can I bring to the situation? › personal › academic › social • ... could/should I have done to make it better? • ... is my new understanding of the situation? • ... broader issues arise from the situation?	• ... do I need to do in order to make things better/stop being stuck/ improve my work/resolve the situation/feel better/get on better • ... broader issues need to be considered if my action/this project is to be successful? • ... might be the consequences of my action/this project?

4. Reflective writing structure and vocabulary support

The Portsmouth University provides a structure and vocabulary to help students with reflective writing:
University of Porthsmouth (2022) Reflective writing: A basic introduction. University of Portsmouth, ASK- Academic Skills Unit. https://www.port.ac.uk/sites/default/files/2022-10/reflective-writing.pdf

5. Recommended reading for academic staff new to assessing reflective writing

"Assessing reflective learning" by Bourner (2003) is the recommended reading for academic staff new to reflective assessments.

6. CampusEngage Toolkit for implementing Service-learning

https://www.campusengage.ie/what-we-do/publications/

7. GreenComp The European sustainability competence framework

https://publications.jrc.ec.europa.eu/repository/handle/JRC128040

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Rolfe, G., Freshwater, D., Jasper, M. (2001) Critical reflection for nursing and the helping professions: A user's guide. Palgrave MacMillan.

University of Portsmouth (2023) Reflective writing introduction. https://www.port.ac.uk/student-life/help-and-advice/study-skills/written-assignments/reflective-writing-introduction

Appendix IV

Examples of incorporation of sustainability competences through Service-learning in food-related courses

Appendix IV summarises the experiences of the NEMOS consortium universities in incorporating sustainability competences through Service-learning in food-related courses including the Graz University of Technology (TU Graz), Institut Supérieur d'Agriculture Rhône-Alpes in Lyon (ISARA-Lyon), Public University of Navarre (UPNA), Technological University Dublin (TU Dublin), University of Pisa (UNIPI).

The examples are presented in the following order:

A. Food science and technology-related courses

B. Agricultural courses

C. Laboratory and practical courses

D. Business and quality control

A. Food science and technology-related courses

Food Biotechnology (5 ECTS, 1st year) TU Graz: Methods of biotechnological production of food are discussed. This comprises GMO foods from plants and animals as well as the production of fermented foods (e.g., tea, coffee, cocoa, dairy products (yogurt, cheese), raw sausages, fermented vegetables). General principles of meat processing (including enzymatic and microbial meat fermentation) are discussed which includes general hygienic measures.

Essential learning outcomes	Students will have an overview of biotechnological processes for food production and will be able to identify relevant processes. Genetic modification of organisms for food use from microbial, plant, and animal origin should be understood as well as the impact on food processing.
Sustainability-related learning outcomes	• The students should be able to discuss the advantages and disadvantages of GMO foods for different stakeholders. • Impact of GMOs on production of e.g., organic food, honey, etc. • Impact of GMOs on environment and the interaction with non-GMO food. • How can "food biotechnology" be integrated in a circular economy model. • Energy and waste reduction in food processing. • Reduce water use in food processing. • Use of "low-temperature" (e.g., solar heat) in heating processes (malt mashing for beer production).
Opportunities for Service-learning with community organisations	• Start a community garden at your university, with free for all fruits and vegetables. • Collect the organic waste and make your own organic soil, distributing it to local small farmers. • Inform people about how GMOs can help with sustainability and waste loss.

Enzymatic and Microbial Food Processing (3 ECTS, 1st year) TU Graz: Methods of enzymatic processing of food are discussed, focusing on the activity of enzymes in postharvest technology and the use of enzymes for the production of food. Discussion of some fermentation processes (vinegar production).

Essential learning outcomes	Students will be able to evaluate enzymatic processes in food production in terms of safety, efficiency, and optimal use. Traditional processes of fermentation and e.g., cheese manufacturing.
Sustainability-related learning outcomes	• Understanding the impact of GMOs for enzyme production. • Reducing the environmental impact of fermentation processes. • Possibility of upgrading production waste for e.g., energy production or design of "new" foods or non-food products from the waste. • Understanding how the use of enzymes can reduce food waste (by prolonging shelf life, transforming waste streams into value-added products).
Opportunities for Service-learning with community organisations	• Start a community garden at your university, with free for all fruits and vegetables. • Collect the organic waste and make your own organic soil, distributing it to local small farmers. • Inform people about how GMOs can help with sustainability and waste loss.

Food Chemistry and Technology 2 (1st year) TU Graz: Description of carbohydrates and possible reactions relevant for food quality; lipid structure and lipid oxidation with the impact on quality and health; food toxicology; food additives; food adulteration.

Essential learning outcomes	After successful completion of the course, the students understand basic reactions in foods that occur during cooking, processing, and storage. After successful completion of the course, the students understand essential technological processes in food production.
Sustainability-related learning outcomes	• Understanding the impact of GMOs for enzyme production. • Reducing the environmental impact of fermentation processes. • Possibility of upgrading production waste for e.g., energy production or design of "new" foods or non-food products from the waste. • Understanding how the use of enzymes can reduce food waste (by prolonging shelf life, transforming waste streams into value-added products).
Opportunities for Service-learning with community organisations	• Start a community garden at your university, with free for all fruits and vegetables. • Collect the organic waste and make your own organic soil, distributing it to local small farmers. • Inform people about how GMOs can help with sustainability and waste loss.

Sensory Analysis of Biotechnologically Produced Food (1st year) TU Graz: Introduction to sensor technology - basic terms of sensory analysis - performance of the threshold test - odour detection - overview of different testing methods and execution on different examples - statistical evaluation of the different testing methods - profile testing - off-flavour demonstration - selection of test persons and requirements of the test room - sample preparation

Essential learning outcomes	Sensory evaluation of foods and is an essential part for the evaluation of (1) the quality of food and (2) to understand consumer behaviour. In order to obtain results that are as objective and comparable as possible, specific techniques have been developed for sensory evaluation. These techniques are described in textbooks and standards. After completing this seminar, students should be familiar with the techniques of sensory analysis and should be able to perform sensory tests independently.
Sustainability-related learning outcomes	• Sensory evaluation/consumer science should be used to understand the consumers' attitudes to be produce products according to the consumers' needs. • Evaluation of the suitability of new products (i.e. insects; plat based protein alternatives) or process by-products; sensory evaluation will help to understand these products.

Opportunities for Service-learning with community organisations	• "Sensory education" with different groups will lead to a better understanding of food properties. • Sensory training will widen the horizon of the involved persons and will help to enlarge the range of consumed food commodities (e.g., higher fruit and vegetable consumption; higher willingness to try food from alternative protein sources). • Specific training with producers on potential off-flavour will help to increase the overall quality and reduce food waste.

Postharvest Technology (1st year) TU Graz: Fruits, vegetables and grains are the focus of this lecture. The technology from harvest to processed product and chemical reactions behind it are covered. - storage of fruits and vegetables - climacteric/non-climacteric fruits - cold storage diseases - CA storage - basis processing methods for fruits and vegetables - production of specific products - harvesting and storage of cereals - cleaning, sorting, shelling - basic dough preparation

Essential learning outcomes	• Students have an overview of the production of essential plant-based foods. They are able to assess plant-based foods in terms of production and quality. • Students learn about the chances and difficulties in fruit/vegetable processing.
Sustainability-related learning outcomes	• Understanding fruit and vegetable from harvest, following storage until the product in the shelf. • Reducing food waste. • Thinking of valuable by-products. • Thinking of alternative ways of production that might be of higher energy efficiency.
Opportunities for Service-learning with community organisations	• Teaching about the right storage of different foods to prevent food waste. • Teaching/training of different groups on heritage fruit varieties to maintain biodiversity. • Science-to-public activities on fruit and vegetables cultivation and processing for a better understanding on what they eat.

Industrial Biotechnology (2 ECTS) TU Graz: -Basics of industrial biotechnology - recapitulation and review of course content from the lecture Biotechnology - introduction or repetition of concepts of biocatalysis, organic chemistry, analysis of proteins and small molecules, molecular biotechnology - real-life issues from industry to research using specific examples - the path from laboratory to production - engineering of biocatalysts - high-value/low-volume products compared to low-value/high-volume products - green chemistry - ethical, societal and legal aspects.

Essential learning outcomes	After successful completion of the course, the students know typical requirements of biotechnological processes on an industrial scale. They are able to understand the approach to a research question and roughly design a project based on a scientific question with the goal of implementation in an industrial setting. The students are able to describe essential molecular and process-technical working methods of biotechnology, and to consider boundary conditions beyond that.
Sustainability-related learning outcomes	• Apply green chemistry principles to food chemistry laboratory techniques. • Use of enzymes for specific processes (manufacturing of food additives and aromas).
Opportunities for Service-learning with community organisations	• Readying producers to participate in school food service by providing training on Good Agricultural Practices (GAP) and other food safety-related topics. • Organise workshops in schools where we point out problems in food industry regarding sustainability (food waste, low-quality food, non-local food).

Sustainable Development in Food Processing (5th year, 6 ECTS). ISARA-Lyon

Essential learning outcomes	• Understand the stakes of sustainable development and apply them to the organisation strategy. • Analyse the sustainability of the food chain in an international context. • Be a creative force and a proactive / leading stakeholder in his/her organisation (intrapreneurship). • Design, implement and assess development projects. • Understand and implement the strategic management items at various levels of the organisation and translate them into operational action plans.
Sustainability-related learning outcomes	This course gives an overview of the holistic approach in sustainable food processing via the consideration of the total value chain. Food production and management tools, food quality systems, occupational health, food crisis management and life cycle assessment are introduced. Upon the completion of the course, the students will be able to: • Acquire creativity skills and problem-solving tools. • Manage teams and organisations in an international context and from the perspective of continuous improvement. • Understand the stakes of sustainable development and apply them to organisation strategy. • Analyse the sustainability of the food chain in an international context.
Opportunities for Service-learning with community organisations	Respond to the request of a client (technical centres, companies, associations, research institutes) on a specific issue related to sustainability of food systems for a more sustainable food processing (06 weeks of project-full time).

Entrepreneurship and Innovation in the Food Business (1st year, 6 ECTS). UPNA

Essential learning outcomes	• To understand the importance of innovation in the management of agri-food companies. • To analyse the main barriers and opportunities for innovation in the agri-food sector, with special attention to SMEs. • To understand the meaning of creativity, leadership, motivation and entrepreneurship, and their importance in the management of agri-food companies.
Sustainability-related learning outcomes	• Students will know how to obtain reliable information, less widespread, on farm practices and the food industry, for decision-making. • Students will become aware of healthy eating. • Integration and dissemination of knowledge among university students on the impact of meat consumption/vegetarianism. • To know, specify and broaden the perspective on the different dimensions of sustainability. • Critical thinking skill. • Understand the impacts of different products and production systems.
Opportunities for Service-learning with community organisations	Then, they will design an innovation to be carried out at the university canteen in order to incorporate this aspect of sustainability, using Design Thinking. • Change in the student's own lifestyle.

Nutrition and Health (2nd year, 6 ECTS). UPNA

Essential learning outcomes	• Curricular learning of the related matter as indicated in the teaching guide: "R2: Identify eating habits in society and their relationship with health". • Knowledge of the physiological role of nutrients. • To identify health-promoting foods, ingredients, substances that promote health. • To know the nutritional needs of the population. • To identify food habits in society and their relationship with health.
Sustainability-related learning outcomes	• Evaluation of diet and lifestyle habits in university students: • Knowledge of the nutritional needs and recommended intakes of a specific population. • Management of dietary guides. • Management of food frequency questionnaires. • Qualitative evaluation of the diets. • Changing public opinions, diets, perspectives, fears. • Healthy and nutritious food (reformulation, reduced sugar, salt, etc). • Development of leadership and project management skills (not included in the profile yet). • Development of communication skills: interaction with students, communication of the results obtained.
Opportunities for Service-learning with community organisations	• Assessment of the dietary habits of the students of UPNA. • Make healthy lifestyle and dietary recommendations. • Disclosure of the results of the study to the university community. • Dissemination of information on healthy dietary habits to the university population.

Innovation in Food Products (3rd year, 6 ECTS). UPNA

Essential learning outcomes	• To acquire knowledge about innovation in order to develop a professional profile with critical and entrepreneurial capacity, which contributes in a sustainable way to continuous improvement both at a business level and at the level of development of new food products and profitable & sustainable processes. • Appreciate the importance of the product concept and its relationship with the market, knowing the different phases of the design process of a food product. the different stages of the design process of a food product. • Develop new food formulations. • Know the legislation related to new foods. • Evaluate the role of design, label, and traceability in the acceptance of a new product.
Sustainability-related learning outcomes	• To develop activities in the field of agri-food and innovation with a social, ethical, and sustainable commitment. • Use knowledge on the valorisation of by-products from the agri-food industry for the improvement of food processes and the development of new products with a sustainable approach.
Opportunities for Service-learning with community organisations	Talks to students given by the food industry with experience in sustainability in the sector. The students will provide proposals to the industry. For instance, in the case of a zero-waste company, students will propose alternative uses to the by-products and residues. Organise visits to zero waste food companies to learn how to reuse residues and by-products to give them added value. • The students acquire knowledge on innovative agri-food waste reduction and by-product use strategies and circular economy from a practical point of view. • Sustainable agri-food companies receive valuable inputs on innovative ideas to their activities.

Food Design and Development I (3rd year, 6 ECTS) - Food design and development II (3rd year, 6 ECTS). UPNA

Essential learning outcomes	• Assess the importance of the product concept and its relationship with the market, knowing the different phases of the design process of a food innovation. • Analyse the risks of the new product. • Know the legislation related to new foods. • Evaluate the role of design, label, and traceability in the acceptance of the new product. • Develop new food formulations. • Determine the shelf life of novel foods. • Analyse the risks of the new product. • Assess the role of design, labelling and traceability in new product acceptance. • Develop new packaging.
Sustainability-related learning outcomes	• Develop activities in the agri-food and innovation field, assuming a social, ethical, and sustainable commitment. • Apply the bases of sustainability in new food product development. • Sustainability of food packaging. • Ability to link theory and practice. • Social sustainability.
Opportunities for Service-learning with community organisations	Sustainable food packaging in practice: The principles of sustainability are applied through activities related to food paper packaging. The students' task is the design of a new food product with a sustainable food packaging (e.g., bread). The students analyse the life of the product (the food quality and aspect vary with or without different paper packaging options). After students are taught by a composting expert, they analyse in practice which paper packaging composts better. They conclude whether or not the packaging is better to maintain the bread and the sustainability implications. The students write a short report, which will be assessed and presented to the social printing block of the Pamplona town hall in risk of exclusion. • Inform the students and the Pamplona town hall (the social printing block of the town hall) about sustainable food paper packaging in practice. • People at risk of social exclusion gain opportunities and resources.

Food and Pharma Instrumentations (5 ECTS). TU Dublin

Essential learning outcomes	1. Describe the principles of analytical instrumentation commonly found in a Food/Beverage/Pharmaceutical laboratory for quantitative and qualitative analysis 2. Apply the principles of chromatography and spectroscopy to select an appropriate chromatographic/spectroscopic technique to the analyte under examination. 3. Demonstrate the basic operation, the components, and the application of common spectroscopic and chromatographic techniques in food/beverage and pharmaceutical analysis. 4. Carry out relevant and experimental laboratories using spectroscopic, chromatographic techniques and present the experiment in the form of an online lab report (following the school template). 5. Conduct lab experiments individually or as part of a team in a good lab practise environment.
Sustainability-related learning outcomes	• Demonstrate the basic operation, the components, and the application of common spectroscopic and chromatographic techniques in sustainable food/beverage and pharmaceutical analysis. [Updated LO] • Conduct lab experiments individually or as part of a team in a good lab practise environment using non-conventional methods for reducing use of organic solvents and chemical reagents. [Updated LO]

Opportunities for Service-learning with community organisations	Underpinning the capstone internship and project modules which include Service-learning opportunities.

Food Analysis (5 ECTS). TU Dublin

Essential learning outcomes	• Describe the basic terminology of chemical analysis and explain the decision process for choice of methods, and use of validated methods. • Describe the principles of sampling. • Explain the uses of traditional sample preparation techniques. • Describe aspects of laboratory Quality documentation for analytical methods. • Describe applications of chemical techniques in food analysis. • Describe applications of instrumental techniques including rapid methods in food analysis. • Discuss food fraud. • Develop enhanced numeracy through in-class and in-practical calculations, including identification and reduction of variance. • Develop enhanced laboratory skills to perform high quality food analyses for a range of food constituents. • Develop enhanced research and scientific writing skills to report on food analysis experiments.
Sustainability-related learning outcomes	• Explain the uses of traditional sample preparation techniques as well as potential for greener solvents for extraction of bioactives. [Updated LO] • Describe applications of chemical techniques in food analysis, and the role of green chemistry in analytical methods. [Updated LO] • Discuss global challenges in the context of food chemistry and analysis: food fraud and the impact of climate change on food chemical contaminants. [Updated LO]
Opportunities for Service-learning with community organisations	Underpinning the capstone internship and project modules which include Service-learning opportunities including research with Teagasc relating to fermentation of BSG to enrich animal feed and knowledge transfer to Priory Brewery.

Advanced Microbiology (5 ECTS). TU Dublin

Essential learning outcomes	• Describe in detail the application of functional food and nutraceuticals. • Display knowledge of global antimicrobial resistant organisms and their role in infectious disease. • Discuss genetic mechanisms of antimicrobial resistance. • Complete Microbiological risk assessments • Describe the role of microbiological biofilms. • Display knowledge of novel microbiological analysis. • Hot topics in Microbiology. • Critically evaluate research topic & develop teamwork skills.
Sustainability-related learning outcomes	• Describe antibiotic resistance and its global impact on society and explain how antibiotics impact on sustainability. • Describe the UN strategy on antibiotic resistance and sustainability. [Updated LO]
Opportunities for Service-learning with community organisations	Underpinning the capstone internship and project modules which include Service-learning opportunities: analysing animal feed for traces of antibiotics due to the prevalence of antibiotics in the food chain.

Beverage Microbiology (5 ECTS). TU Dublin

Essential learning outcomes	• Demonstrate knowledge of the fundamentals of fermentation. • Explain fermenter design, operation, and control. Discuss the stages in the brewing process and the importance of HACCP. • Explain yeast metabolism its role in the brewing process. • Detail the variety of products and the micro-organisms involved. • Distinguish between brewing and distilling processes and the products. • Demonstrate knowledge of the practical aspects of the brewing process.
Sustainability-related learning outcomes	• Relate sustainability to brewing processes. • Discuss alternative sustainable ingredients in brewing including genetically engineered yeasts. • Explain how effective waste management in the brewing process can impact a company's sustainability. [Updated LO]
Opportunities for Service-learning with community organisations	Underpinning the capstone internship and project modules which include Service-learning opportunities: research with Teagasc relating to fermentation of BSG to enrich animal feed and knowledge transfer to Priory Brewery.

Allergen Management and Control (5 ECTS). TU Dublin

Essential learning outcomes	• Explain the implications of Allergens in food & the impact on the body. • Debate and defend the critical control measures to be taken to prevent allergen contamination. • Explain the legislation surrounding the control and presence of allergens in the food chain. • Summarise the methods used to detect a range of allergens in food stuffs and the environment. • Interpret how to formulate products to comply with allergen management legislation.
Sustainability-related learning outcomes	Demonstrate knowledge of the role product development has in using more sustainable, ethical, and non-allergenic ingredients. [Updated LO]
Opportunities for Service-learning with community organisations	Underpinning the capstone internship and project modules which include Service-learning opportunities.

Food and Drink Product Development (5 ECTS). TU Dublin

Essential learning outcomes	• Conduct scientific based food research; be competent in accessing relevant literature and scientifically reporting findings. • Employ the theory of product development to the production of new food products. • Apply advanced sensory methods to problem solving, product development and quality control. • Demonstrate appropriate laboratory skills.
Sustainability-related learning outcomes	• Design Product formulation to utilise sustainable ingredients & raw materials sourcing, innovations in processing, reformulation, water, energy & waste reduction, utilisation of waste/by-products and environmentally friendly packaging. [Updated LO] • Apply advanced sensory methods to problem solving, product development and responsible consumer research. [Updated LO]
Opportunities for Service-learning with community organisations	Underpinning the capstone internship and project modules which include Service-learning opportunities.

Fundamental Sensory Evaluation (5 ECTS). TU Dublin

Essential learning outcomes	• The student should be able to relate the senses to their role in sensory evaluation. • The student should be able to organise and employ sensory tests in the areas of problem solving, product development and quality control. • The student should be able to apply relevant statistical testing to resulting data, interpret and communicate results. • The student should be able to identify and explain the source and manipulation of food flavour, both added and inherent to the product.
Sustainability-related learning outcomes	Apply responsible consumer research incorporating ethics, transparency, GDPR and EDI and assess the H&S and sustainability implications.
Opportunities for Service-learning with community organisations	Underpinning the capstone internship and project modules which include Service-learning opportunities.

B. Agricultural courses

Agronomy (2nd year, 7 ECTS). ISARA-Lyon

Essential learning outcomes	Students will be able to: • Understand the functioning of an agroecosystem at the plot level in order to carry out an agronomic/cultural diagnosis. • Apply their knowledge to a specific crop in a farm, taking into account the soil, climate, technical and socio-economic context.
Sustainability-related learning outcomes	• Analysis of different performance indicators (yield, work time, average income) at the farm level. • Estimate the final yield in relation to the yield potential of the plot of land.
Opportunities for Service-learning with community organisations	Organise workshops with campus neighbours to teach them about sustainable and environmentally responsible gardening.

Diagnosis in agronomy and animal science (3rd year, 15 ECTS). ISARA-Lyon

Essential learning outcomes	• Students will gain an overview of how a crop or livestock system works, with the challenges faced by farmers in a particular context. Students will be able to: • Carry out a diagnosis of livestock system based on a farm field trip. • Apply diagnostic tools and methods designed by technical institutes, research, and agricultural extension services.
Sustainability-related learning outcomes	The students should be able to: • Determine which indicators to use according to the meaning given to the diagnosis. • Highlight the strengths and weaknesses of the system in relation to the objectives of the diagnosis. • Realise an assessment of the sustainability of the farm. • Propose some ways to improve the sustainability of the analysed system. • Justify each adjustment and detail its potential consequences on the food system.

Opportunities for Service-learning with community organisations	• Inform farmers with the key tools to improve the sustainability of the livestock system. • Invite farmers to a student-organised seminar on "How to achieve a sustainable animal product production system?"

Transdisciplinary analysis of territories (5th year, 6 ECTS). ISARA-Lyon

Essential learning outcomes	The module is based on a study tour of a territory in agro-ecological transition. Through this field trip in the territory and meetings with various actors of the territory, the students will be able to analyse the functioning of the territory and its agriculture. This study tour addresses the theme of sustainable development of territories and their agroecological transition. More specifically, students will be able to: • Understand the diversity of the stakes of a territory in its agronomic, ecological, social, economic, and cultural components. • Understand the main determinants of individual and collective innovation processes. • Study the organisation of a production basin, to step back from the game of actors and public policies. • Discover specific agroecosystems in a multifunctional territory.
Sustainability-related learning outcomes	• Understand the macro-landscape, institutional and socio-economic elements of the territory. • Preparation of questionnaires and mapping of actors to be interviewed.
Opportunities for Service-learning with community organisations	Organise this type of debate with different organisations and stakeholders.

Management of Agroecosystems: implications from policies and nature conservation (5th year, 6 ECTS). ISARA-Lyon

Essential learning outcomes	The main objective of this module is to lead students to address the complexity of biodiversity management and apply a critical thinking on this topic, by exploring the negative and positive feedback between biodiversity and agricultural activities and by producing a report presenting case studies on biodiversity management in agroecosystems.
Sustainability-related learning outcomes	• Develop a topic related to agroecosystems management and present it in a poster session to other students. • Active debate taking a stakeholder role with other students-stakeholders on specified topics related to agroecosystem management.
Opportunities for Service-learning with community organisations	Organise debates with different organisations and stakeholders.

Agricultural organic chemistry (Course: Agricultural Sciences, 1st year, 6 ECTS). UNIPI

Essential learning outcomes	The student will acquire the necessary knowledge to understand the physical, chemical, and biological context in which the organic molecules are included, their reactions and the metabolic pathways, by paying attention to the relationships between structures and functions of the main macro-molecules categories and to their metabolic regulations on a molecular and cellular level. The student will understand the structure-function relationships of the main organic molecules and the key biochemical mechanisms that regulate the main metabolic functions.

Sustainability-related learning outcomes	• The knowledge about the cellular metabolism in vegetables can provide useful information in the agronomy field to evaluate the most suitable sustainable technics that could be applied. • Knowledge about using mineral elements such as nitrogen, phosphorus, and sulphur in plant cells can provide important information for responsible agronomy-related choices in the context of economic and especially environmental sustainability.
Opportunities for Service-learning with community organisations	Seminars or workshops about cellular metabolism able to identify the importance of such knowledge in terms of responsible and sustainable choices in the agronomy field. Organisations that can be involved are farms and agricultural-related entrepreneurs, agricultural trade associations, public entities (e.g.: Tuscany Region) and private organisations. Collaboration aiming at providing knowledge about plant metabolism that could raise awareness and guide responsible agronomy-related choices in a sustainable way. Collaborations could also be useful if addressed to citizens, as they could develop knowledge that can guide their choices in terms of sustainability.

Nutrition and animal feeding (Course: Agricultural Sciences, 2nd year, 6 ECTS). UNIPI

Essential learning outcomes	The student will acquire knowledge about the characteristics of animal food, the physiological and metabolic basis of domestic animals' digestion activities, the main evaluation systems of food energy and protein values and nutritional needs of animals of zootechnical interest and the main practical principles for food rationing. The student will acquire the capacity to evaluate the nutritional characteristics of livestock food and consider and choose between the two main zootechnic food evaluation systems and the nutritional needs of animals of zootechnical interest, based on the operative needs and on the rationing basics.
Sustainability-related learning outcomes	The knowledge about the metabolic and physiological mechanisms that regulate the use of nutrients enables the formulation of rations that could enhance the digestive efficiency of animals and, as a consequence, reduce the nutrients waste and their release into the environment. Moreover, the improvement of food efficiency and of knowledge about ruminal metabolism enables the reduction the methane production emissions into the environment.
Opportunities for Service-learning with community organisations	Seminars and workshops about the relationships between livestock nutrition and environmental impact, by involving firms from the animal feed field and food supplements. Meetings with farm owners to discuss the integration of specific food strategies within the farm routine; evaluation of the inclusion of animal feeding policy strategies through meetings with regional decision-makers.

General and Applied Entomology (Course: Viticulture and Oenology Sciences, 3rd year, 6 ECTS). UNIPI

Essential learning outcomes	The course aims to provide students with theoretical and practical knowledge necessary for the recognition of the main pests harmful to vines, with particular emphasis on arthropods (insects and acari). Particular attention will be paid to modern phytophagous species control techniques, with the aim to enable students to implement a profitable and ecologically appropriate integrated vineyard management.
Sustainability-related learning outcomes	The knowledge of modern management methods for vine-damaging arthropods, which are much more sustainable compared to traditional techniques relying on synthetic pesticides, is fundamental for the graduate's education on viticulture and oenology.

Opportunities for Service-learning with community organisations	Seminars addressed to winegrowing and wine-making operators providing information on the most recent innovations for sustainable and effective control of the most significant harmful insects and mites. Companies, Consortia, Trade Associations, public (Tuscan Regional Plant Protection Service) or private structures (Biological Districts). What kind of collaborative initiatives on sustainability can be set up between universities and local communities (organisations, companies interested in community benefits, the third sector, etc.) according to specific disciplines? Collaborative projects on new sustainable defence systems leading to improved wellbeing for practitioners and the public as a result of reducing the synthetic insecticide and acaricide molecules. For an example see Lucchi, Andrea, and Giovanni Benelli. "Towards pesticide-free farming? Sharing needs and knowledge promotes Integrated Pest Management." Environmental Science and Pollution Research 25.14 (2018): 13439-13445

Agronomy and Herb Cultivation (Course: Agricultural Sciences, 2nd year, 9 ECTS). UNIPI

Essential learning outcomes	The student will acquire knowledge of the main agro-techniques, with particular reference to their influence on the agroecosystem. The student will also acquire the necessary skills to recognize and understand the role of environmental and agronomic factors underlying the development, growth and production of herbaceous field plants specific to Italian agriculture. The course will provide an understanding of the effect of agro-techniques on crop productivity, production quality and their impact on the environment as a whole.
Sustainability-related learning outcomes	Knowledge of the correct approach to cultivation systems and agro-techniques is fundamental for the development of standards and techniques for sustainable management of the production systems, in order to ensure the qualitative-quantitative availability of production and the protection/conservation of environmental resources.
Opportunities for Service-learning with community organisations	Field visits to "virtuous" farms and seminars with experts; demonstration of case studies to develop correct agricultural/agronomic practice guidelines. Meetings with the different actors in the local area: companies and/or agricultural entrepreneurs, trade associations, public (Tuscany Region) and private bodies, local authorities, stakeholders, third sector. Community involvement and collaborative projects for the adoption of sustainable and multifunctional agroecosystem. management practices that benefit the environment, operators, and local/rural communities in the local area. How can the adoption of sustainable management practices for soil and resource protection (soil carbon stock, erosion reduction, air, and water quality) benefit communities? What consumer benefits can be derived from food products obtained through sustainable agricultural practices?

Agricultural Ecology (Course: Agricultural Sciences. Elective course aiming to develop 'sectorial technical-practical skills, to be chosen along the three-years course, 6 ECTS). UNIPI

Essential learning outcomes	By the end of the course, the student will have acquired knowledge of the abiotic and biotic components of the ecosystem as well as the structure and functioning of ecosystems with specific reference to agroecosystems.
Sustainability-related learning outcomes	The knowledge imparted, appropriately elaborated, aims at acquiring basic skills for the design and management of the whole farm in an ecologically and sustainable way.
Opportunities for Service-learning with community organisations	Meetings with the different actors in the territory: farms and/or agricultural entrepreneurs, trade associations, public (Tuscany Region) and private bodies, local authorities, stakeholders, third sector. Community involvement and collaborative projects for the adoption of sustainable and multifunctional agroecosystem. management practices that benefit the environment, operators, and local/rural communities in the local area. How can the adoption of sustainable management practices for soil and resource protection (soil carbon stock, erosion reduction, air and water quality) benefit communities? What implications for the ecosystem and agroecosystem?

Phyto depuration and phytoremediation (Course: Agricultural Sciences. Tutored work, 3 ECTS). UNIPI

Essential learning outcomes	• The student will have acquired the necessary knowledge to evaluate the effects that the adoption of phytotreatment and phytoremediation techniques can produce on the water and land concerned. • The student will become aware of the phenomena underlying the functioning of the phytotreatment systems and phytoremediation interventions and of the technical elements useful for their preliminary design. • The student will be able to prepare the activities useful to verify the correct functioning of the systems and the results that can be expected over time.
Sustainability-related learning outcomes	• At the end of the course, the student can acquire and / or develop: • The ability to analyse the conditions that suggest the construction of a phytotreatment system or a phytoremediation intervention. • The ability to size the interventions and to define the planning lines useful for their realization. • The ability to evaluate the effectiveness of interventions and any corrections to be made.
Opportunities for Service-learning with community organisations	Visits to phytodepuration installations; and meetings with actors in the local area: companies and/or agricultural entrepreneurs, trade associations, public (Region of Tuscany) and private bodies, local authorities, stakeholders, and third sector aimed at describing the possibilities of safeguarding and managing water resources sustainably and circularly also in disadvantaged areas where purification through ordinary purifiers is not possible.

C. Laboratory and practical courses

Lab Course on Food Technology. 5 ECTS, 1st year, TU Graz: Selected methods of food technology; from unit operations in food production to full production; modern analytical methods to follow the production kinetics

Essential learning outcomes	The students will have an overview of food production from a practical point of view. The main topics will comprise coffee (roasting, spray drying), beer (fermentation), bread (sour dough, baking), yoghurt (isolation of strains, production from pasteurised milk), cheese (milk clotting with rennet and/or acid, cheese from whey), essential oil from orange peels, production of sausages, alcoholic beverages (distillation), concentrated fruit juice production.
Sustainability-related learning outcomes	• Students will learn to understand the carbon footprint of each food item they inspect and also learn how to calculate it. • Teaching students about the optimal batch size to avoid wastage. • Students will be taught how to reduce water amount for brewing.
Opportunities for Service-learning with community organisations	• Help local smaller bakeries or farmers to calculate their carbon footprints. • Organise workshops to teach small, local breweries how to reduce their water amount for brewing.

Active Project (3rd year - 3ECTS). ISARA-Lyon

Essential learning outcomes	The behavioural skills are essential in the professional life of the future engineer. By the end of this experience, students will be able to: • Develop qualities and soft skills such as: initiative, creativity, autonomy, responsibility, leadership, openness, sense of dialogue and organisation, etc. • Promote, through this commitment, knowledge of oneself and of others. • Communicate orally and to write in a concise and relevant manner, • Implement an ethical reflection on the evolution of our modern society.
Sustainability-related learning outcomes	The Active Project (AP) (individual engagement in the society) may be carried out in different ways: • "Community life/volunteering": taking on a significant responsibility in an association internal or external to the university. • Organise a "challenge" and meet a challenge in the fields of science, solidarity, culture, or sport. • "Tutoring for solidarity" participating in a Success Team (individual or group tutoring).
Opportunities for Service-learning with community organisations	• Provide support to seniors (courses). • Through an organisation that helps the visually impaired, help a member with certain tasks of life every week. • Helping a child with academic difficulties to connect and motivate them to regain confidence in their ability to work and succeed. • Provide basic necessities for people in need (students, homeless people).

4th year internship and workshop (12 ECTS). ISARA-Lyon

Essential learning outcomes	Students will be able to: • Understand, in a concrete way, the functioning of a company or an organisation by participating in it on a daily basis. • Identify the specific role of the actors and the elements that influence the quality of working life. • Analyse a company as a system (structure, operation, environment, evolution, management). • Diagnose malfunctions and propose remedies. • A sharing of experience is organised in November of each year, as part of post-internship workshops.
Sustainability-related learning outcomes	• The internship and workshop will ensure the practical application of the knowledge gained in the university and complete the teaching programme by making students aware of the economic and social realities of the workplace.
Opportunities for Service-learning with community organisations	• State of the art for Consumer Information Labelling (eco-score and nutri-score). • Analysis of R&D needs and priorities related to the development of the Agri and Agro sectors at the "Massif Central" region. • Analysis of a survey of farms in the "Loire and Haute Loire" region over the past decades.

D. Business and quality control

Business (1st year, 6 ECTS). UPNA

Essential learning outcomes	• To identify business activities. • To know the institutional and legal framework of the company. • To identify the different types of business organisations. • To identify the basic principles of markets. • To assess the different actions in the organisation and management of companies.
Sustainability-related learning outcomes	• Sustainability awareness related to mindset and purchasing choices. • Marketing – responsible marketing, consumer, transparency. • Marketing and sociology of communication.
Opportunities for Service-learning with community organisations	Communication design (marketing part) of a small company linked to organic production and/or commercialization. The students will send the best works to the company. Students will know and reflect on the communication needs of a company to reach young people, through the design of an advertising campaign. Provide a communication design to a small company linked to organic production and/or commercialization.

Entrepreneurship and innovation in the food business (2nd year, 6 ECTS). UPNA

Essential learning outcomes	• To understand the importance of innovation in the management of agri-food companies. • To analyse the main barriers and opportunities for innovation in the agri-food sector, with special attention to SMEs. • To understand the meaning of creativity, leadership, motivation and entrepreneurship, and their importance in the management of agri-food companies.

Sustainability-related learning outcomes	• Students will know how to obtain reliable information, less widespread, on farm practices and the food industry, for decision-making. • Students will become aware of healthy eating. • Integration and dissemination of knowledge among university students on the impact of meat consumption/vegetarianism. • To know, specify and broaden the perspective on the different dimensions of sustainability. • Critical thinking skill. • Reduce focus on animal-based food – less energy and
Opportunities for Service-learning with community organisations	The students look for a theme and information on a specific subject (meat/veganism debate) (first awareness raising part). Then, they design an innovation to be carried out at the university canteen in order to incorporate this aspect of sustainability, using Design Thinking. Change in the student's own lifestyle

Quality control and management in the primary sector (3rd year, 6 ECTS)

Essential learning outcomes	• Identify factors related to food safety and quality assurance. • Understand food production. processes in the primary sector. • Know the main legal regulations related to food quality management. • Identify the main food quality and traceability management tools and systems, as well as the different certification systems.
Sustainability-related learning outcomes	• Problem solving. • Ability to transmit information, ideas, problems, and solutions. • Ability to develop activities in the field of food and innovation assuming an ethical and sustainable social commitment. • Ability to work in multidisciplinary and multicultural teams. • Knowing how to apply the bases of sustainability
Opportunities for Service-learning with community organisations	Analyse the socioeconomic and environmental sustainability of small associations in a disadvantaged situation in rural Pyrenees Mountain areas in the north of Spain. For instance, in the case of a new producer dedicated to the rearing of worms/larvae as a new source of protein. The producer has concrete questions about marketing, legal questions (as there is no regulation on the topic in Spain), conversion rates etc. Different groups of students work and answer each of the questions. They prepare a dossier and explain the answers to the farmer.

Quality, safety and project management in the food industry (4th year, 6 ECTS). UPNA

Essential learning outcomes	• Identify the main tools and systems for quality management and food traceability as well as the different certification systems" and "R3. Assess different alternative projects based on the viability of the project and sustainability" • Identify the documents that define an innovation project, as well as their content. • Design and develop food innovation projects. • Evaluate different alternative projects based on the viability of the project (technological, economic, market, etc.). • Knowing the main legal regulations related to food quality management. • Knowing and applying the main parameters and methods of physico-chemical and microbiological control in the food industry. • Identify the main tools and systems of quality management and food traceability and apply them in specific cases.

Sustainability-related learning outcomes	• Capacity for measuring sustainability and environmental quality. • Measuring and benchmarking. • Capacity for measuring sustainability and environmental quality on farms. • Carbon footprint of the lifecycle of common food production. • Emissions reduction.
Opportunities for Service-learning with community organisations	Support in improving socio-economic and environmental sustainability to small associations in the Spanish Pyrenees area related to the primary sector or derived from the primary sector or neighbourhood associations though developing carbon footprint assessments or other simple certifications. This subject area follows-up the case of the former module and do a certificate to the worm producer (e.g., production quality certificate, carbon footprint).

Quality Assurance in Pharmaceutical, Food and Biotechnological Processing. TU Graz: In the lecture/seminar basic elements of quality safety issues according to HACCP and GxP for pharmacology, food technology and biotechnology will be presented. Requirements of national and international process and production safety will be explained in detailed examples. Methods of risk management, GMP-conform design of facilities, industrial sanitation, qualification of installation and devices, validation of processes and cleaning will be explicitly discussed in aspects of biosafety. HACCP will be presented in detail and implementations will be given by examples. The role of microorganisms and their classification will be a focus.

Essential learning outcomes	The students will have the ability to assess quality systems and processes in basic elements of quality safety issues for pharmacology, food technology and biotechnology.
Sustainability-related learning outcomes	• Quality and safety in relation to food waste. • Can food waste be reduced by e.g., extending the shelf life or storing food beyond the shelf life • Can and excessive period of storage compromise the safety of foods.
Opportunities for Service-learning with community organisations	• Organizing workshops to teach about waste reduction, show through quality assurance that food can still be consumed even if it reaches the best before date. • Discuss the value of money regarding organic or natural foods in comparison to high processed industrial food. • Organise workshops to teach about eco-friendly packaging of food.

Basics of Agricultural Economics (Bachelor's degree in Agricultural Sciences, 1st year, 6 ECTS). UNIPI

Essential learning outcomes	Students who have completed the course will acquire skills to learn about the dynamics of economic systems, economic actors, and their interactions in agri-food markets. Students will understand agricultural enterprises' main characteristics and the major problems they face in their business activities.
Sustainability-related learning outcomes	• Orientation of farm business models towards economic, social, and environmental sustainability. • Assessment of the environmental sustainability of production processes and creation of farm-related services. • Reflection on assessing sustainability within supply chains and food ecosystems. • Possibilities for in-depth study of policies regarding sustainability in agri-food supply chains.
Opportunities for Service-learning with community organisations	• Presentation of case studies of sustainable farms • Seminars on farm sustainability • Project-based learning/challenge-based learning: students analyse and propose practicable and innovative solutions based on the sustainability needs of farms using tools such as the triple-layered business model canvas and insights into the economic, social and environmental benefits and impacts of the farm.

Occupational Safety Management for the Food/Beverage Sector (5 ECTS). TU Dublin

Essential learning outcomes	1. Understand the key requirements of health and safety legislation in Ireland. 2. Develop the students' ability to use and apply risk assessment techniques. 3. Fully familiar with workplace hazards associated with the food and beverage sector. 4. Contribute to accident prevention and workplace behavioural safety. 5. Evaluation and completion of a safety statement and safety management system. 6. Compile an overall protective and preventive strategy for an organisation as part of their work placement activities. 7. Demonstrate evidence of reflective learning. 8. Understanding of safety management systems accreditation.
Sustainability-related learning outcomes	Evaluation and completion of a safety & sustainability placement action plan. Amended LO being piloted
Opportunities for Service-learning with community organisations	Assessment while on Work placement will include a Sustainability audit of the stakeholder.

Food Safety: WKPL3011 Industry Work Placement (25 ECTS). TU Dublin

Essential learning outcomes	1. Demonstrate the development of core competencies relating to theoretical principles, concepts and skills studied to a real working situation. 2. Reflect on participation in and contribution to the successful operation of a food or brewing/distilling facility. 3. Demonstrate a clearer understanding of structures in industry, the role of the technologist in those structures, and the relationship between theoretical modules and the workplace. 4. Demonstrate oral communication and presentation skills. 5. Reflect on their professional development and learning through the work placement experience, relating it to programme aims, and identify future goals 6. Develop employability skills, including successfully seeking employment
Sustainability-related learning outcomes	1. Demonstrate the development of core competencies relating to theoretical principles, sustainability competencies, concepts and skills studied to a real working situation. [Update LO] 2. Reflect on participation in and contribution to the successful operation of a production/research facility, as well as the use of greener technologies [Updated LO] 3. Demonstrate a clearer understanding of structures in industry, the role of the technologist in those structures, and the relationship between theoretical modules, sustainability practices, and the workplace. [Updated LO] 4. Reflect on their professional development and learning through the work placement experience, relating it to programme aims, identify future goals and their impact with regard to sustainability. [Updated LO] 5. Develop employability skills, including successfully seeking employment 6. Evaluate food sustainability in a work environment and identify potential areas for improvement [Updated LO] Updated LOs being piloted

Opportunities for Service-learning with community organisations	An assignment focusing on assessing sustainability within a host placement organisation will be completed by the student as part of this module. More specifically, they will apply sustainability knowledge acquired during years 1-3 of their degree through this assessment. This will consist of an interview/discussion between the industrial supervisor and the student in order to review the overall sustainability of the company, and to identify a priority area for improvement and a proposed timeline. The student will follow a newly designed sustainability framework and work (independently) to examine possible measures to improve sustainability with regard to the selected priority area e.g., food waste, packaging, food reformulation etc., Following review and feedback from TU Dublin, a final report and recommendation list will be presented to the host organisation for possible future implementation. Work placement is completed in a variety of different organisations, including social enterprise and government institutions (e.g. Teagasc, FSAI, Safefood), food companies (e.g. Diageo, Tayto, Dawn Farm Foods) and laboratories (Oldcastle laboratories, MiCRA etc.)

Training and Auditing (5 ECTS). TU Dublin

Essential learning outcomes	1. Classify the range of potential biological, physical and chemical hazards encountered from farm to fork, that may harm consumers, brands, companies and in extreme cases, entire industry sectors. 2. Analyse a given food safety situation and propose the appropriate controls or combination of controls to prevent, eliminate or control the potential food safety hazards identified in learning outcome 1. 3. Appreciate the 4 levels of food safety training from 'beginner/basic/FSAI Level1'; to 'intermediate or FSAI level 2'; to Management/FSAI level 3'; and advanced/auditor levels. 4. Demonstrate their understanding of basic principles of food safety auditing. 5. Carry out a food safety audit on a food premises using an appropriate standard. 6. Understand the variety and depth of skills required to audit food safety, legality and quality in more specialised production, processing and large-scale food handling facilities. 7. Developing their ability to evaluate and integrate existing food safety and quality controls along the food chain and be able to train others to at least intermediate level.
Sustainability-related learning outcomes	Demonstrate their familiarity with the basic principles of food safety auditing, including the emerging consideration of energy and food waste reduction. Updated LOs being piloted
Opportunities for Service-learning with community organisations	Students audit a commercial or not for profit food premises against an appropriate audit template amended to include sustainability, analyse and report their results as a case study. The challenge is to maintain food safety, but to make sure that recommendations are as sustainable as possible. This is graded and feedback given. Aided by the feedback students then present their audit report to the class group where they are questioned on their recommendations.

Quality Assurance: TFQM2001 Quality and Hygiene Systems (5 ECTS). TU Dublin

Essential learning outcomes	1. Demonstrate their understanding of food safety, legality and quality concepts and how these should be applied in commercial practice. 2. Develop and maintain appropriate documented pre-requisite programmes standards and systems in commercial premises. 3. Evaluate the compliance of otherwise of quality and hygiene systems with the appropriate standard for sector. 4. Assess the basic components food safety & quality systems and how these are applied in commercial practice 5. Develop an appreciation of how food safety & quality systems are constructed and maintained and the interrelationships between the components of food safety systems.

Sustainability-related learning outcomes	Evaluate the components food safety & quality systems as applied in commercial practice and recommend improvements where possible to include energy efficiency and waste reduction. [Updated LO] Updated LOs being piloted
Opportunities for Service-learning with community organisations	Analysis of culture and attitudes within a food business site towards sustainability. Underpinning sustainability auditing Service-learning.

Food laws and regulations: TFFS2001 Food Product Regulatory Affairs. (5 ECTS). TU Dublin

Essential learning outcomes	1. Understand the official control system for food in the EU and nationally. 2. Apply the principles of food hygiene to food businesses. 3. Appreciate the legal obligations relating to food and food production. 4. Evaluate legal compliance of food in respect of additives, supplements, labelling and health claims. 5. Place food regulation in an international context.
Sustainability-related learning outcomes	• Identify the legal obligations relating to food, food production, food packaging and the minimisation of waste. • Evaluate legal compliance of food in respect of additives, supplements, labelling and health claims, packaging use and disposal. • Explain the legal basis of sustainability in the EU.
Opportunities for Service-learning with community organisations	A survey will be conducted of waste recycling practices in households of primary school kids (SWC based) and an information package, either leaflet or app designed to remedy any practice failures. This to be done in conjunction with Repack.

Project / Dissertation (20 ECTS). TU Dublin

Essential learning outcomes	1. Apply scientific principles and method, interdisciplinary knowledge, and skills to research a specific topic, a central question or an issue in depth 2. Explain, critically evaluate, effectively interpret, and contextualise information, theories and findings in a disciplinary relevant area 3. Search, access, and ethically use information 4. Devise a set of objectives that can be managed to achieve the research aim 5. Communicate effectively through writing, speech and/or visual information 6. Demonstrate an ability to think globally and consider issues and knowledge from a variety of perspectives 7. Demonstrate the capability to work both independently and in cooperation with others
Sustainability-related learning outcomes	Apply scientific principles and method, interdisciplinary knowledge and skills and sustainability competencies to research a specific topic, a central question, or an issue in depth Updated LOs being piloted
Opportunities for Service-learning with community organisations	Various capstone research project activities in collaboration with Service-learning partners, for example: • Students carried out research to find a higher value use for the Brewers Spent Grain as part of a sustainable circular bioeconomy. Projects included Bioprocessing using enzymes and Fermentation of BSG to enrich animal feed. • Students carried out practical research to address various sustainability challenges at Dublin Zoo in areas related to food quality, phytoremediation & food safety.

Appendix V

Examples of assessment tools for incorporating sustainability competences through Service-learning in food-related courses

The examples of assessment tools for incorporating sustainability competences through Service-learning in food-related courses presented here have been provided by ISARA.

A. Questionnaires to students, lecturers, and social entities

1. Student questionnaire

Learning through "community service" - Evaluating the socio-economic and environmental sustainability of a farm in France

This survey enables us to evaluate your experience of the "Farm Diagnosis" module, which took place during the 22/23 academic year. Please indicate your level of satisfaction with the following aspects.

1. Your progress in terms of mastering the diagnostic approach to production systems in order to propose technical, social, organizational, economic and environmental improvements.
   - ○ Not satisfied at all
   - ○ Extremely satisfied

2. Your overall satisfaction with the diagnostics activity
   - ○ Not satisfied at all
   - ○ Extremely satisfied

3. How useful was the diagnosis in acquiring technical knowledge? Only one possible answer.
   - ○ Not at all
   - ○ Very little
   - ○ A little
   - ○ A lot
   - ○ Too much

4. To what extent has the diagnosis contributed to the development of your human qualities (personal and professional)? Only one possible answer.
   - ○ Not at all Very little
   - ○ A little
   - ○ A lot
   - ○ Too much

5. After taking part in this diagnostic module, has your motivation in the subject improved? Only one possible answer.
   - ○ Not at all
   - ○ Very little
   - ○ A little
   - ○ A lot
   - ○ Too much

6. Would you like to repeat this learning method in other subjects? Only one possible answer.
   - ○ Yes
   - ○ No
   - ○ Don't know

7. To what extent do you think the educational activity you took part in helped the farmer to solve the technical problems linked to his professional activity?

- ○ Not at all
- ○ Very little
- ○ A little
- ○ A lot
- ○ Too much

8. Your opinion: strengths, weaknesses, difficulties encountered, suggestions for improvement

2. Questionnaire for teachers

1. Your overall satisfaction with the Service-learning activity
   - ○ Not satisfied at all
   - ○ Extremely satisfied
2. Are you thinking of applying Service-learning to other subjects?
   - ○ Yes
   - ○ No
   - ○ Don't know
3. What's the main motivation for incorporating Service-learning into your module?
4. What difficulties have you encountered?
5. Comments or suggestions for improvement regarding Service-learning

3. Farmer's questionnaire

1. Your satisfaction with the overall Service-learning experience
   - ○ Not satisfied at all
   - ○ Extremely satisfied
2. What's the student evaluation in terms of:
   - ○ Communication (verbal/oral/written)
   - ○ Diligence (punctuality, reliability)
   - ○ Enthusiasm (energetic, eager to learn and serve)
   - ○ Sensitivity to community needs (service provided with the organization's mission and needs in mind, adapted to changes as necessary)
3. Impact of the Service-learning experience on your farm
4. Suggestions for improving the Service-learning experience

B. Reflective journal

What did you learn in this course that helped contribute to your Service-learning project? What did you learn during your Service-learning project or at your community site that relates to your course?

In what way did your Service-learning project contribute positively to the community? How did you/your class/your team accomplish the project?

How has your experience during your Service-learning project affected your thinking about the community, its problems, and the solutions to those problems?

What personal, academic or career goals did you achieve? If you do not feel you achieved any, why do you think that is? How has your experience affected your thinking about personal, academic or career goals? How will you serve the community in the future?

C. Reflective journal rubric

1. What did you learn in this course that helped contribute to your Service-learning project? What did you learn during your Service-learning project or at your community site that relates to your course?

4	Skilfully conveys perspectives from the course (and other courses, if applicable) and the community partner site with respect to an audience.
3	Adequately conveys perspectives from the course (and other courses, if applicable) and the community partner site with some respect to an audience.
2	Conveys ideas and facts from the course (and other courses, if applicable) and the community partner site that may be related but doesn't explicitly explain their relationship. Demonstrates minimal attention to an audience.
1	Conveys ideas and facts from the course and community partner site that don't seem to be related. Demonstrates little attention to an audience.
0	Does not meet level one performance.

2. In what way did your Service-learning project contribute positively to the community? How did you/your class/your team accomplish your project?

4	Skilfully explains the problem(s), his/her intervention, his/her process learned from the course and community partner site (decisions, thinking, info literacy, reasoning), and the positive effects of that intervention.
3	Adequately explains the problem(s), his/her intervention, his/her process learned from the course and community partner site (decisions, thinking, info literacy, reasoning), and the positive effects of that intervention.
2	Explains most of these: the problem(s), his/her intervention, his/her process learned from the course and community partner site (decisions, thinking, info literacy, reasoning), and the positive effects of that intervention.
1	Explains some of these: the problem(s), his/her intervention, his/her process learned from the course and community partner site (decisions, thinking, info literacy, reasoning), and the positive effects of that intervention.
0	Does not meet level one performance.

3. Explains changes in thinking about some of these: its problems, and the solutions to those problems as a result of the Service-learning experience (and other related experiences).	
4	Skilfully explains changes in thinking about the community, its problems, and the solutions to those problems as a result of the Service-learning experience (and other related experiences).
3	Adequately explains changes in thinking about the community, its problems, and the solutions to those problems as a result of the service- learning experience (and other related experiences).
2	Explains changes in thinking about most of these: the community, its problems, and the solutions to those problems as a result of the service- learning experience (and other related experiences).
1	Explains changes in thinking about some of these: its problems, and the solutions to those problems as a result of the Service-learning experience (and other related experiences).
0	Does not meet level one performance.

D. Written report assessment

Evaluation Rubric

Action Project Report

First name:

Last name:

Objectives of the written assessment:

ATTENTION: this evaluation does not focus on the project as such, but on the following aspects

- your ability to step back and learn from experience (background)
- your ability to express yourself effectively in writing

Report outline:

- Cover page: Surname, first name, class, date, ISARA logo, association or organization logo, action project, project title, illustration (note: no footer on the cover).
- Project presentation, summary of initial expectations, your role and function (1 page)
- Using selected situations, illustrate your approach, the difficulties you encountered, how you reacted, and what you think in retrospect (2 pages).
- Personal lessons learned from this experience (1 page)

1. Spelling
2. Grammar (syntax, punctuation, etc.)
3. Precise, relevant vocabulary without repetition
4. Titles of the different parts of the development
5. Speech structure (outline, paragraphs, flow, transition, coherence, length, etc.)
6. Analysis, reflection, stepping back

E. Oral presentation assessment

Action project Oral presentation assessment

Jury:
Date:
Student:
Action Project:

Message quality

- Coherent message, clearly presented, in a register adapted to the audience
- Quality of objectives presented, compliance with these objectives
- Ability to summarize and get to the point

Quality of presentation

- Slide show compliant with best design and production practices (legibility, simplicity, consistency)
- Slideshow to reinforce the oral message without competing with it

Self-confidence

- Speaker's level of involvement, ease of communication
- Clear, colourful voice, intonation variation
- Open, steady gaze
- Relaxed body, natural, dynamic, alive, open, vertical
- Adapted gestures

Audience interaction

- Contact ("hello, my name is", look at the jury AND the students)
- Level of speaker's persuasiveness
- Ability to ask questions and take a step back
- Level of human relations (warm, cordial, credible, honest...)

Validation: Yes / No
General comments:

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Verlag der Technischen Universität Graz
www.tugraz-verlag.at
ISBN 978-3-85125-989-6
DOI 10.3217/978-3-85125-988-9