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North-West Europe
SIMONE

# ON-FARM EXPERIMENTS GUIDE

## FOR VOCATIONAL EDUCATIONAL CENTERS

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# 1
# OVERVIEW

This guide is delivered as part of the Interreg North-West Europe SIMONE project.

SIMONE will identify, evaluate and deliver agroecological measures through a farmer centric innovation approach with multi-performance evaluations in real farming situations. By fostering cooperation among diverse actors, SIMONE seeks to enhance rural linkages and bolster agricultural sustainability across North-West Europe.

SIMONE targets three areas of systemic innovations: weed management in the context of reducing the use of phytosanitary products, plant nutrition in relation to soil fertility and crop establishment in a context of climate change. The project will provide easy-to-use tools and methods for farmers to identify and predict the combined effects of agroecological measures on input reduction and crop establishment at the farming system level.

SIMONE engages in six living labs strategically positioned across NWE's rural areas. These living labs serve as collaborative platforms where stakeholders from various backgrounds converge to co-design and test innovative solutions tailored to local needs. This naturally leads to On-Farm Experiments (OFE) to demonstrate and evaluate how innovative practices can be implemented within a farming system. Knowledge exchange is fostered through cross-visits at OFE farms with farmers, agronomists and other stakeholders. This approach will ensure that system innovation and territorial resilience measures developed from the OFE are incorporated into farming systems in the future.

Education is recognized as a key pillar in the agroecological transition. SIMONE will lever this by interconnecting educational institutes with the living labs and engage students in OFE. Students will bring the educational and social skills gained through OFE with them into farming practices. Furthermore, by implementing results obtained out of the SIMONE and other relevant OFE in the lessons, education can contribute to a large spreading of innovative agroecological measures in the agricultural sector.

This guide is specifically developed for VET centers to aid the agroecological transition at farm system scale through OFE within the themes of crop establishment, weed management and nutrient efficiency. The guide uses the farming system approach, from the SIMONE project, and uses this as a key element of OFE design. The steps outlined in this document enable VET centers to incorporate OFE within their curriculum design, while allowing sufficient flexibility to tailor to the VET center region, expertise and interest, whether it is crop establishment, weed management, nutrient efficiency and/or the use of technology.

This OFE Guide aims to establish a culture of getting students involved in OFE and levering the agroecological transition at regional level, meanwhile reducing innovation capacities disparities between regions Nort-West Europe. It will be widely shared with other educational institutes and VET centers among other regional living labs. The guide delivers concrete tools for getting started with OFE. Furthermore, it stresses the importance of cooperation between farmers, VET centers and other agricultural value chain actors which is an essential link in the agroecological transition.

# 2
# WHY ON-FARM EXPERIMENTS?

## INTRODUCTION TO ON-FARM EXPERIMENTS AND THE OFE GUIDE

On-farm experiments (OFE) are practical experiments conducted within the framework of an existing farm. They differ from traditional scientific trials as they take place in a real agricultural context, providing a unique opportunity to test agroecological innovations directly within the farming system and enabling effective implementation of innovations in similar farming systems. OFE bridges the gap between theory and practice and offers a wide range of benefits for students, farmers, and agricultural stakeholders described in detail further in this guide.

This guide can help Vocational Education and Training (VET) centers and other educational institutes (EI) to lever the agroecological transition at regional scale through conducting OFE at different levels. The guide is addressing VET centers providing European Qualification Framework (EQF) level 5 and 6 but will also suit for EI's providing EQF at 7.
The guide uses the farming system approach, from the SIMONE project, and uses this as a key element of OFE design.

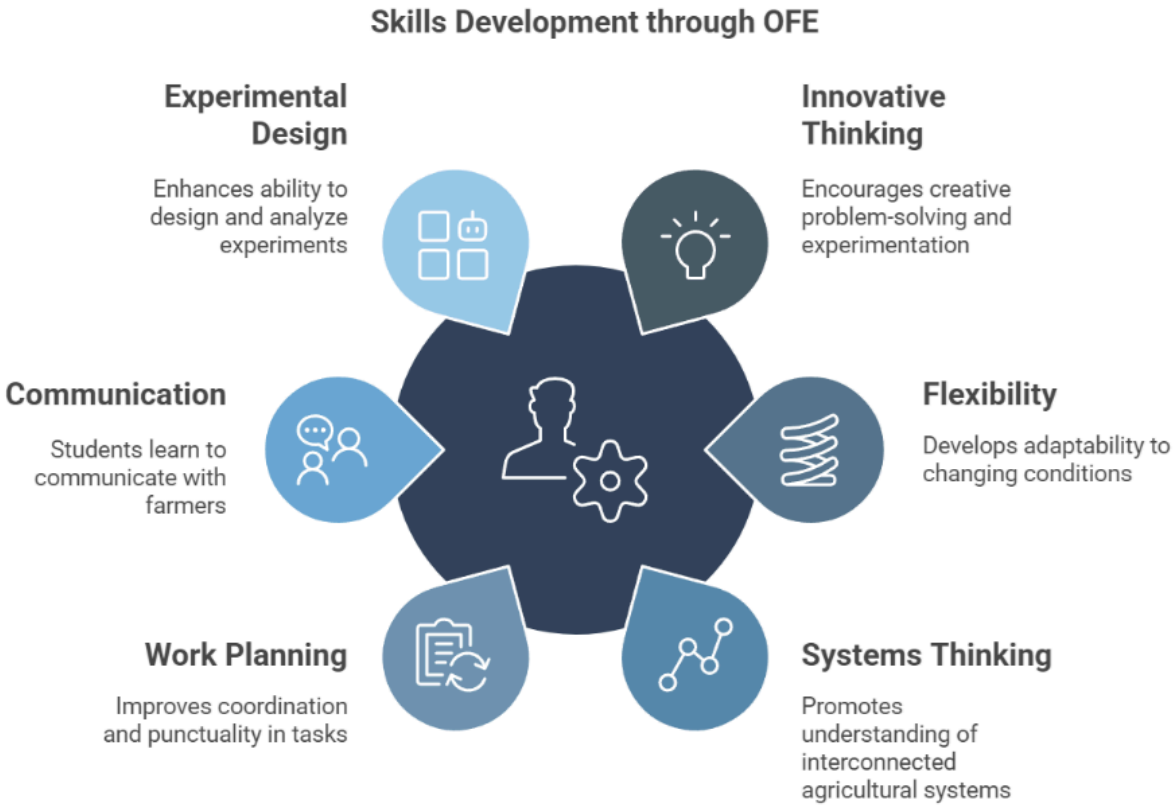
The steps outlined in this document enable VET centers to incorporate OFE within their curriculum design, while allowing sufficient flexibility to tailor to the VET Center region, expertise and interest, whether it is crop establishment, weed management, nutrient efficiency and/or the use of technology.

## KEY ASPECTS OF CONDUCTING OFE

From educational viewpoint the key aspect of OFE is not only investigating the effects of treatments but also overcoming the practical challenges of conducting experiments in a real farming environment. Learning to handle unforeseen circumstances such as field variability, weather conditions and farmer interactions, is as valuable as the scientific outcomes of the experiment itself. Students learn how agroecological measures function within the constraints and opportunities of an existing farming system. This perspective is valuable for farmers as it helps them understand how innovations can be practically applied. Furthermore, students and farmers involved in OFE will develop a continuing interest in experimental testing of innovations at their farm.

# ADDITIONAL SKILLS & COMPETENCES FOR STUDENTS ENGAGING IN OFE

Students pursuing their bachelor's thesis and internships in agricultural studies develop a wide range of competencies, including scientific and technical knowledge of the agro- and biotechnological sectors, problem-solving skills, and project management. They learn to work independently in both familiar and unfamiliar situations and develop critical thinking by analyzing and evaluating information. The following skills are developed more thoroughly through student engagement in OFE:




# 3
# BUILDING BLOCKS FOR A SUCCESSFUL OFE

## KEY ELEMENTS FOR SETTING UP AN OFE

A succesful OFE is a farmer centric innovation process and requires careful planning and collaboration. First, it is important to clearly coordinate with the farmer, knowing exactly what will be examined and clearly state what the expected outcomes will be. Afterwards, the trial design on the farm must be carefully thought out to ensure that the right multi-performance conclusions can be drawn. The building blocks of a succesful OFE are:

- **Clear objectives:** Clearly define the goals of the experiment. What do you aim to investigate, and how can this contribute to the farmer's or business's practices?

- **Farmer involvement:** Collaboration with farmers is crucial for OFE success. The experiment should align with their needs and field realities. Communication throughout the OFE process is critical for the success of the OFE from a farmer, student and VET perspective.

- **Align expectations:** Make sure farmers and students understand the process of the OFE and its limitations. Discuss the expected outcomes to avoid disappointment about the process results. Assess the farmers perspective on the economic and ecological outcomes.


- **Research design:** A solid experimental design is necessary. This includes selecting appropriate techniques for data collection, analysis, and interpretation of results. A proper understanding of the crop calendar is primordial to setting up a succesful OFE.

- **Plot selection:** Choosing the right field section is crucial. It should be representative of the farm's general conditions, considering variability in soil, crops, and water management.

- **Field variability:** Farms often have variable environmental conditions. Students must learn how to incorporate this variability into the experimental design, for example, through randomization or repetitions.

- **Replications and sample size:** The number of repetitions is critical for the statistical reliability of results, depending on field variability and the desired accuracy of conclusions.

- **Observations and data collection:** There should be a clear understanding of the type of data to be collected, the timeframe for collecting data (e.g. critical crop stage) and the appropriate observation required to satisfy the objective of the OFE. Both agronomic, environmental, social and economic output indicators needs to be considered to measure agroecological impact.

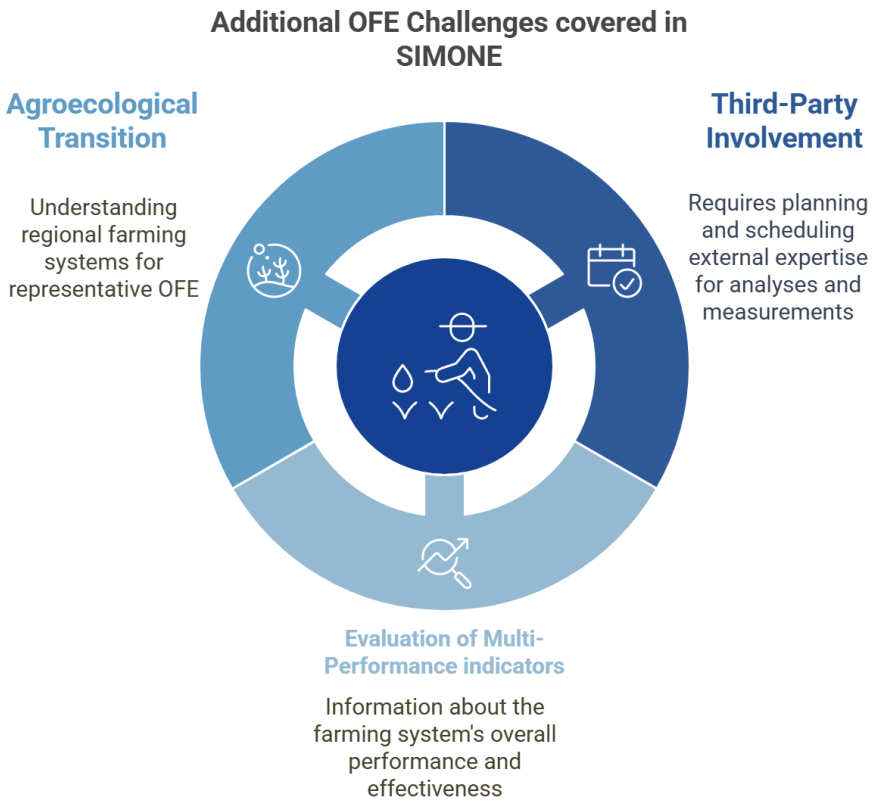
- **Data analysis and conclusions:** The student should understand the appropriate (and by preference standardized) method to analyze the results, to undertake the required statistical analysis and draw appropriate conclusions. The student must also understand the limitations of the results and understand the barriers for implementation.

# WHAT ARE THE ADDITIONAL **CHALLENGES** SIMONE WANTS TO COVER?

In on-farm experiments, additional challenges often arise, particularly when it comes to the need for third-party involvement for specialized analyses or access to specific technologies. This involvement must be planned and scheduled well in advance to ensure all necessary analyses are conducted on time.

OFE provide valuable insights into the benefits for farmers which are closely related to the type of farming system. Each system demands distinct evaluation methods, observations, and data collection, such as time, effort, and risks involved. It is crucial to account for these process parameters to draw meaningful conclusions about the farming system's overall performance and effectiveness.

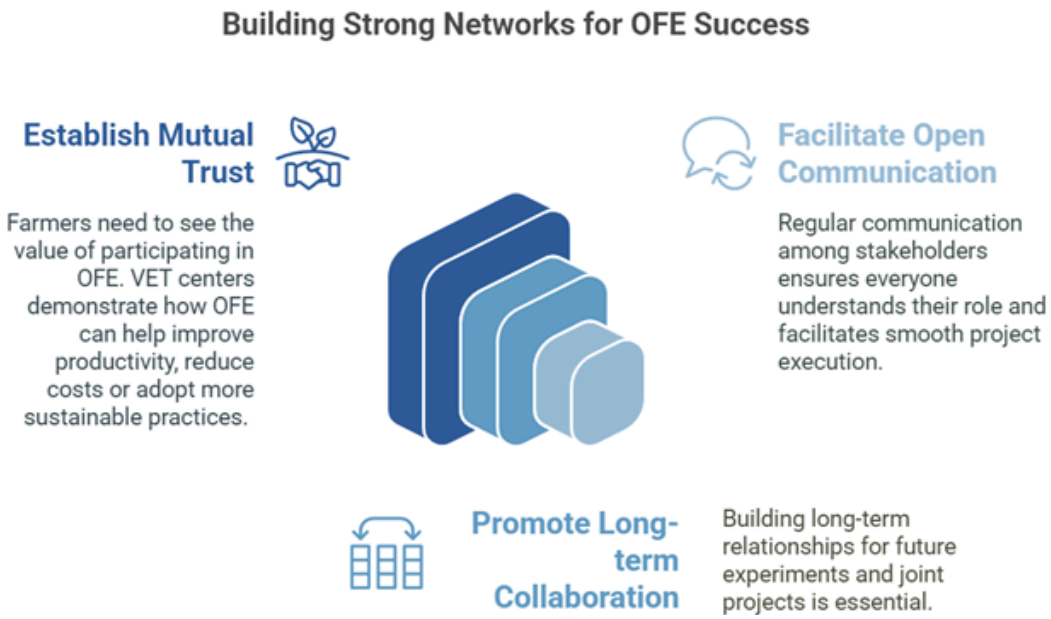
Furthermore, OFE are key in enabling an agroecological transition in a region. It is important to study and understand the regional cropping systems typology (climate, soil type, farmers' preferences) to ensure that OFE are representative of farming activities within the region.




# NETWORKING AND RELATIONSHIPS BETWEEN VET CENTERS AND FARMERS/BUSINESSES

It is highly recommended that early in the process the VET centers source and contact farmers willing and suited to work as partners on OFE with the VET center. Some methods to find such suitable farmers might include:

- Advisory or research organisations, farming organisations or farm supply chain actors can help when the VET center is developing their own farmer relationships. Living labs set-up within SIMONE can be a good starting point.
- Students (the advantage of this approach is the student will already have a relationship with the farmers).
- Staff personal connections to suitable farmers (most connections become tight during collaboration in internships, company visits, etc.)



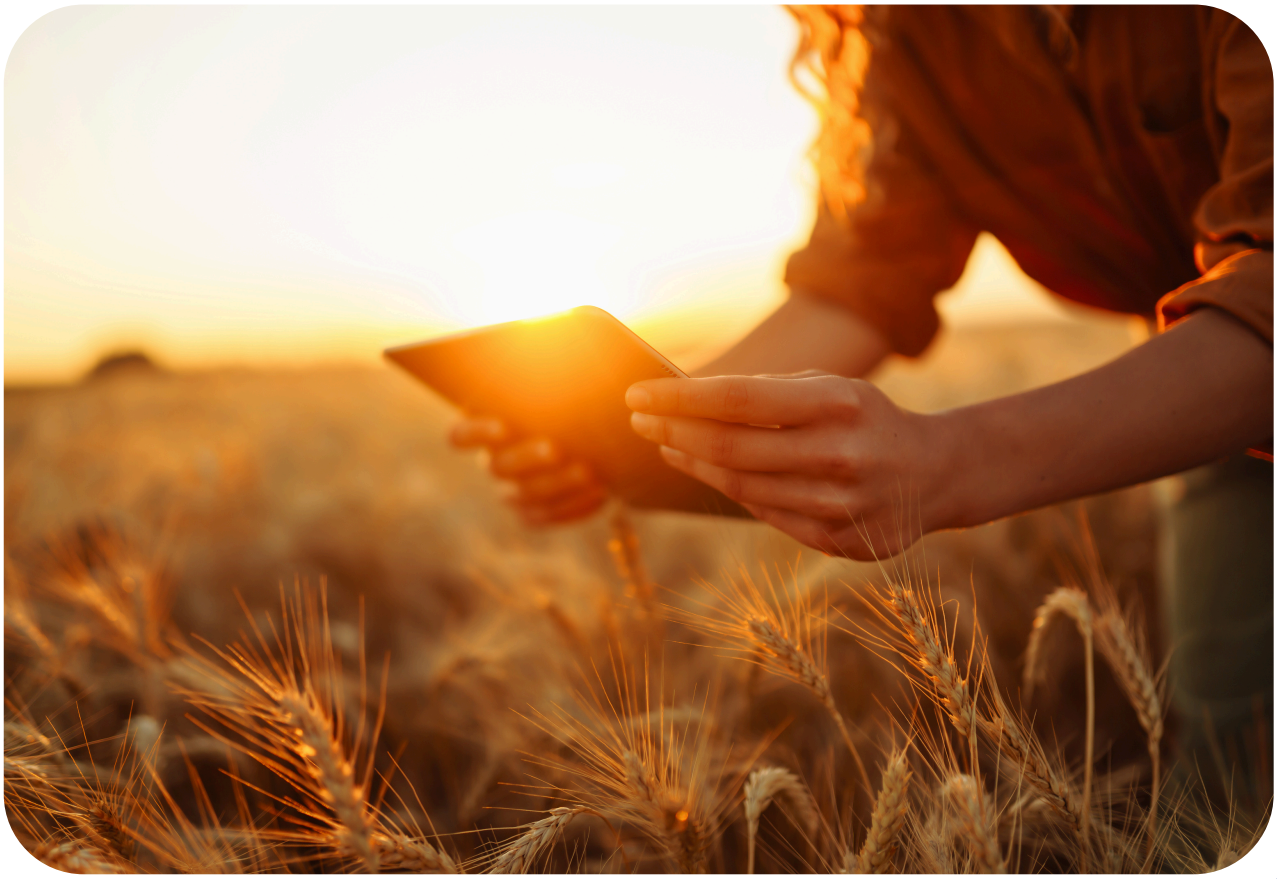

Initial contact via someone known to the farmer often helps to establish the relationship. If possible, it is preferable to have the first meeting on the farm rather than the VET Center. It is important to have a clear understanding of how the relationship between VET Center staff, students and farmers might work. The essence of OFE reflects that each farm is different and so plans must also be flexible to reflect different farming practices and systems, and farmer needs. Building strong networks between VET centers, farmers, and businesses is crucial for OFE success. This can be achieved through mutual trust, open communication and long-term collaboration.

# KEY ASPECTS OF **RISK ASSESSMENT AND RISK MANAGEMENT**

**Risk assessment is a critical component when students engage in on-farm activities. Ensuring the safety and security of students requires a structured approach to identify and mitigate potential hazards. Additionally, students must be properly insured before participating in on-farm experiments. Risk management includes following elements:**

- **Risk analysis:** A comprehensive risk assessment should be conducted by the farmer to identify potential hazards on the farm. This includes evaluating risks related to, for example machinery, livestock handling, chemical exposure, biological hazards and other farm-specific dangers.
- **Information sharing:** The farmer must clearly communicate these identified risks to the student. This briefing helps ensure the student is fully aware of the environment they will be working in and can take appropriate precautions.
- **Insurance:** The VET center should engage with the insurance provider to confirm that risks related to the OFE are covered. This ensures that the student, and the VET centers are protected.
- **Task agreement:** If certain risks cannot be fully covered by insurance, the farmer and student must agree on which tasks can safely be performed. Tasks deemed too risky should be explicitly excluded from the student's responsibilities.
- **Contractual agreement:** The outcomes of the risk analysis and the details of the insurance coverage must be formalized in a contract between the student and the farmer.

# BEST PRACTICES FOR SUCCESSFUL OFE

# 4

# INTEGRATION OF OFE IN THE STUDY PROGRAM

This chapter explains how OFE can fit into the study program. The advice and inspiration is based on two examples of Educational Institutes, namely Munster Technological University located in Ireland and Vives University of Applied Science located in Belgium.

## STUDENT VISITS TO OFE

MTU and Vives students are visiting OFE throughout their studies to see and hear the experiences of farmers trialing new innovative agroecological measures. This exposure increases and develops the student's awareness of OFE processes. These visits expose the students to current best investigations of agriculture systems and are used as a basis for areas to be incorporated into bachelor's thesis OFE later in their degree programs. Furthermore, students learn from the OFE and apply this knowledge later in their jobs.

# OVERVIEW OF THE STUDY PROGRAM AT MUNSTER TECHNOLOGICAL UNIVERSITY

Munster Technological University (MTU) has two main campuses which host students studying agriculture the Bishopstown Campus in Cork City and Tralee Campus in Co. Kerry. Between both campuses various programmes are on offer including:

**Ordinary bachelor degree programs, B. Sc. (3 years) in:**

- Agriculture (Cork)
- Agricultural Science (Kerry)
- Agricultural Engineering (Kerry)
- Horticulture (Cork)

**Higher bachelor honours degree programs of B. Sc. Hons. (4 years) In:**

- Agri-Biosciences (Cork)
- Agricultural Engineering (Kerry)
- Agriculture Science (Kerry)
- Horticulture (one year add on) (Cork)
- Agriculture (one year add on) (Cork)

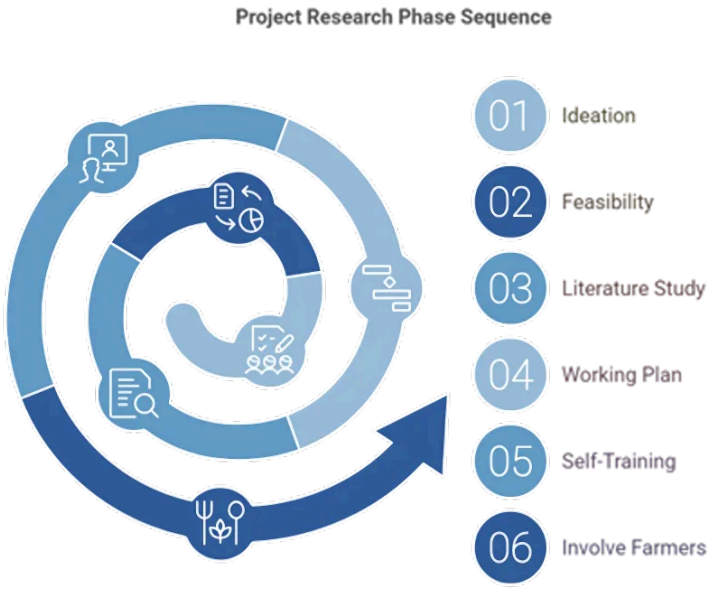
**Postgraduate Diploma in:**

- Innovative and Sustainable Agriculture (Kerry)

For the purpose of this case study, we will showcase how OFE are incorporated in the B. Sc. Hons in Agriculture and B. Sc. Hons in Horticulture on the Bishopstown campus, Cork (EQF level 6). As part of these degree programs, the OFE are typically undertaken as part of their bachelor's thesis in year four (the add on year). The bachelor's thesis is divided over the year with a total of 15 ECTS credits with a 5 credit module in Semester 7 entitled '**Project Research Phase**' and a 10 credit module in Semester 8 entitled '**Project Implementation Phase**'. The thesis is structured to enable a student to develop a project from concept to implementation.

# Project Research Phase

This module is the planning stage of the OFE where the student develops a concept and plan for implementation. The different steps in this Project Research Phase:



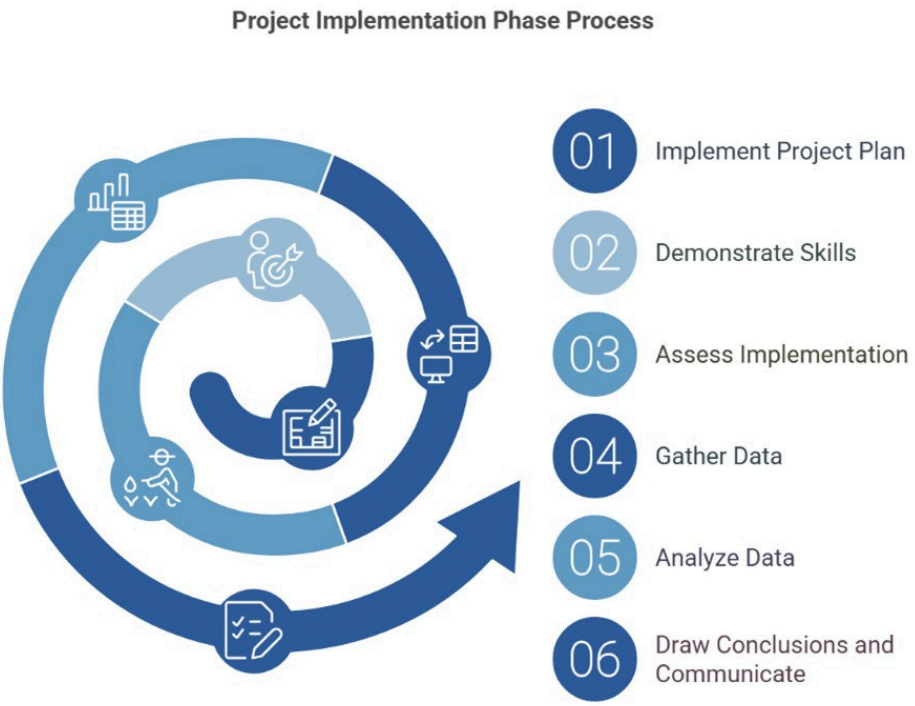

- **Ideation**: Develop an idea of the project and create a working title.
- **Feasibility**: Indicate whether the project is broadly feasible or not based on factors such as the timeframe, farmer resources, and necessary skills.
- **Literature study**: Undertake a study of peer reviewed literature. The student should also understand how the published material might fit into their OFE given soil, climate and other farm conditions.
- **Working plan**: Draft a working plan in a provisional Gantt chart of the possible experiment work.
- **Self-Training**: Students undertake premiminary experimental methods like pot trials and quadrant measurements to learn about the materials and process to help them understand what they will be doing in the later OFE.
- **Involve Farmers**: For OFE, students usually make initial contact with the farmers during this module to assess the farm status, determine the premise of the OFE and establish a plan for the OFE.

From this module the student is more ready to interact with a farmer and in the OFE model, to discuss plans with the farmer to gain input from the farmer and potentially modify based on farmer experience. During a farm visit with the student and university supervisor they discuss the plans with the farmer, but also to review potentially where on the farm it might happen and how and when it might fit in with the farming system.

# Project Implementation Phase

In terms of OFE, this implementation module deals with implementing the OFE and assessing its results. Its purpose is to:

- Implement the project plan developed in the Project Research Phase.
- Demonstrate initiative, flexibility and problem-solving skills while undertaking OFE.
- Assess the OFE implantation in terms of the farming system.
- Gather and store data using appropriate methods.
- Analyse the data in the context of the farming system.
- Draw appropriate conclusions from the OFE.
- Communicate the findings to the farmer, peers and the university.




# OVERVIEW OF THE STUDY PROGRAM AND INTEGRATION OF OFE AT VIVES

Vives University of Applied Science has one campus which hosts students in agriculture. The campus is located in the city center of Roeselare, in the heart of the West-Flanders intensive and diverse agricultural region.

**Agricultural programme at Vives:**

- Bachelor (EQF level 6): 3 years
- Undergraduate (EQF level 5): 2 years

Each year is divided into:

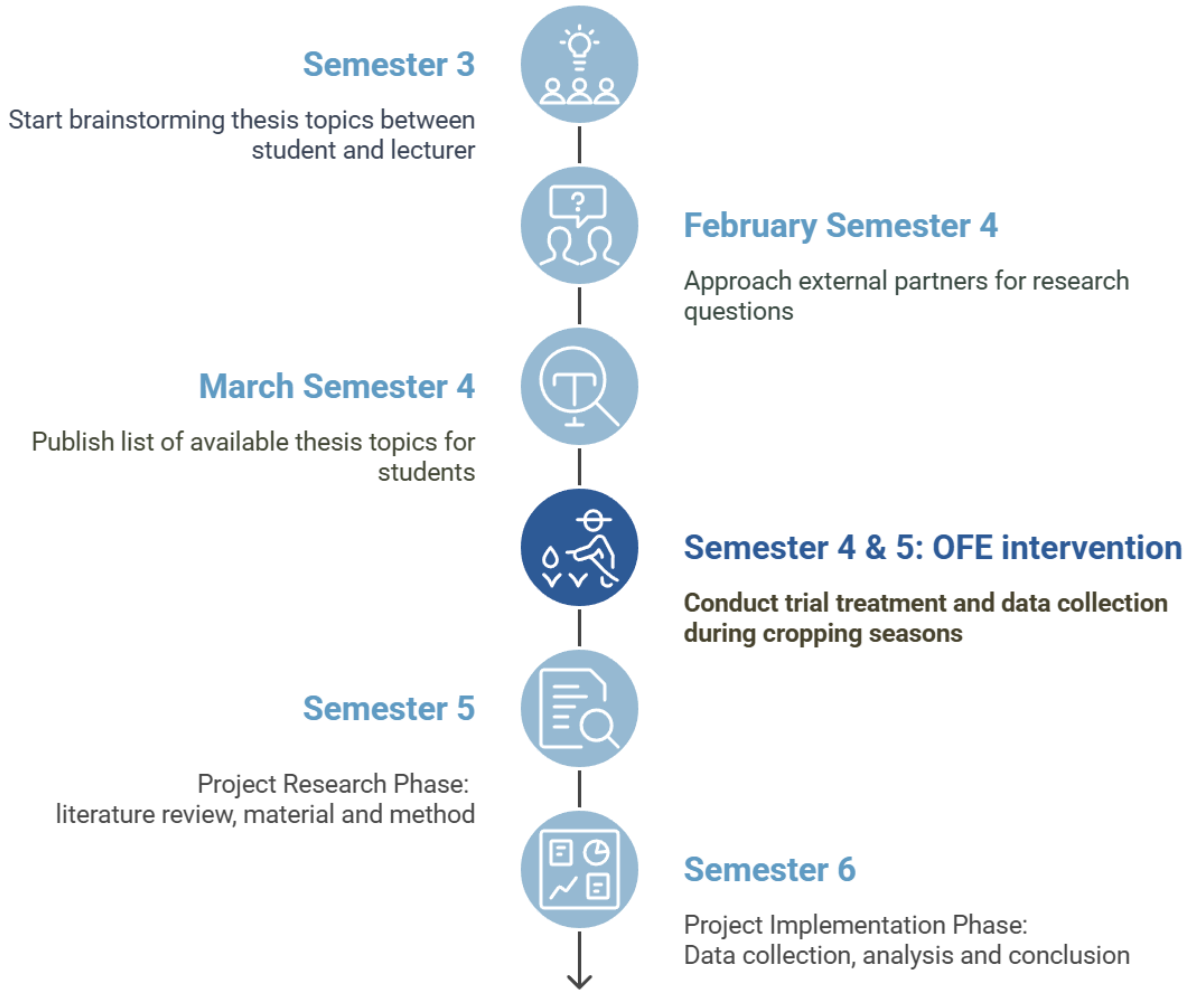
- two semesters
- We count semesters 1-6 or 1-4 because students can start in both September or February.

OFE are always **embedded within the bachelor's thesis**. This thesis is undertaken during the third academic year, spanning semesters 5 and 6.

The preparations for the bachelor's thesis start earlier in semester 3 with lecturers encouraging students to begin brainstorming topics and domains of interest. In February of semester 4, external partners (research institutions and companies) are approached for research questions to integrate into thesis projects. Students who wish to propose their own topics must develop their ideas further in February and March. In March, a list of available topics is published for students to select from.

This timing is important to enable OFE in diverse cropping systems. In te context of SIMONE, OFE are conducted in weed management for winter wheat which is already sown in semester 3. Data should be collected during the cropping season and harvesting period (semester 4 and 5). It is important to notice that in such cases the logical order of literature review, materials and methods, results and discussion is disturbed, the description of the trial setup takes place before the literature review (semester 5) is completed in the Project Research Phase.

**Standard Bachelor's Thesis Journey and OFE intervention at Vives**



Students can engage in OFE through **three pathways** (type 1, 2 and 3). Depending on the type, some adaptations to the Bachelor's Thesis Journey are necessary to enable OFE.

**Type 1**: Student-proposed research topic: A student brings forward a research question, often related to their family farm or an internship host.

**Type 2**: Company-proposed research topic: A company from our tight network of farming companies, research institutes, farming organisations, etc. submits a research question.

**Type 3**: Research Institution experiments: A research institution provides an existing trial for a student to follow as part of their thesis. In the SIMONE project, Vives collaborates with partner Inagro within the Flanders Living Lab in order to offer type 3 OFE to the students.

Each type brings different points of attention to ensure a smooth execution of the OFE, particularly regarding timing and planning in relation to the cropping season.

*Table 1: attention points per type of OFE*

| Type 1<br>Student-proposed research topic | Type 2<br>Company-proposed research topic | Type 3<br>Research Institution experiments |
|---|---|---|
| Students must begin developing ideas **early in semester 3**, even while others only start their bachelor's thesis in semester 5. | Topics are assigned in March, requiring students to quickly develop their protocols to align with planting and treatment schedules. | Since a researcher is often already overseeing these trials, students focus on specific tasks or data collection at the appropriate stages. Use Type 3 as an introduction for students less familiar with designing and managing experiments. |

Students need to ensure that their experimental planning fits within the crop's growing season. For crops such as winter cereals, students need to be fully prepared by semester 3, as planting occurs in November (semester 3) and harvesting aligns with semesters 5 and 6. This timeline demands early planning of treatments and protocols.

Type 3 offers a low-barrier opportunity for students new to experimental management.

# 5

# CASE STUDY BELGIUM: CONDUCTION OF OFE AT VIVES IN THE REGION OF WEST-FLANDERS


Vives is located in the city center of Roeselare, in the heart of the agriculture province of West-Flanders. In an area of less than 3200 km$^2$ with over 65% of land used by agriculture (which is a big number for a small and densely populated country like Belgium) we find a remarkable variety of farming systems (1):

**1. Polder region - heavy clay soils**
A typical arable farming area with crops such as grains, potatoes, maize, and some flax, along with grasslands. Farms focus on arable farming and livestock, particularly cattle and pigs.

**2. Sand region**
Known for intensive livestock farming, including cattle, pigs, and poultry, primarily involving maize and grassland.

**3. Central West-Flanders**
Primarily known for vegetable cultivation, both in open fields and greenhouses, alongside a strong livestock farming sector

**4. Southwest Flanders**
Characterized by intensive livestock farming (pigs, cattle, poultry) with grass and maize, and arable farming, including grains, potatoes, and sugar beets.

The province of West-Flanders is a net exporter of agricultural products. As such, the region is home to a number of prominent players in the food industry (vegetable freezing plants, potato processing plants, dairies, slaughterhouses, etc.). Being located in the center of West-Flanders is a big opportunity for students to gain expertise in different fields and to become familiar with the farming system of their interest.

# STUDENT TESTIMONIAL

***Camille Leterme, Bachelor Agro-Industry, 3rd Year***

***This is a Type 1 On-Farm Experiment (OFE) within the theme of crop nutrition. Camille proposed and initiated this topic herself in semester 3, and the experiment was conducted on her family's farm in semester 4 (planting and trial treatment in May (delayed till June)). Observations took place during summer, harvest and soil sampling occurred in semester 5, data analysis and conclusion in semester 6.***

**What was the driver for the choice of the OFE and the topic?**

Camille: Potato cultivation is economically significant in the farm and in Flanders. A key issue is the high nitrogen residue, which exceeds the Flemish regulations related to the EU Water Framework Directive. Literature suggests that row fertilization can reduce nitrogen use without compromising yield or quality. This method also eliminates the need for additional fertilization and allows for efficient use of manure as a starter fertilizer. I chose this topic cause I wanted to test if row fertilization could help our farm to answer to the strict nitrate residue regulation.

**Can you describe the setup of your on-farm experiment?**

Camille: The potatoes were planted using row fertilization across the field, with a designated zone for broad-spectrum fertilization. Each treatment had four repetitions, and potatoes were sorted and measured for underwater weight per sample.

**What were the challenges you encountered during the OFE?**

Camille: Selecting the test plot was difficult; it needed to be away from field edges to avoid variability. The plot was divided into zones based on spray paths to minimize variations. The timing for the treatment and the harvest was determined together with my father. The collection of post-harvest soil samples for the nitrate residue was challenging. We struggles to find a sampler available shortly after harvest.

**Where there any unexpected events?**

Camille: Waiting for suitable weather for planting (laughs). The experiment was delayed due to prolonged rain but proceeded smoothly with close monitoring alongside my father. Clear agreements with partners ensured proper data collection.

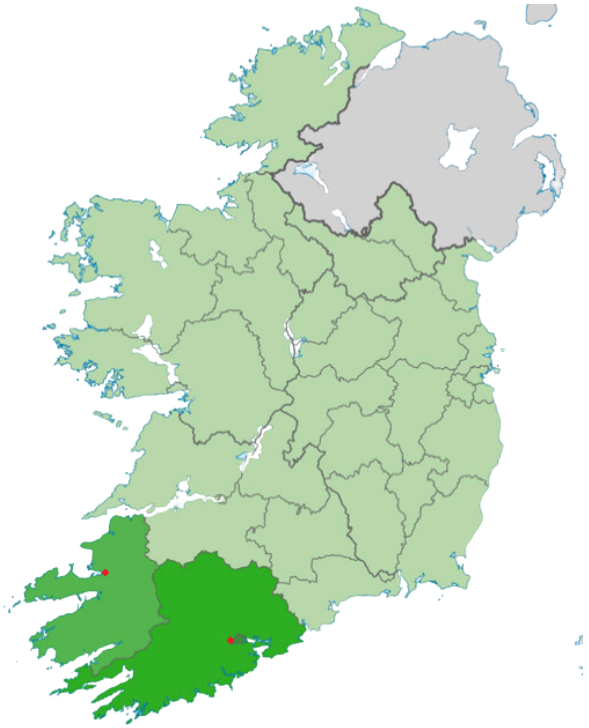
**What is the most important thing you learned during the process of the OFE?**

Camille: Family support and good coordination with partners (the potato processing company and the lab) are very important. I could really rely on the support of the farmer, who was my father in this case.

# 6

# CASE STUDY IRELAND: MUNSTER TECHNOLOGICAL UNIVERSITY - REGIONAL APPROACH FOR OFE

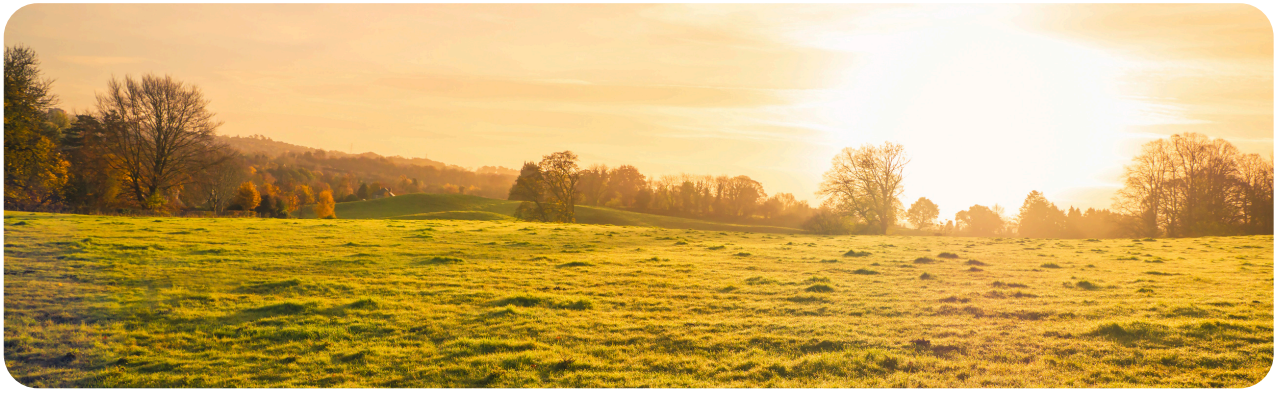
## FARMING SYSTEMS & AGRONOMIC REGION



Before implementing OFE, **students must study the farming systems and the agronomic practices of their region** to fully understand the relevance of the OFE as a lever for agroecological transition for the region. Munster Technological University is located in the South-West Region of Ireland. Grassland cropping (Lolium perenne mainly) dominates the Munster region, supporting forage for mainly bovine animal dairy and beef production systems. Sheep and other animal production mainly for meat also figure in the region.

**Students must also understand the dominant farming elements in the region namely soil and climate.** It is always recommended that such an evaluation is done before starting to develop OFE design, so that OFE are developed best to reflect regional or local soils and climate factors and that correct comparisons to previous studies are truly comparable and not impacted by significant differences due to soil or climate. Soils in the region are mainly mineral soils, many nutrient rich. However, it is estimated that throughout Ireland 60-65% of the soils are in soil P index of 1 and 2 and 55- 68% have soil K index of 1 and 2 [2]. Organic soils, mainly blanket bog also exists especially in the west of the region with some animal farming practiced on the soils. Therefore, students must understand the variation across the region, so when engaging with farmers they have an appreciation of the farming system and challenges.

Since the main crop and soils in Ireland, in terms of area covered is permanent grassland for grazing and silage harvest, on mineral soils, the OFE approach here will reflect these cropping systems. However, the approach taken is the same regardless of whether it is grassland or other arable crops, students must understand the farming practices whitin the region and how agroecological measures perform within the boundaries of a farming system and region. Therefore the case study would be best to support development of OFE in moderate maritime northern European farming regions but could also be applied to OFE development in other regions.



# OFE APPROACH

Several approaches can be employed. But soil tests for texture, structure, nutrient levels, organic matter content as well as evaluation of farm for aspect, drainage ability, exposure etc. of farmland should be undertaken to avoid outlier areas as such that would harm true comparisons.

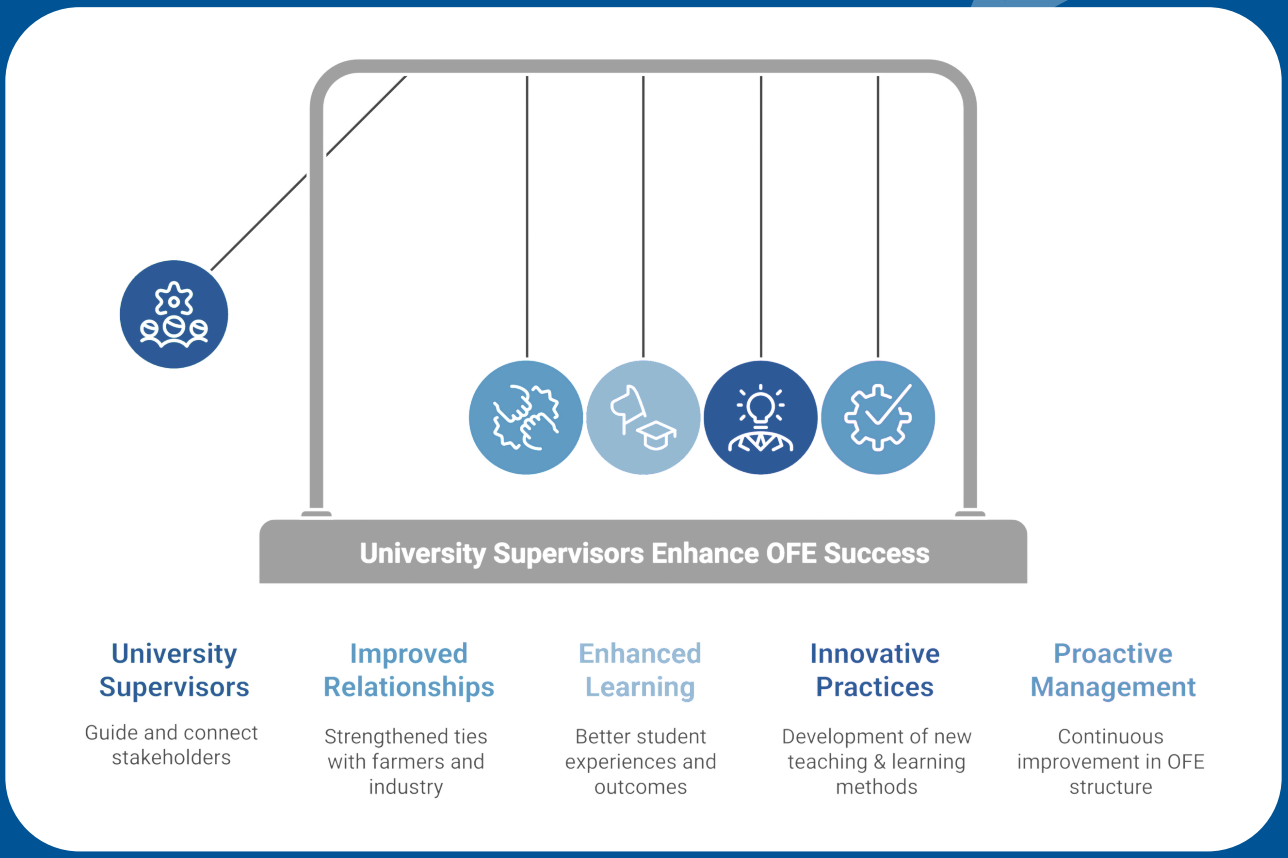
Area of grassland is more used in grass systems for comparison with common areas of OFE of 1m x 1m, 5m x 5m and 10m x 10m. In arable crops, students should start by determining the width of the working aisle and the location of spray trails to avoid edge effects in their plots. The number of replicate plots employed can be modified lower or higher depending on OFE and farm.

In some experiments, quality attribute analysis would often be undertaken such as grass carbohydrate, protein, minerals or other, either at all dates or on final harvest depending on objectives of experiments. OFE always try to have experimental objectives that are meaningful to farmers and are always informed by and agreed with farmers during the planning phase.

# OFE LEARNINGS: COLLEGE SUPERVISOR TESTIMONIAL

***Joe Croke, lecturer at the Department of Biological Science, Munster Technological University, Cork, Ireland***

Student OFE are an important and rewarding process. Each student has a dedicated university supervisor for the two modules which cover OFE. The supervisor dealing with student OFE is part of that process every year and offers a different perspective to students. The supervisor develops a wealth of knowledge of the process. The below points are a summary of some of the reflections from supervisors who have undertaken OFE over a period of time and might be useful in developing student OFE to other universities or educational institutions.



# 7 LEARNING OUTCOMES & SKILLS DEVELOPED

This chapter explains the competences a student will develop by engaging in OFE in the context of the Bachelor or Master graduate thesis. The content is based on the Munster Technological University example but accounts for most Educational Institutes or VET centers who want to engage in OFE.

For the Project Research Phase module, the learning outcomes as per the module descriptor used in the Irish educational system may be viewed in Table 1 and those for the Project Implementation Phase are highlighted in Table 2. In the context of OFE the skills developed by the students of the B. Sc. Hons in Agri-Bioscience and B. Sc. Hons in Horticulture are also highlighted within both tables.

*Table 2: Learning outcomes and skills developed during phase 1 of the thesis, the Project Research Phase.*

| Learning Outcome | Skills Developed |
|---|---|
| Undertake a **comprehensive review of relevant and appropriate literature** to determine current knowledge in the project area. | Ability to source and organise relevant information from reliable sources and assess whether this literature is transferable to an Irish context given local climatic, soil and farm systems. |
| Utilising **professional skills** developed throughout the curriculum, outline a number of viable methodologies to address the identified project area. | Develop OFE related questions and outline methodologies to test those questionsthrough consultation with the farmer and the VET center. |
| Select the **most likely methodology** by exercising professional judgement in evaluating potential courses of actions against appropriate design, safety, commercial and ethical criteria. | Evaluate and select pragmatic realistic experimental design. This is achieved through, again, consultation with the farmer. It is important that the methodology fits into the farming system |
| Develop a **project plan** to implement the proposed methodology. | Include a Gannt chart with outline of timeframe and identify the critical path to achieve the implementation of the OFE. |
| Demonstrate the appropriate **written and oral communication skills** required of the professional practioner. | This requires the student to develop communication on two fronts, in writing but also oral communication through their interactions with the farmer and the university. |

*Table 3: Learning outcomes and skills developed during phase 2 of the thesis: the Project Implementation Phase.*

| Learning Outcome | Skills Developed |
|---|---|
| **Display initiative, analysis and problem-solving skills** in developing a detailed, viable methodology for addressing an open-ended problem | Throughout OFE it is usual that unforeseen circumstance arises (e.g. weather, breakdown of equipment), and challenges are encountered, therefore the student must display initiative, flexibility and problem-solving skills to overcome these issues. |
| Develop a prototype or conduct a feasibility **study** of the proposed methodology | Refine and test methods of OFE, especially through discussions with the farmer. |
| Systematically **review and adapt** the design during implementation in response to practice real world response | Ability to observe and recognize design issues, develop a modification/ response and make the changes in OFE. Demonstrate critical thinking on how the OFE can fit within the existing farming system. |
| **Critically assess** the outcome against, inter alia, appropriate design, safety, commercial and ethical criteria | Develop skills in analysing and interpreting data and drawing appropriate conclusions from the OFE and the appropriate limitations of the results (e.g. just because it works for this farm, does not mean it will work for all farms). |
| **Demonstrate the appropriate written and oral communication skills** required of the professional practitioner | This again requires the student to develop communication on two fronts, in writing through the thesis, but again through oral communication through their interactions with the farmer and the university. The ability to explain the outcomes and limitation of the OFE is important. |

# 8 CLOSING REMARKS

## FROM THEORY TO PRACTICE: ENGAGING THE NEXT GENERATION FOR AGROECOLOGICAL TRANSITION THROUGH ON-FARM EXPERIMENTATIONS

The implementation of On-Farm Experimentation (OFE) in education creates a vital bridge between theory and practice. OFE foster a farmer centric innovation approach enabling that agroecological measures are incorporated into farming systems transitioning agricultural regions beyond the current situation. Education is an important pillar in this agroecological transition ensuring that the next generation is equipped to drive meaningful change.

Futhermore, engaging in OFE delivers the students extra social, scientific and management competences. Students involved in SIMONE OFE benefit from the experience of farmers, agronomists or other stakeholders they interact with in the context of the OFE and the broader regional living lab. They will understand already early in their careers the benefits of exchanging knowledge, building strong networks and engaging for transition.

This guide aims to motivate and support VET Centers in integrating OFE in their curriculum design and leveraging the agroecological transition at regional level in order to lift Northwest Europe as a sustainable agricultural region and eliminate disparities between regions.

We hope this guide provides a strong foundation for successful and innovative farming practices. By enriching students' knowledge and skills, and fostering sustainable and effective agricultural systems, OFE represents a pathway to a more resilient future. Through continuous experimentation and learning, we can collectively shape and improve the future of agriculture.

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*All graphs and charts in this guide were created using NapkinAI.*

**References:**

(1) Met de klas de boer op: www.metdeklasdeboerop.be
(2) Imke Harms, Ivona Sigurnjak, Renata Sultanbaeva, Franky Coopman, Alain Bouthier, Robert Trochard, Thierry Denis, Romke Postma, Katharina Laub, Anke De Dobbelaere, Inès Verleden, Niamh Power, 'Exploring the demand for recycling-derived nutrients and organic matter in regions of Northwest Europe', Interreg NEW, ReNu2Farm