MODULE 5

plant power

Boosting Innovation for Food SMEs

Imagining a Better World Via Plant Power

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Contents

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01

Purpose and Objectives

Purpose

This module empowers learners to understand the critical role plant-based food systems play in shaping a resilient future. SMEs are equipped with the knowledge to align their practices with sustainability trends, and shifting consumer demand for plant-based products.

Learners are encouraged to reflect on current global challenges and imagine transformative solutions rooted in plant-based innovation. It helps SMEs identify opportunities for innovation, cost-efficiency, and new market growth in plant-based food systems.

This module serves as a foundational introduction to a plant-based food future, encouraging participants to critically examine traditional food systems and envision alternatives that align with the Sustainable Development Goals (SDGs). We use blended content, and practical activities so learners will become agents of change in the transition to sustainable food systems.

Objectives

By the end of the module, learners will be able to:

- Explain the role of plant-based food systems in environmental and public health.
- Identify how plant-based solutions align with the EU Green Deal and UN SDGs.
- Reflect on the socio-economic impact of shifting to plant-based diets.
- Envision innovative plant-based ideas that promote sustainability and equity.

02

Introduction to Global Sustainability and Food Systems

What do we mean by sustainability in food systems?

Sustainability, in the **food-system** sphere, means developing and operating food systems that **fully meet human needs** without **compromising** the ability of future generations to meet their needs. It implies balancing environmental, social, health, and economic concerns across all aspects from **production** to **consumption**.

Sustainable Food Systems

Food Security

Ensuring access to sufficient, safe, and nutritious food for all.

Environmental Stewardship

Minimizing harm to natural ecosystems and reducing resource overuse.

Waste Reduction

Conserving resources by minimizing food loss and waste.

Social Equity

Promoting fair access to food and supporting sustainable livelihoods.

Economic Viability

Ensuring food systems are economically sustainable for all stakeholders.

Health & Wellbeing

Producing diets that promote health and reduce disease risks.

Resilience & Adaptability

Adapting food systems to change and reducing vulnerability.

How do the Sustainable Development Goals apply?

The Sustainable Development Goals (SDGs) are a set of 17 intersectional goals adopted by UN member states in 2015, aiming to achieve a fairer, more sustainable, and prosperous world by 2030.

The SDGs set out a blueprint for ending hunger, improving health, protecting the environment, and ensuring equality. Global food systems are central to all of this. It's due to the way we produce what we eat, affect the health of people and the planet, and involve the livelihoods of millions. To reach goals like Zero Hunger (SDG 2), Clean Water (SDG 6), Climate Action (SDG 13), and Life on Land (SDG 15), we need food systems that are not only productive but also sustainable, fair, resilient, and inclusive.

Watch this!

This video focuses on how the Common Agricultural Policy (CAP) aims to make agriculture greener and more efficient.

It addresses natural resource use, climate change mitigation, and biodiversity protection thus illustrating how EU policy links with agriculture's environmental impacts.

How Current Food Systems Contribute to Ecological Degradation

1

Soil Degradation and Loss of Soil Health

The European Environment Agency reports that soil degradation has been worsening in recent years across the EU. Degradation includes erosion, reduction in organic matter, compaction, and declining fertility.

2

Water Resource Stress and Pollution

Agriculture is one of the major users of freshwater. Over-use leads to water scarcity. This is especially true in southern Europe.

3

Biodiversity Loss

Agricultural expansion, especially conversion of semi-natural land to intensive farming, reduces natural habitat.

How Current Food Systems Contribute to Ecological Degradation

4

Greenhouse Gas Emissions and Climate Impacts

Agriculture contributes significantly to greenhouse gas emissions via land use change, methane from livestock, nitrous oxide from fertilizers, and CO_2 from soil and deforestation.

5

Overuse of Inputs and Chemical Dependency

Heavy reliance on pesticides and synthetic fertilizers harms ecosystems such as pollinators, beneficial insects, and soil microbes.

Next we look at how these systems play a role in driving inequality.

The Current Food Systems Contribution to Inequality

1. Unequal Access to Healthy and Sustainable Food

Low-income households in Europe often have less access to high quality, nutritious food. Affordability and availability of sustainable and organic options can be limited.

2. Unequal Exposure to Environmental Hazards

Vulnerable groups are more exposed to polluted water, air pollution, pesticide drift, and degraded environments. These exposures can affect health, nutrition, and livelihood.

3. Disparities Among Farmers and Producers

Smallholder farms, farms in less favourable climates, or poorer regions are more negatively affected by climate change, soil degradation, water scarcity, and lack of access to resources or capital.

The Current Food Systems Contribution to Inequality

4. Inter-Regional Inequalities

Regions exposed to environmental stress like drought, degraded soils, and marginalised rural areas bear more risk. Those with less infrastructure, institutional support, or investment will be less resilient.

5. Health Inequalities

Poorer populations are more likely to suffer diet-related diseases due to less access to healthy food, higher exposure to environmental toxins, and less adaptive capacity to climate impacts.

Impact of Food Waste in Food Systems

Wasted Resources

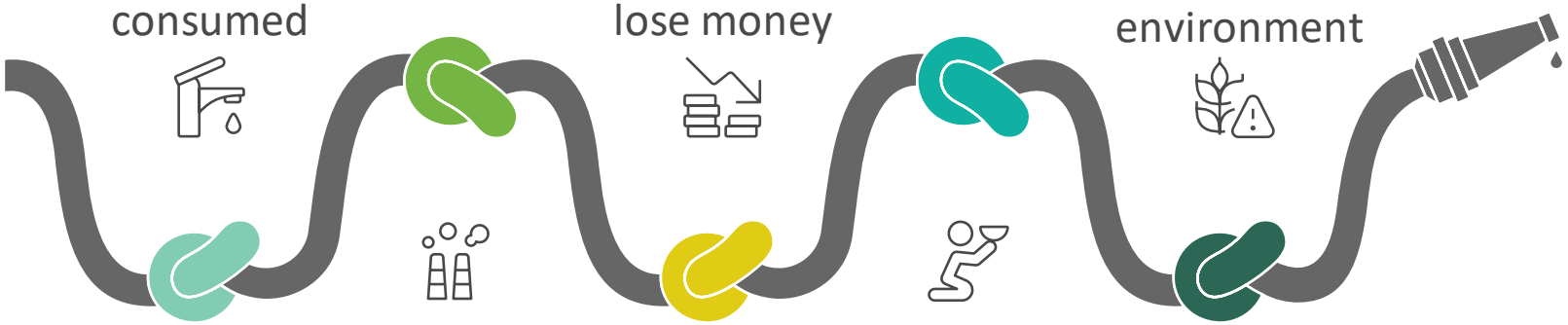
Inputs used are never consumed

Economic Loss

Producers and retailers lose money

Systemic Consequences

Production inefficiencies degrade environment



Environmental Impacts

Emissions contribute to greenhouse gases

Social Inequity

Food insecurity is greatly increased

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Personal Action & Vision

Reflect on your own eating or food consumption habits.

- What changes could you make to align your food choices with a more sustainable, plant-powered, or equitable system?
- What challenges might you face?
- How could you overcome them?

03

The Environmental Case for Plant-Based Diets

What is the European Green Deal?

- A roadmap by the EU to make Europe climate-neutral by 2050.
- Aims to cut greenhouse gas emissions, restore biodiversity, and reduce pollution.
- Transforms how Europe produces, distributes, and consumes food.

How Plant-Based Diets Fit the Green Deal

Lower Environmental Impact

- Animal-based foods produce far more greenhouse gases and use more land and water than plant-based alternatives. Switching diets can reduce the climate and ecological footprint of food systems.

Supports Key Green Deal Targets

- Contributes to reducing food-related Greenhouse Gas Emissions by 20%. Helps cut biodiversity damage by 40–50%. We focus on land use and feed production here.

How Plant-Based Diets Fit the Green Deal

Aligned with the Farm to Fork Strategy

- Promotes sustainable food consumption and healthier diets. It brings reduction of red and processed meat in diets. Supports increased production and access to plant-based protein and legumes.

Part of a circular food system vision

- Reduces waste across the supply chain. It makes better use of plant resources and by-products. It integrates dietary change with sustainable farming and land use.

How Do We Reduce Greenhouse Gas Emissions and Resource Consumption?

Episode 4 Farm to Fork: Feeding a continent without wrecking a planet

Sustainability, in the food-system sphere, means developing and operating food systems that fully meet human needs without compromising the ability of future generations to meet their needs.

It implies balancing environmental, social, health, and economic concerns across all aspects from production to consumption.

Read this!

This article by **Nature Food** discusses circular food system approaches and will help you further understand the environmental footprints of animal vs. plant-based foods.

FOLLOW LINK

nature food

Article

https://doi.org/10.1038/s43016-024-00975-2

Circular food system approaches can support current European protein intake levels while reducing land use and greenhouse gas emissions

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Check for updates

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Protein transition and circular food system transition are two proposed strategies for supporting food system sustainability. Here we model animal-sourced protein to plant-sourced protein ratios within a European circular food system, finding that maintaining the current animal–plant protein share while redesigning the system with circular principles resulted in the largest relative reduction of 44% in land use and 70% in greenhouse gas (GHG) emissions compared with the current food system. Shifting from a 60:40 to a 40:60 ratio of animal-sourced proteins to plant-sourced proteins yielded a 60% reduction in land use and an 81% GHG emission reduction, while supporting nutritionally adequate diets. Differences between current and recommended total protein intake did not substantially impact minimal land use and GHG emissions. Micronutrient inadequacies occurred with less than 18 g animal protein per capita per day. Redesigning the food system varied depending on whether land use or GHG emissions were reduced—highlighting the need for a food system approach when designing policies to enhance human and planetary health.

In recent years, various actors within the European Union (EU) have actively pursued changes in the food system. Initiatives such as the European Green Deal aim to position the EU as a global leader in achieving climate neutrality[1]. Two possible approaches in redesigning the food system have received increased attention: protein transition and circularity in a food system.

Protein transition scenarios in the European context refer to the reduction of the share of animal proteins in human diets[2,3]. Today's protein intake levels in the EU are around 82 g per capita per day, of which 49 g comes from animal products and 33 g from plant products[4]. In comparison, the European Food Safety Authority (EFSA) sets an average requirement (AR) intake of 46 g protein per capita per day[5], indicating a protein overconsumption of 36 g per capita per day. Multiple studies indicated that eating less animal source proteins (ASP) positively affects health and the environment[6–11].

Nevertheless, there remains a lack of consensus regarding how to strike an optimal balance between ASP and plant source proteins (PSP) to promote a healthy diet while mitigating environmental pressures. Some studies suggest that eating an entirely plant-based diet is the most sustainable[12,13], while there remains uncertainty about the effects of ASP reduction in diets on protein and micronutrient adequacies[14]. Other studies introduced the concept of circularity and reported that

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Role of Agriculture in Deforestation

1. European import demand drives deforestation abroad

The EU is responsible for about 16% of tropical deforestation associated with international trade. In 2017, approximately 203,000 hectares of tropical forest were cleared because of EU-imported commodities which contributing to 116 million tonnes CO_2 emissions.

2. Agricultural expansion and feed demand

Livestock farming requires large amounts of feed for which soy is one of the major feed crops. The demand of feed from non-EU countries makes deforestation risk higher, and contributes significantly to forest land conversion.

Role of Agriculture in Deforestation

The EU's Common Agricultural Policy (CAP) plays a role in shaping this demand through subsidies or incentives, and some reports point out that CAP reforms are needed to reduce incentives for deforestation.

3. EU regulation to tackle deforestation

The EU Regulation on Deforestation-free Products was adopted to ensure that certain commodities entering the EU market don't come from recently deforested land. The regulation aims to reduce greenhouse gas emissions and biodiversity loss by stopping agricultural expansion that causes deforestation and forest degradation.

Watch this!

What do you think of when you think about air pollution? Most likely you think of cars, planes or industry. However, it's agriculture.

This video by the European Environmental Bureau talks about the causes of this pollution and about the solutions.

Group Activity: Sustainable Meal Plan

Step 1 – Menu Planning (15 mins) Each group creates a breakfast, lunch, and dinner menu using mostly plant-based foods. They must minimize foods with high GHG emissions such as beef, cheese, etc. Include foods with low land and water use like legumes, and seasonal vegetables. Avoid or reduce ultra-processed items and food waste.

Group Activity: Sustainable Meal Plan

Step 2 – Impact Justification (5–10 mins) For each meal, the group adds a short justification. It must include

Why is this food environmentally better?

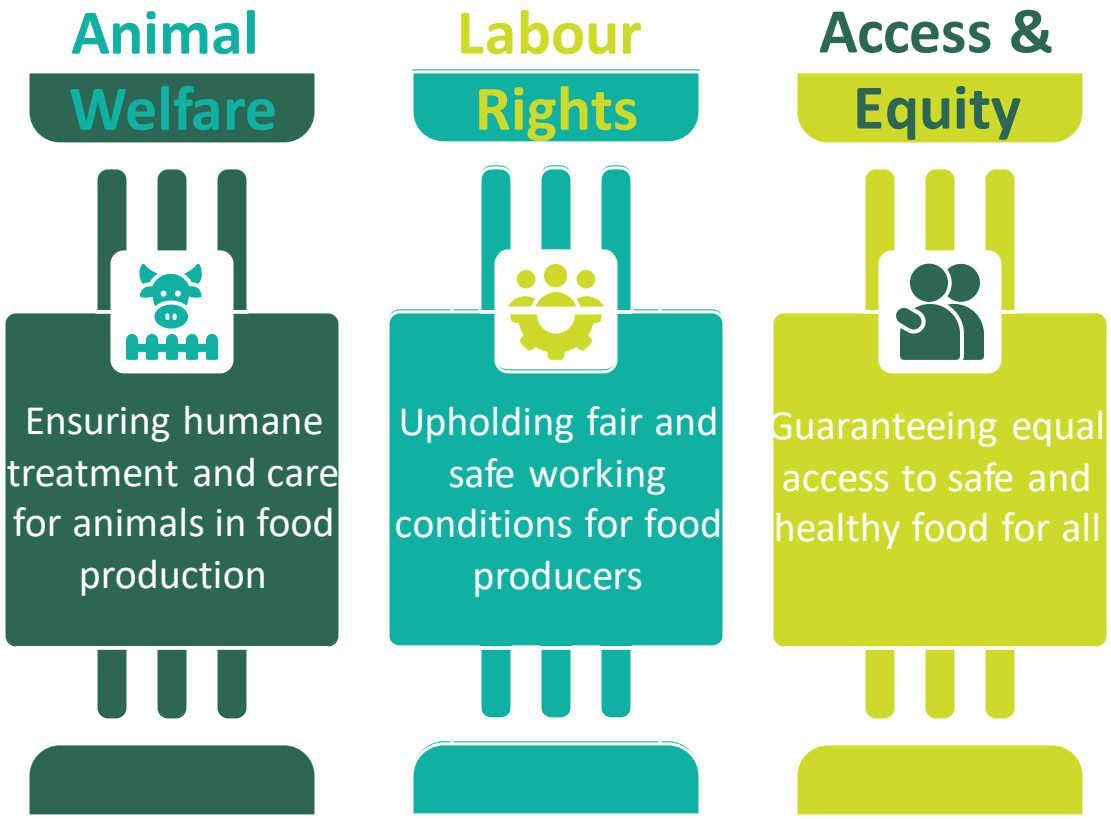
How does it support sustainability or align with the Green Deal?

Step 3 - Presentation (5 mins per group) Groups can briefly present their menu and reasoning to the class.

04

Food, Ethics, and Social Justice

Ethical Dimensions of Food Choices



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Ethical Issues in Industrial Farming

1. Animal Welfare

- Animals are often kept in high stocking densities, with restricted movement. This can mean confinement in cages or cramped barns. Welfare issues include stress, inability to exhibit natural behaviours, mutilations. While specific EU law regulates some of this, there are still arguments related to the standards not being sufficient.
- Transport and slaughter practices can also lead to suffering due to handling, distance, and poor conditions. Even though regulated, the compliance and enforcement can vary.

2. Environmental & Health Impacts that Affect Ethics

- Antibiotic use to control disease in high-density systems can lead to antibiotic resistance, which is a public health, and ethical issue.

Ethical Issues in Industrial Farming

- Industrial animal agriculture contributes heavily to greenhouse gas emissions, pollution, and biodiversity loss. These environmental harms affect both animals and human communities.

3. Equity, Social Justice and Workers

Conditions for labour are also a concern. Many workers in industrial systems may face difficult working conditions, exposure to hazardous materials, low pay, and little power to influence practices.

4. Moral Responsibility and Beyond

- Industrial farming benefits from large subsidies like the EU CAP programs,

which can perpetuate inefficiencies and environmental harm. However, the public cost is not always reflected in prices.

Read this!

This article by the **European Academies Science Advisory Council** discusses practices such as reduced chemical inputs and improved land management which contribute to lower pollution and more sustainable food production.

FOLLOW LINK

Why Worker's Rights Matter

This video will help you understand why worker's rights in agriculture are important in food production.

From Spain, this documentary exposes working conditions of agricultural workers, including wage issues, hours, treatment, and more.

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Get to Know Why Plant-Based Diets Benefit Food Sovereignty

This academic document gives you a theoretical and practical link between who controls the food system, what is produced, and how diets can shift.

Click and read for more!

Reflection time!

Write a short essay and focus on what you have learned.

Answer the following question: What does food justice mean to you?

05

Vision: Future Food Systems

What is Futures Thinking?

A systematic exploration of possible and desirable futures to improve decision-making today. It embraces uncertainty, considers multiple pathways, and uses creative and participatory methods such as, scenario planning, foresight, and design fiction.

You explore how current choices shape future outcomes. It is used by EU institutions to support anticipatory governance, sustainability, innovation, and resilience.

How do we define Speculative Design?

It’s a forward thinking, and critical design approach that uses fictional, imagined, or future scenarios to explore what could be. Speculative Design encourages reflection, dialogue, and ethical inquiry.

It is widely used across Europe in public policy, education, and research to envision alternative futures, and stimulate inclusive conversations about change.

Best Practice: Nordic Harvest (Denmark)

Founded in 2020, this is a vertical farm that uses renewable energy, robotic technology, and various resource-efficient systems. It's the largest one in Europe.

What they do:

- Their farm structure allows them to produce 200× more greens per square meter compared to conventional farming.
- They use less water, nutrients, fertilizers, and recycle many of them.

Best Practice: Nordic Harvest (Denmark)

- The farm is powered in part by renewable energy and is designed to reduce its dependency on “weather conditions” so production can be steady all year.
- Being located in or near urban areas helps cut down transportation emissions, ensures fresher produce, and reduces spoilage or logistic waste.

Understand the Circular Economy

Listen to this podcast by the United Nations Economic Commission for Europe (UNECE) to understand this concept.

It explores what a circular economy means in practice while touching on waste, innovation, and natural capital with expert guests.

CLICK ON THE IMAGE

A Zero-Waste System

Zero Waste is a design and management approach that aims to eliminate waste entirely by ensuring that all products, packaging, and materials are reused, repaired, recycled, or composted. It seeks to eliminate burning or sending waste to landfills.

Key Principles:

1. Design Out Waste

Products are designed to be long-lasting, repairable, and recyclable with no unnecessary packaging.

2. Refuse and Reduce

Avoid creating waste so rejects single-use plastic, thus reducing consumption.

A Zero-Waste System

3. Reuse and Repair

Promotes second-hand use, repairability, and systems like refill stations.

4. Recycle and Compost

Ensures any remaining waste is either recycled or composted not incinerated or send to a landfill.

5. Systems Thinking

Focuses on closed-loop systems where “waste” becomes a resource for another process.

Action: Sustainable Food Pledge

- **Reflect:** Think about what you have learned and your current food habits. What you eat, where your food comes from, how much you waste, and how your choices might affect the environment or others.
- **Write Your Sustainable Food Pledge:** Create a short pledge and action plan to improve the sustainability of your food habits. Use the worksheet or template provided.

Action: Sustainable Food Pledge

This activity encourages you to reflect on your current food habits and commit to small, meaningful actions that support sustainable, ethical, and plant-forward food systems. Use the template below to write your own **pledge** and **action plan**.

Name: _____

Date: _____

Pledge:_____

06

Learning Summary

What You Learned:

Global Sustainability and Food Systems

- Sustainability in food systems means meeting current food needs without compromising future generations' ability to do the same.
- The UN Sustainable Development Goals (SDGs) emphasise food security, climate action, biodiversity, health, and social equity.
- Food production is deeply interconnected with the environment, economy, and society, requiring us to think about systems and inclusive governance.
- Inefficiencies like food waste and hunger highlight global inequity. Overproduction and loss coexist with undernourishment.

The Case for Plant-Based Diets

- Plant-based diets help reduce greenhouse gas (GHG) emissions, land use, water use, and pollution which hare the key drivers of the EU Green Deal goals.
- Animal-based foods have higher environmental footprints than plant-based alternatives.
- Research shows plant-based diets align with food sovereignty by boosting local production, reducing import dependence, and supporting biodiversity.

Food, Ethics, and Social Justice!

- Ethical food systems consider animal welfare, fair labour rights, and equitable access to healthy, affordable food.
- Industrial animal farming raises animal ethics issues pertaining to regenerative practices which aim to rebalance ecosystems and animal to human relationships.
- Food inequality persists in Europe, and faces barriers to access based on geography, income, or systemic exclusion.
- In order to have justice play a role in food systems, we must include empowering small producers, protect workers' rights, and ensure consumer transparency.

On Future Food Systems

- Futures thinking encourages us to explore multiple possible futures rather than predict one outcome.
- Speculative design uses imagination and storytelling to provoke critical thought and envision alternatives.
- Key principles for the future include resilience, circularity, justice, biodiversity, and inclusion. They’re all tied to how we grow, distribute, and eat food.

07

Looking Ahead

The Vision

Our vision for food is clear. One where we focus on sustainable, equitable, and resilient food systems as the foundation of our collective wellbeing. The systems we put into place should be rooted in respect for biodiversity, soil health, social justice, and cultural diversity.

By embracing innovation, circular principles, and inclusive governance, we can shift away from extractive practices towards regenerative ones. The future of food is not only about what we eat, but how we grow, share, and value it.

We must build a future where everyone has access to nutritious food that is produced with care for communities and ecosystems alike.

Best Practice: planted (Switzerland)

This Zurich-based FoodTech is a spin-off from the Swiss Technical Institute of Technology (ETH) and it was founded in 2019. What they do:

- Use fermentation technologies to produce meat from plant proteins, focusing on delicious taste, meaty and juicy texture, while only using clean ingredients.
- They design and structure their meat in any size, shape, and fibrous texture.

Best Practice: planted (Switzerland)

- Their belief that they will outperform animal meat in the future in terms of taste, sustainability, health, efficiency and price.
- Planted's principal meat production is in a glass-house production facility in Kemptthal (Zurich) and it's the first transparent meat production open to the public.

A shift to healthier, more sustainable, affordable and balanced diets is essential for a successful transition to a more sustainable food system, and plant-based foods are part of the solution.

European Environmental Bureau

Thank you for Completing Module 5 Imagining A Better World Via Plant Power

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Supporting Europe's food sector in adopting plant-based innovation and sustainability.

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