“Development of an innovative network for the promotion of extroversion of agro-food companies in Adriatic – Ionian Area”

e-learning

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History Changes

Version Number	Date of Issue	Document Title	Author(s)	Controller
1.0	08.05.2020	D.T2.2.2	Barbara Kobale	Darko Ferčej

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1 Summary

Withing the WP T2 the virtual transnational business innovation & entrepreneurship center (e-platform) have been development and implemented. The platform is offering support through e-incubators, e-business network platform, digital tools for the self-assessment of an SME's level of extroversion and includes the e-learning section to gain knowledge on 50 important innovative topics selected within the project INNOVAGRO activities.

The users of the platform can obtain knowledge on business innovation and entrepreneurship. The e-learning platform (D.T2.2.3) can be reached at https://innovagro.green-projects.com.gr/. The registration of user have to made before using the platform.

The e-learning module contains 50 topics (Annex I.):

1. Sustainable agriculture
2. Agroecology
3. Circular approach in agriculture
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49. Sustainable diet
50. Agro-food sector and tourism

2 E-learning platform

There is no direct link to e-learning module. The users must be register and signed in to use the developed tool. The link to the platform is https://innovagro.green-projects.com.gr/

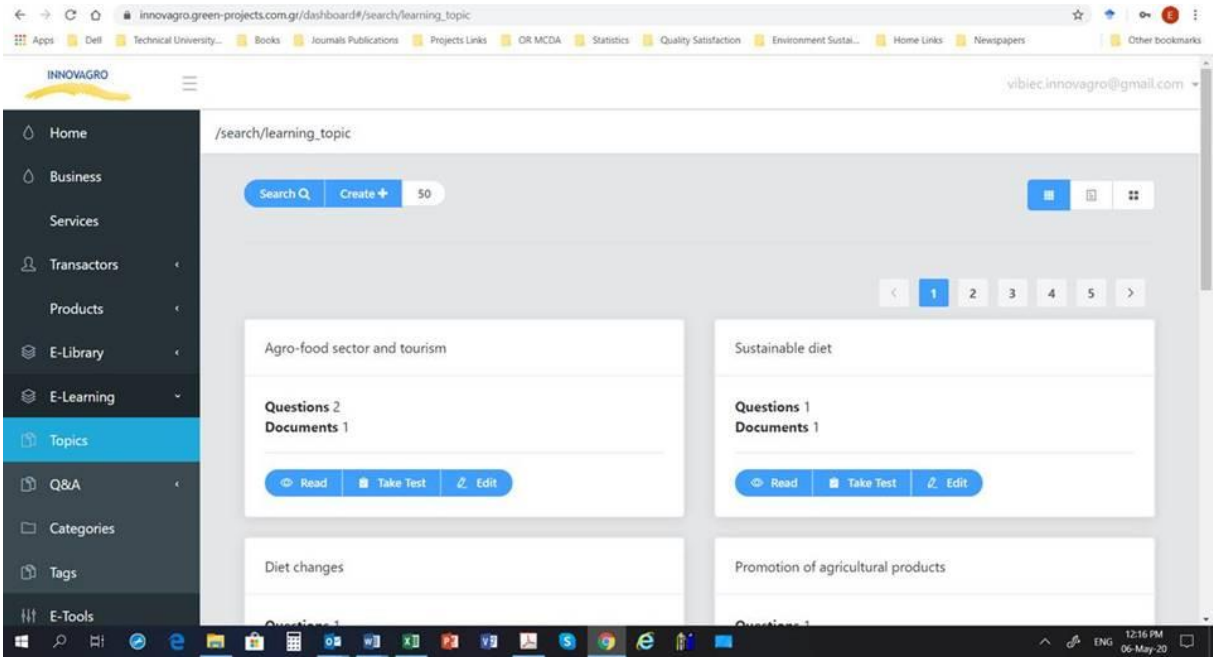


Figure 1: Screen shot of the e-learning platform

More detail description of the platform functionalities is presented in deliverable T2.2.3 Virtual transnational business innovation & entrepreneurship center (e-platform).

3 Annex I. 50 topics for e-learning

Sustainable agriculture

Sustainable agriculture can feed the world without damaging the environment or threatening human health. It is a way of growing food in an ecologically and ethically responsible manner. Sustainable crop production practices can lead to higher yields over time, with less need for expensive and environmentally damaging inputs.

Sustainable Agriculture Initiative is stating »*Sustainable agriculture is the efficient production of safe, high quality agricultural products, in a way that protects and improves the natural environment, the social and economic conditions of farmers, their employees and local communities, and safeguards the health and welfare of all farmed species.*«[1]

Globally, food and farming systems contribute up to 30% of greenhouse gas (GHG) emissions. As much as 31% of the land required to meet EU food demand is located outside Europe.

From 1961 to 1990, CO_2 emissions caused by agriculture in the European Union (EU) had grown by 26.4%. Today, agricultural activities in the EU-28 generate about 10% of the Union's total GHG. [2]

Organic isn't necessarily sustainable, and vice versa. Organic products can be produced on large industrial farms that are not sustainable. Meanwhile, not certified organic can produce food using methods that will sustain the farm's productivity for generations.

Key principles of sustainable agriculture:

- The incorporation of biological and ecological processes into agricultural and food production practices. For example, these processes could include nutrient cycling, soil regeneration, and nitrogen fixation.
- Using decreased amounts of non-renewable and unsustainable inputs, particularly the ones that are environmentally harmful.
- Using the expertise of farmers to both productively work the land as well as to promote the self-reliance and self-sufficiency of farmers.
- Solving agricultural and natural resource problems through the cooperation and collaboration of people with different skills. The problems tackled include pest management and irrigation.

Different sustainable agricultural practices:

- Rotating Crops
- Embracing Diversity
- Planting Cover Crops (hairy vetch or clovers during the off-season times when the farm is left bare can be beneficial for soil)
- Eliminating or Reducing Tillage
- Appling Integrated Pest Management Methods
- Integrating Crops and Livestock
- Adopting Agroforestry Practices
- Managing Entire Landscapes and Systems

Investing in sustainable farming methods can help you increase your productivity without over-exploiting the farm.

Other links: www.youtube.com/watch?list=PLzp5NgJ2-dK6rvL0nelyknuTmM-3QKwBh&time_continue=191&v=WeoIsjYBQH0

[1] https://saiplatform.org/our-commitment/#Learn
[2] www.euractiv.com

Agroecology

Agroecology is the science of running our farms as an ecosystem. By not working against nature, farmers managing their farms using various agroecological principles can protect the ecosystem without reducing profitability.

Agroecology is based on the application of ecological principles for the design and management of sustainable food systems while placing farmers and citizens at the centre of the governance of food.

The 10 Elements of Agroecology are interlinked and interdependent[1]:

- **Diversity**
- **Co-creation and sharing of knowledge: agricultural innovations respond better to local challenges when they are co-created through participatory processes**
- **Synergies: building synergies enhances key functions across food systems, supporting production and multiple ecosystem services**
- **Efficiency: innovative agroecological practices produce more using less external resources**
- **Recycling: more recycling means agricultural production with lower economic and environmental costs**
- **Resilience**
- **Human and social values: protecting and improving rural livelihoods, equity and social well-being is essential for sustainable food and agricultural systems**
- **Culture and food traditions: by supporting healthy, diversified and culturally appropriate diets, agroecology contributes to food security and nutrition while maintaining the health of ecosystems**
- **Responsible governance**
- **Circular and solidarity economy: circular and solidarity economies that reconnect producers and consumers provide innovative solutions for living within our planetary boundaries while ensuring the social foundation for inclusive and sustainable development**

Agroecology is not only an agricultural and environmental movement, but also has a deeply social component. It is based on the idea that natural resources, including land, seeds, livestock, water, biodiversity, and knowledge (the global commons) have a shared ownership. Agroecology involves a shift of power from private operators to local communities, to manage the commons in a democratic and efficient way. Managing these resources through collective and democratic control is the way to create a long-term sustainable food system.

Agroecology is fundamentally different from other approaches to sustainable development. It is based on bottom-up and territorial processes, helping to deliver contextualised solutions to local problems. Agroecological innovations are based on the co-creation of knowledge, combining science with the traditional, practical and local knowledge of producers. By enhancing their autonomy and adaptive capacity, agroecology empowers producers and communities as key agents of change.

Unless conventional farming is made to internalize its costs to society (its 'externalities'), agroecological farming shall find it difficult to emerge beyond the niche market it currently occupies.

Other links: www.youtube.com/watch?time_continue=1&v=z0_Ux9jRvyE
www.youtube.com/watch?v=w7zqBnrLxiw

[1] FAO

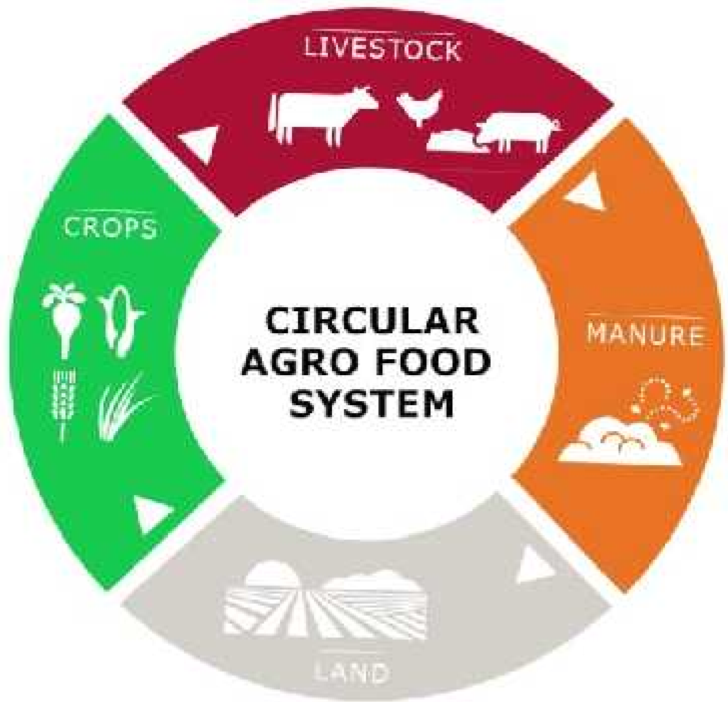
Circular approach in agriculture

Agriculture is a critical sector of the EU economy, providing the food, feed, and bio resources that help sustain society. This sector is at the centre of the challenges associated with population growth, food security, climate change and resource scarcity. In the last 50 years, agriculture has become more resource intensive, relying heavily on the availability of fossil inputs in the form of synthetic nitrogen and phosphorus fertilisers, oil derived agro chemicals and fossil fuels. 'Circular economy' principles can offer many opportunities for agriculture in general, and livestock production in particular, to become more resource efficient.

What is the circular economy in agriculture?

- Production of agricultural commodities using a minimal amount of external inputs
- Closing nutrient loops and reducing negative discharges to the environment
- Valorising agri-food wastes

The UN FAO estimate that inefficiencies in the global food economy cost between $1-2 trillion per annum (FAO, 2011). Ultimately, when analysing the entire agri-food chain, up to one third of the food produced for human consumption is wasted (FAO, 2011).



Source: https://i.ytimg.com/vi/FKrmTbxUKBw/maxresdefault.jpg

Other links:
www.youtube.com/watch?v=zCRKvDyyHmI
www.youtube.com/watch?v=40bHcoEtoxA
https://epthinktank.eu/2019/07/19/3-key-questions-on-circular-economy/

Biodiversity

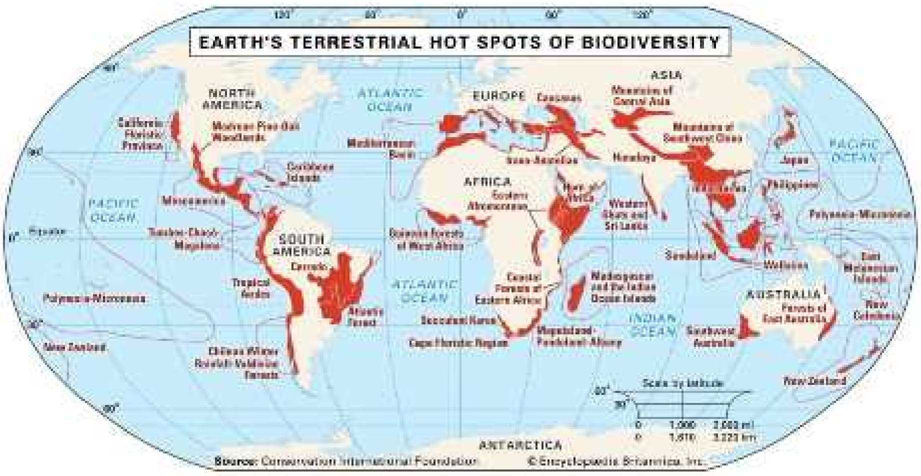
Biodiversity, or biological diversity, is the variety of life and includes all living organisms found on Earth. It plays a key role in the functioning of ecosystems and the provision of ecosystem services which are essential for human life and well-being. It provides us with clean air and water, food, materials and medicines, health and recreation; it supports pollination and soil fertility, regulates climate and protects us from extreme weather.

Europe's biodiversity continues to be eroded resulting in ecosystem degradation. Recent data show that 60% of species assessments and 77% of habitat assessments continue to be in unfavourable conservation status. Constant habitat loss, diffuse pollution, over-exploitation of resources, and growing impacts of invasive alien species and climate change contribute cumulatively.[1]

The six targets covered by the EU Biodiversity Strategy to 2020:

- **Fully implement the Birds and Habitats Directives**
- **Maintain and restore ecosystems and their services**
- **Increase the contribution of agriculture and forestry to maintaining and enhancing biodiversity**
- **Ensure the sustainable use of fisheries resources**
- **Combat invasive alien species**
- **Help avert global biodiversity loss**

The key threats to biodiversity — habitat loss (in particular through urban sprawl, agricultural intensification, land abandonment, and intensively managed forests), pollution, over-exploitation (in particular fisheries), invasive alien species and climate change — continue to exert pressure causing loss of species and habitats and resulting in ecosystem degradation and weakening ecosystem resilience. The EU-28 footprint is still over twice its biocapacity and this compounds pressures on biodiversity outside Europe.



In the last 100 years, some 75% of plant genetic diversity has been lost, as a consequence of abandoning multiple local varieties in favour of genetically uniform, high-yielding varieties.

Agricultural land covered 43.5% of the total European land-area in 2012. Due to the clearing of natural habitats for intensive monoculture, Europe loses 970 million tonnes of soil every year.

Source: https://cdn.britannica.com/s:700x450/09/102009-004-60451671.jpg

Other links: www.youtube.com/watch?time_continue=32&v=pcSTq-9dReM
www.ipbes.net/system/tdf/spm_2b_eca_digital_0.pdf?file=1&type=node&id=28318

[1] www.eea.europa.eu/soer-2015/europe/biodiversity

Closed loop agriculture

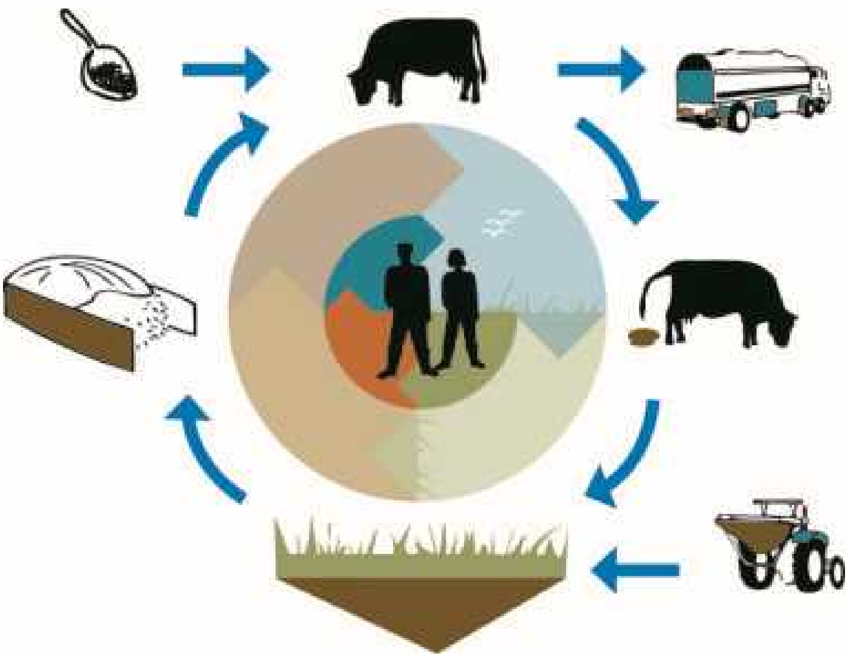
Closed loop agriculture is farming practice that recycles all nutrients and organic matter material back to the soil that it grew in. This forms part of an agricultural practice that preserves the nutrient and carbon levels within the soil and allows farming to be carried out on a sustainable basis.

Closed loop agriculture not only stops the waste of nutrients to watercourses as pollution, it can also reduce the high energy inputs needed for artificial nitrogen production and could go a significant way towards reducing overall agricultural greenhouse gas emissions.

Closed loop agriculture has direct benefits for biodiversity also, within the soil itself, in the aquatic environment, and within the context of climate change.

As global consumption expands, the world is increasingly facing threats to resource availability and food security. To meet future food demands, agricultural resource efficiency needs to be optimized for both water and nutrients. Policy makers should start to radically rethink nutrient management across the entire food chain. Closing the food loop by recycling nutrients in food waste and excreta is an important way of limiting the use of mineral nutrients, as well as improving national and global food security.

Closed loop agriculture:



One third of food internationally produced for human consumption, equivalent to 1.3 billion tons per year, is lost or wasted.

To keep pace with rising population, 70% more food will have to be produced worldwide over the next 30 years. Yet the amount of land available to grow it on is finite. The world's population grew from one billion in 1800 to 7.6 billion in 2018. It is expected to go on rising this century. Estimates put the total population at 8.6 billion by mid-2030, 9.8 billion by mid-2050 and 11.2 billion by the end of the 21st century.[1]

Source: www.nedmag.com/news/closed-loop-agriculture-magnesium-chloride
Other links: www.youtube.com/watch?v=M6MLFJDddM4

[1] United Nationons Population Division

Organic agriculture

Organic production means a sustainable agricultural system respecting the environment and animal welfare, but also includes all other stages of the food supply chain.

The EU regulation on organic production and labelling of organic products ensures that the same high quality standards are respected all over the EU. The rules refer to agriculture and aquaculture farming practices, food processing and labelling, and certification procedures for farmers as well as to the import of non-EU organic products.

Organic farmers in the EU use energy and natural resources in a responsible way, promote animal health and contribute to maintaining biodiversity, ecological balance and water/soil quality.

Organic farming practices in the EU include:

- Crop rotation for an efficient use of resources
- A ban of the use of chemical pesticides and synthetic fertilisers
- Very strict limits on livestock antibiotics
- Ban of genetically modified organisms (GMOs)
- Use of on-site resources for natural fertilisers and animal feed
- Raising livestock in a free-range, open-air environment and the use of organic fodder
- Tailored animal husbandry practices

European Union first certified organic food in 1991.

The organic logo can only be used on products that have been certified as organic by an authorised control agency or body. This means that they have fulfilled strict conditions on how they are produced, transported and stored.

At global level in 2017, 69.8 million ha were farmed organically (including area in conversion towards organic). The EUreached12.6million ha in 2017, which represents 18% of the global organic area and 7% of total EU agricultural land. The impressive growth of organic production by 70% over the past ten years reflects the importance gained by the sector. Over half of the EU's organic area is concentrated in four countries: Spain, Italy, France and Germany.[1]

Source:
www.europarl.europa.eu/resources/library/images/20180830PHT11326/20180830PHT11326_original.jpg

Other links:
www.youtube.com/watch?v=8DQla2PO54A

[1] European Commission

Sustainable water management in agriculture

Agriculture production is highly dependent on water and increasingly subject to water risks. It is also the largest using sector and a major polluter of water.

Climate change is projected to increase the fluctuations in precipitation and surface water supplies, reducing snow packs and glaciers and affecting crop's water requirements.

Farmers in many regions will face increasing competition from non-agricultural users due to rising urban population density and water demands from the energy and industry sectors. In addition, water quality is likely to deteriorate in many regions, due to the growth of polluting activities, salination caused by rising sea levels and the abovementioned water supply changes.

Irrigated agriculture remains the largest user of water globally, a trend encouraged by the fact that farmers in most countries do not pay for the full cost of the water they use. **Agriculture irrigation accounts for 70% of water use worldwide and over 40% in many OECD countries.**[4] Intensive groundwater pumping for irrigation depletes aquifers and can lead to negative environmental externalities, causing significant economic impact on the sector and beyond. In addition, agriculture remains a major source of water pollution; agricultural fertiliser run-off, pesticide use and livestock effluents all contribute to the pollution of waterways and groundwater.

Governments should act at the farm, watershed and national levels to

- strengthen and enforce existing water regulations
- create incentives for farmers to improve their water use and better manage the use of polluting agricultural inputs
- remove policies that support excessive use of water and polluting activities

Within Europe, there is a great variability in the availability of water resources and, therefore, a marked spatial variability in agricultural water management practices and consumption. Climate is the main factor that determines agricultural water consumption; there are regions where irrigation is the only source of water for crop cultivation (this is the case during summer in some Mediterranean areas), while in other regions, irrigation is used as a supplement to rain-fed agriculture.

We live on a planet that is 70% water, making it look blue from orbit. Unfortunately, only 3% of that water is drinkable, with the other 97% making up the planet's saltwater oceans. Of the remaining 3%, we only have access to one-third of that water. [1]

In 2016, the total agricultural area equipped for irrigation (irrigable area) in the EU was 15.5 million ha. However, the area actually irrigated (irrigated area) was lower, reaching 10.2 million hectares (ha). [2]

Nearly 40% of the country's water used for agriculture in Europe is sourced from other countries outside the borders of the European Union. This makes the EU especially vulnerable to global water scarcity. [3]

5,000 and 20,000 litres of water are needed to produce 1 kilogramme of meat, compared to the much smaller amount (500 to 4,000 litres of water) needed to produce one kilogramme of wheat.

Other links:
www.youtube.com/watch?time_continue=7&v=TbCwZyJEb8Y

www.euronews.com/2015/06/08/helping-farms-produce-more-crops-with-less-water

[1] EuroScientist, 2019
[2] European Commission , 2019
[3] EuroScientist, 2019
[4] OECD, 2012

Nutrients in waste waters

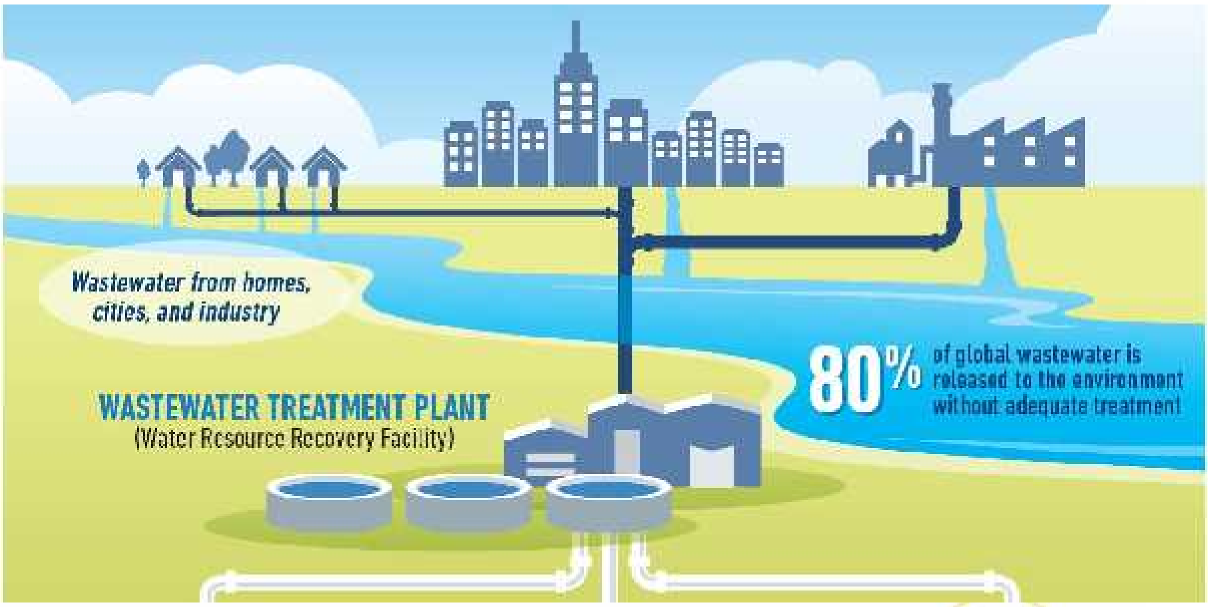
Nutrients are substances essential for growth of humans, plants and animals. Phosphorus, nitrogen and carbon are nutrients that are essential to aquatic health. In excess they pose a serious problem. Nitrogen and phosphorus are the main nutrients of concern.

Phosphorus is an element in all living things; however, it is never found in elemental form and is very unstable. Typically, influent wastewater has a total phosphorus concentration from 5-9 mg/L and is needed in the waste stream for biological growth and treatment. Phosphorus is vital for food production since it is one of three nutrients (nitrogen, potassium and phosphorus) used in commercial fertilizer. Phosphorus is limited resource which means that it cannot be manufactured, and there is no substitute or synthetic version of it available. Global reserves will run out within 75-100 years and peak phosphorous 2030 demand will exceed supply. [1]

Nitrogen is a chemical element found in all living things. It is a constituent of amino acids, protein, DNA and RNA. Nitrogen makes up 78% of our atmosphere and is the seventh most abundant element on earth.

Wastewater is being viewed as a valuable resource of nutrients. Nutrients may be removed chemically, physically (through filtering) or biologically (using microorganisms for example).

Wastewater – from waste to resource



Source: https://blogs.worldbank.org/water/wastewater-treatment-critical-component-circular-economy

Other links: www.youtube.com/watch?v=pXaXjzbccPo

[1] Research Gate, January 2009

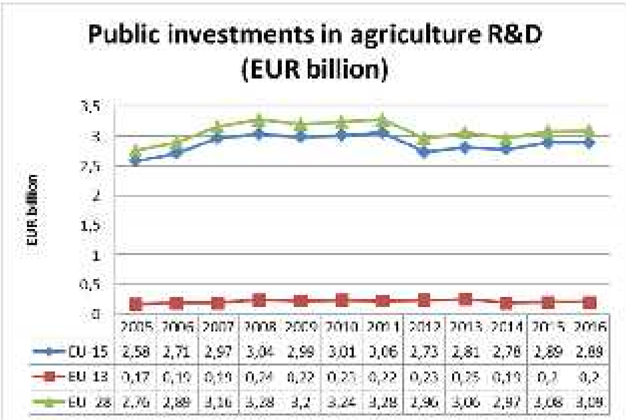
Innovation in agriculture

The innovations that are most urgently required are social, organizational, and governance-based – and without them, much-needed technological innovations will not reach their full potential.

Social innovations in food systems include short food chains and community supported agriculture; new ways of reducing waste; various types of urban agriculture; an inventive use of public procurement schemes; or new forms of sharing food within local communities. Cities and regions are emerging as major actors in these innovations, and new alliances are being formed between public entities, local entrepreneurs, and civil society groups.

Technological innovations that can be adopted without questioning the logic of current systems – solutions that reinforce rather than challenging the large-scale, monoculture- based production model – continue to be prioritized. The status quo is further entrenched by short-term political cycles, which put a premium on short-term fixes and allow the costs of inaction to be passed onto the next generation.

In 2014, 1.8 % of agricultural gross value added for the EU-28 was spent on agricultural R&D, compared to 2.4 % in 2009. Eurostat data summarised shows public investments in agricultural research for the EU-15, EU-13 and EU 28. They show that over the five years from 2012 to 2016 the pattern of expenditure was relatively flat.[1]



Source: www.europarl.europa.eu/RegData/etudes/BRIE/2019/630358/EPRS_BRI(2019)630358_EN.pdf

European Commission has identified five priority areas for research and innovation:

- resource management – notably soil, water, nutrients and genetic resources, where the aim is to strike a balance between productivity and environmental goals in agriculture through efficient resource use;
- healthier plants and animals – involving research on tools to prevent and control plants and diseases and a holistic one health approach
- integrated ecological approaches – for example, research into better use of ecosystem services instead of external inputs and developing specific farming systems such as organic and mixed farming systems
- new openings for rural growth – involving the deployment of new business models, circular value chains and digital transformation to sustain and boost rural economies
- enhancing the human and social capital and rural areas through innovation networks, advisory services and demonstration sites in rural areas

Other links: www.youtube.com/watch?v=Qmla9NLFBvUhttps://www.youtube.com/watch?v=Qmla9NLFBvU

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[1] European Parliament, 2019

www.youtube.com/watch?v=v1DT4yvxpMw
www.youtube.com/watch?time_continue=4&v=-1TrJjGlwmM

Innovative agri-start-ups

Some examples of innovative ag-tech start-ups:[1]

AgCode: This vineyard management company helps winegrowers track harvests, field conditions and grape maturity in order to maximize yields and manage labour.

AGERpoint: This start-up produces nut and citrus orchard management software that uses satellite data. The data is granular enough to provide tree-specific information, like the size of the canopy or the trunk diameter.

BluWrap: Using a patented oxygen management technique that extends the shelf life of fresh protein, BluWrap allows fresh protein suppliers to ship by ocean rather than by air, saving on costs.

Bovcontrol: This livestock manager is helping cattle farmers keep better track of their herds using cloud technology. Bovcontrol tracks inventory, vaccinations, nutrition needs and more.

BrightFarms: is building and operating greenhouses in urban and suburban areas. The company partners with supermarkets and puts the farm at or near the store to maximize produce freshness.

Clear Labs: This science start-up is making a database of the world's food supply by studying food on a molecular level. The goal is to use the information to help food retailers pick the best suppliers and avoid the next crippling food borne illness outbreak.

CropX: An Israeli start-up, CropX sells cloud-based software which aims to boost crop yields by focusing on saving water and energy. With in-field sensors, the system automatically delivers the correct amount of water to each plant instead of watering a whole field at a time.

mOasis: is making a non-toxic gel-like soil additive that helps seeds get farther on less water. It works by holding extra water near a plant's roots and releasing it was the soil dries out.

Pivot Bio: Before the advent of chemical fertilizers, microbes in the soil would provide nitrogen to crops. Using a proprietary process, Pivot has figured out a way to reawaken the genes of those microbes, enabling crops to be fertilized without the need for chemicals.

S4: Argentina-based precision ag company with a fintech side that pays producers or companies along the supply chain when systemic risks like drought or flood occurs.

Sample6: claims to be "the world's fastest food pathogen detection system" by detecting a bug within 6 hours. Its products can detect pathogens and listeria in plants.

Spensa Technologies: Its software lets farmers record, upload and track observations about their fields; its Z-Trap hardware allows farmers to track pests in the fields by trapping and identifying bug species.

Strider: A Brazil-based ranch management start-up that sells a pest monitoring application which allows farmers to monitor and decide how to treat infestations.

Trace Genomics: It's 23andMe for soil health: using machine learning and genomics testing, Trace Genomics can ID microbes and other biological data in soil, helping farmers maximize yields.

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[1] Forbes, 2017 and 2018

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European Regional Development Fund - Instrument for Pre-Accession II Fund
INNOVAGRO

Fertilizers

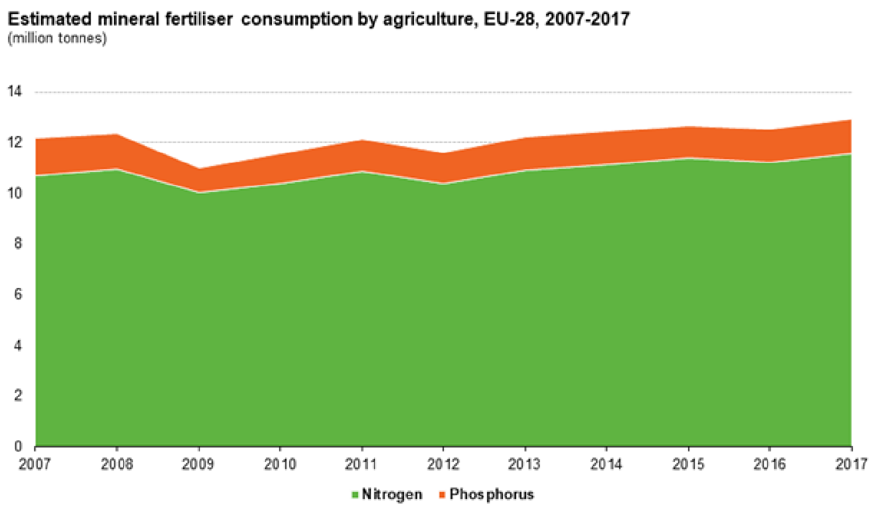
Nutrients, such as nitrogen (N) and phosphorus (P), are absorbed from the soil by plants for their growth. Mineral, or inorganic, fertilisers are widely used in agriculture to optimise production, and organic fertilisers are a significant additional source of nutrient input. Organic farmers do not apply synthetic mineral fertilisers. Nitrogen and phosphorus fertilisers greatly enhance crop production, but losses of nitrogen and phosphorus from agriculture contribute to environmental pollution. N and P behave differently in terms of their availability for loss from the agricultural system. N is highly soluble with limited build-up in the soils, and research shows a positive relationship between application rate and nitrate loss from the soil root zone. P losses from land occur due to soil erosion and agricultural run-off. Historic over-fertilisation of P can build up soil P reserves to high levels and under such conditions it is possible for significant pollution to take place even with negligible new fertiliser inputs. However, the main focus of losses is related to the timing and loading of inputs of N and P either from fertiliser or organic manure applications.

Food production has become highly dependent on mineral P fertilisers. Some 80% of phosphorus use is in agriculture. The main source of P in the world is phosphate rock; a non-renewable resource. The majority of phosphate rock reserves in the world are concentrated in a few countries, none of them EU Member States. Phosphate rock is on the list of critical raw materials for the EU. It means that phosphate rock is a high supply-risk and of a high economic importance. Therefore the European Commission is monitoring the situation to identify priority actions, such as trade agreements.

Organic fertilisers may consist of manure, composts and sewage sludge. These organic fertilisers are important sources of N and P, especially on livestock farms and farms near urban areas. Increasing the effectiveness of organic fertiliser use will contribute to decreased use of mineral fertiliser.

Legislative initiatives through the Nitrates Directive and the Water Framework Directive have sought to limit nutrient losses to water bodies through more careful management of agricultural land. Implementation of the Nitrates Directive has been generally poor, with advice lacking on the adoption of sustainable practices allowing for reduced fertilizer usage.

Mineral fertiliser consumption remained at a high level between 2007 and 2017.



Pesticides and nitrogen-based fertilizers are impacting biodiversity loss, which jeopardises a range of environmental services, including the pollination of many food crops, threatening future yields and costing some 3% of global GDP each year. [1]

Source: Eurostat (aei_fm_usefert)

[1] IPES-FOOD, 20019

Biofertilizers

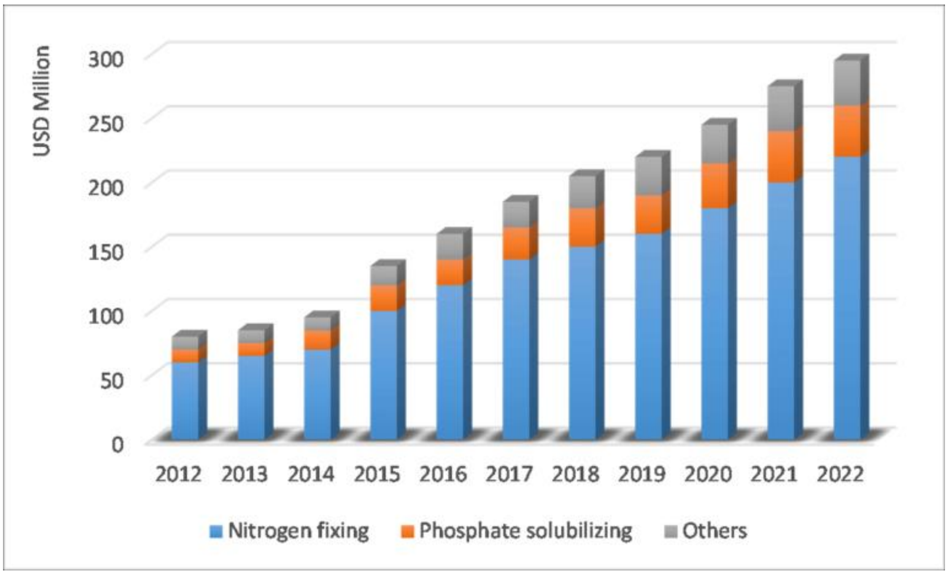
Biofertilizers are preparations containing living cells or latent cells of efficient strains of microorganisms that help crop plants' uptake of nutrients by their interactions in the rhizosphere when applied through seed or soil.

Biofertilizers can be categorized based on substrate/origin or treatment method or both. The main sources of biofertilizers are residues from agriculture, forestry, fishery/aquaculture and food processing, sewage and municipal waste. Treatment options include anaerobic digestion for biogas production, composting, combustion and pyrolysis.

Most of the evidence suggests that nutrient losses are higher when biofertilizers are used, than when mineral fertilizers are used. There is a need both for better treatment options for organic residues to produce tailor made fertilizers, and better guidelines for how to use biofertilizers. There is a need to produce biofertilizers with better and more predictable qualities, and also to understand their effects over multiple seasons.

The biofertilizers market is expected to grow at a CAGR (compound annual growth rate) of 14.08% from 2016, to reach USD 2,305.5 million by 2022.[1]

Biofertilizers market by type of biofertilizer



Source: www.bio-fit.eu

ADVANTAGES

- They help to achieve high yields of crops by enriching the soil with nutrients and useful microorganisms necessary for plant growth.
- They replace the chemical fertilizers, as the latter are not beneficial for plants and environment.
- They protect the environment against pollutants.

[1] www.marketsandmarkets.com/Market-Reports/compound-biofertilizers-customized-fertilizers-market-856.html

- If the soil is free of chemicals, it will retain its fertility, which will be beneficial for the plants as well as the environment, because the plants will be protected against diseases and the environment will be free of pollutants.
- Biofertilizers destroy those harmful components from the soil which cause diseases in plants. By using biofertilizers, plants can also be protected against drought and other restrictive conditions.
- Biofertilizers are cost effective.

DISADVANTAGES

- Gives much lower nutrient density – it requires large amounts.
- Requires a different type of machinery to apply Sometimes is hard to locate in certain areas.
- Odour.
- Difficult to store.
- Specific to the plants.
- Requires skills in production and application.
- There is inadequate awareness about the use and benefits of biofertilizers.

Other links: www.youtube.com/watch?time_continue=2&v=UKpDdfbm8Vw

Fertilizing with bio carbon

Soils are the largest reservoir of terrestrial carbon, and relatively small changes in soil carbon content can have an amplified mitigation effect on the Earth's climate. Therefore, improved management of soils for carbon storage is receiving a lot of attention. There is a need for win-win solutions for soil carbon storage, which benefit both food production and climate mitigation.

The application of bio-fertilizers is one of the management practices that can help to maintain or increase the content of organic matter and improve soil fertility in arable soils.

'Biochar', which is short for 'bio-charcoal', is plant-derived carbon obtained through the pyrolysis of plant biomass of various origins, but generally sawmill waste or agricultural residue. It comes in the form of small black, light and highly porous fragments. It is mostly composed of carbon, but the overall composition depends on the type of biomass and the pyrolysis process used.

Biochar can be created from any form of biomass – animal by-products, agricultural waste, forest product residuals, and more. The source of biochar production may be: plant biomass, meal-bone mixtures, segregated municipal waste mixtures with woodchips, technological waste biomass.

Biochar can offer the following benefits to soil:

- Reduced nitrogen runoff
- Possible nitrous oxide emissions reduction
- Improved soil fertility through increased cation-exchange capacity
- Moderation of soil acidity
- Better water retention
- Increased number of beneficial soil microbes

Source: https://operanewsnow.com/wp-content/uploads/2019/05/Biochar-Fertilizer.jpg

The use of bio carbon and ash from plant biomass as a fertilizing material has a positive effect on the physical, chemical and biological properties of the soil and thus contributes to an increase in the yield of plants.

Other links: www.youtube.com/watch?v=jkGWfRu3Y84

By products in agriculture and their use

European Commission defined by-product – a production residue that is not a waste.[1]

A major use for by-products from the food and drink sector is animal feed. The production processes in numerous sectors (e.g. sugar production, oilseed crushing, starch production and malt production) generate materials that are used as feed material either directly by farmers or by the animal compound feed industry.

Food industry by-products can be divided into three main groups:

- of animal origin
- of plant origin
- of the fermentation industry

A separate group of by-products is represented by those collected in big urban centres, e.g. kitchen wastes especially coming from large catering establishments, which after suitable steaming and ensiling are added to swine feed.

Methods and means of by-product preparation for feed:

- removal of substances or micro flora harmful to animal health
- increasing storage-life and subsequent use as feed components or directly as fodder
- improving digestibility and nutrient availability
- improving the nutritional value by using some constituents as a medium in the biosynthesis of protein and of other biologically active substances required in animal feeding

The feed situation in Europe indicates that to maintain the population of animals at the present level, the protein deficit is of the order of 25 to 28 million tonnes and varies from several hundred thousand to several million tonnes in various countries. [2]

Examples of agricultural by-products:

- Pigs: suede, insulin for regulation of diabetes, valves for human heart surgery, gelatine
- Cattle: shampoos, conditioners, instrument strings, charcoal, glass
- Goats: soap, paint, leather, candles
- Worms: silk
- Horses: glue from the hooves
- Cotton: oils, fertilizer, candles
- Trees: toothpaste, tires

Other links:
www.youtube.com/watch?v=lGwoOihpBOY
www.youtube.com/watch?v=2d__B2zWa-c

[1] European Commission
[2] www.fao.org/3/X6553E04.htm

Genetic engineering

Genetic engineering is the alteration of an organism's genetic, or hereditary, material to eliminate undesirable characteristics or to produce desirable new ones.

Although the positive impacts could be enormous, there are many questions raised that needs to be answered. New organisms created by genetic engineering could present an ecological and health problem. One cannot predict the changes that a genetically engineered species would make on the environment and human/animal.

Process of Genetic Engineering

- Identification of an organism that exhibits the desired trait or gene of interest.
- Extracting the DNA from that organism.
- Through a process called gene cloning, one desired gene (recipe) must be located and copied from thousands of genes that were extracted.
- The gene is slightly modified to work in a more desirable way once it is inserted inside the recipient organism.
- The transformation process occurs when new gene(s), called a transgene is delivered into cells of the recipient organism. The most common transformation technique uses bacteria. The transgene is inserted into the bacteria, which then delivers it into cells of the organism being engineered.
- The characteristics of the final product are improved through the process called traditional breeding.

Pros of Genetically Modified Foods

- **Higher yields**
- **Provide all round quality and taste**
- **Disease resistance**
- **More nutritious**
- **Longer shelf life**
- **Used in the creation of vaccines**
- **Ecological benefits (less time, land, machinery and chemicals)**
- **Lower risk of crop failure**

Cons of Genetically Modified Foods

- **Can bring about allergies**
- **May lead to environmental degradation**
- **Bear no economic value (GMOs take the same amount of time to mature, and same effort to cultivate and grow)**
- **Causes gene escape**
- **GMOS have reduced resistance to antibiotics**

Source: www.conserve-energy-future.com/what-is-genetic-engineering.php

Further testing and research is required.

Other links: https://multimedia.europarl.europa.eu/en/az-g-for-gm_J002-0041_ev

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Nanotechnology

Nanotechnology refers to controlling, building, and restructuring materials and devices on the scale of atoms and molecules.

The unique physicochemical properties of nanomaterials, that is, catalytic reactivity, high surface area, size and shape, have the potential to open new paradigms and to introduce new strategies in agriculture.

Nanotechnology in the agricultural industry has shown impressive potential in terms of improving seed germination, plant growth, and protection through a controlled release of agrochemicals and an overall reduction in the use of fertilization that subsequently minimizes the potential loss of nutrients.

Specific agronomic applications of nanotechnology include:

- enabled delivery systems of release of agrochemicals allowing a controlled release of fertilizers, pesticides and herbicides
- field-sensing systems to monitor the environmental stresses and crop conditions
- improvement of plant traits against environmental stress and diseases

Nanoparticles can serve as ‘magic bullets’, containing herbicides, chemicals, or genes, which target particular plant parts to release their content. Nanocapsules can enable effective penetration of herbicides through cuticles and tissues, allowing slow and constant release of the active substances.

Potential applications of nanotechnology in agriculture:

- increase the productivity using nanopesticides and nanofertilizers
- improve the quality of the soil using nanozeolites and hydrogels
- stimulate plant growth using nanomaterials (SiO_2, TiO_2, and carbon nanotubes)
- provide smart monitoring using nanosensors by wireless communication devices

The exposure route of particular concern involves the potential bioaccumulation of nano-enhanced materials within the environment and food chain that can eventually reach human consumption. Limited knowledge concerning nanomaterial biosafety, adverse effects, fate, and acquired biological reactivity once dispersed into the environment, requires further scientific efforts to assess possible nano-agricultural risks.

Source: http://news.agropages.com/News/NewsDetail---27192.htm

Other links: www.youtube.com/watch?v=d7dt8X1GS20
www.foodingredientsfirst.com/videos/taking-nanotechnology-into-future-packaging.html
www.youtube.com/watch?v=cDUv3hUQ2C8
www.youtube.com/watch?v=dIPQ9vBRZ3c

Agroforestry

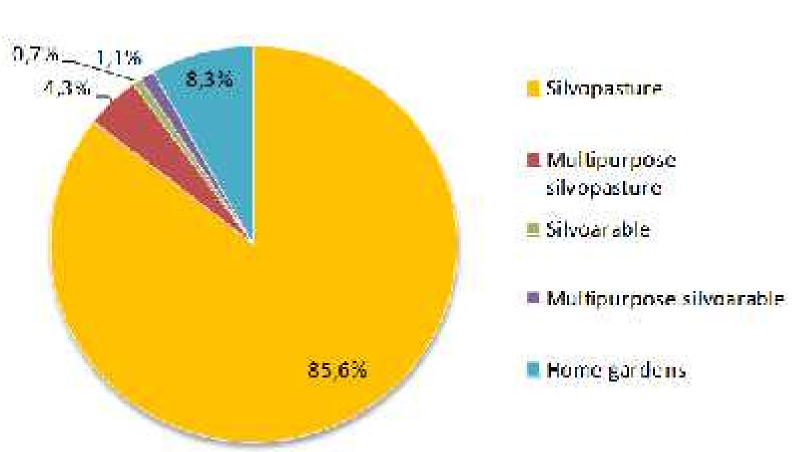
Agroforestry is the integration of woody vegetation, crops and/or livestock on the same area of land. Trees are integrated into agricultural landscapes to create microclimates and shelter for animals or crops, also improving biodiversity and water and soil conservation. The trees also produce crops in their own right in the form of timber, coppicing or fruit.

Spatial agroforestry practices in Europe

Silvopasture	Combining woody with forage and animal production. It comprises forest or woodland grazing and pastoral land with hedgerows, isolated/scattered trees or trees in lines or belts.
Homegardens or kitchen gardens	Combining trees/shrubs with vegetable production in peri-urban and urban areas, also known as part of "trees outside the forest"
Riparian buffer strips	Strips of perennial vegetation (trees/shrubs) natural or planted between croplands/pastures and water sources such as streams, lakes, wetlands, and ponds to protect water quality. They can be recognized as silvoarable or silvopasture but are signified by its role in preserving water streams.
Silvoarable	Widely spaced woody vegetation inter-cropped with annual or perennial crops. Also known as alley cropping. Trees/shrubs can be distributed following an alley cropping, isolated/scattered trees, hedges and line belts design.
Forest farming	Forested areas used for harvesting of natural standing speciality crops for medicinal, ornamental or culinary uses.

Most of the current agroforestry practices are placed in the south of Europe and that most of the agroforestry practices are silvopastoralism (85,6% of agroforestry practices). Silvopasture occupies 17.78 million hectares (4.1% of the EU territory).

Proportion of agroforestry land in the EU allocated to different agroforestry practices:



The production from one hectare of a walnut/wheat mix is the same as for 1.4 hectares with trees and crops separated. This is a 40% increase in productivity.

Other links: www.youtube.com/watch?v=7HgW3HmAOdA

Insects as a source of protein for food and feed

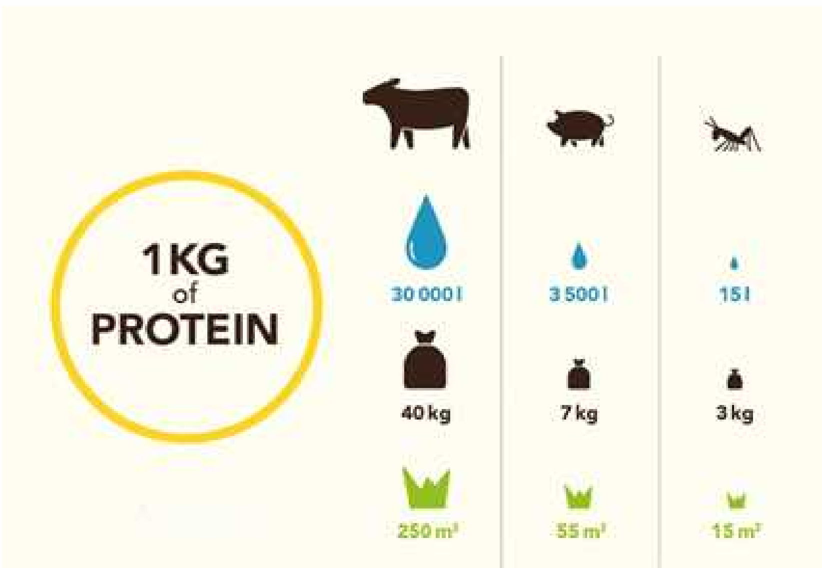
The global population is currently approximately 7 billion and it has been estimated by the United Nations that it will reach over 9 billion by 2050. In addition there has been an approximate fivefold increase in global meat consumption since the 1940s as a result of income growth, increasing urbanisation and changes in lifestyles and food preferences. This has resulted in increasing pressures on the production of protein crops for animal feed.

Insects are increasingly recognised as an excellent protein alternative for use in animal feed. Many species are highly nutritious and the production of insects has less environmental impact compared with traditional sources of livestock feed protein.

Insects can also be reared successfully and quickly on a range of organic waste materials, thus reducing the overall amount of waste created in the process by up to 60%. The remaining waste can also be recycled as fertiliser. Insects can be reared economically by using substrates, such as vegetable and domestic waste and manure. Legislation on the safe use of substrates will also need to be considered.

EU law currently prohibits including protein derived from insects in animal feed - with the exception of feed intended for fish or shellfish.

In 2011 the European Parliament adopted a resolution to address the EU's protein deficit, stating that urgent action is needed to replace imported protein crops with alternative European sources.



Source: www.sensbar.com/en/blog/we-have-a-meat-problem

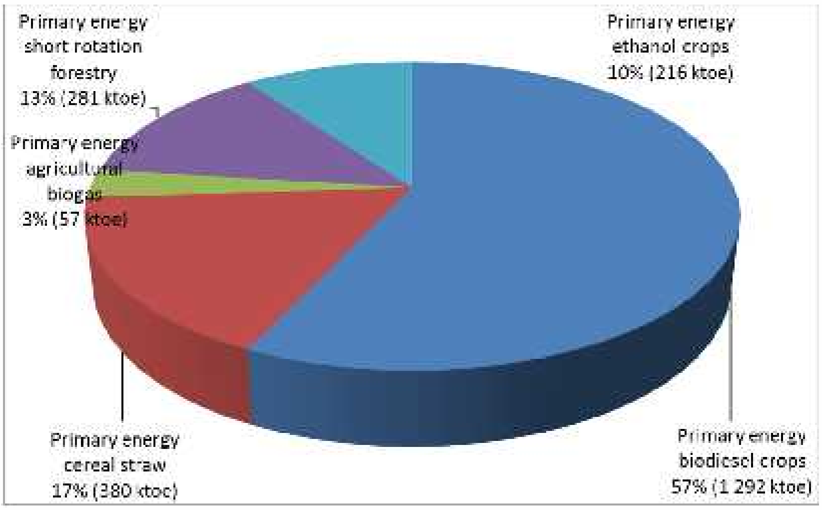
Other and more sustainable sources of protein are: fungi-derived proteins, cultured meat (from stem cells), protein rich plants (lentils, soya and wheat) and algae.

Other links: www.foodnavigator.com/Article/2019/02/13/Microalgae-protein-grown-in-tanks-to-be-the-next-generation-future-of-food

Renewable energy in agriculture and agro-food sector

The agricultural sector accounts for almost 10% of greenhouse gas emissions in the European Union, mainly for food production and transport. In recent years, European farmers have made efforts to significantly reduce this environmental footprint by increasing their consumption and production of renewable energy, which is derived from natural resources that are naturally replenished.

Production of renewable energy from agricultural sources (EU-15)



Source: www.eea.europa.eu/data-and-maps/figures/production-of-renewable-energy-from-agricultural-sources-eu-15

The total amount of renewable energy produced on farms can be estimated at 22.6 Mtoe (million tonnes of oil equivalent) in 2015, which represents around 10% of total renewable energy production in the EU.

The EU could double the renewable share in its energy mix, cost effectively, from 17% in 2015 to 34% in 2030.

EU agriculture and forestry play an increasing role in supplying renewable energy. The production of renewable energy from agriculture and forestry in the EU-27 reached 98.4 million tonnes of oil equivalent in 2010. Forestry is by far more important in absolute term (80.8 million tonnes) than agriculture (17.5 million tonnes).

The contribution of agriculture to the total production of primary energy and to the total production of renewable energy increased by 1.8 percentage points between 2004 and 2010 (from 0.3 % to 2.1 %) and by 8.4 percentage points (from 2.2 % to 10.6 %) respectively. The share of forestry in the total primary energy production increased by 4.2 percentage points between 2000 and 2010 (from 5.6 % to 9.8 %), whereas the contribution of forestry to the total production of renewable energy decreased by 5.8 percentage points (from 54.3 % to 48.5 %) in the same period.

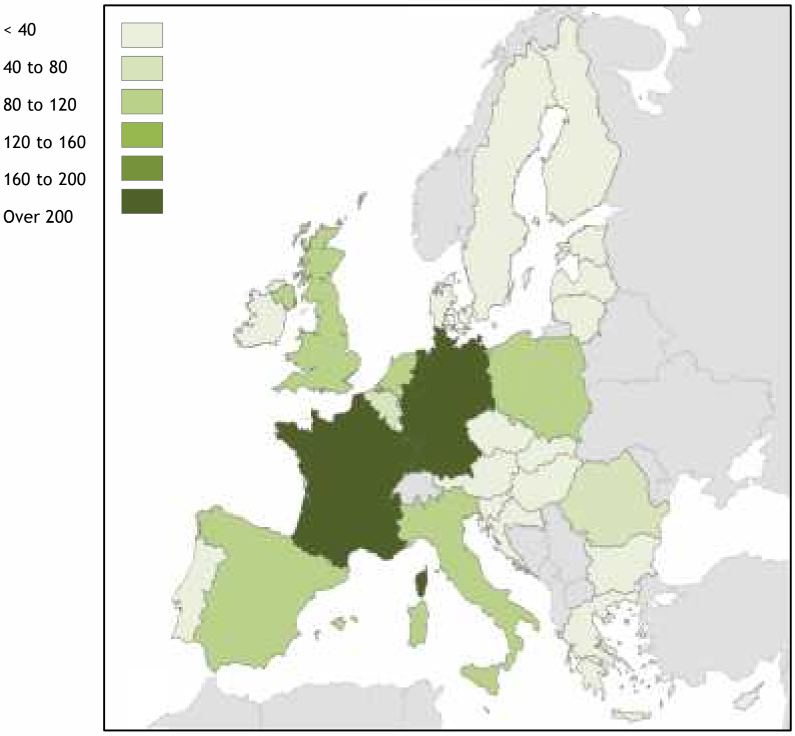
Other links:
https://ec.europa.eu/eurostat/cache/infographs/energy/bloc-3a.html
www.youtube.com/watch?v=bOdlMHvcyLU
www.youtube.com/watch?v=aUpCgTWUFhQ
https://ec.europa.eu/eurostat/statistics-explained/index.php/Archive:Agri-environmental_indicator_-_renewable_energy_production#Main_statistical_findings

Biomass in EU

Biomass currently used in Europe includes wood from forests, agricultural crops and residues, by-products from the wood and agricultural industry, herbaceous and woody energy crops, municipal organic wastes and manure, and could potentially integrate algae and marine biomass in the future.

Biomass is by far the most significant renewable energy source in the EU: it accounts for 63.3 % of all renewable energy production. This makes the agriculture and forestry sectors particularly important to renewable energy production. In 2010, 48.5 % (80.7 Mtoe) of the renewable energy produced across the EU came from forestry biomass, while agricultural biomass accounted for a further 10.6 % (17.6 Mtoe). Whilst renewable energy represents 26.7 % of the energy produced in the EU, according to the Commission's Renewable Energy Progress Report from 2017, the share of renewable energy in the EU in terms of consumption had reached only 16 % in 2014. This is because more than half of the EU's energy consumption was supplied by net imports.[1]

Distribution of agricultural biomass supply across EU Member States in 2013 (In Mt dry matter of vegetal biomass equivalents)



EU is a net importer of biomass. On the contrary, the EU is a net importer of plant-based food, solid biofuels, fish and seafood as well as algae.

A cornerstone in renewable energy projections of the European Union is biomass, which is expected to account for 56% of the renewable energy supply in the EU27 by 2020.

Source: http://publications.jrc.ec.europa.eu/repository/bitstream/JRC109869/jrc109869_biomass_report_final2pdf2.pdf

By 2020, bioenergy is expected to contribute to half of the EU's 20% renewable energy target. In 2015, bioenergy consumption reached 111.807 kilotonnes of oil equivalent which is more than double the consumption in 2000.[2]

Biomass will remain a key renewable energy source in 2030 and beyond.

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[1] European Biomass Industry Association

[2] www.europeanbioenergyday.eu/bioenergy-facts/bioenergy-in-europe/what-is-the-eu28-bioenergy-consumption/

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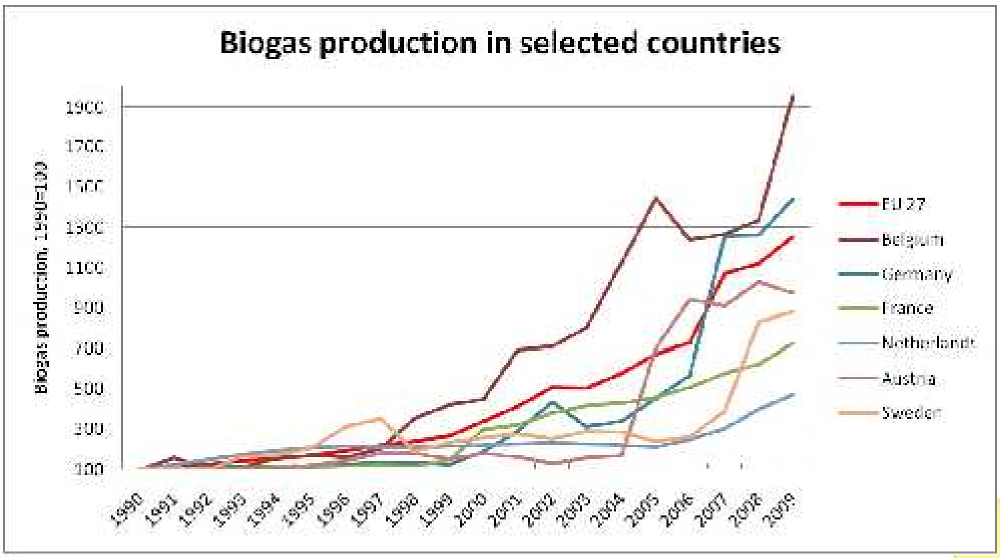
Biogas in EU

Biogas and its refined form, biomethane, represent an interesting alternative in the future supply of renewable energy. Compared to other renewable energy sources, biogas has the advantage that it can be used to provide flexible power production, including in times of low wind and solar intensity, and it also can provide an option for the decarbonisation of natural gas grids. In 2015, the total production of biogas in the EU-28 corresponded to 653 PJ, or 4% of the region's primary supply of gaseous fuels (natural gas and biogas)[1] and came mainly from dedicated crops (51%) and manure (22%). Electricity generation was the predominant use corresponding to 62% of the biogas production. The production of biogas has the potential to increase to 1683PJ in 2030 from the use of available organic waste streams and with the potential of biogas capture from landfill sites. The largest growth potentials are found to be in liquid and solid manure, and in organic wastes.

European Biogass Association believes that there is a realistic overall potential for biogas production from anaerobic digestion of at least 30 billion m3/year. With the right policies in place, by 2030, the industry could produce renewable energy equivalent to approximately 10% of EU's current natural gas consumption, for use for electricity generation, heating/cooling and as a transportation fuel.

In 2010, the European Union made the commitment to reduce greenhouse gas emissions by 20% before 2020. Amongst other approaches, biomethane production from agricultural wastes has been proposed. In Germany alone, more than 7000 biogas plants are now in operation, and other countries in Europe are starting to follow this trend.

Anaerobic Digestion (AD): is a biological process in which microorganisms break down biodegradable material in the absence of oxygen creating two important products: biogas and digestate. AD makes the best use of organic materials by producing biogas for the generation of renewable heat, electricity, fuel and fertilizer while closing the nutrients cycle and reducing greenhouse gas emissions. AD is the technology which currently delivers the most benefit from organic wastes and crops, extracting energy whilst recycling the nutrients and organic matter. Crops grown for biogas production can be integrated into food crop rotations, thus improving the overall productivity of farming and providing preceding crop value and soil quality improvements.



Source:
https://vmisenergy.com/2011/12/15/renewables-in-europe-1-biogas/

Other links:
www.youtube.com/watch?v=hdIQ1G-2VXk

[1] Eurostat, 2017

Bio-waste in EU

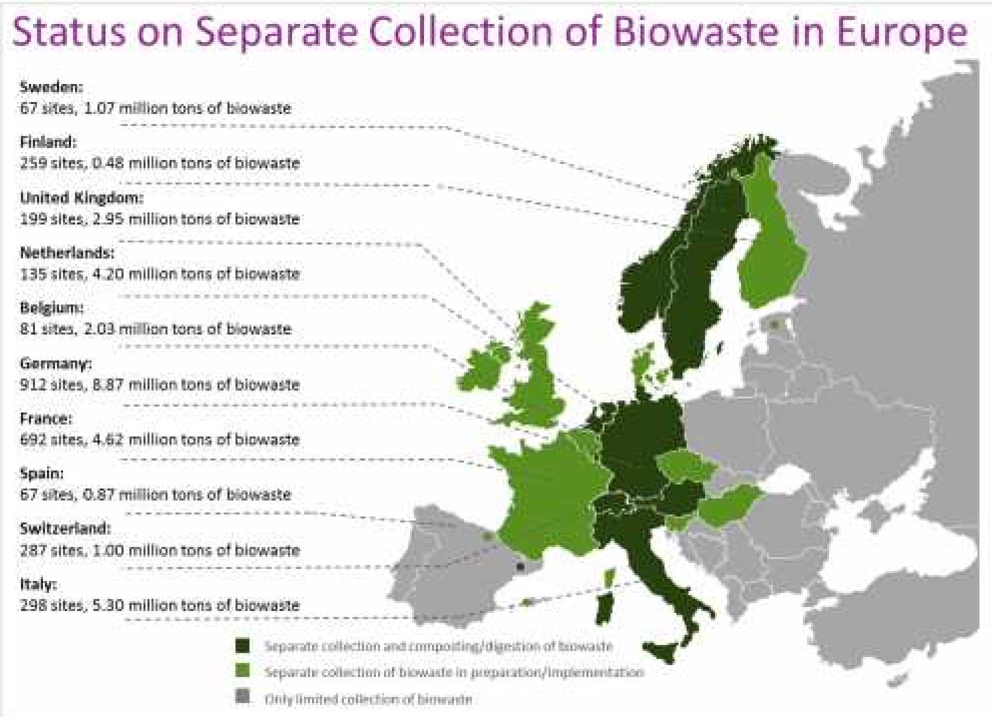
Across the European Union, somewhere between 118 and 138 million tonnes of bio-waste arise annually, of which currently only about 25% (equivalent to 30 million tonnes per annum [M tpa]) is effectively recycled into high-quality compost and digestate.[1]

The majority of municipal waste generated in Europe is still disposed of through landfilling (31%) or incineration (26%), with less than half (43%) recycled. The recycling of glass, paper and cardboard, metals and plastics has increased in recent years. On the other hand, there has been no corresponding increase in bio-waste recycling.

About 96 million tonnes of bio-waste from municipal waste is created every year across Europe.[2]

A survey by the European Compost Network indicated that in 2014 only about a third (30 million tonnes) of this was separately collected and composted and/or digested. Notably, these figures exclude the significant quantities of food residues (41 million tonnes) which are produced industrially during food manufacture.[3]

Approximately 30 million tonnes of separately collected bio-waste is composted or digested annually in about 3,500 treatment plants across Europe. Green waste accounts for more than 50% of this bio-waste, which is processed in more than 2,000 composting plants. Composting predominates over anaerobic digestion for the bio-waste stream, resulting in over 90% of food and green waste being processed into compost.



Source:
www.compostnetwork.info/policy/biowaste-in-europe/separate-collection/

Other links:
www.youtube.com/watch?v=W_wzF79FaOs

www.youtube.com/watch?v=IrB2PXGNqzg

www.youtube.com/watch?v=ayVt9M_0rMM

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[1] European Commission, 2010
[2] Eurostat
[3] European Compost Network

Precision/smart/digital farming

The agricultural industry is changing in a remarkable way. Technological innovations are reshaping the way farming is done. Modernization of agriculture and the use of digital technology have caused new concepts to emerge such as precision farming, digital farming and smart farming.

Between 2010 and 2014, 5,337 new patent applications relating to precision and conventional equipment for agriculture were registered worldwide; 70% of those new agriculture patents were assigned to North America, only 15% in Europe. [1]

Precision farming

It is a modern farming management concept using digital techniques to monitor and optimise agricultural production processes. The key point here is optimisation. Instead of applying equal amount of fertilisers over an entire field, precision agriculture involves measuring the within-field soil variations and adapting the fertiliser strategy accordingly. This leads to optimised fertiliser usage, saving costs and reducing the environmental impact. Examples include electronic devices for sensor-assisted soil assessment, the automated monitoring of free-ranging animals on pastures and the targeted control of agricultural machinery.

Smart farming

Smart farming is the application of information and data technologies for optimising complex farming systems. Unlike with precision farming, the focus of smart farming is not on precise measurement or determining differences within the field or between individual animals. The focus is rather on access to data and the application of these data – how the collected information can be used in a smart way.

Smart farming involves not just individual machines but all farm operations. Farmers can use mobile devices such as smart phones and tablets to access real-time data about the condition of soil and plants, terrain, climate, weather, resource usage, manpower, funding, etc. As a result, farmers have the information needed to make informed decisions based on concrete data, rather than their intuition.

Digital farming

Digital farming is integrating both concepts - precision farming and smart farming. Digital farming is understood to mean consistent application of the methods of precision farming and smart farming, internal and external networking of the farm and use of web-based data platforms together with Big Data analyses.

European Data Market Monitoring Tool (2016) shows: crop yields up to 50% and 23% thanks to smart water management and improved plant variety selection; cost savings (25% reduction of use of fertilizers, 9 - 42% herbicides, up to 84% pesticides), increased productivity (5% increased yields), reduced environmental contamination and time savings (drones covering one hectare in 10 minutes versus 90 minutes normally taken by traditional farm machines).

Source: http://assets.e-agriculture.fao.org.s3-eu-west-1.amazonaws.com/public/styles/full_node/public/news/AI.png?itok=iWtY9z7L
Other links: www.youtube.com/watch?v=t1UAY85cgOc

[1] Farm Europe, 2017

Digitalization in agriculture

Agriculture is impacted by global trends related to demographics, economics and climate change. The new emerging technologies that are becoming available can boost effectiveness and reduce risks. Consequently, a "farm-tech revolution" is emerging in the scope of global trends which generate structural changes in farms and the wider value chain in unexplored ways.

Digital technologies in agriculture figure high on the European Union's agenda, with around €100 million available under the Horizon 2020 work programme 2018-20 to advance the development and uptake of digital technologies in agriculture and rural areas and anticipate the impacts of the digital revolution. [1]

The challenges farmers are facing today are immense: producing more and better from less, at affordable prices, while reducing their impact on the environment and keeping pace with consumer demands, and all of this in the light of climate change and volatile global markets. Digital technologies can help adapt to those challenges, supporting farmers in their efforts to produce our food in a sustainable way: tracking weather patterns and biodiversity, sensors for animal welfare, tools to assess exact state of soils and plants or swarms of drones destroying weeds, reducing need for herbicides or antimicrobials, or the internet of things connecting all levels of the value chain. On the farm, but also for consumer needs, digital technologies can bring a lot of benefits. New technologies increase food safety and traceability, from farm to fork.

Source: www.euractiv.com/wp-content/uploads/sites/2/2018/10/shutterstock_524457472-800x450.jpg

The European Innovation Partnership for Agricultural productivity and Sustainability (EIP-AGRI) was launched by the European Commission in 2012. It aims to foster a competitive and sustainable agriculture and forestry sector that "*achieves more from less*". It contributes to ensuring a steady supply of food, feed and biomaterials, and to the sustainable management of the essential natural resources on which farming and forestry depend, working in harmony with the environment. To achieve this aim, the EIP-AGRI brings together innovation actors (farmers, advisors, researchers, businesses, NGOs, etc.) and helps to build bridges between research and practice.

[1] European Commission

Blockchain technology in agriculture

Blockchain is an emerging digital technology allowing ubiquitous financial transactions among distributed untrusted parties, without the need of intermediaries such as banks. Since 2014 it has increasingly been realized that blockchain can be used for much more than crypto currency and financial transactions

The blockchain represents one of the technologies with the most promise to provide more consistency in wide areas of the agricultural industry. Whether it is applied to managing warehouses, silos and supply chains more intelligently, or utilized in the field as a tool to transmit real-time data about crops and livestock.

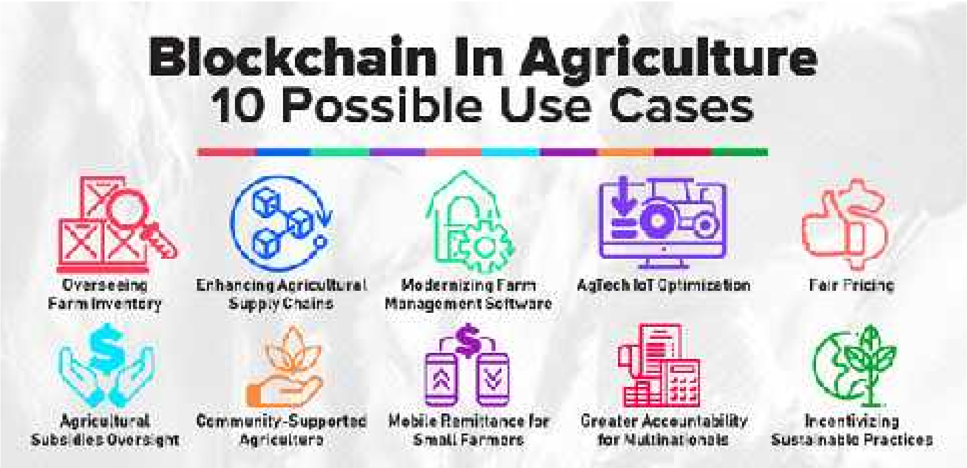
The biggest advantage is the ability to track food from harvest to storage to delivery.

Blockchain technology offers many benefits, providing a secure way to perform transactions among untrusted parties. To improve traceability in value chains, a decentralized ledger helps to connect inputs, suppliers, producers and buyers. In particular, blockchain is suitable for the developing world, where it can support small farmers by providing them with finance and insurance and facilitate transactions. Although small farmers supply 80% of food in developing countries, they rarely have access to insurance, banking or basic financial services.

There are various barriers and challenges for the wider adoption of blockchain technology. A case study in the Netherlands revealed that small and medium-sized businesses are too small or lack the expertise to invest in the blockchain by themselves. Current uncertainties are preventing individual parties from developing a convincing business case. With respect to education, there is a lack of awareness about the blockchain, and training platforms are non-existent. Important barrier is regulation. The current experience of crypto currencies indicates that they are vulnerable to speculators and massive price fluctuations.

Examples of using blockchain technology:

1. The agricultural conglomerate Cargill Inc. aims to harness blockchain to let shoppers trace their turkeys from the store to the farm that raised them.
2. Coca-Cola has attempted to employ blockchain to sniff out forced labor in the sugarcane sector.
3. The European grocer Carrefour is using blockchain to verify standards and trace food origins: meat, fish, fruits, vegetables and dairy products.
4. Downstream beer (Ireland Craft Beers, 2017) is the first to use blockchain technology, revealing everything one wants to know about beer, i.e. its ingredients and brewing methods (consumers are scanning QR code on the bottle).
5. The e-commerce platform JD.com monitors the beef produced in Inner Mongolia, distributed to different provinces of China. By scanning QR codes, one can see details about the animals involved, their nutrition, slaughtering and meat packaging dates, as well as the results of food safety tests.
6. Gogochicken uses an ankle bracelet to showcase that its chickens are free-range, and this information is then available through the web.
7. Ripe.io has created the Blockchain of Food which constitutes a food quality network that maps the food's journey from production to our plate.



Source: www.disruptordaily.com/blockchain-use-cases-agriculture

Other links:
www.youtube.com/watch?v=MMOF0G_2H0A&list=PLhGyaxIbWEk-mRtMQ_muR0lj83qGBeie-&index=5
www.fao.org/3/ca2906en/CA2906EN.pdf
https://new.siemens.com/global/en/markets/food-beverage/exclusive-area/blockchain-iot.html

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Biodegradable food packaging

The amount of plastic waste in oceans and seas is growing rapidly and causes widespread concern. On 28 May 2018, the European Commission presented a comprehensive set of measures in the new single-use directive to address the important issues of littering and marine pollution, with the additional objective to stimulate the circular economy. The proposal banned items such as plastic straws, balloon sticks, drank stirrers.

Increasingly, supermarket shelves are taken up with ready meals - precooked food that requires simple reheating. Consumers in the EU bought over 6.5 billion ready meals in 2017. However, while ready-made meals evidently suit modern lifestyles, the packaging they come in does not suit the environment.

Biodegradable refers to the ability of materials to break down and return to nature.

Biodegradable goods include those that comprises of paper, food waste, fabric and wood. Biodegradable packaging is generally defined as a means of giving a naturally degradable protection utilized majorly for information, identification, presentation, and convenience for products from production to utilization. The biodegradable food packaging is different from non-biodegradable packaging as former degrades completely and quickly when decomposed without any poisonous emission.

Biodegradable packaging types:

- Plastic (Starch, PLA, PHA, PBAT and PBS)
- Paper

The levels of biodegradability:

- Biodegradable in industrial compost
- Biodegradable in home compost
- Biodegradable in soil/soil-biodegradable

The Foodservice Packaging Association (FPA) from UK, called for an end to the term "biodegradable" when used in reference to packaging. The association did so because the term biodegradable may lead some to wrongly assume that packaging carrying the presumed ecological tag of "biodegradable" will "disappear to nothing within a very short period" and in any location. However, this is certainly misleading for the public and can result in the erroneous belief that it is acceptable to litter biodegradable packaging.

Other links:
www.youtube.com/watch?time_continue=340&v=vgJ3et8KK_o
www.youtube.com/watch?time_continue=4&v=hckcytMxL4Y

Biodegradable plastics are plastics that can be broken down by bacteria or fungi into the water. It is not necessarily biodegradable plastics are made of biomaterial many plastics are made from oil in the same way as conventional plastics. 99% of all this plastic is made using oil or gas.

PLA (Polylactic acid) is bioplastic made from lactic acid used in food industry for packing of sensitive food products.
PHA (Polyhydroxyalkanoates) is biopolymer stores within the cell by various microorganisms they can be either thermoplastic or elastomeric materials.
PBAT (Polybutylene adipate terephthalate) is a synthetic polymer based on fossil resources it is 100% biodegradable and very flexible.
PBS (polybutylene succinate) is biodegradable aliphatic polyester produced by polycondensation of succinic acid.

Less processed papers, such as mechanically pulped products, biodegrade at slower rates than more highly processed papers. Paper containing mechanical pulp has higher amounts of lignin — very complex phenolic polymers found in the cell walls of trees — which interferes with biodegradation.

Bioplastics in packaging

In 2018, global production capacities of bioplastics amounted to about 2.11 million tons with almost 65% of the volume destined for the packaging market – the biggest market segment within the bioplastics industry. Bioplastics production capacities have been forecasted to grow to 2.62 million tons by 2023 with most of these new volumes being converted to innovative packaging solutions.[1]

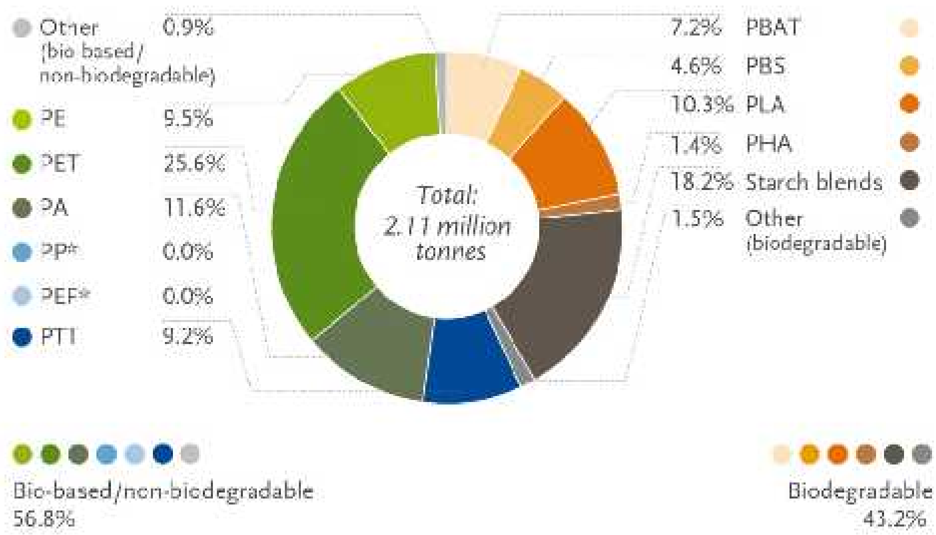
Bioplastics are a diverse family of materials with differing properties. There are three main groups:
- bio-based, non-biodegradable materials such as bio- based PE or bio-based PET
- bio-based and biodegradable materials such as PLA, PHA or starch blends
- fossil-based and biodegradable materials (foremost blended with group 2)

Packaging from bio-based plastics has been developed over the past 10 years. New materials such as PLA, PHA, cellulose or starch-based materials create packaging solutions with completely new functionalities, such as biodegradability/compostability. The bio-based versions of conventional plastics, such as bio-based PE and partly bio-based PET, are technically equivalent to their fossil counterparts.

PEF is a new, 100% bio-based polymer whose properties are very similar to PET and recyclable within the PET stream. PEF performs better than PET, offering remarkable shelf-life and down gauging opportunities in rigid and flexible (BOPEF) applications. As a carbonated soft drink bottle PEF has demonstrated six times better CO_2 barriers and ten times better O_2 barriers.

Thanks to a confluence of regulatory pressure, consumer demand, growing capacity and fast-moving R&D, we can be certain that bioplastics will be an ever more prominent element on the European packaging landscape.

Global production capacity of bioplastics 2018 (by material type)



Source: www.european-bioplastics.org/market/

Other links: www.youtube.com/watch?v=YWs_VVLNWC0

[1] European Bioplastics

a

Biopolymers from renewable sources

Biopolymers from renewable resources derive from biomasses and as such have a much lower environmental footprint than oil-based polymers, thanks to reduced CO_2 emissions in their Life Cycle Assessment.

Biopolymers are polymers that occur in nature, such as carbohydrates and proteins. Many biopolymers are already being produced commercially on large scales:

- ***cellulose*** is a carbohydrate and 40% of *all organic matter* is cellulose.
- ***starch*** is found in corn, potatoes, wheat, cassava, and some other plants. Annual world production of starch is over 70 billion pounds, with much of it being used for paper, cardboard, textile sizing, and adhesives.
- ***collagen*** is a protein found in mammals. Gelatine is denatured collagen, and is used in sausage casings, capsules for drugs and vitamin preparations, and other miscellaneous industrial applications.
- ***casein***, commercially produced mainly from cow's skimmed milk, is used in adhesives, binders, protective coatings, and other products.
- ***soy protein*** and ***zein*** are plant proteins which are used for making adhesives and coatings for paper and cardboard.
- ***polyesters*** are produced by bacteria, and can be made on large scales through fermentation. They are now being used in biomedical applications.

Starch-based bioplastics can be processed by all of the methods used for synthetic polymers, like film extrusion and injection moulding. Eating utensils, plates, cups and other products have been made with starch-based plastics.

Soybeans can be processed with modern extrusion and injection moulding methods.

Water soluble biopolymers are used for flexible films mainly as food coatings. They have potential use as non-supported stand-alone sheeting for food packaging.

Polyesters are now produced from natural resources-like starch and sugars-through large-scale fermentation processes, and used to manufacture water-resistant bottles, eating utensils, and other products.

Poly (lactic acid) has become a significant commercial polymer. Its clarity makes it useful for recyclable and biodegradable packaging, such as bottles, yogurt cups, and candy wrappers. It has also been used for food service ware, lawn and food waste bags, coatings for paper and cardboard, and fibers-for clothing, carpets, sheets and towels, and wall coverings. In biomedical applications, it is used for sutures, prosthetic materials, and materials for drug delivery.

Triglycerides have recently become the basis for a new family of sturdy composites. With glass fiber reinforcement they can be made into long-lasting durable materials with applications in the manufacture of agricultural equipment, the automotive industry, construction, and other areas. Fibers other than glass can also be used in the process, like fibers from jute, hemp, flax, wood, and even straw or hay. If straw could replace wood in composites now used in the construction industry, it would provide a new use for an abundant, rapidly renewable agricultural commodity and at the same time conserve less rapidly renewable wood fiber.

Other links: www.youtube.com/watch?v=YXtxsv4h8kU
www.youtube.com/watch?v=mojRZ_rIBPM

Glass packaging

Glass is the trusted and proven packaging for health, taste and the environment.

- Glass is 100% recyclable and can be recycled endlessly without loss in quality or purity.
- 80% of the glass that is recovered is made into new glass products.
- A glass container can go from a recycling bin to a store shelf in as little as 30 days. An estimated 80% of recovered glass containers are made into new glass bottles.
- Glass is **nonporous and impermeable**, so there are no interactions between glass packaging and products to affect the flavour of food and beverages. No nasty after taste.
- Glass has an almost **zero rate of chemical interactions**, ensuring that the products inside a glass bottle keep their strength, aroma, and flavour.
- When consumers choose foods or beverages that are packaged in glass, they avoid potential risks while enjoying a number of benefits.

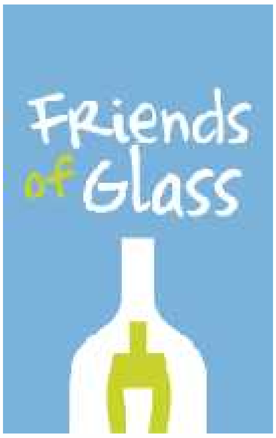
Latest industry data on glass recycling show that the average glass recycling rate in the EU28 is steady at 74%. Countries such as Belgium, Slovenia or Sweden, with excellent separate collection systems, continue to outperform beyond 95%.[2]

The 1st glass objects for holding food are believed to have appeared around 3000 BC.

The production of glass containers involves heating a mixture of silica (the glass former), sodium carbonate (the melting agent), and limestone/calcium carbonate and alumina (stabilizers) to high temperatures until the materials melt into a thick liquid mass that is then poured into molds.

Recycled broken glass (cullet) is also used in glass manufacture and may account for as much as 60% of all raw materials.

By recycling glass, over 12 million tons of raw materials are saved each year and over 7 million tons of CO2 are avoided - equal to taking 4 million cars off the road. We save 2.5% energy for each 10% of glass recycled in the furnace.[1]



Source: www.friendsofglass.com

Other links: www.youtube.com/watch?v=_XpIpT3fSjc

[1] http://pr.euractiv.com/pr/eu-glass-packaging-closed-loop-recycling-steady-74-166126

[2] The European Container Glass Federation, 2018

Smart packaging

Smart packaging provides enhanced functionality that can be divided into two submarkets:

- ***Active packaging*** is packaging that can 'sense' the environment of a packaged product. It can understand and correctly retain the quality of contents. With active packaging, it can understand variables such as the current time, the current temperature, the current moisture and if it contains a spoilable food and the ripeness of the product inside.

- ***Intelligent packaging*** can 'sense' changes in the packaging of a product and is able to communicate or signal information regarding to the change. This type of packaging has much more varied uses, including anti-counterfeit capabilities, marketing and branding custom messages and even the ability to detect microorganism or bacterial growth.

Types of Intelligent packaging:

- Interactive packaging refers to data carrier devices, able to store information regarding storage, distribution and traceability of the foods. They are also known as automatic identification devices making the information flow more efficiently within the food supply chain.

- Sensors are used in packaging to collect information of the package and its content. Sensors can collect information of the changes in the environment, the condition or the operating history of the packed material. The sensors monitor specific functionalities, e.g. pH, time and temperature, hydrogen sulphide or carbon dioxide.

- Indicators cannot, in contrast with sensors, provide quantitative information (e.g. concentrations) and are not able to store the data of measurement and time. Indicators can provide visual, qualitative (or semi-quantitative) information about the packaged food by means of a colour change. They can be used to provide information regarding temperature, gas and volatiles presence, pH change and microbiological contamination.

The safety of food contact materials requires evaluation as chemicals can migrate from these materials into food. The materials should be manufactured in compliance with European Union (EU) regulations, including good manufacturing practices, so that any potential transfer to foods does not raise safety concerns, change the composition of the food in an unacceptable way or have adverse effects on quality.

The general task of evaluating substances intended for use in food contact materials as well as carrying out additional risk assessments in relation to food contact materials are carried out by European Food Safety Authority's (EFSA) Panel on Food Contact Materials, Enzymes, Flavourings and Processing Aids (CEF).

Source: https://fmsblog.azurewebsites.net/smart-packaging-the-next-evolution-in-print/

Global Smart Packaging Market is expected to reach $37,797 million by 2022.[1]

Other links:
www.youtube.com/watch?v=tpLnQtLx9vQ
www.youtube.com/watch?v=q1gTN334JH4

[1] Allied Market Research

Reuse and refill concept

European Union Parliament and Council ended the year 2018 with a provisional agreement to phase out problematic single-use plastic items by 2021.

Reuse provides an economically attractive opportunity for at least 20% of plastic packaging (by weight), worth at least $9 billion.

There is a lack of standardization that is boosting costs and limiting the efficiency of the burgeoning reuse market. Standardized containers, which are interchangeable and may be used by a number of brands, minimize the number needed by using a common stock to cover demand variations between companies. Standardized sizes and shapes also help make logistics more efficient, by maximizing storage and distribution space. The efficiency of the logistics system can also be improved using a "shared pool system" rather than a strict one-for-one return.

Good practice example:
The Loop effort will allow consumers in select markets to buy Unilever, Nestlé and Procter & Gamble products – ice cream, shampoo, toothbrushes, laundry detergent and more – in refillable metal and glass containers instead of single-use packaging. Consumers will be able to order goods online (from the Loop website or partner stores) and have them delivered. Once the containers are empty, TerraCycle will pick them up, clean them and deliver refilled containers back to consumers.

Source: www.greenbiz.com/sites/default/files/styles/gbz_article_primary_breakpoints_kalapicture_screen-lg_1x/public/images/articles/featured/loop-group-shot.jpg?itok=x23rnUz7&timestamp=15480165840

Ghirardelli Chocolate example: To reduce packaging costs and cardboard waste, the company switched to reusable totes for internal distribution in 2003. Based on a five-year life of the totes, the company realized net savings of $1.9 million, and prevented 350 tons per year of soiled cardboard going to landfill, resulting in additional savings from avoided disposal costs of $2,700 per year.

In Western Europe alone, sales of refillable beverage containers have dropped from 63.2 billion units in 2000 to 40.2 billion units in 2015. [1]

Other links: www.youtube.com/watch?time_continue=45&v=YSxoiF6N2M4

[1] https://reloopplatform.eu/policy-instruments-to-promote-refillable-beverage-containers/

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European Regional Development Fund - Instrument for Pre-Accession II Fund
INNOVAGRO

Reforming Common Agricultural Policy

The Common Agricultural Policy (CAP) is the European Union's answer to the questions of how to ensure food security, the sustainable use of natural resources and the balanced development of Europe's rural areas.

CAP consists of two pillars:

- a market support pillar (Pillar 1) and
- rural development programmes (RDPs) (Pillar 2)

which form the basis for administering payments to the present day.

Large agri-businesses and big landowners receive more from the CAP than Europe's small farmers. About 80% of farm aid goes to about a quarter of EU farmers; those with better revenues.

Reforming the CAP payments mechanism is a first crucial step to achieving goals of sustainability. The following changes are essential in order to shift the balance of incentives in favour of new entrants and sustainable modes of production:

- shifting from an area-based payment logic to composite criteria(labour intensity, farm size, regional specificities, etc.) with mandatory redistribution to small-scale farms
- capping payments to individual farms
- providing a positive definition of an active farmer at EU level
- introducing a minimum percentage for payments to young farmers

Further steps would be required under CAP Pillar 2 to address the array of barriers to new entrants in agriculture, including increased support for national and regional initiatives which enable land access (e.g. starter farms, land trusts, incubators, land matching); in the long-term, all support measures to farmers would be managed under a single-pillar CAP, ensuring full coherence between tools to support new entrants.

The EU supports farmers with € 58,82 billion in 2018 (which is 36,74% of the total EU budget).[1]

The future common agricultural policy (CAP) 2021–2027 has nine objectives that will reshape the sector within the European Union in the next 7 years

Source: https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/key_policies/images/cap-nine-objectives_en.png

Other links: www.euractiv.com/section/agriculture-food/video/financing-eu-agriculture-after-2020-what-future-for-the-cap/

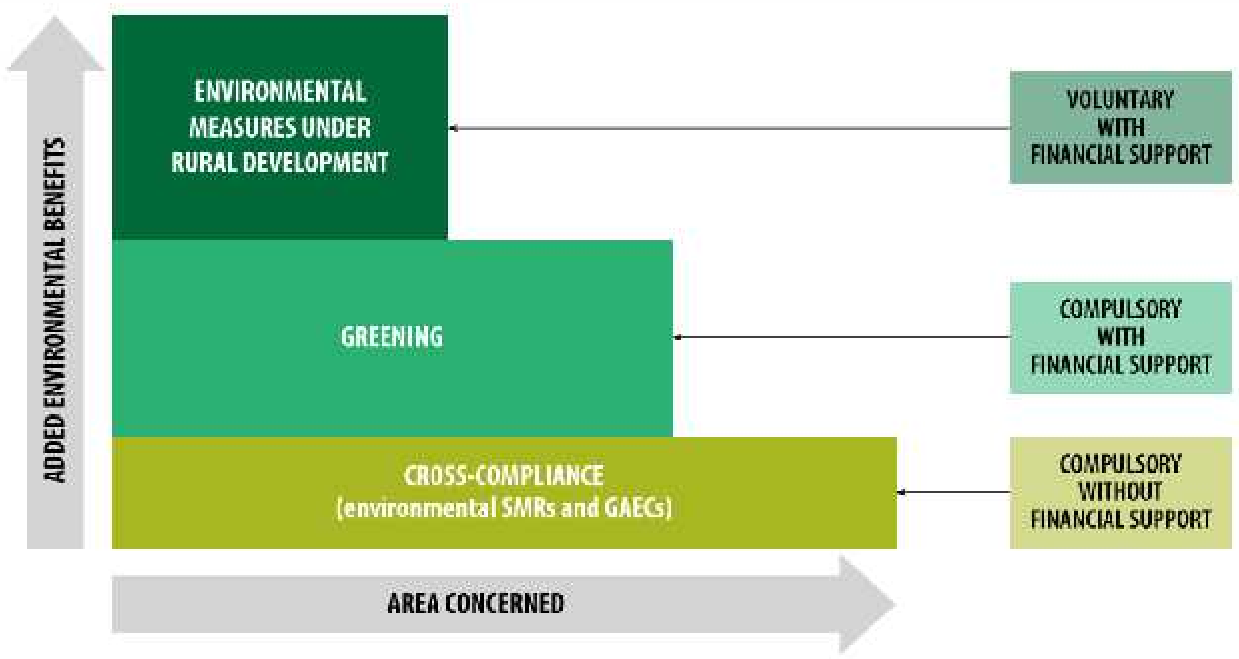
https://multimedia.europarl.europa.eu/en/fairer-farming-in-the-eu-post-2020_N01-PUB-100531-FARM_ev

[1] https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/cap-glance_en

Greening

The European Union pays direct subsidies to farmers as part of Pillar I of its Common Agricultural Policy (CAP). A key aim of these direct payments is to support farmers' income. However, the CAP has come under increasing criticism for not doing enough to limit the negative effect that certain farming practices have on the environment and climate. Such negative environmental impacts of agriculture include soil depletion and erosion, water pollution, greenhouse gas emissions and biodiversity loss.

The 'green payment' or 'greening' – a new type of direct payment introduced with the 2013 CAP reform – is the most recent attempt to address this issue. It is the only direct payment whose main stated objective is 'green', namely to enhance the CAP's environmental performance.



Source: ECA, based on the European Commission's Staff Working Document SWD (2016) 218 final

Farmers receive the green direct payment if they comply with three mandatory practices that benefit the environment (soil and biodiversity in particular):

- **crop diversification**: a greater variety of crops makes soil and ecosystems more resilient
- maintaining **permanent grassland**: grassland supports carbon sequestration and protects biodiversity (habitats)
- dedicate 5% of arable land to **areas beneficial for biodiversity**: Ecological Focus Areas (EFA), for example trees, hedges or land left fallow that improves biodiversity and habitats

Other links: www.euractiv.com/section/agriculture-food/video/greening-european-agriculture-can-the-new-cap-be-really-green/1256648/

Common food policy

It is a policy setting a direction of travel for the whole food system, bringing together the various sectorial policies that affect food production, processing, distribution, and consumption, and refocusing all actions on the transition to sustainability.

5 key objectives in order to build sustainable food systems in Europe:

- Ensuring access to land, water and healthy soils
- Rebuilding climate-resilient, healthy agro-ecosystems
- Promoting sufficient, healthy and sustainable diets for all
- Building fairer, shorter and cleaner supply chains
- Putting trade in the service of sustainable development

The prevailing incentives to over-produce, to over-consume, and to externalize costs onto taxpayers and future generations must be replaced by a new green taxation paradigm, and by a macro-economic paradigm no longer focused on GDP growth as an end in of itself. These changes are civilizational in nature. They must be underpinned by a new contract between citizens, businesses, and policymakers.

Source: www.ipes-food.org/_img/upload/files/CFP_FullReport.pdf

EU Quality Schemes

EU quality policy aims at protecting the names of specific products to promote their unique characteristics, linked to their geographical origin as well as traditional know-how.

Product names can be granted with a 'geographical indication' (GI) if they have a specific link to the place where they are made. The GI recognition enables consumers to trust and distinguish quality products while also helping producers to market their products better.

Protected designation of origin (PDO)
Product names registered as PDO are those that have the strongest links to the place in which they are made. Every part of the production, processing and preparation process must take place in the specific region.

Protected geographical indication (PGI)
PGI emphasises the relationship between the specific geographic region and the name of the product, where a particular quality, reputation or other characteristic is essentially attributable to its geographical origin.
For most products, at least one of the stages of production, processing or preparation takes place in the region.

Geographical indication of spirit drinks and aromatised wines (GI)
The GI protects the name of a spirit drink or aromatised wine originating in a country, region or locality where the product's particular quality, reputation or other characteristic is essentially attributable to its geographical origin.
For most products, at least one of the stages of distillation or preparation takes place in the region. However, raw products do not need to come from the region.

Traditional speciality guaranteed (TSG) highlights the traditional aspects such as the way the product is made or its composition, without being linked to a specific geographical area. The name of a product being registered as a TSG protects it against falsification and misuse.

As part of the EU's system of intellectual property rights, names of products registered as GIs are legally protected against imitation and misuse within the EU and in non-EU countries where a specific protection agreement has been signed.

For all quality schemes, each EU country's competent national authorities take the necessary measures to protect the registered names within their territory. They should also prevent and stop the unlawful production or marketing of products using such a name.

Non-European product names can also register as GIs if their country of origin has a bilateral or regional agreement with the EU that includes the mutual protection of such names.

The names of various products (wine, food, aromatised wines and spirit drinks), produced in several countries outside the EU, such as Colombia or South Africa, have been protected.

Voluntary certification schemes at the national level or those run by private operators can also help consumers be confident about the quality of the products they choose. [1]

Other links: www.youtube.com/watch?v=IjpXTMA3Ymk

[1] European Commission, 2019

Young farmers in EU

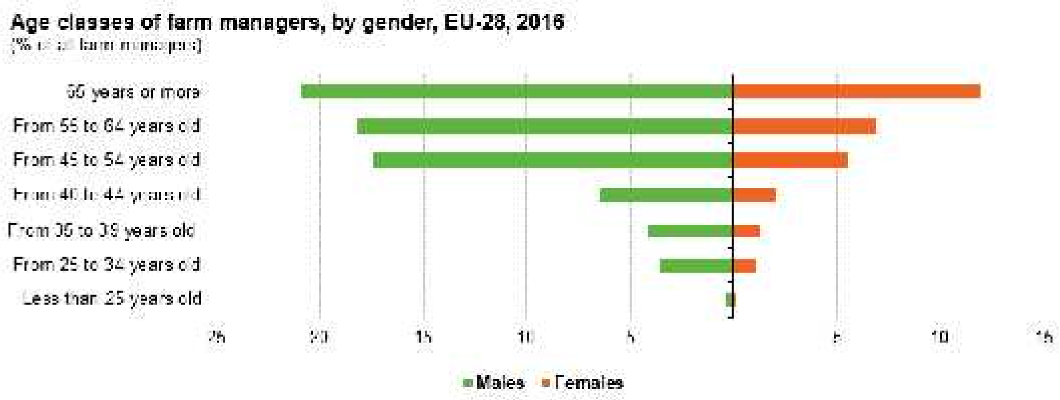
According to the national accounts around 10 million people worked in agriculture in the EU-28 in 2015 and accounted for 4.4 % of total employment. Almost three quarters (72.8 %) of the agricultural workforce in the EU-28 was concentrated in seven countries: Romania, Poland, Italy, France, Spain, Bulgaria and Germany.

As reported in the 2016 Labour Force Survey (LFS), in the EU-28, 31.8 % of the agricultural labour force was below 40 years old compared to 42.4 % in the total working population. 59.2 % of those working in agriculture were 40-64 years old, against 55.2 % of the overall working population. 9.0 % were older than 64, compared with only 2.4 % in the total working population. Looking at national data, the proportion of people aged under 0 was higher in the total working population than among people working in agriculture in all countries except for Luxembourg and Denmark. By contrast, in all countries the proportion of people aged 65 and over was higher among people working in agriculture than in the total working population.

Only 6% of all farm holdings in the European Union (EU) are run by farmers under 35 – and persuading more young people to begin farming is a significant challenge.

The highest proportions of young people (below 40 years old) in the agricultural labour force were reported in Luxembourg (50.0 %) and Denmark (44.7 %) and the lowest in Portugal (13.9 %). People aged 65 and above accounted for over 15 % of farm workers in six Member States, with the highest levels reported in Portugal (41.6 %) and Ireland (21.7 %). More than half of farmers were aged between 40 and 64 in all countries but Luxembourg, Portugal and Denmark.[1]

One of the biggest factors that will determine how well the agriculture industry will cope with and adopt the newest AgTech applications related to food production will be young farmers. The industry is facing a problem with ensuring effective food production due to the fact, hat most farms are run by older demographics that can range from 40 years old and above. If this persists happening and if we will not be able to figure out methods of raising the interest of farming and agriculture to millennials, the pace at which new technology will be adopted will be hindered, as well as the progress of finding new solutions to current problems in the industry will be slowed down tremendously as well.



Source: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Age_classes_of_farm_managers,_by_gender,_EU-28,_2016_(%25_of_all_farm_managers).png

Other links: www.youtube.com/watch?v=Br-o-kL1HYw
https://www.youtube.com/watch?v=B29EuKANqmE

[1] Eurostat, 2017

Sharing economy in agriculture

The sharing economy's explosive growth has astounded even optimistic market pundits. On the one hand, there are now many thousands of sharing economy platforms operating in almost every sector and activity around the world. Back in 2009, there were only a handful: Zipcar, BlaBlaCar and Couchsurfing among them. Airbnb had launched in fall 2008, Uber in spring 2009. "Access over ownership" is a shift that has taken root, as digital and mobile technologies make it ever easier to access goods and services on-demand. It is no longer a millennial preference, but a part of modern society.

Sustainable sharing economy platform depends essentially on two elements: mind-set shifts and trust.

The Sharing Economy and the EU have common goals: increase resource efficiency, create jobs and support micro-entrepreneurship, build community participation and advance digital innovation.

Models of sharing economy in agri-food systems include community gardens, food swapping, food consumer groups and networks.

European policy makers should play an active role in making publicly owned assets available for maximum utilisation by designing sharable infrastructures, services, incentives and regulations that facilitate the Sharing Economy at local level. In the area of Shareable Food:

- Encourage urban agriculture by removing barriers to growing and selling
- Provide tax credits to property owners who farm vacant land
- Conduct inventories that explore the potential for food cultivation on unused land
- Allow food distribution points to increase access to local food production
- Support the establishment of food redistribution programs
- Support local commercial kitchens and food enterprises

Source: www.canstockphoto.com/sharing-economy-collaborative-global-60160247.html

Other links:
www.youtube.com/watch?v=pjV575LdTxk
https://toogoodtogo.co.uk/en-gb
https://vimeo.com/171453044
https://blog.p2pfoundation.net/food-commons-europe/2017/02/01

Examples of alternative food networks:

- **Community supported agriculture - refers to local farmers and consumers engaging with one another in a small-scale supply chains that connect them directly**
- ***Associations pour le Maintien de l'Agriculture Paysanne*** **(AMAP) - are forms of sharing that widely engage both consumers and producers in decision-making processes around pricing, production sustainability and small-scale viability**
- **Solidarity purchasing groups refer to groups of consumers jointly organized to buy goods directly from nearby producers in accordance with fair environmental practices and social justice**

In these different forms of alternative food networks, participants co-access or co-owned tangible resources such as land, water, money, food, and agricultural equipment to a certain extent.

Urban agriculture

It is estimated that by 2050, 67% of the world's population will live in urban areas. The rapid growth of cities in the developing world is placing enormous demands on urban food supply systems.

Agriculture – including horticulture, livestock, fisheries, forestry, and fodder and milk production – is increasingly spreading to towns and cities. Urban agriculture provides fresh food, generates employment, recycles urban waste, creates greenbelts, and strengthens cities' resilience to climate change.

According to the United Nations' Food and Agriculture Organization urban agriculture is defined as "the growing of plants and the raising of animals for food and other uses within and around cities and towns, and related activities such as the production and delivery of inputs, processing and marketing of products".[1]
Urban agriculture is much more than growing food. It can bring multiple benefits to health, social, economic and ecological issues.

According to the European Environment Agency (EEA), 75% of the EU's inhabitants live in cities.

Driven by urban planning in the form of the intensive cultivation of food products in places such as rooftops, balconies, city gardens, and parks, as well as individually worked micro-gardens, urban agricultural initiatives are proving to be easily managed and highly productive. A study by the FAO found that per square meter of cultivated micro-gardens an average of 25kg of vegetables can be produced.

The greatest beneficiaries of urban agriculture are low-income households, with micro-gardening and other green practices that encourage the production of vegetables at home, resulting in improved nutrition and food security to the segment of the population that is usually deprived from it.

Urban agriculture is practised by 800 million people worldwide. Today 15% of the world's food is produced in cities. This percentage will probably double in the next 20 years.

Source: www.powerhousehydroponics.com/5-benefits-of-urban-farming/

Other links:
https://www.youtube.com/watch?v=rYlk-Hd3Y3I
www.youtube.com/watch?v=Gs_UCVuKDK8

[1] FAO, 2007

Indoor farming

As indoor farming becomes more visible it will continue to change the face of agriculture. Farmers face the challenges of climate change. Cities are looking at ways to source locally grown produce to cut down on transportation greenhouse gas emissions. Food service companies and restaurants are heeding the request by their customers to buy and be served food that is less carbon-intensive, and healthier. For farmers, it means rethinking their business by embracing these new technologies. And it likely means that the face of farming as the 21st century unfolds will be far different from what we have seen in the past.

Source: https://industryreports24.com/362160/indoor-farming-technology-market-report-forecasting-41-billion-growth-by-2025-competitive-analysis-by-philips-lighting-everlight-electronics-argus-controls-systems-netafim-lumigrow-and-others/

The global indoor farming market was valued at USD 106.6 billion in 2017 and is expected to register a CAGR of 3.4% during the forecast period (2018-2023).

North-America is accounting for nearly 44.2% of the global market in 2017. Countries in Europe such as France, Italy, Germany, Netherlands, and the UK are at the forefront in the implementation of indoor farming technologies. Increasing awareness of the benefits and demand for food is expected to drive the establishment of indoor farms in regions such as the Asia-Pacific and South America.[1]

The intensive plant nursery, located in North Lincolnshire, England, will be the largest indoor farm in Europe, producing up to 420 tonnes of leafy greens per year across a growing area of 5120m2, arranged in racks rising to the height of 11m. It will use up to 90% less water and 50% less fertilizer than conventional growing methods.

Limitation on types of crops grown is one of the major restraints that is restricting the indoor farming marketing. The types of crops grown in indoor farming are fruits and vegetables, herbs and microgreens, flowers and ornamentals, and other crops. Among these, the crops that give maximum profits are grown on a large scale (cannabis, greens, and herbs or microgreens are the most profitable crops).

As indoor farming is costly, in order to operate profitably, farmers have to grow crops that are high revenue generating thereby limiting the varieties of crops produced. This kind of crops includes specialty items, such as flowers or farmers target crops which have quick growth cycles, such as leafy greens.

Other links: www.youtube.com/watch?v=AXZWI0QufrI
www.goodhousekeeping.com/uk/food/a579334/underground-farm-growing-underground-london/

[1] www.apnews.com/Business%20Wire/ce494569fb044b34b0373ac1b5a7ff89

Interreg ADRION ADRIATIC-IONIAN
EUROPEAN UNION
European Regional Development Fund - Instrument for Pre-Accession II Fund
INNOVAGRO

Food donations

Around 88 million tonnes of food is wasted annually, which has an associated cost estimated at 143 billion euros.[1]

Food waste prevention is an integral part of the Commission's new Circular Economy Package to stimulate Europe's transition towards a circular economy which will boost global competitiveness, foster sustainable growth and generate new jobs.

The Circular Economy Package consists of an EU Action Plan for the Circular Economy and annex to the action plan outlining the timetable for proposed actions, and related legislative proposals on waste. The Revised EU Waste Legislation, adopted on 30 May 2018 by co-legislators, calls on the EU countries to take action to reduce food waste at each stage of the food supply chain, monitor food waste levels and report back regarding progress made.

The EU and the EU countries are committed to meeting the Sustainable Development Goal 12.3 target to halve per capita food waste at the retail and consumer level by 2030, and reduce food losses along the food production and supply chains.

The EU food donation guidelines seek to:

- **facilitate compliance of providers and recipients of surplus food** with relevant requirements laid down in the EU regulatory framework (*e.g.* food safety, food hygiene, traceability, liability, VAT, *etc.*)
- **promote common interpretation by regulatory authorities** in the EU Member States of EU rules applying to the redistribution of surplus food

Source:
https://previews.agefotostock.com/previewimage/medibigoff/60d925795a242dedbdf16c687def6a34/esy-047815105.jpg

In 2016, members of the European Federation of Food Banks (FEBA) distributed 535 000 tons of food to 6,1 million people, which represents only a small fraction of the estimated volume of food waste generated annually in the EU.

The EU Platform on Food Losses and Food Waste (FLW) is an initiative of the European Commission dedicated to the prevention of food losses and waste. The Platform has been established as part of the Commission's Circular Economy Action Plan in order to support the achievement of the global Sustainable Development Goal (12.3) target on food waste which calls on all nations to halve food waste and reduce food loss by 2030.

Other links:
www.youtube.com/watch?v=qWPgwS7Vdmw

www.dw.com/en/czech-republic-food-donations-by-law/av-48347745

www.fooddrinkeurope.eu/uploads/publications_documents/6194_FoodDrink_Europe_Every_Meal_Matters_screen.pdf

[1] European Commission, 2016

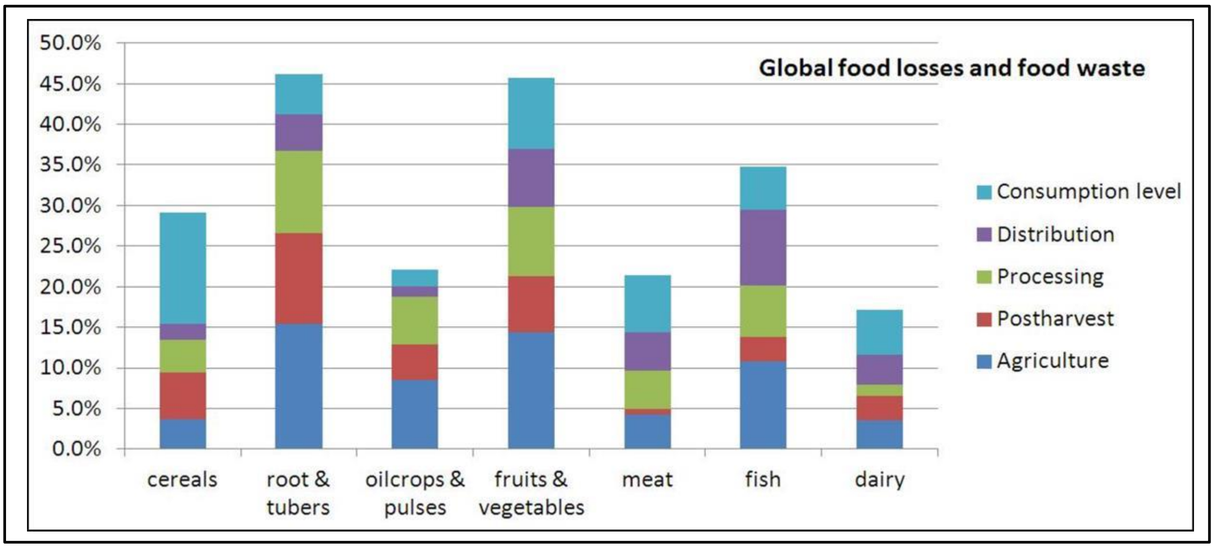
Food waste

Up to 50% of food gets wasted in EU households, supermarkets, restaurants and along the food supply chain each year, while 79 million EU citizens live beneath the poverty line and 16 million depend on food aid from charitable institutions.

Currently food wastage amounts in the EU27 to 89 million tonnes per annum (i.e. 179 kg per capita) and the projection for 2020 – if no action is taken – is 126 million tonnes (i.e. a 40% increase).

Food waste prevention and reduction are important aspects in the wider context of food security and resource efficiency. In its recent CAP-Opinion the EESC recommends that the Commission review best food waste reduction practices in countries such as Germany and support them with legislative measures at EU level.
The proposed own-initiative opinion should give impetus to draw up at the European level a coordinated strategy, combining EU-wide and national measures, to improve the efficiency of food supply and consumption chains and to tackle food wastage as a matter of urgency.

Global food losses and food waste



Source: FAO, 2011. Global food losses and food waste: extent, causes and prevention, by J. Gustavsson et al., Rome.

Without accounting for GHG emissions from land use change, the carbon footprint of food produced and not eaten is estimated at 3.3 G tonnes of CO_2 equivalent. Presenting these emissions as a country, food waste would be the third top CO_2 emitter after the USA and China. Globally, the blue water footprint (i.e. the consumption of surface and groundwater resources) of food loss and waste is about 250 km^3, which is equivalent to the annual water discharge of the Volga River, or three times the volume of Lake Geneva. Food produced but not eaten occupies almost 1.4 billion hectares of land in vain.

Key facts on food loss and waste

- Roughly one third of the food produced in the world for human consumption every year — approximately 1.3 billion tonnes — gets lost or wasted.
- Food losses and waste amounts to roughly US$ 680 billion in industrialized countries and US$ 310 billion in developing countries.
- Industrialized and developing countries dissipate roughly the same quantities of food — respectively 670 and 630 million tonnes.
- Fruits and vegetables, plus roots and tubers have the highest wastage rates of any food.
- Global quantitative food losses and waste per year are roughly 30% for cereals, 40-50% for root crops, fruits and vegetables, 20% for oil seeds, meat and dairy plus 35% for fish.
- Every year, consumers in rich countries waste almost as much food (222 million tonnes) as the entire net food production of sub-Saharan Africa (230 million tonnes).
- The amount of food lost or wasted every year is equivalent to more than half of the world's annual cereals crop (2.3 billion tonnes in 2009/2010).
- Per capita waste by consumers is between 95-115 kg a year in Europe and North America, while consumers in sub-Saharan Africa, south and south-eastern Asia, each throw away only 6 -11 kg a year.

Other links:
www.youtube.com/watch?v=ogn-UfrsQVA
www.youtube.com/watch?v=dmbfylJZ_NI
www.fao.org/save-food/resources/keyfindings/en/

Agro-food clusters

Clusters are groups of specialised enterprises - often SMEs - and other related supporting actors that cooperate closely together in a particular location. In working together SMEs can be more innovative, create more jobs and register more international trademarks and patents than they would alone.

According to the European Cluster Excellence Scoreboard, for a number of selected emerging industries and regions in the period 2010-2013, 33.3 % of firms in clusters showed employment growth superior to 10%, as opposed to only 18.2% of firms outside clusters.

Well-developed clusters are vehicles for competitiveness and innovation.

EU countries differ in terms of both occurrence and relative strength of the agro-food clusters and levels of comparative advantage in agriculture commodities and food products.

The European Cluster Excellence Initiative, initiated by the European Commission DG Enterprise and Industry, developed methodologies and tools to support cluster organisations to improve their capacities and capabilities in the management of clusters and networks.

GOLD Cluster Management Excellence PROVEN FOR CLUSTER EXCELLENCE Cluster Management Exellece Label GOLD

Name	Country	www
AGRI SUD-OUEST INNOVATION	France	www.agrisudouest.com
Cluster de la Acuicultura de Galicia	Spain	www.cetga.org
Flanders' Food	Belgium	www.flandersfood.com/
INOVCLUSTER	Portugal	www.inovcluster.pt/
Lebensmittel Cluster Niederösterreich	Austria	www.ecoplus.at/de/ecoplus/cluster-niederoesterreich/lebensmittel
PORTUGALFOODS	Portugal	www.portugalfoods.org
VEGEPOLYS	France	www.vegepolys.eu/
VITAGORA	France	www.vitagora.com

SILVER Cluster Management Excellence DEDICATED TO CLUSTER EXCELLENCE Cluster Management Excellence Label SILVER

Name	Country	www
AgroTransilvania Cluster	Romania	www.agrocluster.ro
Food-Processing Initiative e. V.	Germany	www.foodprocessing.de
FoodNetwork	Denmark	www.foodnetwork.dk
foodRegio	Germany	www.foodregio.de
IND-AGRO-POL	Romania	www.inma.ro/indagropol

Cooperatives

A cooperative is owned by its farmer members. Its objective is to provide services to its members that can generate added value for them. The cooperative model is as a user-owned, user-controlled and user-benefit business. A cooperative's objective is to maximise benefits for its members through the services provided.

Agriculture is the largest sector by cooperative annual turnover with more than 39% (347 € billion) of the total cooperative annual turnover in Europe.

Governance model ensures its farmer-members get better returns:

- Self-governance is one of the keys to the success of cooperatives
- Within the economy as a whole, cooperatives are a business model with specific values
- Owned and controlled by farmers -cooperatives help their members to better market their produce, add value to it and seek new market outlets
- Agri-cooperatives now operate in a globalised economy and have moved from an economy driven by farmers to an economy where the consumer is king
- Cooperatives must translate consumer expectations into concrete projects. This can only be done with the full involvement of their members.

Agri-cooperatives play a vital role in European agriculture and the way that they are managed is the key to their success. 51,000 agri-cooperatives in the EU generate a €347 billion turnover by collecting, processing and marketing produce from their 9,5 million members and by directly employing over 600,000 individuals. The 100 largest agricultural cooperatives demonstrated a significant growth trend: from 2011 to 2013, total turnover had grown by 18%.[1]

Agri-cooperative enterprises: 51,392
Members: 9,592,704
Employees: 675,566
Annual turnover: 347 € billion

Top 5 agriculture cooperatives in Europe by turnover (billion €), 2013:

1.	Bay Wa	15.9
2.	FrieslandCampina	11.4
3.	Arla Foods	9.8
4.	DLG	7.9
5.	Danish Crown	7.8

Source: www.musikawa.es/algunas-ideas-mas-para-el-curso-que-comienza-musikawa/

Other links: www.youtube.com/watch?v=sUDuTHhkoxo
www.youtube.com/watch?v=YDwrKIjuJEA
www.youtube.com/watch?v=_uyEZFZ74MY

[1] Cooperatives Europe, 2016

Short supply chains

Short food supply chains (SFSC) are in the EU understood as being the chains in which foods involved are identified by, and traceable to a farmer and for which the number of intermediaries between farmer and consumer should be minimal or ideally nil.

Several types of SFSCs can be identified:

- community-supported agriculture
- on-farm sales
- off-farm schemes
- collective sales

In 2015, 15% of farmers sold half of their products through these short food supply chains.[1]

Local agriculture and short food supply chains have economic, social and cultural benefits for farmers, consumers and rural areas in general. This sector increases the income of farmers and the consumption of fresh and relatively unprocessed food, brings consumers and farmers closer, engages public institutions in its promotion, helps to strengthen rural-urban linkages (particularly in the case of peri-urban agriculture) and contributes to sustainable development. The sector is growing across Europe to meet rising consumer demand.
The development of short food supply chains should result in fairer remunerations for farmers and higher quality local food products.

Source: www.euractiv.com/section/agriculture-food/opinion/europe-must-get-serious-about-short-food-supply-chains/

Smallholders often find themselves in a weak negotiating position against food processors, traders, wholesalers, and large retail chains. In some cases, the “big players” provide the only access to the market for small-scale farmers, which results in unfair trade practices.

According to Copa-Cogeca, the EU farmers’ association, farmers receive on average 21% of the share of the value of the agricultural product whilst 28% goes to processors and as much as 51% to retailers.

A 2016 Eurobarometer survey noted that four out of five European citizens consider that ‘strengthening the farmer’s role in the food chain’ is either fairly or very important.

[1] European Parliamentary Research Service, 2015

Degradation and revitalization of soil

52% of the agricultural land is moderately or severely affected by soil degradation and threatens 1.5 billion of people globally and 74% of the poor directly. In 2015 the UN adopted Sustainable Development Goals (SDGs) to end poverty, to protect the planet, and to ensure prosperity for all by 2030, one of which, Goal 15, is directly related to soil degradation.

Scientists have calculated that 0.025 to 0.125 mm of soil is produced each year from natural soil forming processes.[1]

Intensive and unsustainable land management practices are driving severe soil degradation. Loss of soil functions is a major concern and is expected to accelerate over the coming years. Soil erosion affects 25% of agricultural land in the EU and increased by some 20% between 2000 and 2010. Around 45% of the mineral soils in Europe have low or very low organic carbon content (0 – 2% organic carbon), while soil contamination affects up to three million sites. Soil biodiversity is reduced by intensive agriculture, making soils less efficient and more sensitive to weather events such as extreme drought and rainfall. 83% of EU soils contain one or more pesticides residues; 58% contain mixtures. Diffuse pollution by agrochemicals has become a major soil threat, and presents major human health risks. Significant areas of EU farmland are facing salinization and desertification, with 32 - 36% of European subsoil highly susceptible to compaction. Land and soil degradation have major implications for climate change, while undermining efforts to meet a variety of SDGs.

Seven ways to improve soil health:

- Act rapidly to build organic matter in soils
- Protect soils using continuous plant cover and trees
- Examine the impact chemical inputs have on soil life
- Reduce soil compaction which impacts soil structure and soil biology
- Reduce the chances of erosion
- Help mitigate and adapt against the effect of climate change
- Lobby for organic farming to be recognised by government policy

Achieving sustainable soil management requires the strengthening of independent advisory and extension services, and new modes of knowledge dissemination.[2]

In Europe, there are 170 million hectares of agricultural soils, equivalent to approximately 39% of EU territory. Although considerable, this area is insufficient to supply food and raw materials to the European market, which claims twice the actual cultivated area. Although Europe accounts for 7% of world population, it exploits 20% of the 1.6 billion hectares of global agricultural land.

Europe loses 970 million tonnes of soil every year, with more than 11% of the EU's territory affected by moderate to high soil erosion. Regaining just one cubic centimetre of topsoil can take centuries.

Around 12.5% of arable land in the EU is estimated to suffer from moderate to high erosion, but the rate varies widely from country to country.

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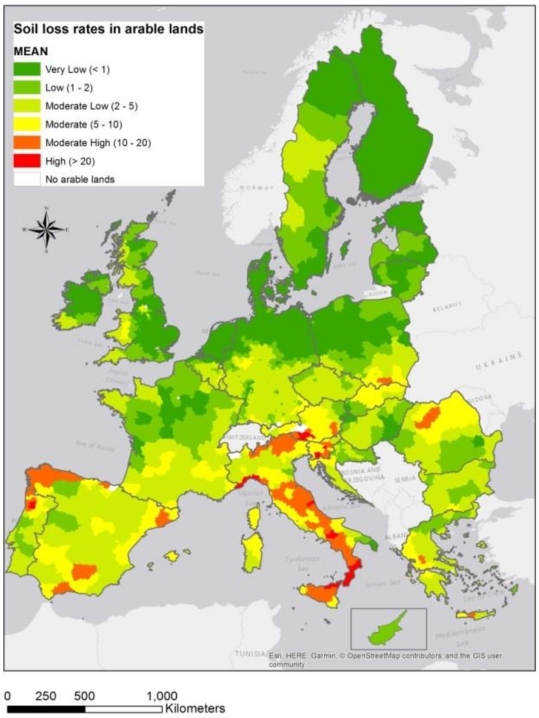
[1] Lal, R. Soil-erosion from tropical arable lands and its control. *Advances in Agronomy* 37, 183-248 (1984)
Montgomery, D. R. *Dirt: The Erosion of Civilizations*. Univeristy of California Press, 2007
Pimentel, D. *et al*. World agriculture and soil-erosion. *Bioscience* 37, 277-283 (1987)
Wakatsuki, T. & Rasyidin, A. Rates of weathering and soil formation. *Geoderma* 52, 251-263 (1992)

[2] European Academies' Science Advisory Council (EASAC)



Source: https://ec.europa.eu/eurostat/statistics-explained/index.php/agri-environmental_indicator_-_soil_erosion

Other links:
https://easac.eu/fileadmin/PDF_s/reports_statements/EASAC_Soils_complete_Web-ready_210918.pdf
www.ipbes.net/system/tdf/spm_3bi_ldr_digital.pdf?file=1&type=node&id=28335

Interreg ADRION ADRIATIC-IONIAN
European Regional Development Fund - Instrument for Pre-Accession II Fund
INNOVAGRO

Reuse of waste water in agriculture

Approximately 70% of world water use, including all the water diverted from rivers and pumped from underground is used for agricultural irrigation, so that the reuse of treated municipal wastewater for purposes such as agricultural and landscape irrigation reduces the amount of water that needs to be extracted from natural water sources as well as reducing discharge of wastewater to the environment. Thus, treated municipal wastewater is a valuable water source for recycling and reuse in the Mediterranean countries and other arid and semi-arid regions which are confronting increasing water shortages.

Direct wastewater re-use is treated wastewater that is piped into a water supply system without first being incorporated in a natural stream or lake or in groundwater. Indirect wastewater reuse involves the mixing of reclaimed wastewater with another water supply source before reuse. The mixing occurs for example when the groundwater is too saline and needs to be improved by the treated waste water.

Drivers for the implementation of water reuse systems:

- strict quality controls to minimise the risk of environmental contamination and human health problems
- proper household metering
- water pricing strategies

Climate change is expected to reduce water availability and increase abstraction for irrigation in Mediterranean regions. Under mid-range assumptions on temperature and precipitation changes, water availability is expected to decline in Southern and South-eastern Europe (by 10% or more in some river basins by 2030). Agriculture is expected to remain the largest water user in the Mediterranean countries, with more irrigation and warmer and drier growing seasons resulting from climate change.

The risks of wastewater reuse in agriculture are extensive, ranging from changes to physicochemical and microbiological properties of soils to impacts on human health. In unfavourable economic conditions, the search for alternative irrigation sources irrigation, such as the reuse of raw or inadequately treated wastewater may result in avoidable risk factors.

The lack of quantitative evaluation of microbiological risk, referring to the concentration of helminths, is the missing piece that is required for the proper implementation of agricultural reuse. This deficiency has promoted the use of raw sewage water, triggered by the incipient development of norms and the standards of some countries that do not conform to global guidelines. In addition, the improvement of the detection technique of helminths should be the next milestone to eliminate subjectivity and to advance the safe reuse of residual water.

Water stress already affects one third of the EU territory all year round.[1]

The first evidence of wastewater reuse is found among the ancient Greeks, who used public latrines that flushed wastewater through a sewer system towards a storage chamber. Greek and Roman civilizations used domestic wastewater at the perimeters of major cities (Athens and Rome). Wastewater was transported to the agricultural fields to be used as fertilizer for crops and orchards.

We could potentially reuse 6.6 billion m^3 of water by 2025, compared to the current 1.1 billion m^3 per year. That would require an investment of less than €700 million and would enable us to reuse more than half of the current volume of water coming from EU wastewater treatment plants theoretically available for irrigation, avoiding more than 5% of direct extraction from bodies of wastes and groundwater.

[1] European Commission, 2012

Other links:
www.youtube.com/watch?v=pXaXjzbccPo
www.youtube.com/watch?v=arVtT-RCc7k

Promotion of agricultural products

Promotion campaigns about EU farm products are designed to open up new market opportunities for EU farmers and the wider food industry, as well as helping them build their existing business.

Promotion policy rules set out how EU funding – rising from €142.5 million in 2017 to €188.5 million in 2018 and €200 million in 2020 – can be used for information and promotion initiatives in EU member states and countries outside the EU.

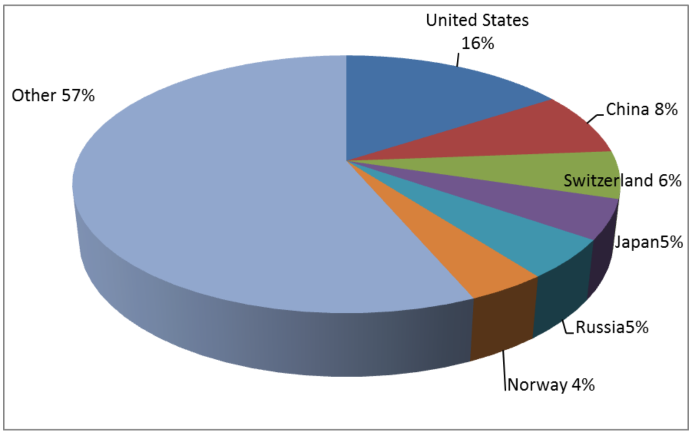
There are two kinds of promotion action:

- those run by European trade or inter-trade associations and co-financed by the EU
- those run directly by the EU itself, such as diplomatic offensives by the Commissioner in non-EU countries to develop agri-food trade, or participation in fairs and communication campaigns to promote EU farm products

The 2019 work programme focuses on campaigns aimed at non-EU countries with the highest potential for growth such as Canada, Japan, Mexico and Korea. Within the EU itself, the EU will co-finance campaigns designed to promote the different EU quality schemes and labels: organic, protected designation of origin - PDO, protected geographical indication - PGI, traditional speciality guaranteed -TSG, product of EU's outermost regions.

Public authorities have critical role in ensuring adequate capacity for effective monitoring and enforcement of regulations on food advertisements and product promotion.

Eu-28 exports of agricultural products by main partner, 2018



Source: https://ec.europa.eu/chafea/agri/funding-opportunities/instructions-on-the-use-of-the-signature-enjoy-it-s-from-europe

In 2018 EU exported for 137 EUR billions of agricultural products, this was 0.4% less than in 2017. Between 2002 and 2018, trade measured in value more than doubled, equivalent to an average annual growth of 5.0%, with exports (5.8%) growing faster than imports (4.3%).

The United States was the main recipient of EU-28 exports of agricultural goods, with 16% of the total.

The most exported groups:

- **Foodstuffs (57%)**
- **Vegetable products (22%)**
- **Animal products (20%)[1]**

Source: https://ec.europa.eu/eurostat/statistics-explained/index.php/Extra-EU_trade_in_agricultural_goods

[1] Eurostat, 2019

Diet changes

In order to feed the world's rapidly expanding population with healthy diets, the scientists said more fruit and vegetables must be produced alongside a shift to plant-based proteins. Such a shift would also reduce land use and cut greenhouse gas emissions.

Harvard University's "healthy eating plate" guide recommends half of our diets consist of fruit and vegetables, a quarter whole grains and the remaining quarter protein, fat and dairy. [1]

The WHO projects that diabetes will be the 7th leading cause of death in 2030. Estimated 85 - 95% cases of diabetes in adults are type 2, which is associated with poor diets and sedentary lifestyles.

Unless the appropriate changes are made, feeding the 9.8 billion people expected to make up the global population by 2050 will require 12 million more hectares of arable land and at least one billion more hectares of pasture land.

It is recommending we get most of our protein from nuts and legumes (such as beans and lentils) instead of meat.

The dominant consumption pattern in the EU can be denoted as a diet with a considerable intake of animal-based products, fats, added sugars, refined carbohydrates as well as more processed foods while simultaneously showing a lower dietary intake of vegetables, grains and legumes.

We observe three trends in consumption:

- consumer involvement in flexitarianism or semi-vegetarian diets in order to reduce their meat intake
- consumer interest into local agricultural produce in order to (re)connect with the food one eats
- conscious consumerism or greening of food consumer behaviour in order to practise one's beliefs. This trend is about 'alternative' or 'avantgardistic' consumption styles under such labels as slow food, organics, collaborative consumption, simply living, anti-consumption, cultural creatives, prosumerism, etc. Part of this trend of conscious consumerism put emphasis on social justice or true pricing.

Over 50% of the European population is overweight and more than 20% are obese.[1] Unhealthy diet is the leading risk factor for disease and mortality in Europe, and affects poorer population groups the most severely. Unhealthy diets are responsible for 49% of the burden of cardiovascular disease - the leading cause of death in the EU. Chronic diseases - often diet-related - account for 70 - 80% of healthcare costs in the EU. This corresponds to €700 billion and this number is expected to increase in the coming years. [2]

Success in implementing sustainable diets at the population level ultimately depends on consumers' willingness and ability to change behaviour. Behaviour change is arguably the most difficult to achieve.

Other links:
www.euronews.com/2019/01/17/what-should-you-eat-to-stay-healthy-and-save-the-planet-euronews-answers
www.foodnavigator.com/Article/2018/09/26/What-will-be-the-top-trends-for-the-Nordic-region-in-2019-Fazer-picks-5
www.foodnavigator.com/Article/2018/12/12/Clean-eating-vegetarian-craft-lifestyle-trends-having-profound-impact-on-UK-food-choices
www.foodnavigator.com/Article/2016/08/03/Spotlight-on-meat-free-trends-innovation-in-Europe-Country-by-country#news

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[1] www.health.harvard.edu/staying-healthy/healthy-eating-plate
[2] WHO, 2008
[3] European Commission, 2019

Sustainable diet

Sustainable diets are those diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimizing natural and human resources.[1]

Climate impact from primary production of food: Low, Medium, and High CO_2e values per kg edible weight:[2]

Low < 1 kg CO_2e/kg	Medium 1 - 4 kg CO_2e/kg	High > 4 kg CO_2e/kg
• Field vegetables • Root vegetables • Greenhouse vegetables (heated with renewable resources) • Potatoes • Beans, peas, lentils • Cereals • Pasta • Bread • Fruits, local (apples, pears) • Vegetable oil (palm*, coconut) • Sugar	• Poultry • Greenhouse vegetables (heated with fossil fuels) • Rice • Fish • Vegetable oil (olive, rape) • Sweets • Snacks • Fruits (bananas, melons) • Vegetables imported from a far distance • Wine • Eggs • Milk, yoghurt	• Beef • Lamb • Pork • Cheese • Tropical fruits and vegetables transported by air • Butter

* Palm oil can in principle have a low climate impact due to the high efficiency of its production. However, the rise of demand for palm oil has been associated with deforestation, which affects biodiversity and raises the climate impact of palm oil.

Summary of potential actions individuals might take to achieve a more sustainable and healthy diet:[3]

Target to achieve a more plant-based diet	Prefer and use more	Avoid and use less
Fruits and vegetables	Use more and different varieties of fruits and vegetables. Prefer seasonal products.	Inform decisions about place of production, seasonality and excessive irrigation. Avoid juices with added sugar.
Meat and dairy	Consume in moderation. Prefer plant-based proteins. Have meatless days.	Eat less red meat (less often, and smaller portions). Avoid high content of saturated fats.
Pulses	Use as protein source. Use more varieties.	Avoid salt during cooking.
Fish	Use more and different varieties. Prefer oily fish from sustainable fishing grounds or aquaculture.	Avoid fish products with high salt content, e.g. preserved fish and fish sauces.
Cereals	Prefer whole grain cereals. Use different varieties.	Avoid processed products with added sugar and salt.

[1] FAO, 2010
[2] Nordic Nutrition Recommendation, 2012
[3] European Public Health Association

Other links: www.foodnavigator.com/Article/2019/07/19/Consumers-confused-over-sustainable-and-organic-Regenerative-food-production-in-Crete

Agro-food sector and tourism

In recent decades, tourism has become one of the most important service industries in the global economy and governments are developing active and innovative policies to build a competitive, inclusive and sustainable tourism sector. In the OECD area tourism directly contributes on average 4.1% of GDP, 5.9% of employment and 21.3% of service exports[1]. Part of its importance lies in the wide range of services required to produce tourism products: transportation, accommodation, information, marketing, financial services, insurance, etc.; as well as in the strong linkages with other sectors such as agro-food and the creative industries.

The focus of many tourists has changed from the classic 'must see' physical sights, such as museums and monuments, towards a 'must experience' imperative to consume intangible expressions of culture, such as atmosphere, creativity and lifestyle. Food is one of the main elements stimulating this shift. Indeed, food and gastronomy are artistic and cultural expression and one of the most noticeable examples of the tourism experience. This provides new opportunities for tourism destinations and at the same time creates new challenges, particularly in the areas of experience development, marketing and branding.

Rural areas with specific history, traditions and enogastronomic heritage are suitable for the development of successful food niches. Authenticity in food experiences is important because of the appeal this can make to the wider demands of tourists.

The relationship between tourism and food experiences can play an important role in local development. Both food and tourism have a wide range of linkages to other areas of the economy that tend to increase the value of these activities to the local economy.

Source: www.contiki.com/v-ch193gn3268u/-/media/cml/homepage-redesign/eat.jpg?w=788&hash=E29BF3AA0AF7F151484FC3665985CF0417F800EF

Other links: www.youtube.com/watch?v=Jm5j76HcbcU
www.youtube.com/watch?v=1HpK2PnFPYc
www.youtube.com/watch?v=UMJnO_o5mMc

The relationship between tourism and food experiences can play an important role in local development. Both food and tourism have a wide range of linkages to other areas of the economy that tend to increase the value of these activities to the local economy.

[1] OECD, 2016

4 Annex II. Question for e-learning

Questions

1. What are the challenges of sustainable agriculture for your farm/farms and your country? (key words: sustainable agriculture, climate change, food security, CO2 emissions, greenhouse gas emissions)
2. Which principles of agroecology are you planning to implement in the future? (Key words: agroecology, ecological farming, sustainable agriculture)
3. Do you know of any good example of circular economy in your local environment? (Key words: circular economy, sustainable agriculture, closed loop, recycle)
4. How can you enhance biodiversity at your farm? (key words: biodiversity, EU biodiversity Strategy, habitat loss, ecosystem degradation)
5. What can you do at your farm to further close the loop? Do you know of any good example in your local environment? (key words: closed loop, circular economy, sustainable agriculture, recycling)
6. What are the limits for your farm/farms in your country to become an organic farm? (key words: organic farms, ecological agriculture, crop rotation, GMO, pesticides)
7. Did you get new idea on how can you better manage water on your farm/farms in your country? (key words: water management, irrigation, climate change)
8. How efficient is wastewater treatment in your local environment? (key words: water managements, waste water, nutrients, water treatment plant)
9. Do you give enough funds for innovations on your farm/farms in your country? (key words: innovations, start-ups)
10. What are your short term plans regarding next innovation at your farm? (key words: innovations, start-ups)
11. In what sense do you see synthetics minerals dilemmas relevant for your farm/farms in your local environment? (key words: fertilizers, nutrients, healthy soil, biodiversity)
12. Could you state a case on biofertilizer experience? (key words: fertilizers, nutrients, healthy soil, biodiversity)
13. What are your experiences with biocarbon? (key words: fertilizers, biocarbon, soil fertility)
14. How do you solve the (further)use of by-products on you farm?(key words: by-products, closed loop agriculture)
15. What are by your opinion advantages and disadvantages on global and local level of GMOs? (key words: genetical engineering, GMO)
16. What is on your opinion realistic use of nanotechnology in farming in next 3 years? (key words: nanotechnology, nanoparticles)
17. Where do you see the benefits of involving agroforestry in your farming practice? (key words: agroforestry, silvopasture, biodiversity, forest farming)
18. Would you produce or use as animal feed alternative proteins like insects, algae, grown meat on your farm? (key words: proteins, diets, insects, grown meat, algae)

19. Can you describe yourself as innovative in using renewable energy on your farm/country? (key words: renewable energy, biomass, greenhouse gas emissions)
20. How would you describe biomass as appropriate for production in your country? (key words: biomass, renewable energy, forestry biomass, greenhouse gas emissions)
21. What are advantages and disadvantages for production of biogas? (key words: biogas, biomethane, renewable energy, greenhouse gas emissions).
22. How familiar are you with bio-waste collection system in your local environment? – Please describe (key words: bio-waste, by-products, closed loop agriculture, compost).
23. Could you describe the opportunities and threats for precision/smart/digital farming? (key words: precision farming, smart farming, digital farming, technological innovation, digital technology)
24. How do you see your farm in year 2024 in the light of digital technology? (key words: digital technology, drones, smart phones, technological innovation).
25. What do you think will be the benefits of blockchain technology for your farm/farms in your country? (key words: blockchain, digital technology, big data)
26. What biodegradable packaging do you see using on your farm in the future? (key words: biodegradable packaging, renewable packaging, compost, waste).
27. Do you use bioplastics as packaging with your products? What are the main obstacles for not using it (more)? (key words: bioplastics, renewable packaging, biodegradable)
28. Can you foresee biopolymers in the future of your farming? (key words: biopolymers, biomass, renewable packaging)
29. How do you think we could use more glass packaging in agriculture? (key words: glass packaging, glass reuse, renewable packaging)
30. What would be the main benefits of smart packaging in your agricultural activity and why? (key words: smart packaging, new technologies in packaging, active packaging, intelligent packaging)
31. What do you reuse on your farm? How would you develop reuse systems further? (key words: reuse, refill, closed loop, packaging)
32. How would you prefer CAP to be reformed? (key words: CAP, EU direct payments)
33. How do you think greening will change the way farms operate in your local environment? (key words: CAP, greening, environmental EU funds, EU direct payments, biodiversity)
34. Could you state any of your consideration on climate changes in relation to your farm/farms in your local environment?

1. (key words: sustainable food system, climate change, sustainable agriculture)

35. How do you think quality scheme labels boost sale of agricultural products? (key words: quality schemes, Protected designation of origin, Protected geographical indication, Geographical indication, Traditional speciality guaranteed).

36. Who do you see will manage your farm in 20-30 years? (key words: young farmers, farmers' age structure, successors).
37. How do you think sharing principle could change agriculture in your local environment? (key words: sharing economy, sustainability, community gardens, food swapping, food consumer networks)
38. What are your experiences with urban gardens in local environment – if any? (key words: urban gardens, micro gardens, city gardens)
39. What do you think are the pros and cons of Indoor farming? (key words: indoor farming, urban gardening, vertical gardens)
40. Where do you see the opportunities and your role in setting up a food bank in your local community? (key words: food donations, food bank, food waste)
41. Which opportunities do you see for improvement in limitation of food waste from production to consumption? (from production to consumption)? (key words: food waste, by-products, food bank, food donation)
42. What did/would persuade you to be a member of a cluster? (key words: cluster, co-operation, networking)
43. Which benefits would you expect for being in a cooperative? (key words: cooperative, co-operation, networking)
44. Where do you see the opportunities to shorten your supply chains? (key words: short supply chains, local food)
45. How effective are you in guaranteeing quality of your soil? (key words: soil management, healthy soil, fertilizers, compost)
46. How can re-use of water benefit you? (key words: water reuse, water management)
47. How successful are you in promoting your agro-products? (key words: promotion, campaigns, quality scheme)
48. How are diet changes in the population affecting the way you do your farming? (key words: diet change, sustainable diet, healthy diet, nutrition)
49. How are you supporting more sustainable diets? (key words: sustainable diet, healthy diet, nutrition)
50. In what way could you get involved with tourism sector? (key words: tourism, promotion, sector cooperation)

5 Annex III. Key words for browsing

Question no.	Topic	Question	Key words
1	Sustainable agriculture	What are the challenges of sustainable agriculture for your farm/farms and your country?	sustainable agriculture, climate change, food security, CO2 emissions, greenhouse gas emissions
2	Agroecology	Which principles of agroecology are you planning to implement in the future?	agroecology, ecological farming, sustainable agriculture
3	Circular approach in agriculture	Do you know of any good example of circular economy in your local environment?	circular economy, sustainable agriculture, closed loop, recycle
4	Biodiversity	How can you enhance biodiversity at your farm?	biodiversity, EU biodiversity Strategy, habitat loss, ecosystem degradation
5	Closed loop agriculture	What can you do at your farm to further close the loop? Do you know of any good example in your local environment?	closed loop, circular economy, sustainable agriculture, recycling
6	Organic agriculture	What are the limits for your farm/farms in your country to become an organic farm?	organic farms, ecological agriculture, crop rotation, GMO, pesticides
7	Sustainable water management in agriculture	Did you get new idea on how can you better manage water on your farm/farms in your country?	water management, irrigation, climate change
8	Nutrients in waste water	How efficient is wastewater treatment in your local environment?	water managements, waste water, nutrients, water treatment plant
9	Innovation in agriculture	Do you give enough funds for innovations on your farm/farms in your country?	innovations, start-ups
10	Innovative agri-start ups	What are your short term plans regarding next innovation at your farm?	innovations, start-ups
11	Fertilizers	In what sense do you see synthetics minerals dilemmas relevant for your farm/farms in your local environment?	fertilizers, nutrients, healthy soil, biodiversity
12	Biofertilizers	Could you state a case on biofertilizer experience?	biofertilizers, fertilizers, nutrients, healthy soil, biodiversity
13	Fertilizing with biocarbon	What are your experiences with biocarbon?	fertilizers, biocarbon, soil fertility
14	By-products in agriculture and thier use	How do you solve the (further)use of by-products on you farm?	by-products, closed loop agriculture, innovation
15	Genetic engineering	What are by your opinion advantages and disadvantages on global and local level of GMOs?	genetical engineering, GMO, innovation
16	Nanotechnology	What is on your opinion realistic use of nanotechnology in farming in next 3 years?	nanotechnology, nanoparticles, innovation

17	Agroforestry	Where do you see the benefits of involving agroforestry in your farming practice?	agroforestry, silvopasture, biodiversity, forest farming
18	Insects as a source of protein for food and feed	Would you produce or use as animal feed alternative proteins like insects, algae, grown meat on your farm?	proteins, diets, diet change, insects, grown meat, algae
19	Renewable energy in agriculture and agro-food sector	Can you describe yourself as innovative in using renewable energy on your farm/country?	renewable energy, biomass, greenhouse gas emissions
20	Biomass in EU	How would you describe biomass as appropriate for production in your country?	biomass, renewable energy, forestry biomass, greenhouse gas emissions
21	Biogas in EU	What are advantages and disadvantages for production of biogas?	biogas, biomethane, renewable energy, greenhouse gas emissions
22	Bio-waste in EU	How familiar are you with bio-waste collection system in your local environment? – Please describe	bio-waste, by-products, closed loop agriculture, compost
23	Precision/smart/digital farming	Could you describe the opportunities and threats for precision/smart/digital farming?	precision farming, smart farming, digital farming, technological innovation, digital technology
24	Digitalization in agriculture	How do you see your farm in year 2024 in the light of digital technology?	digital technology, drones, smart phones, technological innovation
25	Blockchain technology in agriculture	What do you think will be the benefits of blockchain technology for your farm/farms in your country?	blockchain, digital technology, big data
26	Biodegradable food packaging	What biodegradable packaging do you see using on your farm in the future?	biodegradable packaging, renewable packaging, compost, waste
27	Bioplactics in packaging	Do you use bioplastics as packaging with your products? What are the main obstacles for not using it (more)?	bioplastics, renewable packaging, biodegradeble
28	Biopolymers from renewable sources	Can you foresee biopolymers in the future of your farming?	biopolymers, biomass, renewable packaging
29	Glass packaging	How do you think we could use more glass packaging in agriculture?	glass packaging, glass reuse, renewable packaging
30	Smart packaging	What would be the main benefits of smart packaging in your agricultural activity and why?	smart packaging, new technologies in packaging, active packaging, intelligent packaging, innovation
31	Reuse and refill concept	What do you reuse on your farm? How would you develop reuse systems further?	reuse, refill, closed loop, packaging, social innovation
32	Reforming CAP	How would you prefer CAP to be reformed?	CAP, EU direct payments, policy
33	Greening	How do you think greening will change the way farms operate in your local environment?	CAP, greening, environmental EU funds, EU direct payments, biodiversity, policy

34	Common food policy	Could you state any of your consideration on climate changes in relation to your farm/farms in your local environment?	sustainable food system, climate change, sustainable agriculture, policy
35	EU Quality Schemes	How do you think quality scheme labels boost sale of agricultural products?	quality schemes, Protected designation of origin, Protected geographical indication, Geographical indication, Traditional speciality guaranteed, promotion
36	Young farmers in EU	Who do you see will manage your farm in 20-30 years?	young farmers, farmers' age structure, successors
37	Sharing economy in agriculture	How do you think sharing principle could change agriculture in your local environment?	sharing economy, sustainability, community gardens, food swapping, food consumer networks, social innovation
38	Urban agriculture	What are your experiences with urban gardens in local environment – if any?	urban gardens, micro gardens, city gardens
39	Indor farming	What do you think are the pros and cons of Indoor farming?	indoor farming, urban gardening, vertical gardens
40	Food donations	Where do you see the opportunities and your role in setting up a food bank in your local community?	food donations, food bank, food waste, social innovation
41	Food waste	Which opportunities do you see for improvement in limitation of food waste from production to consumption? (from production to consumption)?	food waste, by-products, food bank, food donation
42	Agro-food clusters	What did/would persuade you to be a member of a cluster?	cluster, co-operation, networking
43	Cooperatives	Which benefits would you expect for being in a cooperative?	cooperative, co-operation, networking
44	Short supply chains	Where do you see the opportunities to shorten your supply chains?	short supply chains, local food
45	Degradation and revitalisation of soil	How effective are you in guaranteeing quality of your soil?	soil management, healthy soil, fertilizers, compost
46	Reuse of waste water in agriculture	How can re-use of water benefit you?	water reuse, water management, waste water
47	Promotion of agricultural products	How successful are you in promoting your agro-products?	promotion, campaigns, quality scheme
48	Diet changes	How are diet changes in the population affecting the way you do your farming?	diet change, sustainable diet, healthy diet, nutrition
49	Sustainable diet	How are you supporting more sustainable diets?	sustainable diet, healthy diet, nutrition
50	Agro-food sector and tourism	In what way could you get involved with tourism sector?	tourism, promotion, sector cooperation

6 Annex IV. Knowledge test - quiz

Question no.	Theme	Topics	Question/Answers	Key words	Remarks
1	Circularity	Sustainable agriculture	1. What is sustainable agriculture? A) is the efficient production of safe, high quality agricultural products, in a way that protects and improves the natural environment, the social and economic conditions of farmers, their employees and local communities, and safeguards the health and welfare of all farmed species. B) certified organic agriculture C) agriculture with no green house gass emissions D) agrucutlural practices with high productivity methods	Correct answer: A	if wrong, please read again the topic Sustainable agriculture
3	Circularity	Circular approach in agriculture	2. What is the circular economy in agriculutre? A) recyling all the waste B) efficiently rotating the crops C) production of agricultural commodities using a minimal amount of external inputs, closing nutrient loops and reducing negative discharges to the environment, valorising agri-food wastes D) ecological farming	Correct answer: C	if wrong, please read again the topic Circular approach in agriculture
4	Circularity	Biodiversity	3. Key treats to biodiversity: A) habitat loss (in particular through urban sprawl, agricultural intensification, land abandonment, and intensively managed forests), pollution, over-exploitation (in particular fisheries), invasive alien species and climate change B) heavy industry and transport C) farming D) rising average annual temperatures and melting glaciers	Correct answer: A	if wrong, please read again the topic Biodiversity
6	Circularity	Organic agriculture	4. The EU organic logo can only be used: A) only when European Safety Authority grants a permit B) on products that have been certified as organic by an authorised control agency or body. This means that they have fulfilled strict conditions on how they are produced, transported and stored C) when European Commission issues a Certificate for use D) on the ecological products produced in EU	Correct answer: B	if wrong, please read again the topic Organic agriculture
7	Circularity	Sustainable water management in agriculture	5. What % of the country's water used for agriculture in Europe is sourced from other countries outside the borders of the European Union? A) 25% B) 55% C) 30% D) 40%	Correct answer: D	if wrong, please read again the topic Sustainable water management in agriculture
9	Innovation/New products and technologies	Innovation in agriculture	1. Which areas has European Commission identified as priorities for research and innovation? A) resource management – notably soil, water, nutrients and genetic resources, healthier plants and animals, integrated ecological approaches, new openings for rural growth – involving the deployment of new business models, circular value chains and digital transformation, enhancing the human and social capital and rural areas B) digitalization and big data C) genetical engineering and nanotechnology D) renewable energy in agriculture	Correct answer: A	if wrong, please read again the topic Innovation in agriculture
12	Innovation/New products and technologies	Biofertilizers	2. What is the disadvantage of biofertilizers? A) they cannot replace the chemical fertilizers B) difficult to store C) they are not cost effective D) by using biofertilizers, plants can not be protected against drought	Correct answer: B	if wrong, please read again the topic Biofertilizers
13	Innovation/New products and technologies	Fertilizing with biocarbon	3. What benefits can biocarbon offer to the soil? A) reduced nitrogen runoff, possible nitrous oxide emissions reduction, improved soil fertility through increased cation-exchange capacity, moderation of soil acidity, better water retention, Increased number of beneficial soil microbes B) bigger soil acidity and better water seepage C) increased nitrogen runoff D) decreased cation-exchange capacity	Correct answer: A	if wrong, please read again the topic Fertilizing with biocarbon
17	Innovation/New products and technologies	Agroforestry	4. Silvopasture is: A) production in peri-urban and urban areas B) widely spaced woody vegetation arround urban areas C) combining woody with forage and animal production D) trees and crops are grown seperately	Correct answer: C	if wrong, please read again the topic Agroforestry
18	Innovation/New products and technologies	Insects as a source of protein for food and feed	5. How much water we need if we want to get 1 kg of protein from insects: A) 200l B) 30.000l C) 150l D) 15l	Correct answer: D	if wrong, please read again the topic Insects as a source of protein
19	Energy	Renewable energy in agriculture and agro-food sector	1. The total amount of renewable energy produced on farms can be estimated at 22.6 Mtoe (milliontonnes of oil equivalent) in 2015, which represents around A) 19% of total renewable energy production in the EU B) 5% C) 10% D) 25%.	Correct answer: C	if wrong, please read again the topic Renewable energy in agriculture and agro-food sector
		Renewable energy in agriculture and agro-food sector	2. The biggest % of production of renewable energy from agricultural sources (EU-15) is from: A) biodiesel crops B) cereal straw C) short rotation forestry D) ethanol crops	Correct answer: A	if wrong, please read again the topic Renewable energy in agriculture and agro-food sector
20	Energy	Biomass in EU	3. The most significant renewable energy source in the EU: A) sollar B) biomass C) wind D) geothermal heat	Correct answer: B	if wrong, please read again the topic Biomass
21	Energy	Biogas in EU	4. EU-28 primary supply of gaseous fuels (natural gas and biogas) comes mainly from A) organic waste B) manure C) dedicated crops D) microalgae	Correct answer: C	if wrong, please read again the topic Biogass
22	Energy	Bio-waste in EU	5. Which country in Europe collects and separates most tons of biowaste? A) Finland B) France C) Sweden D) Germany	Correct answer: D	if wrong, please read again the topic Bio-waste

23	Digitalization/IT	Precision/smart/digital farming	1. How much time can be reduced when using drones to traditional farm machines on an hectar? A) from 90 to 10 minutes B) from 90 to 30 minutes C) from 100 to 10 minutes D) from 100 to 30 minutes	Correct answer: A	if wrong, please read again the topic Precision/smart/digital farming
		Precision/smart/digital farming	2. What % of new patent applications relating to precision and conventional equipment for agriculture registred worldwide between 2010 and 2014 were registered in Europe A) 32% B) 20% C) 28% D) 15%	Correct answer: D	if wrong, please read again the topic Precision/smart/digital farming
24	Digitalization/IT	Digitalization in agriculture	3. The European Innovation Partnership for Agricultural productivity and Sustainability (EIP-AGRI) was launched by the European Commission in 2012 to: A) brings together innovation actors (farmers, advisors, researchers, businesses, NGOs, etc.) and helps to build bridges between research and practice to foster a competitive and sustainable agriculture and forestry sector B) to help foster international cooperation between farmers C) to support and connect small farmers D) to support environmentaly friendly farming	Correct answer: A	if wrong, please read again the topic Digitalization in agriculture
25	Digitalization/IT	Blockchain technology in agriculture	4. The biggest advantage of blockchain technology is A) cutting the middleman B) the control in production process C) the ability to track food from harvest to storage to delivery D) avoiding price fluctuations	Correct answer: C	if wrong, please read again the topic Blockchain technology in agriculture
		Blockchain technology in agriculture	5. A case study in the Netherlands revealed that small and medium-sized businesses A) don't invest in blockchain becouse they see no use in it and don't need it B) are too small or lack the expertise to invest in the blockchain by themselves C) don't have enought connection to the market D) invest the most in the blockchain technology	Correct answer: B	if wrong, please read again the topic Blockchain technology in agriculture
27	Packaging	Bioplactics in packaging	1. PEF is: A) a federation of polymer producers in Europe B) fossil based polymer C) is not bio-degradable polymer D) a 100% bio-based polymer whose properties are very similar to PET and recyclable within the PET stream	Correct answer: D	if wrong, please read again the topic Bioplastics in packaging
28	Packaging	Biopolymers from renewable sources	2. Biopolymers from renewable resourses A) derive from biomasses and as such have a much lower environmental footprint than oil-based polymers, thanks to reduced CO2 emissions in their Life Cycle Assessment B) are made from waste C) are produced from ecological by-products D) cannot be produced for commercial use	Correct answer: A	if wrong, please read again the topic Biopolymers from renewable sources
29	Packaging	Glass packaging	3. Countries that have excellent separation collestion of glass are: A) Denmark, Finland, Italy B) Germany, France, Denmark C) Belgium, Slovenia, Sweden D) Netherlands, Austria, Luxemburg	Correct answer: C	if wrong, please read again the topic Glass packaging
30	Packaging	Smart packaging	4. The general task of evaluating substances intended for use in food contact materials as well as carrying out additional risk assessments in relation to food contact materials are carried out by A) European Food Safety Authority's (EFSA) Panel on Food Contact Materials, Enzymes, Flavourings and Processing Aids (CEF) B) European Commision C) European Parliament D) national ministries for agriculture	Correct answer: A	if wrong, please read again the topic Smart packaging
31	Packaging	Reuse and refill concept	5. The big problem of todays refill concept is: A) regulation B) lack of network from procuders to consumers C) lack of standardized containers D) no interest on the market	Correct answer: C	if wrong, please read again the topic Reuse and refill concept
32	Policies/structure/models/organization	Reforming CAP	1. The EU supports farmers with A) є 58,82 billion in 2018 (which is 36,74% of the total EU budget B) є 102 billion in 2018 (which is 56,74% of the total EU budget C) є 28,82 billion in 2018 (which is 16,74% of the total EU budget D) є 10,82 billion in 2018 (which is 21,74% of the total EU budget	Correct answer: A	if wrong, please read again the topic Reforming CAP
33	Policies/structure/models/organization	Greening	2. Farmers receive the green direct payment if they comply with A) 100% ecological farming B) crop diversification, maintaining permanent grassland and dedicate 5% of arable land to areas beneficial for biodiversity C) environmentaly friendly livestock farming D) digitalization on the farms	Correct answer: B	if wrong, please read again the topic Greening
35	Policies/structure/models/organization	EU Quality Schemes	3. Products with protected designation of origin A) are those that have the strongest links to the place in which they are made B) are those with relationship between specific geografical region and the name of the product C) highlight the traditional aspects such as the way the product is made or its composition, without being linked to a specific geographical area D) are those that the European Commission approved	Correct answer: A	if wrong, please read again the topic EU Quality Schemes
36	Policies/structure/models/organization	Young farmers in EU	4. The highest proportions of young people (below 40 years old) in the agricultural labour force were reported in A) Italy and Greece B) Portugal and Spain C) Luxembourg and Denmark D) Greece and Spain	Correct answer: C	if wrong, please read again the topic Young farmers in EU
39	Policies/structure/models/organization	Indor farming	5. The largest indor farm in Europe is in: A) Sweden B) Germany C) Denmark D) UK	Correct answer: D	if wrong, please read again the topic Indor farming
45	Policies/structure/models/organization	Degradation and revitalisation of soil	6. How much soil is produced each year from natural soil forming processes A) 0.025 to 0.125 mm B) 1.000 to 1.250 mm C)1.250 to 1.500 mm D) 1.500 to 1.750 mm	Correct answer: A	if wrong, please read again the topic Degradation and revitalisation of soil
47	Behaviour/Promotion/Education	Promotion of agricultural products	1. Which are the EU quality schemes? A) EU Food and drinks B) Food from Europe C) Protected designation of origin, Protected geographical indication, Geographical indication of spirit drinks and aromatised wines, Traditional speciality guaranteed D) Copyright EU	Correct answer: C	if wrong, please read again the topic Promotion of agricultural products

48	Behaviour/Promotion/Education	Diet changes	2. Harvard University’s “healthy eating plate” guide recommends A) half of our diets consist of fruit and vegetables, a quarter whole grains and the remaining quarter protein, fat and dairy. B) 33% of of fruit and vegetables, 33% if whole grains, 33% of protein, fat and dairy C) 20% of fruit and vegetables, 60% of whole grains and 20% of protein, fat and dairy D) 40% of fruit and vegetables, 40% of whole grains and 20% of protein, fat and dairy	Correct answer: A	if wrong, please read again the topic Diet changes
49	Behaviour/Promotion/Education	Sustainable diet	3. Sustainable diets are: A) those without GMO B) those with low carb C) those with a lot of ecologicaly grown fruit and vegetables D) those diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations	Correct answer: D	if wrong, please read again the topic Sustainable diet
50	Behaviour/Promotion/Education	Agro-food sector and tourism	4. Better alternatieves from where can we get proteins: A) low fat dairy B) beans and lentils C) whole grain D) protein sport bars	Correct answer: B	if wrong, please read again the topic Sustainable agriculture
	Behaviour/Promotion/Education	Agro-food sector and tourism	5. In the OECD countries tourism directly contributes on average A) 2,6 % of GDP B) 4,1% of GDP C) 6.5% of GDP D) 9.2% of GDP	Correct answer: B	if wrong, please read again the topic Agro-food sector and tourism