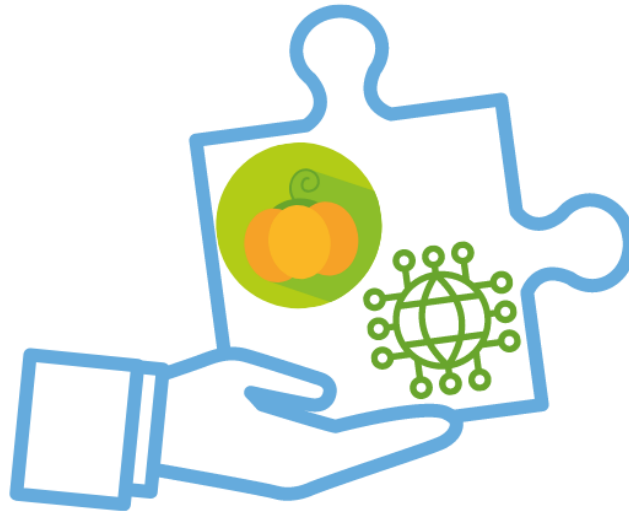


Agriculture 4.0: Equipping young NEETs with basic & advanced digital and green skills

Module 4

Challenges of technology in agriculture



Developed by



Disclaimer:

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1. Introduction

Following the analysis of the findings from the literature review and field research activities there is a strong need to train and upgrade rural young people to become attractive, employable and to take up central positions in the circular and regenerative economy.

Adapted training material will be further described and developed for practical implementation within our project. The training material will provide young / women NEETs with a package of digital learning resources designed based on the concept of micro-learning: short and coherent learning nuggets delivered in multimedia formats aiming to promote blended learning methodologies. The digital learning nuggets will include a variety of resources such as interactive games, podcasts, e-learning videos, interactive case studies, infographic resources, etc.

2. Content

Main objectives

- Understand how bad practices in agriculture harm the environment
- Comprehend what are the challenges behind the application of new technologies in agriculture
- Decipher how to overcome the digital divide among farmers
- Investigate what kind of technology and infrastructure we have available
- Learn what is food waste, why it is harmful for the planet, and how to overcome it
- Study what kind of data collection technology we have available

Learning contents

The module consists of 5 submodules:

- 4.1 Digital Divide: lack of digital education of farmers
- 4.2 Large investment in infrastructure and technologies
- 4.3 Climate-Smart Agriculture
- 4.4 Food Waste
- 4.5 Data Collection

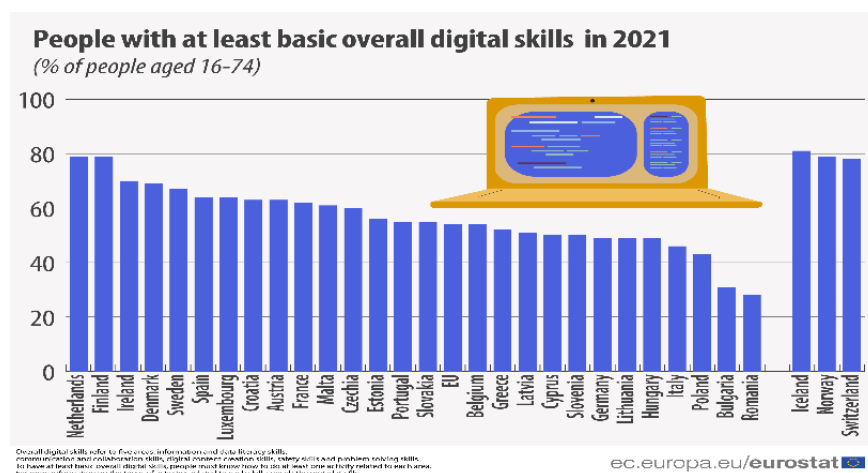
Learning outcomes

Young NEETS will acquire a comprehensive understanding of how “old-fashioned” practices in agriculture are worsening the climate change situation and are essentially ineffective. On the other hand, we will learn how new technologies are helping farmers to be more efficient, how it reduces food waste, and how it provides precise data about fields.

Digital Divide: lack of digital education of farmers

According to Eurostat, only a 54% of adults in Europe (aged 16 to 74) are digitally literate. This grade impacts the European Union greatly, as it hugely impacts the way citizens access and process information, as well as many other things. Unfortunately, this percentage is highly linked with demographics as, mainly, digital literacy is correlated with income and education. Even though this is a problem for all citizens, when we apply this to farmers, we can easily find that they are one of the most disadvantaged affected groups of population. Although, in this case, the most serious part isn't not understanding how to use smartphones, an internet browser, or social media, but also the access to the information of the available technology that is not only going to save them time and resources, but also money.

Farmers work protracted hours while making a huge physical effort, expose themselves to polluted air and extreme weather conditions, and more. Technology is an answer to ease up these conditions, lessening their dangers and promoting the acquisition of new skills, improve their ability to self-organize and receive assistance and overall, improve their working conditions. Also, moving forward on this subject ensures more productive farms.



But what is the “digital divide” and why does it matter?

This term refers to the disparities in skills related to the practical and correct use of the available technology. That is, cognitive and technical skills, but also internet connection.

When it comes to rural areas, also named “low settled areas”, Eurostat says that even though there was a vertiginous growth from 2013 to 2021, only the 37% of its population have internet access.

Technology has proven multiple times to have the power to upgrade many traditionally analogical industries in a way that makes work safer, more accurate, and faster. Tackling the digital divide is important because it contributes to the critical processing and validation of new information, to ensure access to healthcare, to promote the adaptation to innovative new technologies in their field of work, favor connection between farmers and networking to increase their business opportunities, among other things. However, this will only be possible through practice in order to get familiar with all its possibilities and boost their digital literacy.

All in all, every innovative technological upgrade intends on improving the quality and sustainability of the produced goods, earn money for the farmers in the long-run, ensuring safer working conditions and save time for the growers, even though this implies certain level of specialization for the hired workers.

Now that we have stated the benefits of adapting to the new technological possibilities in this field of work, we will begin to point out the different identified challenges of technology in agriculture, in order to make all of the participants aware of the weak points to take into account and, also, how to overcome them.

Large investment in infrastructure and technologies

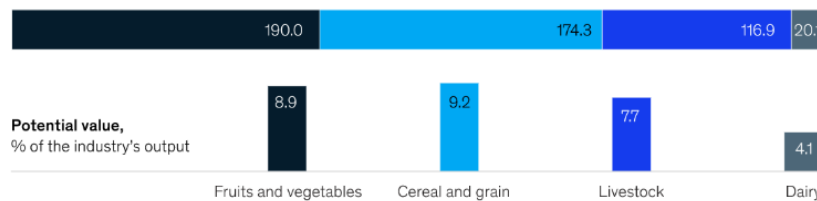
We will first manage the necessary investment in infrastructure and technologies.

Not everyone has access to new technologies or the option of digitalizing their businesses due to financial reasons. Even in Western countries like the United States, only a quarter of its farms use connected equipment or devices to access data. However, this is the first necessary step in order

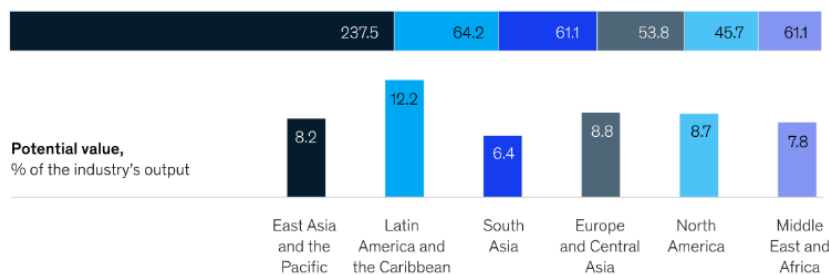
to achieve the digital optimization of this field of work, as an improvement in this area will add more than \$500 billion to global gross domestic product by 2030, together with a productivity improvement of 7 to 9 per cent.

Agriculture connectivity could unlock more than \$500 billion in GDP by 2030.

Distribution of potential value from connectivity in 2030, by subindustry, \$ billion



Distribution of potential value from connectivity in 2030, by region, \$ billion



Source: McKinsey & Company. "Agriculture's connected future: How technology can yield new growth".

Available at: <https://www.mckinsey.com/industries/agriculture/our-insights/agricultures-connected-future-how-technology-can-yield-new-growth>

The radical transformation agriculture has gone through in the last 50 years has been able to expand the productivity of this sector, with special regard to data and connectivity. Artificial Intelligences, sensors and other emerging technologies improve harvesting, and contribute to sustainability and resilience. However, without a proper connectivity infrastructure, these changes cannot become a reality.

Therefore, the industry needs to address two main challenges: the development of connectivity infrastructure; and in the cases where connectivity is already in place, a leap in further quality

must be taken. The introduction of these new tools will provide farmers with new capabilities, like: massive internet of Things; mission-critical services; and near-global coverage.

Available options

When it comes to available options both nationally and internationally, we find several interesting opportunities. First of all, crop monitoring is one of the most powerful tools available, as it can further enhance the observation and care of crops by providing farmers with useful information about weather data, irrigation or nutrient, among others. Sensors can help workers in their daily tasks by improving their capacity to predict deficiencies; maximizing the revenue of its crops by paying more attention to the quality of the products; or getting early warning on diseases, pests, natural disasters, and so on.

Secondly, livestock monitoring is another technique that must be taken into account. By implementing chips and body sensors to animals, farmers can easily get information about their temperature, pulse, or blood pressure in order to detect illnesses beforehand. This technology will bring numerous advantages, such as the prevention of herd infections, the tracing of disease outbreaks, the improvement food quality and the enhancement of the living conditions of animals.

An appropriate management of the inventory can definitely make a difference, and that is why a good building and equipment management is paramount to save costs. Employing chips and sensors to monitor and measure warehouses and barns can dramatically reduce inventory costs, post-harvest losses and energy consumption, as well as improve storage conditions and save time to farmers, by automatically reordering what is necessary.

The extensive benefits of farming by drone have already been experimented in several countries around the globe. This new technology not only helps to spray fields more easily, but it also brings a more efficient way of surveying crops and herds thanks to the transferring of real-time data to other interconnected machinery.

Finally, a considerable way of boosting the autonomy of machinery through better connectivity can be achieved with autonomous farming machinery. With highly precise GPS technology,

together with computer vision and sensors, workers can use their equipment without human intervention.

Climate-Smart Agriculture

For some decades now, the steady rise of temperatures, together with an increasing percentage of the world population – nearly 690 million people today - facing hunger, is raising concern about how to achieve food security, as well as about how to reduce greenhouse gas (GHG) and carbon emissions. Thus, with the growing of the global population, the draining of seas and lakes, and the lack of available land and farming inputs, humanity is facing a problem that needs immediate answers. Climate change is a key issue to be tackled in order to meet the Sustainable Development Goals (SDGs), and transforming the existing agricultural systems is crucial for that purpose.

Similarly, our agricultural practices are seriously harming the environment, too. Agriculture generates between 19% and 29% of the total GHG emissions, it consumes over 90% of the world's water, and food produced globally has been proved to be inefficiently distributed, since a third of it is lost or wasted, causing more people to starve every day. Consequently, since around 2.5 billion people worldwide depend on agriculture for their subsistence, we need to make substantial investments to adapt our approach to mitigate climate change and achieve food security.

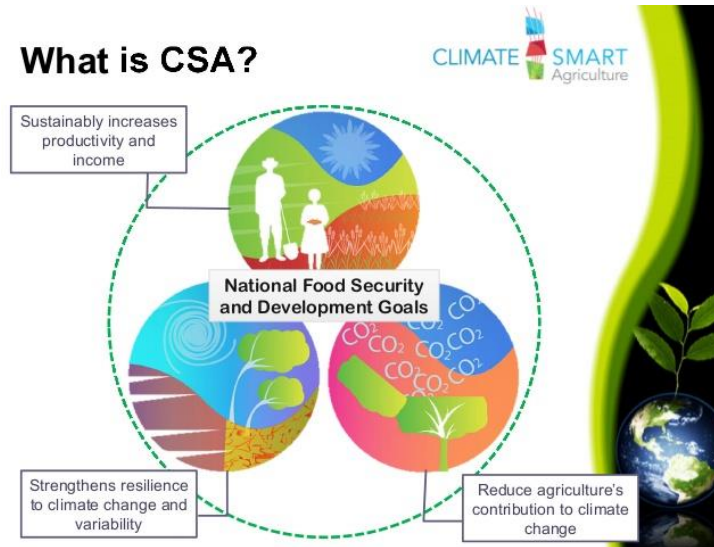
What are our alternatives?

This evolution in agriculture must be attained through integrated, multispectral approaches that are gender-transformative, inclusive, environmentally-friendly and supportive of the most disadvantaged sectors of society. Climate-Smart Agriculture (CSA) meets all these requirements. This integrated approach, coined by the Food and Agricultural Organization of the United Nations (FAO), aims to tackle three main issues:

- Mitigation. CSA is committed to minimizing GHG emissions and avoiding deforestation.
- Adaptation. The goal is to help farmers adapt to short-term risks and long-term stresses.

Another crucial objective is to protect the ecosystem in order to maintain productivity.

- Productivity. This approach intends to increase agricultural productivity in a sustainable manner, thus raising food security.



Source: Presentation by Irina Papuso and Jimly Faraby, Seminar on Climate Change and Risk Management, May 6, 2013.

Why CSA?

Even though it is inspired in existing knowledge, technologies and principles of sustainable agriculture, CSA represents an interesting approach due to several reasons. CSA helps strengthen national and local institutions; it has an integral focus on addressing climate change; it creates the perfect balance between the synergies between productivity, adaptation and mitigation; and creates new funding opportunities to alleviate the deficit in investment.

Entities such as the World Bank Group (WBG) are strongly encouraging CSA by investing large sums of money into the implementation of this brand-new idea. For instance, in 2020, 52 per cent of WB financing in agriculture was destined to sustainable agriculture projects, and in the first and following Climate Change Action Plan (2016-2020), the WB announced that it would engage with countries to help them adapt CSA to their agricultures. The Climate-Smart Agriculture Investment Plans (CSAIP) accounts for more than \$2.5 billion, which translates into 80 million people across the world being helped.

Apart from the above-mentioned benefits of implementing CSA, we have multiple examples across the globe where this method is making a huge difference. Some of the countries that are already taking a chance on this model are Bangladesh, Senegal, Uruguay, the Philippines, Brazil, Morocco, or Mali, among many others.

More importantly, the countries that are already implementing CSA are also creating a powerful network where knowledge is shared among members, thus making CSA terminology more approachable for everybody. With the support of international entities and an increasing number of countries, CSA is gaining momentum over other alternatives that are not as efficient or sustainable.

Food Waste

It is expected that in 2050 the world population will surpass 9.7 billion people, which translates into more people needing to be fed. This is likely to become a serious conundrum if our agricultural techniques do not change soon, as millions of tons of food – roughly 40 per cent of the total food produced globally - are wasted every year due to the inefficiency of our methods. Nonetheless, we need to differentiate between food waste and food loss. The latter refers to any edibles that go uneaten at any stage, which includes uneaten food at homes and supermarkets, crops left in the field, food damaged in transportation. On the other hand, food waste alludes to a specific part of food loss, that is, food thrown away by retailers due to its color or appearance, as well as half-eaten dishes at restaurants or homes.

We find numerous causes that lead to food waste: bad weather, overproduction, unstable markets, overbuying, processing problems, poor planning, etc. This waste translates into huge losses for supermarkets, as unsold goods cost billions of dollars to stores, not to mention the massive impact it has on the most vulnerable sectors of society, who continue to starve due to poor business strategies that lead to food being thrown away.

Similarly, food waste is negatively affecting our environment. When food is put into landfills, it starts forming methane, which is highly harmful for the environment. Moreover, food waste is also responsible for fresh water pollution.

Existing technology

Apart from the already mentioned CSA, there already exist multiple alternatives that are more environmentally-friendly and efficient. For instance, there exist real-time weather forecasting mechanisms that help farmers to choose the best time to irrigate, fertilize, harvest, spray pesticides. Consequently, the negative impact that agriculture has on nature and climate is greatly mitigated.

Similarly, farmers are making use of smart greenhouses that work with algorithms that give out information about roof ventilation, light and heating, therefore helping workers to ensure the best conditions for crops.

The use of drones provides farmers with ultra-high-quality images of their fields in order for them to detect diseases, water stress or soil degradation beforehand. Moreover, these devices can also spray fertilizers, water, pesticides with high accuracy, saving farmers physical work.

Biotechnology and especially, seed science, are helping crops to grow more resistant to drought, pest, infestations and natural disasters, which translates into an enhancement in productivity.

Nevertheless, all these mechanisms help to increase farmers' ability to produce more food in a more efficient way, but that does not prevent food from being wasted.

How can this problem be overcome?

As we have seen, food is wasted from its harvest until its consumption. But, what methods do we know to prevent this situation? How can technology help us to solve this issue?

One of the proposed ideas to avoid this situation is to cut out the so-called middlemen from the transit of food from farmers to consumers. This way, food would flow from the farm to the kitchen table of consumers, resulting in less time spent in transit, more income for farmers and a reduced amount of food waste.

Another idea, at the selling stage, is to use technologies that extend the shelf life, or to better adjust the demand planning in order to avoid overbuying. When it comes to the consumption

stage, upcycling allows unused food to become valuable ingredients for other products again, rather than being disposed.

Data Collection

Many of the problems associated with food waste and climate change oftentimes start in the first stage of “the journey of food”, that is: the farming. Therefore, it is paramount that we reflect on what changes can be introduced in this stage so that some of the abovementioned negative effects can be remedied or reduced.

One of these improvements in agriculture is data collection, which consists on the installation of sensors and systems in the field that collect information about crops. This technology (GPS, GIS, geo-mapping, IoT sensors, drones) measures available resources, such as water, fertilizers, seeds by creating maps on soil, farm and wildlife.

Thanks to this sophisticated technology, farmers can make better decisions that will consequently result in lower costs, higher productivity and profitability, less environmental damage, stronger supply chain relations, increased transparency of their products, the identification of the most productive parts of the field, etc.

In particular, drones are one of the tools that are gaining the most ground among farmers, as they enable them to take high quality field shots with multispectral cameras. This information allows workers to identify the state of vegetation and problem areas in their fields, and at the same time it provides farmers with information about land, soil or farm.

In like fashion, data-gathering robots assist farmers with similar tasks. These tools are spread throughout the fields in order to analyze the crops and return important details about warnings and threats to workers. Consequently, this method comes in handy when farmers want to have a good performance in pest management and disease prevention.

As a result, we can conclude that there exists plenty of mechanisms that make the work of farmers easier and more efficient, and with the advancement of new technologies, more of these sophisticated tools are yet to come. We already have many different ways to collect useful

information to achieve the best harvest possible. The only step yet to be taken, as it has been pointed in the previous paragraphs, is that this technology becomes more and more accessible for farmers.

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