GRAND FRIEND

Grand Friend

Pedagogical Guidebook

A Manual for Entrepreneurs in the Agricultural Sector and the Benefits of Intergenerational Programs

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Deliverable Factsheet

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Statement of originality

This deliverable contains original, unpublished work except where indicated otherwise. Acknowledgement of previously published material and the work of others has been made through appropriate citation, quotation, or both.

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Table of content

1. Introduction to the Grand Friend Project

1.1. The Grand Friend Project

According to the United Nations, world food production needs to double by 2050 to cater to a growing population and evolving food habits. These requirements, in addition to current environmental impacts of climate change, affect biodiversity, soil and water quality. The Grand Friend project is an innovative approach to addressing the challenges of food production and sustainable agriculture in a rapidly changing world. Grand Friend is an Erasmus+ project co-funded by the European Union and implemented in four countries (Germany, Poland, Cyprus and Greece) by 5 partners. More information about the partners is available on the following page.

Key to this project is creating opportunities for positive interactions and learning experiences between older and younger generations in the agricultural industry through intergenerational programs.

The objectives of the project are to:

- Raise awareness on the benefits of Intergenerational Programs in sustainable Agricultural development;
- Promote active citizenship among the former generation of Agro-Entrepreneurs;
- Boost the new generation's engagement with Sustainable Agricultural Practices;
- Raise awareness on Intergenerational Programs' inclusive characteristics;
- Address the new and previous generations' problems in the Agricultural sector; and
- Find solutions to these problems through the involvement of Lifelong Learning Institutes / Trainers / Educators who focus on agriculture and other relevant stakeholders

The Grand Friend project will fulfil these objectives through the creation and development of three main work packages (WP2, WP3, WP4). This pedagogical guidebook is the first work package (WP2). WP3 consists of an interactive Digital Game and WP4 consists of practical learning modules and AgroLabs. The GrandFriend project

uses these work packages to bring different generations together to promote sustainable agriculture and agro-entrepreneurship.

1.2. Introduction to the Grand Friend Partners

The partnership of GrandFriend is cross-sectoral, including non-profit organisations, agri-entrepreneurship educational and research centres. Partners are specialised and experienced in their field.

L4Y Learning For Youth is an innovative and forward-thinking art and technology company founded to empower young people and VET trainees to thrive in a rapidly changing world. With a focus on emerging technologies such as quantum technologies (QT), blockchain, digital art, and Artificial Intelligence, L4Y recognises the transformative impact these technologies will have on our daily lives and the skills required of the workforce future.

In a world where technology is changing at an unprecedented pace, we need to equip young people and VET trainees with the skills and knowledge to succeed in the digital age. At L4Y, we believe that by training the next generation in these cutting-edge technologies, we are not only helping them to achieve their personal and professional goals, but we are also contributing to the greater good by solving social problems such as the integration of refugees, asylum seekers, and immigrants, and environmental protection.

PFA is a company dedicated to providing farm advisory services, enhancing the entrepreneurial spirit in rural areas, and fostering rural development. Their activities aim to fight unemployment in rural areas, improve soft skills, and meet the growing demand for transversal skills such as critical and innovative thinking, entrepreneurial mindset, and

creativity by current employers. The valuable experience of PFA in training agro-entrepreneurs will promote the innovation of the project, and specific innovative digital and game-based methodology for training and assessment will be developed.

Citizens In Power (CIP) is a research and educational NGO with expertise in entrepreneurship and agro-entrepreneurship. They have also implemented complementary projects such as "Grow-green", "Green STEAM Incubator", 'Agro-entrepreneurship accelerator', and an ENI-CBC MED. GrandFriend will be the first project of CIP that will emphasise intergenerational programs to promote agro-entrepreneurship (AE) in adult education. CIP's experience and network of AE education will benefit this project, especially for quality assessment and dissemination to youth trainers and training centres.

Challedu is a pioneer in GBL. GrandFriend will not be their first project related to AE since 'Agro_Edugames' and 'AgriCharisma' are some of the organisation's flagships. Other E+ projects that Challedu has worked on and are related to entrepreneurship are INSPIRE, Mumpreneurship and Momentum (all KA2 Erasmus+).

KMOP – Social Action and Innovation Centre, established in 1977, is one of the oldest civil society organisations in Greece offering social support services and implementing various programs aimed at empowering and enhancing the well-being of individuals and communities. KMOP established KMOP Education & Innovation Hub, with the aim to create a knowledge hub that offers access to a wide range of educational programmes, resources and trainings, capitalising on the knowledge that the organization has gained from its extensive work in the field. Our training programmes enable individuals

and teams to navigate their social ecosystem towards achieving their goals and contribute to a more inclusive and sustainable future. So far, these programs have impacted the lives of more than 17,500 individuals, providing them with the tools and skills they need to succeed in all aspects of life.

2. Introduction to the Guide

2.1. Introduction

The purpose of this guidebook is to provide valuable insights and practical information on the benefits of intergenerational programs (IPs) in the agricultural sector, specifically targeting the new generation of Agro-Entrepreneurs (30-45 years old) and the former generation of Agro-Entrepreneurs (over 65 years old). By highlighting the pedagogical advantages of IPs, the guide aims to raise awareness among both generations about the potential positive impacts on their entrepreneurial skills, physical and mental health, well-being, and social relationships.

What is contained in this Guidebook?

Chapter 3. *Previous and recent Agricultural practices*: This unit explores previous and current agricultural practices and their advantages and disadvantages, how the agricultural sector has changed in the pandemic, and how agricultural practices differ in terms of ecology and biodiversity.

Chapter 4. *Climate change and its effects on agriculture:* While emphasising the effects of climate change on agricultural practices, this unit also discusses the process of climate change and the variables that contribute to it. Furthermore, the reader is informed about the effects of global warming on agricultural production.

Chapter 5. *Previous and new generations' problems during the pandemic:* In this unit, the positive and negative effects of the COVID-19 pandemic on agriculture and the

agricultural sector in general are addressed, while the effects of the pandemic on younger and previous generations are considered.

Chapter 6. *Pedagogical Approach to Agro-Entrepreneurship:* This unit provides an overview of Agro-Entrepreneurship (AE) and Intergenerational Learning, as well as a discussion of the challenges facing the Agro-Entrepreneurship sector and the opportunities presented by intergenerational programs. Based on data analysis from interviews with experts and representatives of civil society organisations conducted within the scope of the Grand Friend Project, the needs and problems in the field of AE, the impact of education in the field of AE, intergenerational programs, and some best practices are presented to the reader.

2.2. Specific objectives of this guidebook

The Specific Objectives of this Guidebook are;

- To raise awareness on the pedagogical benefits of Intergenerational Programs for the new generation of Agro-Entrepreneurs;
- Raise awareness on the benefits of Intergenerational Programs for the former generation of Agro-Entrepreneurs;
- Address problems that the new and former generations of Agro-Entrepreneurs faced during the pandemic.
- Most importantly, the guide aims to involve more agricultural organisations - such as Lifelong Learning Institutions, Rural organisations, Rural municipalities, and Lifelong Learning Trainers and educators focusing on agriculture - and other stakeholders in IPs.

The guide has been developed with specific objectives in mind, aiming to address the challenges faced by different generations in the agricultural sector and promote the benefits of intergenerational programs.

2.3 New and old farmer definitions

New farmers refer to individuals who have recently entered the agricultural profession or are in the early stages of their farming careers. They often bring fresh perspectives, technological expertise, and a drive for innovation to the industry. These individuals may include young entrepreneurs, career changers, or those from non-farming backgrounds who have embraced sustainable agricultural practices.

According to the Regulation of the European Parliament and of the Council, a young farmer is defined according to the following criteria:

- a young farmer can be maximum 35-40 years old (EU countries are to set the exact upper age limit),
- a young farmer must be a 'head of the holding' (i.e., must have an effective control over the holding, and EU countries must detail the specifications),
- a young farmer must have appropriate training and/or skills (EU countries must detail the specifications).

Old farmers, on the other hand, represent the experienced agro-entrepreneurs who have spent a significant portion of their lives in the agricultural sector. They have amassed a wealth of knowledge, skills, and practical wisdom through years of hands-on experience. These individuals may be retiring, transitioning to other roles, or seeking ways to contribute their expertise beyond active farming.

According to Eurostat data, in 2010, 33% of the agricultural labour force was under 40 years of age (44% of total employment), 57% was between 40 and 65 years of age (54% of total employment) and 10% was 65 years and over (only 2% of total employment) (EU Agricultural Economics Briefs, 2017).

The current Eurostat data (Figure 1) is for 2020 and may not reflect all agricultural workers, but according to this data, farmers under the age of 40 manage only 11 percent of all farm businesses in the European Union (EU).

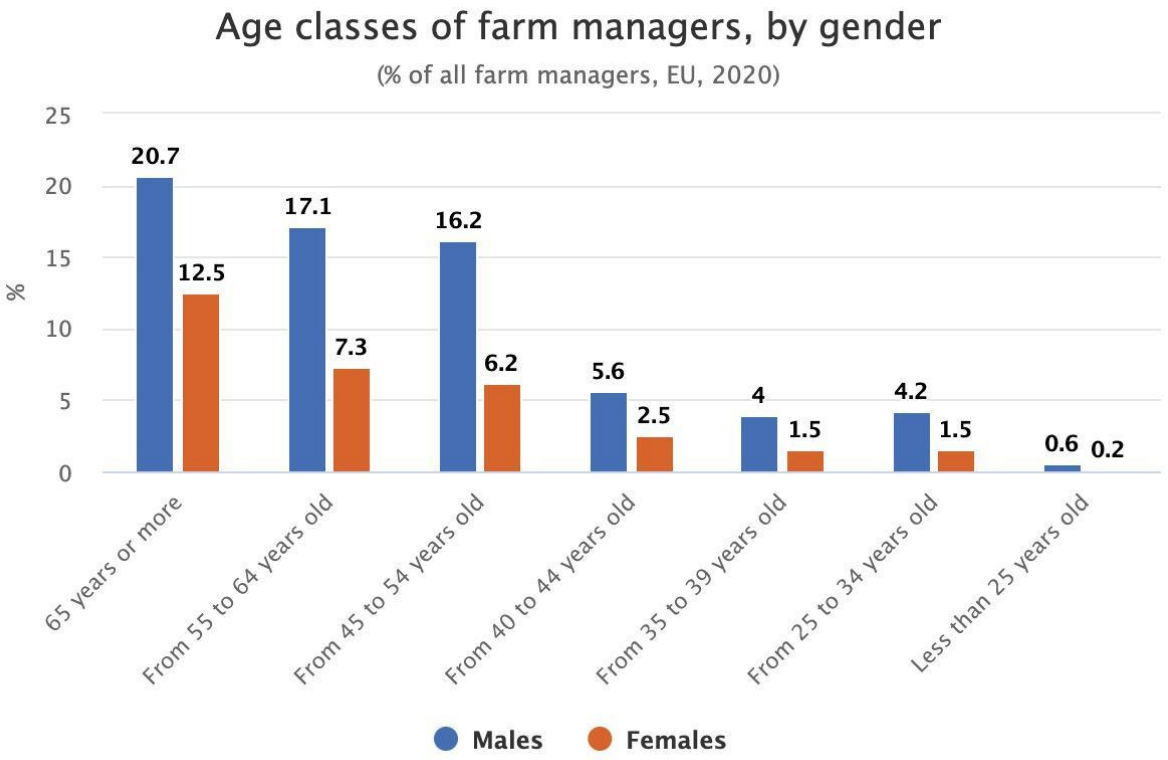


Figure 1. Age class of farm managers. Source: Eurostat, 2020

2.4 Previous and recent entrepreneurial methods in the farming industry

Throughout history, the farming industry has experienced considerable changes because of the need for higher production, market needs, and sustainability. Agriculture entrepreneurs have created numerous approaches to solving these difficulties over time.

In the past, most farming techniques were centred on the practice of subsistence farming, in which farmers grew crops and reared cattle primarily for their own sustenance. Agribusiness enterprises originated alongside the development of society. These enterprises integrated several facets of agriculture and placed an emphasis on commercial farming. Farmers adopted tools and machines in order to streamline their operations and fulfil the expanding demand for food, which played a significant role in the development of mechanisation and the increase in productivity.

There has been a noticeable shift in recent years towards more sustainable farming practices. Organic farming has grown in popularity, with natural fertilisers, crop rotation, and biological pest control methods being prioritised. Sustainable and organic agriculture is growing due to environmental deterioration, climate change, and food safety concerns (Pallavi, G. et al., 2023).

Precision agriculture has arisen as well, utilising advanced technologies such as GPS, sensors, and drones to optimise resource allocation and crop management (Shafi, U. et all., 2019). Furthermore, agricultural technology and digital breakthroughs have altered the farming business, allowing farmers to use farm management software, collect data via the Internet of Things (IoT), and apply robotics and automation technologies.

3. Previous and recent Agricultural practices

3.1. Module Description

The "Previous and Recent Agricultural Practices" module provides an in-depth exploration of the historical development of agricultural practices and their modern counterparts. The module delves into the changes and advancements that have taken place in the agricultural industry over the years, with a focus on how the COVID-19 pandemic has influenced these practices. The module highlights the significance of sustainable and eco-friendly approaches in the face of ecological challenges and pandemics. Readers will gain a comprehensive understanding of the evolution of agricultural techniques and their impact on the environment and human health.

3.2. Learning Objectives

By the end of this module the reader will:

- Understand the influence of the COVID-19 pandemic on agricultural practices, exploring how it has affected various aspects of farming and food production.
- Compare and contrast traditional and modern techniques of soil management, irrigation, and water usage in agriculture, analysing their benefits and drawbacks.

- Examine the historical use of pesticides and fertilisers in agriculture and assess the shift towards modern pest control methods, considering the environmental and health implications.
- Analyse the relationship between agriculture, ecology, and biodiversity, and explore ways to modify farming techniques to promote biodiversity and mitigate future pandemic risks.
- Explore contemporary practices in organic farming and permaculture, understanding their role in sustainable agriculture and their potential to address current challenges in the farming industry.

By the end of this module, readers will have a comprehensive knowledge of the historical development of agricultural practices, the impact of the pandemic on the industry, and the importance of adopting sustainable and environmentally conscious approaches in modern agriculture. They will be equipped with the knowledge to critically evaluate different agricultural practices and contribute to the advancement of more resilient and sustainable food production systems.

3.3. Previous and recent Agricultural practices

Agriculture has played a central role in European history and culture, shaping landscapes, economies, and societies for millennia. From the ancient Greeks and Romans to the medieval serfs and modern industrial farmers, European agriculture has undergone many transformations and challenges. Today, European agriculture faces new challenges related to sustainability, climate change, and globalisation, which require innovative approaches and policies that balance economic, environmental, and social priorities. This chapter explores the rich history and diverse practices of European agriculture and the ways in which they shape our present and future. (Marglin, 1996).

For centuries, farmers around the world have developed agricultural practices that are in harmony with nature. These traditional methods are often based on indigenous knowledge and are adapted to local conditions. They prioritise soil health and biodiversity, and often involve intercropping, crop rotation, and the use of natural fertilisers. By

preserving traditional agricultural practices, people can learn from the wisdom of our ancestors and create a more sustainable future for agriculture. (FAO, n.d.).

Agricultural practices have evolved significantly throughout human history in response to changing needs, technological advancements, and environmental conditions. From the early development of agriculture thousands of years ago to modern industrialised farming methods, the approaches to food production have undergone notable transformations. In the early stages of human civilisation, people relied on traditional and subsistence agriculture to meet their basic food needs. This involved the cultivation of crops and the raising of livestock on small-scale farms. Techniques such as slash-and-burn agriculture, crop rotation, and the use of natural fertilisers were common. Farmers relied on traditional knowledge passed down through generations to maximise yields and adapt to local environmental conditions. (FAO, 2017).

The Industrial Revolution in the 18th and 19th centuries brought about significant changes in agricultural practices. Innovations such as the seed drill, mechanized harvesting equipment, and the development of steam power revolutionised farming. This led to increased agricultural productivity, larger-scale farming operations, and the migration of people from rural areas to cities. (National Geographic, 2022).

In response to the negative impacts of intensive farming, sustainable agriculture and agroecology gained prominence. These approaches emphasize ecological principles, biodiversity conservation, and the integration of natural processes. Sustainable agriculture incorporates practices like organic farming, permaculture, agroforestry, and conservation agriculture. Agroecology focuses on enhancing the ecological health of farming systems,

minimising external inputs, and promoting biodiversity to ensure long-term food security and environmental sustainability. Recent years have witnessed the rise of precision agriculture, which leverages technological advancements to optimise resource use and increase efficiency. Techniques such as remote sensing, GPS technology, and data analytics are utilised to monitor crop health, manage irrigation, and apply fertilisers and pesticides precisely. Precision agriculture aims to minimise inputs, reduce environmental impacts, and improve yield and profitability. (Lampkin, 2017).

3.4. How the pandemic influenced agricultural practices

The COVID-19 pandemic has brought about unprecedented challenges to the agriculture industry. From supply chain disruptions to labour shortages, farmers have had to adapt quickly to keep feeding the world. This section explores the innovative solutions and new practices that have emerged in response to the pandemic.

As a result of the coronavirus crisis, response plans were developed for the food sector to ensure continuity of operations in food processing plants and manage coronavirus risks in the food industry. Meat and poultry processing can be defined as a critical infrastructure for food and agriculture. The plan includes a series of control requirements for cleaning, sanitation, disinfection of facilities, screening and monitoring of workers for COVID-19, management of infected workers and education programs for workers and supervisors to prevent the spread of coronavirus (CDC, 2020).

One of the biggest challenges has been maintaining the food supply chain. With restaurants and schools closed, and consumers panic-buying at grocery stores, demand for certain foods has fluctuated wildly. Farmers have had to pivot from selling to commercial buyers to selling directly to consumers through online platforms or farm stands. In some cases, they've had to throw out perfectly good produce because they couldn't sell it fast enough (OECD, 2020). Labour has also been a major concern. Many farms rely on seasonal workers, who typically travel from other countries to work in fields. With travel restrictions and border closures, many workers were unable to travel for seasonal work. Some farmers have been able to find local workers to fill the gaps, but

others have resorted to using automation technology like robots and drones to help with planting and harvesting (EPRS, 2021).

Another area of innovation has been in food processing and distribution. With meatpacking plants and other processing facilities forced to close due to outbreaks, there has been a renewed interest in local and decentralised food systems. Small-scale meat processors and independent grocers have seen increased demand for their products as consumers look for alternatives to the large, centralised food companies (Aday, 2020).

COVID-19 also led to disruptions in global supply chains, including the transportation and distribution of agricultural products. Lockdowns, travel restrictions, and reduced labour availability affected the movement of farmers, farmworkers, and essential agricultural inputs such as seeds, fertilisers, and machinery. This disrupted the timely delivery of agricultural products, leading to market instability and food shortages in some areas. The pandemic altered consumer behaviour and preferences, leading to changes in food consumption patterns. Restaurants and institutional buyers were closed or operated at reduced capacities, while there was an increase in demand for staple foods and food products that could be stored for longer periods. Farmers had to adjust their production plans to meet changing consumer demands, which sometimes required shifting from commercial crops to more staple or local food production (Workie, 2020).

The pandemic-induced travel restrictions and social distancing measures made it difficult for seasonal migrant workers to travel and work on farms. This created labour shortages during critical planting and harvesting periods. Farmers had to adapt by seeking local labour sources, mechanising certain tasks, or adjusting their production plans. With disruptions in the traditional supply chains, there was a rise in demand for local food and direct-to-consumer sales. Farmers' markets, community-supported agriculture (CSA) programs, and online platforms for selling produce gained popularity. This shift highlighted the importance of local food systems and direct connections between farmers and consumers (Aday, 2020).

Additionally, the pandemic exposed vulnerabilities in the global food system, leading to an increased emphasis on food security at local, regional, and national levels. Governments and organisations prioritised measures to ensure food availability, accessibility, and affordability. This included supporting local farmers, investing in

agricultural infrastructure, and promoting self-sufficiency in food production. Furthermore, COVID-19 accelerated the adoption of digital technologies in agriculture. Online platforms for selling produce, remote sensing, data analytics, and precision agriculture tools became more prevalent. These technologies helped farmers optimise production, reduce waste, and connect with customers in a contactless manner (FAO, 2022).

In the wake of the 2020 coronavirus outbreak, the European Commission swiftly launched financial measures to support farmers and food producers to stabilise agricultural markets (EC, 2020). This includes:

- **€200,000 loans or guarantees for operational costs** offered to farmers and other rural development beneficiaries.
- **€7,000 per farmer or €50,000 per small-medium enterprise (SME)** offered by the European Commission to EU countries with remaining rural development funds to pay farmers and small agri-food businesses in 2020.
- **70% and 85% advances** for common agricultural policy (CAP) of income supports and certain rural development payments in order to increase the cash flow of farmers.
- **Up to €125,000 for state aid** possible for farmers and food processing companies.

3.5. Soil, irrigation and water

From ancient times to the present day, farmers have used a variety of techniques to manage soil, irrigation, and water resources. Traditional practices such as terracing and crop rotation have given way to modern techniques such as precision irrigation and soil testing. However, the basic principles of soil and water management have remained the same over time: to maximize yields and minimise waste while preserving the health of the land (Tomer, 2005).

One of the earliest known agricultural practices was irrigation, which allowed ancient civilizations such as the Egyptians and Mesopotamians to cultivate crops in arid regions. This involved diverting water from rivers or wells into fields through a network of channels and ditches. Later, the invention of the plough allowed farmers to till soil more efficiently, leading to the development of more complex irrigation systems (FAO, 2020).

In the past, soil conservation techniques focused on preventing erosion through practices like contour ploughing, terracing, and the construction of bunds or ridges. These techniques helped to slow down water runoff and minimise soil loss. Farmers used traditional methods to improve soil fertility, such as applying animal manure, crop residues, and compost. These organic materials provided nutrients, improved soil structure, and enhanced water retention capacity. Crop rotation was a common practice where different crops were grown in a sequence to manage soil fertility, control pests and diseases, and break pest cycles. Leguminous crops were often included in rotation systems to fix nitrogen and enhance soil health. Traditional irrigation techniques included methods like furrow irrigation, flood irrigation, and open canals. These methods were often labour-intensive, water inefficient, and led to water wastage through evaporation and runoff. (Herbold, 2003).

As agriculture became more widespread, farmers began to experiment with different methods of soil management. In China, for example, farmers used a technique known as "slash and burn" to clear land and fertilize soil. This involved cutting down trees and burning them to create a layer of ash that would enrich the soil. In Europe, farmers developed the practice of crop rotation, in which different crops were planted in different fields each year to prevent soil depletion and pest infestations. (Britannica, 2022). With the advent of the Industrial Revolution, new agricultural technologies began to emerge. The use of chemical fertilizers, pesticides, and herbicides allowed farmers to increase yields and control pests more effectively. However, these practices also had negative environmental and health impacts, leading to the development of alternative, more sustainable approaches such as organic farming. (Tudi, 2021).

Today, modern agricultural practices continue to evolve in response to changing environmental and economic conditions. Precision irrigation, for example, uses sensors

Figure 3. Source: Government of Western Australia

and other technologies to deliver water more efficiently, while soil testing allows farmers to optimize soil fertility and nutrient content. The development of new crop varieties and plant breeding techniques also holds promise for increasing yields and reducing the environmental impact of agriculture (Zaman, 2023).

Nowadays, conservation tillage practices, such as no-till or reduced tillage, minimise soil disturbance and maintain crop residues on the soil surface. This helps to improve soil structure, reduce erosion, and enhance water infiltration. Modern technologies like GPS, remote sensing, and data analytics enable precision agriculture. Farmers can optimise irrigation, fertilisation, and pesticide application by accurately mapping soil variability and plant needs. This improves resource efficiency and minimises environmental impacts. Cover cropping involves planting specific crops during fallow periods or alongside cash crops to protect the soil, prevent erosion, and add organic matter. Cover crops also enhance nutrient cycling, suppress weeds, and improve water infiltration.

Soil testing is used to analyse nutrient levels and pH, guiding farmers in applying precise amounts of fertilisers and amendments. This ensures optimal nutrient availability for crops while minimising nutrient runoff and water pollution. Also, rainwater harvesting techniques capture and store rainwater for irrigation purposes. Methods like rooftop collection, rain barrels, and water storage ponds help farmers utilise rainfall efficiently, particularly in areas with limited water resources (Francaviglia, 2023).

As the global population continues to grow, the need for sustainable and efficient agricultural practices has become more urgent than ever before. By drawing on the wisdom of traditional practices and embracing the latest advances in technology, farmers can help to ensure a secure and prosperous future for themselves and for generations to come (FAO, 2017). As society has developed, so too has agriculture. In recent years, the trend has been towards more sustainable and efficient practices that prioritise the health of the land and the well-being of farmers and consumers. For example, agroforestry is a technique that combines traditional farming practices with modern agroecological principles to create sustainable, integrated systems that benefit both people and the environment. In agroforestry systems, trees are integrated into agricultural landscapes to provide shade, prevent soil erosion, and improve soil fertility (ibid).

Other examples of sustainable farming practices include conservation agriculture, which emphasizes reduced tillage, cover crops, and crop rotation to maintain soil health, and agroecology, which seeks to create self-sustaining ecosystems by using local resources and traditional knowledge to manage soil and water resources. These approaches can help to reduce the environmental impact of agriculture while also improving yields and promoting biodiversity. (Muhie, 2022).

In addition to sustainable farming practices, there are also efforts underway to promote more equitable and socially responsible agricultural systems. For example, fair trade certification programs help to ensure that farmers receive fair prices for their crops and are not exploited by intermediary parties or large corporations. Similarly, community-supported agriculture (CSA) programs allow consumers to develop closer relationships with farmers and support local food systems (Fairtrade, n.d.). There are many challenges facing agriculture, including climate change, water scarcity, and soil degradation. However, by continuing to innovate and develop new techniques, farmers can help to ensure that agriculture remains a sustainable and productive industry that benefits people and the planet (FAO, 2017).

3.6. Pesticides and fertilisers

Farmers have used a variety of techniques to control pests and protect their crops. Traditional methods such as crop rotation and companion planting have given way to modern techniques such as genetically modified crops and integrated pest management. While modern techniques can be more effective, they also raise concerns about their long-term impact on the environment and human health (Pretty, 2015).

One of the earliest forms of pest control was simply picking insects and other pests off plants by hand. Farmers also used a variety of other techniques to deter pests, such as planting crops in specific patterns to confuse insects or using natural repellents such as garlic or tobacco. While pesticides have helped to control crop pests and diseases, they have also had unintended environmental and health consequences. Similarly, synthetic fertilisers have dramatically increased crop yields, but have also contributed to soil degradation and water pollution (StudySmarter, n.d.).

Another traditional method of pest control is crop rotation, in which different crops are planted in different fields each year to prevent the buildup of pests and diseases. Companion planting is another technique in which different crops are planted together to repel pests or attract beneficial insects. For example, planting marigolds in a vegetable garden can help to repel aphids and other pests (Gabryś, 2022).

One of the most significant advances in pest control in recent years has been the development of genetically modified (GM) crops. These crops are engineered to contain genes that make them resistant to pests and diseases, reducing the need for pesticides and other chemical treatments. However, GM crops are controversial, with some critics arguing that they could have unintended environmental and health effects (Smyth, 2019).

Figure 4. Patrick Kavanagh, digging in a potato field. Source: National Library of Ireland

Some of the latest innovations in this field include the use of precision agriculture technologies to apply inputs more precisely, as well as the development of biological pest control methods and the use of organic fertilisers such as compost and manure (Muhie, 2022). By combining these approaches with traditional techniques such as crop rotation and cover cropping, we can create more resilient and sustainable agricultural systems that are better equipped to meet the challenges of the future. Integrated pest management

(IPM) is a more holistic approach to pest control that combines various methods to manage pests in an environmentally friendly and cost-effective way. IPM involves monitoring pest populations, identifying the most effective control methods, and using a combination of techniques such as biological control, crop rotation, and pesticide application only as a last resort (Muhie, 2022). Biological control involves using natural predators or parasites to control pest populations. For example, ladybugs can be released in a garden to eat aphids, while nematodes can be used to control soil-dwelling pests such as grubs. This approach is generally considered to be more environmentally friendly than chemical pesticides, although it can be less effective in some cases (Lee, 2000).

While modern pest control techniques can be more effective than traditional methods, they also raise concerns about their long-term impact on the environment and human health. Pesticides, for example, can contaminate soil and water, harm non-target species such as beneficial

insects and birds, and pose risks to human health if not used properly. Similarly, synthetic fertilisers have dramatically increased crop yields, but have also contributed to soil degradation and water pollution. As we look to the future of agriculture, it will be important to continue developing new and innovative approaches to pest and nutrient management that are effective, while also being sustainable and environmentally friendly (Pathak, 2022).

GM crops are controversial due to concerns about their potential impact on the environment and the safety of consuming genetically modified food (StudySmarter, n.d.). As a result of these concerns, there has been growing interest in developing more sustainable and environmentally friendly pest control methods. Organic farming, for example, avoids the use of synthetic pesticides and relies on natural methods such as crop rotation and biological control. Other approaches such as agroforestry and permaculture seek to create self-sustaining ecosystems that minimise the need for external inputs such as pesticides and fertilisers (Muhie, 2022).

3.7. Ecology and biodiversity

Ecology and biodiversity are essential for the health and sustainability of our planet. Biodiversity provides the foundation for many of the ecosystem services that are critical to human well-being, such as food and clean water. Additionally, healthy ecosystems help to regulate the climate, prevent erosion, and maintain soil fertility. However, human activities such as habitat destruction, pollution, and land exploitation are putting increasing pressure on ecosystems and the species that depend on them. To address these challenges, it is important to develop strategies that promote the conservation and restoration of natural habitats, as well as the sustainable use of natural resources (WHO, 2021).

Biodiversity is a measure of the richness and variety of life in an ecosystem, encompassing the diversity of species, genes, and ecosystems themselves. It is a product of millions of years of evolution, resulting in an astounding array of organisms, each playing a unique role in the web of life. From tiny microorganisms to larger mammals, and towering trees to microscopic bacteria, every organism contributes to the complex tapestry of biodiversity. Biodiversity provides numerous ecological services that are vital for the functioning of ecosystems and the well-being of humanity. Crucially, biodiversity regulates ecosystems. This means that a balance is maintained wherein different species interact, and this balance supports the health and stability of the environment. For example, pollinators like bees and butterflies play a critical role in the reproduction of flowering plants, ensuring the continuation of plant species, and providing food sources for other organisms (National Geographic, 2022).

As agriculture continues to evolve, there is an increasing need to develop more sustainable and environmentally friendly farming practices that support biodiversity.

Strategies include restoring and enhancing natural habitats on farms, such as wetlands, grasslands, and forests, and incorporating agroforestry practices that combine trees with crops and livestock. These approaches can help to provide habitat for a wide range of wildlife, from pollinators to birds and mammals (ibid).

Another important ecological service is nutrient cycling, wherein organisms decompose and recycle organic matter, returning essential nutrients to the soil and facilitating their uptake by plants. Decomposers such as fungi and bacteria break down dead plants and animals, releasing nutrients that sustain the growth of new life. This cyclical process is vital for maintaining the fertility of soil and supporting plant growth, which in turn sustains the entire food chain. Biodiversity also contributes to the resilience and adaptability of ecosystems, making them more capable of withstanding and recovering from disturbances such as disease, natural disasters, or climate change. Ecosystems with higher biodiversity tend to be more stable and have a greater capacity to recover from disturbances because diverse species provide a wider range of functional traits and responses to environmental changes (Morgan, 2023).

However, in recent decades, human activities have significantly impacted both ecology and biodiversity. Deforestation, habitat destruction, pollution, overexploitation of resources, and climate change have resulted in a rapid loss of species and ecosystems worldwide. This loss of biodiversity not only disrupts the delicate balance of ecosystems but also threatens the services they provide, such as clean air and water, climate regulation, and the provision of food and medicine (Shivanna, 2022).

Another key strategy is to develop innovative technologies that can help to reduce the environmental impact of agriculture. For example, new biotechnologies such as gene editing and synthetic biology have the potential to create crops that are more resistant to pests and diseases, while also being more environmentally friendly (Vrchota, 2022).

There have been global efforts to conserve and restore ecosystems, protect endangered species, and promote sustainable practices. Conservation initiatives aim to establish protected areas, implement sustainable land, and resource management practices, and raise awareness about the value of biodiversity. Individuals can also contribute to the preservation of ecology and biodiversity in their daily lives. Simple actions like reducing waste, conserving water, and energy, supporting local and sustainable food sources, and avoiding the use of harmful chemicals can make a difference. Additionally, educating oneself and others about the importance of biodiversity and advocating for policies that prioritize its protection are crucial steps towards a sustainable future (UNESCO, n.d.).

On the other hand, the COVID-19 pandemic has brought to light the intricate connection between biodiversity and emerging infectious diseases. While the exact origin of the virus is still under investigation, it is widely believed to have originated from wildlife, possibly bats, and transmitted to humans through an intermediate animal host, such as a pangolin. This transmission highlights the potential risks associated with the exploitation and trade of wildlife, as well as the disruption of natural ecosystems. Biodiversity loss and habitat destruction due to human activities have increasingly brought humans into closer contact with wildlife species that may carry novel pathogens. When natural habitats are disturbed or destroyed, it can force wildlife to seek new habitats or come into closer proximity to human settlements, increasing the likelihood of zoonotic disease transmission. As a result, viruses and other pathogens can "spillover" from wildlife to humans, leading to the emergence of new infectious diseases (Lawler, 2021).

It is important to note that not all wildlife poses a direct risk to human health. In fact, many wild species play important roles in maintaining ecosystem balance and preventing the spread of diseases. For example, bats, despite being carriers for many viruses, also provide valuable ecosystem services such as pollination and insect control. The key lies in promoting sustainable and responsible interactions with wildlife and ecosystems, reducing

the risk of disease transmission while safeguarding biodiversity. The COVID-19 pandemic serves as a stark reminder of the potential future risks associated with biodiversity loss and ecosystem disruption. As human populations continue to grow and encroach upon natural habitats, the likelihood of encountering novel pathogens increases. Climate change further exacerbates these risks by altering habitats, shifting species distributions, and affecting disease vectors (Bonilla-Aldana, 2021).

Furthermore, the loss of biodiversity can impact the resilience of ecosystems and their ability to cope with and recover from disease outbreaks. High biodiversity often provides a buffer against the spread of diseases, as diverse ecosystems are better able to regulate populations, limit the dominance of potential disease vectors, and maintain a healthy balance among species. When biodiversity is reduced, ecosystems become more vulnerable to the introduction and spread of pathogens, potentially leading to more severe and widespread disease outbreaks (WHO, 2015).

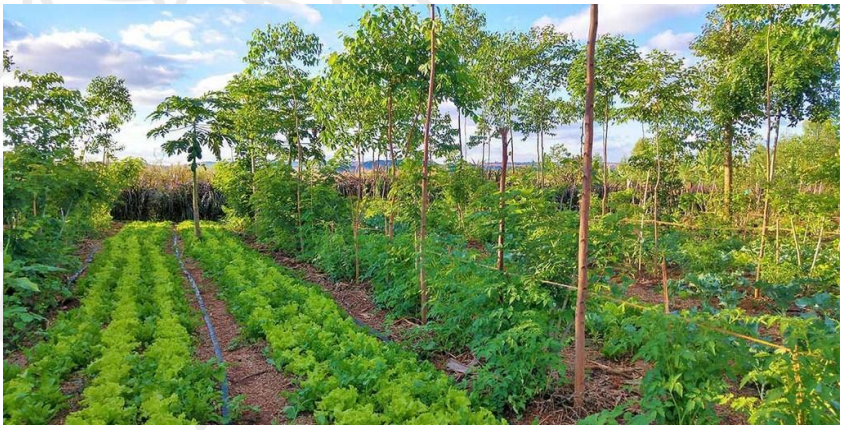
To mitigate future risks, it is essential to adopt a holistic and interdisciplinary approach that addresses the complex interactions between human health, biodiversity, and ecosystems (Petrovan, 2021). This includes measures such as:

- Strengthening wildlife conservation efforts and combating illegal wildlife trade to reduce the likelihood of zoonotic disease spillover.
- Promoting sustainable land use practices that prioritise the preservation and restoration of natural habitats, ensuring the continued functioning of ecosystems and their disease-regulating capabilities.
- Enhancing disease surveillance systems to detect and respond to emerging infectious diseases in a timely manner, including early detection, monitoring of wildlife populations, and tracking potential disease reservoirs.

- Investing in research to better understand the ecological factors contributing to disease emergence and the complex relationships between biodiversity, ecosystems, and human health.
- Educating and raising awareness among the general public about the importance of biodiversity conservation, responsible wildlife interactions, and the potential risks associated with biodiversity loss.

3.8. Organic farming/permaculture

Permaculture and organic farming are two sustainable agricultural approaches that prioritize environmental stewardship, biodiversity conservation, and the production of healthy, nutritious food. Both methods share a common goal of working with nature rather than against it, aiming to create resilient and regenerative agricultural systems that benefit both people and the planet.



Permaculture, which stands for "permanent agriculture" or "permanent culture," is a design system that integrates principles from ecology, sustainable agriculture, and social systems. Developed in the 1970s by Bill Mollison and David Holmgren, permaculture seeks to create self-sustaining and productive ecosystems that mimic the patterns and resilience of natural systems. At its core, permaculture emphasizes the careful observation of natural processes and the design of integrated systems that maximise resource efficiency, reduce waste, and foster biodiversity. It encompasses various principles such as working with nature, valuing diversity, using renewable resources, and promoting cooperation (Aiken, 2017).

Permaculture designs often incorporate elements like food forests, polycultures, water catchment systems, composting, and natural pest control methods. By integrating diverse

plant and animal species, permaculture systems strive to create mutually beneficial relationships that enhance soil fertility, conserve water, attract beneficial insects, and reduce the need for external inputs like pesticides or synthetic fertilisers. These systems are designed to be highly resilient, adapting to and mitigating the impacts of climate change and other environmental challenges (Ziton, 2023).

Organic farming refers to a method of agricultural production that avoids the use of synthetic pesticides, herbicides, fertilisers, genetically modified organisms (GMOs), and antibiotics or growth hormones in livestock. Organic farming aims to enhance soil health, protect ecosystems, and promote the well-being of plants, animals, and humans. Organic farmers employ a range of practices to maintain soil fertility and prevent pest and disease issues, such as crop rotation, cover cropping, composting, and the use of natural pest control methods like beneficial insects or physical barriers. They prioritise building healthy soils rich in organic matter, which not only supports plant growth but also enhances water retention, reduces erosion, and sequesters carbon (Thompson, 2009). Certification standards and regulations govern organic farming practices in many countries, ensuring transparency and consumer trust. Organic farming systems vary in scale, from small-scale family farms to large-scale operations, and encompass a wide range of crops, livestock, and production methods (EC, 2008).

Both permaculture and organic farming promote ecological balance and resilience, as well as prioritise the use of renewable resources and the reduction of external inputs. These approaches also prioritise the well-being of farmers and local communities by promoting fair trade practices, local food systems, and community engagement (Anderson, 2019). Permaculture and organic farming have numerous benefits, but they also face some challenges. Here are the pros and cons of both approaches:

Advantages	Disadvantages
Ecological resilience: Permaculture designs mimic natural ecosystems, enhancing their resilience and ability to adapt to environmental changes, including climate change (McCann, 2013).	Steep learning curve: Implementing permaculture principles requires knowledge and experience, which can be challenging for newcomers to the approach (McCann, 2013).
Environmental protection: Organic farming avoids the use of synthetic pesticides and fertilisers, reducing chemical runoff and pollution of soil and water systems (Çakmakçı, 2023).	Yield limitations: Organic farming often faces lower crop yields compared to conventional farming due to limitations in pest and disease control methods and nutrient availability (Çakmakçı, 2023).
Resource efficiency: Permaculture maximises resource utilisation and minimises waste through principles like stacking functions, using renewable energy sources, and minimising inputs (McCann, 2013).	Time and labour-intensive: Setting up and maintaining permaculture systems can be labour-intensive, especially during the initial stages of establishment and design implementation (McCann, 2013).
Soil health improvement: Organic farming practices prioritise soil health through organic matter addition, crop rotation, and reduced tillage, enhancing soil structure and fertility (Çakmakçı, 2023).	Certification costs: Organic certification processes can be costly and time-consuming, particularly for small-scale farmers who may face financial constraints (Çakmakçı, 2023).
Biodiversity conservation: Permaculture systems prioritise biodiversity, creating habitats that support a wide range of plant and animal species (McCann, 2013).	Limited scalability: Permaculture designs often work best on smaller scales, making it challenging to implement on large commercial farms or in highly mechanised agricultural systems (McCann, 2013).

Improved food quality: Organic farming aims to produce food free from synthetic chemicals, potentially resulting in healthier and more nutritious food options (Çakmakçı, 2023).	Market competition: The organic market can be competitive, and price premiums may not always offset the additional costs and lower yields associated with organic production (Çakmakçı, 2023).
Local food production: Permaculture often emphasises local and community-based food production, promoting food security and reducing reliance on distant supply chains (McCann, 2013).	Complexity: Designing and managing permaculture systems require a holistic understanding of ecological processes, which can be overwhelming for some individuals (McCann, 2013).
Market demand: Organic products have a growing market demand, which can provide economic benefits for farmers who adopt organic practices (Çakmakçı, 2023).	Pest and disease management: Organic farmers may face challenges in effectively managing pests and diseases without the use of synthetic chemicals, requiring more labour-intensive and diverse pest control strategies (Çakmakçı, 2023).
Regenerative agriculture: Permaculture aims to restore degraded land and ecosystems, contributing to soil health, water conservation, and carbon sequestration (McCann, 2013).	Initial investment: Setting up permaculture systems may require significant upfront investments in infrastructure, such as earthworks, water catchment systems, and the establishment of perennial plants (McCann, 2013).

4. Climate change and its effects on agriculture

4.1. Module Description

This module focuses on climate change and its impact on agriculture. It is considered necessary to analyse the phenomenon and the causes of climate change to better understand its effects on agriculture and on the livelihood of agricultural households and

countries. It is addressed to AEs, professionals in the agricultural sector, trainers and educators in Life Long Learning Centres focused on agriculture, and the general public interested in learning about the relationship between climate change and agriculture.

4.2. Learning objectives

By the end of this module the reader will:

- Be able to explain the phenomenon of climate change and its causes.
- Be aware of the impact of climate change on agriculture.
- Understand the influence of global warming on crop yields.

4.3. The phenomenon of climate change and its causes

The first part of the module explains the phenomenon of climate change and its causes. Concrete examples are provided regarding human activities emitting greenhouse gases, and how this has led to the phenomenon of global warming. A specific focus is given to the impact of agricultural activities on climate change.

The term **climate change** describes the phenomenon of long-term shifts in temperatures and weather patterns (UN, n.d.). Nowadays, the phenomenon of climate change is characterised by the rise of average global temperature and the increased frequency of extreme weather events. This is why the term ‘global warming’ is also widely used, even though these two terms are not interchangeable (NASA, n.d). Another term used to describe the temperature rise is the greenhouse effect, because the mechanism causing the global temperature to increase resembles that of a greenhouse (UN, n.d.).

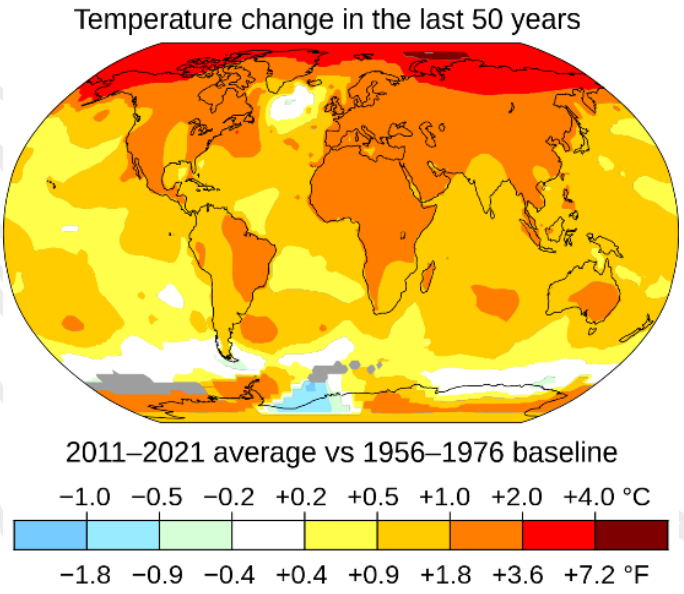


Figure 11. Average surface air temperatures from 2011 to 2021 compared to a baseline average from 1956 to 1976. Source: IPCC, 2023

Changes in climate patterns can happen naturally, due to changes in the sun's activity or large volcanic eruptions. However, today's problem of global warming is caused by human activities. After the 1800s, when the industrial revolution took place, the increased emission of fossil fuels led to the increase of average global temperature by 1.1° Celsius (IPCC, 2023).

The difference between the natural greenhouse effect and the enhanced greenhouse effect must be highlighted, since it is the latter that is responsible for climate change. The Earth has a natural greenhouse effect due to trace amounts of water vapour (H2O), carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O) in the atmosphere. These gases let the solar radiation reach the Earth's surface, but they absorb infrared radiation emitted by the Earth that warms the surface of the planet (World Meteorological Organisation, n.d.). The natural greenhouse effect is caused by the natural amounts of greenhouse gases and is vital to life, since without the greenhouse effect the surface of the Earth would be approximately 33°C cooler (World Meteorological Organisation, n.d.). However, the enhanced greenhouse effect is the result of increased concentrations of

greenhouse gases emitted by human activities that remain trapped in the earths atmosphere.

The main greenhouse gases are carbon dioxide, methane, nitrous oxide, hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs) and ozone in the lower atmosphere (World Meteorological Organisation, n.d. & UN, n.d.). Among the main sectors causing greenhouse gases are energy, industry, transport, buildings, agriculture, and land use (Naz et al, 2022 & UN, n.d.).

As Figure 12 illustrates, agriculture and related land use emissions accounted for 17 percent of global GHG emissions from all sectors in 2018, down from 24 percent in 2000. In addition to the noted slight decrease in absolute emissions, this reduction in 2018 was also the result of emissions from other economic sectors growing at relatively faster rates during 2000–2018.

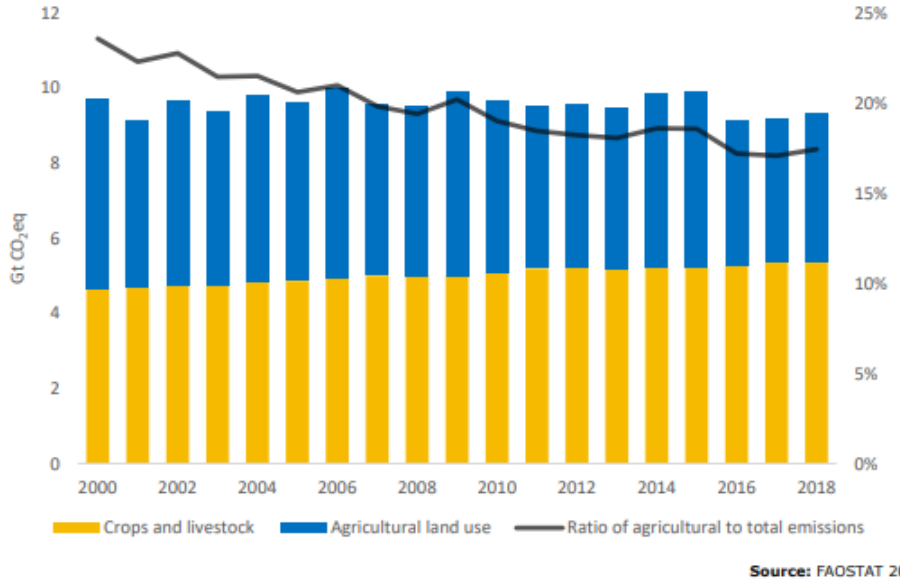


Figure 12. Share of agriculture in global GHG emissions from all sectors, 2000–2018. Source: FAO, 2020

4.4. Climate change effects on agriculture

On the one hand, agriculture contributes to the phenomenon of global warming and on the other hand, the agrifood systems are threatened by temperature increases and the resulting extreme weather events. The second part of this chapter analyses the impact of

climate change on crop yields and the livelihood of farmers, as well as the increasing problem of food insecurity.

The Intergovernmental Panel on Climate Change (IPCC) 2023 report mentions long-term changes in climate, such as:

- an increasing mean temperature,
- altered seasonality,
- combined heat and drought stress,
- heavy rain events,
- water stress,
- changes in the occurrence of pests and diseases,
- sea level rise and ocean acidification.

Moreover, the global water cycle will continue to intensify as global temperatures rise, with precipitation and surface water flows projected to become more variable over most land regions within seasons and from year to year. Around the globe increased events of droughts, foods, irregular patterns of precipitation, heat waves and other extreme weather phenomena are already experienced (Arora, 2019). These impact the agricultural sectors and related value chains, livelihoods and ecosystems.

The biophysical effects of climate change on agriculture leads to changes in production and prices, which affects national and global economic systems. Farmers and other market participants adjust autonomously, altering crop mix, input use, production, food demand, food consumption, and trade (Nelson et al, 2009).

Climate change has an impact on the following three dimensions of agriculture:

1. Biological effects on crop yields and production
2. Social and economic impact

3. Impact on food security and malnutrition

4.5. Biological effects on crop yields and production

Climate change has both direct and indirect impacts on agricultural production systems. Direct impacts include effects caused by the modification of physical characteristics such as temperature levels and rainfall distribution on specific agricultural production systems (FAO, 2015). Indirect effects are those that affect production through irrigation water availability (Nelson et al, 2009) and changes on other species such as pollinators, pests, disease vectors and invasive species (FAO, 2015).

Figure 14. Climate change adaptation in the agriculture sector in Europe. Source: European Environment Agency, 2019.

The projected impacts of climate change on major crop yields are now well documented, based on two decades of research. Globally, negative impacts are more important than positive ones. Observations of the effects of climate change on crop production show that wheat and maize yields in many regions globally are already negatively affected (FAO, 2015). IPCC has expressed with certainty that crop production

will be consistently and negatively affected by climate change in the future in low-latitude countries, while climate change may have positive or negative effects in northern latitudes. Overall, findings indicate that climate change will also increase crop yield variability in many regions (FAO, 2015).

It is possible that pests and diseases will move affecting areas previously immune, and thus less prepared, biologically and institutionally, to manage and control them (FAO, 2015). These changes may also counter-balance direct positive effects of climate change, since climatic conditions will become more favourable to crops, but also to pests.

4.6. Social and economic impact

Impacts on production directly translate into social and economic consequences at the farm level and at the food chain level (FAO, 2015).

At the **farm level**, negative impacts on production affect incomes and physical capital. They can force farmers to sell productive capital, for instance, cattle, to obtain complementary revenue and they can reduce the capacity to invest. This directly bears social impacts on farming households, limiting their capacity to face other expenditures, such as health and education.

At the **food chain level**, they can trigger an increase in agricultural commodities' prices (food and feed). This in turn affects the socioeconomic situation of the whole population, especially in agricultural countries, where agriculture consists of a big part of the GDP and of the employment. Frequent extreme weather events are also a factor that discourages investments in agriculture and therefore, undermines agricultural development (FAO, 2015).

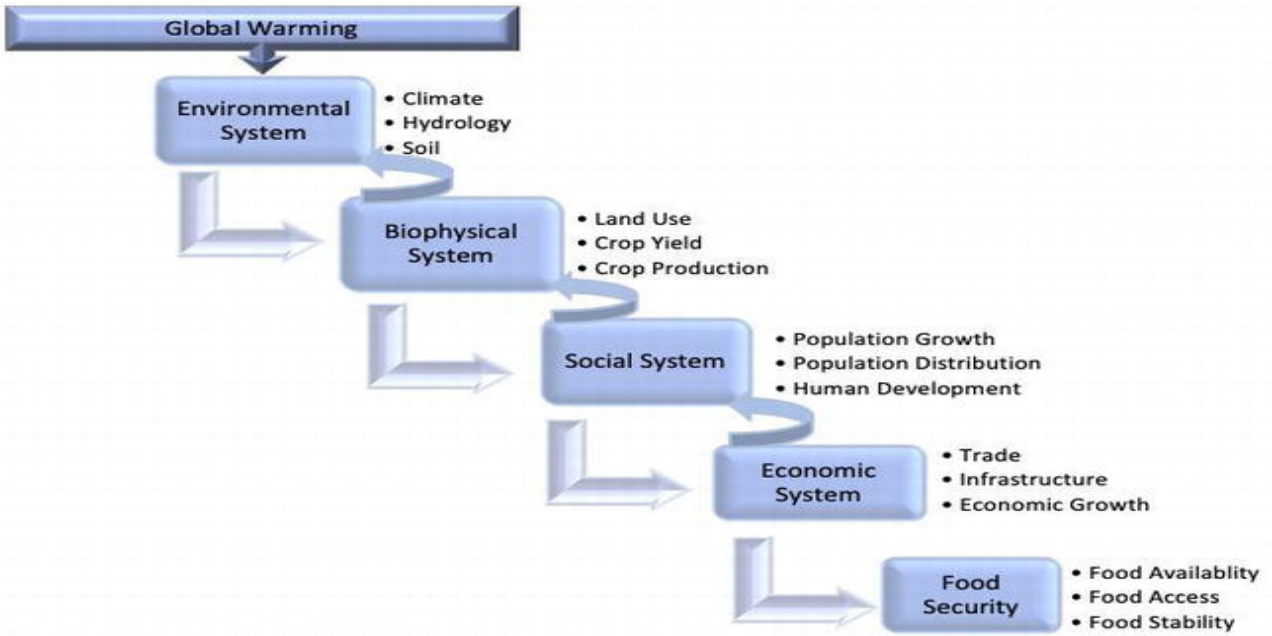


Figure 15. Global warming impact chain. Source: Atewamba, & Rhodes, 2020.

4.7. Impact on food security and malnutrition

Climate change, which is linked to environmental pollution and loss of biodiversity, threatens agrifood systems and their ability to provide, in a sustainable and affordable way, healthy and adequate food for the whole population (Arora, 2019). As a result, any progress made in promoting sustainable rural livelihoods and fighting against hunger and malnutrition is undermined.

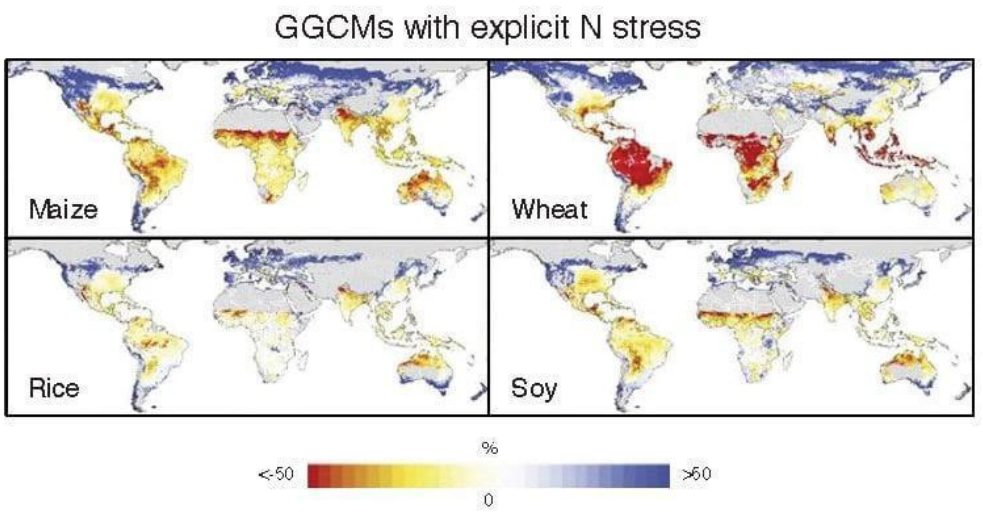


Figure 16. Median yield changes (%) for 2070–2099 in comparison to 1980–2010 with CO2 effects and explicit nitrogen stress over four Global Gridded Crop Models (GGCMs) for rainfed maize, wheat, rice, and soy. Source: IPCC, 2023.

5. Previous and new generations' problems during the pandemic

5.1. Module Description

This chapter explores the challenges and problems faced by both previous and new generations during the COVID-19 pandemic. The focus is on understanding how the pandemic has impacted different age groups and their ability to adapt, cope, and find innovative solutions in the face of adversity. The unit also examines the impact of COVID-19 on entrepreneurial activities, with a specific emphasis on agricultural entrepreneurs and their innovative solutions.

5.2. Learning Objectives

By the end of this module the reader will:

- Understand the unique challenges faced by different generations during the pandemic and the factors that contributed to their experiences.
- Explore the social, economic, psychological, and health issues that both older and younger people have had to deal with as a result of the pandemic.
- Examine the impact of COVID-19 on entrepreneurial activities and how various sectors, including agriculture, have been affected.
- Review innovative solutions that agri-entrepreneurs have implemented to adapt their businesses to the pandemic response.

5.3. Previous and new generations' problems during the pandemic

The COVID-19 outbreak, which was first detected in early December 2019, spread from person to person and caused respiratory infections. On January 30, 2020, the World Health Organisation declared it a global health emergency, and on March 11, 2020, it was

designated a global pandemic. COVID-19, which has been present in our lives since March 2020, has led to the loss of nearly 7 million lives so far (WHO, 2023).

The COVID-19 pandemic, which deeply affects our world today, has provided a unique experience for humanity. Beyond being a disease that limits the medical world, the pandemic has deeply impacted the social, economic, and psychological structures of societies. One area where these effects have intensified is the difference in experience between different generations. The impact of the pandemic manifests itself in different ways among young people and the elderly.

The implications of the COVID-19 outbreak on entrepreneurial activities will be addressed first. Entrepreneurs in pandemic-affected countries have faced difficulties as they seek new business prospects and struggle to maintain economic activity. While the epidemic forced many businesses to close, it also created new opportunities in particular industries. With the outbreak's impact, digitalisation has intensified, resulting in large increases in areas like online commerce and remote work. However, entrepreneurs have faced barriers to new business prospects, challenges in obtaining financial resources, and have had to cope with uncertainty.

In addition, the pandemic has significantly affected the problems faced by the younger generation. Educational systems suddenly had to adapt to digitalisation, and students were introduced to remote learning, greatly restricting their social interactions. Young people have experienced psychological challenges due to limited social interactions and strict lockdown measures, and they have had to deal with issues such as loneliness and lack of motivation. Additionally, their employment prospects and career plans have been greatly affected. The younger generation is experiencing anxiety about the future due to increased unemployment rates and economic uncertainty.

Meanwhile, the pandemic has deeply affected the problems faced by the elderly generation. The elderly are the most vulnerable group impacted by the outbreak, having to cope with more health issues. Additionally, they have encountered problems such as social isolation, inadequate care services, and a lack of technological connectivity. The pandemic has negatively affected the physical and mental health of the elderly, reducing their social relationships and quality of life.

With the impact of the COVID-19 outbreak, different problems have emerged between previous and new generations. The effects on entrepreneurial activities as demonstrated in Figure 18, the challenges faced by young people in their education and career prospects, and the difficulties experienced by the elderly in their health and social life domains are some of the effects of the pandemic.

5.4. The Impact of COVID-19 on Entrepreneurial Activities

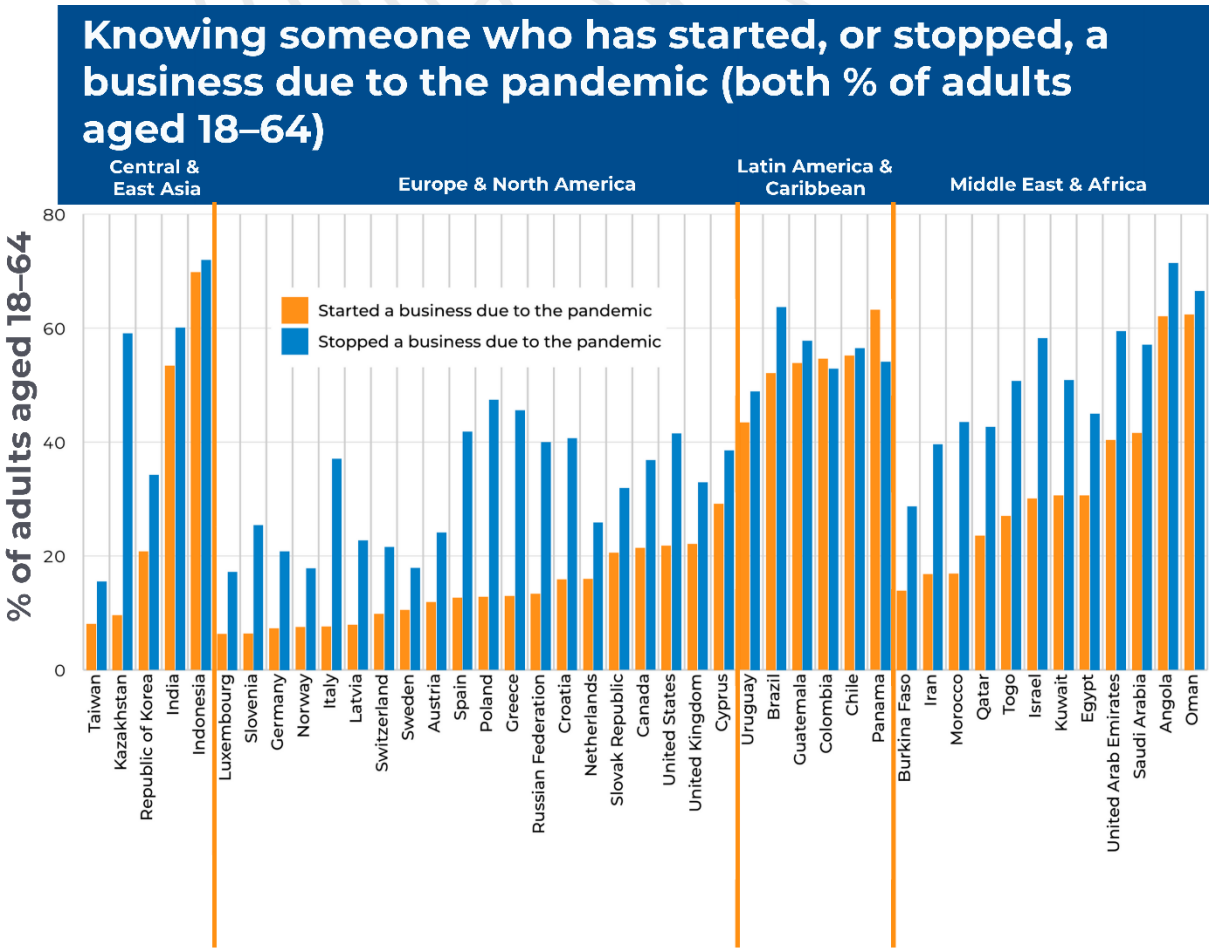


Figure 18. Knowing someone who has started, or stopped, a business due to the pandemic (both % of adults aged 18-64). Source: Global Entrepreneurship Monitor

The COVID-19 pandemic, one of the greatest challenges humanity has ever faced, has shaken the world over the past few years. This global outbreak has not only disrupted

healthcare systems and social order but has also been deeply felt in terms of its economic impacts. In this unit, we will examine the crises that have emerged alongside the challenges posed by the pandemic from an entrepreneurial perspective.

During this challenging period, entrepreneurs have faced increasing difficulties while also discovering innovative solutions. The pandemic has led people to question traditional business models and generate solutions for new market needs. Entrepreneurs have had to adapt to new challenges, such as accelerating digital transformation, embracing remote work models, and adjusting to changes in consumer behaviour.

The COVID-19 pandemic has also deeply affected the entrepreneurial ecosystem. While some sectors underwent a significant transformation during this period, others collapsed. Investors showed a decrease in risk-taking tendencies during times of uncertainty, and capital flow has been disrupted in many sectors. However, on the other hand, the entrepreneurial spirit for some was awakened during this crisis period, and innovative ideas were created. Entrepreneurs have had to demonstrate flexibility in line with changing needs and market dynamics.

The Effects of the Pandemic on Agricultural Entrepreneurs

The COVID-19 pandemic has been a turning point that has profoundly impacted our lives and industries worldwide. Alongside challenging healthcare systems and economies, it has significantly affected entrepreneurs in the agricultural sector. Agricultural entrepreneurs have had to navigate numerous obstacles during this challenging period, where resources are limited, and supply chains have become complex. However, the pandemic has also presented agricultural entrepreneurs with opportunities to generate innovative solutions and deepen their pursuit of sustainability within the industry. In this unit, we will examine the effects of the COVID-19 pandemic on agricultural entrepreneurs and explore the transformative processes it has initiated. By focusing on the impact on the agricultural sector's supply chains, production, and marketing processes, we will address how agricultural entrepreneurs have adapted to this new norm and determined strategies for the future.

Key Effects of COVID-19 on Agricultural Entrepreneurs

In this text, we will discuss the effects of the COVID-19 pandemic on agricultural entrepreneurs and the process of change within the sector. The discussion will progress within the framework of the pandemic's impact on supply chain management, production processes, marketing strategies, and sustainability.

a) Supply Chain and Logistics Challenges

The COVID-19 pandemic caused significant disruptions in supply chain management and logistics processes. Limited mobility, border closures, and quarantine measures created challenges in sourcing agricultural production materials and delivering products to the market (Özdemir et al., 2022). Supply chain disruptions affected the production processes of agricultural entrepreneurs and resulted in delays in reaching consumers.

b) Labour Shortages

During the pandemic, labour shortages became a significant challenge for agricultural entrepreneurs. Travel restrictions and quarantine measures limited the mobility of agricultural workers, leading to disruptions in harvest processes. This situation resulted in a decline in agricultural production and harvest losses (Ghosh-Jerath et al., 2022).

c) Marketing and Demand Fluctuations

The COVID-19 pandemic brought about significant changes in consumer behaviour and demand patterns. With the closure of restaurants, hotels, and other food service businesses, consumer demand shifted, requiring agricultural entrepreneurs to reassess their product marketing strategies. For instance, the importance of direct sales channels (farmers' markets, subscription packages, online sales platforms, etc.) increased during the COVID-19 pandemic (Bloem, J.R., Farris, J., 2023). However, along with these changes, adapting marketing strategies and reaching new customers posed challenges for many agricultural entrepreneurs.

5.5. Challenges Faced by the New Generations During the Pandemic

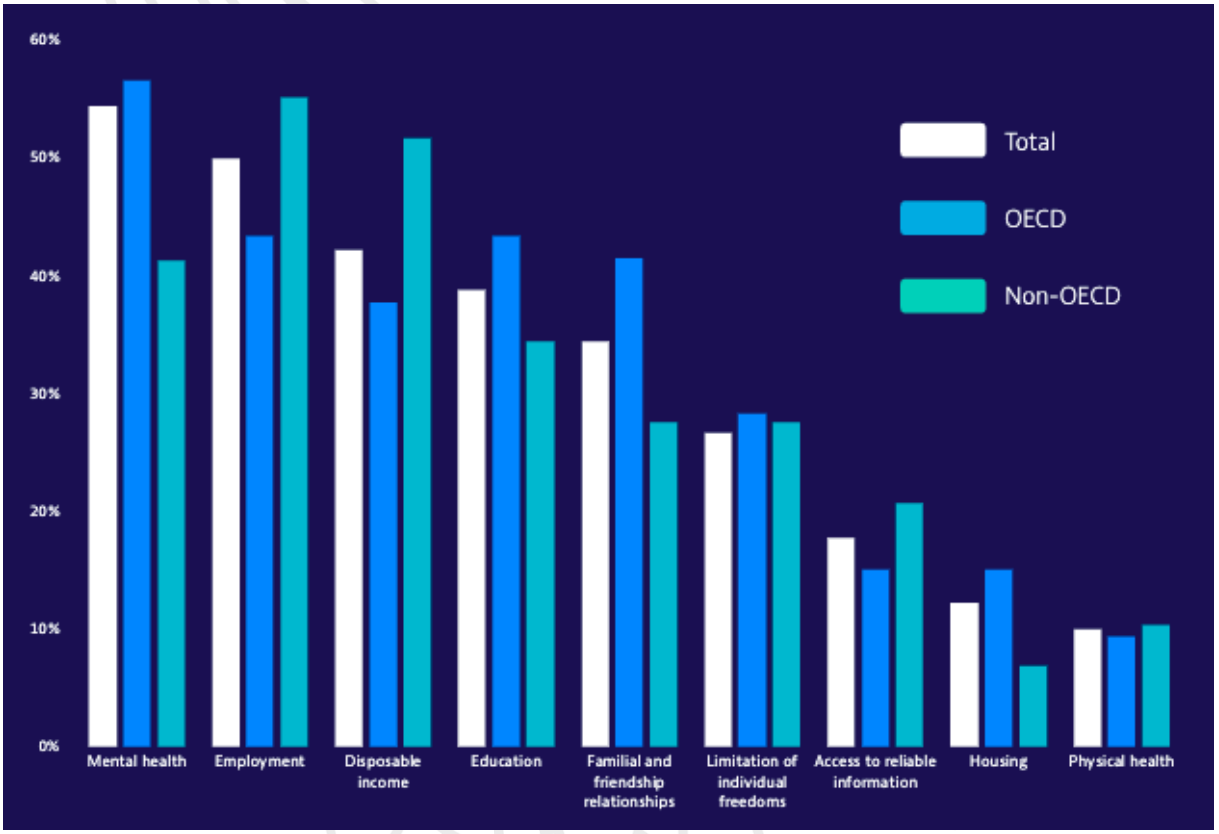


Figure 19. Youth express concerns about mental health, employment prospects, and disposable income impacts of the COVID 19 crisis. Source: OECD Survey on Covid-19 and Youth, 2020.

The COVID-19 pandemic has been a crisis that has deeply impacted the world and particularly had significant effects on the younger generation. The pandemic presented numerous challenges to young people and compelled them to adapt and learn quickly. In this section, we will discuss the impacts of the pandemic on the younger generation, the challenges that emerged, and the changes experienced during this period.

Education and Learning Processes

The pandemic had a profound impact on the education system. School closures, the transition to remote learning models, and a decrease in social interactions among students created hardships for the young generation. Remote learning required students to develop their technology skills and adapt to digital learning platforms. However, this process led to issues such as unequal access to resources, a loss of motivation, and a lack of social connections (Loades, M.E., et al., 2020).

Mental and Emotional Health

The pandemic greatly affected the mental and emotional health of the younger generation. Measures like isolation and limited social interactions, along with feelings of stress and uncertainty, had negative effects on young people. They had to cope with issues like anxiety, depression, and loneliness. As a result, there was an increased need for mental health services, and young individuals sought self-support (Mansfield et al., 2022).

Employment and Career Planning

The pandemic also affected employment opportunities for the younger generation. Many young people faced difficulties finding jobs and had to postpone their career plans. Job losses, uncertainties in the job market, and changes in the hiring processes meant young individuals had to compete in a more challenging environment. However, at the same time, the pandemic also created new opportunities such as entrepreneurship and digital job prospects (Aristovnik et al.,2020).

Resilience and Innovation

The pandemic provided an opportunity for the younger generation to develop resilience and innovation skills. During times of crisis, young people demonstrated their ability to adapt quickly to change. Factors such as the use of digital technologies and adapting to online learning and working environments, brought forth the innovation and creative potential of the younger generation. This process made young individuals more flexible, resilient, and open to change (Akkermans et al., 2022).

In conclusion, the COVID-19 pandemic brought significant changes and challenges to the lives of the younger generation. The younger generation underwent a significant process of adaptation and learning in areas such as education, job opportunities, and mental health. However, the pandemic also created new opportunities and allowed young

people to enhance their resilience, innovation, and digital skills. This process can potentially prepare the younger generation to face future challenges more effectively.

5.6. Challenges Faced by the Old Generations During the Pandemic

The COVID-19 pandemic had a profound impact on the lives of the elderly population worldwide. The older generation faced unique challenges and struggled to cope with the difficulties brought by the outbreak, leading to significant isolation during the pandemic. In this section, we will discuss the effects of the pandemic on the elderly, the problems that arose, and the importance of solidarity.

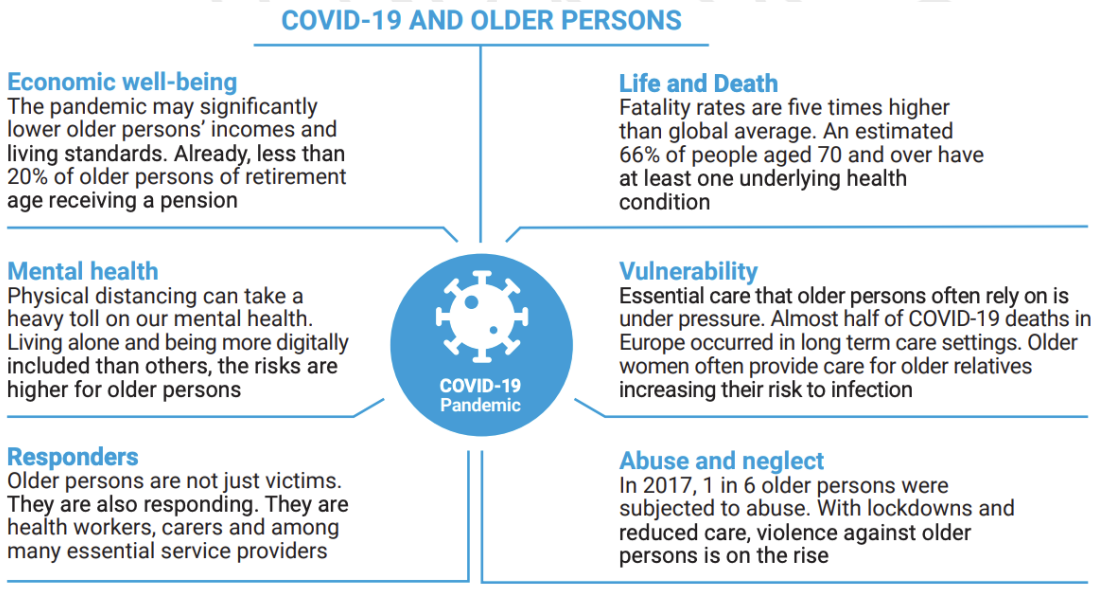


Figure 20. The impact of COVID-19 on older persons. Source: UN SG Policy Brief, 2020

Health Risks and Protective Efforts

The elderly were one of the most affected groups by the COVID-19 outbreak. As individuals age, their resistance to infections decreases, making them more vulnerable to health risks. As a result, the elderly had to isolate themselves more, strictly adhere to preventive measures, and limit their social interactions. Additionally, difficulties in accessing healthcare services were among the challenges faced by the elderly (Armitage, R, & Nellums, L.B. 2020).

Social Isolation and Loneliness

Social isolation and loneliness were two significant issues that the elderly faced during the pandemic. The measures implemented to control the spread of the virus limited physical contact with family and loved ones, reducing social interactions for older individuals. This had negative effects on their mental well-being, leading to feelings of loneliness, depression, and anxiety. Furthermore, limited access to technology prevented them from fully benefiting from digital communication tools (Joseph L. M,2022).

Community Solidarity and Support

Despite the challenges faced by the elderly during the pandemic, community solidarity and support played a crucial role. Factors such as neighbourly relationships, volunteer work, social assistance organizations, and family support helped meet the needs of older individuals and provided them with moral support. This process demonstrated the strengthening of respect and care for the elderly within society (Santini, Z.I., et al., 2020).

The main difficulties included health risks, social isolation, and loneliness. However, through solidarity and social support, the older generation managed to cope with these challenges. This process highlights the need for improvements in areas such as increased support for the elderly, opportunities for social interaction, and improved technological access.

As a result, the COVID-19 pandemic has created several challenges in the agricultural sector. Entrepreneurial activities have been affected differently between younger and older generations. However, to overcome these challenges, innovative solutions and technological tools must be used to support the sustainability and growth of the agricultural sector. In addition, specific support and education programs need to be developed to meet the needs of both the younger and older generations. In this way, the agricultural sector can be effectively rebuilt and contribute to sustainable development in the post-pandemic period.

Innovative Solutions by Agricultural Entrepreneurs

A. Digital Transformation and Innovation

The COVID-19 pandemic has accelerated the need for agricultural entrepreneurs to undergo digital transformation and focus on technological innovations. For example,

innovative solutions such as smart farming technologies, data analytics, and remote monitoring systems that enhance agricultural productivity have helped optimise the operations of agricultural entrepreneurs (Swinnen, J., & Vos, R., 2021). Additionally, the use of e-commerce platforms has increased, enabling direct-to-consumer access to agricultural products.

B. Sustainability and Focus on Local Markets

The COVID-19 pandemic has led agricultural entrepreneurs to place greater emphasis on sustainability and focus on local markets. Many entrepreneurs have preferred approaches that involve production, supply, and marketing strategies tailored to local markets to adapt to changes in consumer demand and establish shorter supply chains. Furthermore, practices focused on sustainability, such as organic farming, environmentally friendly production methods, and resource efficiency, have gained importance.

In conclusion, the COVID-19 pandemic has had significant effects on agricultural entrepreneurs. However, these challenges have brought forth the ability of entrepreneurs to generate innovative solutions and adapt to change. Strategies such as digital transformation, innovation, sustainability, and a focus on local markets have enabled agricultural entrepreneurs to succeed during this period. In the future, it will be crucial for agricultural entrepreneurs to further strengthen these strategies for a more resilient and sustainable industry.

6. Pedagogical approach to Agro-Entrepreneurship

6.1 Module Description

This module focuses on the pedagogical approach used in the Grand Friend project and how it connects to the challenges faced by agro-entrepreneurs during the pandemic. We will touch on the existing definitions of agro-entrepreneurship, the connection to intergenerational learning and its benefits to different generations. This module will also explore the effects of climate change on agriculture to gain a better understanding of the role of intergenerational learning in this context. This chapter examines the identified

needs derived from the interviews conducted in Germany, Poland, Greece and Cyprus and the best practices of intergenerational programs in each country.

6.2 Learning Objectives

By the end of this module, the reader will:

- Be able to define agro-entrepreneurship and intergenerational learning.
- Understand how intergenerational programs can be used as pedagogical tools and the benefits to agro-entrepreneurs.
- Identify needs and best practices in agro-entrepreneurial adult education.

6.3. Definition of Agro-Entrepreneurship and Intergenerational Learning

Globally the agriculture sector primarily depends on the family farm model whereby an older generation of farmers pass on their legacy, knowledge and farmland to their younger family members for the survival and success of the business (Conway et al., 2019). However, in Europe, the farming population is ageing, and there is a decrease in the number of young people in the agricultural industry (Conway et al., 2019). Agro-entrepreneurship has the potential to encourage interest and development of the agricultural sector (Far & Rezaei-Moghaddam, 2019); however, consensus on what this means and how it is achieved differs.

Nawi et al. (2022) define agro-entrepreneurship as an individual's inclination to participate in and create business activities in the agricultural field. Renting et al. (2009) argue that through the development of a new identity as rural entrepreneurs rather than traditional farmers, young people may be encouraged to perceive agriculture as a viable

professional pathway. Using a business-oriented approach, young people can broaden conventional understandings of the agricultural sector, and through innovation and investment, improved practices and economic development can occur (Nawi et al., 2022). If young people perceive themselves to be entrepreneurs with a stake in ecology and the environment in general, they can push for specific land-use approaches, as well as policy and governance mechanisms for biodiversity conservation (Nawi et al., 2022).

Seuneke & Bock (2022) take a different approach to define agro-entrepreneurship as the involvement of non-farming methods, such as the creation of new access points to networks and information, that farmers and other professionals in the industry already use to increase interest in the sector. An example of this is turning farms into a place of agro-tourism where people can holiday at a farm while learning about daily activities. This improves tourism and brings new sources of revenue to the farm as well as connecting society to agricultural processes (Seuneke & Bock, 2022). In this light, the farm landscape serves multiple functions that were not previously considered part of agricultural practices and opens up new opportunities for farmers to expand their businesses.

The terms ‘multifunctional entrepreneurship’, ‘entrepreneurial learning’ and ‘multifunctional agriculture’ have also been used in the literature as synonymous with agro-entrepreneurship (Far & Rezaei-Moghaddam, 2019; Seuneke & Bock, 2015). This terminology is mostly used to emphasize the learning processes through which farmers acquire knowledge and skills to begin, create and implement new business activities on their farms. These terms refer to the cognitive changes and social phenomena which lead to the development of non-traditional attitudes to agriculture and redefine the identity of the farmer, as well as strategies to bring in more money and establish networks and partnerships (Far & Rezaei-Moghaddam, 2019; Seuneke & Bock, 2015).

Therefore, the understanding of agro-entrepreneurship, whether phrased as “multifunctional” or “entrepreneurial learning”, finds at its core a set of skills and competencies that contribute to the identity shift of farmers to entrepreneurs. In order to engage in the entrepreneurial process, there are certain steps needed, from defining the idea to developing the business model and launching it, that require different skills and competencies (Perez-Encinas et al., 2021). In accordance with Chell’s (2013) study, these skills fall into the following broad categories:

- Innovative thinking and creative ability to come up with ideas and envision them.
- Identifying and recognizing market opportunities.
- Leadership, interpersonal and managerial skills.
- Decision-making and strategic planning.
- Conflict resolution and risk management.
- Flexibility, adaptability, and resilience; and
- Making contacts and expanding your network.

Within the agricultural sector, the development of entrepreneurial skills can occur through knowledge transfer by capturing learnings and methods that are passed down from farmers to a broader audience and have the potential for the adaption of new practices, which can improve conservation efforts beyond an individual farm level (Far & Rezaei-Moghaddam, 2019). It is often the case that young people interested in entrepreneurship and starting a new business consult their parents, relatives, or mentors for advice (Nawi et al., 2022). This may involve consulting people already in the agricultural sector for knowledge, practices, and recommendations. In this sense, intergenerational learning can be a tool for knowledge transfer of sustainable agricultural practices that can be learnt and implemented.

The term ‘intergenerational learning’ refers to the processes aimed to promote reciprocal knowledge exchange among a multi-generational workforce (Singh, Thomas & Numbudiri, 2021; Rupcic, 2018). Intergenerational knowledge refers to the practical behaviours obtained through experience which are not connected to cognitive ability, often involving the older workforce sharing this knowledge with younger people (Singh, Thomas

& Numbudiri, 2021; Rupcic, 2018). Thus, intergenerational learning (IGL) programs enable practical knowledge transfer and the development of cross-generational relationships.

6.4. Intergenerational Programs (IPs) as pedagogical tools

Singh, Thomas & Numbudiri (2021) propose a conceptual framework for IGL, which follows a step-by-step process. In comparison to the more conventional understanding of a mentor and mentee, their conceptualisation requires three agents, two participants and a facilitator. The rationale behind this is that the facilitator acts as the connecting link between the two participants to allow for greater flexibility and role-swapping between them. As such, the following stages are used to implement their framework:

1. **Association:** Different generations are brought together and identify areas of need and knowledge exchange. This dialogue leads to learning goals and plans to respond to mutual learning needs. This process is flexible since knowledge acquisition is an ongoing and changing process.

2. **Acquisition:** Two-way knowledge-sharing process begins using various methods e.g., informal meetings, on-the-job training. Role of mentor and mentee change according to shared learning goals.

3. **Application:** Learning outcomes adopted and applied. They can be adapted where necessary, given the work-related context. This stage allows the identification of issues and limitations of prior learning. This is a self-driven process.

4. **Advancing:** A learning relationship between participants develops through a knowledge-sharing journey. They continue to share practical skills and knowledge and seek new ones. If participants bond, they are more likely to openly share experiences.

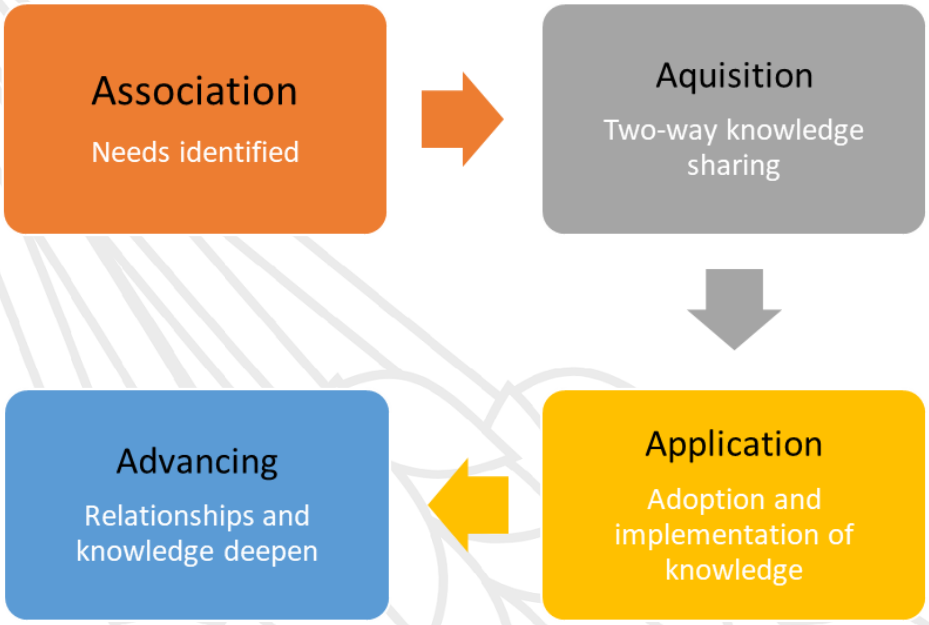


Figure 23. A conceptual framework for IGL, based on Singh, Thomas & Numbudiri (2021)

This framework closely ties in with the efforts of the Grand Friend project to provide the opportunity to agro-entrepreneurs of different generations to learn from one another through lifelong learning opportunities. A way to expand on this framework would be to adopt Rupcic's (2018) identified four learning approaches:

1. Zero learning: Learning certain behaviours and repeating them to build knowledge.
2. Learning 1: Changing skills and attitudes depending on acquired knowledge.
3. Learning 2: Learning how to learn. This process depends on the individual.
4. Learning 3: Mental shift leading to the transformation of thinking, which can lead to new practices.

This learning approach presents similarities with Kolb's (1986) framework of experiential learning and Mezirow's (1997) transformational learning. These approaches can be complementary to one another since they utilise learners' experiences to build knowledge and transform their perceptions through active learning methods. Similarly, in

Rupcic's (2018) conceptualisation, learning occurs in stages and can progressively result in a shift in mental perceptions and attitudes to lead to the adaptation of new practices.

Collective shared learning processes can support the development of agro-entrepreneurship. For instance, family farms becoming more than places of food production and as spaces for the creation and development of new and sustainable practices through knowledge exchange and mutual understanding and awareness (Singh, Thomas & Numbudiri, 2021; Rupcic, 2018). New ideas adopted from entrepreneurs by entrepreneurs can lead to new economic activity being generated in the family farm, which can help farms survive the economic and environmental challenges they experience (Singh, Thomas & Numbudiri, 2021; Rupcic, 2018). Food and agricultural programs derived from bringing together generations of agro-entrepreneurs can establish the connection between humans, food and land and encourage the uptake of green practices sector-wide.

6.5. The benefits of Intergenerational Programs (IPs)

Through intergenerational programs, different generations of agro-entrepreneurs can benefit by engaging in a two-way street of knowledge exchange and experience. Martins et al. (2019) conducted an intergenerational program review where they reported that although inconsistencies were found across different programs, their results were successful in improving the overall well-being and self-efficacy of younger and older

participants. As such, the design of such programs should take into account the use of specific objectives and expectations that are consistently measured and evaluated.

In their study, Santini, Baschiera & Socci (2020) provided training to older adult entrepreneurs on mentoring and 2 intergenerational programs with young people who were neither in employment nor in education (NEETs) in Germany, Italy and Slovenia. Their results demonstrated that both parties benefited from these programs. On the one hand, mentors were able to become more nurturing and communicative whilst enhancing their own well-being and self-esteem. On the other hand, mentees built a trusting relationship with their mentors that enabled them to gain entrepreneurial and interpersonal skills. Similarly, in the study of Gimmon (2014), mentoring contributed to greater self-efficacy and improved interpersonal skills for both mentors and mentees.

Perez-Encinas et al. (2021) investigated how older and younger generations of entrepreneurs complement or differ from each other to form partnerships. Through their study, they discovered that although they present significant differences in how they function and approach entrepreneurship, their antithetic internal and external circumstances can be complementary, such as motivation, financial situation, life circumstances, and network.

Nevertheless, interactions should be free from prejudice and encourage open communication for an intergenerational program in entrepreneurship to be successful (Perez-Encinas et al., 2021). In this light, as stated by Perez-Encinas et al. (2021), mediation by stakeholders, such as NGOs, play a key role to encourage fruitful interactions between younger and older generations of agro-entrepreneurs as a way to reach their full potential. Thus, the interaction and dynamic of three agents, where one is the mediator, as described in the conceptual framework of IGL (Singh, Thomas & Numbudiri, 2021), can have positive results. As a way of extending the stakeholders' approach, Molina-Luque, Casado & Stončikaitė (2018) invited senior students to participate as stakeholders in research programs at the university, which enhanced social cohesion and quality of life.

In addition, important components to the successful implementation of such programs appear to be the teaching and learning methods chosen, as well as the time and frequency spent on them. Accordingly, active learning methods and practical programs have proven to be effective in intergenerational programs related to entrepreneurship in order to engage participants of different generations (Gimmon, 2014; Perez-Encinas et al., 2021). As reported by Santini, Baschiera & Socci (2020), the consistency of the program was one of its main strengths in keeping up the motivation of the participants. More frequent interactions in long-term programs are more effective in maintaining the engagement of the participants and maximising the positive effects of intergenerational interaction (Martins et al., 2019).

6.6. Identifying the needs of Adult Education (AE) through interviews in partner countries

In an effort to consolidate data from the participating countries in this project (Germany, Cyprus, Greece and Poland), semi-structured interviews of 30-45 minutes were completed with a total of 8 experts on lifelong learning and/or agricultural entrepreneurship, as well as a total of 8 Civil Society Organisation (CSO) representatives on environmental awareness. Interviews took place in May 2023 and June 2023. Most interviews were conducted online via Zoom or MS Teams, two interviews in Cyprus occurred face-to-face and one interview

in Greece occurred over the telephone. The partners compiled a list of suggestive questions for each group and provided one summarised report for each interviewee.

The purpose of semi-structured interviews is to allow participants to respond freely and for researchers to further investigate their responses (McIntosh & Morse, 2015). Before the conduction of the interviews, the participants were informed of the purpose of the interview and the treatment of their personal data. The analysis of the interviews follows the thematic analysis approach, which starts by identifying common themes and grouping them into categories.

In the following pages, we will outline the key findings of the interviews and highlight differences found between the two different groups of interviewees on agro-entrepreneurship, its challenges, education, and intergenerational programs.

Experts

Perceived Benefits of Agro-Entrepreneurship

Through the analysis of the interviews, the perceived benefits of becoming an agro-entrepreneur fall into two broad categories: **intrinsic and extrinsic**. The intrinsic benefits mentioned by the participants were greater freedom and flexibility to structure your business and the opportunity to reinvent your path and bring positive impact to the general public through your products and/or services. A benefit mentioned by one interviewee focused on fostering innovation and talent in the sector, which can be understood as both an intrinsic and an extrinsic benefit. The extrinsic benefits focused mostly on financial incentives and the sustainability of agricultural businesses. The latter contributes to long-term stability for the individual and security during times of crisis, as mentioned by one interviewee. An interesting observation is that interviewees from Cyprus had a more pessimistic view and did not see any benefits for the individual apart from supporting the development of the sector. One reason for this perspective is the absence of collective action in Cyprus.

General Challenges to Agro-Entrepreneurship

The challenges identified by the interviewees follow a similar pattern to the benefits that are categorised into external and internal challenges. Within the internal ones lie individual knowledge and development capabilities on agronomic processes, technology, and financial management. The external challenges focused on climate change, global food problems, regulatory frameworks, electricity costs and consumption, high costs of infrastructure or lack thereof, and external crises affecting the market, such as the Ukraine war and inflation. The external challenges can be broadly grouped into mainly economic and environmental.

Challenges for Agro-Entrepreneurs of different generations

Expanding on these challenges, different generations of entrepreneurs face their own shortcomings. For the older generation, these include a lack of technological knowledge and effective communication skills. For the younger generation, these challenges revolve around a lack of experience and under-utilisation of skills and digital tools. Based on the interviewees, older generations follow a more conservative approach to their businesses, whereas younger generations are more impatient, creative, and idealistic. Another challenge faced by both generations is the lack of trust in cooperative structures, which are much needed to support their needs and secure their rights. In addition, one interviewee noted that there is a negative view of the agricultural profession regarding its status and prestige within society in Poland.

Education: role, shortcomings, and improvements

All interviewees agreed that education plays a crucial role in the development of agricultural entrepreneurship and individuals involved in the sector. The shortcomings of education in Germany, Poland, Cyprus and Greece present certain commonalities ranging from content to structure. As such, interviewees stated that practical training is not embedded in educational courses, as well as the economics and management of agro-businesses. Moreover, the curricula taught are outdated and inflexible to address new technologies and the changing business landscape. The design of educational courses should take into account the needs of the agro-entrepreneurs and the market.

Another suggestion focused on updating the curricula based on research findings to connect education and research.

Regarding the structure, suggestions were made to dedicate more time to training, providing opportunities for apprenticeships and exchange programs between different countries, sharing educational materials publicly and offering more options for online training. Going a step further, some interviewees highlighted the importance of social capital and bringing together different stakeholders, such as Vocational Education and Training (VET), Higher Education Institutions (HEIs) and agro-entrepreneurs, to collaborate and co-design educational programs and encourage knowledge exchange.

Intergenerational learning: potential and implementation

The interviewees' views on intergenerational learning and programs were mostly positive and underlined the importance of sharing different perspectives, experiences and knowledge to develop the agricultural profession and practices. As mentioned, bringing different generations of agro-entrepreneurs together can increase employment and partnership opportunities for all, as well as enable a culture of collaboration in the sector. Advice on the implementation of intergenerational programs focused on effective communication and working together on new techniques, meetings and discussions on specific topics, and encouraging changes in agricultural practices by asking the opinion of older farmers so that they feel part of the change. One of the most important aspects is creating room for discussion within a friendly and encouraging atmosphere to encourage the participation of different generations. One interviewee was not as positive about different generations engaging in discussion and said that it might be more fruitful to allow participants to share without directly interacting, like in Q&A sessions that focus on specific topics and areas of concern.

CSO representatives

Challenges to sustainable agricultural development

The main challenges identified by CSO representatives to sustainable agricultural development revolved around climate change and its effects, such as side degradation, biodiversity losses and conservation of natural resources, working conditions and the

adaptation of sustainable agricultural practices and techniques that contribute to environmental protection. As such, sustainability and environmental protection appear to be interrelated and synonymous with each other. This occurs due to rapid changes brought upon by the effects of climate change, which directly affects agricultural production. As stated by other interviewees, challenges related to climate change should also consider the environmental impact of current practices, the management of resources, i.e., land, water and energy, as well as food production and security. Other challenges focused on the lack of education on the matter and proper guidance on implementation. In addition, the lack of coordination and collaboration between different stakeholders appeared to be an obstacle to sustainability, according to one interviewee.

Challenges for Agro-Entrepreneurs of different generations

The challenges of agro-entrepreneurs of different generations were not so much differentiated, although interviewees stated that older generations lack technological knowledge and younger generations lack experience. As such, the challenges were viewed from a more general scope. These are mainly grouped into financial, legal, environmental and educational aspects. In particular, financial challenges focused on access to the market and competitiveness, access to funding and affordable capital. From a legal perspective, the reconciliation between sustainable agriculture and environmental protection was highlighted by the interviewees. They added that legislation and regulatory frameworks should contribute to environmental protection, natural resources management and reducing greenhouse gas emissions. Moreover, technology is interconnected with sustainability and environmental protection to mitigate the effects of climate change and support risk management for disaster relief. Specifically, in Poland, one of the interviewees mentioned that there are unfavourable government policies in place for disaster relief and compensation. From an educational perspective, the lack of technological knowledge and usage hinders the development of agricultural businesses, as well as access to such knowledge with appropriate guidance. Another challenge is the adaptation of agricultural techniques that support sustainable development.

Collaboration with Civil Society Organisations and other stakeholders

The collaboration between civil society organisations, agro-entrepreneurs and other stakeholders holds favourable views, according to the interviewees. Through such collaboration, knowledge exchange and capacity building are encouraged and reinforced. This can also support policy advocacy and exert influence on stakeholder engagement for regulations and incentives towards sustainable agriculture. As suggested by some interviewees, some actions to materialise this collaboration could be seminars, interdisciplinary teams and internships. Civil society organisations can also aid agro-entrepreneurs in market development, increasing consumer awareness and promoting consumer demand for sustainably produced food. In this way, creating a pathway for sustainable and green agricultural practices to be advocated and implemented on policy and legal levels. Expanding on this, the collaboration between these stakeholders can contribute to community initiatives such as farmer cooperatives and community-supported agriculture programs to further development in the sector. Through this, collaboration in research and development projects for sustainable agricultural techniques can also be promoted.

Education: role, shortcomings and improvements

Interviewees agree that education holds a pivotal role in the development of sustainable agricultural businesses. They noted that the link between sustainability, the environment and agriculture is still not clearly reflected in educational courses. The content included should include the benefits of sustainable and green practices, as well as provide an understanding of how technology and techniques can be integrated into this. Apart from theory-based content, the need to include practical training within local contexts was highlighted.

Regarding teaching and learning methods, the combination of formal and informal educational methods was preferred by interviewees, as well as experiential learning. Imparting the

right mindset for sustainable agriculture begins by demonstrating how agricultural actions and practices affect the environment and how threats or risks can negatively impact agro-businesses. Therefore, raising awareness through education on sustainability and environmental protection from multiple angles.

As reported by the interviewees, the curriculum of educational agriculture programs does not reflect the current situation, nor does it include views from different disciplines. Another issue is the lack of qualified personnel, which affects the effectiveness of training and education programs. In addition, these programs should be aligned with the real needs of agro-entrepreneurs and the market. One more significant issue is the incentives and motivation provided to agro-entrepreneurs to engage in education, as well as support outside the classroom, in order to ensure the implementation of green and sustainable practices. Some suggestions made by the interviewees were strengthening support ecosystems, raising awareness and outreach of information and designing education for continuous professional development. Furthermore, content should include the intersection of technology, agriculture and entrepreneurship. As such, regular curricula updates and the expansion of access to agricultural education via online platforms, scholarships and distance learning programs were suggested by the interviewees as solutions to these issues. It was also underlined that collaboration with industry experts and agricultural associations should be reinforced, as well as mentoring schemes for new individuals into the sector.

Intergenerational learning: potential and implementation

The interviewees acknowledge the benefits of intergenerational learning as a way to encourage knowledge transfer, networking, collaboration and community building, as well as find innovative solutions to problems in modern agriculture. Some key elements in the design of intergenerational programs include:

- clear objectives and expectations,
- effective communication channels,
- structured networking and mentoring approaches,
- recognition and incentives,

- mutual respect and transparency,
- continuous and long-term engagement, and
- consistent evaluation and feedback.

Several suggestions were made for implementing intergenerational programs, such as the creation of a collaborative platform for different stakeholders to come together, share ideas and collaborate; organising conferences, fairs and workshops; creating online communities; documenting successful and unsuccessful stories; and implementing mentoring programs. In addition to this, one interviewee emphasised the importance of attracting new people into the field through internships and service-learning programs for secondary and tertiary education students.

Summary

Based on the analysis of the interviews, the challenges faced in the field of agro-entrepreneurship mainly involve environmental, educational, legal and financial aspects. When it comes to agro-entrepreneurs of different generations, lack of knowledge of technology for older generations and lack of experience for the younger generations were most commonly mentioned. Interviewees of both groups also acknowledged that perceptions and attitudes differ according to the generation, which is something to be considered when structuring an intergenerational program. Moreover, from an educational point of view, the shortcomings identified were a lack of qualified trainers, access, incentives, support, and motivation of learners, as well as the outdated curricula and teaching and learning methods used. One notable difference between the two groups was that CSO representatives were adamant about providing incentives and support to agro-entrepreneurs more than experts. Intergenerational learning was mostly encouraged by the interviewees. Some of the recurring elements noted were clearly defined objectives and expectations, structured networking and mentoring approaches and mutual respect for

such programs to flourish and reach their full potential. The commonalities presented between the two groups of interviewees are depicted in the figure below.

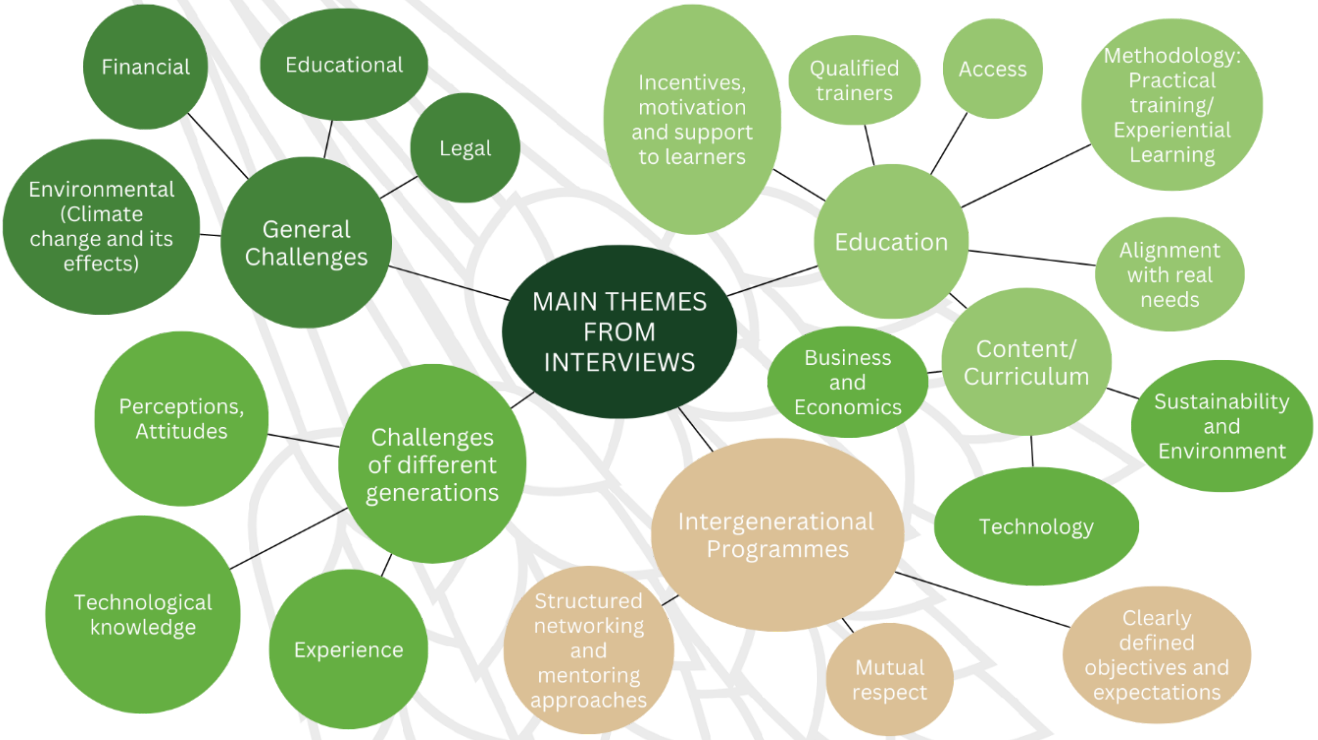


Figure 27. Summary of interviews main themes

6.7. Best Practices in Adult Education and Intergenerational Programs in each national context

In this section, we provide a collection of best practices that focus on adult education and intergenerational programs in each country. It should be noted that some of these programs are not specifically considered intergenerational. However, intergenerational interaction and learning are naturally occurring as part of adult education, whether intentionally or unintentionally. Based on the themes addressed in the Grand Friend project, some best practices also address the green transition process, as well as sustainable development.

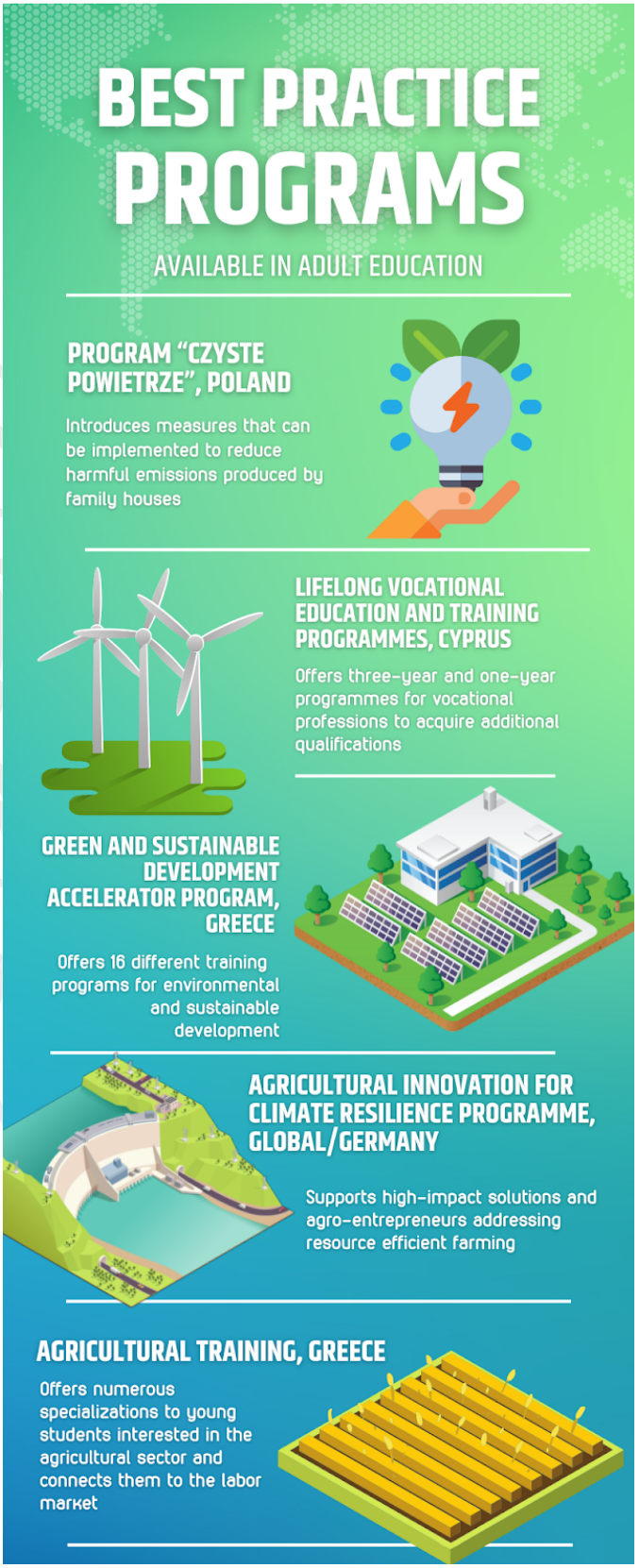


Figure 28. Best practices in adult education

7. Conclusions

7.1. The importance of Intergenerational Programs for Active Citizenship

In this guidebook, we have delved into the significance of intergenerational programs in fostering active citizenship and promoting sustainable agricultural practices. As outlined in the pedagogical guidebook, these programs play a crucial role in addressing the challenges faced by both previous and new generations, particularly during the COVID-19 pandemic. The following key points highlight the importance of intergenerational programs in enhancing active citizenship:

- Bridge-building and Mutual Understanding:
  Intergenerational programs serve as bridges that connect different age groups within society. By facilitating interactions between the older and younger generations, these programs encourage mutual understanding, empathy, and respect. Participants can learn from one another's experiences, knowledge, and perspectives, fostering a cohesive and compassionate community.
- Knowledge Transfer and Skill Enhancement:
  The exchange of knowledge and skills between older and younger participants is a vital aspect of intergenerational programs. Older generations possess traditional agricultural practices and wisdom, while the younger generation brings innovative ideas and technological expertise. This knowledge transfer enhances agricultural practices and ensures the preservation of valuable traditions while embracing advancements.
- Active Civic Engagement:
  Engaging in intergenerational activities promotes active citizenship by encouraging participants to take responsibility for their communities. As individuals from different age groups collaborate on projects, they develop a deeper understanding of societal issues and are motivated to drive positive change. This heightened sense

of civic engagement leads to collective efforts for sustainable agriculture and community development.

- Social Inclusion and Empowerment:
  Intergenerational programs promote social inclusion by providing a space for all members of society to participate actively. This inclusivity empowers marginalised groups, such as the elderly and youth, by offering them opportunities to voice their perspectives and contribute to decision-making processes. It fosters a sense of belonging and ownership, leading to a more cohesive and harmonious society.
- Sustainable Development:
  As we explore the impact of climate change on agriculture, intergenerational programs offer a platform for devising sustainable solutions. By combining the wisdom of the older generation with the innovative ideas of the younger generation, these programs can contribute to more resilient agricultural practices that address environmental challenges and ensure food security.
- Best Practices in Adult Education:
  Intergenerational programs also play a role in adult education. By identifying the needs of adult learners and incorporating intergenerational learning, these programs create enriching and engaging educational experiences. Collaborative and diverse learning environments encourage active citizenship as participants gain knowledge and skills relevant to real-world challenges.

In conclusion, intergenerational programs are invaluable in cultivating active citizenship, particularly in the context of agricultural practices and sustainable development. As evidenced by the pedagogical guidebook, these programs foster mutual respect, knowledge exchange, and social inclusion while empowering individuals to contribute to their communities actively. They serve as essential pedagogical tools that bridge the generation gap and empower participants to drive positive change for a better, more sustainable future. By embracing and investing in intergenerational programs, societies can build a stronger foundation for active citizenship and collectively work towards a more equitable and prosperous world.

8. Resources

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