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Black Sea CROSS BORDER COOPERATION

AGREEN
CROSS-BORDER ALLIANCE FOR CLIMATE-SMART AND GREEN AGRICULTURE IN THE BLACK SEA BASIN

Subsidy Contract No. BSB 1135

FEASIBILITY STUDY

CLIMATE-SMART AGRICULTURE IN THE BLACK SEA BASIN REGION OF GREECE

Common borders. Common solutions.

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Table of Contents

List of Abbreviations

EXPLANATION TABLE OF TERMS AND ABBREVIATIONS	
RCM	Region of Central Macedonia
EMTH	Eastern Macedonia & Thrace
CSA	Climate Smart Agriculture
CSOA	Climate Smart and Organic Agriculture
CAP	Common Agricultural Policy
GHG	Greenhouse Gasses
CO_2	Carbon Dioxide
EU	European Union
GDP	Gross National Product
m.v.	Mean Value
EUROSTAT	European Statistics
ELSTAT	Hellenic Statistical Authority
NECP	National Energy and Climate Plan
NASCC	National Adaptation Strategy to Climate Change
RAPCC	Regional Adaptation Plan to Climate Change
R.U.	Regional Unit
M.D.	Municipal Department
PDO	Protected Designation of Origin
PGI	Protected Geographical Indication
OPEKEPE	Payment and Control Agency for Guidance and Guarantee Community Aid
ESPA	National Strategic Reference Framework

1. General Description

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1.1. Definitions and Acronyms

Definition of Climate – Smart Agriculture

Climate-smart agriculture (CSA) is an approach for the transformation and reorientation of agriculture under the new reality of the changing climate. The definition most commonly used comes from the "Food and Agriculture Organization of the United Nations" and states that CSA is «the agriculture tha sustainably increases the productivity, promotes the adaptation to climate change, reduces / removes greenhouse gas emissions (GHG) where possible while promoting the food security and development national goals. The concepts of production, adaptation and mitigation consist the three interconnected pillars necessary for the achievement of CSA.

- Productivity: CSA aims at the sustainable increase of agricultural productivity and therefore the incomes of agricultural farming, livestock and fishery, without having the negative impacts on the environment. A fact that is directly related to food security and nutrition.
- Adaptation: CSA aims at the farmers' development of adaptation and elasticity to climate change and extreme weather conditions. Through CSA, the farmer has the opportunity to develop abilities allowing him/her to adapt to extreme weather conditions while protecting the ecosystem kai therefore its basic supplies (food, water, fiber, wood).
- Mitigation: CSA promotes, in every possible way, the reductions and / or removal of Greenhouse Gas Emissions. This means reducing GHG emission by every kilo produced, avoiding deforestation for the sake of agriculture and land and forest management in ways that attain the largest amount of carbon dioxide absorption.

This, of course, does not mean that every agricultural practice in every region must attain all three goals of CSA. Alternatively, the CSA approach seeks for the best solution taking into account elements of all three pillars and always adapting to the needs of the specific farm and / or region weighing the costs and benefits. Moreover, the CSA approach does not consist of a specific set of practices that can be applied worldwide but rather it includes different elements that are integrated at local level. Finally, it is directly related to "on and beyond" the farm actions since it corelates technology, policies, institutions, investment and financing.

The most significant characteristics of Climate-Smart Agriculture consist of:

- Taking climate change into consideration. Unlike conventional agriculture, CSA continually integrates climate change into the design and development of sustainable agricultural systems.
- Integrates multiple goals and manages compromises. Ideally, CSA promotes the production of threefold results: production increase, adaptation development and reduction of GHG emission. Very often this is unattainable and therefore there must be some king of compromise where one or two goals are further strengthened than the third goal. In this way, every farmer or/and every region weighs the costs and benefits and chooses the actions most suitable to their specific goals and needs.
- Promotes the sustainability of the Ecosystem. The Ecosystem supplies the farmers with basic resources such as clean air, water, food and material and CSA ensures that any interventions realized do not bring degradation to this very ecosystem. For this reason, Climate-Smart Agriculture adopts the "landscape approach" and develops on the principles of sustainable agriculture aiming at a fully integrated planning and management.

- Offers multiple application points at different levels. Climate Smart Agriculture should not be taken as a set of practices and technologies. It has multiple application points that cover a wide range from the development of technologies and practices to the implementation of climate change models, information technologies, value chains as well as the strengthening of organizations, agencies and institutions. So, it is not just about installing technology at the field level but the integration of multiple interventions at the field level, food safety system, value chain and institutional framework.
- It addresses a specific framework. What is considered climatically smart in one area may not be climatically smart for another, and a climatically smart intervention may be beneficial in one specific area for only a certain period of time. Interventions must take into account the way in which different elements interact with the landscape, within or between ecosystems and always as part of a different legislative framework and bodies. Taking into account that CSA aims at the achievement of multiple goals proves the fact that it is particularly difficult to transfer experience from one context to another.
- Enhances the participation of the marginalized population. In order to achieve its objectives, the CSA approach should involve the most vulnerable population of low-income people living in marginalized areas who are particularly vulnerable to climate change such as drought or floods. The female population is another common CSA target group. Women, in general, have limited legal rights to the land they cultivate as well as limited access to financial resources that could help develop adaptability to extreme weather conditions. Climate - Smart Agriculture aims to involve all local, regional and national stakeholders in decision making so as to identify the most appropriate interventions and synergies for sustainable development.

The development and implementation of Climate - Smart Agriculture is a process that includes data collection and commitment from various sectors of the society and the economy. The first and main concern is the expansion of the evidence base that supports the necessity of implementing CSA and the benefits arising from it. The evidence base consists of the current and projected future effects of climate change in a country, identifying vulnerabilities in the agricultural sector and food security, as well as identifying effective adaptation options. It includes estimates for potential greenhouse gas reductions (or increased carbon sequestration) resulting from adaptation strategies, costs and barriers coming from the adoption of various practices, issues related to the sustainability of the production system and the required legislation and institutional response to mitigate emissions.

Equally important is the creation and / or strengthening of the legal framework concerning the CSA and Climate-smart agricultural products. The CSA should move within a specific framework of legislation, plans, investments and coordination that addresses a variety of bodies and organizations responsible for agriculture, climate change, food security and land use. At the same time, the strengthening of local and / or national bodies is considered necessary as they are the ones who have the ability to empower, facilitate and motivate the rural population.

In addition, an important area of the CSA implementation process is the improvement of financing options which should connect climate change with agricultural financing, both public and private. Tools such as the "National Adaptation Strategy to Climate Change " and the "Regional Adaptation Plans to Climate Change " and projects such as the "LIFE - IP AdaptInGr" are important tools of national legislation to create access to national and international funding sources. The national budget will continue to be the main source of funding and therefore climate integration in sectoral planning and budgeting is needed to adapt to climate change successfully.

Undoubtedly, farmers are the ones better familiar with their own crops, the ecosystem in which they operate and the local climate. Therefore, when it comes to the development and

implementation of Climate - Smart Agriculture, the knowledge and experience of local farmers, their requirements and priorities should be taken into account. Local organizations and local projects must support farmers in order to identify suitable climate-smart options that can be easily adopted and implemented.

The Climate-Smart Agriculture approach is now considered an integral part of the future survival of the rural population mainly due to accelerating climate change. Apart from that CSA faces globally a variety of challenges related to security and unequal food distribution and malnutrition, the direct connection between agriculture and poverty as well as between agriculture and climate change.

Despite the agricultural development and the promotion of food security over the past decade, there are approximately 800 million undernourished people worldwide and 1 billion malnourished. At the same time, 1.4 billion adults are overweight and 1/3 of the food produced ends up as waste. The world population is expected to reach 9.7 billion before 2050 while dietary trends have turned the population's interest to protein consumption. If these indications remain, food production must increase by 60% by 2050. The CSA approach comes in to boost productivity and improve food security in order to adequately feed the entire planet, and especially the marginalized populations, while at the same time promoting waste reduction.

Agriculture still remains the main source of food, labor and income for a large percentage of the population living in developing countries; About 75% of the world's underprivileged population lives in rural areas where the only source of income comes from agriculture. As a result, rural development promoted by CSA incorporates the most environmental - friendly strategies aiming at reducing poverty and developing food security.

Climate change is already causing the rise of the global average temperature and this trend seems to be deteriorating in the near future, a fact that is also causing more weather instability and intensity - hurricanes, floods, heat waves, storms and droughts. All these changes have and will have a strong impact on the ecosystem, agriculture, forestry and fisheries. The agricultural sector is particularly vulnerable to climate change as different crops require specific weather conditions to grow and yield. Thus, agriculture is directly dependent on a somewhat stable temperature range and a consistent availability of water, exactly the elements threatened by climate change. Moreover, the relationship between agriculture and climate change is two-way relationship. This means that not only agriculture is affected by climate change but also agriculture has a significant impact on climate change, mainly through deforestation and greenhouse gas emissions. More specifically, if the emission of gases is not reduced then agriculture will be responsible for 70% of all GHG emitted in the case of a 2^{o} C rise of the temperature. The third main pillar of the CSA, that of mitigation, includes actions aiming at solving this problem. Farmers are motivated to adopt practices and / or technologies that have a direct impact on the reduction of GHG emissions.

1.2. Abstract

The planet's climate is changing, that is for sure. Climate change offers a key challenge for global food security. Farmers, breeders and fishermen, the people who produce our food, are most affected by climate change. Rural societies need to develop resilience and the ability to adapt to climate change in such a way that they can supply a growing population without further degrading valuable land and water resources. This is why we need climate-smart agriculture. Climate-smart agriculture is an approach to identifying production systems that can respond to the effects of climate change and adapt these systems to soothe the local climate now and in the near future.

The agricultural sector in Greece is particularly important as it employs a large percentage of the workforce and contributes significantly to the formation of the country's GDP and the development of rural economies. Although it is characterized by the production of quality products of high nutritional value due to soil characteristics, the average size of farm is small as farming is primarily a family business. The effects of Greek agricultural activity on the environment and climate are evident despite the significant efforts made by the state and the rural population to reduce greenhouse gas emissions.

Climate-smart agriculture, which seems to provide clear solutions to tackle climate change and crop protection, is not very widespread in Greece, let alone in the regions of Central Macedonia and Eastern Macedonia - Thrace. Nevertheless, the rural population seems willing to adopt CSA practices in order to increase crop yields and incomes as well as to protect the environment. In order to develop CSA, there should be a clear legal framework, support from local and regional authorities, improvement of financial choices, applied research, dissemination and awareness of the consumer public and stakeholders.

A significant percentage of farmers are hesitant to adopting CSA practices due to the increased initial cost of installing high-tech systems since they believe that Climate-smart agriculture is only about these investments and the size of their crops does not allow such costly acquisitions. On the other hand, Greek farmers are very skeptical about applying new techniques and do not have much confidence in government and state authorities.

In general, and according to the course of organic products, the market for CSA products is expected to show great growth in the coming years as consumers seem particularly aware of environmental protection and informed about the quality of Greek products. Candidate farmers of CSA products are willing to proceed with the creation of partnerships / alliances for the further strengthening their actions while they are positive about creating of special label for their products to strengthen their competitiveness.

2. Introduction

2.1. The Agricultural Sector in Greece – The case of the Region of Central Macedonia and Eastern Macedonia & Thrace

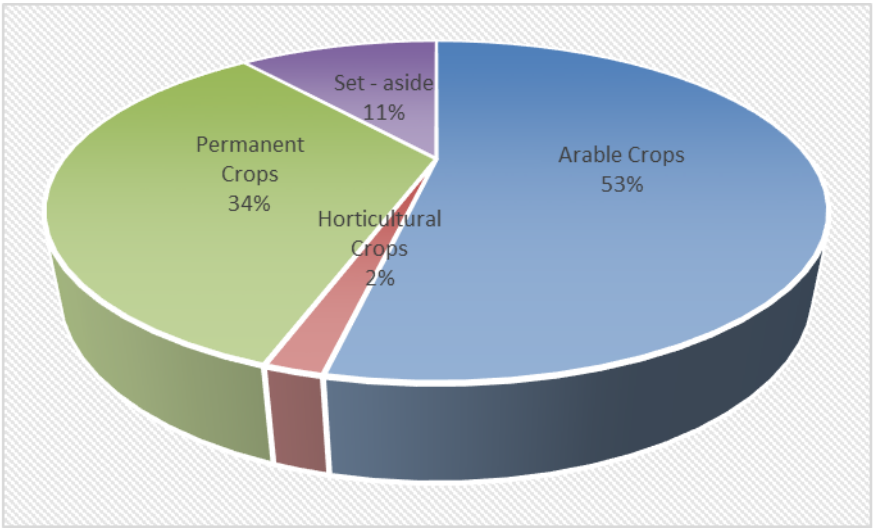
The agricultural sector is the most important sector of the economy as its role is irreplaceable and crucial. Especially for Greece, its importance has always been important since agriculture employs a large percentage of the workforce, ensuring social cohesion and regional development. Following the country's accession to the EU, Greek agriculture is defined by the rules of European agriculture through the Common Agricultural Policy (CAP).

The contribution of the agricultural sector to the country's GDP as well as to employment and the foreign trade balance is particularly important, well above the EU average. Specifically, the share of the agricultural sector in the GDP of Greece amounts to 3.3% compared to 1.4% EU average, employment, 12.5% versus 5.1% and exports 23% versus 8%. At the same time, the agricultural sector largely ensures the smooth supply of the market with food and raw material for the industry while playing an important role in protecting the environment.

In general, the degree of exploitation of the Greek agricultural sector is relatively limited and is characterized by small scattered farms. According to EUROSTAT data, the arable land used in Greece as a percentage of the total area of the country is less than the corresponding percentage of the EU. and especially as compared to other Mediterranean countries. In 2016, almost 24% of the total area of Greece is used as arable land compared to 40% in the EU. while this percentage doubles in the Mediterranean countries.

According to the Annual Agricultural Statistical Survey (2018) the total cultivated agricultural land (arable crops, horticultural land, permanent crops and set-aside) amounts to 32,216.8 thousand acres. As it can be seen from the figure below, the largest percentage - 53.4% - of the cultivated area was used for arable crops, followed by permanent crops with a rate of 33.7%, set-aside with 11% and horticultural crops with a rate of 1.9%. .

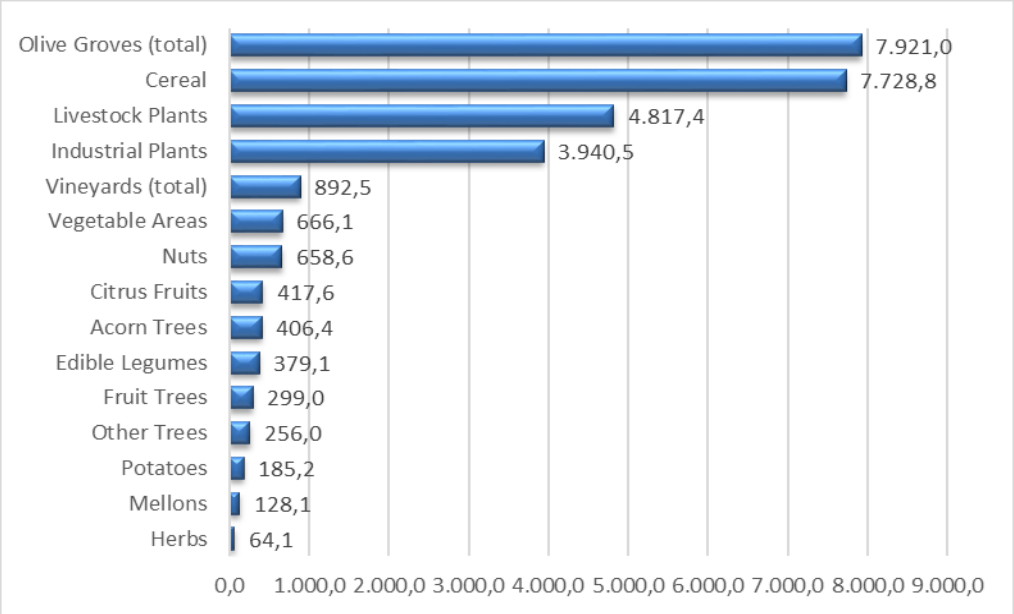
Figure 1: Distribution of basic cultivation groups



The most important arable crops, based on cultivated area, include cereals (soft and hard wheat, barley, maize) occupying an area of about 7,700 thousand acres. Next are the livestock plants with 4,800 thousand acres and the industrial plants (tobacco, cotton, etc.) with about 4,000 thousand acres. It is worth noting that the cultivation of aromatic plants, although occupying a small percentage of the area, has shown a significant increase of 20.6% in just two years. In the category of permanent crops, the regular trees (including citrus, fruit, stone fruits,

nuts and olive groves) play a leading role with 10,000 thousand acres, of which about 8,000 thousand acres concern the olive groves.

Figure 2: Occupation of used agricultural land – 2018 (in thousand acres)



The rural population of the country reached 2.3 million in the year 2017 while for the same year the workforce in the agricultural sector reached 12.1% of the total workforce, showing an increase of 0.8 points compared to the previous year. As shown in the table below, in 10 of the 13 regions of the country the percentage of employees in the primary sector significantly exceeds that of employees in the economy as a whole. In fact, in some regions (Peloponnese, Western Greece, Thessaly, EMTH, Central Greece) this percentage is almost double, which proves the high specialization in the agricultural sectors in these areas.

Table 1: Agricultural employment total employment by Region – 2017

Agricultural Sector			Total		
Country Total	**453.500**	**100**	**Σύνολο χώρας**	**3.752.700**	**100**
Central Macedonia	87.200	19,2	Central Macedonia	626.000	16,7
Western Greece	54.400	12,0	Western Greece	216.800	5,8
Peloponnese	52.900	11,7	Peloponnese	205.0000	5,5
Thessaly	52.700	11,6	Thessaly	250.900	6,7
Eastern Maced. - Thrace	52.000	11,5	Eastern Maced. - Thrace	205.800	5,5
Central Greece	42.100	9,3	Central Greece	188.000	5,0
Crete	38.500	8,5	Crete	234.800	6,3
Western Macedonia	17.900	3,9	Western Macedonia	84.500	2,3
Epirus	16.500	3,6	Epirus	104.600	2,8
Attica	14.000	3,1	Attica	1.366.000	36,4
North Aegean	12.400	2,7	North Aegean	69.400	1,8
Ionian Islands	6.700	1,5	Ionian Islands	73.200	2,0
South Aegean	6.100	1,3	South Aegean	127.700	3,4

*EUROSTAT

In the last three years (2014-2017), there is a decrease, throughout the country, in the family labor force of farms and seasonal workers, while an increase occurs in permanent workers (full-time employees) and other employees (mutual aid and part-time work). In general, the family labor force constitutes 40.5% of the total labor force in agriculture - livestock and the seasonal workers account for 30.9% of the total.

A more detailed examination of the age structure of rural employment in Greece, shows that in the last twenty years the percentage of the "over 45 years old" age group is relatively high while younger ages, under 45 years old, should normally appear in the age pyramid with a higher percentage. According to the latest available data, 57% of the agricultural workforce is over 45 years old, and will gradually step down from active labor, while younger employees cover the remaining 43%, which confirms the unattractiveness of the agricultural sector in younger people.

According to the latest available data of ELSTAT, the number of agricultural holdings in the country amounted to 296,078 while most agricultural holdings are spotted in the Region of Central Macedonia and account for the 23% of the total number of holdings. The Region of Eastern Macedonia - Thrace follows with 42,878 (14.5% of the total) agricultural holdings and the Region of Thessaly with 42,272 holdings. Nationwide, the largest number of holdings concerns cereals for fruit production (about 59% of holdings) and livestock crops (approximately 29%). Followed by set-aside with 82,821 farms and industrial plants with 69,279 farms (Table 2).

Due to the fact that the largest percentage of agricultural holdings is a family owned business, their average size is traditionally low. Although in recent years there has been a shift in the acquisition, maintenance and cultivation of larger agricultural areas, the Greek farmer owned an average area of 46.45 acres in 2016. A more detailed study of the composition at the regional level, the average area of the farm appears higher in regions such as Western Macedonia with m.v. area of 94.4 acres, Eastern Macedonia - Thrace with an average of 71.7 acres and Central Macedonia with 66 acres.

Πίνακας 2: Number of holdings by basic type and region - 2016

Regions	Total	Cereal	Legumes for nuts	Potatoes	Sugar beets	Live stock plants	Industrial plants	Fresh Vegetables Melons Strawb.	Flowers & Décor. plants	Livestock plant crops	Seed production plantations	Other arable	Set - aside
EMTH	42.878	28.273	1.730	2.486	472	7	25.025	4.726	68	10.083	10	319	17.092
Central Macedonia	68.109	52.316	2.284	890	510	14	21.219	5.131	240	16.444	66	198	15.407
Western Macedonia	20.356	16.592	2.884	x	67	0	2.151	920	49	8.693	x	144	7.280
Epirus	12.195	2.866	858	x	0	0	70	925	10	6.503	x	79	2.275
Thessaly	42.272	32.351	2.463	842	189	9	13.829	2.645	202	11.615	125	244	7.552
Central Greece	28.595	16.987	2.108	1.553	x	x	5.677	2.916	32	7.318	x	x	10.927
Ionian Islands	6.045	729	237	3.354	0	0	33	893	28	896	18	167	1.418
Western Greece	30.922	14.002	168	2.051	x	x	642	3.490	20	13.185	x	x	7.693
Peloponnese	14.640	4.046	535	2.217	0	9	159	3.248	54	3.212	42	268	6.952
Attica	3.172	1.005	103	241	0	0	238	1.066	176	251	9	16	1.003
North Aegean	5.758	2.047	678	1.761	0	x	78	1.318	x	1.192	0	x	995
South Aegean	8.048	2.134	552	2.520	0	x	76	1.796	x	3.539	x	x	2.689
Crete	13.086	1.239	623	2.665	0	0	80	5.942	154	3.707	x	x	1.567
Total	296.078	174.588	15.224	24.871	1.242	87	69.279	35.107	1.073	86.640	363	2.700	82.821

*ELSTAT

*x = data not availabl

According to Eurostat, the value of Greek agricultural production in 2017 amounted to 11.3 billion euros, showing an increase of 5%. This increase is due exclusively to the crop production sector. During 2019, the value of agricultural production in Greece appears have increased by 3% while the percentage of Gross Value Added of the sector is increased by 4%.

This increase, 3% on average, compared to the previous year, differs significantly between the individual sectors. According to Eurostat estimates, the value of fresh vegetables seems to have improved by around 15%, potatoes by 43%, cotton by 6%, industrial plants by 4% and cereals by 7%. This positive development is offsetting the particularly negative picture of olive oil, the value of which is estimated to have decreased by 17% in the last 2 years and also the decline of certain kinds of fruits and vines.

Taking into consideration the above-mentioned data together with the course of the intermediate consumption, ie the cost of agricultural inputs, one can specify the course of the agricultural income as a whole. Such as the majority of European countries, Greece's value of inputs is now greater than the Gross Value Added, which is the basis of agricultural income.

More specifically, the consumption of energy, animal food, fertilizers, plant protection products, seeds, propagating material, veterinary medicines, other goods and services, as well as the maintenance of buildings, increased on average by 1% in one year. This development, in relation to the average increase in the value of production, resulted in an increase in Gross Value Added by about 4%. This increase may be less than the 8% decrease of the previous year, but it does not cease to lead to an increase in the elements that determine the final income of the average producer. In addition, if the above adjustments are made for capital consumption, taxation and production subsidy, rents and interest, there is an increase in total business income of 7%, more than three times the average of the rest of the EU.

Table 3 below shows the evolution of production value and income in the last 5 years.

Table 3: Evolution of production value and income of Greek Agriculture – 2019 (million euro)

Year	Gross Value of Agricultural Sector	Value of Production	Intermediate Consumption	Gross Value Added	Income
2015	11.129	10.399	5.267	5.862	5.251
216	10.734	10.078	5.263	5.471	4.752
2017	11.272	10.647	5.465	5.807	5.176
2018	10.942	10.313	5.556	5.386	4.760
2019	11.308	10.661	5.667	5.641	5.101

* Eurostat data processed

The new Common Agricultural Policy

The Common Agricultural Policy (CAP) is the unified Agricultural Policy of the Member States of the European Union. It includes a set of regulations concerning agricultural production, farmers' financing, rural development and the regulation of agricultural markets. At the same time, it takes into account the environmental compatibility of agricultural activity and ensures price stability, high product quality and sustainable land use. The CAP came into force in 1962 and has since been amended several times to meet the changing needs of society.

Responding to the new conditions and challenges, the design and implementation of the new Common Agricultural Policy (CAP) after 2020 will have a more comprehensive and coherent approach which will be implemented through the adoption and approval of a Strategic CAP Plan

per Member State covering both Pillar I (direct payments, sectoral interventions by agricultural sectors) and Pillar II (rural development) of the CAP.

The new operating model of the new CAP will focus on: a) maximizing the CAP 's contribution to environmental protection and encountering climate change ("green architecture") through the establishment of ambitious environmental and climate targets by Member States; b) establishing a new relationship with Member States, strengthening the principle of complementarity and planning flexibility, while moving from a compliance-based system to a more results-oriented system (by achieving relevant goals and milestones) and (c) promoting innovation, knowledge and new technologies in agriculture.

The aim of the new CAP for smart and sustainable agriculture, to strengthen the concern for the environment and the climate and to strengthen the socio-economic fabric of rural areas is expressed through the achievement of 9 specific objectives concerning both Pillar I and Pillar II and are as follows:

- ✓ supporting sustainable agricultural incomes and resilience across the EU to support food security
- ✓ Strengthening market orientation and increase competitiveness, including greater focus on research, technology and digitization
- ✓ improving the position of farmers in the value chain
- ✓ contributing to the mitigation of and adaptation to climate change, as well as contributing to the production of sustainable energy
- ✓ promoting the sustainable development and effective management of natural resources such as water, soil and air
- ✓ contributing to the protection of biodiversity, enhancing ecosystem services and conserving habitats and landscapes
- ✓ attracting young farmers and facilitating business development in rural areas
- ✓ promoting employment, growth, social integration and local development in rural areas, including bio-economy and sustainable forestry
- ✓ Improving the response of EU agriculture to society's food and health requirements, including the demand for safe, nutritious and sustainable food, food management and food waste disposal, as well as the proper treatment of animals.

2.2. Climate Change and Impact on Greece

The term "climate change" means the change in the global climate due to human activities that is mainly caused by the increase in the concentration of greenhouse gas emissions in the atmosphere. The most characteristic indicator of climate change is the increase of the average temperature of the planet, which results in rising sea levels, floods, droughts, extreme weather events, extinction of species and ecosystems.

People are influencing the climate and temperature of the earth continually, through the use of fossil fuels, deforestation and agriculture - livestock. These activities add huge amounts of greenhouse gas emissions to the gases that make up the atmosphere, which to some extent is a desirable phenomenon for the planet and the existence of life on it, causing an increase in the greenhouse effect and leading to global warming. Some of these gases act like greenhouse glass and trap the sun's heat, preventing it from diffusing into space. Many of these gases already exist in nature but human activity intensifies the increase in the concentrations of some of them in the atmosphere. The most important are :

- Carbon dioxide (CO_2)
- Methane
- Nitrogen oxide
- Fluorinated gases

Carbon dioxide is the greenhouse gas most often produced by human activities and is responsible for 63% of global warming, while its concentration in the atmosphere is now 40% higher than at the beginning of industrialization. The other greenhouse gases are released in smaller quantities but trap heat much more than CO_2 and in some cases are much stronger. Methane is responsible for 19% of global warming due to anthropogenic causes and nitrogen oxide for 6%.

- The causes - activities that increase greenhouse gas emissions, and therefore worsen the climate change, include:
- Combustion of coal, oil and gas producing carbon dioxide and nitrogen oxide
- Deforestation. Trees help regulate the climate because they absorb CO2 from the atmosphere. The smaller the forests, the less carbon that can be stored in them and released to the atmosphere, worsening the greenhouse effect.
- Increase of livestock. Cows, sheep and goats produce large amounts of methane when digesting their food.
- Nitrogen fertilizers which are responsible for nitrogen oxide emissions.
- Fluorinated gasses which have a huge heating effect but are released in smaller quantities and are gradually eliminated in accordance with EU regulation.

Climate change is affecting all parts of the world, but some areas are more often affected by extreme weather conditions such as heavy rainfall while others by high temperatures and droughts. The effects of climate change, which are expected to intensify in the coming decades, include:

- Melting ice and rising sea levels resulting in floods and erosion of coasts and lowlands.

- Extreme weather conditions and displacement of rainfall. Extreme weather events cause natural disasters, floods and degraded water quality in some areas while shifting rainfall causes limited water resources in other areas.
- Risks to human health. Climate change has led to an increase in deaths associated with extreme weather events (heat waves, frosts) while significant changes have taken place in the distribution of diseases and disease carriers.
- Costs for the society and the economy. Material damage, infrastructure damage as well as the impact on human health have high costs for society and health. In addition, sectors that are highly dependent on temperatures and rainfall, such as agriculture, forestry, energy and tourism, are severely affected.
- Dangers to wildlife. Large numbers of plants and animals are struggling to cope with climate change. Many species of animals that live on land or in fresh and sea water move to new areas to survive. Some plants and animals are already expected to be at high risk of extinction if the earth's average temperature continues to rise uncontrollably.
- Consequences in developing countries. Many poor developing countries are among the countries most affected by climate change. In these countries people are heavily dependent on the natural environment, are mainly engaged in agriculture, livestock and fisheries, and have minimal resources to deal with climate change.
- Consequences in Europe. The countries of Southern and Central Europe are increasingly affected by heat waves, forest fires and droughts. The Mediterranean regions face a severe water shortage problem with a risk of drought and fires. Northern Europe receives more rainfall with the risk of floods and natural disasters.

Globally, we already have experienced an increase of about 1°C in relation to pre-industrial levels, while according to current research, in Greece the increase can reach up to 6°C in the year 2100 if there are no actions to mitigate climate change. In addition, climate change has and will have significant social and economic consequences such as the spread of disease, massive waves of refugees and migration, declining production, rising product prices, job losses and, ultimately, significant lifestyle changes.

Agricultural production will not remain unaffected due to its inextricably linked relationship with the climate, which affects the type of crop and the quantity of agricultural products produced. Climatic variables that significantly affect crop productivity are temperature, precipitation (rain, hail, snow, water vapor), sunlight and the composition of the atmosphere (concentration of CO^2 in the atmosphere) as well as the duration and intensity of weather phenomena.

The main temperature characteristics affecting the growth of plants include: the daily minimum and maximum air temperature and its variability, the average monthly temperature and its variability, the frequency of occurrence of temperatures that exceed critical points (such as 35°C and 0°C). In addition, temperature affects soil variables, such as soil fertility and moisture, which are important for crop growth. An increase in temperature leads to an increase in microbial activity in the soil resulting in a reduction in organic load and soil moisture. Precipitation, which is also important for agricultural production, is characterized by its daily quantity and seasonal variability and can significantly affect productivity. Finally, solar radiation and the composition of the atmosphere associated with the climate are factors that significantly affect crop productivity.

Changes and alterations in climate variables, as analyzed above, have the effect of shifting the fertile zones as the areas in which specific crops flourish are shifting. In addition, crop yields

increase or decrease with respect to climate change and new types of pests and diseases are emerging due to climate change.

In general, the agricultural sector, due to its nature, is highly exposed to extreme weather conditions and fires, while there will always be the risk of losing fertile soil due to soil erosion and accelerated sea level rise.

The economic impact of climate change on agriculture is found in four main stages, which demonstrate not only the seriousness of the problem globally but also the urgent need for action. The first stage concerns the economic impact of climate change on crops and how field productivity is affected. The second stage concerns the producer and / or the community of producers and the possibility of securing income for their safe living. The third stage includes the economic impact at regional and / or national level which is affected by the disposable income of producers and rural communities and the fourth stage concerns the global economic impact as a result of the impact on all previous stages. The effects on the final stage concern the size of total production, the ability to feed the world population, food safety and quality, and ultimately the prices of the products produced.

The relationship between Climate Change and Agriculture is two-way and dynamic. As much as crops and productivity are affected by climate change and weather, so is agricultural activity affecting climate change, due to the fact that it is a source of greenhouse gas emissions and a means of storing carbon in soil organic matter and biomass.

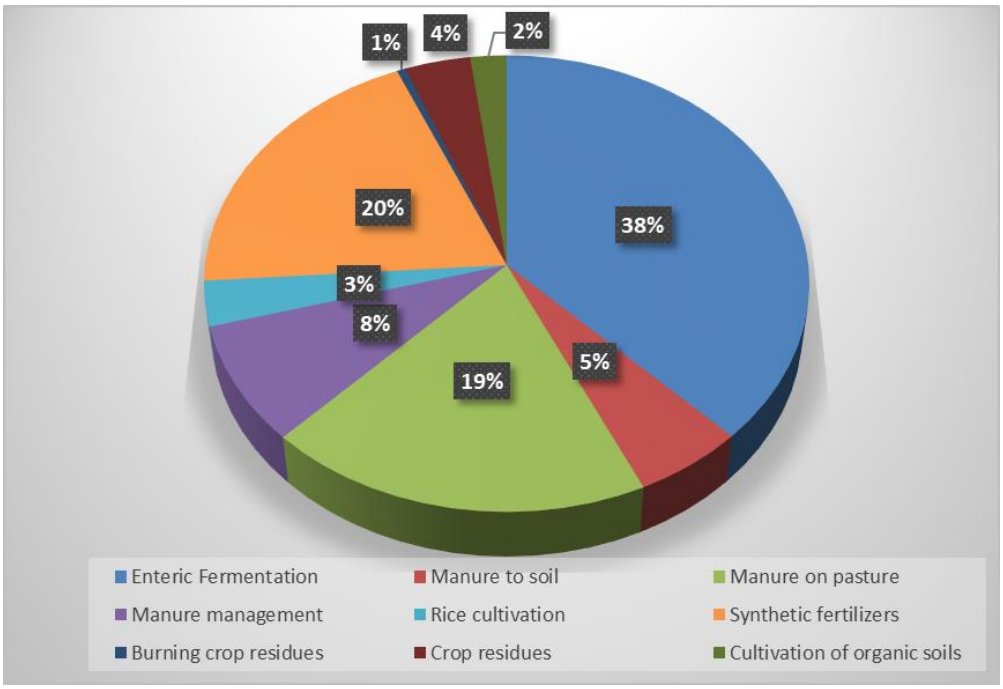
The most important sources of Greenhouse Gas Emissions due to agriculture are:

- Carbon dioxide emissions due to the use of energy from mineral sources in agriculture (fuel, electricity, natural gas), the change of carbon stocks in agricultural lands and the use of energy from mineral sources in the process of production of agricultural inputs (mineral resources, animal food, pesticides, etc.).
- Methane emissions during anaerobic fermentation. Intestinal fermentation of ruminants, anaerobic fermentation during handling and storage of animal manure, anaerobic fermentation in flooded rice fields.
- Nitrogen oxide emissions associated with the use of mineral and organic nitrogen fertilizers and with manure management.

To a lesser extent, agriculture also produces fine particles in the form of salts that reflect the sun into the atmosphere, such as ammonium nitrate and sulfates. In addition, agriculture and forestry have the ability to trap atmospheric carbon dioxide through photosynthesis and bind it to soil and biomass. Grasslands, wetlands and forests in particular can capture large amounts of carbon. However, these carbon stocks can also be lost, for example through land use change (such as deforestation, grassland cultivation, drainage of wetlands) or due to climatic phenomena such as storms or fires that cause the rapid release of the carbon stock in the form of CO^2.

As it can be seen from the figure below, the largest percentage of greenhouse gas emissions comes from the enteric fermentation of ruminants (38%) while together with emissions from fertilizers on pastures and synthetic fertilizers constitute almost 80% of emissions.

Figure 3: Greenhouse Gas Emissions from Agriculture in Greece

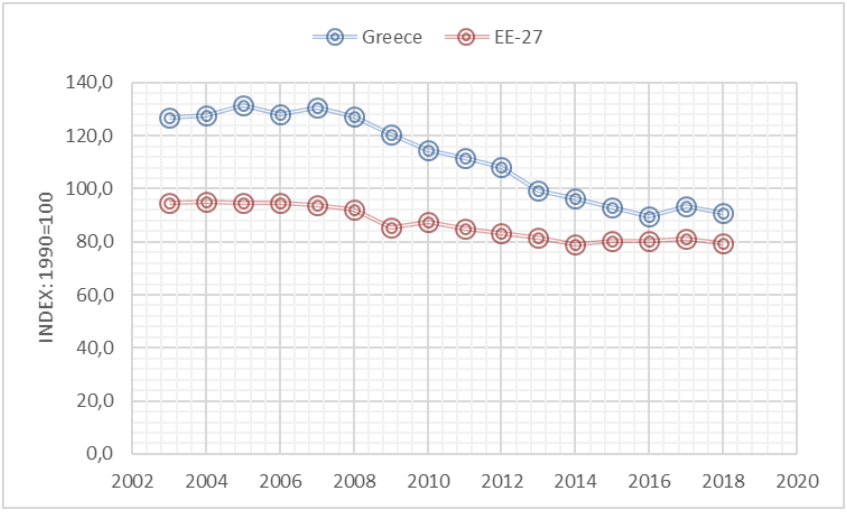


* Eurostat

The already visible effects of climate change together with the studies carried out, demonstrate the need to take action to mitigate climate change. These include actions to slow down global warming, reduce greenhouse gas emissions, and adapt to climate change to reduce the damages caused.

To this end, Greece has developed the "National Energy and Climate Plan" (NECP), which is fully in line with the EU's targets for reducing gas emissions and limited energy use. According to NECP, the country aims to reduce greenhouse gas emissions by a total of 55% in 2030 compared to 2005. The figure below shows the reduction of emissions in Greece from 2003 to 20017 as compared to the course of EU emissions.

Figure 4: Greenhouse Gas Emissions Greece - EU 2003 - 2017



*ELSTAT

NECP is a strategic plan for the country's climate and energy issues that includes a detailed roadmap for achieving specific energy and climate goals by 2030. Priorities and policy measures have six dimensions:

1. Climate Change and Greenhouse Gas Emissions
2. Renewable Energy Sources
3. Improving Energy Efficiency
4. Security of Energy Supply
5. Energy Market
6. Research – Innovation – Competitiveness

In terms of climate change adaptation, Greece has developed the "National Adaptation Strategy for Climate Change" (NASCC), which sets out the general objectives, guidelines and means of implementing a modern effective climate change adaptation and development strategy in the framework defined by the United Nations Convention on Climate Change, by European Directives and international experience. The NASCC includes indicative actions and measures for the adaptation of 15 sectoral policies, among which are Agriculture-Livestock, Forest Ecosystems, Biodiversity, Aquaculture and Fisheries.

2.3. SWOT Analysis of Climate – Smart Agriculture in Greece

The rural population is constantly called upon to meet new challenges, such as the continually changing weather conditions and natural disasters, the improved technological applications and the new market opportunities. Climate change makes it imperative that decisions and actions be taken to address the effects not only of agricultural organizations but also of government / regional authorities. Encountering climate change is not just about changing production practices on a technological basis. In order for farmers to have tangible benefits, changes need to be made at the level of legislation, organizations and funding. In addition, the key role of producers and their ability to adapt to continually changing conditions must be recognized together with the key role of specialists for the development of pioneering solutions.

The implementation of CSA, which provides clear solutions to mitigation of climate change by the agricultural population, is currently in the early stages of dissemination and implementation, mainly in Greece. Taking into account the particularly important role of agricultural activity in our country, in the EU and worldwide, as well as the impact that agriculture has on the environment and vice versa, we consider it important to further analyze the implementation of the CSA.

The results from the up to now analysis and mapping of the concept of CSA, as well as the analysis of the agricultural sector in Greece in combination with the existing level of climate change lead to the depiction of strengths and weaknesses that arise in the case of implementing Climate - Smart Agriculture practices. In addition, the examination of bibliographic data and recent reports leads to the identification of opportunities and threats that exist in the wider external environment and either create a suitable ground for the adoption of the KEG or create obstacles and difficulties.

Below is the list of Strengths, Weaknesses, Opportunities and Threats of Climate - Smart Agriculture regarding the possibility of application in the given socio - economic situation in Greece.

Strengths

The table below shows the main strengths of CSA that mainly come from the benefits of its application not only on farmer level but also in the society in general.

Strengths	
S1	Increase in productivity - income
S2	Increased resilience to climate change
S3	Decrease in the conversion of natural land to arable land
S4	Improving / ensuring soil health and biodiversity
S5	Rehabilitation of degraded soil
S6	Reducing the reckless use of inputs (water, fertilizers, chemicals)
S7	Reducing carbon footprint in the environment
S8	Benefits for the society
S9	Active rural population
S10	Existence of climatic and territorial data – research
S11	Multiple practices – local application

CSA promotes the adoption of practices which, in the medium-long term, contribute to the increase of productivity and as a result to the improvement of the individual and family incomes

of the farmers. In order to adapt to climate change, CSA promotes the use of alternative multiple crops that are resistant to climate change as well as the use of climate-smart technology. Both of these practices contribute to the direct and indirect improvement of crop yields. Directly due to the increase in production and the reduction of costs and therefore the improvement of income and indirectly due to the improved availability of basic food on the market, which in turn contributes to the increase of employment in the agricultural sector and to the increase of the basic salary of workers in this sector.

Of the most important strengths of CSA are those including the benefits on the environment and the society as a whole, but also have a significant impact on the agricultural sector and the farmers' well-being. CSA practices develop in the same spectrum as sustainable agriculture practices, where the natural environment is preserved by reducing the conversion of natural land to arable land and utilizing the potential of existing crops in such a way as to preserve and maintain good soil health and biodiversity. In addition, CSA contributes significantly to the protection of the environment and therefore people's quality of life by promoting the limitation of the inputs required for cultivation, especially fertilizers and chemicals, in order to reduce the environmental footprint (carbon footprint) of products and eliminate the impacts in climate change.

Strengths include elements related to specific local characteristics that define the basis on which the development and implementation CSA practices can be based. Greece has a significant number of agricultural population, which is active and in many cases its livelihood depends entirely on agricultural income. In addition, there is an abundance of research and studies that provide important information and data on the environment, climate, weather and climate change, crops and soils, and can make a significant contribution to the selection of specific CSA practices that will have the best possible results. After all, one of the main characteristics of CSA is its locality - selection of appropriate practices for the best benefits in the local society and economy.

Weaknesses

The weaknesses of Climate-Smart Agriculture concern on one hand the farmer himself and on the other hand the broader environment in which he operates. The table below shows the main weaknesses of CSA given the present situation.

Weaknesses	
W1	Initial implementation cost
W2	The cost undertaken by farmer while the society as a whole receives the benefits
W3	Practical difficulties during the period of adaptation – adoption of CSA cultivation practices
W4	Small and scattered farms
W5	Inelastic attitude of agricultural population towards new practices and technologies – Low level of education – Inability the aging rural population to adapt to new technology
W6	Limited dissemination of data and information – Inability of farmers to get access
W7	Lack of applied research
W8	Limited funding and funds
W9	Difficulty in coordinating actions required by different levels
W10	Limited infrastructure in the agricultural sector
W11	Unclear legal framework for the protection of agricultural land

One of the main disadvantages of implementing CSA practices is the initial costs that farmers have to undertake to make the necessary investments, which is offset by the fact that benefits appear in the medium to long term. In addition, a preventing factor is the fact that while the initial costs are taken up by farmers, the benefits to the local and regional community, the environment and the economy are multiple and in line with sustainability principles.

Moreover, there may be practical difficulties at local level (eg lack of infrastructure or limited infrastructure) during the period of adaptation to CSA practices, leading to further delays, while some features of the agricultural sector, such as small farmland ownership, makes application costs deterrent.

Referring to the characteristics of the agricultural sector in Greece, the rural population appears particularly inelastic, mainly in terms of the adoption of new practices and new technological tools. According to research results, the adoption rate is extremely low, however, the interest of farmers in their use and application is quite high. At the same time, the main obstacles to adoption include the inability to access relevant information and the lack of sufficient funds. Finally, it was documented that the factors that influence farmers' perceptions of smart farming include their educational level and the type of farms they have. In conclusion, the adoption of new practices and technologies by Greek farmers is limited, but has significant potential. To achieve this, the activation of all stakeholders is required together with the coordination of efforts to inform farmers and target the most suitable crops and population groups that could benefit from new practices and technologies as well as the facilitation to access funding.

In many cases, the legal framework for the protection of agricultural land is quite vague and creates confusion among farmers and mistrust in the state. In addition, apart from the fact that funding for CSA practices is limited, the amount of funding as well as the means of access is in no way linked to the level of contribution to environmental protection or to the reduction of greenhouse gas emissions level.

Opportunities

The table below includes the opportunities identified in the external environment and can be an initial basis on which to base the development and dissemination of KEG.

Opportunities	
O1	New Common Agricultural Policy 2021 - 2027
O2	Organic Agriculture – Sustainable Agriculture – Smart Agriculture – Precision Agriculture
O3	Available technological tools
O4	University Research
O5	Dissemination of information - data - research results
O6	Production of high-quality products
O7	From farm to plate
O8	Product branding
O9	Networking
O10	Further organization, empowerment, networking and cooperation between Agricultural Cooperatives – creation of bigger and stronger cooperatives
O11	Development of agricultural infrastructure
O12	Raising awareness in the society
O13	Strategic cooperation with Bodies and Organizations
O14	Commitment of funds for CSA implementation

In Greece today, important steps are being taken towards the development of the agricultural sector in order to become more profitable, competitive and environmentally friendly. The new CAP 2021 - 2027 is one of the main tools that work towards meeting these objectives as it defines the actions on which the activities of the collaborating bodies and organizations will focus. In addition, the concepts and applications of Organic Agriculture, Sustainable and Smart Agriculture are now highly developed and widespread while there is a wide range of university and research studies. These practices are directly linked to the CSA approach as they promote similar principles and results. For the same reasons, the available technological tools and technological applications are highly developed and offered for use, while important steps have been taken to inform the rural population. Using all available information and experience, the relevant Bodies and Organizations have the opportunity to move further and enrich the work done so far with tools and inputs related to Climate - Smart Agriculture. In the same way, the same information channels can be used in order to inform and raise the awareness of the rural population. The Greek agricultural sector is globally recognized for the production of quality products, a fact that is expected to be strengthened in the case of applying CSA practices not only due to the reduced use of inputs (such as fertilizers) but also due to the reduced carbon footprint that CSA products have. This enables farmers to use special labelling on their products and therefore differentiate from competition and achieve higher sales at improved prices. This, of course, presupposes the existence of a network for the promotion and sale of these products (in the same way that organic products are sold) as well as raising awareness of consumers and society for the consumption of foods that have small if none impact on the environment.

It is a fact that the Greek agricultural sector includes a wide number of local Agricultural Cooperatives which are small in size, compared to European agricultural cooperatives, due to the small list of members and the limited areas. CSA gives the opportunity to develop cooperation and alliances between cooperatives tin order to create bigger, better organized and stronger agricultural cooperatives. Working on the common ground of the climate-smart agriculture approach, the new cooperatives will be able to better negotiate with governmental bodies and invest in shared technology and equipment, always aiming at the well-being of their members. In the recent view of the implementation of CAP 2021-2027 and other national plans and strategies such as the National Plan for the Reconstruction of Agri-Environmental Infrastructure, the National Plan for Energy and Climate, the National Strategy and the Regional Plans for Adaptation to Climate Change and the European Life IP Program - AdoptInGR, there are significant opportunities for cooperation between agencies and organizations as well as for the commitment of funds so that the development and implementation of Climate - Smart Agriculture is a possibility.

Threats

Threats, that usually derive from the external environment, are presented in the table below. Although there are not many threats, their existence is quite crusial.

Threats	
T1	Population increase – arable land decrease
T2	Climate change
T3	Pandemics
T4	Absence of legislation
T5	Few funding tools
T6	Rigid state bodies
T7	Limited cooperation among key actors

As mentioned in previous chapters, earth population is increasing while the consumption and demand of food products exceeds the levels of production and cultivation given the limited arable land. The threat of intensifying production with practices opposing the CSA approaches and rather promote the reckless use of artificial means that irreparably damage the environment and produce low quality products is therefore obvious.

Climate change is believed to have determined some epidemiological data on a global scale, since, among other things, it has created the ideal conditions for the spread of infectious diseases - epidemics. The spread of viruses and epidemics, the intensity of which has increased in recent years, is estimated to been caused by the human intervention in nature and in particular: (1) the destruction of ecosystems, (2) the intensification of agricultural and livestock production, (3) the wildlife trade, (4) air pollution and (5) rising temperatures.

The development of CSA in Greece presupposes the development of a legislative framework, which is currently non-existent. In addition, actions should be taken to inform the rural population and the society as well as to identify appropriate practices for the area. This requires the continual cooperation of many stakeholders involving government or agricultural organizations. Finally, significant amounts of capital and funding should be allocated so that farmers will be able to implement CSA practices and improve their productivity and incomes.

CONSOLIDATED TABLE OF SWOT ANALYSIS

STRENGTHS	WEAKNESSES
• Increase in productivity - income • Increased resilience to climate change • Decrease in the conversion of natural land to arable land • Improving / ensuring soil health and biodiversity • Rehabilitation of degraded soil • Reducing the reckless use of inputs (water, fertilizers, chemicals) • Reducing carbon footprint in the environment • Benefits for the society • Active rural population • Existence of climatic and territorial data - research • Multiple practices – local application	• Initial implementation cost • The cost undertaken by farmer while the society as a whole receives the benefits • Practical difficulties during the period of adaptation – adoption of CSA cultivation practices • Small and scattered farms • Inelastic attitude of agricultural population towards new practices and technologies – Low level of education – Inability the aging rural population to adapt to new technology • Limited dissemination of data and information – Inability of farmers to get access • Lack of applied research • Limited funding and funds • Difficulty in coordinating actions required by different levels • Limited infrastructure in the agricultural sector • Unclear legal framework for the protection of agricultural land
OPPORTUNITIES	**THREATS**
• New Common Agricultural Policy 2021 - 2027 • Organic Agriculture – Sustainable Agriculture – Smart Agriculture – Precision Agriculture • Available technological tools • University Research • Dissemination of information - data - research results • Production of high-quality products • From farm to plate • Product branding • Networking • Further organization, empowerment, networking and cooperation between Agricultural Cooperatives – creation of bigger and stronger cooperatives • Development of agricultural infrastructure • Raising awareness in the society • Strategic cooperation with Bodies and Organizations • Commitment of funds for CSA implementation	• Population increase – arable land decrease • Climate change • Pandemics • Absence of legislation • Few funding tools • Rigid state bodies • Limited cooperation among key actors

3. Research Methodology

The report below shows the results of the primary research conducted with the use of a specific questionnaire, and was developed with the initiation of ANATOLI S.A. and realized by the Technical Consultant "OECON Group". The target group of the research include Agricultural Cooperatives / Farmers, Local / Regional Authorities of the Region of Central Macedonia and the Region of Eastern Macedonia and Thrace, Research / Educational Institutions as well as the Central Vegetable Market of Thessaloniki. The aim of the research is to gather information and data about the current cituation and development prospects of Climate-Smart Agriculture in the specified regions.

The present report is an integral part of the Feasibility Study.

3.1. Data Sources

The present primary research developed with the use of a questionnaire, as it was suggested by ANATOLIKI S.A. and it was pointed by the Lead Partner of the BLACK SEA "AGREEN" Project. The structure of the questionnaires was formed in two ways depending on the target group. The first type of questionnaire targeting Agricultural Cooperatives / Farmers, includes 16 open questions while the second type targeting Local / Regional Authorities and Research / Educational Institutions, includes 11 open questions.

In order to gather all necessary information and analyze the current situation we gathered 45 completed questionnaires in total allocated by group targeted as follows:

- 20 Local / Regional Authorities including Regions, General Divisions, Municipalities, Chambers, unions
- 15 Agricultural Cooperatives / Farmers including cooperatives representing the most important cultivations in the region
- 9 Research / Educational Institutions including researchers from the Aristotle University of Thessaloniki, Democratus University of Thrace, International University of Greece, American Farming School and the Greek Agricultural Organization "Demetra"
- 1 Central Vegetable Market of Thessaloniki

Extra attention was placed on the region of Vasilika, which is a reference area for the Project, as well as the Agricultural Cooperation of Vasilika, which participates in the Project as a cooperating partner.

The target group was given three choices on the way to fill in the questionnaire:

i. Online interview
ii. Phone interview
iii. Written form

The research conducted during the period from December the 15th 2020 until February the 5th 2021.

Questionnaire Structure

For the purposes of this research, two types of questionnaires were used depending on the target group. These include:

A' Type of Questionnaire

The first type of questionnaire includes 16 questions and the target group consists of Agricultural Cooperatives / Farmers. The questionnaire is divided into two parts, where the first part has questions about the specific cooperative or farmer and the second part questions about climate-smart agriculture.

The first question refers to the area of operation or the area in which the crops are cultivated.

The second question includes the presentation of indicative data on the size of the cooperative or cultivation with reference to the size of the area, the financial data (production, income), the available capital and the infrastructure and investments.

The third question includes data on the years of operation of the cooperative or farmer while the fourth question includes data on the production process and the annual yield of the crop.

In the fifth question, the interested party is asked to explain the term of Climate - smart agriculture and in case he does not know the researcher gives the definition.

In the sixth question, the interviewees are asked to describe the importance of CSA and its relevance to their situation, while in the seventh question they are asked to describe if and how they incorporate CSA practices.

In case CSA practices are not applied, the interviewees state, in the eighth question whether they are willing to start and in case they already apply CSA practices they are asked if they are willing and for what reasons to continue.

According to the personal point of view of the respondent, the ninth question develops the benefits and the tenth question the costs associated with the application of climate-smart agriculture.

In the eleventh question the interested party is asked to comment on the need of CSA to be supported on national or regional level, while in the twelfth question on the development of a common CSA strategy by the government.

The next two questions, 13 & 14 concern the branding of CSA products and whether it is considered necessary and useful in case of common regional marking.

Question 15 deals with the usefulness of forming an alliance among CSA producers, while the last question, 16th, deals with the level CSA in the present and its future prospects.

B' Type of Questionnaire

The second type of questionnaire consists of 11 questions and the target group is that of Local / Regional Authorities and Research / Educational Institutions. This type of questionnaire is also divided into two parts, the first dealing with information about the organization and the second with data about CSA.

The first and second question includes information about the organization and the title and experience of the person answering the questionnaire.

The third question deals with the term of CSA while the fourth question asks the interviewee to comment of the development of CSA and the degree of familiarization with the term.

In the fifth question, the interviewee has to state any relevant national or regional legislation while in the sixth question has to comment on the development of a better definition / conceptual framework of SCA.

The seventh question contains information on the need for providing incentives in order to familiarize farmers and consumers with CSA.

In the eighth question, the interested party is invited to explain the main benefits and costs associated with the implementation of CSA, while the ninth question includes the importance of creating a regional alliance between users of climate-smart agriculture.

The tenth question examines the introduction of a special designation (label or trademark) on CSA products and whether this would improve the placement of the products in the local and international market.

The last question asks for comments on the present and future trends of climate-smart agriculture.

3.2. Background Analysis

The analysis of the findings is divided into three categories according to the category of the respondents not only because of the difference in the structure of the questionnaires but also because of the difference of views of each target group. In this way, the answers of the Agricultural Cooperatives / Farmers are analyzed in a separate section, in the second section we analyze the answers of Local / Regional Authorities and in the third sections the responses of Research / Educational Institutions.

Agricultural Cooperatives / Farmers

The Agricultural Cooperatives that participated in the research are:

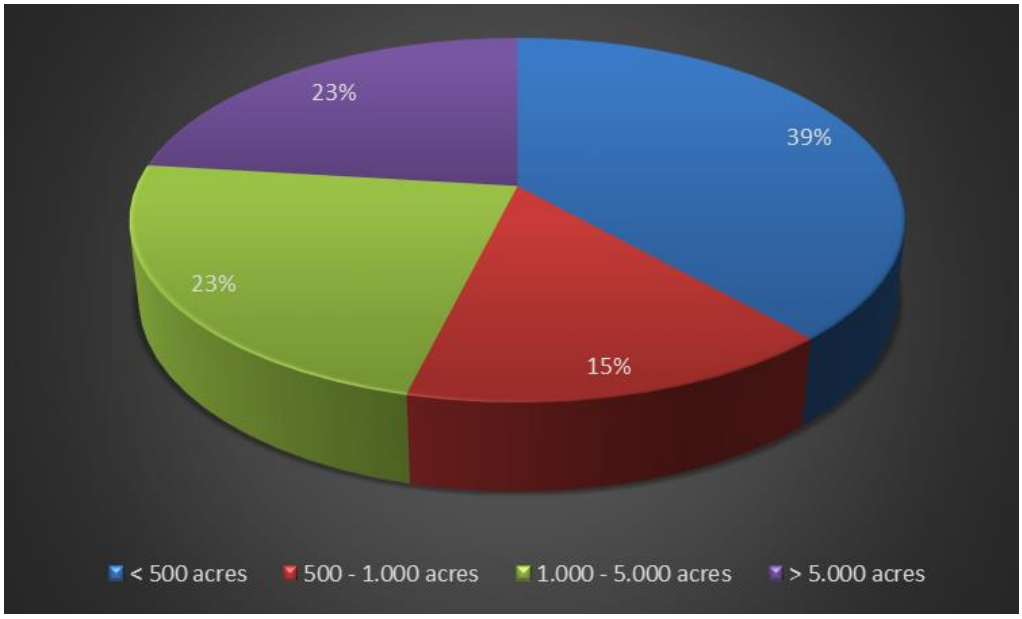
- ✓ Agricultural Cooperative “Menoikio”
- ✓ Agricultural Cooperative of Vissas garlic
- ✓ Agricultural Cooperative of Metagitsi Chalkidiki
- ✓ Agricultural Cooperative of Vassilika (3 participations)
- ✓ Winemakers of North Greece
- ✓ Cooperation of Agricultural Cooperatives of Thessaloniki
- ✓ Agricultural Cooperative of Axioupoli “Axios”
- ✓ Agricultural Cooperative of cherry producers “Saint Lukas”
- ✓ Agricultural Cooperative of Aronia
- ✓ Agricultural Cooperative of Naousa
- ✓ Agricultural Cooperative of Meliki
- ✓ Agricultural Cooperative of Ormylia
- ✓ Aristotelis ABEE
- ✓ Agricultural Cooperative of the Municipality of Propontida

The sample gathered covers big geographical part of the region in matter including: the Perfecture of Evros (Municipality of Orestiada), the Perfecture of Drama (Municipality of Prosotsanis), the Perfecture of Serres (Municipality of Sintiki), Perfecture of Thessaloniki (in total and the Municipality of Thermi – region of Vasilika), Perfecture of Chalkidiki (Municipality of Poligiros and Nea Propontida), Perfecture of Kilkis (Municipality of Paionia), Perfecture of Imathia (Municipality of Naousa and Alexandreia) and the Perfecture of Pieria (Municipality of Katerini.

The largest percentage of respondents (80%) determined the size of the cooperative based on the cultivated acres. As shown in the figure below, 23% of the cooperatives have more than 5,000 acres while one of them has more than 15,000 acres. The largest percentage of

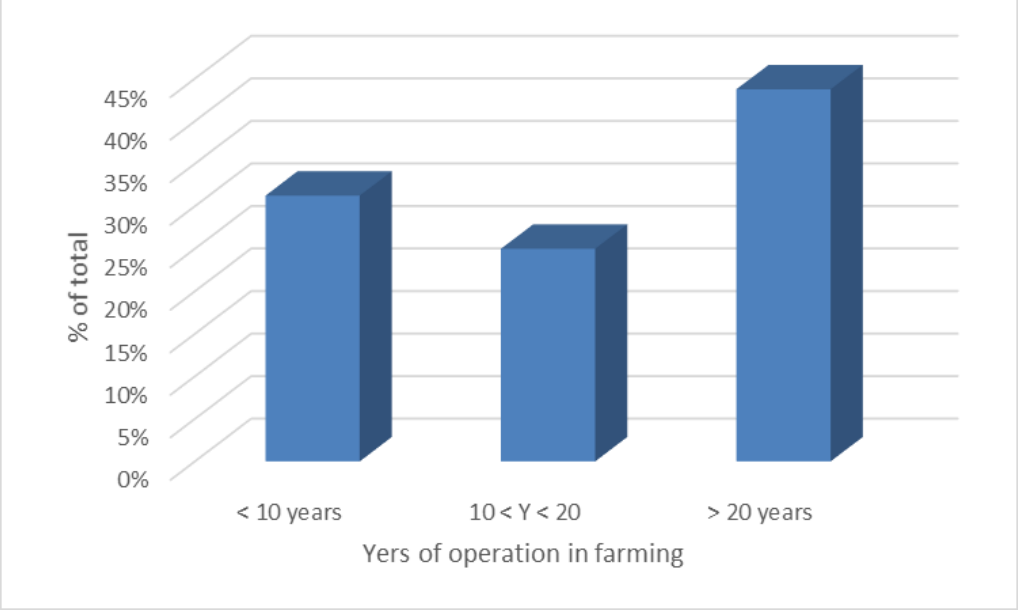
cooperatives amounting to 39%, have areas up to 500 acres. Respectively, 15% have from 500 to 1,000 acres and 23% from 1,000 to 5,000 acres. It is worth noting that the size of the cultivated land depends, on a great extent, on the type of cultivation. Accordingly, we have different sizes when we refer to cereal and different sizes when we refer to orchards. In addition, the size depends on the number of members in the cooperative and the years of operation.

Figure 5: Size of Agricultural Cooperatives based on cultivated area



Concerning the years of operation in farming, the largest percentage, 44%, have been farmers for more than 20 years. 31% of the respondents are operating in farming less than 10 years while 25% between 10 and 20 years.

Figure 6: Years of operation in farming



All the respondents mentioned the type of crops they cultivate. These include:

- Cherries
- Apricots
- Apples
- Peaches
- Kiwi
- Nectarines
- Pears
- Plums
- Pomegranate
- Aronia
- Greenhouse vegetables
- Vegetables
- Legumes
- Garlic – Onions
- Table Olives
- Wine Vineyards
- Cereals
- Wheat
- Corn

Fifty percent (50%) of respondents said they were unfamiliar with the concept of climate-smart agriculture, and from the remaining half only five made comments about CSA. According to them, the concept of CSA includes:

- Fully integrated management of the cultivation, implementation of precision systems
- Management Information Systems, Precision Agriculture, Agricultural Automation and Robotics
- Application of advanced technological methods in order to protect the environment without reducing production
- Application of smart farming practices through programming and supervision e.g. Meteorological station and electronic information even for the appropriate time of cultivation activities in the field, traps with electronic recording, etc.
- remote sensing systems and integrated measurement systems

All respondents believe that climate-smart agriculture is extremely important and fully relevant to their activity. They believe that it will bring positive results both in crops (production costs, yield, quality, protection from weather conditions) and in the protection of the environment (reduction of emissions, rainfall, climate change).

Regarding the implementation of climate-smart agriculture, more than 60% of respondents state that they do not apply it at the moment. The remaining 40% report that they use tools - practices such as: soil analysis with leaf diagnostics on every single farm and electronically recording of applications, use of integrated crop system, use of modern machinery to apply the necessary fertilization and spraying, use of the meteorological station with suggestions for the appropriateness of the weather and the implementation of interventions in the field, electronic traps for the limitation of unnecessary medicines.

Except in two cases, all agricultural cooperatives participating in the research, state that they are willing to start and/or continue to apply climate-smart agriculture. The main reasons include the increase in yield and income as well as the improvement of weather conditions in the region. Most of those already applying CSA are willing to further develop the application and already are in pursue of additional new systems and technological tools.

According to the participants, the benefits of climate-smart agriculture include:

⇒ Decrease of production cost
⇒ Increase in production / yield
⇒ Protection of the crop yield
⇒ Increase of income
⇒ Protection of cultivation from extreme weather conditions
⇒ Protection of the environment

- ⇒ Containment of climate change
- ⇒ Decrease of greenhouse gas emissions
- ⇒ Saving resources
- ⇒ Rational use of inputs
- ⇒ Energy saving
- ⇒ Better marketing of products
- ⇒ Security
- ⇒ Targeted interventions

Regarding the costs / challenges that accompany the implementation CSA, most comments mention the initial investment cost and the required staff training. However, they all agree that the results outweigh the costs in the long run while emphasizing that through cooperation and teamwork these costs can be shared.

All participating cooperatives agree that CSA should be supported at regional, national and even European level, while the respective governmental institutions should develop a common strategy which, however, should be adapted at the local level.

The branding of CSA products is supported by 11 out of the 16 cooperatives and expect that this will add value and recognition to the product, will give an additional incentive to the producer and will also provide information to the consumers. On the opposite side are those who argue that a trademark will incur additional costs in production or argue that CSA products will stand out on their own because of their superior quality. About 90% of the respondents agree with the use regional trademark, mainly due to the high importance of the place of production of some products.

When asked about the formation of an alliance, the vast majority is in favor, as it is consistent with the existence of cooperatives by definition. The partnership could help in information and experiences exchange, in the allocation of costs when adopting CSA practices as well as in setting common goals and demands.

Regarding the level CSA in the region, most respondents emphasize that it is at a very early stage but there are opportunities for development and growth. They claim that it is not widely widespread and there are no incentives for its adoption. Nevertheless, farmers and agricultural cooperative show an increased as long as there is a legal framework, financing tools and production costs remain low. Many recognize the threat posed by climate change and believe that they must act upon as soon as possible.

Regarding the region of Vasilika, the Agricultural Cooperative of Vasilika that participated in the research, states that its members are somewhat familiar with the concept of CSA while they know that it is particularly important for the protection of the environment and their income. None of the members seem to use CSA practices at the moment but they say they are willing to start as soon as possible. The benefits of adopting a climate-smart approach include increasing crop yield and income of farmers, protecting the environment and saving resources. They want support at national / regional level for the development CSA and look forward to the development of a national common strategy. They emphasize in particular the value of a collaboration / partnership between the CSA users as well as the development of a common brand name that will add value to the products. In general, they believe that the level of dissemination and implementation of CSA is very low at the moment but they hope it will

develop soon through informing the rural population, the cooperation of all stakeholders and the provision of incentives and funding.

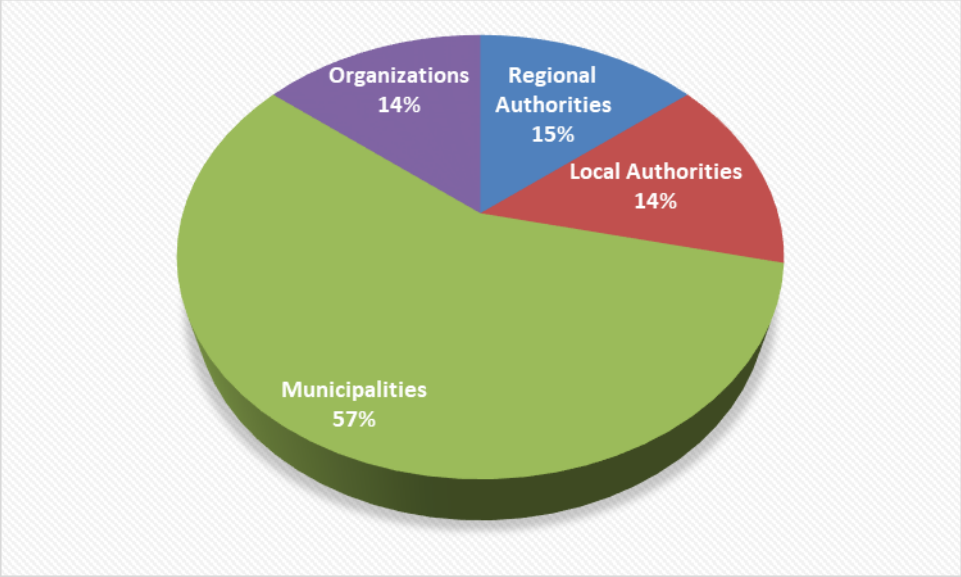
Local / Regional Authorities

The composition of the sample of Local / Regional Authorities that participated in the research is shown in the figure below. The largest percentage of participants (57%) are Municipalities that both come from the Region of Central Macedonia and the Region of Eastern Macedonia and Thrace. The same percentage of participation, amounting to 14%, have both the Local Bodies and Organizations, while 15% are Regional Bodies. This category also includes the answers given by the Central Vegetable Market of Thessaloniki

The Authorities participating in the research are:

- ✓ Municipality of Langada
- ✓ Municipality of Paionia
- ✓ Municipality of Thermaikos
- ✓ Municipality of Oraiokastro
- ✓ Municipality of Delta
- ✓ Municipality of Kilkis
- ✓ Municipality of Aristotelis
- ✓ Municipality of Serres
- ✓ Municipality of Thermi
- ✓ Municipality of Miki
- ✓ Municipality of Avdira
- ✓ Municipality of Topeirou
- ✓ Perfecture of Xanthi
- ✓ Department of Agricultural Affairs – RCM
- ✓ Counter-region of Agricultural Economy - RCM
- ✓ Chamber of Chalkidiki
- ✓ Industrial Chamber of Thessaloniki
- ✓ Agri-food Partnership of RCM
- ✓ Winemakers of Northern Greece
- ✓ Central Vegetable Market of Thessaloniki

Figure 7: Sample composition of Local / Regional Authorities



The title / position of the representatives that answered the questionnaire include for the Municipalities: Deputy Mayors, Municipal Councilors, Heads of Departments and Scientific Associates; For the Regional Authorities: Directors, Supervisors and Executives; For the

Chambers: Presidents and Vice-Presidents; For Local Organizations: Administrative / Management Executives

Only 10% of the respondents is not familiar with the term Climate-Smart Agriculture. The remaining 90% presented their views on the subject. According to them, CSA includes:

- New methods to reduce emissions of carbon dioxide and other compounds that contribute to the growth of the greenhouse effect and climate change
- More efficient management of agricultural holdings
- Mitigation of the greenhouse effect through best animal nutrition practices or sustainable use of inputs while increasing agricultural income
- Application of technologies (microclimate management, telescopy, climate intelligence) at the farm in order to adapt to climate change
- Application of ICT at all stages of the production process
- Selection of specific crops, smaller quantities of inputs (precision agriculture), adaptation of agricultural practices

The majority of respondents believe that climate-smart agriculture is not at all developed in the area of interest and its development is at early stages. According to the answers given, a campaign for the dissemination of the CSA concept and its applications should be developed as well as a plan for awareness raising towards relevant stakeholders. It is mentioned, among others, that Greece is one of the EU countries which has not yet submitted a climate change adaptation plan and that in order to implement such an approach strategic planning is needed. Finally, a small percentage of respondents believe that the adoption of CSA practices is steadily growing, especially in the RCM and that young farmers are more familiar with information systems. The cost of implementation is considered to be the main disadvantage of the CSA approach.

None of the participants are familiar with any CSA relevant national / regional legislation. Some of greenhouse gas emissions reduction legislation and/or protection of the environment legislation are moving towards the right path but they seem scattered without bringing the desired outcome. Moreover, some state that Greece only develops the absolute necessary legislation in order to comply with EU rules.

Although most participants agree that CSA needs a better definition / conceptual network, they also stress the importance of developing a strategic plan for better enhancing its popularity and attractiveness targeting the rural population. CSA must be supported by a clear legislative framework and should be appealing to farmers. Moreover, there should be strong initiatives offered by regional authorities, “multiple compliance” initiatives that will link direct financing with the application of environmental legislation and the maintenance of farm-land in good environmental condition. Extra effort should be made to develop the connection and cooperation among agriculture, industry and technology.

Most of the participants were quite explicit referring to the benefits of CSA while the costs/challenges mainly include the initial cost of application, the cost of technology and the Το μεγαλύτερο ποσοστό των Φορέων αναφέρθηκε εκτενώς στα οφέλη που προκύπτουν από την εφαρμογή της ΚΕΓ ενώ τα κόστη / προκλήσεις περιλαμβάνουν κυρίως το αρχικό κόστος υιοθέτησης, το κόστος της τεχνολογίας και τη distrust of rural population. Benefits according to Local / Regional Authorities include:

- ⇒ Social benefits
- ⇒ Environmental benefits – Protection of the environment
- ⇒ Improvement of microclimate
- ⇒ Increase of employment
- ⇒ Enhancing the economic development of the region
- ⇒ Development of the agricultural sector
- ⇒ Reduction of inputs, reduction of water use
- ⇒ More efficient use of factors of production
- ⇒ More efficient cultivations
- ⇒ Sustainable ecological crops
- ⇒ Expanding production options
- ⇒ Enhancing the quality and competitiveness of products
- ⇒ Added values to existing products
- ⇒ Deployment of new technology
- ⇒ Better marketing – branding
- ⇒ Promoting exports

All respondents agree with the creation of a regional partnership of CSA users. Authorities believe that such an alliance will contribute to the constructive communication between the members for the exchange of views and experiences. The cooperation provides incentives and tools to address problems and obstacles and enhances the overall competitiveness of the agricultural sector. In addition, the partnership gives farmers the opportunity to be heard, to enforce their decisions, to claim privileges and promote their actions. In addition, a partnership could increase their efficiency and competitiveness.

All respondents believe that the use of special designation (brand or label) to CSA products would be useful for their differentiation and better placement on the market. Useful information such as carbon footprint and water consumption for the production of the product would be useful as long as it is combined with extensive advertising and consumer awareness.

According to Authorities Climate-Smart Agriculture is either non-existent and not applied or is in early stages and not at all developed in Greece. In the long run, there is plenty room for improvement starting with awareness raising and information sharing. CSA in not only the future of agriculture but also a one-way road for the survival of farmers. This of course assumes the development of a smart, multilevel and holistic approach that will be based on the collaboration of all relevant parties.

Research / Educational Institutions

The sample of Research / Educational Institutions consists of the following:

- ✓ Aristotle University of Thessaloniki – Department of Chemistry
- ✓ Aristotle University of Thessaloniki – Department of Agriculture
- ✓ International University of Greece – Department of Food Technology
- ✓ International University of Greece – Department of Agriculture (2 participations)
- ✓ Democritus University of Thrace – Department of Production Engineering and Management
- ✓ American Farming School – Office of Strategic Projects Management
- ✓ Agri-food Partnership Demetra (2 participations)

The participants are either professors or researchers.

The specific target group seems to be quite familiar with the term of climate-smart agriculture, as compared with the previous two target groups. Their answers were quite explicit and targeted. Trying to describe CSA they state that it is:

- The "bridge" we are trying to build between agriculture / livestock and the field of new information and communication technologies in order to better meet the environmental challenges of agriculture / livestock
- An integrated approach to landscape management - arable land, livestock, forestry and fisheries - addressing the interrelated challenges of food security and climate change
- Climate-smart agriculture contributes to increasing agricultural production and improving agricultural income by using methods that do not have a negative impact on the environment.
- Precision agriculture, robotic agriculture
- Agricultural sector management systems with the main goal of either saving natural resources or utilizing natural resources in a more sustainable way and more consumer and environment friendly
- Production of agricultural products in such a way that we do not enhance climate change and not deplete valuable natural resources

All respondents agree that CSA is not very developed in the region and is still in its early stages. Stakeholders do not seem to be familiar with the concept while its benefits have not been disseminated to either the rural population or the average citizen. There seems to be a partial and scattered development of some CSA practices. This is due to the lack of a clear framework and on the lack of information.

Except respondent, all Institutions state that they are not aware of any national and / or regional legislation on climate-smart agriculture. The representative of the International University of Greece claims that there is legislation that defines a strategy CSA for 2050 as well as initiatives such as HORIZON 2020 and LIFE.

Regarding the definition of CSA, there are those who argue that the concept of climate-smart agriculture needs a clear definition and a clear framework to move along. But there are also those who believe that defining the framework is not a problem. The problem lies in the inability to inform stakeholders and provide the appropriate incentives. The implementation of CSA requires the cultivation of a new culture in the rural population.

All institutions believe that regional authorities should provide incentives through special programs and funding. First of all, regional authorities should communicate comprehensible information about CSA and set key steps for its development. Secondly, incentives should be adjusted both to farmers and consumers. Finally, a reward and bonus system should be developed and perhaps incentives should connected to specific crops or specific age groups of farmers.

This category of respondents referred quite extensively on the benefits of CSA, as compared to the costs / challenges. The references are quite similar to benefits already mentioned.

⇒ Reduced climatic and environmental footprint
⇒ Reducing the impact of agriculture to the environment
⇒ Enhancing soil resilience and health
⇒ Rationale use of factors of production
⇒ Reduction in wasting soil and water reserves

⇒ Production risk management
⇒ Utilization of natural energy sources
⇒ Reduction of production costs
⇒ Increase of productivity and efficiency
⇒ Improved product quality
⇒ Promotion of the special characteristics of local products
⇒ Adoption of innovative actions

Costs of CSA include the initial cost of application as well as the small size of farms.

Creating a partnership between CSA users find all the respondents in agreement. Reasons include better dissemination of knowledge and achieving economies of scale. An alliance could improve the bargaining power of producers by further enhancing their competitiveness. In addition, this partnership should offer the correct solutions in order to matchmake the needs of producers and the available tools. The comments of the institutions include comparisons with the market of organic products as it has been developed so far. In this sense, a list of farmers and respective selling points as well as a supervisory body and / or certification body of these products could be developed.

Labelling is preferred by most respondents as it will provide added value to the product and improve its competitiveness and market position - domestic and international. This of course should be combined with consumer awareness and an affordable market price. Trademarking could help identify and trace the product. Tools that can be used include the carbon footprint and the QR code which include information about the producer and the production process.

The present situation of CSA is considered quite underdeveloped and in the initial stages. However, there is a significant growth potential given the existence of incentives and the creation of a more favorable environment. CSA is a very promising approach, with rapidly developing applications, which is expected to benefit the Agri-Food sector in various ways. However, many efforts must be made to raise the stakeholders' awareness in order to proceed with its implementation. Climate change will inevitably lead the rural population in adopting CSA in order to survive. For many, the agricultural sector is in a transitional period as the generations of producers change and the baton is taken by younger farmers who are more familiar with technology and more open-minded in adopting innovative systems. Let's not forget though, that the farmer is also an entrepreneur who cares primarily for the profitability of his business.

3.3. Research Limitations

During the primary research and data collection some limitations were observed which need to be recorded and taken into account.

The main limitation concerns the outbreak of the Covid pandemic and the restrictive measures that were in force at the time of the research. The original plan was to conduct live interviews in order to complete the questions, which became impossible due to travel bans and the restriction of personal contacts for the safety of the population. For this reason, alternatives actions were used as mentioned in previous chapters. It is worth noting here that throughout the research there was a possibility that one of the participants would get sick and this would cause a delay in the collection of results. There was only one such case.

In addition, the inability to conduct live interviews and the option to complete the questionnaire in writing did not allow the researcher to intervene and elicit more detailed answers and explanations from the respondents. In the case of the telephone interview and since the recording of conversations is not allowed, the recording of the answers had to be done in writing in real time, which created delays and difficulty.

Equally important was the restriction due to the time period of the event which coincided with the period of the Christmas holidays. This created many delays in the availability of the people responsible for answering the questionnaire as many of them were on holiday leave.

4. State of Organic Farming and Sustainable Agricultural Practices in the Region

4.1. Country – specific conditions for sustainable agriculture implementation

Greece is moving towards a more competitive agriculture aiming at the production of quality and widely recognizable products. Taking into account the advantages offered by each region, agriculture contributes significantly to the development of the Greek countryside. Today a greener and more sustainable agriculture is being promoted by improving the complementarity between Agricultural Policy and Renewable Energy Sources. In addition, Greece promotes the high nutritional value of the products of the Greek land and sea as well as the importance of the Mediterranean Diet.

New plantations, innovative technologies as well as campaigns for the promotion of the Mediterranean diet and Greek PDO and PGI products have already contributed significantly to the strengthening of Greek efforts and the introduction of the country into a new era.

Organic farming in Greece has its roots in the ecological movement of the 1980s. The first certification of a Greek organic product was given in 1984, by a Dutch certification body, to raisins grown in Aigio to be exported to the Netherlands, while since 1986 a German company supported the production of organic olives and olive oil in Greece.

In Europe, the first consolidated legislative framework for organic farming was introduced in 1991 by EU Regulation 2092/91. European legislation sets rules for the processing, standardization and handling of organic products, imposes penalties on offenders and establishes a control and certification system for all organic products.

In our country, the certification of organic products began with the establishment of the first certification body, DIO, in 1992, which began inspections and certifications in 1993. Today there are fifteen certification bodies, which are approved by the Ministry of Agriculture and are active throughout Greece.

According to the statistics of the Ministry of Agriculture, in 2019 the total arable land that was in a organic stage covered 3,857,815 acres while those in transition represented an area of 1,429,702 acres (arable land and pastures). In other words, this is a total area of 5,287,517 acres, recording an increase of 47% only in the last three years (2014: 3,606,410 acres) and constitutes 16% of the total arable land in Greece (about 4% was 10 years ago).

The largest percentage (14%) of organically cultivated land is covered by arable crops such as cereals (wheat, rye, barley, oats), fruit crops (legumes and protein crops) and industrial crops (oilseeds, spinach and spinach). medicinal plants). Next comes the olive, covering 10% of the areas and the vineyard, while fresh vegetables also play an important role. The total number of entrepreneurs engaged in organic farming in 2019 was 33,609, including processing installations. The largest percentage of organic farms are located in Western Macedonia (21%) while Central Macedonia includes about 10.3% and the Region of Eastern Macedonia - Thrace 6.5% of organic farms. It is worth mentioning that after Western Macedonia, RCM and REMTH present the largest average farm size that reaches 164 acres and 135 acres respectively.

Today Greece has a very dynamic internal market of organic products despite the initial export orientation. Organic products are currently available in more than 70 organic markets, supermarkets and hundreds of specialized and non-specialized stores.

The further strengthening and dissemination of organic farming is directly linked to the financial support of growers both during the transitional period and in their subsequent course.

Important elements are also strengthening the reliability of the control and certification system as well as the simplification of the process of entering organic farming. Further strengthening of research at the local level as well as raising public awareness could further promote the penetration of organic farming.

4.2. National Capacities

The agricultural sector in Greece is controlled and financed by specific authorities which include the Ministry of Agriculture at national level, the respective Regions at local level and the relevant financing organization.

The Ministry of Agriculture is the main authority for the development and enforcement of national legislation on agriculture and organic farming. The Ministry is primarily responsible for the development, implementation and monitoring of the Common Agricultural Policy in accordance with EU directives. The CAP includes a set of regulations relating to agricultural production, farmers' financing, rural development and the regulation of agricultural markets. At the same time, it takes care of the environmental compatibility of the agricultural activity as well as the distribution of agricultural products aiming at price stability and high-quality maintenance. Ensures sustainable land use and employment in the agricultural sector. The Ministry is the Body that manages the Agricultural Development Program that aims to provide incentives and grants for the integrated development and sustainable competitiveness of the rural area

The Region of Central Macedonia and respectively the Region of Eastern Macedonia - Thrace are responsible for the planning, programming and implementation of policies at regional level in accordance with the country’s principles of sustainable development and social cohesion, taking into account national European policies. The Regions are implementing strategies to tackle climate change with the main aim of reducing the region's vulnerability to the effects of climate change and its protection against it. These strategies will be included in the Regional Adaptation Plans to Climate Change which are being developed.

An important body in the field of agriculture is the Payment and Control Agency for Guidance and Guarantee Community Aid (OPEKEPE), which is supervised by the Ministry of Agriculture. The aim of the Agency is to pay on time, correctly and transparently the agricultural aid granted by the European Union in the agricultural sector. OPEKEPE manages the aid of two Community funds to finance agricultural expenditure in the Community budget. Beneficiaries of the aid are mainly farmers - stockbreeders and investors in the agricultural sector such as processing companies.

Other organizations that play a key role in the development and implementation of sustainable agriculture include University and Research Institutions in the research area as well as companies developing technological applications suitable for the agricultural sector.

The term Climate - Smart Agriculture is not found in any texts of the above authorities nor did it appear in a relevant secondary research. In Greece, smart agriculture is more widespread and it concerns the application of modern Information and Communication Technologies (ICT) in agriculture such as precision equipment, Internet of Things (IoT), sensors and actuators, geo-location systems, unmanned aerial vehicles, robotics, etc. Certainly, the two concepts are identical in many respects and mainly aim at a more productive and sustainable cultivation which will be based on a more accurate and efficient use of resources.

According to the analysis of the agricultural sector carried out in a previous chapter, the Regions of Central Macedonia and Eastern Macedonia-Thrace show significant mobility in the

agricultural sector. Key data captured above include firstly the significant percentage of the population employed in the agricultural sector which reaches 19% for RCM and 11.5% for REMTH. Secondly, in terms of the number of holdings, these two Regions occupy the first two places. Regarding the composition of crops cultivated, in both cases most crops include the cultivation of cereals for fruit production, followed by the industrial plants and the cultivations of livestock plants. Fresh vegetables, melons and strawberries also play an important role.

In the case of the region of Vasilika, agriculture is the main occupation in the area. The local population is mainly engaged in agriculture, greenhouse crops and livestock. There are about 500 acres of greenhouses in the area, with the main crops being zucchini and tomatoes. In addition, there are vegetable crops, flower crops as well as cereals. The crops produced in the land of Vasilika are especially famous for its taste and quality. Although the Agricultural Cooperative of Vasilika has an active role in the region, its participation in the primary research shows that its members are not familiar with climate-smart agriculture and its practices. The participation of Vassilika in the Project shows that significant efforts are being made in this direction.

Taking into account the most important crops in the areas of interest we can identify the products that could be produced using Climate - Smart Agriculture. We mainly refer to the products that occupy the largest areas in each region as this will have the greatest impact on environmental protection and the largest reduction in emissions. These products include cereals, industrial plants, livestock plants and vegetables. In the case of Vasilika products that could be produced with climate-smart agriculture include greenhouse crops and country vegetables as well as cereals.

4.3. Existing Policies and Instruments for Funding

As mentioned above, agriculture in Greece is an important sector not only from an economic point of view but also from a social and environmental point of view, while it is also a key tool for rural development. Changes to the Common Agricultural Policy include strengthening the effectiveness of the "direct payment" system, diversifying management tools, increasing the focus of agricultural policy on mitigating climate change, and tackling price and income volatility. The fact remains that the country is showing difficulty in meeting many of the above challenges but is gradually becoming more flexible and less dependent on EU enforcement.

The legislation currently available in Greece mainly comes from the Common Agricultural Policy, Energy and Climate Directives as well as Climate Change Directives.

According to the objectives of the new CAP 2021 – 2027, policies will be implemented through the adoption and approval of a CAP Strategy Plan that will cover both Pillar I (direct payments, sectoral interventions by types of products) and Pillar II (agricultural development) of the CAP. Its goal is to form and develop a smart and sustainable agriculture that cares about the environment and the climate.

The National Energy and Climate Plan (NESP) is a strategic plan for climate and energy issues and includes specific quantified targets by 2030, mainly on climate change and the reduction of emissions, further penetration of Renewable Energy Sources and improving energy efficiency. The NECP includes guidelines for the National Adaptation Strategy to Climate Change (NASCC), which is another legislative framework related to the environment and agriculture.

The National Energy and Climate Plan (NECP) refers to the national level and includes measures to adapt to climate change and curb the effects of socio-economic factors. The strategy includes indicative actions and measures to adapt 15 sectoral policies, including Agriculture-

Livestock, Forest Ecosystems, Biodiversity, Aquaculture and Fisheries. Further specialization of the strategy at local level is carried out through the preparation of the Regional Adaptation Plans το Climate Change which are in development.

Among the most important financing tools in Greece is the LIFE Program, which is a financial instrument for the environment and climate change, and the LIFE-IP AdaptInGr project that will strengthen the implementation of the Regional Adaptation Plans to Climate Change.

In addition, financial resources are available from the Recovery Fund, the ESPA, the Agricultural Development Program and OPEKEPE.

4.4. Domestic and International Markets for Climate-Smart Agriculture

Since in our country there are no registered products of climate - smart agriculture, the only way to examine the dynamics of a domestic market and distribution channels is through organic products.

Greece has seen a significant increase in the consumption of organic products in recent years, a fact that strengthens the belief that consumers are increasingly turning to healthier food choices. According to the latest research conducted by Nielsen, organic products are in a high position in consumer preferences and it seems that these percentages will continue to rise while this consumer group will continue to grow. The largest percentage of consumers of organic products state that they prefer these products due to a healthy diet and the maintenance of a healthy body. Other reasons include, contributing to the protection of the environment and the improvement of natural resources as well as the prosperity of agricultural societies. The top choices of organic products include eggs, milk, fresh fruits and vegetables. Cereals, yogurt and legumes follow just as dynamically. The research concludes that the market for organic products will be extended to bread, rusks and crackers. According to the market channels, when it comes to organic products, organized retail holds 72% while specialized stores account for 44%.

In conclusion, the development of a market for climate-smart products will find fertile ground for growth in Greece. Taking into account the shift of consumers to better quality food, their awareness of environmental issues and the growing consumption, the production and sale of CSA products is expected to acquire a pretty good position in the market from early on.

As far as the distribution channels are concerned, following a path similar to organic products seems to be the best solution. All over Greece, the operation of organized outdoor markets for the retail sale of organic products has become an institution. Specifically, in Thessaloniki, where the CSA products coming from Vasilika can be sold, outdoor markets for organic products are organized four times a week. In addition, there are now many organic retail stores in many parts of the country and especially in large cities such as Thessaloniki. Other distribution channels include special sections in large supermarkets or selling activities of agricultural cooperatives. Especially in the case of Vasilika, the Agricultural Cooperative of Vasilica could be used to sell CSA products.

4.5. Benefits of Climate – Smart and Green Agriculture

The identification of the benefits and challenges of climate-smart agriculture was realized through the primary research. Below they are grouped and divided into 3 three main categories depending on the sector they concern.

<u>Social Benefits</u>

⇒ Sense of contribution to the protection of the environment

⇒ Consumption of quality and healthier products
⇒ Penetration of new technology
⇒ Promotion of the special characteristics of local products

Economic Benefits

⇒ Reduction of production costs
⇒ Increase of production
⇒ Increase of income
⇒ Energy saving
⇒ Better product marketing
⇒ Increase in employment
⇒ Development of agricultural sector
⇒ Economic development of the region
⇒ More efficient cultivations / farms
⇒ Increased products' competitiveness
⇒ Increased products' added value
⇒ Increase in exports
⇒ Production risk management
⇒ Better marketing – branding
⇒ Expanding production options

Environmental Benefits

⇒ Crop yield protection
⇒ Environmental protection
⇒ Reduction in climate change
⇒ Reduction in GHG gas emissions
⇒ Reduced climatic and environmental footprint
⇒ Reducing the impact of agriculture to the environment
⇒ Reducing the use of soil and water reserves
⇒ Saving resources
⇒ Enhancing soil resilience and health
⇒ Rational use of inputs
⇒ Improvement of micro-climate
⇒ Limit the use of inputs / water
⇒ More efficient utilization of production factors
⇒ Sustainable ecological crops

4.6. Challenges before the Implementation of CSA Practices

Regarding the challenges that proceed the implementation of the CSA approach, and according to the results of the primary research, the initial investment cost seems to be the most important challenge. Farmers believe that installing high-tech systems involves a significant investment of capital, which prevents them from engaging. The fact that the average Greek farmer owns limited land also contributes to this belief and for this reason the cost of installation seems unbearable. Additional cost is considered the training of staff in case of installation of technological tools.

At this point, it is worth mentioning that from the research carried out in the field of Climate - Smart Agriculture, a gap is identified in terms of the knowledge the rural population in Greece has. In this way, the belief that farmers have of the practices included in CSA is quite distorted and directly linked to the application of high technology which is particularly costly. Instead, CSA promotes any action that can contribute to its initial objectives, namely to increase yields and income, adapt to climate change and mitigate the impact of agriculture on the environment. These actions may include adopting resilient crops, switching to organic farming and / or installing low-cost digital tools. This gap in knowledge is identified mainly due to the

lack of information and promotion of CSA and the practices it includes, as well as the absence of training seminars for the rural population.

An additional challenge is the low educational level of farmers and their limited familiarity with technology in general. Fortunately, this seems to be changing as we move on to a younger generation of farmers who seem to have both university education and experience in using technology.

Lastly, but equally important, is the disbelief shown by the agricultural population to the adoption of new techniques and to changes of the production process. Moreover, farmers are quite suspicious towards the state and the government.

5. Climate – Smart Agricultural Practices and Crop Models in the Region

Name of Organization: Agricultural Cooperative of Vasilika – Legumes Producers Group

Region of Operation: Vasilika - Municipality of Thermi, Thessaloniki

Size of cultivation: 250 acres

Number of employees: 5

The Legume Producers Group started its operation with 15 members and carried out the first plantation in 2015 and the first sales in May 2016. The varieties it produces include Samos lentils and Amorgos chickpeas. The specific varieties were chosen because of their domestic origin as they are already adapted to the domestic soil-climatic conditions.

The producer group uses the practice of "greening" according to the CAP 2017-2020 according to which for areas over 150 acres there should be a set-aside piece of the farm while 5% of the arable area should be characterized as "ecological focus area". This is done by growing legumes in the specific area. These practices are particularly beneficial for soil fertility as it binds atmospheric nitrogen and enriches the soil while reducing the use of nitrogen fertilizers in the next crop.

The benefits stemming from the implementation of the above-mentioned practices include:

- ✓ Soil enrichment
- ✓ Decrease in the use of fertilizers
- ✓ Decrease in the use of inputs / resources
- ✓ Decrease in production cost
- ✓ Increase in cultivation yield - production
- ✓ Increase in product quality
- ✓ Decrease in greenhouse gas emissions
- ✓ Protection of the environment and ecosystem

Name of Organization: Greek Organic Herbs “Inoni”

Region of Operation: Monopigado – Mhnicipality of Thermi - Thessaloniki

Size of cultivation: 15 acres

Yield of cultivation: 1 τόνο

Number of Employees: up to 8 employees at harvest season

Cultivated crops include: dittany, thyme, lavander, oregano, mountain tea, sage, resomary, estragon, achinacea, marjoram, pennyroyal

The company pays special attention to the quality, color, aroma and taste of the herbs it cultivates while the owners are present at every stage of their processing, observing all the principles of good agricultural practice.

The crops are collected manually and transported immediately to specially designed chambers for drying. The final sorting and selection is made by carefully studying the plants, which are then packed in special packages with hermetic closure, in order to maintain the quality characteristics of the herbs.

The company does not make any interventions in the crops or the cultivation since all the work (harvesting, weeding) is done manually with the use of tools and no fertilizers are used.

In this way they do not interfere at all in the natural environment and the ecosystem of the area. The activity of the company does not burden the environment and has no impact on climate change since no fertilizers are used and no greenhouse gas emissions are made. Finally, the cultivation of herbs does not produce waste.

The company received a grant for its initial installation from the "Young Farmers Subsidy" Program

Link: https://www.inoni.gr/el/

Name of Organization: Agricultural Cooperative "Agios Loukas"

Region of Operation: Rachi Pierias

Size of cultivation: 2.200 acres

Yield of cultivation: cherries 1.000 tn/year, apricots 350 tn/year and apples 150 tn/year

The cooperative implements Integrated Management practices and Precision Agriculture Systems. These include farm monitoring, local application of nutrition or plant protection, leaf and soil diagnostics and analysis on each farm as well as recording of applications on an electronic basis.

During 1994-1995, the Cooperative implemented an investment plan for the construction of a sorting unit / refrigerator unit, with a total area of 600 sq.m., with 2 cold rooms with a capacity of 200 tons. In 2007 they implemented a 4-year investment plan totaling € 3.700.000. The investment plan includes the expansion of the building facilities, the modernization of the cold rooms, the installation of a water cooler (Hydrocooler) and the installation of an electronic line for sorting cherries by size and color (GP Graders / Australia), with a capacity of 4 tons / hour. The plan also included the replacement of old cherry plantations and the installation of rain protection systems.

The cooperative has been implementing an integrated management system since 2004 and has been certified by TUV HELLAS. They also implement quality systems both for the cultivation and for the processing - standardization - maintenance and marketing of the products. The quality systems are: Agro & Global Gab for the products and ISO 22000 for the sorters.

The results from the implementation of practices and investments include:

- Rational use of all inputs
- Monitoring and control of all production phases
- Maintenance and improvement of the quality of products
- Ability to standardize the products
- Increase efficiency and turnover
- Protection of the environment and the ecosystem

The Agricultural Cooperative "Agios Loukas" constantly invests in new machinery aiming at its development and improvement of its products market position.

The Cooperative received a grant from the Local Initiative LEADER I

Link: https://www.cherries-asporachis.gr/

Name of Organization: Paranos Chrisostomos

Region of Operation: Kolindros Pierias

Size of cultivation: 10,5 acres

Yield of cultivation: 3 tn/year, 300 kg/acre/year

Αριθμ. Εργαζομένων: 0

The organization deals with the organic cultivation of aronia.

Aronia is a bush that grows in wet areas and mainly in acidic soils. It is a crop without great cultivation requirements and can be grown in different climates (dry or wet) and soils (sandy to clayey, acidic, neutral, alkaline). It thrives and grows faster in moist, light and peaty soils, and although it requires sunshine, it also grows in semi-shady environments. It makes small black fruits that are eaten and used in the pharmaceutical industry. It can withstand even frost (-25 degrees Celsius), does not need much water and its efficiency is very high.

The farmer applies very few interventions to the crop. The applications he uses uses include spraying with copper and destruction of weeds with a destroyer and / or manually. Watering is carried out with active microorganisms.

The creation and development of cultivation in this area facilitated the creation an ecosystem and the development of biodiversity.

In the future, the farmer plans to apply straw onto the soil in order to maintain soil moisture and reduce water use for irrigation. In addition, he plans the installation of a meteorological station, ie the installation of sensors that "read" the data of the microclimate and the crop, informing about weather conditions, temperature, humidity, even if an insect invasion is imminent.

The farmer did not receive any form of financing.

Name of Organization: Agricultural Cooperative of Naousa

Region of Operation: Naousa Imathia

Yield of Cultivation: 20.000.000 kg of fruti

Number of Employees: 20 full time and 70 seasonal in periods of high production

The Agricultural Cooperative of Naousa is an organization that fully controls the production process and the cultivation care applied by each producer - member, in each farm from the planting of trees to the harvest and packaging of fruits. Produces and sells superior quality fruits through a Certified Integrated Production Management system for the safety, hygiene and quality of its products, but also the protection of the unique natural environment of the region. Products grown include peaches, apples, cherries, pears, plums, quinces, persimmons, kiwis.

The main activities of the organization include:

- the organization and control of the production of superior quality fruit with the constant cooperation of each producer with a highly trained agricultural department
- the collection and quality control of fruits by specialized and accredited laboratories
- the maintenance of the products until they are placed on the market
- the organization of a diverse trade and export activity, fully covering the quality requirements of the Greek and international market.

In this context, every year it develops a complete network of actions in terms of marketing and advertising, creating a more direct communication with consumers and enhancing the good image of products. The Cooperative with the aim of ensuring the highest quality for the consumer has developed a dynamic system of integrated production management and has been certified by AGROCERT and according to ISO 22000 for peaches, apples, cherries and plums.

The Cooperative has a privately owned area covering 41.259 sq.m. in Kopanos Anthemion and 3.437sq.m. in Naoussa. The facilities that cover a total of 13.682 sq.m. are considered one of the most effective because they are located in the heart of fruit production.

Facilities include electronically controlled refrigerators of 7,000 tons of fresh fruit, standardization and packaging stations for apples and peaches, storage facilities and offices.

The results from the implementation of integrated management systems include:

- ✓ control of all stages of the production process
- ✓ reducing production costs
- ✓ the rational use of water, fertilizers, plant protection products, etc.
- ✓ environment protection
- ✓ the production of safe and quality products
- ✓ promoting the region

Link: https://acn.com.gr/

6. Conclusions

The Climate-Smart Agriculture approach has a broad meaning and includes a variety of practices and tools that serve its objectives. Following the previous analysis and taking into account the three distinct categories of respondents of the primary research, it is possible to draw findings and conclusions about the current situation in the Region of Central Macedonia and the Region of Eastern Macedonia - Thrace where the area of interest is. The main findings - conclusions include the following points:

- Agricultural Cooperatives / Farmers are less informed and familiar than the other two categories of respondents regarding the concept of CSA and have associated it mainly with the application of technological tools.
- All categories of respondents agree that CSA is quite important and will bring significant benefits to crops and the environment. The Agricultural Cooperatives declare their readiness to start or continue to implement climate - smart agriculture.
- None of the respondents recognizes the existence of a legal framework for Climate - Smart Agriculture. There is some kind of legislation but in the broader sense of reducing emissions and protecting the environment.
- CSA needs a clear definition framework and targeted informative activities for the agricultural population. It needs to be adapted locally.
- The development of CSA presupposes the cooperation between the agricultural sector, the regional authorities, the industry and the financial institutions.
- The main benefits stemming from CSA include the increase in production and income in combination with the saving of resources and the protection of the environment.
- The main and basic cost of implementing CSA includes the initial cost of implementing the tools and technologies, which, however, in the long run is covered by the benefits. All relevant parties believe that incentives offered by the state are necessary and important.
- The contribution of the state, either at national or regional level, is absolutely necessary for the dissemination of CSA, for awareness raising of all the interested parties, especially consumers who will be the end users of the CSA products, and for the development of incentives.
- All respondents, and especially Agricultural Cooperatives, are in favor of creating alliances and collaborations in order to exchange information and experiences, to allocate the cost of CSA practices / tools and to promote their actions.
- The branding of CSA products is particularly important for their recognizability and competitiveness. Information that may be included on the label can relate to the carbon and water footprint as well as the cultivation practices used (code QR).
- The level of Climate - Smart Agriculture today is low to non-existent in region.
- The development and adoption of CSA practices in the future is a one-way road for the survival of the rural population and important steps must be taken for raising awareness, developing incentives and funding tools and setting a clear legislative framework.

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