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Community for climate-smart agriculture

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 COUNTRIES AND A COMMON BRAND FOR CLIMATE SMART AGRICULTURE (CSA)

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The project **Cross-Border Alliance for Climate-Smart and Green Agriculture in The Black Sea Basin (AGREEN),** Ref. No. BSB 1135 is funded by the Joint Operational Program for Cross-Border Cooperation under the European Neighbourhood Instrument "Black Sea Basin 2014-2020", under Priority 1.2 "Increasing cross-border opportunities for trade and modernization of agriculture and related sectors".

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ABSTRACT

The purpose of this project is to analyze the trends in what is called Climate-Smart Agriculture (CSA) and to propose the grounds and principles of developing relevant branding strategy which can benefit both the producers and market agents in the Black Sea region. This is done considering the changes in the consumer perception on the healthy living and healthy, clean food and water, the digitalization of the marketing mix and market structure, especially the combination of e-marketing communications channels and distribution channels. These changes lead to significant increase of the brand as a major factor in the decision-making process in the B2C as well as in B2B markets. The digitalization inflated the role of the brand in the decision-making process as the information search and analyses have been inspired by the search engine options as main source of relevant market information. As a result this gradually transformed the classical marketing mix into e-marketing mix, where the role of brand in the decision making process is decisive.

In the case of CSA, the brand will inspire sustainability in every step of the agricultural production and provides supreme value for the end consumers by implementing the principles of climate change adaptation, environmental protection, health benefits, social
inclusion and enhanced profitability for the local producers. This is especially true for the case of organic GREEN agricultural production, especially when the branding underlines the common history of the geographic region, and the common traditions in raising same products following same or very similar traditions in the whole food providing process, with an accent on the taste and health related issues.

From producer's perspective, branding of the Climate Smart and Green Agriculture products can become the pivotal point of a specific-quality virtuous circle within a regional or territorial approach, meaning that its promotion can have positive effects that are reinforced over time, thus allowing preservation of the agricultural food system, related social networks and agritourism development, which in turn contributes to economic, sociocultural, and environmental sustainability.

The use of country-of-origin or region based (BSB) brand marketing can communicate information and promote agricultural products in a quite attractive and inspiring buying and consumption way. Branding can be a successful marketing tool due to the fact that it communicates more than an image to the consumer. It develops a packing of virtual reality and imagination, which inspires strong feelings in the potential customer and decision maker.

In general, an AGREEN BSB CSA product brand will refer to:

- regional visibility in the world/ EU, along with a national representation in the region
- need for preserving and advancing national products, habits and traditions
- need for a local brands stating and stimulating more intensive investment in modern agriculture, offering to the local producers (farmers) a promise for a larger solid, sustainable market

A CSA regional brand, as well as the local CSA corporate and product brands should aim at bringing health and wealth to regional economies, especially to the rural areas.

1. CLIMATE CHANGE & IMPACT IN THE BSB/PARTNER COUNTRIES

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.
In all ten countries in the Black Sea basin, including those having Black Sea coastline - Bulgaria, Romania, Ukraine, Russia, Georgia and Turkey, and the close neighbor countries Moldova, Armenia, Azerbaijan and Greece, (Fig.1), climate changes which affect significantly the local agriculture are observed in the last decade (e.g., Amare, 2016; Boncheva & Simeonov, 2016; Nojarov, 2020, 2016; Sundaram et al., 2019).

Fig.1: Black Sea basin countries

The climate changes, and the related to them agricultural risks in the countries in the Black Sea basin are expected to be like those in the EU, or even higher compared to the EU average (e.g., FAO, 2017). The recent history in 2015-2020 for example, shows high number of extreme weather events, with significant production losses affecting practically all countries in the Black Sea area (Boncheva & Simeonov, 2016). It is important to note that different regions experience different climate changes which obviously lead to specific effects on the local agriculture. For example:

Decreased precipitation

Climate change will increase the water requirement in agriculture and cause a decrease in surface and underground water resources. Despite technological advances in plant cultivation, fertilization and irrigation, climate is still the most important factor in agricultural production. The decrease in precipitation and the increase in the amount of potential evaporation causes and will cause significant decrease in soil moisture (SYGM, 2016). In Romania the most affected regions so far are South-East, South-Muntenia, Bucharest-Ilfov and South-West Oltenia (Fig.2). The development in Eastern Bulgaria, including in the North-East, is similar to that in South-East Romania. The main extreme climatic phenomenon to which agricultural crops in these regions are subjected is drought.

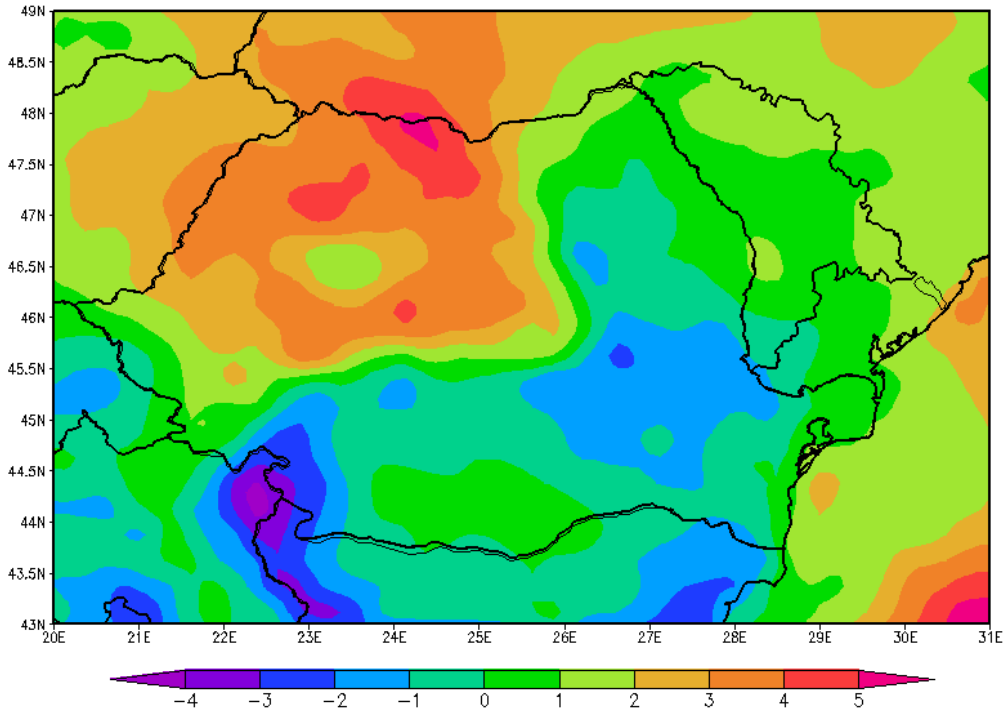


Fig. 2: Change in the estimated annual rainfall for 2001-2030 (in%) (reference range - 1961-1990) under the conditions of scenario A1B

The number of hot days is expected to change from 35 days to 112 days in a year. Changes in temperature extremes will increase the intensity and frequency of heat waves. Depending on the increase in temperature, the growing season of the plant gets longer. This is not expected to be the case for Black Sea coastline of Turkey. The number and the intensity of rainy days on the Balkans is expected to decrease by 10-20 per year (Nojarov, 2015). The climate in Bulgaria will shift from continental to more sub-tropical and tropical-like, which will challenge in numerous ways the balance of the existing eco and agro-food systems. Traditional crops will have to adapt or be replaced with more dry-resilient varieties.

At the same time, the observed regions will be affected from time to time by some heavy rains, which leads to other unwanted effects.

Number of heavy rainy days and frequency

Especially in the Black Sea coastline of Turkey increases in the frequency and intensity of heavy rainfall are observed (SYGM, 2016). In June-July 2021 severe rainfalls were observed in Ukraine, Russia, e.g., Crimea and Sochi, Varna and Burgas regions in Bulgaria. Such heavy rains and flooding lead to loss of agricultural outcome and significant financial loses of the local farmers. In the Northeast region of Bulgaria, for example in June 2014, a heavy rainfall lead to a significant flooding of residential and agricultural areas, leading to loss of human lives, damaged homes and ruined harvests. As per a recent research lead by L. Boncheva and P. Simeonov (2016), there was

58 recorded cases of tornadoes on the territory of Bulgaria for the period 2001 – 2016, a rare abnormality for our country, which becomes more frequent due to climate change impact.

Greenhouse Gas Emissions

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.

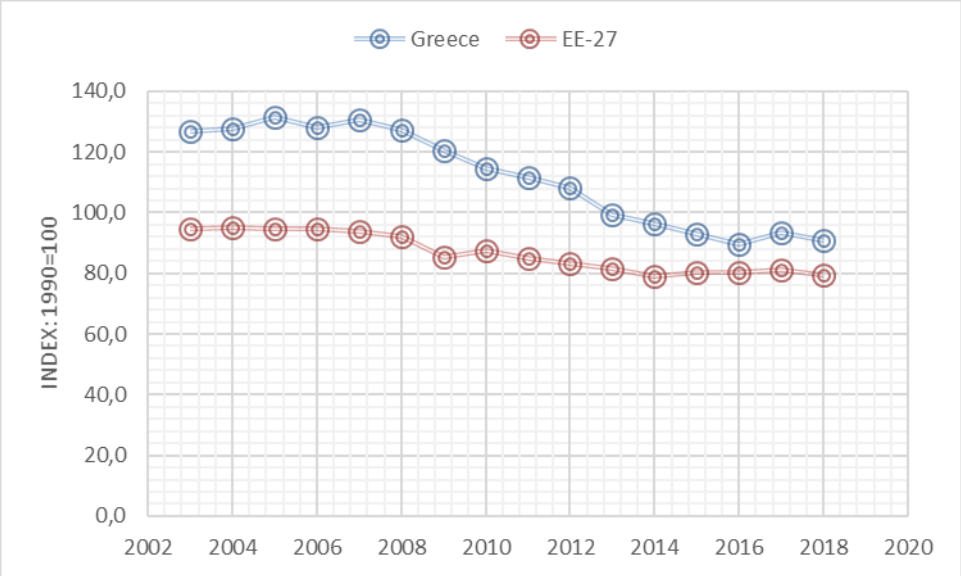


Fig. 3: Greenhouse Gas Emissions Greece - EU 2003 – 2017 (ELSTAT)

More diseases and pests

If the cold winters can no longer control them, some diseases and pests can survive or even multiply more and more every year, causing epidemics. As temperatures and humidity conditions change, new diseases and pests can cause damage in areas previously unseen. For example, previously unseen Septoria leaf spot in wheat in Central Anatolia and yellow dwarf virus diseases

are seen now. In addition, it is a common situation that excessive rainfall causes an increase in rust and powdery mildew diseases in plants.

Summary

Changes in precipitation regime, heavy rainfall and associated floods may delay planting and harvest times. On the contrary, the early warming of the weather may cause the sowing and planting dates to be brought forward as the last frost date is brought forward. For example, 1-3 degrees of warming in the country means that warm season cereals such as corn, rice and summer crops are put into production earlier. Thus, it may be possible to protect from summer heat and evaporation rate (Akinerdem, 2014; Ozturk, 2005; Kadioglu et al., 2017).

Many studies have been carried out in order to determine how the yield and phenological periods have changed in the face of increasing air temperature as a result of climate change. Especially the increasing temperatures in winter and spring shifts the plant development phases (phenological period) in field crops and orchards earlier; this causes frost damage in early blooming fruit trees and a decrease in the quality of products (Turkoglu et al., 2016; Kadioglu et al., 2017). Soil water deficit in the crop growing season, increases in the frequency and severity of the flood events will adversely affect the crop production and biodiversity. At the same time, drier periods cause prolongation of the fire season and pose a serious risk for agriculture.

Changes in precipitation regime, heavy rainfall and associated floods may delay planting and harvest times. On the contrary, the early warming of the weather may cause the sowing and planting dates to be brought forward as the last frost date is brought forward. For example, 1-3 degrees of warming in the country means that warm season cereals such as corn, rice and summer crops are put into production earlier. Thus, it may be possible to protect from summer heat and evaporation rate (Akinerdem, 2014; Ozturk, 2005; Kadioglu et al., 2017).

2. SWOT ANALYSIS

The results from the analysis and mapping of the concept of CSA, as well as the analysis of the agricultural sectors in the countries belonging to Black Sea basin 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 EU regulations 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 the Black Sea surrounding countries.

2.1 STRENGTHS

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

Strengths	
S1	Diverse and fertile soils, which have been used as agricultural land for centuries to produce agricultural products with specific qualities and taste. Long-term traditions in crops production and animal breeding
S2	A number of plant varieties well-suited to the local climate conditions and soils
S3	Institutes and universities for agricultural research and development with internationally recognized achievements in biogenetics and plant breeding
S4	Growing demand (both domestic and international) for bio, organic and climate-smart food products
S5	Availability of traditional local varieties of fruits, vegetables, essential oil bearing plants, herbs and cereal crops which are appealing to the domestic market and marketable abroad
S6	Increased resilience to climate change
S7	Improving / ensuring soil health and biodiversity
S8	Rehabilitation of degraded soil
S9	Access to a number of financial schemes and instruments for organic, bio and climate-smart agricultural production.
S10	Reducing the reckless use of polluting inputs, especially fertilizers, chemicals
S11	Network of over 100s secondary schools and dozens of universities which offer specialization in agriculture and/or food production, thus ensuring availability of productive and well-educated labour resource for the industry
S12	Existing agricultural policies are aligned to the CAP of the EU, facilitating exchange of best practices between farmers and producers

In addition to those common strengths, listed above, there are many specific strengths which can be considered as local strengths for the particular country.

2.2 WEAKNESSES

The table below shows the main weaknesses of CSA given the present situation.

Weaknesses	
W1	Initial implementation cost too high for the small farmers. Small and scattered farms with limited access to funding
W2	The cost undertaken by farmer while the society as a whole receives the benefits is reducing the incentives to develop such farming
W3	Unfair competition between small, local producer and large farms. Most EU programs benefit big-scale agri-cooperatives, and very few are applicable to small-size farm producers.
W4	Loss of traditional markets in the post-communist period
W5	Inelastic attitude of the agricultural population towards new practices and technologies - Low level of education - Inability the aging rural population to adapt to new technology
W6	Difficulty in coordinating actions required by different levels
W7	The irrigation system in Romania, Bulgaria, Ukraine, and Georgia partly or fully destroyed and what has survived in precarious conditions, expensive to use and with little coverage of agricultural areas that would need to be irrigated
W8	Underdeveloped system of geographical recognized brands which leads to lack of incentive for traditional variety production and loss of financial benefits
W9	Excessive fragmentation of the agricultural area due to the existence of a large number of small agricultural holdings under 2 ha. The average area of a farm well below the European average
W10	Historically formed opposition of farmers to unite in cooperatives
W11	Unclear legal framework for the protection of agricultural land
W12	Lack of information on climate-smart agriculture among the farmers, population and stakeholders

For some of the participating countries there are specific weaknesses.

2.3 OPPORTUNITIES

The following table contains the opportunities which can provide an initial basis for development of CSA in the Black Sea region.

Opportunities	
O1	Organic products demand will continue to increase, both domestically and globally. Consumers will demand more locally raised produces. Consumer orientation towards niche products, healthy and clean, environmentally friendly products
	New Common Agricultural Policy 2021 - 2027
O2	Creation of regional international alliances for common branding and marketing activity and for transfer of best practices and know-how
O3	Use of robots and AI controlled equipment to substitute labour intensive and not suited for mass production agricultural operations
O4	Training and development of education in the field through projects of associative and governmental forms, supported by EU non-reimbursable funds
O5	Dissemination of information - data - research results
O6	Scientific development and new technologies, leading to more resilient crop varieties and plants
O7	Creation of alliances, cooperatives and other organisations of argi-producers for support, lobbying and marketing purposes
O8	Opportunity to use the local genetic fund with plant and animal species having a great adaptability and resistance to aggressive climatic factors, respectively having clearly superior qualitative characteristics
O9	Commitment of funds for CSA implementation
O10	Creation of bigger and stronger cooperatives
O11	Development of agricultural infrastructure
O12	On-line sales as a direct sale channel and a tool to reach and establish long-term relationship with the final consumer
O13	Non-reimbursable European and governmental funds for investments in farm modernization, in the development of primary agricultural processing activities
O14	Education, information and specialization courses for farmers, offering consulting services through EU-funded projects
O15	CSA product branding

For some of the participating countries there are specific opportunities.

2.4 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 crucial.

Threats	
T1	Climate change with worsening of the favorable growth conditions for the plants, with the accentuation of the extreme phenomena of drought and heat wave
T2	Increased usage of invasive chemical pesticides and fertilizers
T3	Decrease of arable land
T4	Changes in climatic zones and reduction of agricultural biodiversity
T5	Pandemics
T6	Absence of appropriate supportive legislation for CSA
T7	Few funding tools for the small organic farmers
T8	Limited cooperation among key actors

For some of the participating countries there are specific threats.

3. EXAMPLES OF CLIMATE-SMART AGRICULTURAL PRACTICES AND CROP MODELS IN THE BSB

There are hundreds of examples of excellent Climate-Smart agricultural practices in the studied countries, which are presented in an excellent way in the country reports. A few of them will be presented here as an illustration of the general trends, which have been observed.
SC AGRO GHEORDUNESCU SRL, operating in Com Mereni, CONSTANTA County in Romania is such an example (Fig.4 and Fig.5).

Fig 4: Storage facilities

Fig. 5: Variety of wheat crops

The company's management understood from the first moment that one of the key elements of the operation of the processes is the adaptability to the market requirements. The company has adequate resources to be able to demonstrate that the products are made according to its quality objectives.
Crop rotation is done using the following indicative distribution:
Wheat 40%, Barley 15%, Rapeseed 20%, Corn 10%, Sunflower 3%
Beyond these classic crops, the company is concerned with the introduction of new drought-resistant and profitable crops.
Thus, the chickpea culture was established on 7% of the surface, a culture that grows well in drought conditions. The sale is ensured by concluding firm contracts with companies that purchase chickpeas, produced relatively by the niche and with a market not yet covered.
Specific for the company are:
- environmentally friendly agriculture, minimum tillage and reduced crossings, using complex equipment that can execute multiple works at the single crossing
- use of GPS technology for the accuracy of the works
- fertilization in turn for both cereals and straws to optimize the quantities used
The average yields obtained are 6 tons for wheat, 7 tons for barley, 3.5 tons for rapeseed, 8 tons for corn and 2.2 tons for chickpeas.

Having the experience of practicing in the past and of the intensive agriculture with the return of the furrow, the conclusion of the specialists from the farm is that the modern applied technology is sustainable and comes together with a series of major advantages:
- reduction of fuel costs, inputs and labor
- increases the service life of the equipment by reducing wear
- water conservation in the soil
- its preservation and even the improvement of the soil fertility

Although other farmers complain about the disadvantage of more complex and expensive weed management, experience on this farm has shown that there are no major disadvantages, and they can be compensated. The company is determined to promote and encourage minimum tillage technology in the future.
As sources of financing, the company uses commercial banks and approaches to projects partially financed from European funds.

A similar example shows Micul Agricultor SRL in Osmancea village, Constanta county (Fig.6 and 7).


Fig.6: Rapeseed harvesting


Fig.7: High-capacity agricultural machinery

The company exploits a large area of 3000 Ha on which it establishes crops of Barley, Wheat, Sunflower and Corn. The crop rotation is balanced annually, the distribution of the cultivated area is indicative as follows:
30% Barley, 30% Wheat, 20% Sunflower and the rest of the surface is cultivated with Corn.
The average productions obtained are 8 tons for Barley, 7 tons for Wheat, 4 tons for Sunflower and 12 tons for Corn.
The experience gained on the farm led to the conclusion that CSA brings performance by:
- Precision agriculture GPS, drones, management software
- minimum tillage
- wells for irrigation
- protective edging curtains
- adaptation of technology to optimal temperatures

The impact on the social and economic environment being very favorable, achieving constant productions, profit security, food for the population and jobs,

The financing sources are represented by the commercial banks and the European Funds by applying projects on the development measures in agriculture.

The rotation of the gown plants is a key issue. In many cases the cooperation of the agricultural farmers forming cooperatives is a crucial moment. A very good example in this shows Cooperativa Agricola Dobrogea Sud in South of Constanta County (Fig.8 and 9).

Fig.8: Cooperativa Agricola Dobrogea Sud


Fig.9: Seed analysis

The cooperative has accumulated from the member farms and farmers 20,000 Ha.
Cooperating members apply a modern technology in large culture ensuring the rotation and diversity of species according to the following indicative model: 45% Wheat, 15% Barley, 5% Rapeseed, 5% Corn, 20% Sunflower and 3% Peas.
They will apply CSA due to the impact of climate change, drought, heatwave.
The practices used in this direction are:
- delaying the sowing season by 2 weeks due to adaptation to climate change
- minimum works,
- precision agriculture using GPS technology for 30% of farmers
- software applications and crop / farm management for 10% of farmers, especially young ones.
- organic and ecological agriculture - 2 farmers

Organic technology is being tested on experimental batches of wheat for the feasibility of large-scale implementation, understanding that in the medium term they will have to do so due to the increasing ban on synthetic pesticides. Organic farming is starting to gain momentum, prices have become affordable for both inputs and products.

However, the perspective will be only medium-long term, especially.
It is desired to continue the activity in conditions of major climate change, drought, heat, heat wave, reduction of pollution and GHG generation and increase productivity in the application of smart agriculture.
The financing sources are represented by the commercial banks and the European Funds by applying projects on the development measures in agriculture.
As challenges can be mentioned:
- investments in CSA adapted equipment

- no tilage technology in dry areas does not convince due to diseases, pests, plant debris that accumulates in the soil.
CSA is already applied in 10% of farms and in the future will develop in the medium and long term due to climate pressure.

Another excellent example is PFA Stefanoiu Danut in Satu Nou, Tulcea county.
The area being with low precipitation, has lead the farmer to important ideas. His point of view is very interesting: "We try not to do agriculture according to the pattern, but to respect the requirements of the plants from every moment of the vegetation. We make decisions at the head of the field, as they say, because we have a small area and we can monitor it perfectly.
The costs are high for no tillage in terms of crop maintenance, at first it will be harder but over time there will be a balance of harmful predators that will regulate the situation." The country report has more on this particular case.
There are many other cases of farmers who want to apply CSA approach and practice, for example SC Visan Martrans SRL.They trust the CSA approach and practice because there are:
- low number of passes
- manure fertilization
- crop rotation

They share the belief that the CSA approach will bring safe and efficient production. In the future they see the further development of the farm to include:
- irrigation from wells, water in the foreground
- electricity supply infrastructure
- investments in high-performance equipment

It has to be noted that the EU member states do their best to change their practices to correspond to the changes in the European legislation in 2017. According to the EU regulations, the company is obliged to keep part of the areas with nitrogen-fixing crops in order to be able to obtain the maximum of the European subsidies.

Socially responsible business
There are cases of developing CSA practices with strong social orientation, such as of Chudnata gradina (“Wonder Garden”) in Dobrich, Bulgaria. This company is unique for it is considered to be the biggest and best developed social enterprise in Bulgaria. The farm was launched less than two years ago in an abandoned lot near Dobrich main street. The founder is the non-profit organization “Saint Nicholas the Wonderworker” which CEO Mrs. Maria Metodieva was actively seeking for employment opportunities suitable for intellectually challenged adults. The land was provided by the municipality and the noble endeavor soon draw many supporters. As for now, several public institutions, private companies and individual sponsors are providing assistance in various ways: the water for irrigation is paid by Dobrich municipality, a local investor donated an automobile for transportation of produces, etc. Families and friends are also involved in the daily work of the garden as volunteers. The produce output is growing considerable and the vegetable harvest is abundant each year. The farm has won the trust of the local community, and residents of Dobrich and the nearby towns and villages are loyal clients of the company. They are motivated not only by the noble cause which stays behind the enterprise, but also by the excellent qualities of the

produce. The farm in practice has ensure the market for its production by repeated customers and gross sales to several bigger institutions (such as Dobrich municipality) and restaurants. Despite this success, the revenues from sales are not sufficient to provide for the workers' compensation and the managers are constantly applying for participation in programs for state assisted employment. As social inclusion is one of the CSA pillars, this farm is an excellent example of CSA best practice by providing numerous benefits and employing innovative approaches in a sustainable way, including:

such as:

- Application of the principles of conservation agriculture (minimum mechanical soil disturbance/ no tillage; permanent soil organic cover with crop residues, etc.)
- careful selection of crop variety and seeds. Various sorts of vegetables and seed providers were tested in order to choose the best match for the particular soil and climate
- spare use of fertilizers and minimal use of pesticides. The weeding is done mostly manually since it is a part of the therapeutic activities and help developing physical stamina
- crop diversification by including more vegetable varieties, legumes, greeneries and flowers
- Ingenious irrigation scheme where water is transported in cisterns from distant natural springs. The water has undergone checks for health safety and environmental cleanness
- Soil amelioration techniques including usage of natural fertilizers, "lasagna layering" and composting of organic wastes.
- Protected growth in greenhouses to combat pests without chemicals and maintenance of the optimal temperature and humidity
- Direct sale to the end consumer and constant communication (via social media or regular PR activities)
- Social inclusion and providing employment opportunity for marginalized people

Another excellent example is of Agroproduct Stoikovi Ltd. Some of the CSA approaches applied by the producer include:

- Innovations in mechanical treatment of the soil. For example, plants are used instead of agricultural machines (radish for example which is planted in 0.30-0.40 m. depth can replace mechanical tillage)
- Conservative use of invasive chemicals and pesticides which destroy the humus content in the soil
- Strip-till or no-till techniques with special care for the soil-protection and least disturbance
- Composting techniques for bio-degradable wastes

Presently the company is cultivating 20% of its land capacity using the above-mentioned CSA techniques.

The experience of the Greek agricultural companies is also very positive. For example, Agricultural Cooperative of Vasilika – Legumes Producers 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

The experience of Greek Organic Herbs “Inoni” is very similar to that of Vasilika. They pay 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.

The experience in Turkey is very interesting and positive as well. As in the other studied countries, there is a need for smart machines as well as climate, soil, water and plant data capacity development for data management. In order for the technology to be effectively promoted, there is a need for (Zwane, 2019: https://www.intechopen.com/books/climate-change-and-agriculture/capacity-development-for-scaling-up-climate-smart-agriculture-innovations)

- Policy financial support and the willingness of farmers to adopt such technologies on conditions the benefits outweigh the costs of implementing it, and
- Advisors accommodated in institutions and to train the advisors in climate-smart principles to enable them to be ahead of their farmers with knowledge in climate change and climate smart in agriculture.

The following tools and trained advisors to the farmers are needed in order to implement precision farming (http://www.journalcra.com/sites/default/files/Download%20366.pdf).

- Global positioning system (GPS),
- Geographical information system (GIS),
- Grid sampling,
- Variable rate technology,
- Remote sensors for soil mapping, wasteland mapping, water stress, insect detection, nutrient stress,

- Auto-guidance systems,
- Proximate sensors,
- Computer hardware and software in order to analyse the data collected by other precision agriculture technology components and to make it available in usable formats such as maps, graphs, charts or reports, computer support.

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.

In Georgia, whose climate leads to delays of the crop by two and more weeks, compared to the competitors, some farmers are introducing practices that would help increase production during periods of relatively high market prices. In the farm of Leri Tsitsagi, a small farmer in Gori municipality, the following decision was made:

- Arrangement of 100 m^2 greenhouse;
- Production of tomato seedlings in cassettes in a greenhouse farm;
- Organize seedling cultivation in such a way that almost fully-grown plants can be moved to open ground as soon as the danger of a drop in temperature disappears.

After this, the example of the climate-smart model had the following form:

- Using 80% of the greenhouse area, 37,000 seedlings could be grown in a 100 m^2 greenhouse with a single-tier cassette layout;
- Seedling growth period was 25-30 days ahead of traditional growth period;
- Plants transplanted into the ground ripened 20-25 days earlier than plants planted in the traditional way.

This model gave the following economic effect:

- Growing period increased by 25%, which increased the yield by about 20%;
- the ripening period of 20% of the additional harvest coincided with the period when the selling price (due to the peculiarities of the year) was 140% higher than the seasonal price;

With a one-time small investment, this model brought farmers 32% more annual income.

The Biological Farming Association ELKANA supported the establishment of a niche market for local legumes and a direct offer of various legumes to target consumers.

As a result, more than 40 farmers are already growing and distributing local legumes today. An incentive is the difference in prices offered by the market. In the case of wholesale, farmers are paid at least 30% more. When delivered directly to the customer, their profit is increased by 100% compared to haricot production.

Considering that the yield of local legumes is about the same as that of haricot (1.5-2.5 t / ha) and at the same time they tolerate drought better, the financial effect is even higher.

It should be noted that the cultivation of legumes completely depends on manual labor, so they are common only in small farms and household plots, where manual labor is mainly used. However, on small farms, legumes diversify production, increase soil fertility and generate additional income for farmers.

The process of introducing drip irrigation systems in Georgia was going very slowly for a long time for the following reasons:

- Low cost for using water resources;
- Farmer mentality - Georgian farmers were convinced, and in some regions still believe, that natural precipitations is enough to get harvest;
- Small size of farms;
- Low cost of labor force.

Recently the situation has changed a lot, and the use of drip irrigation systems has become one of the most widely used technologies, which was facilitated by the following factors:

- Expansion of farms;
- Water shortage that in some cases makes impossible timely irrigation of plots;
- Cultivation of industrial, especially perennial crops;
- Distribution and introduction of mechanization and modern agricultural machinery in agricultural production;
- Raised costs of labor force;
- Increased competition on the agricultural market;
- Reducing the number of employed labor force;
- Increase of productivity;
- Reduction of needed water resources;
- Timely irrigation;
- Reducing the cost for application of production means (fertilizers).

In addition, the widespread use of drip irrigation systems is also facilitated by agricultural development programs and projects that are implemented or are being implemented by the state, international and non-governmental organizations. Under these programs and projects, in order to receive some assistance to expand their agricultural production, farmers must invest or co-invest in the purchase and installation of a drip irrigation system.

This process began with the cultivation of perennial orchards and today extends to the vegetable sector, regardless of traditional, organic or other production standards.

As a result, drip irrigation systems are widespread in almost all regions of Georgia and have become an integral part of modern agricultural production. This has been largely aided by improved technology, lower prices for irrigation systems, and increased yields for at least 40% using these systems, which in some cases have reduced the return on investment to one year.

Production of organic humus (vermicompost)

Attempts to produce vermicompost using vermiculture in Georgia began in the early 2000s, but significant results were achieved only in the last 2-3 years. The reasons of the process stagnation were the following:

- Shortage of local production and deficit of agricultural products on the market;
- Low purchasing power of the population and high demand for cheap products;
- Shortage of information among farmers and the population about the negative impact of chemicals on human health;
- Broad promotion of agricultural production expansion by conventional methods.

Today, more and more consumers are paying attention to the origin of food and its production methods and more farmers consider this. In addition, greenhouse farms are widely developed, where farmers see the negative results of using untreated manure. These factors have increased the demand for vermicompost. It is worth noting that the majority of Georgian farmers own diversified farms, where, in addition to plant growing, they are engaged in animal husbandry, and the issue of efficient use of their own farm resources is becoming more and more urgent in the face of rising prices and market competition.

These factors coincided with the project implemented by IFAD, ARDA and ELKANA. In the frame of this project, demonstration units for the production of vermicompost were established in different regions of Georgia. One of them was organized in the village of Karaleti, Gori municipality, on the site of the farmer Zaza Kharibegashvili.

A vermicompost production area of 60 m^2 was organized, for which a special building of sandwich panels was built. In the frame of the project, 20 kg of local worms were purchased for processing of manure.

Demonstration of the farmer's work results and the financial results aroused great interest among the farmers who visited the model farm during the demonstration and study tours.

4. STATE OF ART OF ORGANIC FARMING AND SUSTAINABLE AGRICULTURAL PRACTICES

There are many examples of state-of-the-art organic farming in the countries covered by this project, which are presented in the country reports. A few examples will be presented here as a summary of the good practices.

Dobrudzha Agricultural Institute is a national research centre for selection and breeding of field crops. The Breeding centre is engaged in solving various CSA related challenges via:

- Creation, testing and implementation of new varieties of crops
- Crops alternation
- Precise tillage techniques
- Pest, weeds and disease control
- Fertilization
- Improving the breed composition in animal husbandry
- Scientific research in animal husbandry (poultry, pig, cattle and sheep).

The Center has several research laboratories including biotechnology, phytopathology, entomology and cytogenetics. Their main activities include:

- creation of new advanced cereals and legumes, varieties and hybrids of sunflower and development of modern technologies for their cultivation;
- development of new biotechnological methods in the selection of field crops;
- collection and research of genetic plant resources;
- production of basic seeds with guaranteed origin and quality
- selection of elite breeds animals

Good agricultural practices based on control-certification within the framework of the country's legislation started in Turkey with the Regulation on GAP published in 2004. After the authorization of the control and certification bodies, GAP, which started with 651 producers in 5.360 ha and in 18 provinces in 2007, showed a significant improvement in 10-year period between 2007 and 2016 and reached 5.027.892 tons of production in 64 provinces with 55.609 producers (Table 1).

Table 1: Organic farming and good agricultural practices in Turkey (2016)

Year	Organic Farming			Good Agriculture Practices		
	Number of producers	Production area (ha)	Production (ton)	Number of producers	Production area (ha)	Production (ton)
2002	12.428	89.827				
2003	14.798	113.621				
2004	12.751	209.573				
2005	14.401	203.811	422.934			
2006	14.256	192.789	458.095			
2007	16.276	174.283	568.128	651	5.360	149.693
2008	14.926	166.883	530.225	822	6.023	168.190
2009	35.565	501.641	983.715	6.020	170.280	2.709.132
2010	42.097	510.033	1.343.737	4.540	78.174	1.902.072
2011	42.460	614.618	1.659.543	3.042	49.963	1.717.222

2012	54.635	702.909	1.750.127	3.676	83.717	1.538.556
2013	60.797	769.014	1.620.387	8.170	9.809	1.599.636
2014	71.472	842.216	1.642.235	21.332	214.770	4.151.661
2015	69.967	515.268	1.829.291	39.740	346.569	3.271.239
2016	67.878	523.778	2.473.600	55.609	474.107	5.027.892

CSA is a new concept in Turkey and the target region of AGREEN, and the following six practices are not directly performed for CSA but serve it:

- Use of smart irrigation technology to save water and mitigate the adverse effect of climate change,
- Residue management
    - minimum tillage and direct seeding and
    - ban of burning residue
- Shifting or adjusting planting dates
- Agricultural insurances
    - Crop production insurance:
    - Village based drought yield insurance:
- Environmentally Purposed Agricultural Land Protection (CATAK) Project
- National Drought Management Strategy Document and Action Plan

Very important practices include:

- **Minimum tillage and direct seeding:** In this context, direct seeding is practiced in summer corn as second crop for silage after harvesting wheat, barley, vetch or pea in about 3.000 ha area in Trakya region for the last 10 years to keep soil water, increase organic matter, decrease cost of seeding and use time effectively. Ekmen Agriculture Inc. has the machine of direct sowing and the farmers purchase the direct sowing services from it. In the region there are 10 direct sowing machine with disc which is imported from Brazil. The local company (Irtem Farm Machinery Inc.) has also started to manufacture pneumatic direct sowing machine. While the direct sowing of maize is increasing day by day, it has not been successful in sunflower due to its rooting system (Personnel communication with Irfan Ekmen, owner of Emen Farming Inc.).
- **Ban of burning residue:** Following the harvest, the remaining stubble after the straw of the product is collected is burned by the farmers on the grounds that it causes difficulties in preparing the seed bed for planting and its disposal is costly.
- Stubble burning is prohibited legally due to environmental and fire safety reasons, but it also serves the CSA as it increases organic matter in the soil, prevents erosion, increases water infiltration into the soil, increases the water holding capacity of soils and prevents damage to soil organisms.
- **Shifting or adjusting planting dates:** Although drought and climatic changes, especially felt in recent years, have not yet caused a significant change in Thrace agricultural production, shifts in seasonal climate have caused some changes in the management of diseases and pests. For instance, in order to prevent yellow dwarf disease, which is seen in wheat due to the changing climatic conditions in Thrace and has caused quality and yield losses up to 33% in recent years, the planting time has been shifted from October towards November.

- **Environmentally Purposed Agricultural Land Protection (CATAK) Project**
  CATAK Program aims to protect the quality of soil and water, which are the main resources of agricultural production, to reduce the negative effects on the environment due to agricultural production, to ensure the sustainability and balance of natural resources, to direct renewable energy resources in this sector and to develop these resources. Environmental protection is ensured by conserving natural vegetation cover and biodiversity and controlling soil erosion in the target area. CATAK Support is calculated on a unit area with the agreements made between the relevant Ministry and the farmers (Bal, 2019). The detail of CATAK is given under paragraph 4.3. Existing policies and instruments for funding.
- CATAK is developed for environmentally purposes but it contributes to the first and third objective of CSA, i.e. sustainably increase agricultural productivity and the incomes of agricultural producers, and where possible, reduce and/or remove greenhouse gas emissions.

In Romania Cooperativa Agricola Dobrogea Sud is applying CSA due to the impact of climate change, drought, heatwave.
The practices used in this direction are:
- delaying the sowing season by 2 weeks due to adaptation to climate change
- minimum works,
- precision agriculture using GPS technology for 30% of farmers
- software applications and crop / farm management for 10% of farmers, especially young ones.
- organic and ecological agriculture - 2 farmers

Organic technology is being tested on experimental batches of wheat for the feasibility of large-scale implementation, understanding that in the medium term they will have to do so due to the increasing ban on synthetic pesticides.
Organic farming is starting to gain momentum, prices have become affordable for both inputs and products.

5. MARKETS

Market saturation and global competition

It is predicted that climate change will significantly affect agricultural production. For instance, studies in cereal products, which are very important for world food supply security, predict that each °C increase in global average temperature will reduce global average land yields by 6% in wheat, 7.4% in corn, 3.2% in rice and 3.1% in soybeans. Model results foresee a 25-50% yield loss around 2050 for a 3 °C temperature increase. Moreover, it is predicted that the annual yield variability in grains will also increase (Karapınar, et al., 2020).

Economic models based on the results of climate models estimate that the price increases caused by climate change will reach 84% on product basis (Nelson et al., 2011; IPCC, 2014). Increases in food prices create significant impoverishing effects in both rural and urban areas, even in the absence of climate stress, and cause food insecurity at the local level.

The contribution of the agrarian sector in Bulgaria to the country's foreign trade is significant: 17,1% of the total export, 10,9% of the total import and 13,8% of the trade flow of the national economy. The balance between the exported and imported goods and commodities is positive. The Table below outlines the main features of the import and export in 2016 as per NSI data

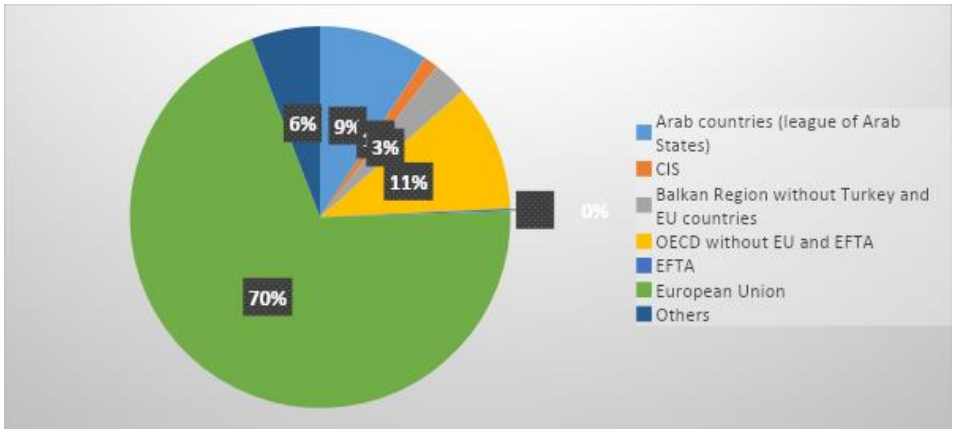
***Table 4**: Agricultural goods relative share in Bulgarian foreign trade in 2016, in thousand EUR*

	Total for Bulgaria	Agricultural Sector	Share of the agricultural sector
Export	23 575 817	4 036 993	17,1%
Import	26 090 153	2 839 205	10,9 %
Trade flow	49 665 970	6 876 198	13,8 %

Source: MAFF, 2017

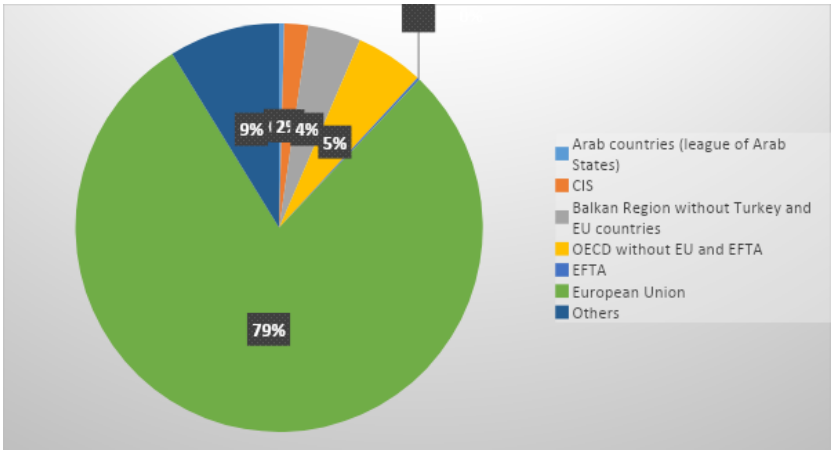
Countries in the European Union are Bulgaria's main partner in agricultural commodities trade (70% of the total export and 88% of the total import), due to advantages caused by the single European market policy. Other international markets of paramount importance are OECD (excluding EU) which accounts for 11% of the agrarian export and 5,4% of the import in 2016. For the same period Balkan region (excluding EU countries and Turkey) accounted for 3 % of the export and 4% of the import. The Arab countries are important export region contributing to 9,3% of the export and only 0,4% of the import of agricultural goods and services (NSI and MAFF, 2016)

***Fig 15**. Bulgaria's agricultural export structure by economic communities for 2016*



Source: MAFF, 2016

Fig 16. *Bulgaria's Agricultural import structure by economic communities for 2016*



Source: MAFF, 2016

The following countries are among the top EU markets for Bulgarian agricultural production: Greece, Romania, Germany, Spain, Italy, the Netherlands and France, while the import is done mostly from Turkey, Greece, Romania and Poland.

The most important agricultural products exported outside our country are cereal (wheat, maize and barley) , oil-bearing plants and seeds, tobacco and fruits.

Climate change is thought to affect products that Turkey is competitive in global markets. Regional concentration of these export products increases supply risks. In this context, regional production and export revenue risks are analyzed by exemplifying major export products, namely hazelnuts, raisins, and apricots by Karapınar, et al. (2020).

In the process of climate change for example, the regions in Turkey will not be affected at the same rate. Considering the increases in average temperature and decreases in precipitation, the target region of AGREEN, the Thrace region, has been and will be among the least affected regions (Konukcu et al., 2019).

Using the climate change data of Thrace region, models estimated that the yield of wheat will not change in the short and medium term while it will increase up to 60% in long term compared to the present yield data. In sunflower, while the yield does not change in the short term, yield loss of up to 15-20% is predicted in the medium and long term (Konukcu et al., 2019).

Although the rates change, there will be significant crop losses in the yield of summer crop due to the decrease of the share to be allocated for irrigation with the increase of competition for water in the summer period due to the decrease in water resources, decrease in the summer precipitation both in Turkey and in Thrace. It is clear that this situation will cause serious problems in our country, which has a deficit for oilseed and legume plants.

As a result, with the climate change process, the cultivation areas of summer plants will shrink in dry farming areas or significant yield losses will be experienced; It can be predicted that the production of winter oilseeds, legumes or other plants will increase. In this case, it may be possible to decrease the sunflower cultivation areas and increase the canola cultivation areas in Thrace.

The development of the demand in Romania (Source: https://financialintelligence.ro/analiza-vanzarile-de-produse-alimentare-ecologio-au-atins-65-milioane-usd/) will depend to a high extent on the customers' understanding that the products should be healthy, their production should not involve pollution, and the activity should be in harmony with nature, which is currently fulfilled in organic farming, a concept that in Romania was assimilated equivalent to organic or organic in Europe.

Nowadays in Romania, organic, ecological or organic products are mostly imported, over 75%.

According to media sources in Romania, the consumption of organic food is much lower than in developed Western countries. According to industry sources, sales of healthy food have reached 65 million euros, with demand growing by 30% in 2 years. However, the percentage of sales of these products compared to the total volume does not exceed 2%.

Given the fact that the introduction of VAT reduced to 5% for these types of products to stimulate sales is expected to increase by 15-20% / year.

The market of healthy and nutritious products in Romania is far below that of the leading EU member states.

Germany has the most developed market for this type of products with sales of 9.5 billion Euro / year representing almost 10% of the total EU market.

Other examples are Denmark with 9.4% of total food sales, Luxembourg with 8.6% and Switzerland with 8.4%.

Price and availability are important for those interested in organic products. 55% of survey respondents said their interest in organic fruits and vegetables will not be affected by price, while 35% said they are willing to pay for organic products more especially for the percentage of organic vegetables and fruits. . Another study of a global retail network present in Romania shows that 8% of those interviewed are interested in buying "organic" products.

Ecological certification, i.e. the one that gives the comparator the security that a product is in accordance with its requirements, is important for consumers, 52% being concerned about this aspect.

Regarding the availability of products 61% of respondents prefer to buy in modern trade (supermarkets and hypermarkets) while 59% believe that such products are in the markets.

Modern retail is the main channel through which sales of organic products develop; the national networks of these players in the retail market are the engine of sales growth to consumers and give them the availability of organic products. It should be noted that all foreign players present in modern retail promote organic products.

On average, the basket of a consumer who also buys organic products is substantially higher than the basket of a non-organic consumer and for this reason retailers will support the promotion of such products.

The total area used for organic production has increased from about 182,706 hectares to 258,471 hectares.

The production and consumption of organic food in Romania has followed a positive trend in the last decade, but the growth in this field is still very small compared to the European average.

Thus, between 2010 and 2017, the total area used for organic production increased from about 182,706 hectares to 258,471 hectares, according to a study published in 2019; this growth has been helped by the consumption trends of Western European markets, which have become a customer for some of the local producers.

At the same time, the number of environmentally authorized operators has increased from over 3100 to over 8400, with improved access to technical information. However, organically cultivated areas represent only about 2-3% of the total cultivated area in Romania and is one of the lowest among EU Member States, well below the EU average of about 7%.

4.4.3 Competition

The areas cultivated with organic cereals and organic industrial crops are the most important, of 84,926 hectares, respectively 72,388 hectares in 2017. In the same year, the organically harvested plants registered an impressive growth of over 40%, up to 20,350 hectares. The areas cultivated with permanent crops of vineyards, fruit trees and walnuts also exceeded 10,000 hectares.

The growth of the organic market in Romania in recent years is the result of various factors, starting with increasing the purchasing power of the population and continuing with better consumer information, growth and diversification of retail channels that offer organic food.

Increasing consumer demand and a limited variety of products on the domestic market lead to imports, especially for value-added products. According to industry sources, 80% of organic products sold in Romania are imported. The main suppliers of organic food are Germany, Great Britain, Italy, Austria, France and Spain, according to the same industry sources. The remaining 20% organic products locally consumed in Romania are milk, eggs, honey, rice and corn.

The value of sales of packaged organic food by category between 2012 and 2018 is presented in the table below, which is based on Euromonitor data (developed by the USDA study). Dairy products represent the largest category in terms of value, USD 7.4 million in 2017, which is twice as high as in 2012. Organic baby foods have grown at an even faster rate (+ 137%) , representing sales of USD 5.7 million in 2017.

According to the USDA study, the sale of packaged foods will increase by 45% in the next 5 years. Organic beverages accounted for sales of $ 3.2 million in 2017, of which organic coffee and tea accounted for $ 0.7 million, with the rest being organic soft drinks (fresh and concentrated). Organic beverage sales are expected to double in the next five years, according to the USDA study.

Modern retail is the dominant distribution channel for organic products

Both the studies we had access to and the profile sources indicated that the organic products market in Romania, although still at an early stage compared to those in Western countries, is connected to European trends in the sense that it will have significant potential. growth in the coming years.

The subject area and challenges are in line with the scope of CSA and general objective of AGREEN project.

In 2018, Republic of Turkey Ministry of Development prepared "Competitive Agriculture and Food Production Expertise Commission Report" for the 11th (2019-2023) Development Plan (Anonymous, 2018: https://www.sbb.gov.tr/wp-content/uploads/2020/04/Tarim_ve_GidadaRekabetciUretimOzelIhtisasKomisyonuRaporu.pdf). (FAO 2017). This section has made extensive use of this report.

The world population, with an average increase of approximately 1.2% in the last ten-year period, reached to 7.8 billion whereas Turkey's population became about 83.7 million. The world population will reach 9.1 billion by 2050 with an increase of 34% and the problem of feeding the world population will be one of the priority policy areas of all countries and international organizations. The increase in income of the increasing urban population will change the

traditional food demand based on basic food and this will create significant changes in the global agriculture and food production capacity and habits (FAO, 2017).

The agriculture sector in Turkey, with the exception of 2016, generally grown in recent years and has contributed significantly to the national economy. In 2020, the share of agriculture in GDP was 6.5% and its share in employment was 19.8% (TUIK, 2020).

Turkey also experienced significant changes in the foreign trade of agricultural and food products. Turkey's share in the global food and agricultural exports increased from 0.8% to 1.2%. As of 2016, exports of agricultural products were 16.9 billion dollars and imports were 15.6 billion dollars. Due to the developments in the domestic market prices of agricultural and food products in 2017, periodic changes were made in customs taxes. As a result of these developments, as of 2017, exports of agricultural products were 17.6 billion dollars and imports were 18.3 billion dollars, and the ratio of exports to imports declined to 96 percent. However, a foreign trade surplus of 4.3 billion dollars in foodstuffs still continues (TUIK, 2018; Anonymous, 2018).

In the Eleventh Development Plan period (2019-2023), the crop production sector aims at important developments in production and export with the vision of a highly competitive and well organized crop production sector that provides environmentally, socially and economically sustainable, sufficient and reliable food. Within the framework of the 2023 vision, a target of 150 billion dollars agricultural income and 40 billion dollars export of agricultural products has been set for the agricultural sector. In order to achieve these goals, substantial transformation is expected in the plant production sector in the management, structural condition, supply and demand areas of the system.

As for the domestic and international markets for CSA, because CSA is a new concept, data on the global CSA market size is very limited while there is no data on domestic CSA market size.

A report by Grand View Research (https://www.grandviewresearch.com/industry-analysis/smart-agriculture-farming-market) entitled with “Smart Agriculture Market Size, Share & Trends Analysis Report 2018 – 2025” discusses the smart agriculture market size in general.

Smart farming was defined as an integrated approach to manage farming activities, such as preserving resources and optimizing yields, with the implementation of IoT and information communication technologies. Smart farming entails real-time data on the conditions of soil, air, and crops. It aims at ensuring profitability and sustainability of the farm yield while protecting the environment.

Based on agriculture types, the smart farming market has been segmented into precision farming, smart greenhouse, livestock monitoring, and others. The others segment includes fish farming and horticulture.

The market estimates and forecasts of the smart greenhouse segment include vertical farming. Smart greenhouse enables farmers to cultivate crops with minimal human intervention. Climatic conditions such as soil moisture, temperature, and humidity are continuously monitored and any variation observed in them triggers an automated action.
The global smart agriculture market size was valued at USD 5.79 billion in 2016. Increasing automation of commercial greenhouses and growing implementation of the Controlled Environment Agriculture (CEA) concept in greenhouses, in a bid to obtain higher yield and

maintain optimum growing conditions, are the key factors driving demand over the projected period.

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.

Consumer awareness about the principles and benefits of organic and CSA farming remains low in Armenia. The growth of the CSA market is further challenged by low purchasing power, unstable supply, lack of branding, fluctuating quality, as well as a small range and volume of products available. For both domestic and export marketing, the links in the CSA value chains are underdeveloped. In addition, fluctuating export markets discourage long-term investments in CSA production, branding, marketing and trade infrastructure. There is also an insufficient capacity of producers and processors to ensure product quality and quantities for the international marketplace. Most producers also lack access to information about international markets and industry terms of trade.
Currently, organic products are subject to the same tariffs and quotas in major export markets as non-organic products. Therefore, organic producers have to comply with all the broader agri-food product export requirements, as well as standards and certification procedures that are specific to organic produce. For example, for exports to the EU, the certification body has to be accredited according to EU organic regulation, or the exporting country must be listed on the Third Country List, which recognizes some countries that have equivalent organic production rules and systems as the EU. All in all, this means that the regulatory barriers for organic products are higher than those for non-organic products. Armenia's organic certification body, Ecoglobe, has obtained EU approval as an organic certification body, which greatly facilitates the accreditation process for Armenian organic producers. Another barrier for Armenian, as well as any other middle to low-income producers is that the EU-USA equivalency agreement for organic trade does not facilitate trade for producers outside the EU and the USA, even though they are technically also partnering under the agreement. This causes superfluous duplications of USA and EU equivalent certifications and creates the need for multiple accreditations of local certification bodies. The result is *de facto* discrimination of third country producers, compared to those based in the EU and USA. Additionally, some of the standards demanded by export destinations are difficult for producers in Armenia to fulfil. For example, the US standards are very detailed regarding composting procedures and it is difficult for producers in Armenia to ensure that all these requirements are met. Likewise, the EU and US requirements for organic seeds are hard to fulfil for virtually any country with a small organic sector, primarily because seed companies are not interested in supplying organic seeds to small markets and may offer high prices to small markets. There are no public organic standards in place in Russia or in the EEU, and thus there are currently no special barriers for exports of organic products to those countries.

In addition to regulatory demands, organic products also face special requirements from importers. For example, a buyer in the target market (such as the EU) might demand certification from a specific certification body because of its reputation or his or her personal familiarity with the label. In addition, various markets have strong preferences for certain organic labels (e.g., the BioSuisse label in Switzerland, Soil Association in the UK and KRAV in Sweden) and may also be required to comply with fair trade, climate neutral or other additional product certification. While compliance with several standards can provide new market opportunities, the complexities associated with their attainment constitute major market access barriers, particularly for small-scale producers. There are no such preferences for imports to Russia, as there are no national organic certification bodies operating in the country. Armenian products are well known in the Russian market and where they can easily compete with similar products from other sources.

Medium and small greenhouse producers of vegetables, as a rule, market their products via two distribution channels: direct selling and selling through intermediaries (brokers). Statistical data on production and export of vegetables, flowers and berries are not segregated by greenhouse and open-field productions. This means that no data are available on greenhouse crop production and export volumes. The geography of export is focused: greenhouse crops are mainly exported to Russia and, in small numbers, to Belarus and Georgia. Tomato and cucumber are mostly exported to Russia, flowers to Russia, Georgia, and Belarus, and berries (strawberry) — mostly to Russia.

At the same time, there are important developments taking place in the Russian market. Particularly, competition in the Russian market drastically intensifies, despite international economic sanctions against Russia and limitations applied by Russia lately on imports from Turkey. After lifting international economic sanctions against Iran last year, Iran's role in exporting vegetables and fruits to the Russian market will probably grow. As shown in tables below, prices offered by Iranian vegetable producers are rather competitive. At the same time, competition from other countries grows as well. Israel too, which has over 8,000 hectares under greenhouse crops, may play a serious role in supplying certain crops, such as strawberries, to the Russian market. In addition, there is such factors as notable expansion of greenhouse areas and developments in the Russian greenhouse sector, and Russian greenhouse producers also are serious competitors. To export vegetables from Armenia, it is necessary to obtain a phytosanitary certificate, which is issued by the Phytosanitary Inspectorate of the State Service for Food Safety of the RA Ministry of Agriculture. Businesses have not reported problems associated with obtaining phytosanitary certificates.

REFERENCES:

Akınerdem, F. (2014). Dünya ve Türkiye'de Su Arzı ve Kuraklık. Agrotime Uluslararası Bitkisel ve Hayvansal Üretim Dergisi. Yıl: 2, Sayı:11, Sayfa: 30-32.

Amare, T. (2016). Review on Impact of Climate Change on Weed and Their Management. American Journal of Biological and Environmental Statistics. Vol. 2, No. 3, pp. 21-27. doi: 10.11648/j.ajbes.20160203.12

Ayan, A. K., Boz, İ., Kaynakçı, C., & Aytaç, S. (2017). Consumers' perceptions of organic food items: A case study of Sisli and Kartal organic bazaars of Istanbul. International Journal of Agriculture and Environmental Research, 3(5), 3635-3643. ISSN: 2455-6939.

Boncheva L, Simeonov P. (2016), Tornado cases in Bulgaria in the 21st century – creation of database and analysis, 3rd National congress of physical science, Sept-Oct. 2016, Sofia

Boz, İ., and Rasulov, A. (2018). The effects of local bazaars on marketing of organic products: The cases of Turkey and Uzbekistan. Development of Organic Agriculture in Central Asia, Tashkent & Samarkand, Uzbekistan.

FAO (2017) The future of food and agriculture: Trends and challenges, http://www.fao.org/3/ai6881e.pdf.

FAO (2018). Statistics of Food and Agricultural Commodities Production on 2016, Food and Agrıculture Organızatıon of The Unıted Natıons, FAOSTAT.

Intergovernmental Panel on Climate Change. (2014). Climate change 2014: impacts, adaptation and vulnerability. Contribution of working group II to the fifth assessment report of the Intergovernmental Panel on Climate Change. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press.

Kadioglu, M., Unal, Y, Ilhan, A. and Yuruk, C. (2017). Türkiye'de İklim Değişikliği ve Tarımda Sürdürülebilirlik. Türkiye Gıda ve İçecek Sanayii Dernekler Federasyonu Yayını. https://www.tgdf.org.tr/wp-content/uploads/2017/10/iklim-degisikligi-rapor-elma.compressed.pdf

Karapınar, B., Özertan, G., Tetsıji, T., An, N. Tufan, M., Turp, M.T. (2020). İklim Değişikliği Etkisi Altinda Tarimsal Ürün Arzinin Sürdürülebilirliği. TÜSİAD-T/2020-03/616. file:///C:/Users/Admin/Downloads/iklim-degisikligi-etkisi-altinda-tarimsal-arzin-surdurulebilirligi%20(3).pdf.

Konukcu, F., Albut, S. Ve Altürk A. (2019). TR21 Trakya Bölgesinde İklim Değişikliğinin Etkileri ve Uyum Stratejileri. Namık Kemal Üniversitesi Yayınları No: 2.08-027-0030/A-I, 46-60.

Nelson, G., Palazzo, A., Ringler, C., Sulser, T., Batka, M.,(2009). The Role of International Trade in Climate Change Adaptation, ICTSD-IPC Platform on Climate Change, Agriculture and Trade.

Nojarov P. (2020), Climate and its change in the period 1979-2018 in selected model karst regions in Bulgaria, Project: Current impact of global changes on evolution of karst (based on the integrated monitoring of model karst geosystems in Bulgaria), Bulgarian Academy of Sciences

Nojarov P. (2016), Temporal and spatial trends in greenhouse gases and aerosols in the atmosphere over Bulgaria

Nojarov P. (2015), Circulation factors affecting precipitation over Bulgaria, Theoretical and Applied Climatology

Sundaram, P.K., Sarkar, B., Pawanjeet;R., Parray, A., Jyoti, B. (2019). Role of Farm Mechanization in Mitigating Climate Change Effects In: Sundaram, P.K., Parray, A., Jyoti, B.(Ed): Conservation Agriculture: Mitigating Climate Change Effects & Doubling Farmers' Income. 1-8.

Teixeira, E.I., Ruiter, J. Ausseil, A.G., Daigneault, A., Johnstone, P., Holmes, A., Tait,A., Ewert, F., (2018). Adapting crop rotations to climate change in regional impact modelling assessments. Science of the Total Environment. 616–617 (2018) 785–795.

UNDP (2020), Climate change adaptation in Agriculture.

Zwane, E.M. (2019). Capacity Development for Scaling Up Climate-Smart Agriculture Innovations. https://www.intechopen.com/books/climate-change-and-agriculture/capacity-development-for-scaling-up-climate-smart-agriculture-innovations

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