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Jointly preparing the conditions in the agricultural and connected sectors in the BSB area for the digital transformation (BSB Smart Farming)



Project Ref: 908 | No. MLPDA 94989/10.07.2020

REGIONAL ANALYSIS (TEMPLATE)

Deliverable D.T1.3.1

**WPT1 – Investigation on the level of preparedness
for Smart farming in BSB area**

**Activity A.T.1.3. Common research on the level of
preparedness for Smart farming of BSB area countries**

Version 01, 09/02/2021



SUMMARY

The Deliverable *D.T1.3.1. Regional analysis* constitutes a document that aims to provide conclusions and recommendations for the relevant BSB Smart Farming project partners countries agriculture and connected sectors.

It was produced during the implementation of *WPT1.1. Investigation on the level of preparedness for Smart farming in BSB area, Activity A.T1.1. Common research on the level of preparedness for Smart farming of BSB area countries.*

It is the outcome of work of PP6 partner in collaboration with BSB Smart Farming partners.

Joint Operational Programme Black Sea Basin 2014-2020

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March 2021

Joint Operational Programme Black Sea Basin 2014-2020 is co-financed by the European Union through the European Neighbourhood Instrument and by the participating countries: Armenia, Bulgaria, Georgia, Greece, Republic of Moldova, Romania, Turkey and Ukraine.

This publication has been produced with the financial assistance of the European Union.

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Objectives of the investigation

The aim of this document is to present the results of the investigation in the Black Sea Basin (BSB) farming communities, that is in an urge need of becoming more competitive, sustainable and productive, by improving their businesses, production processes, products and services through a smart farming ecosystem, supported by the digitisation of services. The main objective of the research is to identify of the preparedness for smart farming in BSB Smart Farming project partners' country. This regional analysis will become part of the final synthesis report that aims to present specific recommendations on smart farming and IoT solutions to agricultural problems and identified constraints/basic needs of the main actors in the partner's countries.

There were more research activities conducted: primary research and secondary research. In the following sections it will be explained the main approaches that stands to the elaboration of this report, prepared with the collaboration of the BSB Smart Farming project partners, during the implementation of work package **T.1. Investigation on the level of preparedness for Smart farming in BSB area**, activity **A.T.1.3. Common research on the level of preparedness for Smart farming of BSB area countries**.

The present report started with the preparation of a common research methodology, applicable to every partner countries participating in the project. The methodology is presented in Deliverable D.T1.1.1. Moreover, this research comes with results collected from a stakeholder's database of 600, 100 per country, and in-depth primary research and secondary research analysis. A desk research has been conducted using materials published in research reports and/or similar documents, available from public libraries, websites, data obtained from already filled in surveys etc. The resources used were the data available from the internet, governmental and non-governmental agencies collected and processed data, public libraries data, research and/or educational institutions data reports, commercial information sources like newspapers, journals, magazines, radio and TV interviews.



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The focus was pointed on the overall situation, policies, quadruple helix stakeholders, projects implemented on both the agricultural needs/challenges of the rural communities and smart and IoT technologies that can be adopted to meet the needs/challenges.

Another research method was the elaboration of an online survey on the stakeholders needs, concerns, level of preparedness, regional digital entrepreneurship ecosystem and related opportunities. The online survey was conducted through a specific questionnaire elaborated during the implementation of the project. It included specific questions related to the stakeholders needs, concerns, level of preparedness, regional digital entrepreneurship ecosystem and related opportunities. There were created focus groups that offered support to the respondents in order to fill the proposed and agreed questionnaire, aiming the identifications of the smart and the IoT technologies that can address stakeholders needs.

In addition, a training needs assessment and draft estimation was conducted, in order to identify the current level of competency, skill or knowledge in the project specific field. In case of BSB Smart Farming project the training needs assessment can be conducted the following phases as: the identification of the business needs, performing a gap analysis, assess training options, and finding training needs and training plans.

During the investigation on the level of preparedness for smart farming, in Black Sea Basing (BSB) partner countries, from the project consortium, all the stakeholders from the quadruple helixes were envisaged to be involved in the investigation. In order to obtain a detailed analysis of the regional BSB partners country areas level, the following quadruple helix figures were envisaged: farms, farmers, regional public and national public authorities, sectoral agency, infrastructure and (public) service providers, interest groups including NGOs, higher education and research institutes, education/training centres and schools, business support organisations, international organisation under national law and enterprises.

The main research questions raised in the investigation were:

- ❖ What are the agricultural needs of the rural and peri-urban communities that, when addressed through the application of smart technologies and IoTs, can

lead to the poverty alleviation, improve the effectiveness and efficiency of use of the rural area resources;

- ❖ How is possible to address the agricultural local needs and identified constrains through IoT and smart technologies solutions to strengthen the development of smart farming in rural and peri-urban areas within BSB partner countries to decrease the poverty level and increase the efficiency of agriculture production and natural resources use? What smart and IoT technologies are implemented already in the country, which of the existing might be transferred from one country to another and what smart technologies and IoTs can in the future be designed and developed by the involved stakeholders and entrepreneurs in the BSB area to meet these needs effectively and efficiently, mobilising the local/regional resources to further fostering the competitiveness of the economies in the BSB area in answer to other main socio-economic challenges in the area, such as the brain drain, youth unemployment and brain waste.
- ❖ What are the successful use cases of smart farming in BSB partner countries and how we can adopt and widen it?
- ❖ How to strengthen the interactions between the relevant helixes, particularly how to boost research, innovation and business cooperation development?

In the investigation recommendations and conclusions on the level of preparedness for smart farming in BSB partner countries were drawn and will be presented in this deliverable. The recommendations are based on findings from the investigation achieved in Republic of Moldova.

Chapter 1. Republic of Moldova's background / situation

Description of country's background

The Republic of Moldova is a tiny landlocked nation with a total area of 32,870 square kilometers, located between 460 and 480 N latitude and 270 to 300 E longitude. In Eastern Europe, bordered to the west by Romania and to the north, east, and south by Ukraine. Due to the breakup of the Soviet Union, it proclaimed independence in 1991. Moldova's current Constitution was adopted in 1994. The nation is divided into 32 districts (raioane), 5 municipalities (muniten, which are special-status cities), and two autonomous regions - Găgăuzia and Transnistria - the latter of which is embroiled in political strife and claims unrecognized independence. Since 1990, the breakaway government of Transnistria has had de facto control of a strip of Moldovan territory on the east bank of the Dniester River. Chisinau, the country's capital, has a population of about 786,000 people.

Moldova's topography is primarily an undulating hilly plain sloping northwest to southeast with an average elevation of about 147 meters above sea level. Hill Balanesti (429.5 m) in Nisporeni district is the highest point in the district, which has a very fractured landscape with hilly terrain and deep valleys. Sedimentary minerals, such as limestone, chalk, gypsum, sand, sandstone, bentonite, tripoli, and diatomite, are commonly found in parent rocks and can be used in construction, cement and glass manufacturing, food processing, chemical and metallurgical industries, and so on.

Black dirt, also known as chernozem, covers about 75% of Moldova. More clay-textured soils can be found in the northern hills. Red-earth soil dominates in the south. Although the soil becomes less fertile as you travel south, you can still grow grapes and sunflowers. The soils in the hills are forested. The Prut and Dniester rivers' lower reaches, as well as the southern river valleys, are saline marshes.

Approximately 60% of the country's waters flow into the Nistru river (1,352 km, including 657 km within the country's borders), approximately 34% into the Prut river (a tributary of the Danube that flows for 695 km along the Romanian border), and the remainder into a series of small rivers that directly flow into the Black Sea. There are approximately 60 natural lakes and 3,000 reservoirs in Moldova. Costesti-Stinca (678 million m³) on the Prut River, run jointly by Romania and Moldova, and Dubasari (235

million m³) on the Nistru River are the two largest reservoirs. In the north and central parts of the country, reservoirs are used to regulate water levels over the course of the year, while in the south, they are mostly used for inter-annual storage.

Deep enclosed aquifers hold the majority of groundwater supplies. Boreholes for groundwater withdrawal number about 7,000. The restricted aquifers' natural recharge ability is minimal, and there is a risk of overexploitation. The country's total available water supplies are 5.6 km³, with 4.3 km³ of surface water and 1.3 km³ of groundwater (including 0.7 km³ that comply with the national standards for drinking water).

Around 15% of the land is covered by natural vegetation, mostly trees, steppes, lakes, and rivers. Forests and other wooded land (OWL) occupy 13.7 percent of Moldova's land area (approximately 462,700 ha), in extremely scattered stands ranging from 5 to 1,500 ha. The steppes cover 1.92 percent of the land (roughly 65,000 ha) in 0.5-300 ha fragments. The flora of the steppe is diverse, with over 600 plant species, the majority of which belong to the Asteraceae, Fabaceae, Poaceae, and Lamiaceae families. Just 3% of the land is covered by natural meadows, which are found along the Prut and Nistru river basins (about 101,400 ha).

Due to intensive and unorganized grazing and the reduction of lands with steppe vegetation, the state of flora in steppe habitats is unsatisfactory in the republic. Human activities have had a significant effect on the steppe areas in the southern and south-eastern regions (lower Nistru river terraces and Bugeac plains), but they are still rich in traditional plant communities characterized by grasses and oak forest groves. 2,8% of the nation is covered by rivers, lakes, and other wetlands (95,000 ha). There are 34 dominant aquatic plant groups and 83 partnerships, with 37 of them being endangered.

Moldova can be divided into 3 major agro-climatic zones: (i) the Northern zone including the northern plateau along the Nistru river, the Transnistria highlands and the Balti rolling plain, with annual mean temperatures ranging from 6.3-9.7 °C, and annual precipitation between 550-600 mm; (ii) the central zone covering the Condrii highlands, where hilly terrain and deep valleys alternate, with annual mean temperature between 7.5-10 °C and annual precipitation from 500- 550 mm, up to 60% falling during the crop vegetative period; and (iii) the southern zone including the hilly terrain interspersed with plains and large valleys of the Bugeac plain and the Tigech highlands, with annual mean temperature between 8.3-11.5 °C and annual precipitation of 450-550 mm. In all cases around half of precipitation falls during the crop vegetative period.

Republic of Moldova isn't a big country, it has a total population of 3.555 million people, with 1.266 million who are considered economically active. Of these workers, 822,000 are employed in the non-agricultural sector ; i.e. 444,000 are employed in agriculture; however, according to statistical evidence, up to 1 million people are living and working abroad – in the EU as well as in Russia.¹ Even though it is an agricultural country, the sector's overall contribution to GDP is small in comparison to the number of people employed.

Moldova has adopted a market economy, liberalized prices and interest rates, stopped issuing preferential credits to state enterprises, backed steady land privatization, and abolished export controls since becoming an independent country. However, this resulted in rapid inflation, and Moldova experienced a severe economic crisis from 1992 to 2001, with energy shortages contributing to sharp output declines. Following this, the economy started to change, and the nation has seen consistent annual growth of between 5% and 10% since then. The overall unemployment rate declined to 6.6% in 2011 (from 7.4% in 2010). As a result of decreases in industrial and agricultural production the relative weight of the service sector in the economy of Moldova started to grow and began to dominate GDP.

Brief description of COUNTRY or BSB region agriculture and history

The Republic of Moldova is regarded as an agricultural region, with agriculture serving as the backbone of the Moldovan economy. The contribution of GDP and the impact on the job rate may also support this assertion. The agricultural sector employs a large number of people, particularly when it comes to subsistence agriculture.

Agriculture is a vital part of Moldova's economy and the primary source of income in rural areas. It accounts for nearly 14% of the country's GDP (down from 20% in 2004), with the food processing industry accounting for an additional 7%. Winter and spring grains, such as wheat, barley, and maize, as well as potatoes and other vegetables, as well as horticultural crops and berries, are important crops. Approximately 75% of the population lives in rural areas and makes a living from agriculture and related activities.

¹ JICA. „Data Collection Survey on Agriculture Sector in Moldova”, september 2017, p.5

Despite the fact that agriculture, particularly the agri-food industry, is critical to Moldova's economy, its performance has been uneven, with slow and highly variable growth.²

Moldova is Europe's most vulnerable country to climate change⁸. Over the last century, the temperature and rainfall in Moldova have risen, and extreme floods and droughts have become more common. During the years 1984 to 2006, Moldova suffered an estimated annual economic loss of USD 61 million as a result of natural disasters. This pattern had recently shifted, with the 2007 and 2012 droughts causing losses of approximately USD 1 billion⁹ and USD 290 million, respectively. Floods have also had a major effect on Moldova, costing the country about USD 120 million in 2008 and USD 42 million in 2010.

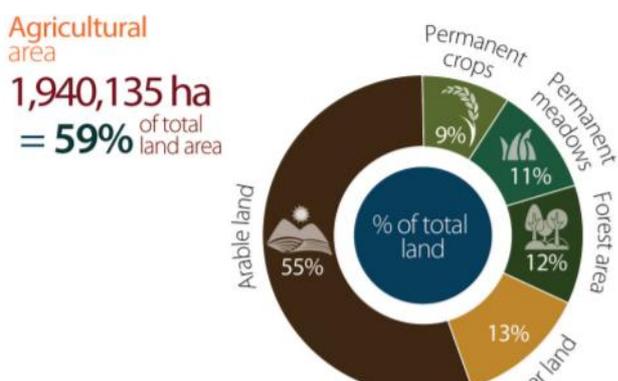
Most of Moldova's agricultural land was shifted from state to private ownership during the 1990s, and today 73.8 percent (1.84 million ha) is in private ownership, while 26.2 percent is owned by the state (660,000 ha). Around 40% of agricultural land is owned by limited liability companies (LLCs), 37% by family farms, 10% by other types of business associations, 10% by production cooperatives, and 3% by individual businesses. Moldova's agricultural production is 70 percent vegetal and 30 percent animal in general.³

Agricultural production amounted for roughly €1.4 billion in 2011 and increased by 4.6% compared to the previous year. Agricultural output has accounted for over 15% of GDP²⁴ in the last five years and 36% when combined with the food processing industry.

Agri-food products account for approximately 41% of total exports and particularly wine and spirits, as well as fruit and vegetables, both fresh and processed. 70% of exports go to CIS countries and 30% to the European Union, mostly in the form of semi-finished products.⁴

Republic of Moldova it is well known for the soil we have, highly fertile black chernozem. In this context, let's take a short look how the land it is used in our country.

Agricultural land makes up about 59 percent (2 million hectares) of Moldova's



² "in Moldova", september 2017, p.5
³ "as from Armenia, Georgia and Moldova", 2013, p.



Figure 1 source: Climate-Smart Agriculture in Moldova



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total land area, with 55 percent of that being arable land for annual crop production (maize, wheat, sunflower, barley, oilseed, soybean, sugar beet). The highly fertile black chernozem soils, which are mostly found in the north and along the Dniester River Valley, provide ideal conditions for farming, especially the production of cereal grains, maize, fruits, and vegetables. Soil degradation and erosion have been exacerbated in recent decades by land fragmentation and low land management capability, inadequate soil health practices (especially tillage), overgrazing, illegal logging of protected forest belts, including wetlands, and general inefficiencies in land-use planning, including crop rotation. Inadequate nutrient management practices, such as insufficient storage and application of agrochemicals and manure, have resulted in contamination of surface and groundwater sources, as well as increased contributions of the agricultural sector to national GHG emissions (primarily due to inadequate nutrient management and soil tillage).⁵

So, we basically have 3 types of farmers⁶, according to the scale of their territory. We should talk about small-scale farmers, who account for 97.7% of all farms and have land sizes ranging from 0.85 to 10 hectares, and medium-scale farmers, who have land sizes ranging from 10 to 50 hectares. Small-scale farmers usually grow sunflower, wheat, maize, vegetables, and orchards, all of which have low yields and high production costs. To cover production costs, the crop is primarily used for animal feed and sold unprocessed/raw on the local market. Just a few of them cultivate high-value crops like potatoes, strawberries, and raspberries. When we look at medium-scale farmers, we can see that they usually grow wheat, maize, sunflower, and soybeans, as well as perennial crops, fruits, and table and wine grapes. On land greater than 50 hectares, large-scale farmers grow field crops such as sugar beet, orchards, and vineyards (table and wine grapes). In Moldova can be found three main agro-ecological zones⁷:

1. Northern Zone – along the Dniester River, also known as the forest-steppe, with high productivity rates for forages, pastures, and livestock, but also suitable for crops, such as maize, wheat, sunflower, soybean, barley, sugar beet, and pea, among others ;

⁵ Climate-Smart Agriculture in Moldova

⁶ *ibidem*

⁷ Climate-Smart Agriculture in Moldova

2. Central Zone – a hilly and forested area best suited for perennial crops (vineyards, orchards) ;
3. Southern Zone – a mix of hills and plains which, due to higher temperatures and low rainfall, is less suitable for agricultural production

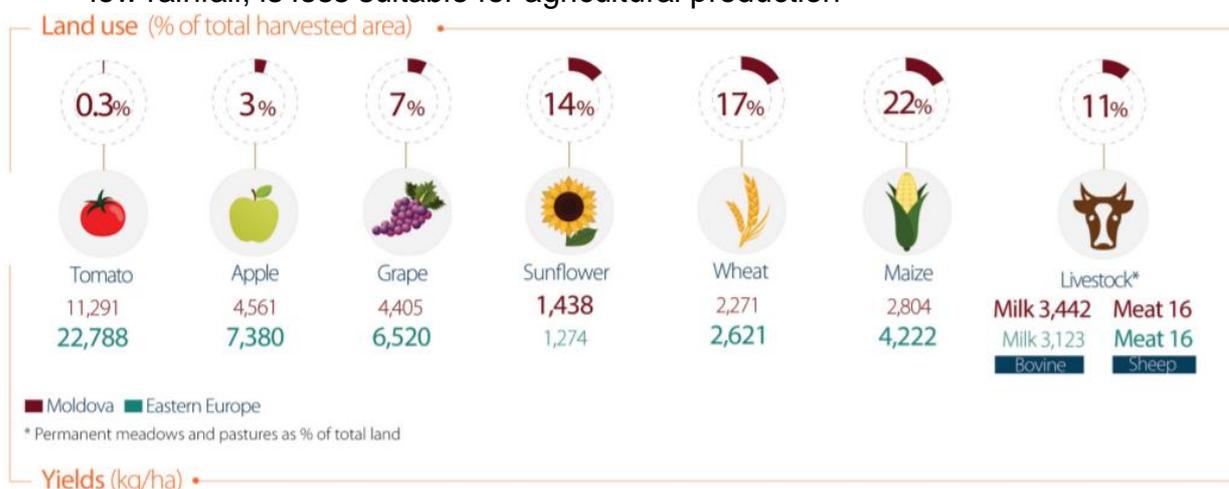


Figure 2 source: *Climate-Smart Agriculture in Moldova*

Moldova is capitalizing on its agricultural export potential, especially in cereals, sunflowers, fruits, vegetables, and sugar. Exports of animal origin goods to EU Member States are currently not possible due to underdeveloped food safety institutions.

Agriculture is becoming a polarizing practice in the Republic of Moldova. A small number of large-scale farmers are increasingly able to take advantage of the expanded opportunities provided by the country's main agricultural export destination, the EU. Smallholders, on the other hand, find it difficult to meet the stringent EU business conditions and instead focus on the more open markets. Young people from rural areas are migrating to towns. Small-scale farmers are especially vulnerable to rising costs. They are the least prepared to respond to the consequences of climate change.

| | 2008 | 2018 | Difference | Diff % |
|--|-----------|-----------------|------------|--------|
| Population | 4 112 891 | 4 051 944 | -60 947 | -1.48 |
| Agriculture, value added (% of GDP) | 8.81 | 10.16 | 1.35 | 15.32 |
| Agricultural land (% of land area) | 75.43 | 74.22 (2016) | -1.21 | -1.6 |
| Rural population (% of total population) | 57.32 | 57.37 | 0.05 | 0.09 |
| Employment in agriculture (% of total employment) | 31.06 | 32.18 | 1.12 | 3.61 |
| Employment in agriculture, female (% of female employment) | 28.34 | 27.78 | -0.56 | -1.98 |

Table 1. Basic agriculture indicators in Moldova (World Bank WDI database)

Moldova's mobile broadband penetration is comparable to the CIS average. 3G/LTE coverage is widespread in the territory and population (see Figure 3). The first 3G networks were launched in 2008 (with coverage reaching 100% in 2018), and LTE services were introduced in 2012, with 97 percent of the population covered. The number of mobile broadband subscribers is growing; in 2018, there were 73 subscriptions per 100 people (up 25 points in two years). The Internet is used by 76% of the population, and slightly more than half of households have Internet access at home.

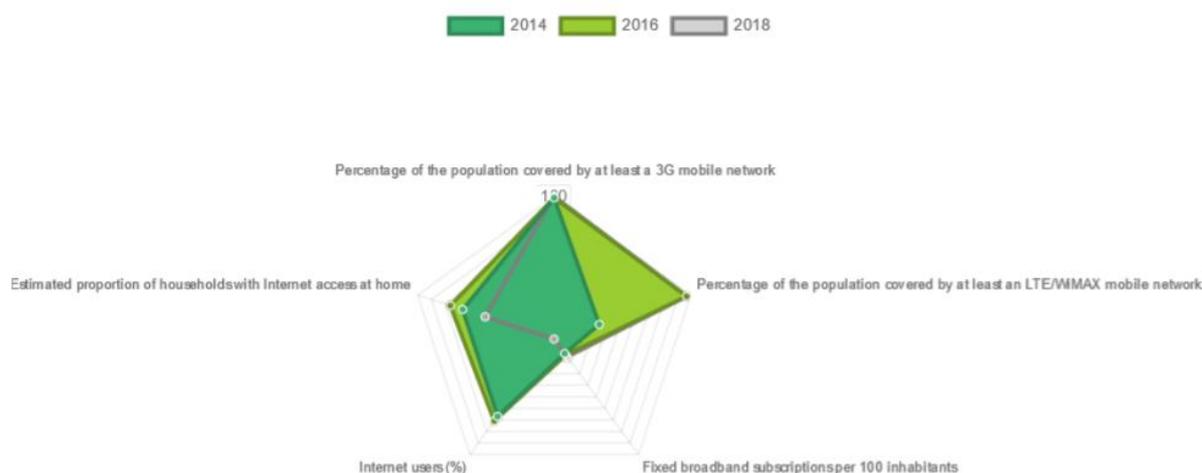


Figure 3. : The basic indicators of ICT access and usage in Moldova (ITU WTI Database)

Agriculture field in comparison with other sectors

Even

though

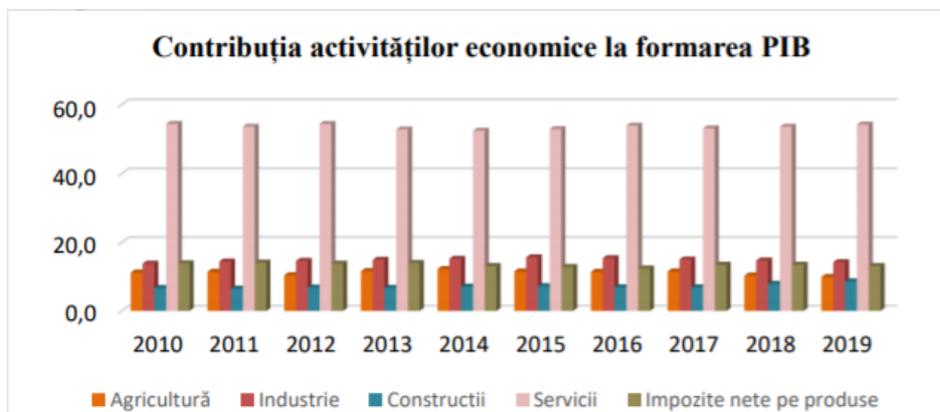


Figure 4. Contribution of economic activities to GDP formation in the Republic of Moldova, 2010 – 2019. Source : National Bureau of Statistics

agriculture's contribution to the development of gross domestic product (GDP) is decreasing at the moment, agriculture remains a significant sector in the Republic of Moldova's economy. During the period 2010-2019, the contribution to GDP of this sector remained stable, fluctuating only slightly from 11.2 percent in 2010 to 9.9 percent in 2019. Looking at the situation from the inside, we may conclude that these fluctuations in the agricultural sector are actually caused by rural infrastructure, such as highways, electricity, and water for household needs, as well as irrigation, which are all in poor condition and have the greatest negative effect on agricultural income.

Figure 3 shows that in 2019, the country's largest economic sector is the service sector, which accounts for 54.2% of GDP, followed by the industry sector, which accounts for 14.2% of GDP. As can be seen, the agricultural sector has decreased, which is due to climatic conditions, especially the drought in recent years.

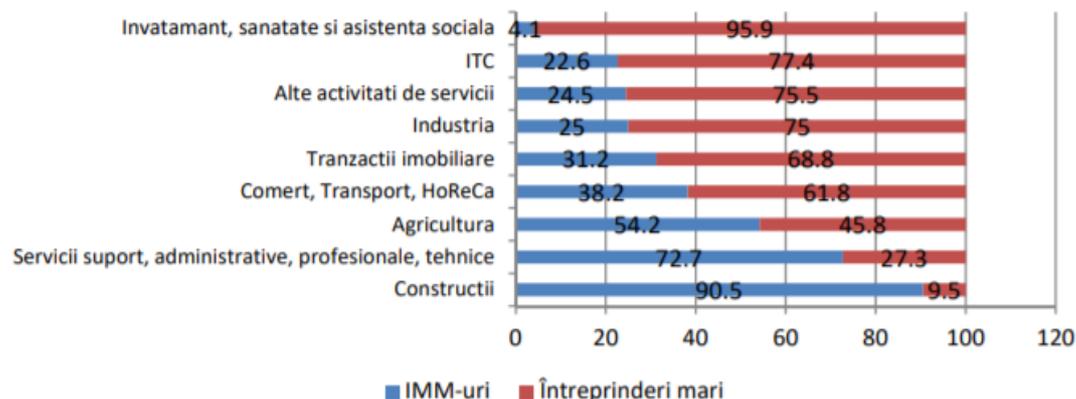


Figure 5. Distribution of value added produced by SMEs by economic activitie in 2020. Source : National Bureau of Statistics

The agricultural sector in the Republic of Moldova is slow-growing and inefficient. Low levels of investment, a lack of access to finance, slow institutional transformation, and limited market prospects have all contributed to Moldova's agriculture operating at a fraction of its potential.

When it comes to the distribution of gross value added between small and medium-sized enterprises (SMEs) and large enterprises, we can see that SMEs dominate in the construction sector, with an average of 54.2 percent in support, administrative, educational, technological, and agricultural services.

Chapter 2. Agriculture policies in Republic of Moldova

Through recent development, Moldova is still a developing nation. Moldova remains one of Europe's poorest nations. Moldova's economy is heavily reliant on its agriculture sector, which includes fruits, vegetables, wine, wheat, and tobacco, thanks to its temperate climate and fertile farmland. Moldova also relies on annual remittances of around \$1.2 billion, or nearly 15% of GDP, from Moldovans employed in Europe, Israel, Russia, and other parts of the world. Moldova imports almost all of its energy from Russia and Ukraine due to a lack of natural resources. Moldova's reliance on Russian energy is highlighted by a \$6 billion debt to Russian natural gas supplier Gazprom, which stems primarily from unreimbursed natural gas consumption in the breakaway region of Transnistria. In August 2014, Moldova and Romania completed the Ungheni-Iasi natural gas interconnector project. The 43-kilometer pipeline connecting Moldova and Romania allows for natural gas import and export. Gas was not allowed to flow into Moldova until March 2015 due to a number of technical and regulatory issues. Gas exports from Romania to Moldova are largely symbolic. Moldova granted Romanian Transgaz a contract in 2018 to construct a pipeline linking Ungheni and Chisinau, carrying gas to Moldovan population centers. By 2022, Moldova wants to be connected to the European power grid.

As a result of the government's stated objective of EU integration, some market-oriented progress has been made. In 2017, Moldova's economy grew faster than predicted, thanks to increased demand, increased revenue from agricultural exports, and improved tax collection. Moldova signed an Association Agreement and a Deep



and Comprehensive Free Trade Agreement (AA/DCFTA) with the EU in the fall of 2014, allowing Moldovan goods to enter the world's largest market. Moldova's exports to the EU have increased significantly as a result of the EU AA/DCFTA. In 2017, the EU bought over 65 percent of Moldova's exports, a significant shift from 20 years ago, when the Commonwealth of Independent States (CIS) bought over 69 percent. A \$1 billion asset-stripping heist of Moldovan banks in late 2014 hit the economy hard in 2015, and the resulting bank bailout exacerbated inflationary pressures and led to the leu's depreciation and a mild recession. Moldova's development has also been hampered by widespread corruption, which restricts business growth and discourages foreign investment, as well as Russian restrictions on Moldovan agricultural imports. The government's efforts to restore stability and enact substantive reform resulted in the approval of a \$179 million three-year IMF program aimed at improving the banking and fiscal environments in 2016, as well as additional assistance from the EU, World Bank, and Romania. In 2017, Moldova earned two IMF tranches totaling \$42.5 million. Moldova's economy is still vulnerable to corruption, political instability, poor administrative capability, entrenched bureaucratic interests, energy import dependency, Russian political and economic strain, heavy reliance on agricultural exports, and unresolved separatism in Moldova's Transnistria region over the long term.

Local/regional/national policies in agriculture and connected sectors

The transformations that occurred in the 1990s in Moldova, as in other countries in transition to market economies, resulted in a variety of issues relating to changes in ownership relations, the transition from a planned economy to a market economy, the alignment of the agro-industrial complex components to new market requirements, the development of market infrastructure, the investment process, and so on. Agricultural policies promoted over the last decade pursued several shared goals for transition economies and included a variety of actions aimed at preventing the agri-food sector from deteriorating further. The financial resources allocated from the government budget is aimed at partially financing some programs aimed at assisting agricultural farmers, subsidizing agricultural production risks, and assisting the grape and winemaking industries, among other things.

For Moldova, the agricultural sector's growth is critical. The agricultural sector and other associated activities provide income to 58 percent of the total population in



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rural areas. In this context, the government must take policy measures to assist rural residents in sustaining their income. The agricultural sector accounts for approximately 12% of GDP, and together with the food processing industry, it accounts for approximately 35%. However, agri-food products, which are the country's main export goods, account for 40% of total exports.

Changes in the agricultural sector resulted from the transition to a market economy, as well as a slew of reforms implemented in the early 1990s. Around the same time, agriculture accounts for just around 5% of total government spending. Farmers do not have enough resources to ensure their activities, many of them being not profitable. In addition, the amount of money invested in this sector is very small. As a result, Moldova's agricultural sector needs government assistance in order to become more attractive to investors, thereby contributing to the sector's growth, as well as a reduction in production costs and prices.

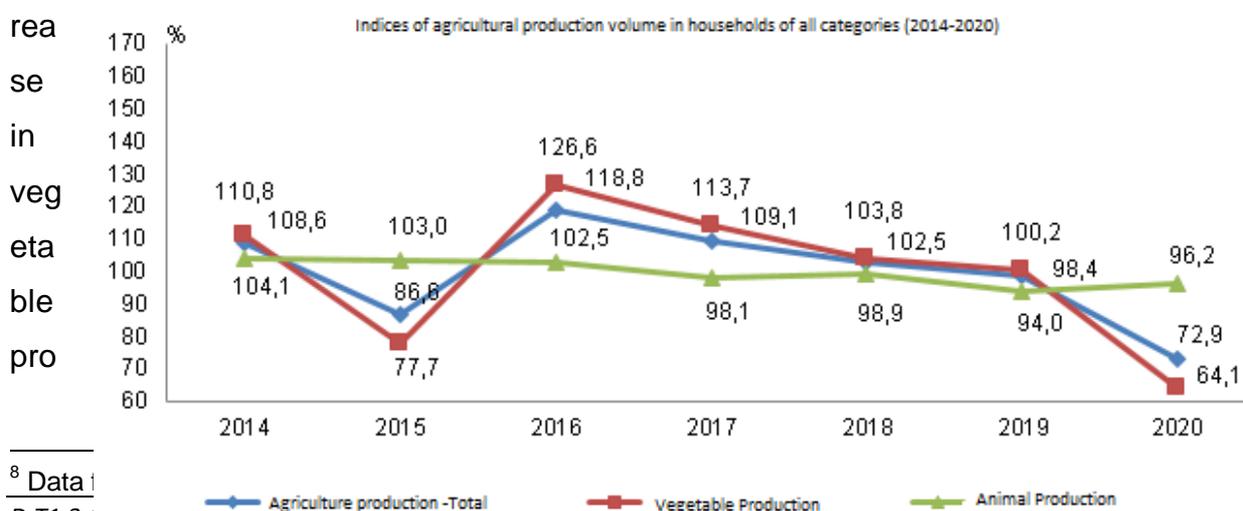
State funding for the agricultural sector is one of the most important aspects of government policy. The main goal of subsidy allocation is to maximize the benefits of government assistance while minimizing the negative consequences as much as possible, particularly in countries with low agricultural production competitiveness and limited accumulated capital that could be used to rebuild the sector. In several countries, the agricultural sector is heavily subsidized by the government. Support for farmers has occupied a central role in Moldova's promoted government policy in recent years. As a result, a number of documents reflect Moldova's agri-food sector's long-term development, such as the "National Strategy for the Agri-Food Sector's Long-Term Development for 2008-2015," which has objectives centered on competitiveness, rural population living standards, and rural area preservation, and the "Concept for the Agricultural Producers' Subsidizing System for the Years 2008-2015." The National Strategy for Agricultural and Rural Development of Moldova for 2014-2020 was adopted in 2014, with the key goals of increasing agricultural competitiveness, ensuring the sustainable use of natural resources in agriculture, and improving rural life quality. The subsidizing program was given a lot of weight as a key measure to help farmers and improve the agricultural sector's competitiveness. This was expressed in the "Concept of the Agricultural Producers' Subsidizing Scheme for the Years 2008-2015," which had two key goals:

- agricultural sector modernization – subsidizing investment activities such as the establishment of agricultural storage and processing units, the procurement of suitable equipment, the provision of agricultural raw materials, the establishment of vineyards and orchards, and the development of agricultural services;
- the implementation of efficient agricultural activities in the vegetable and livestock sectors – direct payments will be made for increased agricultural productivity and competitiveness, market stabilization, food security assurance, and equal incomes for agricultural producers, taking into account agricultural crops, animal species, and their individual average yield when compared with other agricultural crops and animal species.⁸

The **Agency for Interventions and Payments in Agriculture (AIPA)** was established as a legal entity under the Ministry of Agriculture and Food Industry in 2010, and it is responsible for administering financial resources aimed at supporting agricultural producers, monitoring their distribution, and evaluating the qualitative and quantitative impact of government support measures.

The subsidizing fund was previously administered by four separate agencies, the majority of which were under the Ministry of Agriculture and Food Industry (about 70 percent).

According to preliminary estimates from the National Bureau of Statistics, global agricultural output in households of all types (agricultural enterprises, farms (households), and households) increased by 72.9 percent in 2020 compared to 2019. The decline in global agricultural output (by 27.1 percent) was exacerbated by a 35.9% dec



⁸ Data |
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Figure 6. Indices of agricultural production volume in households of all categorie (2014-2020)
Source : National Bureau of Statistics



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duction (which resulted in a 26.1 percent reduction in the general index of global agricultural production) and a 3.8 percent decrease in animal production (-1 .0 percent).

Moldova considers itself to be one of those countries committed to boosting the IT industry's growth and prospects. This is emphasized in strategic documents such as the national strategy for the growth of the information society, "Digital Moldova 2020," and the Strategy for the development of the information technology industry and the digital innovation ecosystem for the years 2018–2023, which continue the government's efforts to grow the field. The Strategy includes a number of initiatives aimed at boosting the entrepreneurial and IT educational ecosystems, as well as their start-ups and funding mechanisms, as well as promoting IT goods in niche markets.

The Broadband Development Programme for the years 2018–2020 was approved, and an action plan for its implementation was adopted in the field of electronic communications. The main goal of the program is to build broadband electronic communication networks with increased data processing ability. The Radio Spectrum Management Programme for the years 2013–2020 was created to facilitate effective management of radio spectrum resources and thus ensure the continuous growth of public broadband electronic communication networks and services.

The Strategic Program for technical modernization of development policies in the agro-industrial sector (e-agriculture) was approved by the Ministry of Agriculture, Regional Development, and Environment in 2013. The program's goals were to digitize the Ministry's subdivisions' public services, establish integrated information systems for planning and executing the sector's growth strategies, and develop surveillance information systems to ensure food safety and security. E-agriculture was conceived in the light of state food safety and protection, the National Strategy for Agricultural and Rural Development (2014–2020), and the government's strategic program for technical modernization (e-Transformation).

Chapter 3. Funding initiatives in Smart Farming from Republic of Moldova

All national strategies around agriculture are developed in close collaboration with farmers associations (FAs). They participate in decision-making around the regulation of subsidies and water use, lobby for farmers' interests to state structures, and initiate legislation change. FAs also have a seat in the Supervising Committees in the



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implementation units for international financing projects, and many technical assistance projects are implemented directly by FAs. However, FA structures in Moldova are relatively new, and the membership fees are low, which gives them limited financial capacity to act and academic institutions work on sustainable agriculture and soil protection issues.

Projects implemented in the agricultural field and IoT technologies in agriculture

In Republic of Moldova there have been through the years implemented many projects in the agricultural sector, and in the last few years there has been a very hard focus on the projects implemented in agriculture where the smart and IoT technologies could be applied.

One of this types of project is the project "*Supporting Moldova's National Climate Change Adaptation Planning Process*", that had the goal to respond to the needs of farmers, and to ensure that Moldova has a system in place for medium- to long-term adaptation planning and budgeting, with the aim to reduce the vulnerability in key sectors (particularly agriculture), to the impacts of climate change. With funding provided by the Austrian Ministry of Environment via the Austrian Development Agency (ADA), and supported by UNDP Moldova, the project is being implemented by the Ministry of Environment's Climate Change Office. Working in three key sectors: agriculture, energy, and water resources, pilot projects are being implemented in six districts vulnerable to climate, in order to promote adaptation measures and catalyze their replication in other regions of the country. Through the project's dedicated grant scheme to showcase innovative adaptation measures at the local level, three agricultural grants have been used to improve agricultural conservation practices, while helping to restore soil fertility. By promoting new agricultural technologies, like automated GPS navigation to increase the efficiency of pesticide and fertilizer application, or by using improved soil conservation methods and precision machinery, the overall objective is to develop farmers' climate-resilience.

In the North of the country, in the Făleşti district, one of the grants from the same mentioned project, provided funding to the group, Abilitate Agro LTD, to purchase a ripper and a precision no-till seeder. The ripper uses strong tines to loosen hard layers of soil - allowing the roots to grow deeper to access subsoil moisture and the precision



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no-till seeder deposits seeds in the ground more effectively - significantly reducing labor and related fuel costs.

The adjacent community farming pilot project, LLC Sadac-Agro, was the 3rd recipient of the agriculture grants. The farm covers 8,000ha and is comprised of the individual plots of 1,100 villagers. Growing rapeseed, mustard, barley, wheat, corn, and sunflower, the farm also includes a vineyard and an orchard. With their grant they were able to purchase a ripper and a GPS guidance system. Mr. Nicolae Prohnițchi, director of Sadac-Agro LTD said: "We were able to use the GPS auto navigation kit... for a uniform particle distribution without overlap. We are pleased with the purchased... primarily on account of savings resulting from their use and increasing quality work. For all farmers facing climate change issues, I recommend them to purchase this equipment, because they already are a necessity for farms in the country." By promoting new agricultural technologies, like automated GPS navigation to increase the efficiency of pesticide and fertiliser application, or by using improved soil conservation methods and precision machinery, the overall objective is to develop farmers' climate-resilience.

Conservation methods like continuous no-till or minimum-till, crop rotation, and cover crops are keys to building healthy soils. Changing cultivation technology has required building technical skills and raising conservation awareness. In order to implement the right technologies, the Austrian Development Agency and UNDP experts have trained farmers on adaptation practices. Following the successful implementation of pilot projects, local producers are motivated to make plans for the future, applying technologies that contribute to adaptation, simultaneously enhancing food security and improving the welfare of rural populations. As part of the NAP Global Support Programme, assisting Least Developed Countries (LDCs) to advance National Adaptation Plans (NAPs), the project is aligned with the NAP-GSP's aims to strengthen medium and long-term climate change adaptation planning as well as budgeting, with an emphasis on gender-sensitive approaches⁹.

For exemplification we present in table Nr.1 below a list of the most important projects implemented in Republic of Moldova during 2009- 2020 (and some of the project are on-going) in the agricultural sector, also some of the projects present the specific objectives of implementing (or the need to implementation) of IoT tools in the agro-food sector of our country.

⁹ www.adapt.clima.md

Table. Nr.1 List of Project implemented in Republic of Moldova during 2009-2020 in agriculture (also connected to IoT sector)

| Project Title | Total Budget EURO | Period | Objectives |
|--|----------------------|-------------------------|---|
| Improving The Export Capacities of The Ministry of Agriculture and Food Industry | 2 000 000 | 01/10/2008 - 29/11/2010 | |
| Cross- Border Networking For Organic Agriculture | 83 118 | 05/04/2011- 02/10/2012 | The overall objective of the project is to encourage cross border contact and facilitate exchange of information and expertise in the field of production and marketing of organic products, in order to improve the economic and social situation in the border area. |
| Facilitate the trade of Agro-Food Products in The Black Sea Basin (FTAP) | 188 059 | 01/11/2011- 31/10/2013 | Establishing a sustainable partnerships with the Foundation for Promotion of Private, Small and Medium Enterprises of Galati (FPPSME), Romania and the Regional Fund for Entrepreneurship Support of Odessa Oblast, Ukraine, in order to encourage the trading of agro & food products in Black Sea Basin. |
| EC/FAO Programme on information systems to improve food security decision-making in the ENP-East Area | 3 000 000 | 23/11/2009- 31/12/2013 | The formulation and implementation of food security-related policies and programmes (response) increasingly rely on food security information, leading to greater food security for the poorest and the most vulnerable people. |
| Preparing the conditions for penetration of the Black Sea Wines in the International market : Black Sea WinExports | 220 273 | 24/05/2013- 23/05/2015 | Broadening the cooperation among the targeted region in order to exchange knowledge and experience and by the development of innovative digital tools. |
| Cross Border Support Center For The Assisted Development of Zootechny | 121 471 | 16/09/2013- 16/07/2015 | The project is aimed at facilitating the modernization of the livestock sector and building the premises for a competitive cattle breeding business. Agriculture, which also includes animal husbandry, is the main sector of the area, but its potential is difficult to exploit as it contributes little to the GDP of eligible cross-border budgets. In order to improve the economic, social and environmental situation in the cross-border area, during the implementation of the projects a cross-border network to support the Assisted Development of Animal Husbandry will be organized. It will meet the interests of stakeholders and provide them with a support platform to improve their position in the market. |
| "Promoting sustainable production and implementation of good practices in the bovine farms from Romania, the Republic of Moldova and Ukraina cross-border region" | 416 000 | 01/12/2014 - 31/07/2015 | Creating a common network of monitoring centers bovine production in terms of quantity and quality in the three partner countries; Making a joint border survey on production and bovine farms in the three countries; Develop and implement a software sharing - tool for monitoring the quality of milk and meat production; Making 2 pilot farms for qualitative and quantitative determinations in Romania and Republic. Moldova; Campaign implemented training / information and dissemination of |



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| | | | specific information to stakeholders in the sector in all three regions. |
| Creation of a trilateral cross border network for development and marketing of the agro-alimentary local and traditional products in the Lower Danube cross border area | 394 095,28 | 08/11/2013-08/08/2015 | The project idea is to create, in Lower Danube rural area, a cross border network to support and encourage the production and marketing of local agro-alimentary products made in a traditional way. The action is based on local entrepreneurial facilities creation for a sustainable valorisation of the local food products, on the reinforced skills and the training of the local producers and on new microbusiness created in three processing centres (rural affairs incubators). The network will offer local rural producers space to transform, in an organised frame, their agricultural products into agro alimentary ones, preserving their culinary traditions, obtaining new added value to their agricultural primary products and superior quality of their final products. |
| Development of the agriculture sector through creation of an agricultural cross-border network | 552 597,20 | 01/11/2013-31/08/2015 | The purpose of this project is to create a cross-border agricultural network in order to develop the agricultural sector from the cross-border area. The main link of this cross – border network is the Agro-Industrial Logistic Park from Singerei. Inside this Agro – Industrial Logistic Park will be offered services for the agricultural producers: services of sorting, packaging and storage and support services (consulting services in different domains: management, procurement, marketing, product development, accounting). The second link of the cross-border network is the Viilor Marketplace from Botoșani, where an Exhibition Corner will be created, where the producers can present their products. The third link of the cross-border network is the Online Cross-Border Marketplace, for presenting and selling the products. |
| Protection of borders against threats posed by homeless animals | 13 675 | 18/12/2013-17/10/2015 | Overall objectives are reducing and preventing the spread of dangerous infectious diseases that are transferred by stray animals and are a dangerouse for people and animals in the boundary areas; preventing uncontrolled breeding of domestic and homeless pets; creation of the population-safe and harmless conditions; providing sanitary welfare. |



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| <p>Transparent Convergence to EU Policies in Sanitary Issues: the case of Georgia and Moldova</p> | <p>152 216,54</p> | <p>01/11/2013-29/02/2016</p> | <p>The proposed action aims at contributing to improved socio-economic conditions for the citizens of Georgia and Moldova through supporting the transparent convergence to EU policies in sanitary and phyto-sanitary (SPS) issues. The action is both well-timed and relevant in its efforts (1) to enhance stakeholder understanding of and adherence to SPS standards and (2) to contribute to improved food safety legislation and practice in both countries. To achieve these specific objectives, EPF and EEF will target Georgian and Moldovan non-state actors (NSAs), public authorities, consumers, and food operators, in order to enhance their capacity related to SPS issues and foster improved cooperation among the target groups. This will result in (1) informed and active consumers, (2) more competitive food operators, and (3) national food safety frameworks that are both in line with EU standards and balance the diverse interests of all stakeholders.</p> |
| <p>Technical assistance Project to support the project Implementation Unit (PIU) for the “Filiere du vin” operation, and the beneficiary Small and Medium-sized Enterprises (SMEs)</p> | <p>1 706 500</p> | <p>01/07/2014-01/07/2016</p> | <p>The purpose of this Technical Assistance is to help create an administrative, technical, financial and educational framework which will support the Filiere-du-Vin’s stakeholders, and the grape and wine producers in particular, to allow them to recover from previous operational and financial stress, and establish a sound technical and economic base for the future development of key sector of Moldovan economy.</p> |
| <p>Technical Assistance for the Implementation of the Sector Reform Contract: European Neighbourhood Programme to Agriculture and Rural Development (ENPARD)</p> | <p>2 387 160</p> | <p>11/11/2016-10/05/2019</p> | <p>1. Improve design and implementation of agricultural and rural development policies: - By aligning legal and regulatory frameworks to EU systems; - Through institutional strengthening and capacity building of agriculture and rural development policy and the sector entities; - By improving knowledge and skills of programming, planning and implementation of the agriculture and rural development policy and design of respective measures; - By facilitating effective financial management of subsidies. - By involvement of civil society in the policy dialogue and coordination of donors. 2. Improve service delivery in the area of competitiveness of the agri-food sector through its restructuring and modernisation: - By increasing investment in the modernisation of farm-holds, agri-food and feed chains meeting EU food safety and quality standards and requirements; - By improving agricultural education, research and extension services in agri-food sector, including access to knowledge and innovative solutions; - By developing information systems; - By improving access to capital, input and output markets for farmers. 3. Ensuring the sustainable management of natural resources: - By improving sustainable agricultural land and water management practices; - By increasing use of environmentally friendly production practices and ensuring biodiversity in rural natural environment; - By reducing negative effects of natural disasters (floods and droughts) in agricultural production and mitigation of climate change</p> |



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| | | | <p>influencing agriculture and rural areas. 4. Improving conditions for living and working in rural areas: - By investing in physical infrastructure in rural areas where agriculture and food production sector is dominating economy; - By facilitating development of local rural community initiatives. 5. Increasing employment and income opportunities in rural areas: - By diversification of farming activities and farm-hold productivity; - By facilitating off-farm income opportunities for rural dwellers.</p> |
| <p>Twinning project „Support to the National Food Safety Agency of the Republic of Moldova“</p> | 2 000 000 | 17/12/2016-16/12/2018 | <p>To strength the capacity of the National Food Safety Agency (ANSA) in managing all aspects of food safety from the farm to fork, in establishing unified food safety control system at the central level, with regional and local representations and in enforcing compliance of agro-food operators with national/EU standards in view of DCFTA.</p> |
| <p>Development of the Ukrainian-Moldavian cross-border production-scientific-educational cluster for processing of winemaking by-products</p> | 90 350 | 12/12/2017-11/02/2019 | <p>1) Conceptual and economic feasibility study of effectiveness of a cluster approach to processing of winemaking by-products; 2) Market study for several most promising winemaking by-products; 3) Understanding of the social and economic feasibility of a cluster approach to processing of winemaking by-products among business, local authorities, local communities; 4) Initial network among the potential participants of the Ukrainian-Moldavian cross-border cluster for processing of winemaking by-products; 5) Awareness of good practices and innovative technologies in the field of processing of winemaking by-products among the potential participants of the cluster at the cross-border territories; 6) Awareness about the diversification of energy sources and usage of winemaking by-products as alternative energy sources</p> |



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| <p>Strengthening Regional Capacities for Applying Environmentally Friendly Technologies in Integrated Pest Management Systems</p> | <p>300 000</p> | <p>12/12/2017 - 11/01/2019</p> | <p>R1. On the basis of the Institute of Genetics, Physiology and Plant Protection and ASM Engineering and Technology Institute "Biotechnica" created advisory training classes with labs. R2. Curricula are developed on biological methods of plant protection. R3. In the regions participating in the project provided training and field practice sessions spread developed and published visual materials on biological methods of plant protection. R4. Regional online information system to support the integrated pest management (IPM) programs and facilitate effective collaboration across the IPM stakeholder community. R5. Spend a final international scientific-practical conference.</p> |
| <p>Support to Agriculture and Rural Development through promotion of confidence building measures</p> | <p>4 755 776</p> | <p>01/01/2016 - 31/12/2018</p> | <p>The overall objective is to foster confidence building in the Republic of Moldova by targeting regions and territorial administrative units with special status. People from ATU Gagauzia, Taraclia district and neighbouring communities benefit from improved development opportunities in their localities, grasping the benefits of the National Agriculture and Rural Development Strategy. The proposed intervention will aim to address key gaps identified in the main strategic document of the region's development in line with national priorities. It will contribute to fostering confidence building in the Republic of Moldova by enhancing the competitiveness of the agro-food sector in the target regions, promotion of local entrepreneurship, creation of jobs and raising income; as well as increasing capacities of local communities to identify development ideas, develop and fundraise resources, as well as implement development projects.</p> |
| <p>Technical assistance to support the implementation of the "Fruit Garden of Moldova" operation, and the beneficiary Small and Medium-sized Enterprises (SMEs) Republic of Moldova</p> | <p>2 184 000</p> | <p>16/04/2018 - 30/06/2021</p> | <p>The "Fruit Garden of Moldova" loan operation spans a five-year period (2014 – 2019), and is intended to assist in the implementation of the measures included in the national legislation. As such, it is important to ensure the fit between the main objectives and associated conditions of the EIB operation and the on-going implementation of the specific legislation and other relevant national regulations. The purpose of the Technical Assistance is to help create an administrative, technical, financial and educational framework which will support the horticulture sector stakeholders, and the fruit producers in particular, to allow them to recover from their current operational and financial stress, and establish a sound technical and economic base for the future development of a key sector of the Moldovan economy</p> |



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| <p>Cross border network for Innovative Agriculture</p> | <p>99 890</p> | <p>30/11/2017- 29/11/2018</p> | <p>The implementation of the project between Ukraine and the Republic of Moldova aims to create a cross-border network for innovative agriculture, which would allow the added value of the agricultural sector by carrying out key agricultural research aimed at introducing new types of crops for commercial cultivation. Initiate a market study in order to get a detailed picture of the market: company profile (product list, production volume, infrastructure, employees: number and qualifications), main problems of the sector, information needed to perform on the market); Creation of an agricultural cluster including companies from market research sample that have shown interest to join the structure and other interested agricultural companies; in addition to agricultural producers, the cluster will include companies from related areas (trade, transportation, consulting services, financial services, legal services, food industry) as the market research will show; Research on the new agricultural conditions: soils and climate change in order to cultivate new agricultural crops with a higher economic potential. Online platform: to identify local producers by their profile, to identify companies from related sectors and to identify market-related information – all these data will be obtained through the initial market study and research on the new agricultural conditions; Result: closer business link across the border; Creating a Center for Innovative Agriculture where members of the cluster and other local producers will be able to use various equipment for improving their products in order to increase their potential on the European market.</p> |
| <p>“INCREASE TRADING AND MODERNIZATION OF THE BEEKEEPING AND CONNECTED SECTORS IN THE BLACK SEA BASIN” - ITM BEE-BSB 136</p> | <p>758 303</p> | <p>27/03/2019 - 26/03/2021</p> | <p>Creating the organizational and functional framework for the apiculture producers' network in the Black Sea Basin. Development of ICT tools (ICT tools and digital technology resources used for communication, creation, transmission, storage and management of information) to support cooperation in smart, sustainable and inclusive growth. Globalization and technological change - the processes that have accelerated in tandem over the past 20 years, are at the heart of a new global economy "driven by information-driven and knowledge-driven technologies. The expansion of this new global economy has major implications in the structure and purposes of SME advisory and support institutions. Because the information period is continuously diminishing and the access to it increases exponentially, the BSO education system can no longer focus on passing a rigid set of knowledge from the instructor to the learner within a fixed</p> |



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| <p>ENPARD Moldova Program - Support to Agriculture and Rural Development</p> | <p>64 075 000</p> | <p>01/07/2015- 01/07/2022</p> | <p>The general objective of the Program is to assist the Government of the Republic of Moldova in eradicating poverty, promoting sustainable and inclusive growth, and consolidating democratic and economic governance. The specific objectives of the Program are to: improve the financial capability of the Government to achieve agricultural and rural development policy objectives; promote agricultural and rural development policies and reforms; improve service delivery in the agricultural and rural sector; improve governance in agricultural and rural development; address the basic needs of the population; sustainable management of natural resources, including water and biodiversity; foster cooperation with regions and territorial administrative units with a special status.</p> |
| <p>Supply of laboratory diagnostic kits to the National Reference Laboratory of the National Food Safety Agency (ANSA)</p> | <p>196 496,13</p> | <p>24/02/2020- 12/03/2022</p> | <p>The subject of the cproject is the supply, handling, packing, loading, delivery, transportation, unloading, commissioning and 1- year warranty maintenance, of the following supplies as per Annex II " Technical Specifications": Lot 1: Medium, supplements and chemicals for bacteriology (Salmonella) Lot 5: Diagnostic kits and reagents for infectious animal diseases by molecular research</p> |
| <p>"Trade and innovation in the wine industry- WINET"</p> | <p>385 099</p> | <p>04/04/2019- 04/04/2021</p> | <p>WINET project comes in a context of decreasing commercial relations in the wine business among the participating countries, decrease of wine production due to weather, decline in quality due to non standard and lack of modern techniques and aims to solve these problems by means of collaboration, best practice exchange programs, cooperation of authorities, higher education centers and enterprises as well as online trading. The project is in line with several EU initiatives and is complementary with other regional cross border cooperation programs. Due to its innovative ICT approach to trade and collaboration the initiative can be very easily joined by new members from any country in the Black Sea Basin. The project strongly supports environmental sustainability and promotes the democracy and human rights as well as gender equality in its actions and messages. On the long term the project will improve the welfare of people in the regions through cooperation and thus sustainable growth.</p> |
| <p>Further support to agriculture, rural development and food safety in the Republic of Moldova.</p> | <p>2 000 000</p> | <p>01/09/2020- 31/08/2022</p> | <p>The Twinning project covers the three key institutional players (AIPA, MARDE, ANSA). This opens an opportunity to set up coordinated institutional capacities and act as one competent body where the key elements of Food Safety Management, Agricultural and Rural Development Policy making, policy implementation, control, monitoring & evaluation, are strictly defined, separated, but linked with each other. The project supports the development of the sector via the NARDS 2020+ by strengthening the respective implementing institutions. As for the Paying Agency, the alignment with European standards for accreditation of paying agencies is crucial. ANSA should be ready to guarantee Food Safety</p> |



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| | | | standards to enable export of agricultural products to EU. |
| Horizon2020- PRO Business Innovation Moldova | 24 138,99 | 01/01/2020 - 31/12/2021 | The overall objective is to contribute to smart growth by increasing the efficiency of investment in innovation and contributing to a more efficient connecting links along the innovation chain. The specific objectives of the project are: • efficient management of the relationship between SMEs (beneficiary of the SME Instrument) and consultant, in order to increase the number of projects funded under the “Horizon2020” program; • developing regional innovation management capacities in the field of SMEs: conducting an analysis on innovation management, developing an appropriate action plan to increase the effectiveness and efficiency of the innovation management system. |
| Microbiological tools for assessment and prediction of the impact of soil management on soil organic carbon in high-organic black soils of Moldova | 20 000,00 | 25/05/2020 - 25/12/2020 | Identification of the crop rotation with the highest potential to retain and/or increase SOC in the poorly humified Typical chernozem of Moldova; Elaboration of microbiological methodology for assessment, monitoring and prediction of the impact of soil management on SOC of the poorly humified Typical chernozem in Moldova. |
| Establishing Capacities for Isotope Hydrology Techniques for Water Resources and Climate Change Impact Evaluation | 286 633 | 17/05/2020 - 29/12/2023 | Specific objectives of the project are: (1) To improve institutional capacities in stable isotope analysis by the acquisition and installation of field and laboratory equipment: (2) To train staff in stable isotope analysis for enhancing the professionalism of participating institutions; (3) To implement stable isotope technology in the national monitoring programme through the validation of this technology in an accredited laboratory:(4) To test established isotope technology at selected pilot areas for the evaluation of groundwater reserve formation and water cycle study. The expected outcomes of the project are: (1) Improved institutional capacities for groundwater sampling and availability of analytical equipment for stable isotope composition analysis of water samples; (2) Staff trained on stable isotope analysis for the monitoring of groundwater quantity and quality status; (3) A validated methodology of stable isotope analysis in water samples; (4) A study on the stable isotope composition of groundwater containing an analysis of water reserve formation and interaction with surface water and precipitation. |



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| Sterile Insect Technique Based Blood Irradiator Equipment | 349 680 | 01/11/2020 - 30/04/2023 | Implementation of alternative technologies of experimental mutagenesis in the creation of new performing genotypes of crops and elaboration of innovative procedures for regulating the density of harmful insects for integration in sustainable agriculture |
| The Project "Fruit garden of Moldova" | 120 000 000 | 03/11/2014 - 31/12/2021 | This project will create favorable conditions for restructuring the value chain of the horticultural sector in the Republic of Moldova and will provide new opportunities for financing on favorable terms for the horticultural sector businesses through the access to the resources of the European Investment Bank provided through the financing contract signed between the Republic of Moldova and the EIB in order to implement the Project "Fruit garden of Moldova". |
| Bringing Organisations & Network Development to higher levels in the Farming sector in Europe (BOND) | 99 312,50 | 01/11/2017 - 31/10/2020 | The general objective is to directly contribute to unleash, strengthen, and organise, the great potential for collective action and networking of individuals, groups and entities of farmers and land managers in selected countries across Europe, with a view to creating strong, dynamic and effective organizations that have a voice and a place in policy design. |
| FP7-KBBE-2013-7, AGRICISTRADe, nr.612755, Exploring the potential for agricultural and biomass trade in the Commonwealth of Independent States | 47 880 | 01/01/2014 - 31/12/2016 | The on-going negotiations on Deep and Comprehensive Free Trade Agreements between the EU, Armenia, Georgia, Moldova and Ukraine, the accession of Russia to the World Trade Organisation in August 2012 and the establishment of a Custom Union between Russia, Belarus and Kazakhstan in 2011 are expected to boost trade relations between the European Union and its Eastern Neighbours. The ambition of AGRICISTRADe is to accompany these trends by analyzing the potential impact of the free trade agreements and by delivering insights on the potential developments of the food, feed and biomass sectors in Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Moldova, Russia and Ukraine. |
| Capacity building of the Moldovan Agency for Intervention and Payment in Agriculture (AIPA) for the application of EU norms and standards for the administration of ARD support schemes | 1 185 485,68 | 07/12/2016 - 01/07/2020 | Project refers to an improved implementation of agriculture and rural development policies, notably with respect to institutional strengthening and capacity building of agriculture and rural development policy and will strengthen the institutional capacity of the Agency for Intervention and Payment in Agriculture to administer development support measures in line with EU norms and standards. The Project will be implemented during a period of 24 months, its total budget amounts to 1.2m EUR and is financed by the European Union. |



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| Facilitating active engagement of the civil society actors in the agro-rural policy dialog | 266 726,21 | 01/03/2017 - 30/06/2020 | The action is focused on creation of a permanent framework for policy dialog at national, regional and national level. The target groups of the action are three national federations/unions of farmers and rural entrepreneurs, 30 regional NGOs working in agriculture and rural development; one national platform involving all relevant stakeholders, 10 platforms of regional stakeholders, 30 local action groups. Project context: - absence of institutional mechanisms for cooperation between public authorities and CSOs, - insufficient links and tools for cooperation between CSOs and the business sector, - poor organized sector platforms at national level and total lacking of such platforms at regional level, - weak knowledge of the CSOs in conducting advocacy activities and active civic participation, - lack of capacities in policy analysis, problems prioritization for the policy dialog, monitoring the implementation of policy and uses of the allocated budgets for this. |
| Sustainable Agricultural Trade Network in Black Sea Basin - AgriTradeNet | 73 435,16 | 01/09/2018 - 01/12/2020 | The main output of our project is: Increasing capacity of local producers and straightening cooperation between business, producers' organizations and local authorities for regional branding and transnational trading of agricultural products. The main results that will help and achieve our output are: Increased cross-border links for trade and modernization in the agricultural and connected sectors in Black Sea Basin; Increased cross-border trade opportunities for agricultural and agro-industrial products with Ensured safety production of important agricultural products; Ensured IT tools for increasing capacity of local producers – published research reports about the local legislation for safety producing of traditional products, report for the local branding opportunities and study about the international trading links for this type of products and the Developed local producers' market place for promotion of traditional agricultural products in the rural areas. |
| Page Total: | 136 453 920,26 | | |
| Grand Total: | 136 453 920,26 | | |

Financial support was allocated to agricultural producers from state budget through a number of programs or single actions, as well as from external sources (e.g. Project of Investments and Rural Services, Project of Agriculture Revitalizing, Program of Rural Financial Services and Marketing etc.). Nevertheless, a unifying tool of all the programs and projects is the subsidizing fund for agricultural producers.

Investments in agriculture

As to make a small summary of the investments made in the agricultural sector in the last year in Republic of Moldova, we presented here data related to this analysis

D.T1.3.1. Regional analysis





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report. Means of the National Fund for the Development of Agriculture and the Rural Environment (in continued - FNDAMR) is approved each year under the State Budget Law. At the same time, it is counted that in 2020 FNDAMR amounted to 1200 million lei, increasing by 26.3% compared to the financial means allocated in 2019 (950 million lei). FNDAMR is capitalized 100% every year. Benefit of subsidies economic entities, natural persons engaged in the activity of enterprising under national law as well as local public authorities first level.

According to the data presented by the Intervention and Payments Agency in Agriculture (hereinafter - AIPA), the sources of FNDAMR in 2020 were targeted as follows:

- the state contribution in the National Vine and Wine Fund - 17.9 million lei, in accordance with art. 2 lit. g. of the Law on the state budget for 2020 no. 172/2019;
- payment of arrears to agricultural producers in 2019 - about 503.8 million lei, in accordance with art. 33 para. (5) of Law no. 276/2016;
- advance grants for young and women farmers for development start-up projects - 16.2 million lei, according to art. 23 para. (3) of Law no. 276/2016, as well as the Government Decision no. 507/2018;
- grants in advance to improve living and working in rural environment - 25.7 million lei, under the conditions of art. 23 para. (11) of Law no. 276/2016 and Government Decision no. 476/2019;
- financial aid granted to agricultural producers whose agricultural production was affected by natural disasters in 2020 - 310.8 million lei, pursuant to art. 37 para. (2) of Law no. 276/2016, as well as the Government Decision no. 582/2020;
- post-investment subsidy - 325.7 million lei, according to the Decision Government no. 455/2017. Additionally, AIPA administered 59.73 million lei - sources granted from Government of the Russian Federation, intended to partially compensate for the damage caused by the 2020 drought on maize cultivation and soil preparation for harvest of 2021¹⁰.

BSB opportunities

¹⁰ Source SIA ESBS AIPA



The extended Black Sea region has been and remains an area of contact for cultures and civilizations throughout the history. There are three civilizations that now meet in the Black Sea region: Western, Orthodox and Islamic. The region is characterized by some unresolved conflicts: in Transnistrian Zone, in Eastern Ukraine, in Abkhazia and South Ossetia, in Nagorno-Karabakh. This shows that there is a real need for a sincere dialogue between all the countries (nations, cultures) bordering the Black Sea, in order to seek and find a profound and comprehensive solution to all conflicts – a security architecture. In the regional context, Moldova is a unique case. Historically, it was at the intersection of the interests of the Austrian, Russian and Turkish civilizations and empires. Moldova is a civic nation that includes several ethno-linguistic communities (a majority with a neo-Romanic Moldovan language, some Slavic minorities – Ukrainian, Russian and Bulgarian, and a Turkish-Gagauz minority), which nevertheless have political, civilizational (religious), cultural and others common values. This makes Moldova an appropriate platform for intercultural, inter-civilizational and political dialogue between the Black Sea region countries.

BSB projects in Moldova aim to improve the living standards of people in the riparian regions of the Black Sea Basin through sustainable economic growth and joint environmental protection. Actions are mainly focused on the promotion of business and entrepreneurship, the promotion of a coordinated environmental policy and the reduction of marine litter in the Black Sea Basin through joint actions, thus each project where Republic of Moldova is part of helps improve the cooperation between the entrepreneurs ,farmers, local businesses as well as make exchange of good practices study cases and learn from the experience of other countries.

Chapter 4. Quadruple helix approach in agriculture field

Theoretical Approach (theory)

The approach used for this regional analysis study was based on the Quadruple Helix. The Quadruple Helix is a development of Triple Helix approach by integrating civil society, innovation and knowledge. Quadruple Helix innovation theory is a collaboration of four stakeholders, namely: academician, businessman, civil society, and government, that play roles to encourage innovation. It is useful in an innovation process where the citizens needs are central, especially in agriculture sector. Using the Quadruple Helix and involving the citizens in the development of an innovation can lead to more successful, user-oriented innovations. The end users will be more likely to accept and use the innovation.

To increase the success of the collaboration it is important to define which are the specific QH stakeholders that should be involved (stakeholder mapping) and to make sure all QH actors are involved, motivated and have an open mind.



Academia. A generous number of research and academic institutions work on sustainable agriculture and soil protection issues. The education and research system has been restructured in the past years to give a stronger emphasis on applied science and to improve the quality of research output by optimizing the number of scientific institutions. However, knowledge and know-how sharing between scientists and farmers has remained limited, and the research conducted is still insufficient to answer questions about the impact of the various practices and technologies on adaptation/resilience, productivity, and mitigation goals and on how such efforts could be scaled out to reach a higher number of farmers.



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Industry. Rural population involved in agriculture practices in Moldova can be divided in three categories: (i) Smallholder poor farmers with small land properties, who crop their land and own livestock, with limited access to loans; (ii) Small and medium rural entrepreneurs “leaders” that consolidated the land into large plots by renting part of the land to rural residents, sometimes financially backed by investors; they are the major economic driving force in rural areas accounting for a significant portion of employment (permanent and seasonal) and investments; (iii) Rural residents that rent the whole or most of their land to “leaders” account for about 70% of the rural residents, and are not engaged in farming (apart from home garden and poultry); leasing agreements with farming “leaders” are often verbal and fees are in-kind through the provision of agreed quantities of crop production (about 15-20% of average harvest yields).

Public Authorities. The public sector can play a key role in creating an enabling policy and legal environment for climate-smart agriculture, which can permit private sector and civil society stakeholders to make timely, well-informed and efficient decisions related to securing food production, adapting to climate change and reducing and removing greenhouse gases. Many stakeholders, especially smallholder agricultural producers with limited assets will only be inclined and able to take necessary actions if their work is enabled by a coherent climate-smart agriculture policy framework. The transition to climate-smart agriculture requires transcending sectoral and other boundaries and calls for the full integration of climate change issues into the policy-making process at all levels. This means that new institutional structures and alliances among private and public stakeholders in a range of different areas, including policy making, research, extension and financing may be needed.

Moldova's government views information and communication technologies (ICTs) as a high-priority field with significant benefits, and has taken proactive measures in a number of areas. The law on information technology parks, which paved the way for the creation of the Moldova IT Park, is one of its flagship initiatives for IT industry growth. For companies registered in the Moldova IT Park (for a wide range of qualifying IT and related operations, such as software development, IT services, digital graphics and design, research and development, and educational projects), the park offers a special tax regime and streamlined tax administration.

Society. Despite its long history, smart agriculture (SA) is still a relatively new concept in Moldova, and farmers and policymakers, like elsewhere, have been wary of introducing



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novel and unfamiliar agricultural practices. One of the preliminary lessons learned from this study was the identification of bottlenecks in accepting SA and developing national strategies and policies to encourage SA, not only at the smallholder farmer level but also at the ministerial, academic, and civil society levels more broadly.

List of stakeholders from the investigation (100)

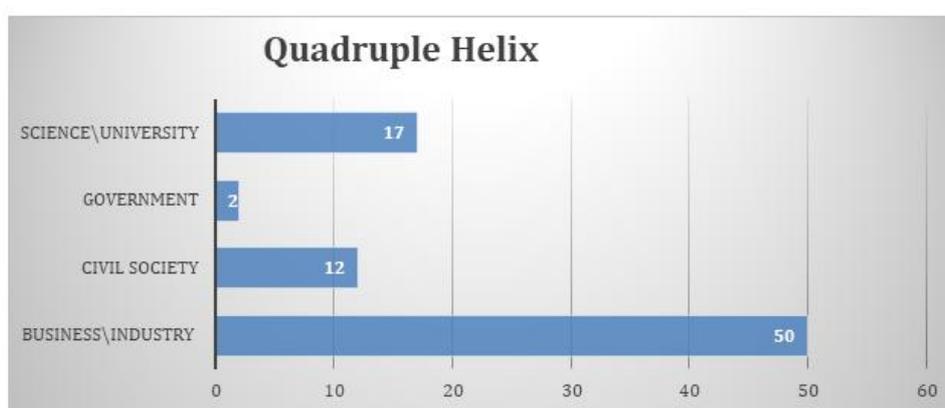


Figure 4.1. Quadruple Helix Representation from the list of 100 stakeholders

Fifty percent of the stakeholders involved in gathering the data for the mapping were representatives of the business and industries (mainly those that are working in the agriculture sector and those that are provider of the technologies for this sector).

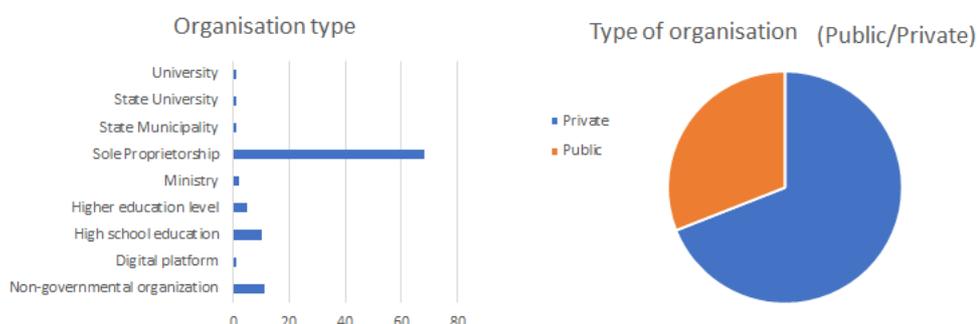


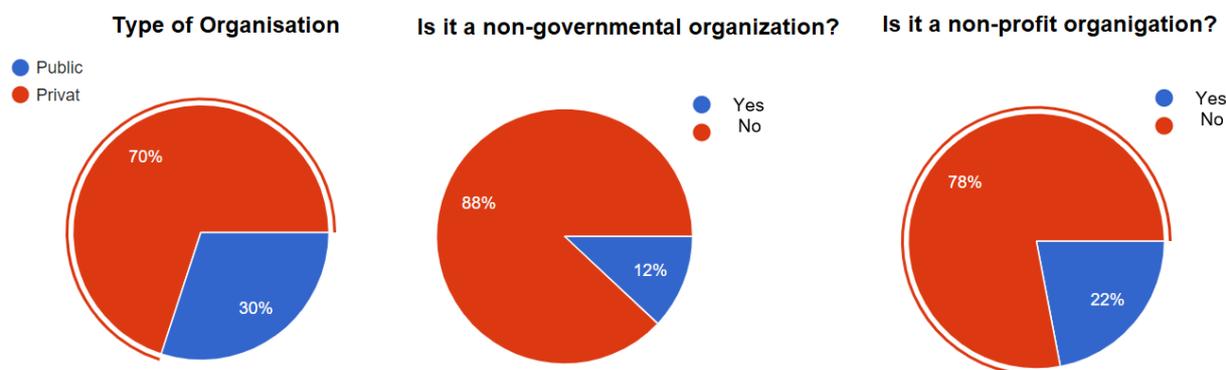
Figure 4.2. Results from the questionnaires regarding the respondents

Despite its long history, smart agriculture (SA) is still a relatively new concept in Moldova, and farmers and policymakers, like elsewhere, have been wary of introducing

novel and unfamiliar agricultural practices. One of the preliminary lessons learned from this study was the identification of bottlenecks in accepting SA and developing national strategies and policies to encourage SA, not only at the smallholder farmer level but also at the ministerial, academic, and civil society levels more broadly.

The key stakeholders involved in the questionnaire (50)

For the regional analysis investigation were interviewed 50 respondents as follows : 35 respondents are from the private sector and 15 from the public sector. From which 6 are governmental organisations and 44 are non-governmental. Eleven (11) entities are non-profit organisations and 39 entities are profit based entities.



From the interviewed respondents 16 are business entities, 13 are in agriculture, 9 entities are offering tools and technologies for the agriculture, 8 respondents are from social/economic field, and 4 are from education and academia environment. As asked by the methodology 68% of the interviewers are from Business/Industry, 12% Society, 10% Government and 10% Academia.

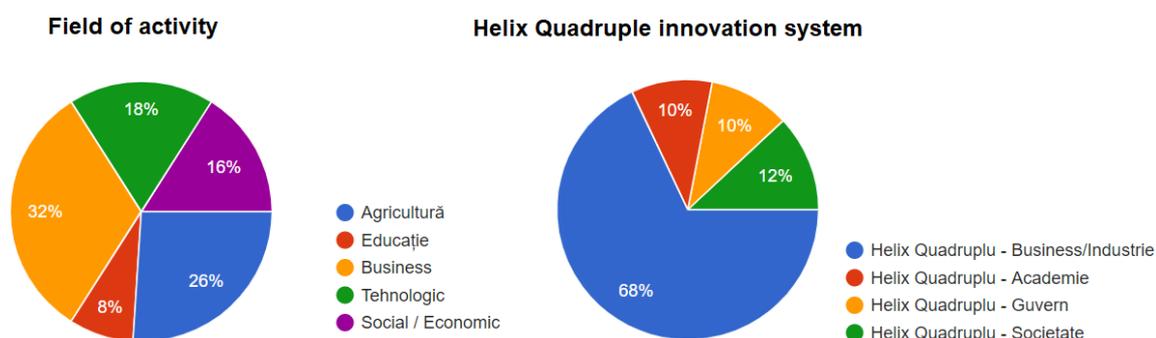


Figure 4.3. Field of activity and the helic representation of respondents

The most of the interviewed entities are Small and Medium Enterprises (SMEs) both from the urban and the rural area, within the agriculture field of activity, 16% are also SMEs but providers of technology in the agricultural sector, 8% are households with agriculture as main activity, 8% are NGOs, 8% Higher Education and Research Institutions, 4% Business Support Organizations, 2% Education and Training center, 6% National Public Authority, 2% Regional public authority, 2% Local Public Authority.

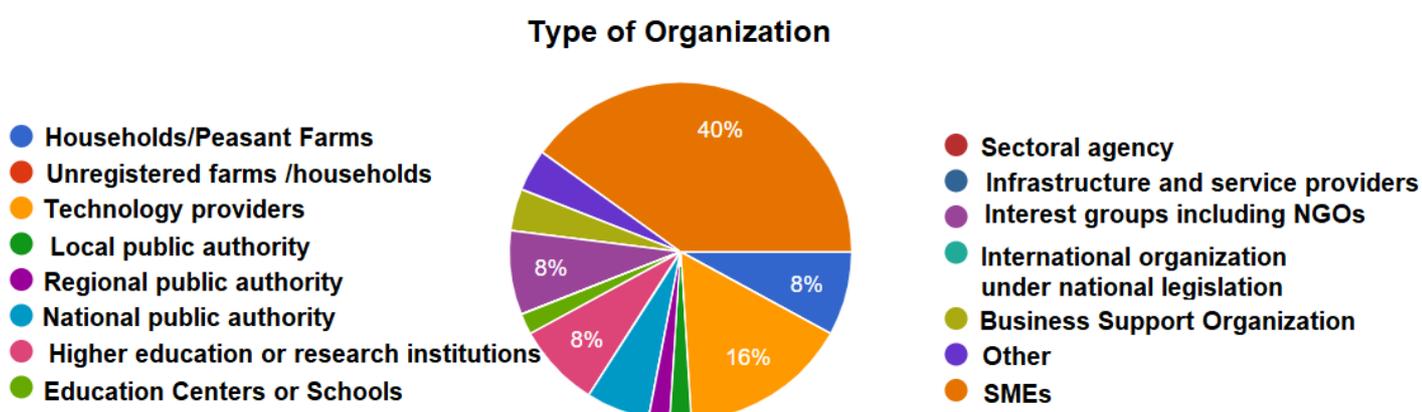


Figure 4.4. Type of organization

The most of the interviewed respondents are SMEs working in the agriculture sector, in rural area, using conventional methods of agriculture, and half of them (54,2%) own (or have in usage/rent) more than 10 hectares of land which means that their production is also considerable. On the other hand 16,7% of respondents are very small farms that have been on the agriculture market recently and are still trying to manage to fit and keep their quota. Around 12,5% cultivate between 4-10 hectares, 8,3% between 2-4 hectares and 8,3% between 1-2 hectares.

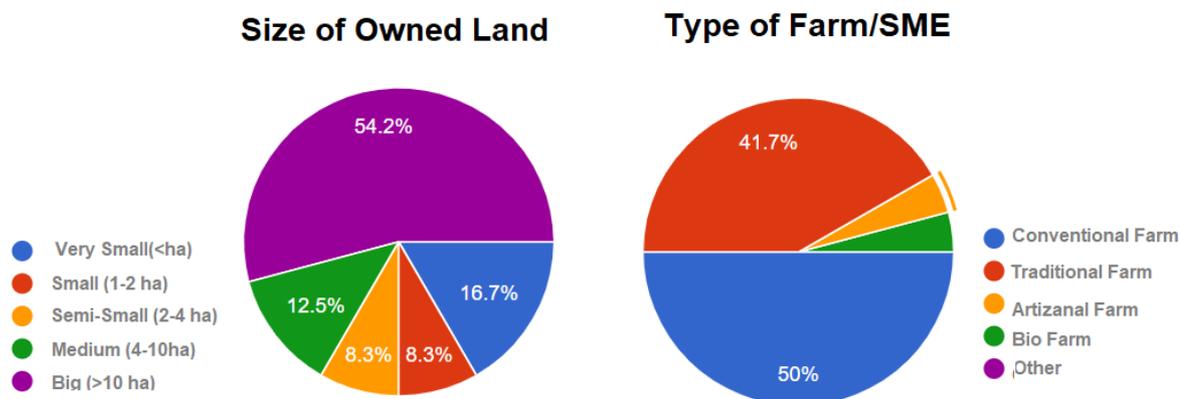


Figure 4.5. Type of farm and size of owned land

Chapter 5. Smart and IoT technologies existent in Republic of Moldova

Agriculture is a mainstay of Moldova's economy. Despite the highly fertile soils, agricultural productivity and yields are constantly threatened by natural hazards such as drought, hails, frosts, severe storms, which multiply already existing processes of land degradation and erosion and volatile market conditions. Water resources for agriculture are scarce, and irrigation infrastructure is almost inexistent among small-scale farmers.

Projections on climate change, manifested through increased rainfall variability and overall drop in rainfall, show an increased demand for irrigation water and a decline in available surface water resources. To sustain livelihoods and overall productivity, CSA investments would, therefore, need to target the development and accessibility of both irrigation and water treatment infrastructure, while improving water-use efficiency through adequate production technologies and knowledge capacity. Climate change is also expected to reduce crop yields across the three agro-ecozones by 10–30% by 2050 (relative to 2013 yields), considering no adaptation measure and given the current water challenges. However, higher temperatures could shift grape cultivation towards the country's northern border and may improve grape quality, by increasing sugar content, which could significantly boost wine quality.

Conservation agriculture techniques, micro-irrigation systems, anti-hail and anti-frost systems, and investments in improved pastures are some of the key practices that



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farmers in Moldova are implementing in response to these climate and environmental threats.

With ongoing EU-integration negotiations, Moldova is bridging the gap between EU markets and the rising markets of the CIS countries. Agriculture plays a significant role in the country; its value added accounts for 15% of GDP, agriculture employs 26% of the labor force, and Moldova has the highest land use for agriculture among the countries that participated in the workshop.

Several information systems have been built to help solve problems in agriculture's priority sectoral needs and contribute to the implementation of agro-industrial sector growth policies:

- the Digital Agricultural Register, to ensure access to operational data on the economic activity of economic agents in the agro-industrial sector and facilitate the provision of public services, including online, according to the single window principle;
- the State Animal Register;
- the System of Identification and Traceability of Animals, a basic subsystem and an integral part of the process of traceability of animal products;
- Management of Strategic Sanitary-Veterinary Measures, to support the preparation, registration and monitoring of the annual strategic plan drawn up by the National Agency for Food Safety;
- Laboratory Management, to generate the information needed for the complete management of sanitary-veterinary and food safety laboratories;
- the Administration of State Agricultural Heritage;
- AGROMAIA, used to monitor and collect operational information on agricultural and harvesting works;
- the Agricultural Equipment Register, used to provide IT solutions for identifying, recording and managing information about the technical potential of economic agents in the agro-industrial sector;
- agricultural subsidy file management, to automate workflows for managing subsidies while offering the possibility of generating different reports and controlling document circulation;

- Wine Register (includes a series of subsystems and modules that automate and ensure the processes of identification, registration, validation, archiving, deletion or modification of the data, according to the activity of the economic agent, to register wine parcels/wineries);
- Management of the Release of Phytosanitary Certificates (includes management of the export and re-export of products of plant origin, the preparation of reports, producer and exporter records, export directives).

EU4Digital, a new EU initiative, will help to improve the digital economy and society in the region. Among other things, the program aims to extend the advantages of the EU Digital Single Market to Eastern Partner States by assisting them in expanding e-services and harmonizing digital frameworks.

From 2020, a new FAO project will greatly boost data collection and management in Moldovan agricultural and rural statistics, bringing them up to international standards and allowing the collection of data on key SDG indicators such as labor productivity and smallholder incomes.

The country's ICT metrics are average or slightly below average: The internet is used by half of the population, and half of the households have internet subscriptions. The cost of telecommunication services is slightly higher than the WS-country average. According to the WEF NRI index, Moldova is making rapid progress in terms of government efforts, especially in terms of online government services and e-participation indicators, and is making good progress in terms of ICT promotion. Other indicators indicate that the country's output is about average, but the effect of ICTs on new services and goods is still a field that needs to be improved significantly¹¹.

The performance of a series of strategies, beginning with the National Strategy for Building an Information Society ("Electronic Moldova" or E-Moldova), adopted in 2005, has been linked to Moldova's progress in ICT growth. The construction of an effective information system at different levels was a top priority of the early strategies. Among the online services introduced were an online fiscal declarations system, a biometric passport and automated biometric border crossing system, the Moldova digital map, mobile digital signature, and other online services (e-record, e-license). The government approved the Technological Transformation Strategic Program or "e-

¹¹ FAO. 2018. Status of Implementation of e-Agriculture in Central and Eastern Europe and Central Asia - Insights from selected countries in Europe and Central Asia. Budapest, 52 pp.



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Transformation" program (supported by the World Bank) in 2011 as the key framework for state ICT progress.

The new "Digital Moldova 2020" plan seeks to create a modern information society. The strategy is accompanied by an Action Plan that outlines the steps that must be taken to achieve the strategy's key objectives. The following are the key pillars of the strategy:

- Access and infrastructure - connectivity and network access improvement;
- Digital content and electronic services promoting digital content and generating services;
- Capacities and utilization - strengthening literacy and digital skills to enable innovation and usage stimulation.

In Republic of Moldova there are a few programmes especially facilitating the process of development, management and implementation of development policies of

Agravista

- Country: **Moldova**
- Organization: National Federation of Agricultural Producers
- Access: Public
- Operational: since 2004
- ICT technology: Web portal

The National AGROinform Federation was established by a network of 30 regional NGOs that were working for the economic development of rural communities. The online service (see www.agravista.md) not only makes a wide variety of market information available to farmers, but producer groups can actually do online trading with domestic and international buyers. In the first year alone, products valued at over USD 90 million were offered for sale online, with more than USD 10 million in contracts being signed. According to the federation's annual report, AGROinform upgraded the Marketing Informational System in 2014. For the MIS, a new software was launched. Farmers placed almost 3 000 commercial offers in the new system, and MIS had 78 000 registered users last year.

www.agravista.md/

"Export Moldova" - Market Assistance website

- Country: Moldova
- Organization: National Agency for Rural Development
- Access: Public, USAID/CNFA
- ICT technology: Web portall

"Export Moldova" has been incorporated into the larger national extension service website. Export Moldova provides a portfolio of important information to traders and producers to facilitate their access to export markets. The information covers 13 products and drills down to detailed market information on export markets, varieties, packaging, and postharvest handling and processes, as well as EU quality standards, the standards endorsed by Global G.A.P., and similar information.

www.acsa.md/category.php?l=ro&idc=178

the agricultural IoT sector , to be mention in this regards, such us « e-Agriculture



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Strategic Program » , « Export Moldova- Market Assistance website » , « Agravista ».A small description of the mis presented below.

e-Agriculture Strategic Program

- Country: Moldova
- Organization: Agricultural Information Centre
- Access: Public
- Operational: since 2012
- ICT technology: Various

The e-agriculture programme, coordinated by the Agricultural Information Centre (AIC), was created in 2012. AIC is an independent economic agency, under the Ministry of Agriculture and Food Industry, responsible for the development and implementation of the e-Agriculture Strategic Program. AIC became the Unique National Operator of all information systems in agri-food sector in Moldova in 2013. The e-agriculture program has three main objectives:

- Modernization of public services through digitization and reengineering the operational processes.
- Streamlining the activities of the entities from agribusiness sector through modern technologies.
- Streamlining the elaboration and implementation of development and monitoring policies from the agri-business sector.

There are many expected results of the programme, especially facilitating the process of development, management and implementation of development policies of the agribusiness sector and providing the business environment with accurate, coherent information, which will enhance business development in the agricultural sector. It also can contribute to the re-engineering of public services and operational processes in agriculture, forecasting business development in agriculture and the professional development of personnel from the agricultural sector.

www.cia.md/eng/about/about_cia

The results of this research show that Moldova has potential for growth in regards to technical equipment used in the agriculture sector. The main suppliers of machineries and tools on the internal market are presented below. Although the technologies in their inventory is vary and of good quality the IoT in agriculture are still lacking from their portfolios. Below are presented the top providers of technologies for the agriculture sector in Republic of Moldova.



Figure 5.1. Providers of technologies for the agriculture sector in Republic of Moldova

These entities provide such smart technologies as : automatic agricultural weather station, combine harvesters and tractors, deep plows, sowing equipment, trailers and semi-trailers, drills, feeders, loaders, compact cultivators, fertilizer harvesters minerals, vegetable seeders, spare parts, grain cleaning and drying equipment, milling cutters, tractors, soil preparation equipment, sprinklers, headers , driving systems, telescopic loaders, precision navigation and agriculture systems, vineyard shredder,

As the research showed on the market there are present few companies that provide with drones, integrated systems, farming OS control systems.

Thus there can be stated a lack of smart tools that could ease the work of entrepreneurs on their farming and agriculture activities.

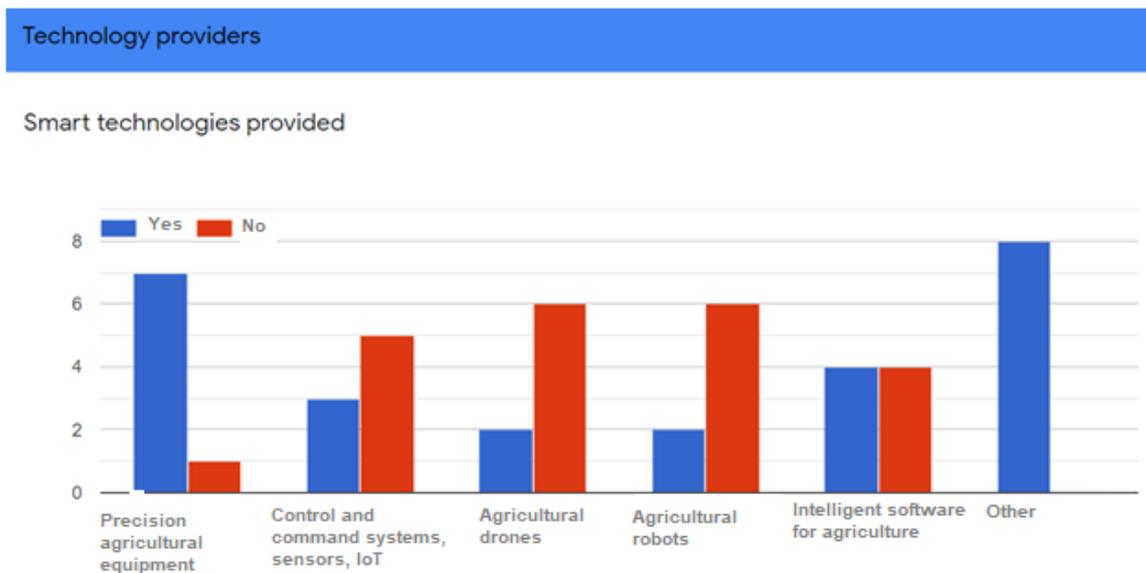
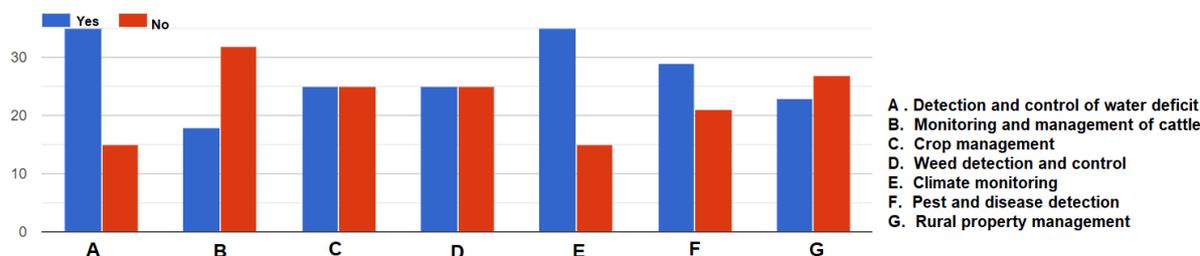


Figure 5.2. Smart technologies provided by the local distributors.

Chapter 6. Agricultural needs of the rural communities in Republic of Moldova

Investigations into the level of preparedness for smart agriculture

1. What smart agricultural application do you know?



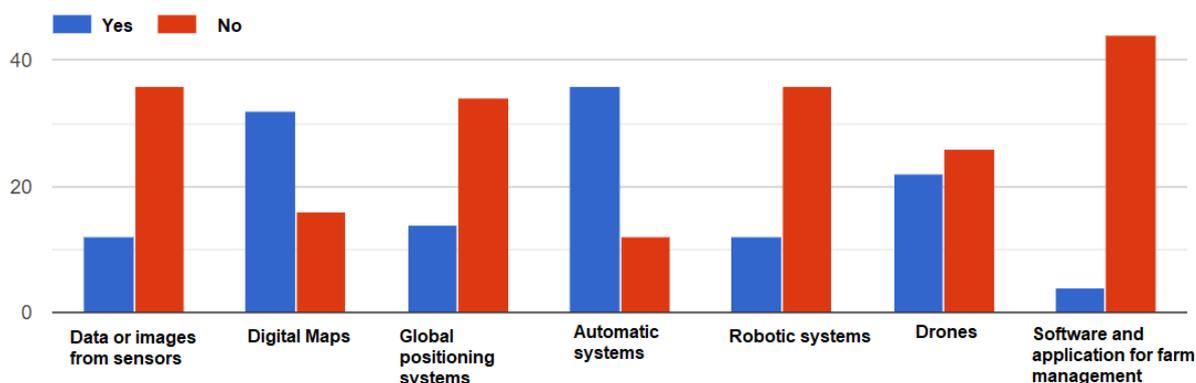
Digital technologies can help Moldovian farmers deliver safe, environmentally friendly and quality food. These technologies not only help farmers to produce more with more few resources , but they can also contribute to combating climate change. Existing and new technologies, such as the Internet of Things (IoT), artificial intelligence, robotics and large volumes of data can all contribute to streamlining processes and can lead to the creation of new products and services.

Digitization can also play a role in creating a better life in rural area of Republic of Moldova. The use in the future of digital technologies will be increasing most important for farmers and other rural enterprises, to enable them to provide sustainable solutions to current and future challenges. As an aim to be set for the National Public Authorities of Republic of Moldova is the digitalization of the agricultural sector and rural areas in Moldova and empower them through data.

Although the digitization of the agricultural sector brings many benefits, and a number of actions and tools have already been implemented, there are still barriers to unlocking its full potential in our country.

Analysing the data from the questionnaire based on the knowledge of the repondents it can be stated that the most common know and used intelligent technologies are digital maps, automatic systems and drones. Still as the answers are subjective we can only state that the info provided by the respondents is not enough to state the reality of the level of the technologization of the rural areas and the use of such technics in the agriculture sector of Republic of Moldova.

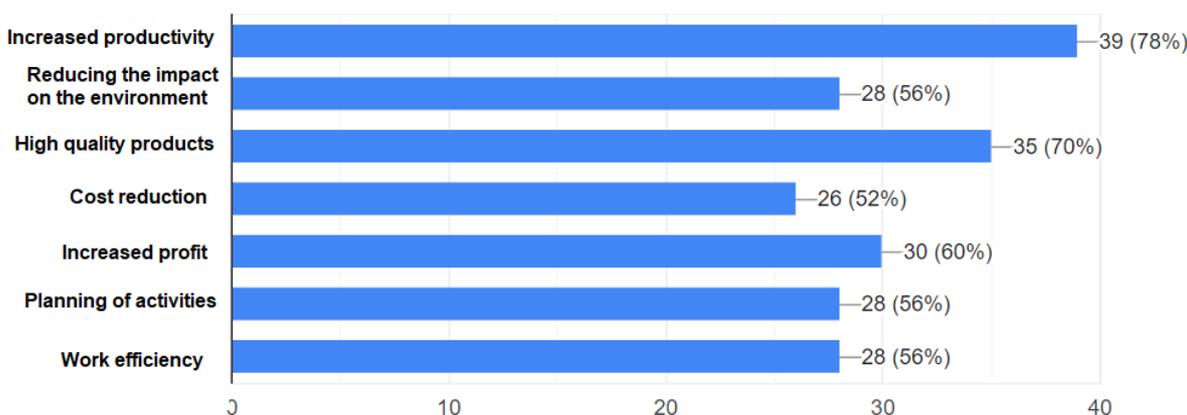
2. In your territory, what kind of intelligent agricultural technologies are used?



Globally, agriculture has advanced significantly. By using technology, agriculture can achieve an efficiency that our parents or grandparents never saw as possible. Technology is advancing at a dizzying pace, and now we are not just talking about software and hardware solutions, but especially about technology capable of interpreting all collected data (eg data entered into the management system, data transmitted by weather stations, various sensors or drone). In addition, there is also the knowledge transmitted by previous generations, information that can be unique to each farm and related to the geology and microclimate of the area. All this, put together and interpreted properly, can be the basis of a "recipe" to farm efficiently, to use resources optimally for maximum results.

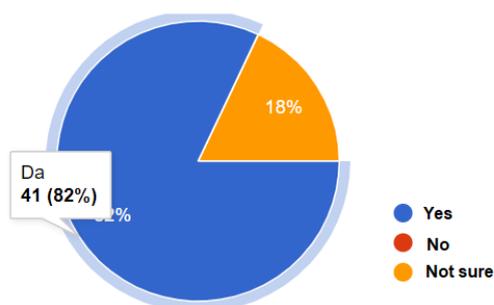
The benefits of using smart agriculture from the point of view of our repondents are increased productivity (78%), high quality products(70%), incresead profit (60%) , planning of activities (56%), work efficiency (56%), reducind the impact on the environment (56%), and cost reduction (52%).

From your point of view, what are the benefits of using smart agriculture?



Due to consumers who want quality food at the lowest possible prices, but also to factors that cannot be controlled, such as unfavorable weather conditions, in general, farmers' incomes are quite low. The supply chain is also becoming wider as the distribution network moves further into the globe, with growing demand for farmers to produce more for less. Farmers will need to find the means to finance such cutting-edge technologies and minimize operating costs, while maintaining effective margins to be competitive.

From your point of view, would farmers in your area want to adopt smart farming technologies?



Only 18% of respondents were not sure of the need of smart farming technologies in their activities and in our country in general, but the majority (82%) consider this a must.

The agricultural sector in the Republic of Moldova has been strongly influenced by climate change in recent years. Torrential rains followed by extensive droughts remove nutrients from the soil and affect the fertility and ability of the soil to grow crops. Under



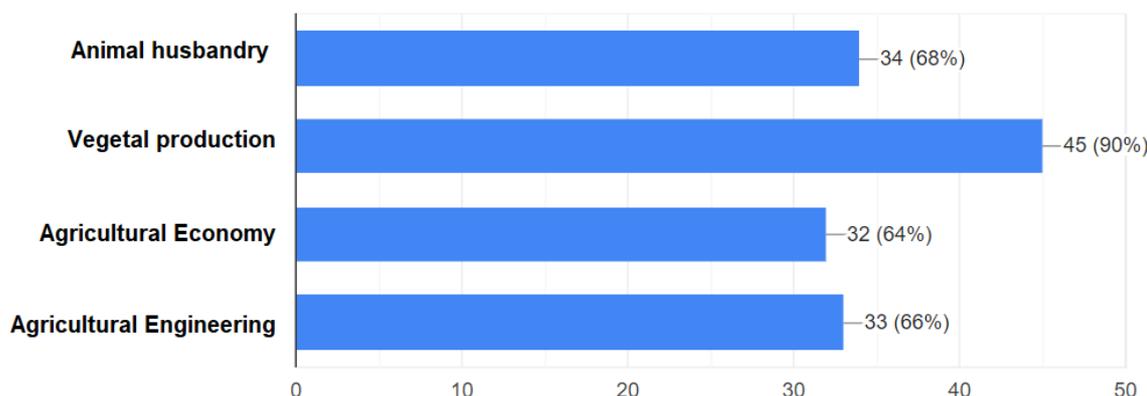
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these conditions, domestic producers are thinking of different strategies to cope with and innovate agricultural products, the technology used and the ways of promotion.

Those respondents that stated the need of smart agricultural technologies in Republic of Moldova, mentioned the most need in the vegetal production, crop growing and soil cultivation (90%) , thus being mostly determined by the fact that the most respondents have their main activity in this field area. Animal husbandary (68%) is another field that could benefit from the IoT, and also agricultural engineering (66%) and agricultural economy (64%).

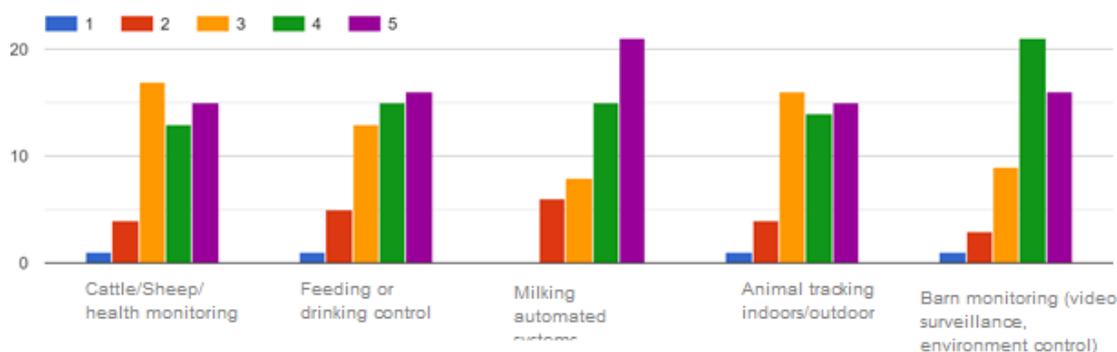
From your point of view, what are the agricultural fields that need smart agricultural technologies in your area?



The Republic of Moldova has an enormous potential to achieve performance in agriculture, if farmers would adopt more innovations and implement modern technologies in production. Many of them have already been convinced of the efficiency of digitizing agricultural businesses, but for some, however, digitization is about the future.

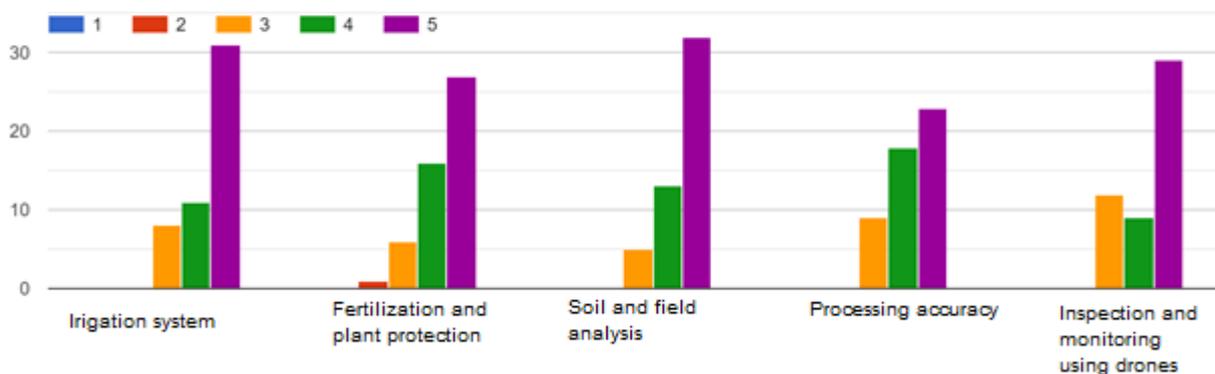
In the field of animal husbandary the need to adopt intelligent agricultural technologies was stated mostly in the area of automated milking and cattle health monitoring, but nevertheless the respondents considered that they could benefit if this types of technologies would be implemented also in tracking animals indoors/outdoors and in barn monitoring, due to the level of thefts in the rural area.

On a scale of 1 to 5, please specify the need to adopt intelligent agricultural technologies in the field of animal husbandry:



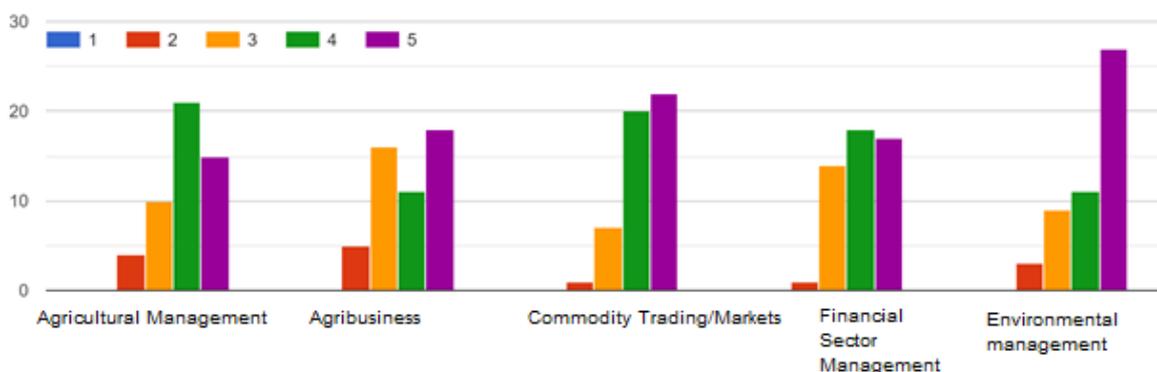
In the field of plant production the need to adopt intelligent agricultural technologies is felt needed in all the areas, but the most in irrigation and soil and field analysis, follow closely by the need of IoTs in the fertilization and plant protection, processing accuracy and inspection and monitoring using drones.

On a scale of 1 to 5, please specify the need to adopt intelligent agricultural technologies in the field specific to plant production:



The need to adopt smart agricultural technologies were appraised as being very high especially in the environmental management field and also for the trading sector and using it in markets, for selling the agri products. The IoT is not used enough in the field of agricultural management, as the management itself is being neglected at some point, thus the respondents stated the high need of smart technologies in this sector, and also in the financial sector.

On a scale of 1 to 5, please specify the need to adopt smart agricultural technologies in the specific agricultural economic field:



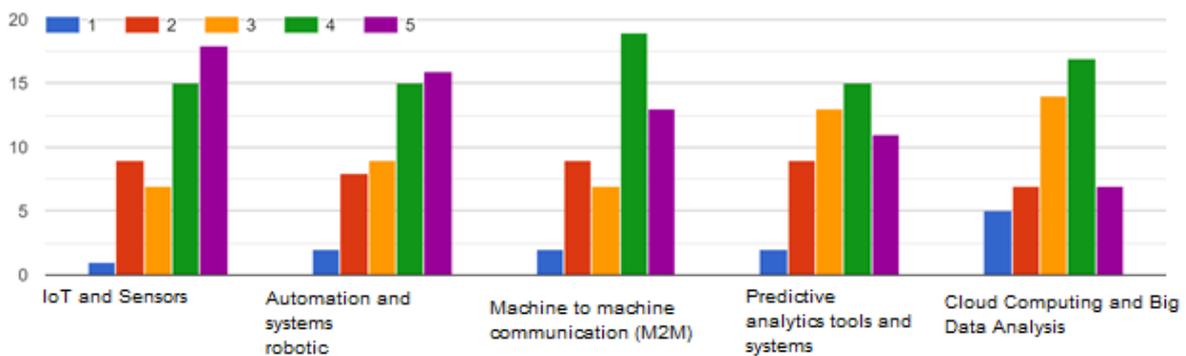
Stating the need of intelligent technologies and systems in the field specific to agriculture engineering the most demanding is the IoT and sensors and the automation and robotic systems. Technologies that would ease the machine to machine communication (M2M) are also needed as this can contribute to a more efficient time management and help the agriculture sector is by providing insights that could make farmers and other members of the agriculture supply chain more aware of risks.

There are situations at risk, where illnesses can spread quickly in a herd of hundreds or thousands of cows. In many instances, the sicknesses contracted by a few cows spread to dozens of others before farmers realize the problem. Thus the need for several IoT gadgets is felt in order to prevent that issue and others. Some of them could monitor fertility, which could be specifically advantageous on properties where farmers depend heavily on successful breeding. Others could notify farmers when cows are in periods of high milk production. Based on what the data says, farmworkers can do things like adding a type of grain that promotes lactation to an animal's feeding regimen. Sensors if implemented could collect data about behavioral abnormalities, too. Since those variations could be the first sign of a severe illness, the information could help farmers be proactive in curbing possible health issues by isolating cows that may be ill. Since these sensors typically receive data continually and could be used on farms with thousands of cows, it's easy to understand why data centers are instrumental in helping agriculture professionals collect and retrieve information.

Predictive analytic tools and systems are less demanding but not to be ignored as such tool are already used in the agriculture sector in regarding to meteo forecast etc.

Agricultural supply chains present a number of challenges for farmers and distributors. Unlike most goods, food products are perishable and can pose a health risk if they're not handled properly during transport. Data analytics can greatly improve the way these products make their way from the farmers' fields to markets around the world. Distributors will be able to identify inefficiencies in their supply chains to help agricultural products get to their destination faster and more cost-effectively. Retailers can use sales and inventory data, as well as information they've gathered about customer behavior, to minimize waste and excess inventory while staying a step ahead of market demands.

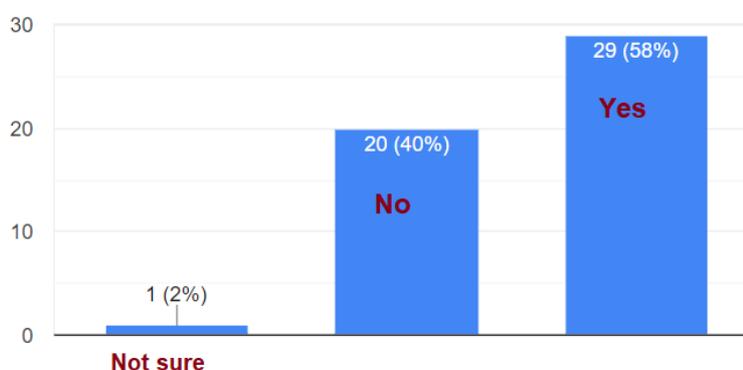
On a scale of 1 to 5, please specify the need for the adoption of intelligent technologies and systems in the field specific to agricultural engineering:



The challenges foreseen in agriculture as far as the need to double food supply is concerned are now putting agricultural sustainability at par with ensuring food security. There is a need for a resource efficient global food system that takes into consideration the aspect of sustainability. For example, if you are struggling to ensure efficiency in how you use water in your farm, ways of reducing soil erosion and ensuring minimum degradation, or even minimizing energy input, you are not alone. Every farmer all over the work hopes to achieve all these and other goals at the minimum possible cost. However, such goals post some of the highest requirements in agriculture which cannot be achieved successfully through traditional approaches of farming. With the increase in the demands and the need for sustainable agriculture, it is becoming really necessary for farmers and the associated stakeholders to invest a lot in knowledge and more sophisticated machines and devices. Unlike in the past, nowadays farmers can use smart farming approaches to collect data and make informed decision from it. There are

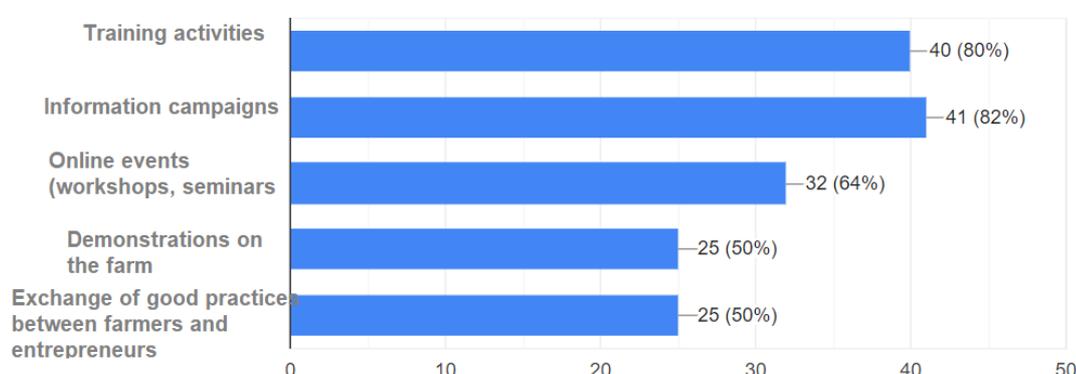
are diverse data analysis techniques that farmers can use. For example, though smart technology, farmers can establish the fertility of their farmland through the analysis and the comparison of satellite images and in the end use the data to derive the yield potential of a given land. Thus most of the respondents stated that smart technologies can help fix major socio-economic challenges.

In your opinion, can smart technologies and IoT lead to proper management of agriculture and address other major socio-economic challenges in your field, such as brain drain, youth unemployment and wasted intelligence?



For the initiatives to promote smart farming in Republic of Moldova the most common requested are training activities and information campaigns, followed by online events (due to the COVID-19 outbreak) that could help local farmers get acquainted to new possibilities in the smart farming area.

In your opinion, what kind of initiatives are appropriate to promote smart farming in the farming community in your territory?





Conclusions and recommendations

Smart farming is the use of modern agricultural technology to increase output while also preserving and improving the land resources on which production is based. SA supports the idea of increasing yields and income while still ensuring the provision of local and global environmental benefits and services. The principles of SA are to restore the land, optimize crop production inputs, including labor, and maximize income. In contrast to other approaches, conservation agriculture advocates a set of values rather than a specific technology to achieve conservation goals. Through reducing the use of fossil fuels, pesticides, and other toxins, and conserving environmental integrity and facilities, agricultural communities become providers of more sustainable living conditions for the wider community.

Adoption of new and unfamiliar agricultural practices is traditionally a difficult process because non-leader smallholder farmers, particularly the poorest and most vulnerable, are hesitant to take risks and depart from generations of conventional approaches.

Agriculture has no future without digitalization. The widespread use of technological tools will also support innovation in agriculture and increase its productivity. Unfortunately, universities do not provide enough knowledge to students about digitization / software, nor there is enough information provided by the public authorities in regards to digitalization of agriculture and the importance of it in the nearest future. The development of the Smart Agriculture (Agricultural Smart Technologies) sector would require new knowledge and skills, which should be implemented in educational institutions. The Agrarian University should add to their curriculum such a course - technologies already implemented in agriculture. Large companies in the agricultural field, do not have knowledge of using digital tools and do not know how to capitalize on solutions. Therefore, a training phase is needed for their employees in this regard. For the digitization of the agricultural sector, the necessary financial resources are very large and there is an acute lack of funds. For example, a platform develops and becomes functional in about 7 years. The existence and granting of subsidies to intensify the digitization process in agriculture is needed today more than ever.

SA encourages minimal soil disturbance (zero tillage and direct sowing), balanced chemical application, and good management of residues and wastes. This decreases land and water contamination, as well as soil degradation, as well as long-term reliance on external inputs, environmental management, water quality, and water use efficiency, and GHG emissions. SA produces excellent results in both small and large-scale cultivation, and it is adaptable to climate change-related issues such as decreased rainfall. In comparison to conventional methods, SA allows for increased soil production while consuming less labor. Even if market access conditions or crop prices stay stable, higher yields result in higher profits.

Private businesses are also involved in providing farmers with digital solutions, including agrometeorological data. Orange Moldova has begun to roll out digital solutions for farmers, including GPS fuel control and vehicle tracking – to reduce prices, conserve fuel, avoid theft, and facilitate auto-guidance – as well as digital tools for capturing, storing, and analyzing weather data to protect crops. The services will be available via high-speed Internet throughout the country.

Despite the significant benefits of Smart Agricultural practices to productivity, resilience, and mitigation objectives, many small-scale farmers are still reluctant to such investments. Limited access to relevant technical assistance and to adequate financial resources, insufficient water resources and technologies for irrigation are some of the main barriers to adoption of CSA practices. Moreover, long-term benefits from investing in CSA are generally unknown to farmers, which makes them skeptical about new agricultural paradigms. Developing policy and institutional mechanisms to deliver relevant extension and financial services to farmers in a timely and effective manner is key for developing a climatesmart agricultural sector in the country. A first step toward this is strengthening the early warning, weather, and hydrological information systems, accompanied by publicprivate mechanisms of compulsory insurance against natural hazards, accessible to small-scale farmers. Rural infrastructure development could help re-emphasize the importance of agriculture as an economic activity, especially since rural areas are the main providers of food for urban populations, and could bring a new agricultural development paradigm, where farmers and investors would have more incentives to invest into long-term solutions to climate-related threats.

It has already been determined that in order for SA to be more widely accepted and enforced, a concerted effort must be made to raise awareness about climate



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change, the effect of climate change on Moldova's agricultural sector, and SA as a form of climate change agriculture that benefits both farmers and the environment.

It was recommended that value chain players, researchers, individual farmers, agriculture companies, forest managers, extension service providers, governmental workers, educators, and NGOs support the development of platforms to help create awareness about Smart Agriculture.

Governments must be able to express their visions, set strategic goals, determine outcomes, identify trade-offs, develop action plans, and negotiate and compromise on individual contributions to the plans' implementation. Although individual smallholders may adopt SA practices, a coordinated response led by a strategic vision incorporating efficiency, connectivity, and conservation is needed to spread SA across the landscape.

In rural areas, the private sector has a dual structure, with a booming modern competitive sector and a static subsistence sector that is being increasingly marginalized. The main challenge is to bridge the gap between the two segments, as well as to re-establish a middle class of farmers and agribusinesses that can provide appealing non-emigration opportunities, especially to young people. Mentoring, extension, and business consulting services are all services that NGOs and service providers can offer.

The country analysis of Moldova's ICT-centric innovation environment reveals that existing policies are focused on international interests and should be refocused on national strengths. Many stakeholders believe that a holistic plan should prioritize particular ICT regions, other economic sectors, or specialized niches. Nanotechnology, e-agriculture, and the aerospace industry were among the suggested fields. ICTs, agriculture and food processing, biomedicine, and energy are the smart specialization areas defined in Moldova (where agriculture also plays a role).



D.T1.3.1. Regional analysis

