Chapter 2
SUSTAINABILITY OF THE AGRICULTURAL SECTOR OF THE REPUBLIC OF MOLDOVA: PUBLIC SUPPORT TO COMBAT THE EFFECTS OF CLIMATE CHANGE

LUCAȘENCO EUGENIA
PhD, Superior scientific researcher,
National Institute for Economic Research,
Academy of Economic Studies of Moldova
eugenia_lucasenco@yahoo.com
https://orcid.org/0000-0002-5032-7963

Alexandru CEBAN
Scientific researcher,
National Institute for Economic Research,
Academy of Economic Studies of Moldova
ceban_alexander@yahoo.com
https://orcid.org/0000-0002-3300-4054

Abstract: *The agricultural sector of the Republic of Moldova represents a significant element of the national economy. It has an important contribution to the GDP formation, provision with employment of rural population and ensuring food security. Nevertheless, it faces severe threats as a result of the effects of climate change, which include droughts, late frosts, floods and degradation of soil area. This chapter studies the agricultural sector's sustainability in the framework of these challenges, emphasizing the role and contribution of public support as a key policy tool for adaptation and mitigation. Based on the analysis of quantitative and qualitative data from the period of 2014–2024, there is provided an overview of the structural aspects of the sector, production trends, foreign trade, and main challenges that it faces, together with the analysis of climate current trends such as increasing temperatures and declining in the quantity of precipitation. The present analysis aims to integrate agricultural, economic and environmental aspects, as well as public policy, through the evaluation of the effectiveness of specific subsidies in the field of promotion of climate-resilient practices like irrigation systems, support and anti-hail equipment, organic farming, conservative agriculture and risk insurance. The chapter also reflects the review of the national legal framework on climate change and agricultural sector, including the alignment with EU CAP standards, and presents responsibilities and*

attributions of institutions in the field. Analysis of subsidy allocations for environmental aspects reveals oscillating, but increasing support for environmental measures. The conclusions express the need for enhanced policy integration and monitoring in order to boost the resilience of the agricultural sector, providing empirical evidence and recommendations to support the development of a sustainable sector in the context of climate effects and vulnerabilities that it causes.

Key-words: *sustainability, agriculture, resilience, public support, subsidies*

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Introduction

The agricultural sector of the Republic of Moldova plays an important role in the economic and social development of the country, due to its contribution to GDP formation, provision of employment, and ensurance of food security for population. At the same time, the sector's performance, development and long-term sustainability are threatened by the emerging impacts of climate change[108]. Prolonged recent drought phenomenon, unanticipated late frosts, large rainfall events, soil erosion, and declining soil fertility have become significant challenges, directly affecting agricultural productivity and food security of the country.

Under these circumstances, the government subsidy policies represent a major and vital instrument for supporting farmers in their actions to adapt to climate change and mitigate the adverse effects[109]. Targeted financial support in this regard can stimulate the adoption of sustainable agricultural practices, promote the use of climate-resilient technologies, and encourage investments in resource-efficient infrastructure, such as modern irrigation systems, renewable energy sources, soil conservation techniques, etc.

Therefore, the research aims to explore an existing breach in the current literature by combining two interconnected dimensions:

[108] Kryszak, L., Czyzewski, B., Sapa, A. Lucasenco, E. (2025). Does a sense of intergenerational commitments modify farmers' preferences for conservation tillage? Evidence from the choice experiment in Moldova In: Ecological Economics, 2025, vol. 233, pp. 1-13. ISSN 0921-8009. DOI: https://doi.org/10.1016/j.ecolecon.2025.108606

[109] Zvyagintsev, D., Lucaşenco, E., & Ceban, A. (2025). Towards better policy monitoring: operational survey results on the impact of agricultural subsidies in Moldova. Economy and Sociology, (2). https://doi.org/10.36004/nier.es.2024.2-09

- the sustainability of the agricultural sector in a country with high effects of climate changes:
- the role of specific subsidies as a policy instrument for climate change adaptation and mitigation.

In this regard, the Republic of Moldova represents a relevant example due to its dependency on the agricultural sector, vulnerability to climate risks, and the ongoing process of policy alignment with EU standards.

From a scientific point of view, the analysis provides an integrated approach that comprises agricultural economics, environmental science, as well as public policy analysis. It relies on quantitative and qualitative methods to evaluate the effectiveness of subsidies targeted for boosting climate resilience. The findings are of interest for policymakers, agricultural stakeholders, researchers and practitioners.

Moreover, generation of empirical evidence and policy recommendations, will contribute to advancing the academic discourse on sustainable agriculture and climate policy design, thus holding substantial theoretical and applied significance.

Overview of the Moldovan agricultural sector

The role of agriculture in the national economy

The evolution of the Gross Domestic Product, total Gross Value Added and the input of the agricultural sector, including forestry and fishing, to the economic development of the Republic of Moldova, represent one of the most important indicators in providing the current evolutionary trend of the sector in the framework of national economy. Thus, GDP has constantly increased from approximately 132 bil. MDL in 2014 to over 303 bil. MDL in 2023, reflecting a general economic expansion, while total GVA has followed a similar trend, from 114 bil. MDL to 262 bil. MDL. The contribution of agriculture was variable, with the highest value of output in 2021 (25.6 bil. MDL), but has diminished in relative terms, indicating a diversification of the economy.

The share of agriculture in GDP and GVA has a declining trend, with minor upward fluctuations in 2017 and 2021. Thus, in 2014, agricultural sector accounted for 14.1% of GDP and 16.2% of GVA, while the same shares decreased to 7.1% and 8.2%, respectively, in 2023, pointing on a decrease in dependence on the agricultural sector. Different annual variations of the share, like the increase in 2021 which was influenced by favorable weather conditions, followed by decreases in 2022-2023, are due to the challenges and difficulties that Moldovan agriculture had faced, such as the Covid-19 pandemic, Russian-

Ukrainian war, climate change adverse effects, supply chain disruptions and important market fluctuations due to price volatility. These data provide for some trends of the potential economic transition to non-agricultural sectors, although agriculture remains an important pillar of the national economy.

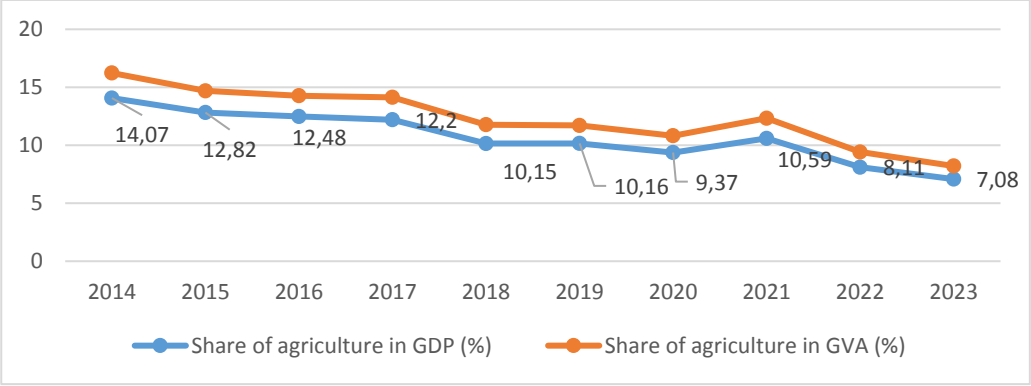

Figure 1. Share of agriculture, forestry and fishery in GDP and GVA, %
Source: developed by authors, based on data from NBS[110]

The existing data on employment by economic activities present the evolution of the structure of the labor force in Moldova during the period of 2014 – 2024. Agriculture still has a significant share in total employment and remains one of the largest sectors throughout the analyzed period, due to the large percent of population living in rural areas, but presenting some decreasing trends recently. Agriculture, including forestry and fishing fluctuated from the maximum of 24.5% in 2018 to a minimum of 18.1% in 2024, indicating a gradual reduction in dependence on this sector. Annual differences as the increase from 2016 of 24.3% or the considerable decrease in 2024, could be related to some exogen factors like labor migration, adverse climate conditions, changes adopted in agricultural policies, etc. Totally, the share of agriculture employment in total employment decreased by approximately 5.6 percentage points over the period, pointing on the transition towards a more diversified economy, including in rural areas.

If to carry out a comparison with other sectors of the economy, employment in agriculture was overtaken by employment in public administration, education and health, which increased from 21.7% in 2014 to 24.7% in 2024, thus becoming the second most important sector (after being first during 2014 – 2016). At the same time, the employment in industry and construction had relatively stable values, with shares between 13 - 15% and 5 -

[110] National Bureau of Statistics (2025). Database. www.statistica.gov.md

8%, respectively. The share of employment in wholesale and retail trade and related services varied between 17 - 19%, reflecting some resilience in times of 2020 Covid-19 crisis. Other activities increased by the end of the analyzed period, accounting for 11.1% in 2024, pointing on a potential expansion of activities from emerging sectors. This distribution emphasizes once again the challenges of the agricultural sector, such as vulnerability to climate change, external shocks, lack of modernization, which have contributed to the migration of workers to sectors with better wages, more stable conditions or even abroad.

The declining trend in the share of agriculture employment in the total employment by all economic activities emphasizes the need for initiation of structural reforms aimed at increasing productivity of the sector, as well as its attractiveness. There is an urgent need for considerable and targeted investments in modern technologies and diversification of agricultural production. Agricultural activities may be accompanied by non-agricultural ones, specific for rural environment in order to mitigate the effects of excessive migration phenomenon. Since 2018, the number of total employees has increased from 794.1 thous. people to 853.9 thous. people in 2024. In this context, the downward trend observed in the agricultural sector could point out on the increasing urbanization processes and migration, but also raises some issues related to food security risks and further development of the rural area. Thus, agriculture as a distinct sector, needs to be supported by public policies aimed at reducing regional disparities and appeal to young people and women to get involved in it, in order to avoid in the future, the excessive dependence on the public and service sectors.

When analyzing the total area of the land fund, it remained stable during 2011 - 2024, varying slightly from 3384.6 thous. ha in 2011 to 3384.9 thous. ha in 2024. Agricultural land still dominates the land use structure, occupying the largest share, with a surface of 2498.3 thous. ha in 2011 (73.8%) and 2467 thous. ha in 2024 (72.9%). This minor decrease points on the subtle redistribution to other categories, but agriculture still holds the largest share of occupied lands. If to carry out an analysis by categories within the agricultural land, arable land holds the highest share and recorded a considerable increase from 1812.7 thous. ha (53.6%) in 2011 to 1870.5 thous. ha (55.3%) in 2024. This suggests on the intensification of crop cultivation. On contrary, perennial plantations decreased from 298.8 thous. ha (8.8%) to 265.7 thous. ha (7.8%), with diminishes in the areas of orchards from 133.3 to 120.2 thous. ha and vineyards from 149.6 to 120.5 thous. ha. This may take place due to conversion of land to arable type or land abandonment due to economic and climate factors.

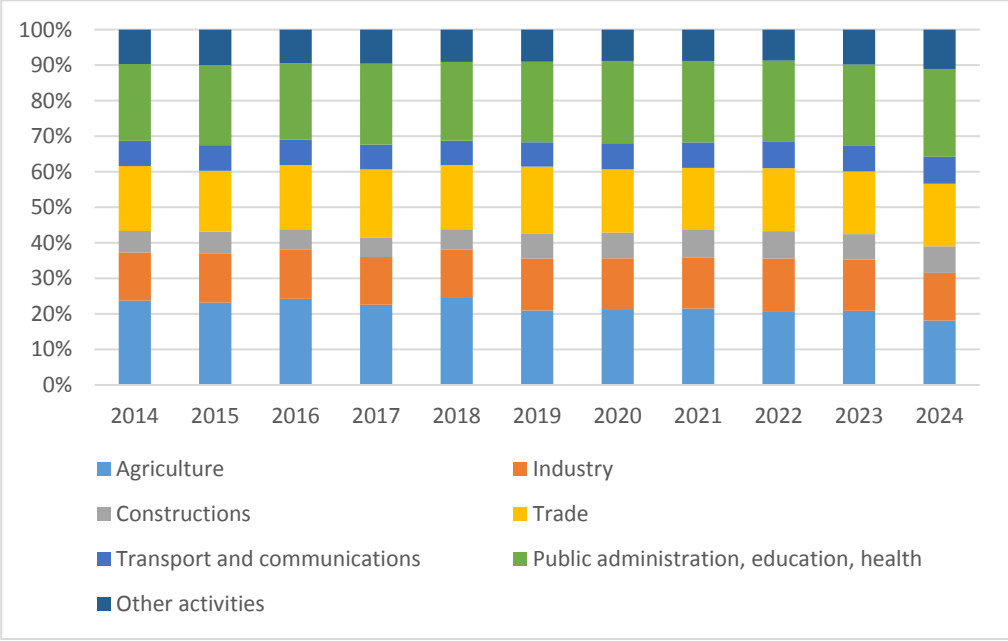

Figure 2. Employment by economic activities, %
Source: developed by authors, based on data from NBS[111]

Pastures have a downward trend, decreasing fom 350.4 thous. ha (10.4%) in 2011 to 308.5 thous. ha (9.1%) in 2024. At the same time, hayfields remained near the area of 2.1 - 2.4 thous. ha (0.1%). Fallow lands, although having a small share (0.8% on average during the analyzed period), varied from 34.2 thous. ha to 19.9 thous. ha, indicating a reduction in long-term unused areas. On the other hand, due to promoted policies of forestation and environmental protection, forests and forest vegetation increased from 463.1 thous. ha in 2011 to 496.2 thous. ha in 2024, accounting for 14.7% of the territory coverage. Areas covered with water resources, including rivers, lakes and ponds, remained relatively stable at approximately 96 - 99.6 thous. ha, without major variations, reflecting the natural and unchanged character of these resources.

Thus, the land distribution in Moldova presents the commitment of the country towards the development of the agricultural sector, at the same time, being noted some signs of sustainable actions, like forestation and preservation of biodiversity. At the same time, the decline in perennial plantations and increase of arable land rise come concerns on the country's specialization in intensive agricultural practices for the raw material (cereals, oleaginous crops) cultivation, whose productivity depends highly on climate conditions and are more often

[111] National Bureau of Statistics (2025). Database. www.statistica.gov.md

suffering from lack of water resources. These evolutions highlight the necessity for a constant monitoring of the land situation, needed for a further balanced management of resources.

Structure of the agricultural sector and main production branches

During 2010 – 2023, the total agricultural production in Moldova has recorded a general increase in monetary values, from 19.873 mil. MDL in 2010 to 41.800 mil. MDL in 2023. The main component of the agricultural sector is represented by plant production, which ranged from 13.616 mil. MDL in 2010 to a maximum of 37.838 mil. MDL in 2021, then decreasing to some extent to 28.837 mil. MDL in 2023. On the other hand, livestock production showed closer to stability values, increasing from 5.786 mil. MDL in 2010 to 11.850 mil. MDL in 2023, but with an almost constant share in the total of agricultural production. Agricultural services occupy a minor part of the output, increasing from 471 mil. MDL to 1.114 mil. MDL over the same period. Overall, the Moldovan agricultural sector is highly dependent on crop production, which is influenced by a series of factors like weather condition, volatility of market prices, disruptions in supply chains, etc.

If to analyze the volume indices of agricultural production, there are present some obvious fluctuations in some specific periods. Thus, in 2016 there was an increase with 118.8% compared to 2015, followed by a sharp decrease in 2020, reaching 72.8%, caused by the severe drought and Covid-19 pandemic restrictions. 2021 was characterized by a spectacular increase up to 157.9%, followed by a same spectacular decrease in 2022 till 70.8%. Having the highest share in the agricultural output, plant production is the most volatile sub-sector, with considerable increases like 126.6% in 2016 and 185.5% in 2021, but also with dramatic decreases to 64.3% in 2020 and 64.1% in 2022, being explained by the susceptibility of the sector to adverse climate phenomena.

On the other hand, the livestock production has demonstrated a relative stability, with figures between 94% and 102.5%. These indices highlight the resilience of the livestock sector compared to the plant sector, its less influence from climate change, at least in short and medium-terms, pointing that the Moldovan agriculture will be able to benefit from diversification of activities in order to reduce the risks associated with plant production fluctuations.

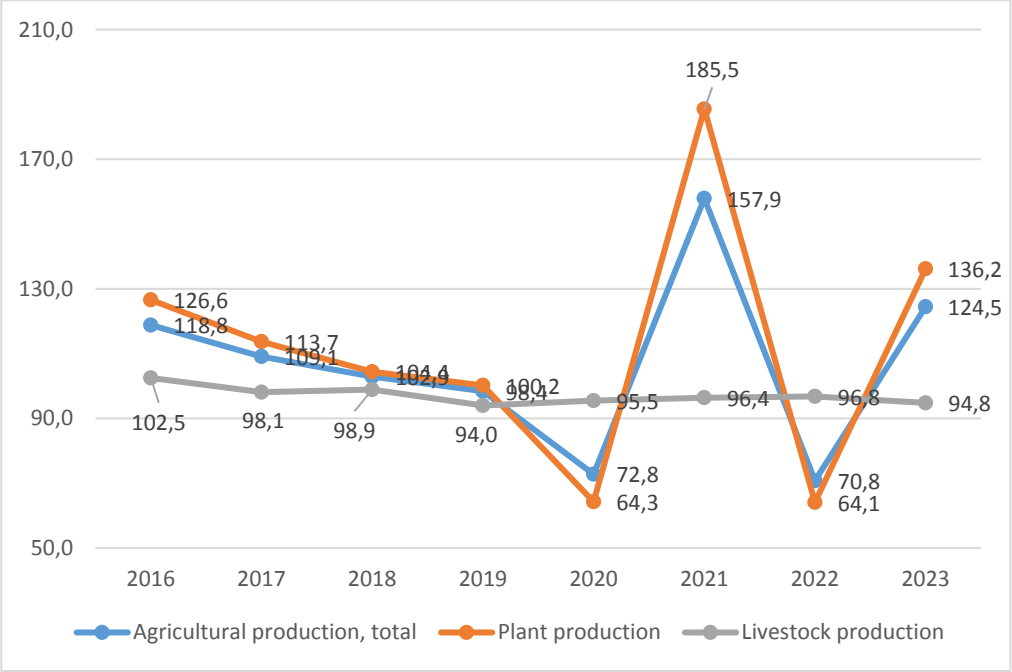

Figure 3. Volume indices of agricultural production, in all categories of producers (previous year = 100)

Source: developed by authors, based on data from NBS[112]

During the period of 2000 – 2023, the plant production was dominant in the total structure of production, accounting, on average for about 70%. Livestock sector provided for about 30%, on average, during the same period. Noteworthy changes in plant production were represented by decline of its share till 58% in 2015 and a maximum value of 81.1% in 2021. At the same time, livestock production reached 42% in 2015, with a shrinkage to 18.9% in 2021. The existing fluctuations reflect some periods of volatility, influenced by external factors like weather conditions, market dynamics, policy changes, etc.

In the sub-sector of plant production, cereal crops are among the most variable ones, starting with a 25% share in the total agricultural production in 2000, then going down to the minimum of 15.1% in 2020 and reaching the maximum share of 37% in 2021. In 2023 it accounted for 26.8%.

Since 2020, sunflower production has had a notable upward trend, from 5% to 15.1% in 2023, pointing on the intensive use of land for growing sunflower and other types of oilseed crops. As for production of multiannual plantations, the share of grapes decreased constantly from 12% to 6.2%, due to some existing

[112] National Bureau of Statistics (2025). Database. www.statistica.gov.md

issues in the field, changes of specialization, and difficulty in facing challenges. Moldovan fruits and nuts share increased from 3% to 9%, with maximum values of 13.4% reached in 2018, while potatoes and sugar beet have been generally diminishing, from 8% to 2.7% and 3% to 0.8%, respectively. Increases observed in the shares of plant production, especially of sunflowers and cereals like in 2021, are due to the proper weather conditions, as well as increasing global demand for grains and oils. Declines in grapes and sugar beet might be linked to climate change impacts, such as droughts and frosts affecting yields.

Animal production's subcomponents reveal a general downward trajectory in traditional outputs. Milk's share fell from 13% in 2000 to 5.4% in 2023, and eggs from 4% to 2.6%, indicating reduced dairy and poultry farming intensity. Livestock raising as a whole increased from 14% to 14.9%, but with internal shifts: pigs fluctuated, but ended at 8% (similar to 2000 levels), while cattle declined from 2% to 0.9%. Poultry raising rose initially to 9.5% in 2015, but moderated to 5.7% by 2023. These patterns point to a contraction in animal husbandry, with sporadic recoveries.

Table 1. Structure of agricultural production by branches, in all categories of producers, percentage, comparable prices

	2000	**2005**	**2010**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
Total agricultural production	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
Plant production, of which:	69,0	68,9	66,2	58,0	72,2	73,6	73,7	72,6	64,4	81,1	69,0	75,5
Cereals	25,0	22,9	18,8	20,3	26,5	25,5	24,3	27,3	15,1	37,0	18,6	26,8
Sugar beet	3,0	2,6	2,3	1,3	1,4	1,9	1,6	1,2	1,3	1,1	1,2	0,8
Tobacco	3,0	0,5	0,6	0,1	0,1	0,1	0,0	0,0	0,1	0,0	0,0	0,0
Sunflower	5,0	6,3	7,3	8,8	13,7	15,0	12,1	12,6	10,0	14,5	15,5	15,1
Potatoes	8,0	6,5	4,9	2,5	3,3	2,3	2,5	3,4	5,6	2,0	3,3	2,7
Vegetables and melons and gourds	5,0	7,3	7,4	7,1	7,0	5,8	5,5	6,8	9,0	5,2	11,6	10,1
Fruits, nuts and berries	3,0	4,4	3,9	6,5	8,0	9,2	13,4	8,8	10,3	11,2	9,6	9,0
Grapes	12,0	12,8	12,1	7,0	7,0	8,5	9,3	7,1	6,4	5,2	7,2	6,2
Forage crops and other	5,0	5,6	8,9	4,4	5,2	5,3	5,0	5,4	6,6	4,9	9,2	11,0
Animal production, of which:	31,0	31,1	33,8	42,0	27,8	26,4	26,3	27,4	35,6	18,9	31,0	24,5
Production of livestock – total	14,0	14,5	18,9	25,9	15,9	15,3	16,6	16,9	23,1	11,8	18,9	14,9
cattle	2,0	2,9	2,2	1,8	1,2	1,1	1,1	1,1	1,2	0,7	1,1	0,9
pigs	8,0	6,8	9,7	13,6	7,8	6,9	8,7	9,3	12,3	5,8	10,2	8,0

sheep and goats	0,3	0,4	0,4	0,6	0,4	0,3	0,3	0,3	0,4	0,3	0,3	0,3
poultry	3,0	4,4	6,2	9,5	6,2	6,6	6,2	5,9	8,7	4,8	7,1	5,7
Milk	13,0	10,9	10,2	10,7	7,7	6,9	5,6	5,9	7,1	4,0	6,9	5,4
Eggs	4,0	4,4	4,0	3,5	2,9	3,0	2,9	2,9	3,5	1,7	3,2	2,6
Wool	0,1	0,1	0,1	0,1	0,1	0,1	0,0	0,0	0,1	0,0	0,0	0,0

Source: data from NBS[113]

In the framework of the global and regional uncertainties that dominate the period since 2020, plant production shows a certain degree of volatility. At the same time, the Government efforts for supporting the livestock sector could bring additional added value and present some potential recovery signs of the sub-sector. Still, Moldova remains plant-oriented which enhances its vulnerability to adverse climate conditions.

Carrying out an analysis on the evolution of Moldova's foreign trade in agri-food products between 2014 and 2024, there is noted a general increase in values, although with the presence of some obvious fluctuations. Agri-food exports accounted for 1.065 bil. USD in 2014, reaching a maximum level of 1.936 bil. USD in 2022, being followed by a slight decrease to 1.624 bil. USD in 2024. Agri-food exports hold a significant share in the total exports of Moldovan goods, varying between 42.8% and 46.6% in the analyzed period. These number emphasize the strong dependence of the Moldovan economy on the agri-food sector, which is being considered as the main pillar of exports. The existing oscillations may be due to external events, like the impact of adverse weather conditions, global and regional prices for the main exported agricultural commodities and even geopolitical situation, that influenced international production and demand.

With respect to imports, agri-food products imports rose from 719 mil. USD in 2014 to 1.465 bil. USD in 2024, pointing on the increasing domestic demand for certain types of products, as well as potential deficits in local production. The share of agri-food imports in total imports are lower compared to exports, ranging between 13.4% and 16.2%. Thus, Moldova is to be considered a net exporter of agri-food products, which still requires to some extent certain imports in order to diversify its supply. At the same time, the increase in the share of agri-food imports in 2024 (16.2%) reflects a potential inflationary pressure, some shifts in consumption patterns that were influenced by several factors such as the Covid-19 pandemic or regional war.

[113] National Bureau of Statistics (2025). Database. www.statistica.gov.md

Generally, the agri-food trade balance is positive for Moldovan commodities and contribute to the reduction of the total trade deficit. Moreover, vulnerability to external crisis and negative events reflects the need for export diversification, especially with added value products, and the necessity for investment in agricultural resilience and sustainability to maintain this favorable position in the long term.

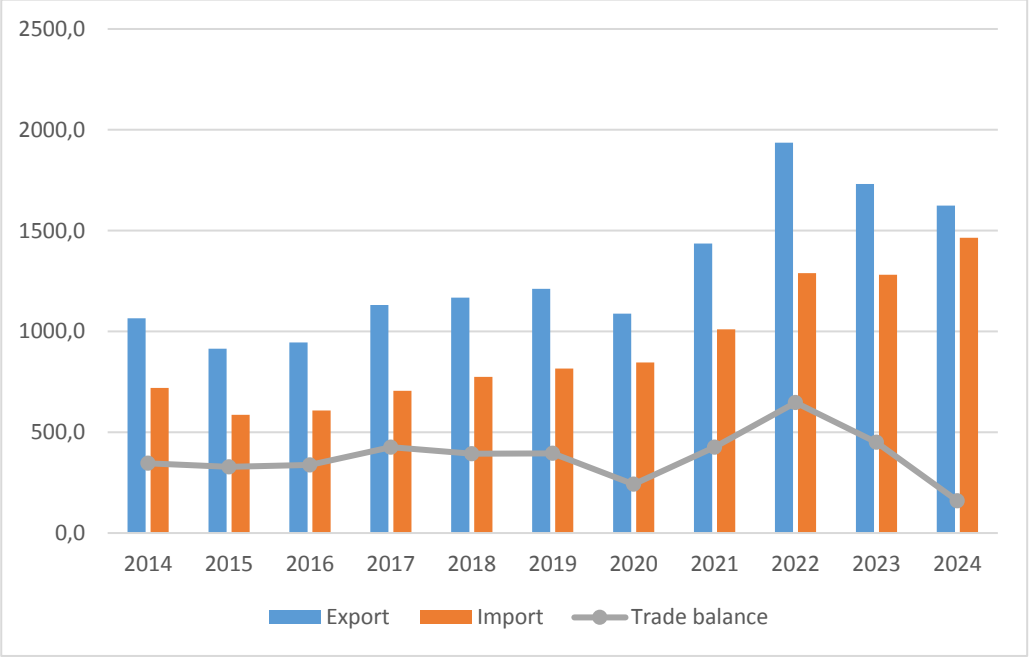

Figure 4. Foreign trade with agri-food products, mil. USD

Source: developed by authors, based on data from UN Comtrade[114]

Current main challenges of the Moldovan agricultural sector

Agricultural sector of the Republic of Moldova is exposed to many endogenous and exogenous risks, that have a considerable influence on the production, development of rural area, ensurance of the food security and social stability. Dependence on climate conditions, external markets and limited resources are among the main challenges faced by the sector. At the same time, in the context of the chosen path for European integration, awareness of the challenges faced by Moldovan agricultural sector becomes crucial for the development of sustainable policies and strategies aimed at enhancing sector's resilience and assure its sustainable development.

[114] UN Comtrade (2025). Database. comtrade.un.org

The existing challenges in the Moldovan agricultural sector may be classified in several categories, all of them having their specific degree of importance.

Climate-related challenges	Economic and financial challenges	Infrastructure and technology challenges	Social and demographic challenges	Geopolitical challenges
• Climate change and extreme weather conditions; • Soil degradation and erosion; • Water scarcity and drought.	• Price volatility and high costs of production; • Limited access to finance and credit; • Disruptions in exports and supply chains.	• Limited and inefficient irrigation systems; • Limited mechanization and use of modern technologies; • Underdeveloped rural infrastructure.	• Labor migration and aging population; • Rural poverty and food insecurity.	• Negative impact of the war in Ukraine; • Alignment with EU standards.

Figure 5. Current main challenges of the Moldovan agricultural sector

Source: developed by authors

These challenges will be further briefly described:

Climate-related challenges

Climate change and extreme weather conditions. As previously mentioned, the Moldovan agricultural sector is highly dependent on good climate conditions. Climate change phenomena like increasing temperatures, significant variations in precipitation and changes in areas of precipitations, as well as extreme events such as droughts, frosts, floods and hail tend to occur more and more frequently in the last years, having a significant impact on productivity of the sector. The most eloquent examples are brought by the years of 2020 and 2022, when extreme droughts contributed to the reduction of plant production by about 26%. Moreover, the assessed impact of droughts does not imply only the productivity, but also the pest and disease pressure, which requires additional financial funds for adaptations and mitigation, such as investments in climate-resilient technologies.

Soil degradation and erosion. The important role of the agricultural sector in the Republic of Moldova has some significant effects of the soil quality alongside the entire country. Poor soils quality and their degradation represent a major problem. Thus, from 1965 to 2021, the area of eroded land has increased by almost 1.7 times, with the chernozems being among the most affected types

of soil[115]. The annual losses of fertile soil from agricultural lands as a result of the erosion processes are estimated to about 26 mil. tons[116] Causes of soil erosion include the excessive use of unsustainable agricultural practices, lack of crop rotation, and reduction of areas of forest strips.

Water scarcity and drought. Water scarcity represents an important phenomenon and is exacerbated by the depletion of sufficient aquatic resources. The irrigation potential is still untapped[117]. At the same time, there is noted an uneven distribution of the available water resources, as the South part of the country is the most exposed to water scarcity, which steadily extends towards the Central and Northern part[118].

Economic and financial challenges

Price volatility and high costs of production. Since 2020, together with the Covid-19 pandemic, followed nearly after by the Russian-Ukrainian war, the prices for agricultural products at the international level suffered from significant changes and oscillations, having a direct impact on Moldovan prices. In a more general trend, there are notable differences in producer prices with reference prices. Thus, domestic producer prices for poultry and dairy products exceeded the reference border prices and prices for wheat, pork, grapes, and eggs have been lower than border reference prices[119]. At the same time, the increase in input costs has contributed to decline in productivity of some landholders, due to limited capacities of production and follow of the technological requirements.

Limited access to finance and credit. Moldovan farmers, especially smallholders face important challenges in accessing finance for their business initiation and development. Even if there is noted a modest increase in

[115] Bejan, I., Sochircă, V., Nagacevschi, T., Titu, P. (2022). Spatial study of soil erosion in the Republic of Moldova. Present Environment and Sustainable Development. 2. 259-271. 10.47743/pesd2022162021.

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[118] Ivanov., V. (2012). Influence of climate changes on water resources in Moldova . In: *Chemistry Journal of Moldova*, 2012, nr. 1(7), pp. 119-121. ISSN 1857-1727.

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agricultural crediting, farmers are still encountering some issues[120]. The credit guarantee fund is just beginning to be operational, there also high collateral requirements and interest rates and banks express some reluctance to finance agricultural projects due to the existing well-known risks. Moreover, agricultural insurance sector, although founded by an existing law, is too expensive and hard accessible, leaving farmers exposed to major financial losses.

Disruptions in exports and supply chains. The war in Ukraine has contributed to the emergence of disruptions in the traditional trade routes[121], the farmers being forced to identify new ways and routes for their products. Generally, these routes were more expensive and affected to some extent the competitiveness degree of Moldovan products on foreign markets.

Infrastructure and technological challenges

Limited and inefficient irrigation systems. According to data from the land fund of the Republic of Moldova at the beginning of 2022, the area of land arranged for irrigation represented 215.9 thous. ha, of which arable land occupied about 201.9 thous. ha (93.51%), multi-annual plantations - 12.9 thous. ha (5.97%), of which 10.8 thous. (4.98%) - orchards and 2 thous. ha (0.92%) - vineyard plantations. The area of drained land amounted to 58.2 thous. ha. At the same time, the irrigation infrastructure is either outdated, or even absent.

Limited mechanization and use of modern technologies. Low productivity is caused by insufficient investment in mechanization, climate-smart technologies, and adequate investment in research and innovation activities. This keeps the sector focused on low-value-added crops such as cereals and sunflowers, and hinders is sustainable development.

Underdeveloped rural infrastructure. Inadequate roads, schools and health services in rural areas are the main negative aspects that determine young labor force to leave rural areas and to not get involved in agricultural sector.

Social and demographic challenges

Labor migration and aging population. Massive emigration from the Republic of Moldova, which is made more acute by the world and regional crises, leads to a shortage of seasonal workers and a continuous decline in the agricultural labor force. Many remaining farmers are elderly, with limited access

[120] Möllers, J., Herzfeld, T., Arapi-Gjini, A. and Batereanu, L. 2022. An analysis of farm support measures in the Republic of Moldova. Halle (Saale), Germany, IAMO Discussion Paper No. 199, Halle (Saale): IAMO.

[121] Cimpoieș, L., & Cojocaru, A. (2024). Unlocking Potential: Assessing Opportunities and Challenges for Moldovan Agri-Food Exports. In *Balkan and Near Eastern Congress Series on Economics, Business and Management* (pp. 205-215).

to resources, reluctant to innovation and modernization, but accepting and using old agricultural practices.

Rural poverty and food insecurity. Demographic pressure[122] observed through the decrease of population number, as well as the fact that most of the population form rural areas depends massively on the agricultural sector are to have a negative effect on the sector's sustainable development. The rural poverty rate accounts for more than 30% of the population, affecting, especially women and young people, who represent vulnerable groups with limited access to finance[123].

Geopolitical challenges

Negative impact of the war in Ukraine. The Russian-Ukrainian conflict had a direct influence on Moldovan agriculture by causing increases in input costs and important disruptions in supply chains. Involvement in the conflict of two economic partners of Moldova has put some initial pressure on the national economy, with urgent measures needed for mitigating the negative effects. Farmers were determined to look for alternative routes, which implied additional or increased costs.

Alignment with EU standards. Taking into account that EU integration requires the alignment of the national legislative framework with the Eu acts, integration process will lead to more strict food safety standards and not all Moldovan farmers will be able to invest in modernization and increase of quality of production.

Table 2. SWOT analysis of the Moldovan agricultural sector

Strengths	Weaknesses
- Favorable geographical positioning of the country with mild climate favorable for production of certain specific agricultural goods (fruits, grapes, vegetables, etc.) and fertile land; - Substantial economic and agri-food export footprint; - Potential of development of sustainable agriculture; - Geographical proximity with EU market and EU partnership and support.	- Low land and labor productivity; - Migration process, especially in rural environment and demographic pressure; - Infrastructure constraints; - Limited access to irrigation; - Fragmented and aging technology base; - Limited access to investments and insurance; - Orientation of the sector towards low added value agricultural products; - Insufficient diversification of products; - Excessive fragmentation of lands.

[122] Stratan, A., Lopotenco, V., Staver, L. (2024). Resilience of Agri-Food Security in the Republic of Moldova. 10.5772/intechopen.1008164.
[123] UNDP (United Nations Development Programme), OPHI (Oxford Poverty and Human Development Initiative). 2022. 2022 Global Multidimensional Poverty Index (MPI): Unpacking deprivation bundles to reduce multidimensional poverty. New York.

Opportunities	Threats
- Statute of EU candidate country and EU market access; - Digitalization and innovations for smart farming transformation; - Initiatives in renewable energy and bioeconomy; - External support; - Regional cooperation potential.	- Climate changes (droughts, hail, floods, early frosts); - Regional geopolitical instability; - Overdependence on raw exports; - High dependency on external energy resources.

Source: developed by authors

Climate changes and agriculture's sustainability

Climate trends in the Republic of Moldova

Due to the geographic position of the Republic of Moldova in the Eastern part of the European continent, in the recent years, and according to the exiting projections in the mid and long-term, it is and will be highly exposed to climate change. Its limited adaptability capacities, strong reliance on the agricultural sector and limited financial capacities are among the main causes of its vulnerability. In the recent decades, many changes have occurred in this geographic area that enhanced the adverse effects of climate change, among them being: instable precipitation regime, increasing temperatures and occurrence of more often extreme weather events. Since 2002, there is noted an important increase in average annual temperatures for all three weather stations across the country, with higher figures since 2019 (with an exception for the year 2021).

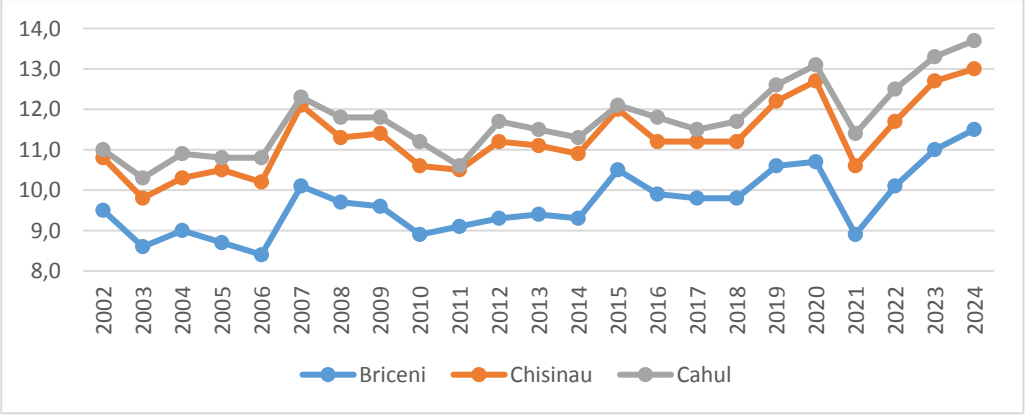

Figure 6. Annual average temperature by regional weather stations, 2002 – 2024, degrees Celsius

Source: State Hydrometeorological Service[124]

[124] State Hydrometeorological Service (2025). Database. www.meteo.md

Based on the existing observations, it is considered that seven out of the ten warmest years in Moldova have been registered during the last two decades[125]. By 2100, the average temperatures are expected to rise with 1.4–4.4°C[126], which represents an important challenge for the country in general, and for the agricultural sector, in particular.

Overall, these temperature trends have enormous impacts, including increasing heat stress on the existing ecosystems, as well as on population. Agricultural vulnerabilities will also be enhanced, as the expected trajectory of temperatures in Moldova is overtaking the averages at the global level.

At the same time, in the period 1945 – 1986, the volume of atmospheric precipitation had increased from 480.0 mm to 576.0 mm (or +2.9 mm per 1 year). But, in the last 35 years (1985-2020), on the contrary, a decrease in the volume of atmospheric precipitation was recorded: from 576 mm to 538.0 mm (or -1.09 mm annually)[127]. Since 2011, there is noted a considerable decrease in precipitation quantities, especially in Chisinau and Cahul regions.

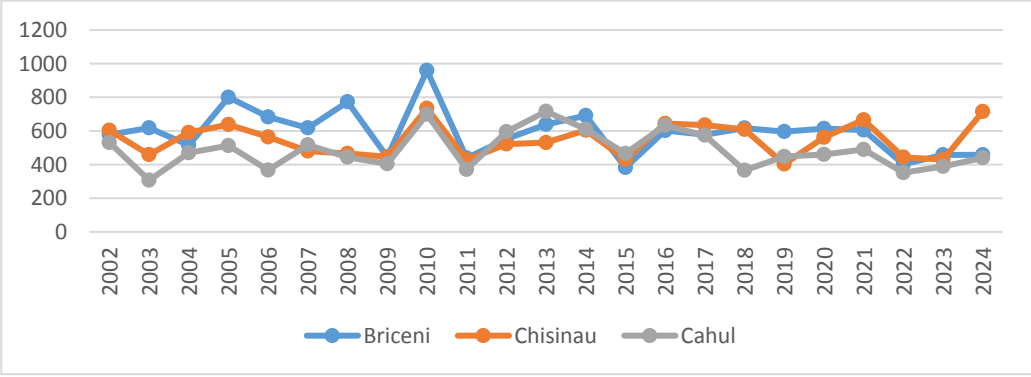

Figure 7. Annual average precipitation quantities by regional weather stations, 2002 – 2024, mm

Source: State Hydrometeorological Service[128]

[125] World Bank Group, GFDRR. (2020). Trenthening Moldova's Disaster Risk Management and Climate Resilience. Facing Current Issues and Future Challenges. World Bank Group. Retrieved from https:// documents1.worldbank.org/curated/en/767811616046683526/pdf/Strengthening-Moldova-s-DisasterRisk-Management-and-Climate-Resilience-Facing-Current-Issues-and-Future-Challenges.pdf

[126][126] Government Decision No. 624 from 30.08.2023 on the approval of the National Climate Change Adaptation Program until 2030. Published: 27-11-2023 in the Official Gazette No. 448-451 art. 1086

[127] Government Decision No. 56 from 17.02.2023 on the approval of the National Strategy for Agricultural and Rural Development for the years 2023-2030. Published: 06-04-2023 in the Official Gazette No. 117-118 art. 244

[128] State Hydrometeorological Service (2025). Database. www.meteo.md

Due to the decrease in precipitation regime, the droughts have become a more often phenomenon in Moldovan climate events. According to the study of Vicente-Serrano et al[129], even if the severity of pluvial droughts has decreased in the last 170 years in Moldova, the impact of precipitation deficits on yields has increased in the last two decades. This situation is associated with the increased warming trend observed in recent decades. Generally, Southern regions are expected to face greater precipitation declines compared to the North and Center ones, fact that will lead inevitably to issues related to water scarcity[130].

Republic of Moldova's recent climate trends are reflected by the emerging extreme events, that include droughts, floods, heatwaves and severe storms. Most recent droughts, such as those in 2007, 2012, 2020, and 2022, have caused significant economic losses. For example, the draught from 2007 event affected 80% of the territory and caused 1 bil. USD in damages[131]. The interconnection between temperature and precipitation tendencies amplifies these extremes.

The future of the country in the framework of facing the effects of climate change is based on a high uncertainty. Thus, according to the Three General Circulation Models (GCMs), the following situations are to be expected:

- Winters will become warmer and wetter, while summers and autumns will be hotter and arid. Together with the warming process, a continuous annual decrease in average rainfall is also expected.

- Extreme weather events will become more common in the future.

- The process of climate aridisation is expected to accelerate considerably in the future. Aridity will be more pronounced during the growing season of crops[132].

Thus, the recent climate trends in Moldova reflect a warning situation, manifested through warming, drying periods will have significant negative

[129] Vicente-Serrano, S. M., Juez, C., Potopová, V., Boincean, B., Murphy, C., Domínguez-Castro, F., Eklundh, L., Peña-Angulo, D., Noguera, I., Jin, H., Conradt, T., Garcia-Herrera, R., Garrido-Perez, J. M., Barriopedro, D., Gutiérrez, J. M., Iturbide, M., Lorenzo-Lacruz, J., & Kenawy, A. E. (2024). Drought risk in Moldova under global warming and possible crop adaptation strategies. Ann NY Acad Sci., 1538, 144–161. https://doi.org/10.1111/nyas.15201

[130] UNDP (2025). Climate change and vulnerable groups in Moldova: impacts, risks and adaptation measures. Final Report on the gender-disaggregated cross-sectorial analysis of the impact of climate change on vulnerable groups. https://www.undp.org/sites/g/files/zskgke326/files/2025-04/climate_report_a4_web.pdf

[131] Government Decision No. 624 from 30.08.2023 on the approval of the National Climate Change Adaptation Program until 2030. Published: 27-11-2023 in the Official Gazette No. 448-451 art. 1086

[132] Government Decision No. 624 from 30.08.2023 on the approval of the National Climate Change Adaptation Program until 2030. Published: 27-11-2023 in the Official Gazette No. 448-451 art. 1086

impact on the socio-economic situation. The already noticeable increases in temperature, lack of precipitation and extreme weather conditions have already put a pressure on natural and financial resources, while projections point on the amplification of risks in the mid and long-term future. Addressing these challenges need for interdisciplinary strategies, development of new synergies, starting from a better monitoring to adaptive agriculture.

Main climate risks for the Moldovan agricultural sector

The agricultural sector of the Republic of Moldova is based on three important pillars represented by the cereal and oilseeds crops (wheat, maize and sunflower), horticulture (vegetables, fruit, grapes and nuts) and livestock products. Currently, in the framework of severe weather events, the sector is facing significant challenges in handling the high temperatures, high evaporation, lack of sufficient precipitations quantities and increased demand for irrigation[133].

In the Republic of Moldova, agriculture contributes to, but also suffers from climate change. On the one hand, it contributes by emitting greenhouse gases (GHG) such as carbon dioxide from the use of fossil fuels to power technical equipment, nitrous oxide from the use of fertilizers and methane from ruminants. However, emissions can be reduced through various mitigation measures, including improving the efficiency of the use of agricultural production factors, but also by increasing the net sequestration of carbon dioxide from the atmosphere in soil and trees. Agriculture is suffering and will continue to suffer from the effects of climate change in different ways. For example, higher summer temperatures and changes in precipitation patterns will expose crops and livestock to heat and water stress, milder winters could impact vernalization, and pests and diseases (including new ones) could intensify. However, the impact of such changes can be reduced through adaptation, for example, through crops and livestock that are more tolerant to extreme conditions, as well as by adopting specific management practices to overcome heat, water and disease-related stresses. There is an overlap between some mitigation and adaptation measures[134].

[133] Sutton, W., Jitendra P., Srivastava, J., Neumann, A., Brent B. (2013). Reducing the Vulnerability of Moldova's Agricultural Systems to Climate Change: Impact Assessment and Adaptation Options. World Bank Study. Washington, DC: World Bank. doi:10.1596/978-1-4648-0045-0. License: Creative Commons Attribution CC BY 3.0

[134] Boincean, B. (2021). Agricultura și schimbările climatice: necesități analitice, opțiuni tehnice și opțiuni de politici pentru Moldova. Chisinau: FAO.

Table 3. The impact of climate change on the agricultural sector in the Republic of Moldova

Changes in the hydrological regime	• *lowering of groundwater levels associated with frequent water stress;* • *decrease of surface water flows;* • *high risk of biodiversity reduction due to excessive evapotranspiration;* • *droughts due reduced summer rainfall.*
Higher temperatures and heat stress	• *high risk for winter cereal crops, orchards or vineyards due to the lack of snow cover for a longer period of time, as well as the physiological solidification of crops;* • *decrease in the quality of several agricultural products as a result of the negative impact of high temperatures on pollination and biochemical processes – necessary for the formation of quality and thermal stress on animals.*
Severe weather conditions	• *the spread of new pests and diseases in crops and animals and the increased risk of infestation with existing diseases as a result of conditions more favorable to their survival;* • *a greater risk of flooding and the spread of contagious diseases to crops, animals and humans;* • *a reduced capacity of soils to accumulate water from atmospheric precipitation and, as a result, the simultaneous occurrence of droughts and soil erosion.*
Other risks	• *high dependence on non-renewable energy sources and their derivatives (mineral fertilizers, pesticides) which are imported, in particular, from abroad;* • *high dependence on planting material and seeds imported from abroad;* • *vulnerability of agricultural producers to prices for agricultural products on the global market, in particular, in years with unfavorable climatic conditions.*

Source: Boincean[135]

The most recent droughts, which took place in 2020, 2022 and 2024 recorded important decreases in crop production[136]. Frequent droughts are increasing the demand for water and irrigation in agriculture. However, much of this water is supplied through outdated and inefficient systems, which result in considerable losses. Consequently, alongside a high per capita water intake and already elevated water stress levels, Moldova continues to face substantial water losses during

[135] Boincean, B. (2021). Agricultura și schimbările climatice: necesități analitice, opțiuni tehnice și opțiuni de politici pentru Moldova. Chisinau: FAO.

[136] Stratan, A., Ceban, A., Lucasenco, E. (2023). Greening policies for the agricultural sector of the Republic of Moldova: current situation and future perspectives, Scientific Papers Series "Management, Economic Engineering in Agriculture and Rural Development", Volume 23, Issue 2/2023, p. 673 – 680

transportation, with little evidence of improvement[137]. Similarly, some of the most direct impacts of climate change on agriculture include water shortages and unreliable water supply, reduced availability of animal feed, lower agricultural yields, the spread of crop and livestock diseases, as well as forest degradation[138].

Being accepted as a candidate country to the EU in 2022, the Republic of Moldova will need to comply with EU policies, the most important for the agricultural sector being the Common Agricultural Policy. At the same time, there are a number of obstacles that may be encountered in the way of adapting Moldovan agriculture to climate change.

Table 4. Obstacles in the field of climate change adaptation. Barriers and gaps in the agricultural sector

Permissive environment	*Organizational environment*
- Limited linkage between policies, functional programs and budgets; *- Lack of access to financial resources and distortions caused by underdeveloped capital markets which also inhibit private investment;* *- Insufficient incentives to develop and use sustainable and climate-resilient technologies in soil conservation in combination with neglected external factors impacting agriculture (pollution, degradation, etc.);* *- Lack of professional institutions that would promote sustainable markets and lack of research in the field of development and adoption of technological systems adapted to climate change;* *- Macroeconomic conditions that affect subsidies, import duties and lead to market distortions;* *- Underdeveloped logistics and supply system;* *- Limited methodologies for measuring the climate impact of policies, plans and available financial resources.*	*- Technical and financial capacity to upgrade and modernize outdated and degraded infrastructure;* *- Ineffective prioritization of climate change issues at the sector and organizational levels;* *- Limited technical knowledge and lack of a training program for officials on climate change and climate change adaptation issues;* *- Climate change adaptation is not an employment opportunity.*

Source: CND[139]

[137] EU4Environment. (2021). Towards Green Transformation of the Republic of Moldova. State of Play in 2021. Monitoring progress based on OECD green growth indicators . 78.
[138] Herzfeld, T., Lucasenco, E. et al. (2021). Moldova: Agriculture Sector Review. Issues paper. FAO.
[139] CND. (2020). Contribuția Națională Determinată actualizată a Republicii Moldova. https://madrm.gov.md/ro/content/republica-moldova-al-vi-lea-raport-na%C8%9Bional-cu-privire-la-diversitatea-biologic%C4%83.

The future projection scenarios for the agricultural sector of Moldova in the context of climate change are quite alarming. Thus, according to Sutton et al, by 2050 there is expected a reduction in yields of wheat, maize, alfalfa, grapes, vegetables, and pasture.

Table 5. Effects of climate change on crop yield for the 2040 – 2050 scenario, relative to current yields, % of change

Irrigated / rainfed	Crop	Northern	Central	Southern
Irrigated	Maize	-8	-6	-9
	Wheat	-14	-30	-34
	Alfalfa	-7	-13	-18
	Grapes	-4	-3	-5
	Apples	0	0	-3
	Vegetables	-5	-9	-13
Rainfed	Maize	-9	-3	-10
	Wheat	-36	-38	-45
	Pasture	-17	-22	-19
	Alfalfa	-13	-18	-12
	Grapes	-4	-3	-2
	Apples	-2	-4	3
	Vegetables	-9	-13	-9

Source: Sutton et al[140]

The NDC2 identified a number of priority investment areas related to the agricultural sector, and indicators of progress in meeting them. For example: sustainable soil management (conservation, precision, organic agriculture, etc.); promoting efficient irrigation systems; promoting diversity and resilience of agricultural crops; increased food security; promoting integrated food, water, and energy systems in a smart and climate change resilient agriculture. In addition, sequestration of carbon into soils and forests is recognized as crucial to reducing global temperature rises.

If the necessary measures are not undertaken, the situation may become irreversible and will require significantly higher expenditures for irrigation, crop protection, soil fertilization, soil tillage, etc. Continuing reliance on imported energy-intensive inputs derived from fossil fuels is undesirable for farmers and

[140] Sutton, W., Jitendra P., Srivastava, J., Neumann, A., Brent B. (2013). Reducing the Vulnerability of Moldova's Agricultural Systems to Climate Change: Impact Assessment and Adaptation Options. World Bank Study. Washington, DC: World Bank. doi:10.1596/978-1-4648-0045-0. License: Creative Commons Attribution CC BY 3.0

for national trade balances, but will also worsen environmental degradation. The strategy for the future development of the agricultural sector of the Republic of Moldova should instead be strongly based on the principle of "doing more with less", reducing resource usage and using (e.g.) crop rotations and greening rather than industrialized processes[141].

Thus, adaptation strategies must be taken into account when discussing on the future scenarios for Moldovan agricultural sector, that will be based on modernization of the irrigation infrastructure and development of the new ones, plantation of drought-resistant varieties of crops, as well as development of the insurance sector, for risk mitigation.

Table 6. Agricultural sector climate change needs for the period 2020 – 2025

Identified need	**Indicator**
Implement sustainable agricultural systems, less dependent on industrial inputs (mineral fertilizers, pesticides, fuel for mechanical soil tillage, irrigation, etc.) and climate-resilient by sustainable soil management (including management of Chernozems) and holistic approach to farm organization and management at the landscape level.	Sustainable and climate-resilient soil management and model farms implemented in different areas of the Republic of Moldova (North, Centre, South). Economic, ecological and social agro-environmental criteria for assessing sustainable and smart soil management in agricultural enterprises established
Develop program of measures to conserve water in the soil and provide adjustment periods for conducting agricultural activities on climate change.	Program of measures to be developed, activities performed.
Identify vulnerable areas and sectors and assess needs and opportunities related to alternative crops and varieties more resistant to climate change.	Study developed, vulnerable areas, needs and opportunities identified.
Implement changes in crop mix towards perennial crops (i.e., grapes and fruit trees), which will be more resilient to the new climate conditions.	Thousands ha planted with orchards and vineyards.
Strengthen scientific studies and research in the field of irrigation of agricultural land using modern innovative irrigation technics.	Scientific studied in the field of irrigation carried out.
Develop irrigation plans based on an assessment of their impact, future water	Plans developed and approved.

[141] FAO (2021). Agriculture and Climate Change: Analytical Needs, Technical Options and Policy Choices for Moldova

availability and water needs, taking into account supply-demand balance.	
Extend rehabilitation of centralized irrigation systems and drainage infrastructure.	Irrigation and drainage systems rehabilitated.
Promote efficient irrigation in the Republic of Moldova through low-flow, low- pressure and water serving drip Irrigation technologies.	Modern drip irrigation systems installed on an area of 133.5 thousand ha planted with orchards and 135.3 thousand ha of vineyards. Increased efficiency of irrigation, reduced costs for fertilizers.
Creating tools for risk and crisis management to cope with the economic consequences of events due to climate change.	Risk management tool (including agricultural insurance) created and supported in order to mitigate the negative consequences of climate risks and the negative effects of natural disasters on agricultural production and competitiveness of farming.
Develop an agricultural subsidy system based on farm compliance with integrated environmental management.	Subsidy system operational.
Capacity building for adaptation to climate change through awareness of stakeholders using the FAS and supply essential information on farm management.	Information campaigns organized, advice, information published.

Source: Updated NDC[142]

Sustainability of agriculture in the Republic of Moldova in the context of climate change

The sustainable development of the agricultural sector is strongly connected to the threats posed by climate change, that have a direct impact on the production system through various disruptions, but also enhances the environmental footprint of agricultural practices. Thus, agriculture is facing a difficult decision, that aims to balance the desired increase in productivity and minimization of environmental impacts.

On the one hand, climate change has a significant impact on the production and average yield. The increased temperatures and erratic rainfall quantities reduce water disposal, that subsequently may lead to soil degradation and decrease in

[142] Updated Nationally Determined Contribution of the Republic of Moldova (2020). https://madrm.gov.md/ro/content/republica-moldova-al-vi-lea-raport-na%C8%9Bional-cu-privire-la-diversitatea-biologic%C4%83

agricultural output[143]. Moreover, heatwaves and soil degradation constrain the adoption of sustainable practices, thus requiring for introduction of innovations in crop management to mitigate the existing and future potential losses[144].

On the other hand, the agricultural sector also contributes substantially to climate change, creating a type of a loop that undermines its own sustainability. High emissions from the livestock sector, use of fertilizers and conversion of land are among the main causes of these negative effects. The existence of this bidirectional relationship points on the need for low-emission farming models, ensuring that sustainability efforts address both adaptation to and mitigation of climate change.

Despite the existing advancements in the sector, significant challenges still persist in achieving sustainable agriculture under climate change effects and impact. The emergence of institutional barriers, as well as limited access to technology, and financial constraints represent important obstacles for the wide adoption of adaptive practices. Moreover, the existing uncertainties in climate projections complicate long-term planning, while the relationship between short-term productivity and long-term environmental health imply for some serious dilemmas for policymakers[145].

Sustainable agriculture includes a series of practices that aim at ensuring the long-term viability of the sector. Thus, the integrated model of sustainable agriculture developed by authors and further presented is based on a series of practices related to the agricultural sector, which are as follows:

- *Diversification*, which involves:

a. diversification of agricultural crops as a method of adapting to climate change and minimizing risks;

b. introduction of organic production cultivation practices;

c. diversification of agricultural activities, by providing services in agriculture, including agrotourism;

d. diversification of activities in rural areas with the introduction of non-agricultural activities, designed to increase sources of income and contribute to the development of the rural environment;

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[143] Hultgren, A., Carleton, T., Delgado, M. et al. Impacts of climate change on global agriculture accounting for adaptation. Nature 642, 644–652 (2025). https://doi.org/10.1038/s41586-025-09085-w

[144] Bibi, F., & Rahman, A. (2023). An Overview of Climate Change Impacts on Agriculture and Their Mitigation Strategies. *Agriculture*, *13*(8), 1508. https://doi.org/10.3390/agriculture13081508

[145] Hultgren, A., Carleton, T., Delgado, M. et al. Impacts of climate change on global agriculture accounting for adaptation. Nature 642, 644–652 (2025). https://doi.org/10.1038/s41586-025-09085-w

- *The use of sustainable agricultural practices*, which involve:

a. the integration of the principles of conservative agriculture,

b. soil quality management,

c. the use of organic fertilizers,

d. the use of No-till and Mini-till technology,

e. pest management, etc.

- *Rational management of natural resources* implemented by:

a. adopting efficient irrigation plans depending on existing crops and the availability of water resources;

b. the application of crop rotation to increase soil quality, with an impact on its subsequent productivity;

c. integrating grasses, shrubs into agricultural lands in order to increase and enhance biodiversity;

- *Socio-economic sustainability*, which focuses on:

a. creating living conditions in rural areas through improved infrastructure;

b. ensuring market access for all types of agricultural producers, regardless of their size;

c. supporting price support for producers;

d. education and training, especially for young farmers and women farmers;

e. creating the premises for effective cooperation and association between farmers.

The graphic presentation of the sustainable and modern agriculture model, by increasing the resilience of the agricultural sector adapted to the conditions of the Republic of Moldova, is as follows:

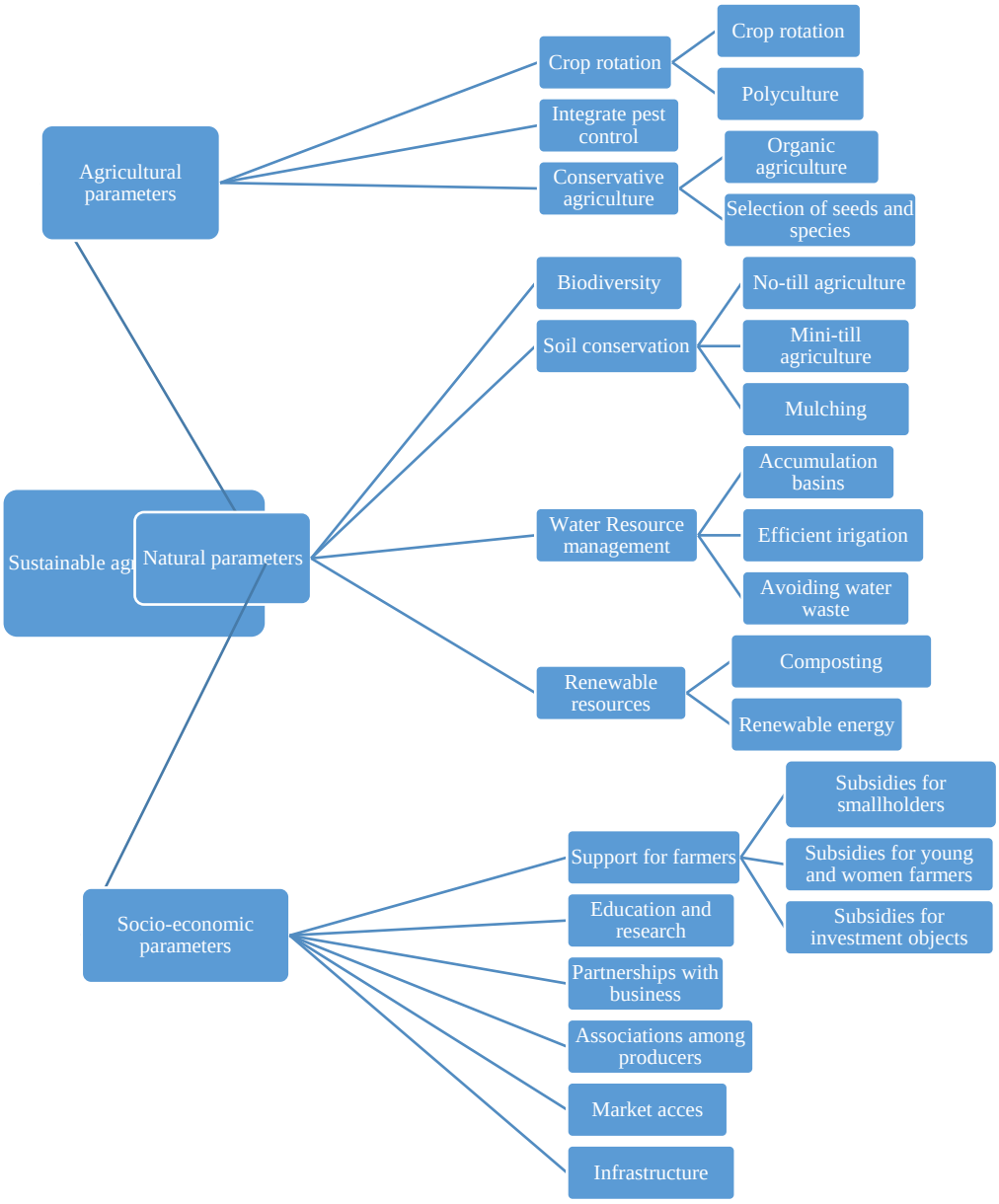

Figure 8. The sustainable agriculture model

Source: developed by authors

Therefore, the sustainability of the agricultural sector in front of climate change is strongly dependent of mitigation and adaptation measures. By having in mind the construction of a resilient agricultural system, the sector can select the path of low-carbon future in order to ensure the food security and its environmental integrity.

Public policy and institutional framework

National legal framework on climate change and sustainable agriculture

Carrying out an analysis on the national legal framework on climate change and sustainable agriculture in the Republic of Moldova aims to provide a clear understanding of the country's strategic direction in addressing the challenges that arise from agricultural vulnerability and environmental issues. Republic of Moldova is one of the most climate-susceptible countries in Europe, as its agricultural sector is more and more often exposed to droughts, floods, soil erosion, and land degradation. Taking into account that agriculture remains an important contributor to the national economy, the consistency and effectiveness of the policy framework directly influence the country's capacity to ensure food security, sustainable rural development, and achieve its foreign commitments.

At the same time, by analyzing these frameworks, researchers, policymakers, and stakeholders can better understand the existing conditions for achieving climate resilience in agriculture and propose improvements where needed.

National Development Strategy "European Moldova 2030". It is a national document of long-term strategic vision, which points on the development directions of the country and society and which adapts the priorities, objectives, indicators and targets of the international commitments assumed by the Republic of Moldova to the national context, in particular the Association Agreement between the Republic of Moldova, on the one hand, and the European Union, on the other hand, and the commitments deriving from the status of a candidate country for accession to the European Union, including the 2030 Agenda for Sustainable Development[146]. Within the Strategy, the importance of increasing the sustainability of the agricultural sector is foreseen through a series of interconnecting sectors like labor force, income, its share in GDP, food security, excessive use of fertilizers that affect the environmental conditions, land use, etc.

At the same time, sustainable development of agriculture is stated a priority direction and intervention. It should be achieved through:

- Supporting farmers' efforts to ensure a sustainable value chain by developing post-harvest and storage infrastructure for agricultural production;
- Implementing quality and safety standards for agri-food products in order to align with European Union food safety requirements;
- Strengthening laboratory capacities in the veterinary and phytosanitary fields;

[146] Law No/ 315 from 17.11.2022 for the approval of the National Development Strategy "European Moldova 2030". Published: 21-12-2022 in the Official Gazette No. 409-410 art. 758

- Defining an integrated agricultural financing system based on deposit certificates;
- Promoting organic agriculture by implementing the principles of organic agriculture and sustainable agriculture;
- Sustainable land and soil management, implementation of mandatory sustainable soil management protocols;
- Priority funding for the development of technological solutions adapted to the national agricultural system to reduce erosion and soil degradation;
- Ensuring long-term funding for research for the development of new indigenous varieties resistant to climate change;
- Reestablishing the national ecological network of natural areas, restoring river protection zones, stimulating the planting of private forests on private agricultural lands, connecting municipal stormwater sewerage systems;
- Promoting sustainable agricultural practices by reducing the consumption of phytosanitary products and fertilizers thanks to the implementation of rational crop rotations with a greater diversity of crops, by implementing innovative agricultural systems, by increasing carbon sequestration in the soil and by reducing the consumption of non-renewable energy resources and their derivatives;
- Encouraging the association of farmers in agricultural cooperatives and other producer organizations;
- Diversification of local food products, including the substitution of some imported products, in order to increase food accessibility and ensure food security;
- Promoting the culture of consumption of local products by raising consumer awareness of the need to develop the local economy.

The Climate Action Act. The purpose of the Climate Action Act is to ensure the gradual and irreversible reduction of greenhouse gas emissions in order to protect human health, the integrity of ecosystems and biodiversity against the threats posed by climate change, to strengthen adaptive capacity, to reduce society's vulnerability to climate change and to increase climate resilience, by applying the financial mechanism for setting a price for carbon dioxide emissions (hereinafter referred to as CO2 emissions) and the "polluter pays" principle[147]. The Law has a general character, being focused on some wider aspects of climate changes. At the same time, it clearly provides for the role and

[147] Law No. 74 from 11.04.2024 on Climate Action adopted by the Parliament of the Republic of Moldova. Published: 16-05-2024 in the Official Gazette No. 209-212 art. 293

attributions of the Ministry of Agriculture and Food Industry with respect to the Law implementation.

National Climate Change Adaptation Program until 2030 (NCCAP). The aim of the NCCAP is to integrate climate change adaptation measures and development planning at all levels and priority sectors, in order to ensure the medium and long-term climate resilience of economic, social and ecological systems[148]. Thus, the focus is placed on six most important vulnerable sectors among which there were identified: agriculture, water resources, health, forestry, energy and transport sectors.

According to the Program, the severity and frequency of extreme weather events have increased in Moldova. Moreover, this trend will continue further, posing a significant risk to the agricultural sector. By 2050, the country's air temperature is projected to be 1.7–2.0°C warmer than in 1961–1990, and by 2100 - it is projected to increase by 4–5°C, if global greenhouse gas emissions are not significantly reduced. Under this scenario, the Republic of Moldova will experience a significant reduction in the productivity of most agricultural crops and will be affected by more frequent extreme weather events, such as torrential rains with hail, late spring and early autumn frosts, floods and droughts. At the same time, the combined effect of changes in the water regime could lead to water shortages for irrigation. Drought will lead to soil degradation, thus reducing the ability of Moldovan agriculture to successfully adapt to climate change. Increased salinization could lead to land abandonment as it becomes unsuitable for cultivation.

The Program sets out several measures for adapting to climate changes recommended for the agricultural sector. They are related to:

- Implementation of the conservative agriculture system, including the use of direct sowing (no-till);
- Systemic improvement of crops and development of drought- and heat-tolerant varieties and hybrids;
- Correlation of mineral fertilizer management with real climatic conditions;
- Changing crop composition in accordance with the climate aridification process;
- Improving the risk insurance system in agriculture;

[148] Government Decision No. 624 from 30.08.2023 on the approval of the National Climate Change Adaptation Program until 2030. Published: 27-11-2023 in the Official Gazette No. 448-451 art. 1086

- Expanding irrigation technologies with low water consumption (in combination with capacity development);

- Preventing soil erosion by planting forest strips with species adapted to local climatic conditions;

- Improving the agricultural subsidy system by introducing requirements for household compliance with integrated environmental management and climate resilience measures;

- Taking advantage of the climate change adaptation potential of migration (through skills, knowledge, remittances), as well as taking into account the impact of immigration on human capital in rural areas.

National Strategy for Agricultural and Rural Development for the years 2023-2030 (NSARD). The strategic vision of the National Strategy for Agricultural and Rural Development for 2023-2030[149] represents the development of a competitive agri-food sector, focused on value chains with increased potential, environmentally friendly and resilient to climate change, which strengthens food security and safety and ensures well-being and better living conditions in rural areas. Thus, the issues of climate change have a deserved front place within the NSARD, pointing on the awareness from the public bodies of the severity of this issue and its impact on the agricultural sector. At the same time, climate changes are recognized among the main constraints in the implementation of the agricultural and rural development policy both, at the global level and at the national one.

The first objective of NSARD is focused on strengthening the potential of the primary agricultural sector and promoting smart, sustainable and climate-resilient agricultural practices. Within this objective, among the priority directions related to adaptation and mitigation of climate change can be noted:

- modernization of crop production sectors with an emphasis on obtaining high added value products through the implementation of climate resilience technologies;

- modernization and consolidation of the wine sector, including through the application of climate resilience technologies;

- adoption of modern practices for the efficient use and management of water resources and expansion of irrigated areas to ensure climate resilience;

[149] Government Decision No. 56 from 17.02.2023 on the approval of the National Strategy for Agricultural and Rural Development for the years 2023-2030. Published: 06-04-2023 in the Official Gazette No. 117-118 art. 244

- implementation of technologies and measures to stimulate the implementation of the principles of bioeconomy and circular economy;
- supporting and strengthening environmental protection by preserving biodiversity, protecting water and soil and promoting the use of ecological agricultural practices;
- supporting the valorization of renewable energy sources within agricultural holdings, including the use of waste of plant and animal origin.

The NSARD will facilitate the development of agriculture with reduced environmental impact and increase the development indicators related to organic agriculture, reduce soil degradation by implementing appropriate agro-technological practices to restore soil biota, implement conservative soil cultivation technologies by applying organic fertilizers, reduce the effects of climate change by increasing crop biodiversity, implement environmentally friendly production technologies, restor buffer strips within agricultural holdings.

An important role in the next stage will be assigned to the development of green agriculture, which: will guarantee food security in the context of climate change and biodiversity decline, will reduce the footprint of the food system on the environment and climate, will strengthen the resilience of the food system and will ensure the transition to competitive sustainability, from farm to consumer[150].

Land improvement program for the years 2021 - 2025. In order to ensure the sustainable management of soil resources, the Program provides for 3 out of 4 general objectives linked to soil improvement, namely:

- Objective No. 2. Preventing and combating soil erosion on an area of 2552 hectares of agricultural land by 2025;
- Objective No. 3. Soil improvement on 68,500 hectares of agricultural land by 2025;
- Objective No. 4. Preservation and increase of soil fertility on an area of 5000 hectares of agricultural land by 2025[151].

The expected impact will have a positive influence on the soil quality, increasing in long-term its productivity.

[150] Government Decision No. 56 from 17.02.2023 on the approval of the National Strategy for Agricultural and Rural Development for the years 2023-2030. Published: 06-04-2023 in the Official Gazette No. 117-118 art. 244

[151] Government Decision No. 864 from 09.12.2020 on the approval of the Land Improvement Program to ensure sustainable management of soil resources for the years 2021-2025 and the Action Plan for the years 2021-2023 regarding its implementation. Published: 08-07-2025 in the Official Gazette No. 353-355 art. 450

Strategic Agricultural Policy Program 2025-2030 (SAPP) which is to be approved**,** identifies increasing resilience to climate change as a primary need[152]. Thus, the General Objective No. 1 is dedicated to strengthening the potential of the primary agricultural sector and promoting smart, sustainable and climate-resilient practices. Within this General Objective, the Specific Objective 1.2. points on the contribution to climate change mitigation and adaptation, including by reducing greenhouse gas emissions and increasing carbon sequestration capacity, as well as promoting sustainable energy and efficient management of natural resources such as water, soil and air, including by reducing dependence on chemicals. According to the Program, most of the foreseen interventions have the components of combating the effects of climate change, being either related to direct payments, sectoral interventions or rural development.

The carried-out analysis of the Republic of Moldova's strategic documents on climate change and agricultural sector's sustainability points on an important institutional commitment assumed by decision makers to aligning the development of the agricultural sector with EU integration processes, as well as the global agenda on achieving sustainability objectives. All the reflected documents emphasize the urgent need to strengthen climate resilience in agriculture through the adoption of innovative, sustainable, and climate-smart practices, that will allow the sector to face the external and internal obstacles caused by the negative effects of climate change.

Moreover, these documents highlight the interconnections created between agriculture, environmental sustainability and rural development, emphasizing the mitigation and adaptation measures. Even more, they distinguish the emerging risks posed by climate change, like drought, floods, erosion, salinization and declining soil fertility. These are seen as threats to agricultural productivity and rural development.

At the same time, the documents have a systemic approach that comprises sectoral policies into a viable framework for promotion of sustainable development. They also indicate on the growing awareness on behalf of Moldovan decisionmakers of the need to harmonize agricultural and climate policies with EU standards, while simultaneously addressing internal vulnerabilities. In this regard, the legal policy framework provides strategic direction and practical instruments for enhancing a competitive, resilient, sustainable and environmentally responsible

[152] Government Decision (Draft) on the approval of the Strategic Agricultural Policy Program 2025-2030 https://particip.gov.md/ro/document/stages/anunt-privind-consultari-publici-al-program-strategic-al-politicii-agricole-2025-2030/13678

agricultural sector, capable of ensuring long-term food security and supporting the country's European direction.

Responsible institutions

Environmental aspects have a multidisciplinary character and cannot be attributed to only a specific sector or area. The interdisciplinarity of the subject made it mandatory to be approached by various institutions from Moldova, in order to achieve the main objective related to the climate neutrality till 2050. The Climate Action Act represents the main legislative framework that sets the attributions and responsibilities of the main publica bodies and stakeholders in the field of environmental protection.

A synthesis of the main institutions and their functions is presented in the table below.

Table 7. Main institutions and their most important attributions in climate policy in the Republic of Moldova

Institution	Main attributions
Government	- approves policy documents and normative acts in the field of GHG emission reduction and climate change adaptation; - approves requirements on the climate financial mechanisms; - ensures the efficient and transparent use of revenues generated from the price for CO2 emissions; - coordinates the activity of all public administration authorities with competences in the field of GHG emission reduction.
National Commission on Climate Change	- promotion of dialogue, cooperation, coordination and coherence between sectors of the economy in planning, developing, coordinating, implementing and monitoring climate change policies and actions; - stimulation of the inclusion of climate change measures in policy documents on socio-economic development at national and sectoral levels; - coordination and monitoring of the allocation of financial resources for the implementation of climate change actions; - ensuring transparency in the implementation of climate change policy documents and actions.
Ministry of Environment	- develops and promotes policy documents and normative acts in the field of climate change adaptation; - ensures compliance with the provisions of international treaties in the field of environmental protection and climate change; - official contact point for international treaties; - monitors, at the national level, the implementation of normative acts in the field of GHG emission reduction and climate change adaptation; - cooperates with central and local public administration authorities in the process of drafting and updating various normative acts in the field;

	- promotes policies and cooperates in the field of education, vocational training, and raising awareness of climate change; - ensures the appropriate assessment of investment projects and policy documents for the implementation of climate actions; - examines proposals on the allocation of financial means from public funds for policies with an impact on the mitigation and adaptation to climate change, submitted by different sectors; - coordinates the working group on climate change.
Ministry of Agriculture and Food Industry	- includes in policy documents for activities in the field of agriculture provisions and measures aimed at increasing climate resilience; - establishes in policy documents in the field of agriculture a intervention measures that contribute to mitigating the effects of climate change; - assesses climate risks to agriculture and the food industry and develops measures to adapt and reduce the impact of climate change; - develops methodologies for assessing climate risks to agriculture; - integrates the concept of smart agricultural policies into sectoral policies for adaptation to climate change in order to reduce GHG emissions.
Ministry of Energy	- establishes and ensures the functioning of the energy governance mechanism and climate actions; - participates in the development and implementation of policies in the energy field and climate actions; - develops policy documents to support the use of low-carbon technologies in the energy sector.
Ministry of Health	- assesses the risks related to the effects of climate change on the health of the population and develops measures to mitigate the impact of those effects; - sets priorities and includes risks in sectoral policy documents on developing measures for the adaptation of the population to the effects of extreme weather phenomena associated with climate change; - informs the population about the health risks associated with extreme weather phenomena of climate change; - strategically mobilizes and allocates financial means to expand and increase the resilience of health institutions to climate change; - develops and promotes public health strategies in the field of education, vocational training, and raising awareness among the population of the impact of extreme weather phenomena associated with climate change.
Ministry of Economic Development and Digitalization	- assesses and includes in sectoral policy documents provisions and measures for the industrial sector aimed at low-carbon development and increased climate resilience; - develops policy documents to support the use of low-carbon technologies in the industrial sector.
Ministry of Infrastructure and Regional Development	- assesses and include in policy documents for activities in the field of transport and regional development provisions and measures aimed at low-carbon development and increased climate resilience;

	- develops policy documents to support the use of technologies that contribute to reducing GHG emissions and to adapting to climate change; - develops normative acts on reducing the impact of GHG emissions from the transport sector and on improving fuel efficiency; - develops the guide on fuel consumption and CO2 emissions; - develop and promote policy documents on mitigation and adaptation to climate change in the planning process of urban planning and territorial development operations.
Ministry of Labor and Social Protection	- develops provisions and measures aimed at strengthening the capacity to adapt to climate change and includes them in sectoral policy documents in the field of promoting inclusion and social assistance and gender equality; - assesses climate risks on the well-being of socially vulnerable groups, gender equality and develops measures to adapt and mitigate the impact of climate change.
Ministry of Education and Research	- develops provisions and measures aimed at promoting knowledge for the formation of the necessary skills regarding the prevention of the impact of climate change and adaptation to it and includes them in sectoral policy documents in the field of education, research and innovation; - cooperates with public law organizations in the fields of research and innovation and promotes the development of studies to estimate the impact of climate change on different socio-economic systems and to assess the uncertainties associated with them; - supplements the curricula and develops teaching materials on environmental protection and combating climate change.
Ministry of Home Affairs	- participates in the development and implementation of state policy in the field of population and territory protection in case of danger or the onset of disasters caused by climate change.
Ministry of Finance	- ensures the integration of the environmental perspective in the methodological framework regarding the budgetary planning process; - develops and implements fiscal policies in order to promote environmental practices and discourage activities that contribute to climate change.
Environment Agency	- ensures the implementation of normative acts in the field of GHG emission reduction and climate change adaptation; - provides support to the Ministry of Environment in the development and amendment of normative acts in the field of GHG emission reduction and climate change adaptation; - coordinates the greenhouse gas emission monitoring plan; - ensures the monitoring and reporting of GHG emissions included in the national inventory.
Inspectorate for Environmental Protection	- carries out control over compliance with the provisions of this law and the normative acts in the field of GHG emission reduction and climate change adaptation;

	- verifies, within the framework of planned or unannounced controls, compliance by operators with the provisions of the Regulation on the monitoring, reporting and verification of greenhouse gas emissions; - ascertains cases of violations of legislation in the field of GHG emissions reduction and climate change adaptation and applies sanctions.

Source: developed by authors based on The Climate Action Act[153]

The above-mentioned institutions play a major role in combating the effects of climate change. Coordinating efforts are needed for achieving the reduction of GHG and addressing all the issues arising from the climate change phenomenon. Each entity has its own attributions, clearly defined roles that are focused on policy development, implementation, and monitoring. Thus, Government is to set the general policy in field, while ministries and agencies aim at integrating climate resilience and low-carbon strategies into their specific sectoral policies.

The public engagement in combating climate change effects is of utmost importance. Cross-sectoral integration will contribute to better addressing climate risks in various sectors such as agriculture, healthcare, infrastructure, social protection, and this holistic approach will allow Moldova to efficiently mitigate and adapt to the impacts of climate change while fostering sustainable development.

Relationship with the European Union's Common Agricultural Policy (CAP)

In 2022, the European Union celebrated 60 years since the establishment of the Common Agricultural Policy (CAP). Representing almost two-thirds of the EU budget in the mid-1980s, agricultural spending has decreased over the past 40 years (37% in 2014-2020) and is expected to represent less than 30% of the European budget in 2027, with cohesion policy being the main component of EU spending[154].

The EU CAP represents a legal framework of major importance for ensuring the development and modernization of agriculture in EU member states, ensuring their food security, especially against the backdrop of persistent crises, but, at the same time, also for achieving the objectives of the European Green Deal. On 2 December 2021, the agreement on the reform of the Common Agricultural Policy

[153] Law No. 74 from 11.04.2024 on Climate Action adopted by the Parliament of the Republic of Moldova. Published: 16-05-2024 in the Official Gazette No. 209-212 art. 293

[154] Barral, S., Detang-Dessendre, C. (2023). Reforming the Common Agricultural Policy (2023–2027): multidisciplinary views. Review of Agricultural, Food and Environmental Studies, volume 104, 47-50.

(CAP) was officially adopted. The new rules, which entered into force on 1 January 2023, pave the way for a fairer, greener and more performance-based CAP. They aim to secure a sustainable future for European farmers, provide better-targeted support for smaller farms and give EU countries more flexibility to adapt measures to local conditions. Agriculture and rural areas are key to the European Green Deal, and the CAP 2023-2027 will be a key instrument for achieving the ambitious objectives of the Farm to Fork Strategy and the Biodiversity Strategy[155].

The CAP, which runs from 2023 to 2027, includes policy reforms aimed at supporting the transition to sustainable agriculture in the EU. It is built around 10 core objectives, focusing on economic, social and environmental aspects.

Figure 9. Objectives of the EU Common Agricultural Policy for the period 2023 – 2027

Source: European Commission[156]

[155] European Commission. (2023). Key policy objectives of the new CAP. https://agriculture.ec.europa.eu/common-agricultural-policy/cap-overview/new-cap-2023-27/key-policy-objectives-new-cap_en .

[156] European Commission. (2023). Key policy objectives of the new CAP. https://agriculture.ec.europa.eu/common-agricultural-policy/cap-overview/new-cap-2023-27/key-policy-objectives-new-cap_en .

The CAP objectives announced by the EU, once implemented in the Republic of Moldova, will contribute to the development and modernization of the country's agricultural sector, taking into account a number of aspects related to the environment, climate change, social welfare, competitiveness, development of rural areas, etc.

The potential actions of the Republic of Moldova to align with the CAP objectives are presented in the table below.

Table 8. Analysis of CAP objectives through the lens of actions that need to be taken by the Republic of Moldova

No.	Objective	Aim	Actions of the Republic of Moldova
1	Supporting fair agricultural incomes	Supporting fair farm incomes and the resilience of the EU agricultural sector, to enhance long-term food security and agricultural diversity, as well as to ensure the economic sustainability of agricultural production.	- Analysis of the current situation of farmers' incomes; - Identification of the causes of disparities between income in agriculture and other sectors of the national economy; - Exclusion of seasonality in farmers' remuneration; - Taking into account, in the support process, farmers' incomes and working conditions for workers in the agricultural sector.
2	Increasing competitiveness	Improving market orientation and increasing the competitiveness of farms in both the short and long term, including with a greater focus on research, technology and digitalization	- A better connection between the research system and entrepreneurs in the field, with the aim of introducing new technologies, initiating precision agriculture, introducing innovations and digitalization; - New research-innovation programs oriented towards the needs of agricultural business; - Improving agricultural advisory systems and increasing their accessibility, especially for small and medium-sized farmers.
3	Improving the position of farmers in the value chain	Improving the position of farmers in the value chain	- Increasing the gross value added of the agricultural sector in the national economy; - Support measures to compensate for the costs of agricultural inputs in years with severe climatic conditions or other force majeure situations; - Strengthening cooperation between farmers; - Increasing market transparency and ensuring effective mechanisms against unfair trade practices.

4	Contribution to climate change mitigation	Contribution to climate change mitigation and adaptation, including by reducing greenhouse gas emissions and improving carbon capture, as well as by promoting sustainable energy.	- Further implementation of the actions undertaken by the Republic of Moldova under the Paris Agreement regarding the reduction of greenhouse gases; - Analysis and development of feasibility studies on new soil management and farm management techniques; - Identification and analysis of climate change risks for the domestic agricultural sector and development of mitigation and/or reduction measures.
5	Efficient management of natural resources	Promoting sustainable development and efficient management of natural resources, such as water, soil and air, including by reducing chemical dependency.	- Adoption of agricultural policies that will emphasize the preservation of soil quality, its improvement and efficient management of crop planting in compliance with crop rotation. - Promotion of soil protection.
6	Stopping and reversing the loss of biodiversity	Contribution to halting and reversing biodiversity loss, improving ecosystem services and conserving habitats and landscapes.	- The need for changes in current agricultural practices, taking into account the preservation of biodiversity and landscapes.
7	Generational renewal	Attracting and supporting young and new farmers and facilitating sustainable business development in rural areas.	- Attracting potential farmers to quality studies in the field, to raise and educate a new generation of innovative farmers to meet the demands of society, from quality food to environmental public goods
8	Jobs, growth and equality in rural areas	Promoting employment, economic growth, gender equality, including women's participation in agriculture, social inclusion and local development in rural areas, as well as circular bioeconomy and sustainable forestry.	- Agricultural policies aimed at alleviating the pressures of rural unemployment and poverty; - Analysis of how income support and rural development expenditure help maintain employment rates and living standards
9	Responding to society's demands regarding nutrition and	Improving the response of EU agriculture to societal demands on food and health, including high-	- Analysis of the challenges presented by antimicrobial resistance in animal husbandry, the close links between animal welfare, animal health and foodborne diseases, and actions of the

	health	quality, safe and nutritious food produced in a sustainable way, to reduce food waste, as well as to improve animal welfare and combat antimicrobial resistance.	Republic of Moldova that can support farmers in the fight against antimicrobial resistance
10	Stimulating knowledge and innovation	Modernizing agriculture and rural areas by encouraging and sharing knowledge, innovation and digitalization and by encouraging their uptake by farmers through improved access to research, innovation, knowledge exchange and training	- Support for knowledge exchange, training, advice and innovation is essential to ensure smart and sustainable agriculture, forestry and rural areas - Modernizing agriculture by increasing cooperation and knowledge exchange and improving agricultural training.

Source: developed by authors, based on European Commission[157]

Environmental objectives have been gradually integrated into the CAP. In 1992, agri-environment schemes were generalized to all Member States and in 2015, these schemes included a target to reduce net greenhouse gas emissions from agriculture, becoming agri-environment-climate schemes. In 2003, the conditionality of direct aid payments against compliance with environmental regulations and the use of best agricultural and environmental practices laid the foundations for the greening of the CAP. Thus, the CAP 2023-2027 maintains the previous architecture on two pillars: the first, fully financed by the EU, covers direct subsidies; the second, co-financed by the EU and the Member States, covers the so-called rural development instruments, namely environmental aspects, aid for regions with natural constraints and aid for investment, rural development and innovation. The strengthening of environmental ambition will be achieved mainly by improving cross-compliance and introducing eco-schemes. These eco-schemes mobilize 25% of the CAP's Pillar 1 resources to support practices that are more environmentally friendly. Pillar 2 measures

[157] European Commission. (2023). Key policy objectives of the new CAP. https://agriculture.ec.europa.eu/common-agricultural-policy/cap-overview/new-cap-2023-27/key-policy-objectives-new-cap_en .

remain very similar to those in the 2014-2020 CAP. The EU framework offers Member States the opportunity to strengthen their own environmental and climate protection measures[158].

One of the CAP's priority directions is towards a greener Common Agricultural Policy, in order to achieve the objectives of the European Green Deal. Adopted in 2019, it sets ambitious targets for the European food and farming system for 2030, some of which are quantitative, with a reduction in the use of pesticides, fertilizers and antibiotics by 50%, 20% and 50% respectively. In addition, a quantitative target was set for increasing the agricultural area under organic farming (25%), agricultural areas with highly diverse landscape characteristics (10%) and protected areas.

The greening of the agricultural sector is a priority in the new CAP, some of the objectives being related to the promotion of sustainable energy, the adoption of appropriate measures for climate change mitigation and adaptation, improving the efficient management of natural resources and their sustainable development, the conservation and enhancement of ecosystems, etc. Therefore, it becomes very important that the development policies of the agricultural sector of the Republic of Moldova are aligned with the CAP and to observe which of the current support measures contribute to the greening of the sector and its further development.

In the Republic of Moldova, public support should be granted to those agricultural producers who respect the entire agricultural system and who have a farm organization plan at landscape level, regardless of the area and form of land ownership, thus contributing to the prevention of soil erosion and reducing the negative impact of drought. The plan for organizing the farm at the landscape level in steppe conditions will include:

- planting shelterbelts depending on the specifics of the landscape;
- construction of a network of water reservoirs in the lower part of the relief;
- compliance with crop rotation through a greater diversity of the main crops and cover crops through the differentiated placement of crops at the landscape level;
- minimization and even avoidance of furrow plows;
- integration of animal and crop breeding, which involves the rotation of fodder crops in the crop rotation system, including legumes, for storing biological nitrogen and the use of manure compost;

[158] Barral, S., Detang-Dessendre, C. (2023). Reforming the Common Agricultural Policy (2023–2027): multidisciplinary views. Review of Agricultural, Food and Environmental Studies, volume 104, 47-50.

- reduction and avoidance of the application of mineral fertilizers, especially nitrogen ones, and pesticides against pests, diseases and weeds[159].

At the same time, there is an urgent need to organize a state system of soil quality monitoring, which can be used as a basis for allocating subsidies in the agricultural sector.

Another principle of the CAP 2023-2027 is the fairness of agricultural policy. Thus, according to the provisions of the CAP, financial support in the form of subsidies is directed to farmers who really need this support.

As a result, one of the types of support is redistributive income support - EU countries must devote at least 10% of direct payments to the redistributive income support instrument, in order to better meet the income needs of small and medium-sized farms[160].

The introduction of redistributive income support in the Republic of Moldova will contribute to reducing income gaps between the agricultural sector and other sectors of the economy, with a beneficial effect on the development of rural areas and slowing down the trend of rural-urban migration of young people.

Active farmers are another category supported by the CAP, namely those farmers who are fully involved in agricultural activity and whose main income comes from agriculture. The new provisions of the CAP contain a mandatory but flexible definition of an active farmer, to be established by EU countries. This specifies the level required for the various activities undertaken. Only active farmers can receive certain support from the EU[161]. In the Republic of Moldova, at the moment, there are no conditionalities related to the degree of activism of farmers, each being able and liable to submit a subsidy application, if they meet the general eligibility conditions stipulated by the regulations in force. At the same time, for a more efficient targeting of subsidies and to stimulate the most efficient and active farmers, the introduction of the active farmer criterion would contribute to achieving these objectives.

Social conditionality, another principle of the fairness of agricultural policy, requires compliance with certain EU labor standards, and beneficiaries are encouraged to improve working conditions on farms. In the Republic of Moldova, such conditionality is not applied in the process of paying subsidies. The lack of labor standards related to the eligibility of the subsidy process is a

[159] Boincean, B. (2021). Agricultura şi schimbările climatice: necesități analitice, opțiuni tehnice și opțiuni de politici pentru Moldova. Chisinau: FAO.
[160] Comisia Europeană. (2023). Politica agricolă comună a UE: 2023-2027. https://agriculture.ec.europa.eu/.
[161] Comisia Europeană. (2023). Politica agricolă comună a UE: 2023-2027. https://agriculture.ec.europa.eu/.

gap in the current domestic system, and their introduction would contribute to disciplining farmers who hire personnel to perform agricultural work. In this regard, the introduction of such a criterion would bring several benefits, especially related to: reducing the shadow economy, better and clearer working conditions and standards for employees in the field, compliance with labor legislation, etc.

Other directions of the CAP are represented by supporting young farmers and improving gender equality. In EU member states, at least 3% of direct payments must be distributed to young farmers. This distribution can take the form of income or investment support or assistance in setting up an agricultural business. With reference to this direction, in the Republic of Moldova, young farmers and women farmers are supported in the subsidy process, through advance subsidies or other types of post-investment subsidies.

Thus, in 2022, for example, 42 novice agricultural producers expressed interest in starting a business, with planned investments in the agricultural sector of over 61.7 mil. MDL, which will generate the creation of over 84 new jobs. The state contribution for the development of 42 start-up projects is to be over 25.3 mil. MDL. Women farmers have submitted more applications, so their share of the total number of applications submitted is 52.4% (22 applications) and 47.6% (20 applications) of the businesses are to be managed by young farmers. As a result, the Republic of Moldova is in full accordance, in that case, with the provisions of the EU CAP in the ongoing subsidy policy.

Another principle of the CAP 2023 - 2027 is represented by improving competitiveness. Thus, the CAP will strengthen the position of farmers in the supply chain and boost the competitiveness of the agri-food sector by:

- increasing bargaining power – the new rules strengthen cooperation between producers, encouraging farmers to collaborate and allowing them to create counterbalancing power in the market;

- market orientation – the CAP 2023-2027 maintains the general market orientation of previous reforms, encouraging EU farms to align their supply with demand in Europe and beyond;

- crisis reserve – to deal with possible future crises, the reformed CAP includes a new financial reserve of at least 450 mil. EUR per year;

- support for the wine sector – specific rules have been agreed to improve support for the wine sector[162].

As a result, the new CAP is designed to shape the transition towards a

[162] Comisia Europeană. (2023). Politica agricolă comună a UE: 2023-2027. https://agriculture.ec.europa.eu/.

sustainable, resilient and modern European agricultural sector. Under the reformed policy, funding will be distributed more fairly to small and medium-sized family farms, as well as young farmers. In addition, farmers are supported to adopt new innovations, from precision farming to agro-ecological production methods. By supporting concrete actions in these and other areas, the new CAP is the cornerstone for food security and farming communities in the European Union.

The public support system in the Republic of Moldova

Types of subsidies

Sustainable development of the agri-food sector represents a basic pillar in the economic development of the Republic of Moldova. Thus, the financial resources allocated to the National Fund for the Development of Agriculture and Rural Environment (NFDARE) are a decisive factor in the development of the agri-food sector, but also for the development of the rural environment. The management of the NFDARE is based on the provisions of Law no. 71/2023 on subsidies in agriculture and rural areas[163], which regulates the distribution of the Fund. The Law aims to increase the competitiveness and sustainable development of the agro-industrial sector, ensure the sustainable management of natural resources and sustainable socio-economic development in rural areas.

In order to achieve the set aims, the Republic of Moldova supports:

- modernization of the agri-food chain in order to align it with the European Union requirements regarding food safety and quality requirements;
- facilitation of access to capital, input and output markets (inputs and outputs) for farmers;
- increasing added value in the agro-industrial sector by developing primary and final processing infrastructure;
- implementation of modern natural resource management practices;
- implementation of environmentally friendly production technologies, organic products, as well as maintaining biodiversity;
- adaptation to climate change and mitigation of its effects on agricultural production;
- developing access and service infrastructure in rural areas;
- increasing employment opportunities in non-agricultural areas and increasing incomes in rural areas;

[163] Law No. 71 from 31.03.2023 on subsidies in agriculture and the rural environment, Published: 20-04-2023 in the Official Gazette No. 134-137 art. 209

- balanced development of rural territories through the involvement of the local community in rural development;

- business development of micro, small and medium-sized farmers[164].

Thus, based on the above-mentioned, there are five types of subsidies that are currently supported through public support, mainly:

1. Advance payments, including LEADER actions – a type of subsidy granted on the basis of an investment project, positively assessed by AIPA and authorized for the payment of the subsidy until the costs of its implementation are incurred. The criteria for applying for advance subsidies are related to availability of a financial contribution of at least 10% of the value of the project; viability of the proposed investment project; implementation of the project in rural area; a 24-month period of implementation. The investment project is to be implemented in rural areas;

2. Post-investment payments – a type of subsidy granted on the basis of an investment project or the extension of an investment project, positively assessed by AIPA and authorized for the payment of the subsidy after the implementation of the respective project based on the costs fully borne by the applicant. The payment is granted if there is a viable investment project; it has fully borne the costs of implementing the project; it has acquired for consideration goods and services, the object of the subsidy, from suppliers and distributors.

3. Investment payment in stages – a type of subsidy granted in stages, based on an investment project or an extension of an investment project, positively assessed by AIPA and authorized for the payment of the subsidy after the implementation of each stage based on the costs fully borne by the applicant. The payment is granted if the subsidy applicant has undertaken to contribute financially at least 50% of the value of the investment project; has a viable investment project; has borne the costs of implementing each stage of the investment project; the full implementation period of the investment project is up to 36 months, divided into no more than 3 stages; has acquired the goods and services, the object of the subsidy, from suppliers and distributors;

4. Direct payments – a type of subsidy expressed in a fixed amount, granted in a single installment, for the consolidation of agricultural activities in the crop, livestock or organic sector. The payment is granted to the subsidy applicant subject to compliance with the following conditions: holds the

[164] Law No. 71 from 31.03.2023 on subsidies in agriculture and the rural environment, Published: 20-04-2023 in the Official Gazette No. 134-137 art. 209

minimum eligible area established by the Government, or holds a minimum number of animals of the species approved by the Government and meets the following requirements: for productive forms, demonstrates the obtaining of the production and its delivery to a local processor or demonstrates its processing; the animals are insured; the animals are registered in accordance with Law No. 231/2006 on the identification and registration of animals, for the species provided for.

5. Complementary payments – a type of subsidy granted in a single installment, to cover current costs or to cover income losses. It is granted to the subsidy applicant in a proportion of no more than 80% of the value of the current costs incurred, with the exception of payments granted to compensate for interest paid to commercial banks and non-bank credit organizations[165].

The sustainable development of the agricultural sector of Moldova represents an important aspect of the economic and social advancement. In this context, public support via financial instruments, namely subsidies, can be an essential tool for supporting the building of a modern, competitive, sustainable and resilient sector. NFDARE is designed not only to boost the economic efficiency and productivity of the sector, but also to promote environmental sustainability and adaptation to climate change. Analyzing the types of subsidies granted, as well as the measures and actions to be funded, is quite important for evaluating their possible impact on natural resource management, agriculture modernization and rural development.

Subsidies aimed at combating the effects of climate change

1. Advance payments

Within this type of support, the following measures in line with combating effects of climate change[166] are subsidized by the state:

- Development of infrastructure of the farm, namely:

- installations for the production of energy from renewable sources and electricity supply equipment;

- construction or rehabilitation of water reservoirs for irrigation, as well as related hydrotechnical constructions;

[165] Law No. 71 from 31.03.2023 on subsidies in agriculture and the rural environment, Published: 20-04-2023 in the Official Gazette No. 134-137 art. 209

[166] Government Decision No. 465 from 05.07.2023 on the approval of the Regulation on advance subsidy measures and the specific eligibility conditions for advance subsidies from the National Fund for the Development of Agriculture and the Rural Environment and on the repeal of certain normative acts. Published: 04-08-2023 in the Official Gazette No. 291-295 art. 693

- construction or modernization of installations for irrigation, drainage, desiccation.

It is important to note that the subject of subsidy under this measure is the micro or small farmer. In order to obtain the payment, the applicant has to have a viable investment project, a technical project and, where applicable, an estimate of expenses; the total cost of the investment project should not exceed 5.0 mil. MDL; the applicant's financial contribution should account for at least 40% of the total cost of the investment project; the applicant should have the necessary permissive documents to carry out the investment; availability of connection to the infrastructure. The subsidy granted under this measure constitutes 60% of the value of the eligible project, but not more than 3.0 mil. MDL.

- Stimulating production on protected land, which means stimulating the production of vegetables, fruits, aromatic, seasoning or medicinal plants on protected land (greenhouses, solar panels, tunnels), by subsidizing namely:
  - equipment, machinery and construction material;
  - covering material, including AGRIL non-woven material.

The subject of the subsidy under this measure is the micro or small farmer. The conditions for obtaining the subsidy are: related to the minimum eligible area of at least 0.05 ha; the covering material of a thickness of at least 150 microns; availability of a viable investment project by the applicant; availability of the project or draft project (plan) for the planned investment, an estimate of expenses prepared by the authorized designer or supplier; location in rural areas; and the applicant has skills in the field. The total cost of the investment project does not exceed 2.0 mil. MDL and the applicant's financial contribution represent at least 40% of the total cost of the investment project. In case the applicant is a young farmer, woman farmer, returned migrant or farmers-peasant household, contribution accounts for at least 30% of the value of the investment project. The subsidy granted under this measure does not exceed the value of 1.2 mil. MDL.

2. Post-investment payments

Within this type of support, the following measures[167] are to be considered as actions for adaptation or mitigation of the effects of climate change:

- Investments in production on protected land - subsidizing the costs of implementing the investment project in the production of vegetables, fruits,

[167] Government Decision No. 491 from 12.07.2023 on the the subsidization of investments from the National Fund for the Development of Agriculture and Rural Environment. Published: 15-08-2023 in the Official Gazette No. 314-317 art. 705

aromatic, seasoning or medicinal plants on protected land (greenhouses, solariums, tunnels). The subsidy is granted for:

- construction material for greenhouses, solariums and tunnels;
- covering material or non-woven material of the AGRIL type;
- equipment, machinery or accessories that constitute systems for controlling environmental conditions;
- machines, machinery or accessories for the production of seedlings in cellular pallets;
- machinery or equipment for soil cultivation, plant protection and crop maintenance.

The subject of subsidy under this measure is the farmer, which has to fulfill several conditions like: at least 0.1 ha; the covering material of the greenhouses or solariums has a thickness of at least 150 microns; the applicant has skills in the field and has the project or draft of the project (plan), developed by the designer or supplier; the applicant has the permissive documents for the investment made. The amount of the subsidy may be granted in the amount of 50% of the cost of greenhouse modules, equipment, machinery, covering and construction material for greenhouses, solariums and tunnels; 30% of the cost of construction or covering materials used in the reconstruction of greenhouses, solariums or tunnels; 25% of the cost (per unit) of the machinery or equipment necessary for soil cultivation, plant protection and crop maintenance, but not more than 300 thousand lei per beneficiary. The amount of the subsidy granted to a beneficiary under this measure does not exceed the value of 4.0 mil. MDL.

- Investments in irrigation systems and equipment - subsidizing new irrigation systems or equipment for stimulating the expansion of irrigated land areas to ensure climate resilience. The subsidy is granted for:

- stationary or mobile irrigation systems (by sprinkling, drip, micro-sprinkling);
- pumping stations, machinery and equipment within the pumping, filtration and/or fertigation station;
- equipment forming the supply and/or distribution networks;
- water treatment system for irrigation by various methods;
- installations for the production of energy from renewable sources as a component part of the project.

The subject of the subsidy under this measure is the farmer or associations of water users for irrigation. They have to adjust to specific conditions for obtaining the subsidy, namely: the applicant owns or uses agricultural land and

has an investment project with the project documentation prepared by a certified designer and, where applicable, the project outline with the cost estimate; the applicant has the permissive documents for the investment made and has the written permission of the local public administration authority that manages on behalf of the state/administrative-territorial unit the irrigation and/or drainage system owned by the state/administrative-territorial unit – in the case of irrigation water user associations that own an irrigation and/or drainage system owned by the public. The amount of the subsidy varies between 50% of the value of the eligible investment project, but not more than 3.0 mil. MDL per farmer and 75% of the value of the eligible investment project, but not more than 7.0 mil. MDL for investment projects implemented by irrigation water user associations.

- Investments in water storage basins for irrigation - subsidization of investments made in water accumulation basins for irrigation in order to ensure climate resilience. The subsidy is granted for:

- carrying out construction or rehabilitation works of water accumulation basins, including rainwater, for irrigation, as well as of the related hydrotechnical constructions (flood protection dams, drainage systems);
- making investments in geomembrane and geotextile covering material.

The subject of the subsidy under this measure is the farmer or associations of water users for irrigation who are to respect a series of conditions like: technical project is developed by a certified designer; the applicant has an investment project; the applicant has the permissive documents for the investment made and holds the written permission of the local public administration authority that manages on behalf of the state/administrative-territorial unit the irrigation and/or drainage system owned by the state/administrative-territorial unit – in the case of irrigation water user associations that own a publicly owned irrigation and/or drainage system in commodation. The amount of the subsidy accounts for 50% of the value of the eligible investment project per farmer and 75% of the value of the eligible investment project – for irrigation water user associations. The amount of the subsidy granted under this measure for an applicant does not exceed 2.5 mil. MDL annually.

- Investments in plant sector farms - in order to increase competitiveness, diversify production, increase the quality of the products obtained and promote smart, sustainable and climate change-resilient agricultural practices, subsidies are granted for:

- installation or modernization of support systems - 50%, but not more than 80 thous. MDL/ha;

- installation or modernization of equipment for protecting perennial plantations against adverse environmental conditions: for anti-hail equipment – 50%, but not more than 150 thous. MDL/ha; for anti-rain equipment – 50%, but not more than 200 thous. MDL/ha; for combined anti-rain and anti-hail equipment – 50%, but not more than 350 thous. MDL/ha; d) combined anti-rain and anti-hail equipment with anti-insect netting on the side – 50%, but not more than 400 thousand lei/ha; for water-based anti-freeze equipment – 50%, but not more than 50 thous. MDL/ha; for anti-freeze equipment based on liquid and solid fuels – 50%, but not more than 250 thous. MDL per unit; for anti-insect equipment – 50%, but not more than 200 thous. MDL/ha; for reflective tape (ground cover/reflective fabric) – 50%, but not more than 300 thous. MDL/ha;

The subject of the subsidy under this measure is the farmer. The specific conditions for obtaining the subsidy are as follows: the farmer is a member of a specialized association; the applicant has skills in the field; the farmer owns land with irrigable vegetables.

- Investments in wine sector farms - in order to expand the areas of vineyard plantations, modernize them and promote smart, sustainable and climate-resilient agricultural practices, the subsidy is granted for:

- installation of modern support systems in young vineyard plantations. The subsidy is granted for installation of: "Tendone/Trentina" type and other subtypes of "Pergola" – 50%, but not more than 200 thous. MDL/ha; "Gable" type – 50%, but not more than 75 thous. MDL/ha; vertical trellis with posts made of galvanized metal and/or wood, in any combination, with at least 4 layers of galvanized wire, fixing and tensioning elements for the leading posts, fixing and tensioning elements for the wires – 100 thous. MDL/ha; ordinary vertical trellis with new poles made of metal, reinforced concrete or wood – 50%, but not more than 30 thous. MDL/ha;

- modernization of the support system in fruit vineyard plantations. The subsidy is granted for modernization of: "Tendone/Trentina" type and other subtypes of "Pergola" – 50%, but not more than 200 thous. MDL/ha; "Gable" type – 50%, but not more than 75 thous. MDL/ha; vertical trellis with posts made of galvanized metal (and/or similar metal = Korten) and/or wood, in any combination, with at least 4 layers of galvanized wire, fixing and tensioning elements for the leading posts, fixing and tensioning elements for the wires – 100 thous. MDL/ha"; ordinary vertical trellis with new posts made of metal, reinforced concrete or wood – 50%, but not more than 30 thous. MDL/ha;

- installation of anti-hail or anti-freeze equipment in the vineyard plantation. The subsidy is granted for installation or modernization of: anti-hail equipment – 50%, but not more than 150 thous. MDL/ha; anti-rain equipment – 50%, but not more than 200 thous. MDL/ha; combined equipment – anti-rain and anti-hail – 50%, but not more than 350 thous. MDL/ha; water-based anti-freeze equipment – 50%, but not more than 50 thous. MDL/ha; gas-based anti-freeze equipment (propane/butane) – 50%, but not more than 250 thous. MDL per unit;

- Investments in soil tillage technologies implies stimulating investments in soil cultivation technologies using conventional or conservative methods (permanent maintenance of soil cover, minimal mechanical disturbance of the soil and crop diversification), through:

- acquisition of soil conservation equipment. The farmer eligible for this type of subsidy is the one who cultivates phytotechnical crops; legally owns the agricultural land area to be cultivated; keeps records of the technological sheet, the model of which is approved by the central specialized body; undertakes to implement conservative agriculture for a period of 5 years from the date of receipt of the subsidy. The amount of dotation should not exceed 50% of the total cost of equipment, but no more than 1 mil. MDL.

- Development of infrastructure related to the farm implies modernization and development of infrastructure through:

- installations for the production of energy from renewable sources;
- construction or rehabilitation of water storage basins for irrigation, as well as related hydraulic structures;
- construction or modernization of the irrigation and/or drainage system.

The farmer should have connection to the infrastructure; a viable investment project; the investment was made based on a technical project and an estimate of expenses. The amount of the subsidy constitutes 50% of the value of the eligible investment project, based on the fully incurred costs, and does not exceed the value of 5.0 mil. MDL.

3. Investment payment in stages

Taking into account that the investments in stages represent a complex approach in developing a business, thus being funded all the stages of a business[168], some elements related to climate changes mitigation and adaptation can be identified within all types of activities funded, mainly related to

[168] Government Decision No. 491 from 12.07.2023 on the the subsidization of investments from the National Fund for the Development of Agriculture and Rural Environment. Published: 15-08-2023 in the Official Gazette No. 314-317 art. 705

installations for producing energy from renewable sources. Taking into account that installation of such equipment is part of a wider project, their costs cannot be estimated within the analysis.

4. Direct payments

Although one of the main objectives of direct payments for the livestock sector is stated to be adapting to climate change and mitigating its effects on agricultural production[169], direct effects of these subsidies on combating climate change are hard to be quantified, therefore, they are excluded from the analysis.

5. **Complementary payments,** with respect to climate change adaptation and mitigation, aim to increase the area of land in the organic system; implement environmentally friendly production technologies; expand the area of irrigated agricultural land; reduce the vulnerability of economic activities in the context of climate change; increase the area of insured agricultural crops and livestock[170].

- Stimulating the use of irrigation systems aims at increasing productivity and competitiveness, reducing the vulnerability of economic activities in the context of climate change by stimulating the use of irrigation systems, by partially covering the expenses incurred in pumping/repumping water for irrigation, as follows:

- use of electricity for pumping water from centralized irrigation systems;
- use of energy resources (electricity or fuel) for pumping water through irrigation systems.

A series of specific conditions for obtaining the subsidy must be fulfilled namely: submission of reports on water pumping, in the case of the existence of a meter with the seal of the local public administration authority of the first level and demonstration, through the 29-agr reporting form, of achieving an increase in the production yield on irrigated land, with the exception of young multi-annual plantations, of agricultural crops intended for the production of seeds for sowing.

- Development of organic agriculture aims to develop organic agriculture by increasing the area of agricultural land for conversion to organic

[169] Government Decision No. 492 from 12.07.2023 for the approval of the Regulation on the granting of direct payments in the livestock sector from the National Fund for the Development of Agriculture and Rural Environment. Published: 24-07-2023 in the Official Gazette No. 256-262 art. 627

[170] Government Decision No. 464 from 05.07.2023 on the approval of the Regulation on complementary subsidy measures and the specific eligibility conditions for complementary subsidies from the National Fund for the Development of Agriculture and Rural Environment and the repeal of Government Decision no. 455/2017 on the distribution of the means of the National Fund for the Development of Agriculture and Rural Environment. Published: 15-07-2023 in the Official Gazette No. 246-248 art. 601

agriculture and maintaining organic agriculture. For this, the farmer has to be registered in the organic farming system; the agricultural land area for which the subsidy is requested is in conversion to organic farming methods; the farmer maintains organic farming practices; the farmer maintains and enhances soil fertility; the farmer is the legal owner of the real estate registered in organic farming; the farmer undertakes to remain in the organic farming system for a period of 5 years from the end of the conversion period; the farmer has not benefited, in the last 7 years prior to the submission of the subsidy application, from a subsidy for the land area subject to the conversion period.

For this purpose, the subsidy is calculated as a fixed amount per unit of area and is:

1. for the period of conversion to organic farming methods for the following crops:

a. orchards, vineyards, fruit bushes and strawberries: 3500 MDL for 1 ha of agricultural land subject to the conversion process in the first year; 4000 MDL for 1 ha of agricultural land subject to the conversion process in the second year; 4500 MDL for 1 ha of agricultural land subject to the conversion process in the third year;

b. medicinal plants and essential oils: 2000 MDL for 1 ha of agricultural land subject to the conversion process in the first year; 2500 MDL for 1 ha of agricultural land subject to the conversion process in the second year; 3000 MDL for 1 ha of agricultural land subject to the conversion process in the third year;

c. field crops, pastures and hayfields: 2000 MDL for 1 ha of agricultural land subject to the conversion process in the first year; 2500 MDL for 1 ha of agricultural land subject to the conversion process in the second year;

d. vegetables: 12 thous. MDL for 1 ha of agricultural land subject to the conversion process in the first year; 14 thous. MDL for 1 ha of agricultural land subject to the conversion process in the second year;

e. beekeeping: 800 MDL for a bee family during the conversion period;

2. for maintaining organic farming practices – 20% of the value of organically certified products and marketed starting with 2 years preceding the submission of the subsidy application;

3. for maintaining and enhancing soil fertility – 2500 MDL for 1 ha of land, but will not exceed the amount of 200 thous. MDL per beneficiary. The subsidy is granted to farmers who sow intercropped or successive nitrogen-fixing crops, such as: soybeans, peas, chickpeas, lentils, alfalfa, phacelia, vetch, beans, sainfoin, clover, vetch, sulfin, lupine, serradela, ryegrass, mustard, buckwheat, fodder radish.

The Law on subsidized insurance in agriculture[171] provides for another types of subsidies aimed at mitigating the effects of climate change. Thus, subsidies are allocated for risks like: excessive drought, hail, early autumn, winter and late spring frosts, floods, torrential rains, seed blast, crop damage, burning of cereal crops, attack by harmful organisms. There are insured the quality of the yield of agricultural crops, multiannual plantations, livestock, livestock's health, fish and bees.

Analysis of subsidies aimed at combating the effects of climate change

Analysis of subsidies aimed at combating the effects of climate change is developed based on the previous classification (till 2023) of the allocated subsidies. It does not differ significantly from the current classification in terms of content, but it provides for a better understating of the situation in field. The data for 2024 is only partial, with more payments to be done in 2025, due to the depletion of the NFDARE in 2024.

For carrying out the analysis, the following sub-measures have been taken into account: stimulating investments for the production of vegetables and fruits on protected land (winter greenhouses, solariums, tunnels), subsidization of anti-hail equipment, subsidization of support equipment, stimulating the risk insurance mechanism in agriculture, stimulating investments for the procurement of irrigation equipment, stimulating agricultural producers to compensate the irrigation expenses, stimulating investments for the procurement of no-till and mini-till equipment and supporting the promotion and development of organic agriculture.

Although the subsidization process of the Moldovan agricultural sector has started before 2010, due to the reliability of data, the selected period for analysis was selected 2014 – 2024. Thus, in the analyzed period, the total value of NFDARE has increased from 400 mil. MDL to 1705,0 mil. MDL, with a maximum amount of 1750 mil. MDL in 2022. In the last 3 years, the value of NFDARE is relatively stable, with values around 1700 mil. MDL. Meanwhile, subsidies allocated for environmental aspects have fluctuated during the analyzed period from 90.9 mil. MDL to 77.67 mil MDL, as a result of the necessities of farmers. 2022 represented the year with the highest allocations for environmental aspects, reaching the maximum value of 311.7 mil. MDL. It's worth mentioning that the new subsidy program is quite focused on greening the sector, but it

[171] Law No. 183 from 11.09.2020 on subsidized insurance in agriculture. Published: 16-10-2020 in the Official Gazette No. 267-271 art. 572

depends on farmers if they would apply for these types of subsidies or not. The maximum value

The average value of the share of environmental allocations in the total allocated funds is 13.7%, with the maximum figure of 18.2% in 2014 to the minimum of 4.6% in 2024 (partial data).

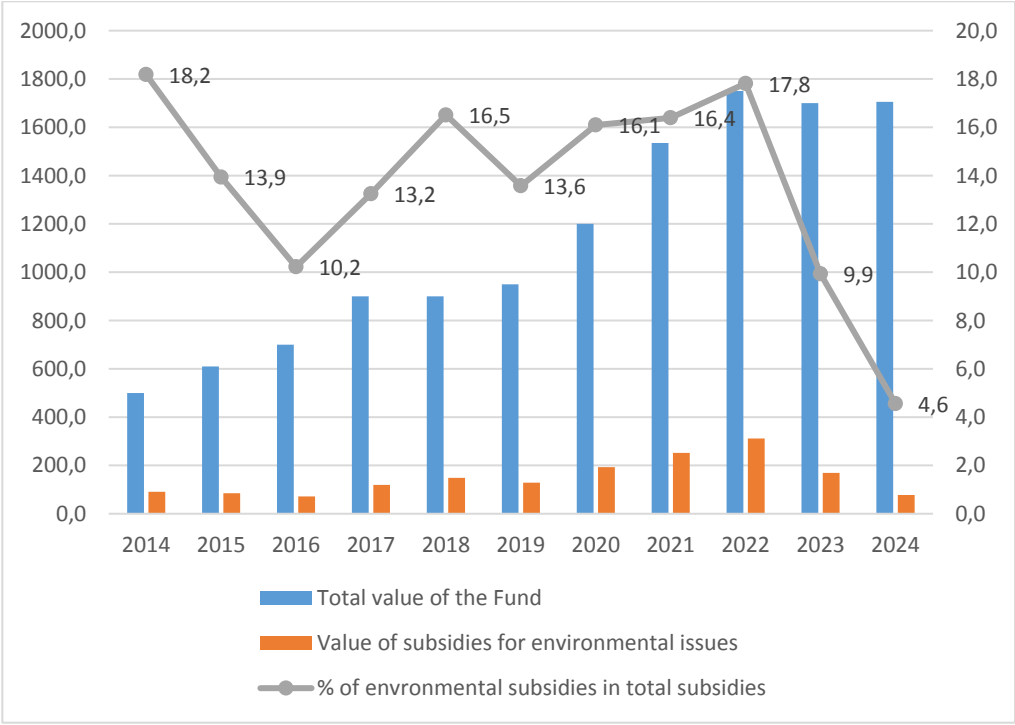

Figure 10. Budget support for environmental actions, 2014 – 2023, mil. MDL
Source: Agency for Intervention and Payments in Agriculture, 2014 - 2025[172]

Within sub-measure on stimulating investments for the production of vegetables and fruits on protected land (winter greenhouses, solariums, tunnels), during 2014 – 2024, the value of allocated subsidies varied from 54.5 mil. MDL to 13.18 mil. MDL. The share in the total environmental allocations also varied from 60% to 17%, which is explained by a lower total number of support measures in 2014. During 2014 – 2023, the new area under the production of vegetables on protected land accounted a total of 2566.26 ha. In the same time, a total of 701 greenhouses, 143 solariums, 26 tunnels, and 27 mulching were created.

[172] Agency for Intervention and Payments in Agriculture (2014-2025), Reports on allocated subsidies for the agricultural sector. www.aipa.gov.md, Accessed on 05.06.2025

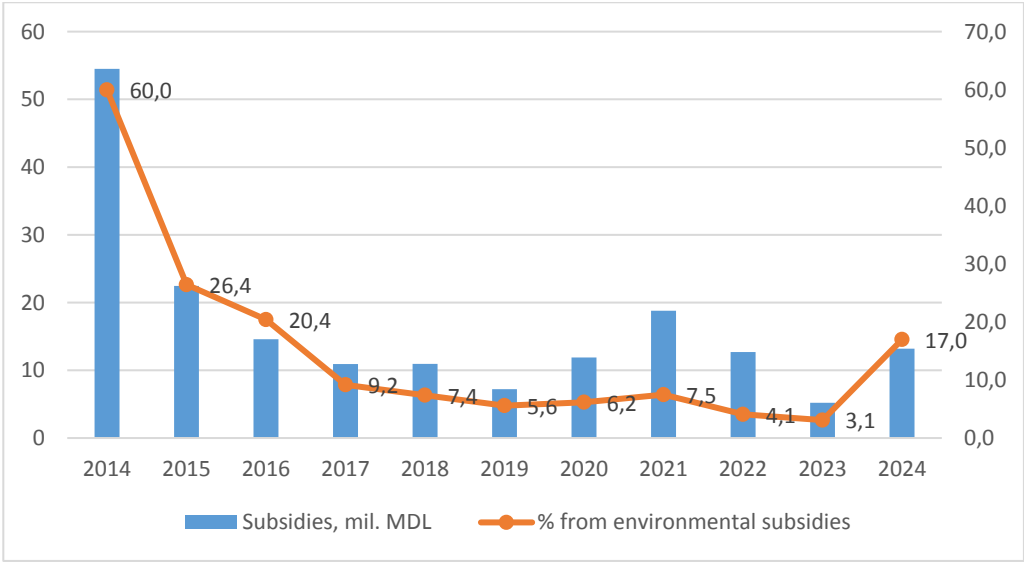

Figure 11. Budget support under sub-measure on stimulating investments for the production of vegetables and fruits on protected land

Source: Agency for Intervention and Payments in Agriculture, 2014 - 2025[173]

During 2014 – 2023, subsidization of anti-hail equipment has been constantly increasing, which is determined by the shift from traditional orchards to intensive and super-intensive ones, with the adequate anti-hail protection. The recent increase represents a clear sign of actions on behalf of Moldova farmers in their tentative to adapt to climate change and protect the productivity of plantations. The maximum level of allocated subsidies with this sub-measure was reached in 2022, accounting for 39.9 mil. MDL. The share in the environmental subsidies varies between 1.2% in 2015 to 16.2% in 2023. In total, 181 applications have been authorized for funding under this sub-measure. The total area of protected land with ani-hail equipment accounted for 1790.6 ha

Subsidization of support equipment as a sub-measure was introduced in 2017 and since then, has become a very popular one. The allocated value of subsidies accounted for 8.8 mil. MDL in 2017, while in 2023 it reached 27.3 mil. MDL. The peak of allocations was reached in 2020 – 40.1 mil. MDL. The share of subsidies for support equipment in the total environmental sub-measures varies between 7.4% in 2017 to 20.8% in 2020. In 2023 it amounted to 16.2%.

[173] Agency for Intervention and Payments in Agriculture (2014-2025), Reports on allocated subsidies for the agricultural sector. www.aipa.gov.md, Accessed on 05.06.2025

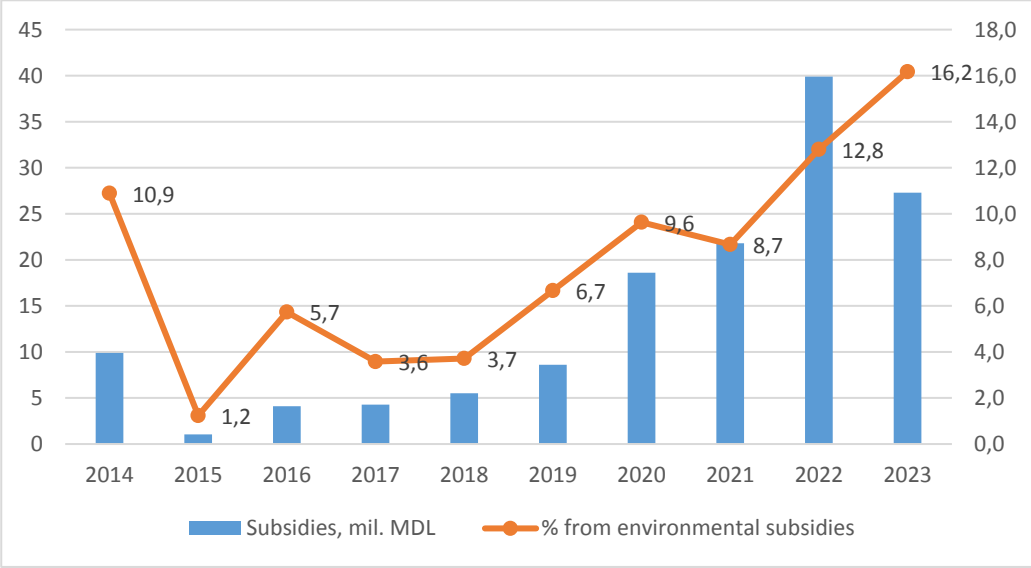

Figure 12. Budget support under sub-measure on subsidization of anti-hail equipment
Source: Agency for Intervention and Payments in Agriculture, 2014 - 2025[174]

The increasing interest in this sub-measure is reflected by a total number of 641 authorized applications. The total area under support installations was 3622.6 ha.

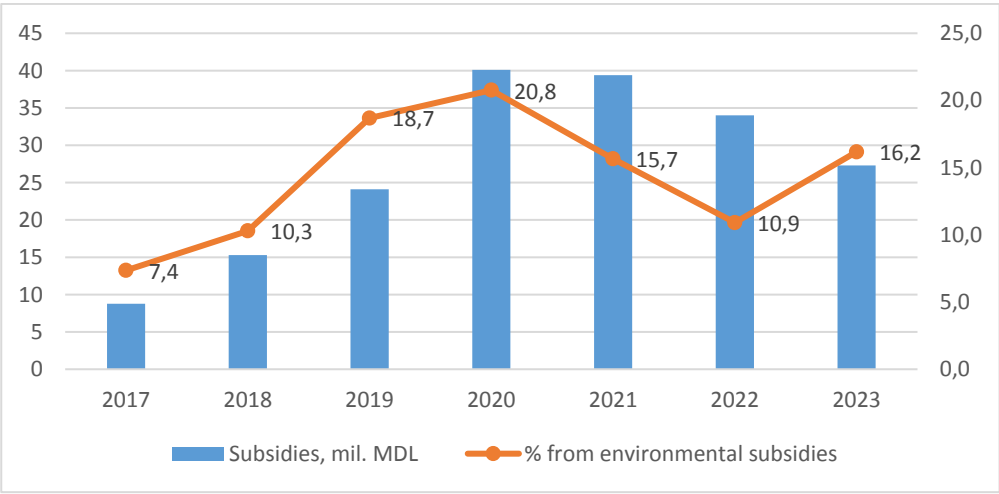

Figure 13. Budget support under sub-measure on subsidization of support equipment
Source: Agency for Intervention and Payments in Agriculture, 2014 - 2025[175]

[174] Agency for Intervention and Payments in Agriculture (2014-2025), Reports on allocated subsidies for the agricultural sector. www.aipa.gov.md, Accessed on 05.06.2025
[175] Agency for Intervention and Payments in Agriculture (2014-2025), Reports on allocated subsidies for the agricultural sector. www.aipa.gov.md, Accessed on 05.06.2025

Subsidization of the sub-measure on stimulating the risk insurance mechanism in agriculture is a very important one, taking into account the multiple obstacles faced by farmers in insuring their land, production or animals. The existing figures fluctuate significantly during 2014 – 2024, with a peak value of 66 mil. MDL in 2022 and the minimum figure of 5.4 mil. MDL in 2019. The share in the total environmental sub-measures in 2024 reached 10.8%. During 2014 – 2023, the total number of authorized applications accounted for 1891, while the insured area also increased from 5868 ha in 2017 to 18627,3 ha. The number of insured animals of all species accounted for 58533 in 2023.

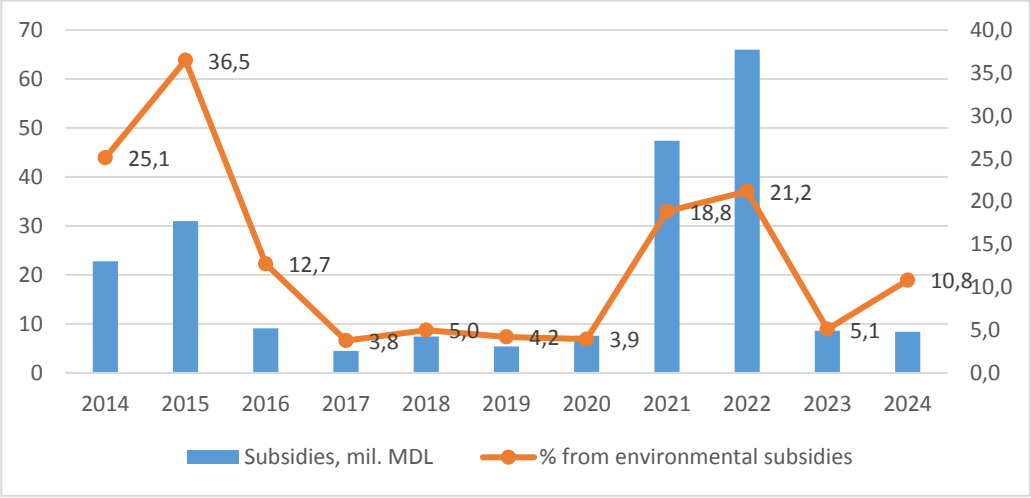

Figure 14. Budget support under sub-measure on stimulating the risk insurance mechanism in agriculture

Source: Agency for Intervention and Payments in Agriculture, 2014 - 2025[176]

Subsidies for stimulating investments for the procurement of irrigation equipment aim to solve one of the most acute problems caused by the effects of climate change – insufficient precipitation quantity. Thus, the amount of subsidies during 2015 – 2024 increased from 11.52 mil. MDL to 36.49 mil. MDL, with a maximum value of 75.4 mil. MDL in 2021. The share of this sub-measure in the total environmental subsidies varied between 13.6% in 2015 to 47% in 2024 (partial data). The total number of authorized applications till 2023 accounted for 2248. The total area under irrigation during 2015 – 2023 was of 49705.6 ha.

[176] Agency for Intervention and Payments in Agriculture (2014-2025), Reports on allocated subsidies for the agricultural sector. www.aipa.gov.md, Accessed on 05.06.2025

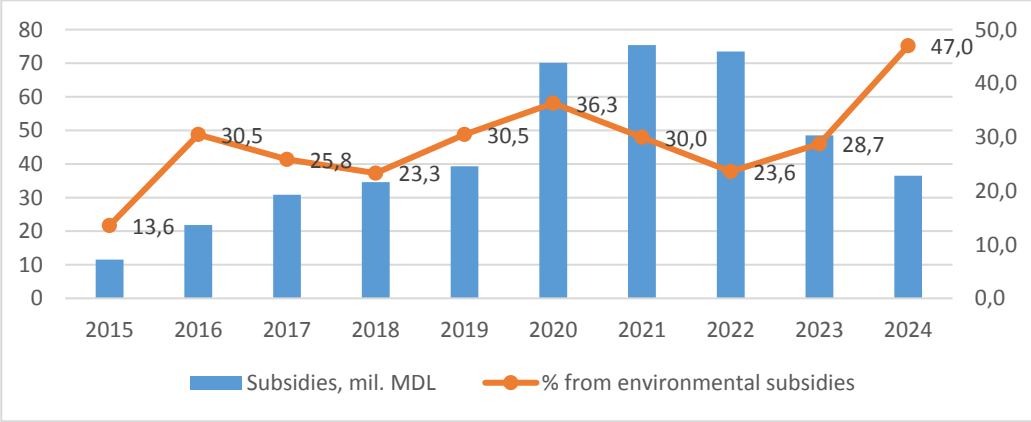

Figure 15. Budget support under sub-measure on stimulating investments for the procurement of irrigation equipment

Source: Agency for Intervention and Payments in Agriculture, 2014 - 2025[177]

Allocation of subsidies under the sub-measure dedicated to stimulating agricultural producers to compensate the irrigation expenses have an increasing trend, with higher values since 2020. In 2022, the maximum of 13.6 mil. MDL was reached. The share of this sub-measure in the environmental sub-measures was on average 4%, with an increase in the last 2 years. The total number of authorized applications during 2014 – 2023 accounted for 317. The annual average area of irrigated land under this sub-measure was 3432.9 ha.

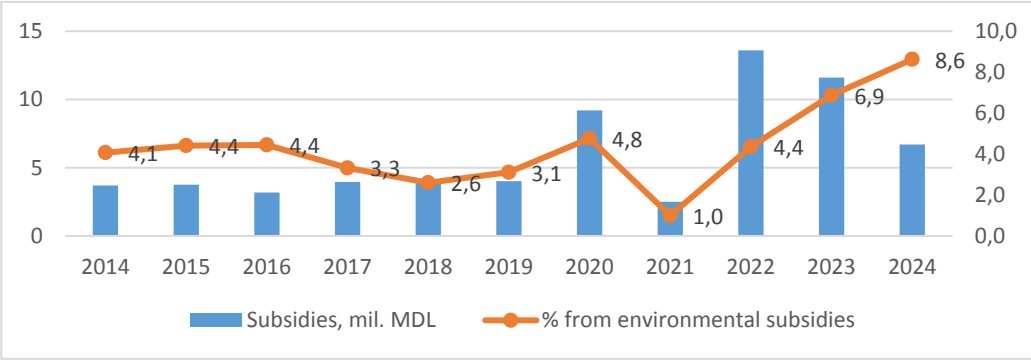

Figure 16. Budget support under sub-measure on stimulating agricultural producers to compensate the irrigation expenses

Source: Agency for Intervention and Payments in Agriculture, 2014 - 2025[178]

[177] Agency for Intervention and Payments in Agriculture (2014-2025), Reports on allocated subsidies for the agricultural sector. www.aipa.gov.md, Accessed on 05.06.2025

[178] Agency for Intervention and Payments in Agriculture (2014-2025), Reports on allocated subsidies for the agricultural sector. www.aipa.gov.md, Accessed on 05.06.2025

Subsidies on stimulating investments for the procurement of no-till and mini-till equipment is intended to promote the principles of conservative agriculture in the Republic of Moldova. The interest in this sub-measure is relatively high, with record allocations of 65.1 mil. USD in 2022. The share in the environmental subsidies in the last 2 years was of about 20% on average. The total number of authorized applications for funding, during 2015 – 2023 accounted for 1943. At the same time, 2324 no-till and mini-till equipment were procured as a result of reimbursement of costs for the made investments. The average processed surface of land with these types of equipment accounted for 69278.45 ha annually.

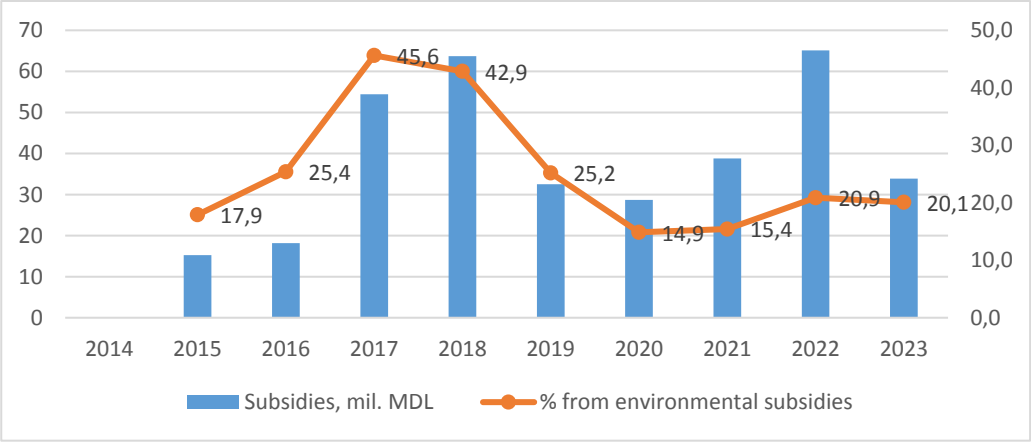

Figure 17. Budget support under sub-measure on procurement of no-till and mini-till equipment

Source: Agency for Intervention and Payments in Agriculture, 2014 - 2025[179]

The last analyzed sub-measure is dedicated to supporting the promotion and development of organic agriculture. Following the current world trends for organic and healthy production, organic agriculture has been supported in Moldova since 2016. The amount of allocated subsidies has increased considerably from 0.6 mil. MDL in 2016 to 12.9 mil. MDL. The share in the environmental subsidies reached 16.6% in 2024.

[179] Agency for Intervention and Payments in Agriculture (2014-2025), Reports on allocated subsidies for the agricultural sector. www.aipa.gov.md, Accessed on 05.06.2025

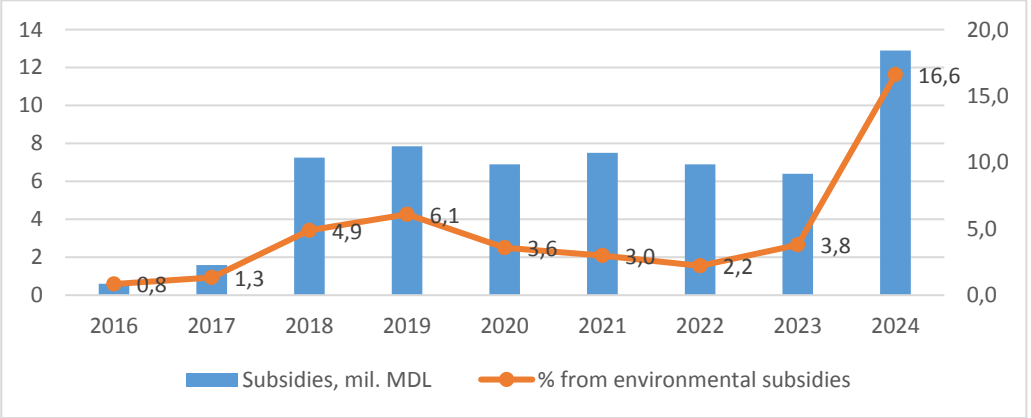

Figure 18. Budget support under sub-measure on supporting the promotion and development of organic agriculture

Source: Agency for Intervention and Payments in Agriculture, 2014 - 2025[180]

Overall, there is noted an increasing interest in environmental subsidies on behalf of farmers and in the nearest future, it is expected to increase even more, due to the EU integration path of the Republic of Moldova. Taking into account the greening EU policy, Moldovan farmers will have to adapt their agricultural practices in order to meet the needed balance of increased productivity and decrease of environmental negative impact.

Conclusions and recommendations

The agricultural sector of the Republic of Moldova remains an important pillar of the national economy, even if its share in GDP and GVA has been steadily declining in the last years. Production indices present some volatile values, especially in the plant sector, with significant oscillations as a result of the exposure of the sector to droughts and other similar extreme events.

Climate change poses important risks to Moldovan agriculture, while the existing projection scenarios point on a further warming and aridification of the land that will cause decreased yields in the staple crops like wheat and maize. The main risks for agricultural sector include water shortages, heat stress, pest proliferation and soil degradation, with more and more often occurrence of droughts that cause significant economic losses.

The existing public policies and institutional frameworks reflect a growing commitment to enhancing the sector's sustainability and resilience. The

[180] Agency for Intervention and Payments in Agriculture (2014-2025), Reports on allocated subsidies for the agricultural sector. www.aipa.gov.md, Accessed on 05.06.2025

main documents like the National Development Strategy "European Moldova 2030," National Climate Change Adaptation Program and National Strategy for Agricultural and Rural Development 2023–2030 point on the climate-resilient practices, together with conservation agriculture, efficient irrigation, and organic production. Alignment with the EU CAP focuses on greening, fairness and competitiveness, with Moldova's need to adopt similar measures like eco-schemes and targeted support for young farmers.

The public support allocated through the NFDARE is vital for adaptation and mitigation of the effect of climate change. Environmental subsidies averaged 13.7% of total allocations of public support, being focused on irrigation, production on protected land, anti-hail, anti-rain and support equipment, conservative machinery, and organic farming. Risk insurance mechanism supported 1891 applications, covering both, plant production and livestock. Overall, these measures have contributed to building resilience, but also face some challenges like high costs, insufficient funds, limited access for small farmers, delays in reimbursement of incurred costs and insufficient monitoring of the effects. Moreover, the carried-out analysis reveals that while environmental subsidies promote the adoption of resilient technologies, their impact is constrained by various barriers and limitations. The interdependence between agriculture and climate change needs for reliable integrated approaches that include both, adaptation and mitigation. At the same time, Republic of Moldova's EU integration direction provides opportunities for policy harmonization, but without enhanced support for environmental issues, the agricultural sector risks decline in productivity and emerging threats for food security.

In order to enhance the sustainability of Moldova's agricultural sector in the framework of climate change, the following **recommendations** are proposed:

Policy enhancements: Alignment with CAP provisions and main objectives will represent one of the most important steps in the EU integration process. The CAP eco-schemes will bring an added value to the Moldovan agricultural sector; thus, support should be provided for farmers implementing innovative farming systems such as: conservation agriculture system, organic (ecological) farming systems, regenerative agriculture, precision farming, etc. At the same time, there is a need for a public discourse on the diversification of production. The shift from cereals and technical crops to high-value products that are also climate-resilient (various types of nuts and medicinal plants) will be beneficial for farmers from the financial and environmental point of view. The high input costs may be addressed through targeted support.

Financial incentives: The current value of NFDARE is insufficient for satisfying the requests from farmers. The system of subsidy allocation should be rethought in accordance with environmental aspects, in order to increase their share in the total amount of subsidies. Thus, small farmers and vulnerable groups could be among the prioritized categories that could benefit from reduced co-financing. Large-scale projects like construction of irrigation basins could be extended to advance and staged payments. Complementary payments for carbon sequestration and increase of payments for organic conversion will also bring additional benefits to the sector.

Institutional reforms: An enhanced coordination among key institutions could be achieved through capacity building programs. Provision of trainings for farmers on sustainable practices, in cooperation with EU programs for knowledge transfer and involvement of academia will create the necessary synergies. AIPA should be mandated to conduct annual evaluations on the assessment of efficiency of subsidies, using different short-term and medium-term methodological approaches. Local community could also be engaged through the LEADER actions, especially for ensuring rural infrastructure investments that also incorporate climate adaptation.

Business-academia related measures: Boosting investments in research on the following directions: development of science-based sustainable models in the framework of demonstration farms; stimulation of research for development of seeds for crops of drought-resistant varieties; annual or bi-annual evaluations of subsidies effects; promotion of digital tools for precision farming in order to optimize the use of resources, etc.

By implementation of these recommendations, resilience and sustainability of the agricultural sector will be prioritized among the state policy. This will require a strong collaboration among government, farmers and international donors. By prioritizing resilience and sustainability, Moldova can transform its agricultural sector into a working engine for economic growth, ensuring food security and environmental integrity in a changing climate.

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