

# Sustainable Development and Modernization of the Agricultural Sector in the Republic of Moldova: A Socio-Economic and Structural Assessment

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## Abstract

*Agriculture plays a strategic role in the Republic of Moldova, driving food security, rural employment, and agro-food value chains. However, the sector remains vulnerable to climate variability, structural fragmentation, and low productivity. This study assesses the structural characteristics of Moldovan agriculture and identifies key priorities for sustainable modernization. Using data from the National Bureau of Statistics, the World Bank, Eurostat, and the FAO, the analysis applies descriptive-statistical, comparative, and analytical methods to evaluate agricultural value added, GDP contributions, and regional differences. The findings indicate high structural and climatic vulnerability, reflected in GDP fluctuations and a reliance on crop production, though agriculture remains vital for rural employment. The study pinpoints key growth areas, including livestock, horticulture, berry and fruit production, organic farming, aquaculture, nurseries, and food processing. Ultimately, the research highlights that diversification, technological upgrades, higher value added, robust value chains, and enhanced climate resilience are essential for the sustainable development and competitiveness of Moldovan agriculture.*

**Keywords:** Republic of Moldova; sustainable development; rural development; agricultural competitiveness; climate change; agricultural diversification.

**JEL classification:** Q01, Q18, O13

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## 1. Introduction

Agriculture occupies a strategically important position in the economy of the Republic of Moldova. Its significance extends beyond the direct contribution of agricultural production to gross domestic product (GDP), encompassing rural employment, food security, exports, household incomes, and the socio-economic development of rural territories. A substantial part of the rural population is directly or indirectly dependent on agricultural production and on related activities

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such as processing, trade, transportation, storage, and agricultural services (Cristea *et al.*, 2020). The importance of agriculture is reinforced by Moldova's natural and geographical conditions. The country possesses fertile soils and an agricultural tradition that supports the production of cereals, oilseeds, fruits, grapes, vegetables, livestock products, and other agricultural commodities. However, these advantages coexist with considerable structural vulnerabilities.

The agricultural sector is affected by soil fertility degradation, climate variability, recurrent droughts, fragmented land holdings, insufficient infrastructure, restricted access to investment, and limited integration between primary production, processing, and marketing (Cristea *et al.*, 2020). Climate change has increasingly become a structural factor influencing agricultural performance. Recent evidence indicates that Moldova is particularly exposed to drought and other weather-related shocks, while the World Bank identifies the country's reliance on drought-prone agriculture as an important source of economic and rural vulnerability (Schojan, Machin and Silberberger, 2024). The effects are transmitted through crop yields, livestock feed availability, production costs, farm incomes, and the stability of rural employment.

Consequently, agricultural modernization should not be interpreted simply as the replacement of traditional technologies with modern machinery. It involves a broader transformation of production systems, institutions, infrastructure, value chains, human capital, and natural-resource management. Recent research on Moldova emphasizes the potential of conservation agriculture to improve economic and climate resilience, particularly through reduced fuel consumption, lower mechanization requirements, and improved yield stability under drought conditions (*Grupul Băncii Mondiale - Dezvoltare internațională, sărăcie și durabilitate*, no date).

Against this background, the objective of this study is to assess the recent socio-economic and structural evolution of agriculture in the Republic of Moldova and to identify major directions for sustainable modernization. The analysis focuses on five interrelated dimensions: (i) the economic contribution of agriculture; (ii) structural transformation; (iii) employment and rural development; (iv) production structure and climate vulnerability; and (v) priority areas for modernization and value creation.

## **2. Material and method**

The study is based on data statistics primarily, (*Statistici pe domenii*, no date), and the methodological framework combines qualitative and quantitative approaches. The literature review includes national and international scientific publications, strategic documents, agricultural development policies, and reports of international organizations. Particular attention was given to publications addressing sustainable agriculture, climate resilience, agricultural competitiveness, rural development, and modernisation. The quantitative component uses statistical information concerning GDP, gross value added (GVA), agricultural employment,

agricultural production, and the structure of the economy. The principal national statistical source is the National Bureau of Statistics of the Republic of Moldova (NBS). International comparisons and contextual interpretation are complemented by World Bank data and reports.

Comparative analysis is used to examine Moldova in relation to selected countries of the region. Structural analysis is applied to identify changes in the relative importance of agriculture, industry, construction, and services. Production-structure analysis is used to assess the relative importance of crop production, livestock production, and agricultural services. The analysis covers the period 2018–2025 primarily, depending on data availability. Values originating directly from the doctoral research material are distinguished conceptually from subsequently updated official statistics. This distinction is important because several 2025 indicators contained in the original material were estimates, while more recent NBS releases now provide preliminary or final observations.

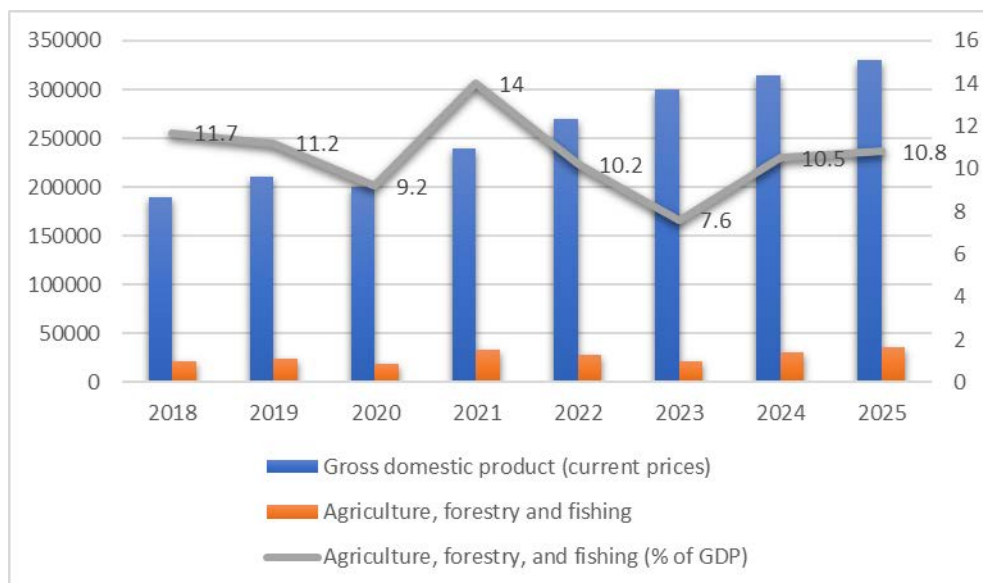
### 3. Results

The agricultural sector is characterized by relatively limited cooperation between primary agricultural production, the processing industry, and the commercial sector, as well as by the underutilization of production capacities and low levels of sustainable investment (Fig. 1).

The Republic of Moldova's Gross Domestic Product showed a general upward trend during the 2018–2025 period. Its value rose from approximately 190,000 million MDL in 2018 to around 274,488.1 million MDL in 2022, and forecasts indicate that this trend will continue in the coming years, with an estimated value of approximately 330,000 million MDL for 2025 (*Biroul Național de Statistică al Republicii Moldova*).

This evolution illustrates an important structural characteristic: although the absolute size of the economy increased, agricultural value added did not expand at the same rate. Consequently, agriculture's relative weight in the economy became increasingly influenced by developments in other sectors. Updated official statistics confirm this structural pattern. In 2025, Moldova's GDP reached approximately MDL 353.5 billion at current prices, according to preliminary NBS data. Agriculture, forestry, and fishing accounted for 7.4% of GDP, while their real GVA increased by 10.7% compared with 2024 (*Biroul Național de Statistică al Republicii Moldova*).

The decline in agriculture's relative contribution should not be interpreted as a disappearance of its economic importance. Rather, it reflects two simultaneous processes: agricultural production remains economically significant, while services, information and communication activities, construction, and other sectors have increased their relative contribution to GDP.



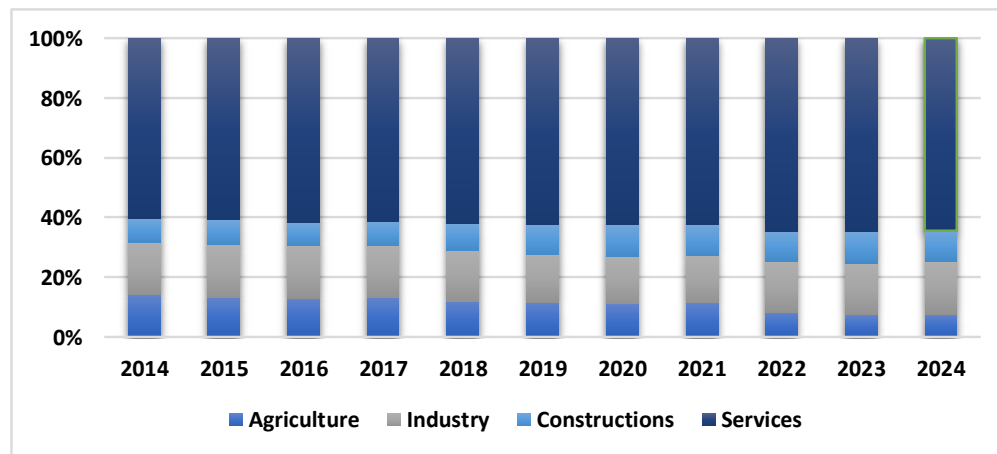
**Fig. 1. Gross domestic product and gross value added of the agricultural sector, 2018-2025**

Source: National Bureau of Statistics, 2018-2025

The research material identifies considerable annual fluctuations in agriculture's share of GDP, with values ranging from approximately 7.6% to 14.0% during the analysed period and a peak in 2021 (*Biroul Național de Statistică al Republicii Moldova*). This volatility is particularly relevant for interpreting Moldova's economic structure. Agricultural value added is strongly affected by weather conditions, especially precipitation and drought (Fig. 2). A favourable agricultural year can significantly increase agriculture's contribution to GDP, while an unfavourable year can generate the opposite effect.

The 2024 agricultural season illustrates this sensitivity. According to NBS, total agricultural production in 2024 represented only 85.4% of the 2023 level in comparable prices, mainly because crop production declined by 22.9%, despite a 5.7% increase in livestock production.

By contrast, agricultural production recovered strongly in 2025. Final NBS data indicate that total agricultural production reached 115.9% of the 2024 level, with crop production increasing by 24.3%, while livestock production declined by 3.4%. These developments reinforce the conclusion that the economic weight of agriculture in Moldova is not determined solely by long-term structural trends. It is also highly sensitive to climatic and production cycles.



**Fig. 2. Structure of gross value added by economic sector, 2014-2024, %**  
Source: Agricultural irrigated land (% of total agricultural land)

The research reports that agriculture represented approximately 10.6% of GDP in Moldova in 2022, compared with 10.9% in Ukraine, 4.6% in Romania, and 4.3% in Bulgaria Table 1.

**Table 1. Share of agriculture in GDP compared to neighbouring countries, %**

| Country  | Share of agriculture in GDP, % (2022) | Share of agriculture in GDP, % (2023) | Share of agriculture in GDP, % (2024) |
|----------|---------------------------------------|---------------------------------------|---------------------------------------|
| Moldova  | 10,6                                  | 8,1                                   | 7,62                                  |
| Ukraine  | 10,9                                  | 8,6                                   | 7,1                                   |
| Romania  | 4,6                                   | 3,81                                  | 3,88                                  |
| Bulgaria | 4,3                                   | 3,71                                  | 2,52                                  |

Source: Grupul Băncii Mondiale - Dezvoltare internațională, sărăcie și durabilitate, 2026

The lower agricultural shares observed in Romania and Bulgaria reflect more diversified economic structures in which services and other non-agricultural sectors account for a larger proportion of total value added. Moldova's comparatively higher agricultural share reflects the continuing importance of primary production within its economic and territorial structure.

The comparison therefore should not be interpreted as a direct measure of agricultural efficiency. A lower agricultural share may reflect higher productivity and stronger development in other sectors, while a higher share may reflect both agricultural importance and slower structural diversification.

The economic structure presented indicates a gradual reduction in agriculture's relative weight during 2014–2024. Agriculture's contribution declined from approximately 13% to approximately 7–8%, while services expanded and industry maintained a comparatively stable or moderately increasing share.

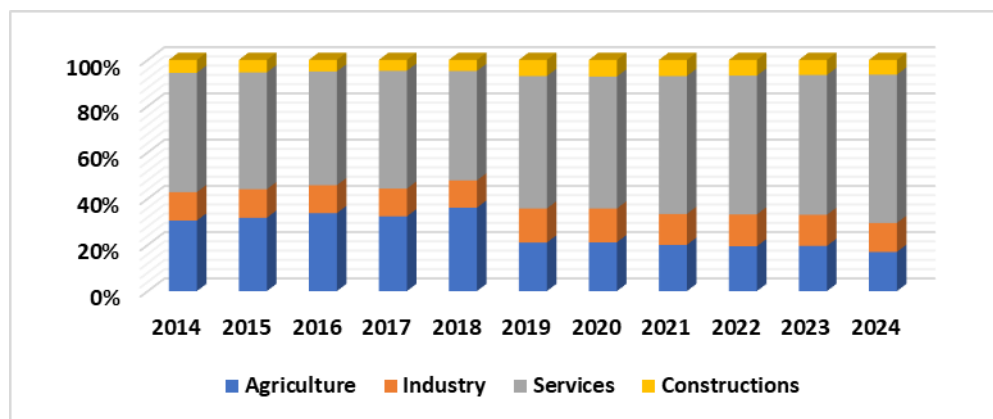
This transformation corresponds to a broader process of structural change. As economies develop, employment and value added generally shift from primary

activities toward manufacturing and services. However, in Moldova, this transition creates an important policy challenge because a substantial part of the rural population remains dependent on agriculture.

Therefore, the decline in agriculture's relative share should be accompanied by productivity growth. If labor leaves agriculture without corresponding increases in productivity, rural depopulation and labor shortages may intensify without generating sufficient value creation in the remaining agricultural enterprises.

According to the doctoral research material, agriculture accounts for approximately one-fifth of the employed population, although estimates differ depending on the statistical methodology used and on whether subsistence agricultural activity is included (Cristea *et al.*, 2020).

The material also identifies lower agricultural wages compared with several other economic activities, together with difficult working conditions, limited attractiveness for younger workers, and shortages of qualified labor (Fig. 3).



**Fig. 3. Structure of the employed population by economic activity, 2014-2024, %**

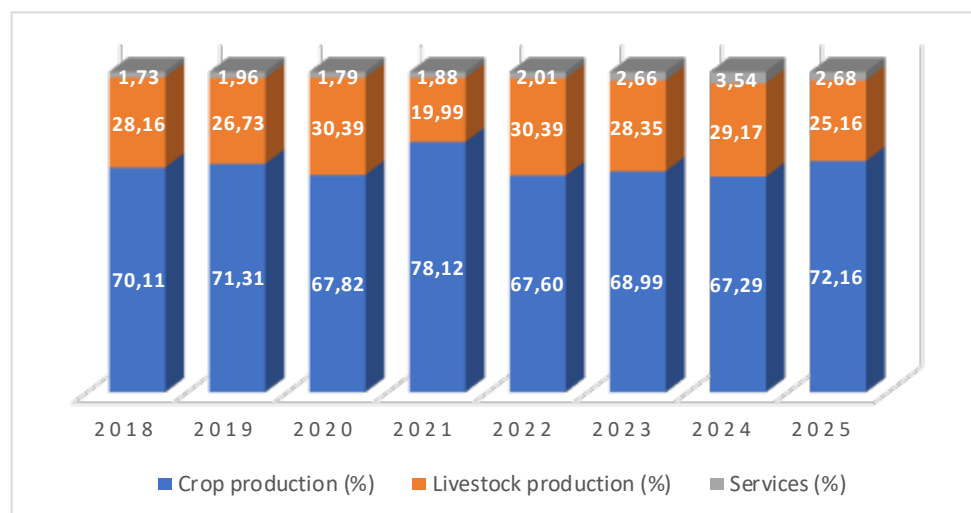
*Source:* Biroul Național de Statistică al Republicii Moldova

At the same time, remuneration levels in this sector are among the lowest in the economy. In 2024, the average monthly wage in agriculture and related activities ranged from approximately 8,000 to 9,000 lei—figures lower than those in other economic sectors. This situation has persisted in recent years and is linked to challenging working conditions in rural areas and the sector's limited appeal to young professionals. The shortage of skilled labor is a direct consequence of these factors. Against this backdrop, public policies aim, among other things, to raise wage levels and strengthen vocational training and education programs within the agricultural. These factors demonstrate that agricultural modernization has a significant social dimension. Investment in machinery, irrigation, storage, processing, and digital technologies can increase productivity, but modernization also requires investment in people.

Training and professional development should therefore accompany technological modernization. Skills related to precision agriculture, digital farm

management, accounting, marketing, quality standards, food safety, machinery operation, and climate-risk management are increasingly important.

The research shows a strong predominance of crop production in Moldova's agricultural output. During 2018–2025, crop production accounted for approximately 67–78% of agricultural production, livestock for approximately 20–30%, and agricultural services for approximately 2–4% (Figure 4).



**Fig. 4. Structure of agricultural production in Moldova, 2018-2025, %**

Source: Biroul Național de Statistică al Republicii Moldova

This structure creates both an economic opportunity and a vulnerability. The crop sector benefits from Moldova's agroecological conditions and export potential. At the same time, high dependence on crop production increases exposure to drought, rainfall variability, heat stress, and other climatic shocks. The 2025 agricultural statistics demonstrate this duality. Crop production increased substantially, including cereals, rapeseed, sunflower, grapes, fruits, and vegetables, while livestock production decreased (*Cancelaria de Stat | Guvernul Republicii Moldova*). Such divergence suggests that diversification remains an important modernization objective. Livestock development can contribute to diversification, strengthen the domestic feed-production chain, create additional value in rural areas, and reduce dependence on a narrow group of crop commodities.

Climate vulnerability represents one of the central constraints on the sustainable development of Moldovan agriculture. The doctoral material identifies drought and moisture variability as important causes of production instability (Guenser *et al.*, 2018).

The 2020 drought provides a relevant example. Reduced agricultural production affected not only crop output but also livestock through a weaker feed base and higher production costs (*Cancelaria de Stat | Guvernul Republicii Moldova*).

More recent World Bank analysis similarly identifies drought-prone agriculture and exposure to natural hazards as important sources of economic volatility in Moldova (*Grupul Băncii Mondiale - Dezvoltare internațională, sărăcie și durabilitate*, no date). The World Bank has also emphasized that climate-related shocks disproportionately affect rural populations because of their dependence on agriculture and natural resources.

Accordingly, resilience should become an explicit component of agricultural modernization. Relevant measures include soil conservation, crop diversification, efficient irrigation, water management, drought-resistant varieties, improved agricultural forecasting, insurance and risk-management mechanisms, and digital monitoring.

Recent research focused specifically on Moldova indicates that conservation agriculture can improve farm-level economic resilience. A 2025 study based on 25 farms for the 2020–2024 period reported higher profitability and lower fuel use under conservation systems compared with conventional systems [3]. These findings provide empirical support for integrating resource-conservation technologies into the modernization agenda.

#### **4. Discussion**

The results indicate that the modernization of Moldovan agriculture cannot be reduced to increasing production volumes. The central challenge is to increase the value, productivity, resilience, and sustainability of agricultural activity. Four interconnected transformations are particularly important.

First, Moldova needs to move from an output-oriented agricultural model toward a value-added model. Producing larger quantities of cereals, oilseeds, fruits, or grapes does not automatically generate higher rural incomes. Greater economic value can be generated through sorting, storage, packaging, processing, certification, branding, logistics, and direct access to final markets. Second, modernization requires diversification. The strong dominance of crop production creates exposure to climate and price risks. Development of livestock, horticulture, berries, vegetables, aquaculture, seed production, nurseries, aromatic plants, and organic agriculture can broaden the agricultural economic base. Third, climate adaptation must become part of mainstream agricultural investment rather than a separate environmental objective. Soil health, water management, conservation agriculture, efficient machinery, crop diversification, and digital monitoring contribute simultaneously to economic and environmental resilience. Fourth, modernization requires stronger integration between producers, processors, traders, logistics providers, research institutions, and financial organizations. Fragmentation along the value chain can reduce the benefits obtained from increased production. The evidence also suggests that modernization should be territorially differentiated. Different regions possess different agroecological conditions, infrastructure, market access, and specialization patterns. A uniform policy framework may therefore be less effective than a portfolio of interventions adapted to local production systems.

Based on the empirical results and the framework developed in the doctoral research material, the following modernization directions can be identified.

Priority should be given to sectors capable of generating higher value added and reducing climate-related concentration risks. Processing should be treated as a core element of agricultural modernization rather than as a secondary activity. Investments in cold storage, sorting, packaging, drying, freezing, fermentation, juice and wine production, dairy processing, meat processing, and other forms of value addition can increase the domestic economic return from agricultural production. Soil degradation represents a long-term constraint on productivity. Modernization should therefore promote conservation agriculture, crop rotation, reduced soil disturbance, organic matter restoration, erosion control, efficient irrigation, and improved water-use efficiency.

Digital technologies can contribute to more efficient use of inputs and better decision-making. Relevant applications include satellite monitoring, geographic information systems, weather information, precision fertilization, automated irrigation, yield mapping, farm-management software, and digital traceability. Digitalization should nevertheless be accompanied by training and affordable access to technology, particularly for smaller farms. The competitiveness of agriculture depends not only on farm productivity but also on coordination between producers and downstream actors. Producer organizations, cooperatives, contractual relationships, logistics platforms, storage facilities, certification systems, and stronger connections with processors and exporters can reduce transaction costs and increase farmers' market access. Modernization requires skilled labor. Agricultural education and extension services should increasingly focus on practical skills related to modern production technologies, business management, climate adaptation, quality standards, digital tools, and export requirements. At the same time, higher productivity should be translated into improved employment quality and rural incomes. Climate resilience should be integrated into investment planning. Instruments may include agricultural insurance, emergency-response mechanisms, drought monitoring, irrigation investments, water storage, diversified crop structures, climate-resilient varieties, and improved access to meteorological information.

## **5. Conclusions**

Agriculture remains a strategic component of the Republic of Moldova's economy despite the gradual decline in its relative contribution to GDP. Its importance is reflected not only in value added but also in employment, rural livelihoods, exports, food security, and territorial development. The analysis confirms that Moldovan agriculture is undergoing structural transformation. The relative weight of agriculture has decreased as services and other economic activities have expanded.

At the same time, agricultural production remains highly variable because of climatic conditions, and the sector continues to face structural constraints related to fragmentation, infrastructure, investment, labor, and value-chain integration. The

production structure is dominated by crop production, which provides important export opportunities but also creates significant exposure to drought and other climatic shocks. The results therefore support diversification toward livestock, horticulture, berries, fruits, grapes, vegetables, aquaculture, organic production, seed production, and agricultural processing. Sustainable modernization requires an integrated approach based on four complementary objectives: economic efficiency, environmental resilience, social development, and technological modernization.

The most important strategic shift should move from a predominantly production-oriented model to one based on productivity, value added, diversification, resource efficiency, innovation, and stronger integration into domestic and international value chains.

The recent recovery of agricultural production in 2025 demonstrates the sector's productive potential. Still, the contrast between the severe decline in 2024 and the strong recovery in 2025 also illustrates the high sensitivity of agricultural performance to climatic and production conditions. Therefore, future modernization policies should place resilience at the centre of agricultural development. For Moldova, sustainable agricultural modernization is consequently not only an agricultural policy objective. It is an essential component of rural development, economic diversification, climate adaptation, and long-term territorial cohesion.

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