VCA4D
VALUE CHAIN ANALYSIS FOR DEVELOPMENT

agrinatura for European Commission

Value Chain Analysis of sunflower in Moldova

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VITAE DISCIMUS

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The information and knowledge produced through the value chain studies are intended to support the Delegations of the European Union and their partners in improving policy dialogue, investing in value chains and better understanding the changes linked to their actions.

VCA4D uses a systematic methodological framework for analysing value chains in agriculture, livestock, fishery, aquaculture and agroforestry. More information including reports and communication material can be found at: https://europa.eu/capacity4dev/value-chain-analysis-for-development-vca4d-

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ACRONYMS

AE	Agricultural Enterprise
AFA	Agrifood Chain Analyses Software
AIPA	The Agency of Intervention and Payments in Agriculture, Moldova
ANSA	The National Food Safety Agency, Moldova
AUAI	Water Users' Associations
AWU	Annual Work Unit
CAP	Common Agricultural Policy
CI	Entrepreneurs' Cooperatives
CNAM	National Health Insurance Company
CO_2eq	Carbon Dioxide Equivalent
CZU Prague	Czech University of Life Sciences Prague
DALY	Disability-Adjusted Life Years
DAMEP	Department for Analysis, Monitoring, Evaluation and Policy
DCFTA	Deep and Comprehensive Free Trade Area
DRC	The Domestic Resource Cost
EPC	Effective Protection Coefficient
EU	European Union
EUR	Euro currency
FAO	The Food and Agriculture Organization of the United Nations
FD	Feed
FiBL	Research Institute of Organic Agriculture
FNDAMR/NARDF	National Fund for Agriculture and Rural Development
FOB	Free on board
GD	Government Decisions
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIS	Geographical Information System
GP	Producer Groups
GT	Gospodării Țărănești (used synonymously with PF)
GWP	Global Warming Potential
HA	Hectare
HoReCa	hospitality industry
HP	Household Plots
HR	Human Resources
HS	The Harmonized Commodity Description and Coding System
IC	Intermediate consumption
ICCPR	International Covenant on Civil and Political Rights
ICESCR	International Covenant on Economic, Social, and Cultural Rights
IFAD	International Fund for Agricultural Development
IGS	Intermediate Goods and Services
ILO	International Labour Organization
IMP	Import
INTPA	International Partnerships
I-O	input-output
IP	Input providers
KII	Key Informant Interviews

LAGs	Local Action Groups
LCA	Life Cycle Assessment
LCI	Life Cycle Inventory
LCU	Livestock Unit
LO	Landowner
M&E	Monitoring and Evaluation
MAFI	Ministry of Agriculture and Food Industry
MDL	Moldovan leu
ML	Industrial mill
Mt	Million tonnes
NACE	The Statistical Classification of Economic Activities in the European Community
NBS	National Bureau of Statistics
NLP	National Land Program
NOP	Net Operating Profit
NPC	Nominal Protection Coefficient
NSARD	National Strategy for Agriculture and Rural Development
NUE	Nitrogen Use Efficiency
OHS	Occupational safety and health
P	Phosphorus
PF	Peasant Farmer (North, Centre, South), used synonymously with GT
PMR	Pridnestrovian Moldavian Republic
PPE	Personal Protective Equipment
PPP	Purchasing Power Parity
PSR	Producer Subsidy Ratio
RoM	Republic of Moldova
S	South region
SA	Joint Stock Companies
SC	Self consumptions
SHS	State Hydrometeorological Service
SNC	National Accounting Standard
SPEI	Standardized Precipitation-Evapotranspiration Index
SPS	Sanitary and Phytosanitary
SRLs	Limited Liability Companies
SSR	Soviet Socialist Republic
SWOT	Strengths, Weaknesses, Opportunities, Threats
T	Tonne(s)
TR	Trader
TUM	Technical University of Moldova
UA	Ukraine
UN	The United Nations
UNDP/GCF	United Nations Development Programme/Green Climate Fund
UNFCCC	The United Nations Framework Convention on Climate Change
USAID	The United States Agency for International Development
USDA	The United States Department of Agriculture
USSR	Union of Soviet Socialist Republics
VA	Value Added
VAT	Value added tax
VC	Value chain
VCA4D	Value Chain Analysis for Development

WHO	World Health Organization
YoY	Year-on-Year

EXECUTIVE SUMMARY

Functional Analysis

The Functional Analysis provides a comprehensive descriptive and contextual assessment of the *sunflower value chain (VC)* in the Republic of Moldova. It examines the international and national context of sunflower production, analyses the commodity flows from production to final markets, identifies the principal actors involved, and reviews the governance arrangements that influence the performance of the sector. The Functional Analysis establishes the basis for the subsequent economic, social, and environmental assessments presented in this report.

The analysis begins by positioning Moldova within the regional and global sunflower market. Particular attention is given to the dominant role of the Black Sea region, where the Russian Federation and Ukraine account for approximately half of global sunflower seed production. Recent years have been characterised by substantial volatility resulting from geopolitical tensions, disruptions in regional trade flows, climate-related shocks, and fluctuations in international demand for oilseeds. The war in Ukraine has altered traditional export routes and trade patterns throughout Eastern Europe, creating both challenges and opportunities for Moldovan producers and traders. Within this context, Moldova has consolidated its position as an important regional exporter of sunflower seeds, benefiting from favourable market conditions and increased demand from neighbouring countries and the European Union. However, the sector remains highly exposed to climatic variability, particularly recurrent droughts that affect yields and production volumes.

The second component of the Functional Analysis examines the historical development of sunflower production in the Republic of Moldova. The review traces the transformation of the agricultural sector from the centrally planned system inherited from the Soviet period to the market-oriented agricultural structure that emerged following land privatisation and economic reforms after independence. These transformations have resulted in a dual agricultural structure characterised by a large number of small family farms and peasant households coexisting with a relatively small number of large agricultural enterprises that cultivate extensive areas through land ownership and leasing arrangements. The analysis highlights the increasing economic importance of sunflower as one of Moldova's most strategic field crops, alongside cereals and vineyards. Particular attention is devoted to the significant fluctuations in production observed between years, driven primarily by differences in rainfall patterns, drought intensity, and changing market incentives. Despite these fluctuations, sunflower remains among the most profitable and widely cultivated crops in the country.

The third major element focuses on the structure, commodity flows, and principal actors of the Moldovan sunflower VC. The analysis demonstrates that sunflower production substantially exceeds domestic consumption requirements, making exports and industrial processing the primary outlets for national production. Moldova is a net exporter of sunflower seeds, while domestic crushing facilities process a significant share of production into sunflower oil and by-products. The principal actors identified within the value chain include **Farmers** (categorised into Smallholders, Peasant Farms, Agricultural Enterprises, including No-Till and Organic producers), **Landowners** (primarily rural households receiving rental payments in cash or in kind), **Input Providers** (supplying seeds, fertilisers, pesticides and technical advice, often through technical credit schemes), **Traders** (responsible for aggregation and export operations), and **Industrial Processors** involved in oil extraction and refining.

Production systems vary considerably in terms of farm size, technological intensity, access to machinery, financial resources, and resilience to climatic risks. Large agricultural enterprises account for the majority of commercial

sunflower production and achieve higher yields through greater mechanisation and use of modern technologies. Peasant farms represent an intermediate category with moderate levels of productivity and investment, while smallholders remain constrained by fragmented land holdings and limited access to capital. Input suppliers play a particularly influential role within the value chain by providing not only seeds, fertilisers and crop protection products, but also technical assistance and deferred payment arrangements that effectively function as seasonal credit mechanisms. Traders and processors constitute strategic actors due to the concentration observed in sunflower marketing and processing activities, which significantly influences price formation and farmers' bargaining power. The analysis also highlights the growing importance of conservation agriculture practices, particularly No-Till systems, which are increasingly adopted as an adaptation strategy to drought and soil degradation.

The final component of the Functional Analysis examines governance structures, the institutional environment, and overall sector performance through a SWOT assessment. The governance analysis maps the key public institutions responsible for regulating and supporting the sector, including the Ministry of Agriculture and Food Industry (MAFI), the Agency for Intervention and Payments in Agriculture (AIPA), and the National Food Safety Agency (ANSA). The analysis reviews the policy framework established under the National Strategy for Agricultural and Rural Development 2030 and evaluates the main regulatory and financial instruments affecting the sunflower sector, including subsidy schemes, market regulations, phytosanitary requirements, and trade policies.

Figure 0-1 presents the structure and product flows of the Moldovan sunflower value chain in the reference year 2023. National sunflower production reached approximately **758 thousand tonnes**, cultivated on **431 thousand hectares**, with an **average yield of 1.8 t/ha.** The left side of the diagram illustrates the production stage, including the main producer categories (Peasant Farms, Agricultural Enterprises, and Smallholders) and their regional distribution. Average farm-gate prices ranged from 6,300 MDL/t in the North to 7,200 MDL/t in the South.

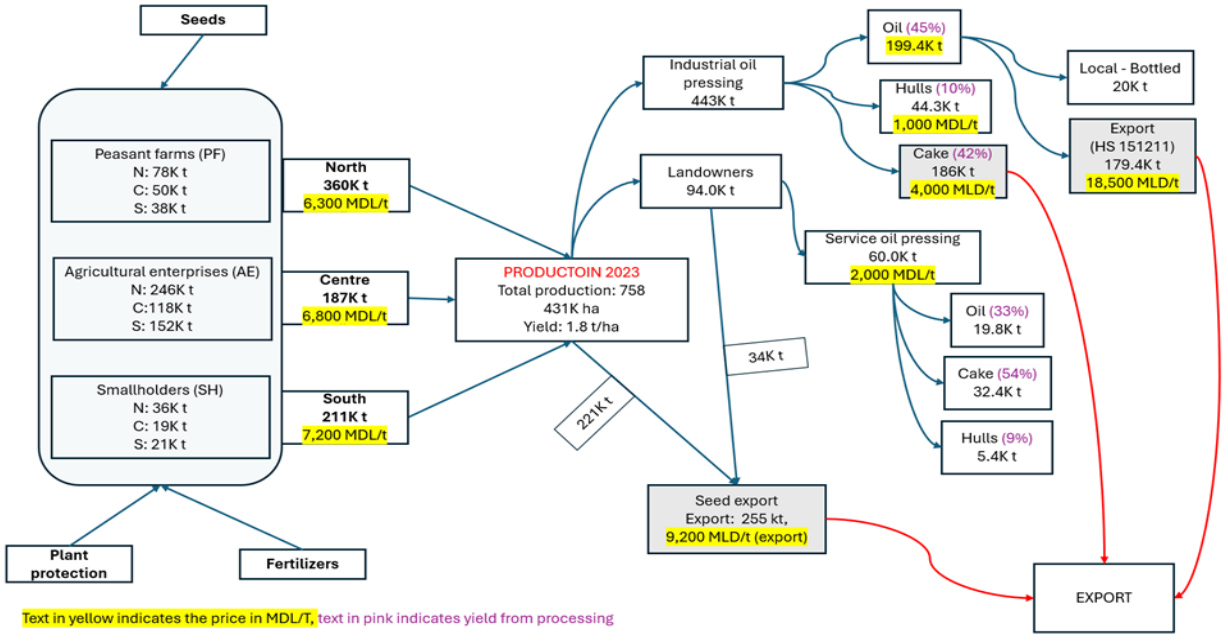


FIGURE 0-1. SUNFLOWER FLOW CHART OF MOLDOVA, 2023

The central and right sections of the figure show the allocation of production among **industrial processing** (443 thousand tonnes), **service oil pressing** (60 thousand tonnes) and **seed exports** (255 thousand tonnes). In addition, 94 thousand tonnes of seed are transferred to landowners as **in-kind payments**; these quantities are subsequently included in the processing and export categories (60 thousand tonnes are processed through service oil pressing, while the remainder 34 thousand tonnes enter the market). Processing generates sunflower oil, cake, and hulls, with oil destined both for the domestic market and exports. The figure highlights the strong export orientation of the sector, with both sunflower seeds and sunflower oil representing major export flows.

The primary production stage generates the largest physical volumes and provides the foundation for the entire sector. Agricultural enterprises dominate production, followed by peasant farms and smallholders. However, profitability at farm level remains highly dependent on climatic conditions and international prices.

Framing Question 1: What is the contribution of the value chain to economic growth?

The economic analysis of the sunflower production sector in the Republic of Moldova was conducted using 2023 baseline data, integrating official statistics, financial accounts and extensive farmer surveys. This study aimed to assess the profitability, contribution to the national economy and international viability of the sunflower production sector in the Republic of Moldova. The research segmented conventional producers into Smallholders (SH), Peasant Farms (PF) and Agricultural Enterprises (AE) in the North, Centre and South regions.

Profitability and Sustainability of Value Chain Actors

The economic analysis demonstrates that the sunflower value chain **generates positive economic returns** for most actors involved, although profitability varies considerably across farm types, regions, and downstream activities. At farm level, economic performance is strongly influenced by yield levels, production costs, and access to subsidies. Smallholders (SH) achieved the highest net margins, ranging from 28% to 41%, mainly due to lower production costs and the extensive use of family labour. Net income reached 5,151 MDL/ha in the North, declining to 2,647 MDL/ha in the South. Peasant Farms (PF) remained profitable across all regions, generating net incomes between 1,029 and 1,554 MDL/ha and net margins between 7% and 12%.

TABLE 0-1 ANNUAL NET OPERATING PROFIT BY TYPE OF ACTOR, 2023, MDL, MOLDOVA

Smallholders (SH)	North	15,453
	Centre	19,245
	South	2,647
Peasant Farms (PF)	North	56,595
	Centre	92,928
	South	66,822
Agricultural Enterprises (AE)	North	121,086
	Centre	140,024
	South	58,220
Small mill		680,000
Industrial mill		655,200,000
Trader seed		8,000,000

Agricultural Enterprises (AE), despite generating the largest share of national production, faced significant profitability challenges during the reference year. While enterprises in the North remained profitable, enterprises in the Centre and South recorded operating losses of 761 MDL/ha and 285 MDL/ha respectively. These results

reflect the relatively low sunflower prices observed in 2023 combined with higher production costs, including labour, land rents, machinery depreciation, and financial expenses.

Downstream segments of the value chain proved substantially more profitable. Service oil mills generated approximately 3,400 MDL profit per tonne of sunflower processed, while industrial crushing facilities generated value added ranging between 2,912 and 3,958 MDL per tonne of seed processed. Traders achieved net profits of approximately 860 MDL per tonne, although profitability remained sensitive to transport costs and international market fluctuations.

Overall, the analysis confirms that sunflower production remains economically viable in Moldova, but profitability is increasingly affected by climate variability, high dependence on imported inputs, and fluctuations in international commodity prices. The processing segment captures a larger share of value added than primary production, indicating significant opportunities for further value addition within the country.

Contribution to the National Economy

The sunflower value chain represents one of the most important contributors to the Moldovan agricultural economy. In 2023, the total value of final production generated by the value chain reached approximately 7.32 billion MDL, while direct value added amounted to 3.94 billion MDL. Total direct and indirect value added generated throughout the economy reaches approximately 5.68 billion MDL, illustrating a strong multiplier effect through upstream and downstream linkages. This corresponds to approximately 1.9% of national GDP and around 12% of agricultural GDP, confirming the strategic importance of the sector for national economic development. The value chain exhibits a relatively high degree of economic integration, with value added representing approximately 78% of total production value. Agricultural enterprises generate the largest share of value added, particularly in the Northern region where higher yields and larger farm sizes contribute to stronger economic performance. The processing sector also plays a critical role, with industrial mills alone generating more than 724 million MDL (18%) of total value added.

The chain creates substantial income throughout the economy. Wages generated directly by the value chain amount to approximately 1.3 billion MDL, while total direct and indirect wages exceed 2 billion MDL. Landowners receive nearly 1 billion MDL through land rental payments, highlighting the importance of sunflower production for rural livelihoods. Net operating profits generated along the chain exceed 1.35 billion MDL, demonstrating the sector's capacity to create income and stimulate economic activity.

Despite these positive effects, the sector remains highly dependent on imported inputs. Total imports associated with the value chain are estimated at approximately 1.59 billion MDL, mainly consisting of seeds, fertilizers, plant protection products, fuel, and machinery. Nevertheless, the value generated domestically significantly exceeds import costs, resulting in a positive contribution to national income and economic growth.

International Competitiveness and Viability

The sunflower value chain demonstrates strong international competitiveness and remains one of Moldova's most export-oriented agricultural sectors. Sunflower seed exports, together with exports of sunflower oil and cake, generate substantial foreign exchange earnings and contribute positively to the national trade balance.
The sector benefits from favourable agro-climatic conditions, relatively competitive production costs, and proximity to major export markets, particularly Romania and the European Union. Moldova functions as a net exporter of sunflower seeds and processed sunflower products, with exports representing the principal market

outlet for a large share of production. The analysis shows that export prices consistently exceed farm-gate prices, generating commercial margins for traders and processors. However, transport costs and logistical constraints significantly reduce these margins, particularly for producers located in Northern Moldova.

Competitiveness is strongest in vertically integrated business models that combine production, processing, and export activities. Industrial crushers benefit from economies of scale and direct access to international markets, while traders remain exposed to fluctuations in international commodity prices and transportation costs.
Nominal Protection Coefficient (NPC) equals to 0.98 and Domestic Resource Cost Ratio (DRC) equals to 0.13. Overall, the value chain exhibits a clear comparative advantage and remains internationally viable. However, maintaining competitiveness will require continued investments in productivity improvements, climate resilience, logistics infrastructure, and domestic processing capacity.

Comparison of Sub-Chains

The sunflower value chain comprises several interconnected sub-chains that differ substantially in terms of value creation, profitability, and economic contribution. The **seed export sub-chain** represents the main commercialization channel for a significant share of national production. It generates considerable export revenues but captures relatively limited value added domestically because sunflower seeds are exported as raw material. The **industrial processing sub-chain** creates the highest value added within the national economy. Industrial crushing transforms sunflower seeds into oil, cake, and hulls, significantly increasing the value of the commodity before export. This segment generates substantial profits, employment, tax revenues, and foreign exchange earnings, making it the most economically important sub-chain from a national development perspective. The **service oil pressing sub-chain** primarily serves rural households and landowners receiving sunflower seeds as in-kind rent payments. Although relatively small in scale, it contributes to local food security, rural incomes, and employment. Comparatively, the industrial processing sub-chain generates the highest value added and strongest multiplier effects, while the export of raw sunflower seeds remains the least efficient pathway from a value creation perspective. Expanding domestic processing and increasing exports of higher-value products would therefore represent the most effective strategy for enhancing the overall contribution of the sunflower value chain to economic growth in the Republic of Moldova.

Framing question 2: Is this economic growth inclusive?

The sunflower value chain makes an important contribution to inclusive economic growth in Moldova by generating income and employment opportunities for a wide range of actors, including smallholders, peasant farms, agricultural enterprises, landowners, processors, traders, and rural workers. The distribution of value added along the chain demonstrates that the economic benefits are shared among several stakeholder groups rather than being concentrated exclusively among a limited number of actors.

At the production level, the value chain involves a diverse farm structure. Smallholders and peasant farms continue to play an important role, particularly in rural communities where sunflower production represents a significant source of household income. Smallholders generate the highest value-added-to-production ratios, reaching over 60% in some regions, and achieve relatively high net margins due to lower production costs and reliance on family labour. This indicates that the sector provides meaningful income opportunities for smaller rural households, contributing to poverty reduction and livelihood diversification.

The value chain also generates substantial employment. In 2023, direct wages amounted to approximately MDL 1.3 billion, while indirect effects generated an additional MDL 710 million, resulting in total labour income

exceeding MDL 2.0 billion. Employment opportunities are created not only in farming but also in input supply, transport, storage, processing, and trading activities. These benefits are particularly important in rural areas where alternative employment opportunities are often limited.

Landowners represent another major beneficiary group. Approximately MDL 983 million was distributed through land rental payments, increasing to nearly MDL 1.0 billion when indirect effects are included. Since a large share of agricultural land is leased from rural households, sunflower production contributes significantly to household incomes, including for elderly and economically inactive landowners who depend on rental payments as an important source of revenue.

However, the inclusiveness of growth is not uniform across all actors. The analysis reveals considerable disparities between regions and farm types. Agricultural Enterprises in the Centre and South recorded negative net operating profits in 2023, reflecting their exposure to climatic risks and rising production costs. At the same time, downstream activities such as industrial processing and trading capture a significant share of profits due to their stronger market position and greater bargaining power. Market concentration among processors and traders may therefore limit the ability of farmers to capture a larger share of the value created along the chain.
Women and young people participate in various stages of the value chain, particularly in administrative, processing, and service activities. Nevertheless, ownership of larger farms and access to investment capital remain concentrated among a relatively limited group of operators, which may constrain broader participation in value creation.

Framing question 3: Is the value chain socially sustainable?

The social analysis examines the sunflower value chain from a broader societal perspective, assessing its contribution to rural livelihoods, food security, and social well-being. The assessment covers key social dimensions, including working conditions, living standards, land and water access, gender equality, social capital, and food and nutrition security, as well as the challenges faced by farming households and agricultural workers. Particular attention is given to the role of sunflower production in supporting household resilience through wage income, in-kind rents, and local processing, while also considering inequalities related to gender, generation, and farm size. The findings are based on field observations, stakeholder consultations, surveys, and interviews conducted with farmers, employees, landowners, processors, traders, and other actors involved in the sunflower value chain. The analysis highlights both the sector's important contribution to rural livelihoods and food systems and the structural constraints that continue to affect its inclusiveness, resilience, and long-term social sustainability.

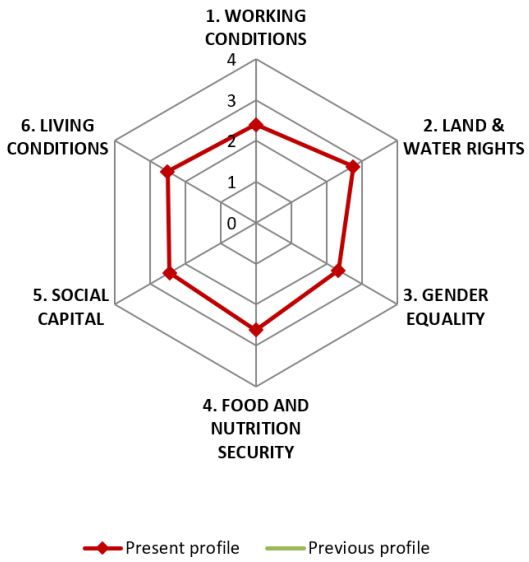


Figure 0-2: Social profile of the sunflower value chain in Moldova

Working Conditions

Working conditions in Moldova's sunflower value chain are moderate but highly uneven. The country has ratified the main ILO conventions and provides a solid legal framework for labour rights and occupational safety. However, enforcement remains constrained by limited institutional capacity and widespread informality. Large agricultural enterprises employ permanent mechanizers and technical staff under formal contracts and provide relatively competitive wages, while seasonal and casual workers—many of them women—often work without contracts, social insurance, or adequate protection. Occupational safety standards are generally respected in larger enterprises but remain difficult to enforce during peak seasons and among informal workers. No systemic forced or child labour was identified, although informal family labour persists. The sector also faces demographic pressures: migration and an ageing workforce limit labour availability and reduce its attractiveness for younger generations. Despite competitive salaries for skilled personnel, agriculture continues to suffer from low social prestige and weak collective representation. Improving labour inspection, formalizing seasonal work, strengthening OHS enforcement, and investing in vocational training are essential for enhancing decent work and long-term resilience.

Land and Water Rights

Land tenure in Moldova's sunflower value chain is generally secure and based on voluntary lease agreements between producers and numerous small landowners. Predictable in-kind payments provide income stability and support household food security, while land ownership remains highly valued as an intergenerational asset. Although Moldova does not explicitly apply the Voluntary Guidelines on the Responsible Governance of Tenure (VGGT), national legislation broadly complies with their principles. Nevertheless, inequalities persist. Land concentration is gradually increasing, and women own smaller plots and control a disproportionately low share of agricultural land. Access to water constitutes the main structural challenge. Irrigation infrastructure inherited from the Soviet period has largely deteriorated, leaving most farms dependent on rainfall and vulnerable to

drought. Larger enterprises have greater access to irrigation systems and water resources, whereas smallholders rely on wells and local ponds. Rural households also face disparities in access to piped drinking water. Overall, land rights are relatively stable and secure, but unequal access to water and increasing climate pressures threaten productivity and long-term sustainability.

Gender Equality

Women make an essential contribution to the sunflower value chain, yet their participation remains constrained by persistent structural inequalities. Although women represent around 42% of the agricultural workforce, they are concentrated in seasonal, administrative, and auxiliary activities and remain underrepresented in technical and mechanized positions. Access to productive resources is uneven: women control only a minority of farmland and possess limited ownership of agricultural machinery and irrigation equipment. They participate less frequently in agricultural training and producer organizations and face barriers to leadership positions. Informal employment affects women disproportionately, reducing access to social protection and increasing economic vulnerability. Women also continue to carry a substantial burden of unpaid domestic and care work, creating a "double shift" that limits professional advancement. Despite these constraints, women are increasingly present in administration, accounting, entrepreneurship, and local civic life. Existing legal frameworks provide equal rights, and targeted support programmes have expanded women's access to credit and business opportunities. Further progress will depend on improving access to training, productive assets, mechanization, finance, and decision-making structures.

Food and Nutrition Security

The sunflower value chain makes an important contribution to food security in Moldova by supplying vegetable oil, generating income, and providing in-kind lease payments that serve as a buffer for rural households. Domestic production generally meets national demand, and sunflower is more drought-resilient than several other crops. Nevertheless, food security remains vulnerable to climate shocks, rising prices, and poverty. In-kind rents in sunflower seeds and cereals help maintain household access to staple foods and support local processing into flour and edible oil. However, diets remain heavily based on cereals and vegetable oils and lack diversity. Moldova faces a double burden of malnutrition, characterized by both micronutrient deficiencies and increasing obesity. Declining livestock numbers and reduced consumption of protein-rich foods further weaken dietary quality. Recurrent droughts and market disruptions threaten production stability, while many low-income households depend on remittances, gardens, and informal exchanges to maintain food access. Although the sunflower value chain contributes positively to food availability and stability, improving dietary diversity, strengthening irrigation and storage infrastructure, and enhancing adaptive social protection remain important priorities.

Social Capital

Social capital within Moldova's sunflower value chain remains limited and highly personalized. Producer cooperation is generally weak, and trust tends to be concentrated around farm managers and personal relationships rather than formal institutions. Farmers often rely on informal networks for information and problem solving, while participation in producer organizations, unions, and community activities remains low. Historical distrust associated with Soviet collectivization and the perception that associations are politicized continue to constrain collective action. Nevertheless, successful examples such as Agrostoc and other cooperative initiatives demonstrate the potential benefits of horizontal cooperation, including better access to

storage, inputs, and markets. Trust in banks and processors is moderate, and repeated interactions help establish stable partnerships. Agricultural enterprises also continue to play important social roles within rural communities, occasionally supporting vulnerable groups and local initiatives. Overall, social cohesion remains based more on interpersonal trust and local leadership than on institutionalized forms of cooperation. Strengthening producer organizations, improving transparency, and promoting participatory governance could enhance collective resilience and bargaining power.

Living Conditions

Living conditions in rural Moldova are moderate and characterized by high housing security but persistent infrastructure and service inequalities. Nearly all rural households own their homes, reflecting the legacy of post-socialist privatization. However, housing quality and energy efficiency remain limited, and access to water, sanitation, and heating services is substantially weaker than in urban areas. The health system has expanded coverage through the national insurance scheme, yet rural populations continue to face shortages of medical personnel, long travel distances, and significant out-of-pocket expenses. Education outcomes are generally positive, with near-universal enrolment and very low dropout rates, but rural schools experience teacher shortages and weaker infrastructure. Vocational education has expanded, though agricultural training remains poorly aligned with labour market needs and suffers from limited practical orientation. Digitalization has improved educational access but territorial disparities persist. Overall, the sunflower value chain operates within a rural environment characterized by secure property rights and basic access to services, yet persistent gaps in infrastructure, healthcare, education, and housing quality continue to constrain well-being and the attractiveness of rural life.

Framing question 4: Is the value chain environmentally sustainable?

Natural resource depletion is closely associated with **soil degradation**, particularly **soil erosion**, nutrient mining and the intensive use of soil resources. Life Cycle Inventory (LCI) data indicate consistently negative nutrient balances across all production systems, demonstrating that nutrient removals with harvested sunflower seeds substantially exceed nutrient inputs from fertilisers. This reliance on soil nutrient reserves contributes to their progressive depletion and represents one of the main resource depletion challenges affecting the long-term sustainability of the sunflower value chain. The situation is further aggravated by simplified crop rotations and the excessive share of sunflower in cropping systems, which exceeds recommended agronomic limits in the country. The largest environmental pressures on ecosystem quality originate from the cultivation phase. Key drivers include intensive soil cultivation, inefficient nutrient management, soil erosion and the degradation of soil organic matter. The adoption of conservation and precision agriculture and site-specific fertiliser application could help reduce unnecessary input use while maintaining productivity and improving nutrient-use efficiency.

Human health does not appear to represent a major environmental constraint within the value chain. The assessment indicates that the principal concern is not the intrinsic toxicity of authorised agricultural inputs, but rather the level of occupational exposure associated with pesticide handling and application. Stakeholder consultations revealed limited use of personal protective equipment and insufficient implementation of basic safety procedures, suggesting that human health risks are driven primarily by exposure rather than by the **quantities or toxicity of agricultural inputs used.**

Climate-related pressures are primarily influenced by **nitrogen fertilisation**, associated greenhouse gas emissions from agricultural soils, and **diesel consumption** during field operations. The assessment indicates

that no-till conservation agriculture achieves the most favourable balance between productivity, fuel consumption and climate performance. Production systems that **reduce soil disturbance** while maintaining yields therefore offer the greatest opportunities for reducing climate-related pressures within the value chain.

Climate change represents one of **the most significant environmental challenges** affecting sunflower production in Moldova. Increasing drought frequency, heat waves and climatic variability directly influence yields, oil content and production stability. The assessment indicates that systems capable of conserving soil moisture, improving soil biological functioning and maintaining productivity under water stress, particularly no-till systems combined with cover crops and diversified crop rotations, are likely to play an increasingly important role in ensuring the long-term sustainability of sunflower production.

Biodiversity does not appear to be under substantial direct pressure from sunflower cultivation within protected areas. However, the ecological quality of agricultural landscapes remains important for maintaining biodiversity and ecosystem services. Maintaining field margins, buffer strips, hedgerows, riparian vegetation and other semi-natural landscape elements would strengthen ecological connectivity and improve habitat quality within agricultural regions.

Overall, **the environmental sustainability of the sunflower** value chain depends on its ability to reduce soil degradation, prevent long-term nutrient depletion and improve resilience to climatic stress. Expanding no-till conservation agriculture, improving nutrient management through site-specific fertilisation and nutrient budgeting, reducing sunflower saturation within crop rotations, and strengthening ecological infrastructure within agricultural landscapes represent the most effective pathways for improving the long-term environmental performance of the value chain.

1.INTRODUCTION

The Republic of Moldova is a small country in Eastern Europe, bordered by Romania to the west and Ukraine to the north, east and south. The country has an area of approximately 33,846 km² and a population of approximately 2.6 million. The capital is Chisinau, the country's largest city, which is the main cultural, economic and administrative centre. Moldova is characterised by its varied landscapes, dominated mainly by plains, hills and forests. The Dniester River, one of the most important watercourses in the region, crosses the eastern part of the country and constitutes an essential source of water and energy. The relief also includes picturesque areas with hills and extensive vineyards, favourable to the development of viticulture and wine production.
The economy of the Republic of Moldova is mainly based on agriculture, viticulture and the wine industry, with agricultural products being exported to numerous international markets. The wine sector is recognised for its long tradition and the quality of the wines produced. However, the national economy faces significant challenges, such as dependence on energy imports and Labour migration. The agricultural sector is traditional in nature, focusing on the cultivation of cereals, vegetables, fruits and vines, with a strong tradition in the export of agricultural products. However, Moldovan agriculture faces numerous challenges, including unpredictable weather conditions, inefficient irrigation systems and limited access to financing. The level of productivity remains relatively low, and the degree of mechanization and adoption of modern technologies is insufficient.

In the last decade, various actions have been initiated to modernize the sector, but the investments made have not been sufficient to ensure sustainable growth. Even under these conditions, exports of agricultural and agri-food products continue to play an essential role in balancing the country's trade balance.
In recent years, agriculture has accounted for approximately 10–11% of Moldova's GDP (Statistical Data Bank, 2022), a significant share compared to many other European countries. Although the sector's contribution to GDP is important, the economy's dependence on agriculture makes the country vulnerable to fluctuations in international agricultural markets and adverse weather conditions. A poor agricultural year can significantly impact the pace of economic growth.[1]

The COVID-19 pandemic has had a mixed impact on agriculture in the Republic of Moldova. In the initial stages, the sector was affected by movement restrictions and supply chain disruptions, which made access to inputs (seeds, fertilizers, fuel) and markets difficult. At the same time, limitations imposed on other sectors have turned agriculture into one of the few stable sources of income, generating constant domestic demand for local products.
However, the pandemic has led to an increase in input and material prices, and the effects have been felt in the long term through increased production costs and reduced access to foreign markets due to logistical bottlenecks.
The Government of the Republic of Moldova has adopted several measures to support the economic recovery and the agricultural sector (AIPA, 2022), including:
• Subsidies and direct aid for farmers: the state has provided financial support to farmers affected by drought and the pandemic, to compensate for part of the losses and facilitate investments in new technologies and equipment.
• Fiscal facilities: measures such as tax deferrals and exemptions have been implemented to support the business environment and the agricultural sector.
• Support for SMEs: small and medium-sized enterprises, heavily affected by the crisis, have benefited from credit lines and support programs from the state and international organizations.

[1] Litvin, A. State of Art of Agriculture in Moldova in the process of EU integration. Agricultural Policy Monitoring: Country report – Republic of Moldova. The Regional Rural Development Standing Working Group in South East Europe (SWG) Blvd. Goce Delcev 18, MRTV Building, 12th floor, 1000 Skopje, North Macedonia. 2025. 30 pag. ISBN 978-608-4760-54-https://seerural.org/wp-content/uploads/2025/01/State-of-Art-of-Agriculture-in-Moldova-in-the-process-of-EUintegration.pdf

In February 2022, still reeling from the effects of the pandemic, the Republic of Moldova faced a new crisis generated by the conflict between Russia and Ukraine. The war led to a rapid increase in prices, and in 2022 Moldova recorded one of the highest inflation rates in Eastern Europe, exceeding 30% in certain periods. This phenomenon was fuelled by the increase in energy and food prices, with a direct impact on the cost of living of the population and on the production costs of companies.
The conflict in Ukraine has exacerbated existing difficulties and generated new challenges for Moldovan agriculture, especially in terms of:

1. Input prices: fertilizers and fuel have increased significantly, given that Ukraine and Russia are important suppliers in the region, which has led to an increase in production costs.
2. Export market: trade routes were disrupted and export flows to neighbouring countries were affected, with many products being redirected along longer and more expensive routes.
3. Access to finance: economic uncertainty and geopolitical risks have led banks to become more cautious in granting loans for agricultural projects, limiting the capital available to farmers.
4. Labour migration: part of the active population has emigrated due to the crisis or in search of better opportunities, which has created difficulties in hiring seasonal workers.

The war between Russia and Ukraine has highlighted the economic and agricultural vulnerabilities of the Republic of Moldova, but has also accelerated the orientation towards the European market and the adaptation to new requirements regarding energy and food security.
Despite all these challenges, agriculture remains a strategic sector for the Republic of Moldova. Its future depends on adapting to climate change, modernizing infrastructure, improving access to financing, and diversifying markets. The integration of modern technologies and the development of irrigation capacities can contribute to stabilizing production and increasing competitiveness on the international market.

The Republic of Moldova, as a country with middle-income levels, has made progress in reforming its economy over the past decade. National production, measured by Gross Domestic Product (GDP), is volatile, but still shows moderate growth during the observed period. GDP at current prices increased from 7,022 million EUR in 2015 to 13,795 million EUR in 2022, showing consistent growth over the years, except for 2020, when GDP dropped to 10,116 million EUR, likely due to the impact of the COVID-19 pandemic. This decline was followed by a strong recovery in 2021 and 2022. GDP per capita also increased, from 2,476 EUR in 2015 to 5,433 EUR in 2022, indicating an improvement in the standard of living. However, there was a slight decrease in 2020, which aligns with the overall GDP decline. (Table 1-1)

TABLE 1-1 MACROECONOMIC OVERVIEW THROUGH SELECTED GENERAL AND AGRICULTURAL STATISTICS, 2015-2023, MOLDOVA

	Units	2015	2016	2017	2018	2019	2020	2021	2022	2023
GDP (at current prices)	mill. EUR	7,022	7,210	8,451	9,527	10,484	10,116	11,569	13,795	-
GDP per capita	EUR	2,476	2,572	3,067	3,519	3,935	3,839	4,457	5,433	-
Total employment	Thous. persons	601.4	594.2	598.9	613.0	625.2	601.6	622.7	623.6	626.3
Employment in agriculture	Thous. persons	36.8	36.7	37.6	37.7	36.4	34.2	34.5	33.9	33.0

Source: Statistical databank for Moldova, 2023

The development of the agricultural sector is largely influenced by climatic conditions. During years marked by drought, the sector experienced stagnation, whereas in years with adequate rainfall, it registered significant growth. Apart from these weather-related variations, no major fluctuations were observed. Overall agricultural output remained relatively stagnant between 2017 and 2020. In the highly productive year of 2021, the sector recorded remarkable growth, followed by a decline in 2022. However, 2023 shows clear signs of recovery and improvement (Figure 1-1).

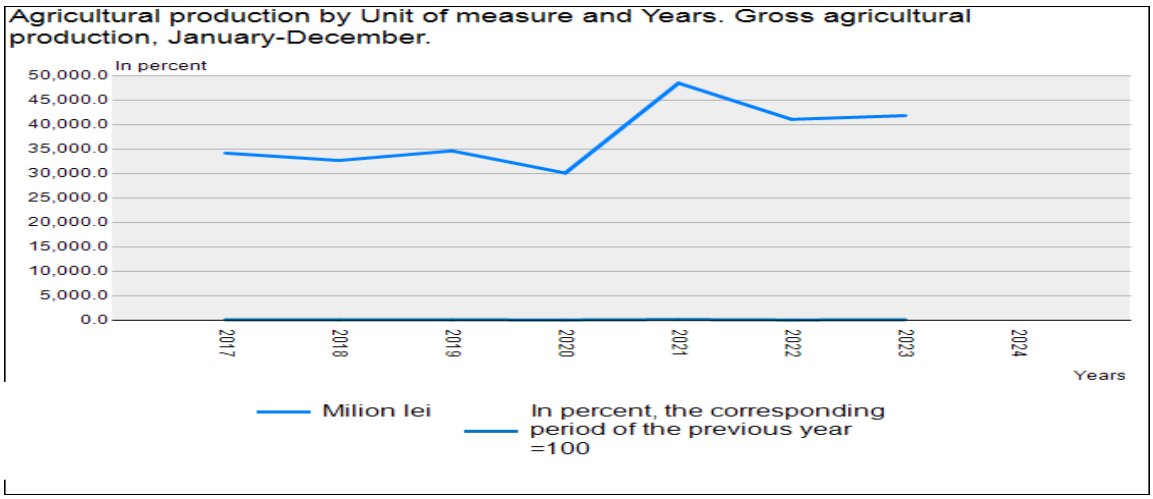


Figure 1-1. Evolution of gross agricultural production, 2017-2023
Source: Statistical databank for Moldova, 2023

Crop production played a decisive role in shaping the general trend of agricultural output. From 2017 to 2020, crop production fell by nearly 17%. Due to favourable climatic conditions, it almost doubled in 2021. In 2022, crop output dropped back close to its 2017 level, while in 2023 it increased again. These pronounced fluctuations in crop production underline the sector's limited resilience to adverse weather conditions (Figure 1-2).

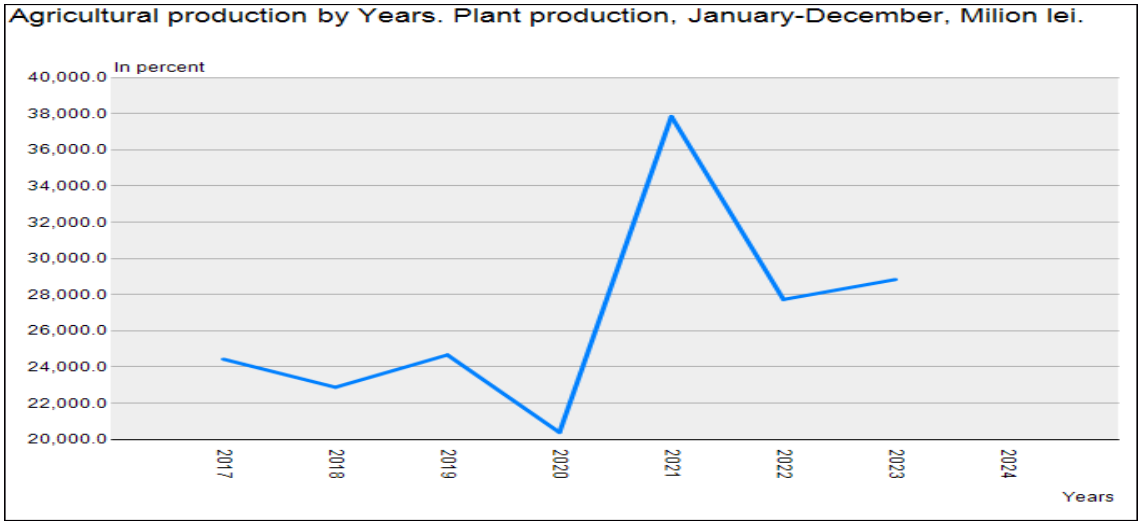


Figure 1-2. Evolution of crop production, 2017-2023
Source: Statistical databank for Moldova, 2023

Sunflower is one of Moldova's key crops. Until the destruction of the livestock sector, sunflower was the exclusive crop for animal feed. After that, corn was grown for export and a very small share for processing. Recently, the government, with the support of the European Union, has begun to support the revitalization of this sector, which means that sunflower will again be the basic raw material for animal feed. However, profitability is increasingly challenged by climate change – especially the rising frequency of droughts – as well as by escalating input costs. Sunflower plays a central role in crop rotation systems and is fundamental to land lease arrangements, which are commonly remunerated in kind. The majority of land cultivated with sunflower is leased, and payments are typically made in seed. Lease contracts are usually based on a payment of 800 kg of wheat per hectare. If the landowner prefers to be paid in sunflower rather than wheat, the conversion rate is set at 1:2, resulting in 400 kg of sunflower per hectare.

2. FUNCTIONAL ANALYSIS

2.1. Overview of the global sunflower market

Global production of sunflower is reported to have reached 61.6 million tons in 2023, while estimates for the 2024/2025 season indicate a substantial contraction to 52.43 million tons, reflecting an overall decline of approximately 15%. The table highlights the continued dominance of the Black Sea region, with the Russian Federation and Ukraine together accounting for nearly half of world output in 2023 (50.5%).

In 2023, the Russian Federation was the largest producer with 18.1 million tons, followed by Ukraine at 12.8 million tons. Argentina occupied the third position with 5.0 million tons, while China, Turkey, France, Romania, and Hungary each produced between 2.0 and 3.0 million tons. The remaining listed countries – Bulgaria, Kazakhstan, Tanzania, the United States, Spain, and the Republic of Moldova – contributed smaller volumes, generally below 2 million tons. The 2024/2025 estimates reveal divergent trends among the major producers: Ukraine shows a modest increase to 13 million tons, Romania exhibits a marked expansion to 4.8 million tons, and Kazakhstan records growth to 1.83 million tons. In contrast, significant reductions are projected for the Russian Federation (to 16.9 million tons), China (to 1.75 million tons), Turkey (to 1.35 million tons), Tanzania (to 0.3 million tons), and the United States (to 0.5 million tons).

These shifts suggest that the anticipated global decline in sunflower seed production for 2024/2025 is driven primarily by lower outputs in several key traditional producers, particularly in the Northern Hemisphere and in drought-affected regions, only partially offset by gains in Ukraine, Romania, and Kazakhstan. The pronounced year-to-year variability underscores the crop's sensitivity to climatic conditions, geopolitical factors, and area allocation decisions in the principal producing countries. These data emphasize the strategic importance of the Black Sea basin for global sunflower seed supply and highlight emerging changes in regional production patterns.

TABLE 2-1 . SUNFLOWER SEEDS PRODUCTION IN LEADING PRODUCTION COUNTRIES, 2023 – 2025, MIL. TONS

Country	2023	2024/2025 (estimates)
World	**61.6**	**52.43**
Russian Federation	18.1	16.9
Ukraine	12.8	13
Argentina	5.0	5.1
China	3.0	1.75
Turkey	2.2	1.35
France	2.1	1.7
Romania	2.0	4.8
Hungary	2.0	1.7
Bulgaria	1.8	1.4
Kazakhstan	1.2	1.83
Tanzania	1.2	0.3
US	1.0	0.5
Spain	0.8	0.9
Republic of Moldova	**0.8**	**0.7**

Source: FAO database; https://www.fas.usda.gov/data/production/commodity/2224000

The data on foreign trade with sunflower reveal significant year-on-year changes in trade flows, with total export volumes among the listed top exporters declining from 2023 to 2024, largely driven by reduced shipments from Ukraine and Bulgaria. In contrast, several countries – notably Moldova and Hungary – substantially increased their export volumes, reflecting adaptive responses to supply disruptions and shifting market opportunities in the global sunflower seed trade. On the import side, the pattern is more heterogeneous, with some major importers (such as Turkey and the Netherlands) recording sharp reductions, while others (including Bulgaria and Spain) maintained or expanded their purchases.

Among exporters in 2023, Romania held the top position with 1,521,080 tons, followed by Bulgaria (875,585 tons) and Ukraine (797,493 tons). France, China, Moldova, and Kazakhstan occupied subsequent ranks, each exporting between approximately 237,000 and 574,000 tons. By 2024, Romania remained the largest exporter despite a reduction to 1,231,992 tons, while Moldova emerged as a major gainer, nearly doubling its exports to 572,460 tons and moving into a higher ranking. Hungary also recorded strong growth, rising to 402,532 tons. In contrast, Ukraine experienced a dramatic collapse in exports to 213,119 tons, and Bulgaria saw its volume fall by about one-third to 576,135 tons. These shifts underscore the profound impact of production conditions, port access, and geopolitical factors on export capacity, particularly in the Black Sea region.[2]

Import patterns in 2023 were led by Turkey (745,948 tons), the Netherlands (650,001 tons), and Bulgaria (657,616 tons), followed by Hungary, France, Germany, and China. The overall contraction in several large import markets, combined with sustained or growing demand in others, illustrates the redistribution of global sunflower seed demand amid supply constraints and changing processing needs in Europe and beyond. Together, these trade dynamics highlight the sector's vulnerability to regional disruptions and its ongoing reorientation toward alternative supply origins.

TABLE 2-2. TOP WORLD EXPORTERS AND IMPORTERS OF SUNFLOWER SEEDS (HS 120600), 2023 – 2024, TONS

	Exports			Imports	
	2023	2024		2023	2024
Romania	1,521,080	1,231,992	Turkey	745,948	287,716
Bulgaria	875,585	576,135	Netherlands	650,001	510,390
Ukraine	797,493	213,119	Bulgaria	657,616	732,391
France	573,510	527,314	Hungary	345,259	202,572
China	462,740	480,200	France	332,747	168,720
Moldova	279,320	572,460	Germany	289,509	326,996
Kazakhstan	237,494	176,971	China	280,165	N/A
Hungary	208,246	402,532	Italy	225,782	189,075
Turkey	93,228	144,739	Austria	146,042	162,687
US	59,253	39,043	Spain	N/A	312,657
			Romania	N/A	350,374

Source: https://wits.worldbank.org/; comtradeplus.un.org

2.2. Sunflower seed production in Moldova

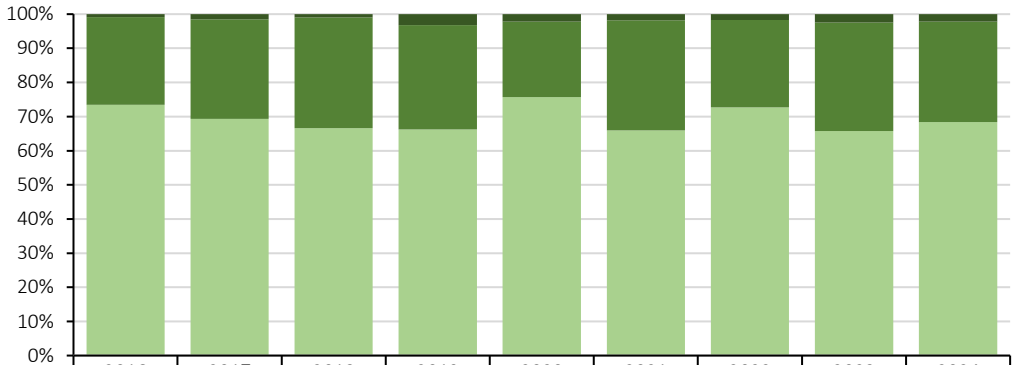
Overall, total production of sunflower exhibited considerable volatility over the period, peaking at 960.1 thousand tons in 2021 and reaching a low of 492.5 thousand tons in 2020, likely influenced by factors such as weather variability, input availability, and economic conditions. By 2024, the total harvest had declined to 619.6 thousand tons, reflecting a partial recovery from earlier fluctuations, but remaining below the highs observed in 2017–2019 and 2021.

In terms of absolute volumes, agricultural enterprises consistently dominated production, contributing between 341.9 thousand tons (2020) and 703.9 thousand tons (2021), with an average of approximately 515 thousand tons across the nine-year span. Peasant households followed as the second-largest contributor, with outputs ranging from 137.2 thousand tons in 2020 to 242.5 thousand tons in 2021, demonstrating similar year-to-year variability. Population households accounted for the smallest share, with production levels generally below 20 thousand tons, though showing a slight upward trend in recent years, from 11.4 thousand tons in 2022 to 13.3 thousand

[2] Litvin, A., Turcan, R., Stratila, A., Turcan, I. Agricultural trade: Impacts on market stability and integration with developing countries, Reference Module in Food Science, Elsevier, 2025, ISBN 9780081005965, https://doi.org/10.1016/B978-0-443-15976-3.00140-9. (https://www.sciencedirect.com/science/article/pii/B9780443159763001409)

tons in 2024. These patterns highlight the sector's dependence on larger-scale operations while underscoring the resilience of smaller holdings in maintaining supplementary output amid broader agricultural challenges.

The percentage distribution reveals the structural composition of Moldova's sunflower seed sector, with agricultural enterprises holding a commanding share of 68–73% throughout the period, peaking at 73.5% in 2016 and stabilizing around 68% by 2023–2024. Peasant households' contributions fluctuated between 20% and 36%, with notable increases in 2018 (34.1%) and 2021 (35.8%), potentially reflecting policy incentives or market opportunities for mid-sized producers. Population households consistently represented less than 4% of total production, with their share dipping to 0.8% in 2016 and rising modestly to 2.1% in 2024.



	2016	2017	2018	2019	2020	2021	2022	2023	2024
Rural households	0.8	1.6	1.0	3.4	2.0	2.0	1.7	2.6	2.1
Peasant farms	25.7	30.6	34.1	32.3	20.3	35.8	25.0	32.9	29.4
Agricultural enterprises	73.5	72.9	69.9	70.2	69.4	73.3	71.2	68.3	68.4

FIGURE 2-1. YIELD OF SUNFLOWER BY TYPES OF OWNERSHIP, 2016 – 2024, %
Source: NBS database, 2025

Regionally, the North consistently outperformed other areas, with yields varying from 1.75 tons per hectare in 2020 to 2.62 tons in 2021, and achieving the highest five-year average of 2.02 tons. The Centre followed closely, recording yields from 1.10 tons in 2020 to 2.57 tons in 2021, with an average of 1.79 tons, indicative of its transitional climate supporting relatively stable outputs. In contrast, the South exhibited the lowest performance, with yields ranging from 1.05 tons in 2020 to 2.56 tons in 2021, and a five-year average of 1.57 tons, likely attributable to its warmer, drier conditions that exacerbate water scarcity issues. These disparities underscore the influence of pedo-climatic factors, including soil fertility and precipitation gradients, which favor northern regions with more reliable rainfall and cooler temperatures conducive to sunflower growth.

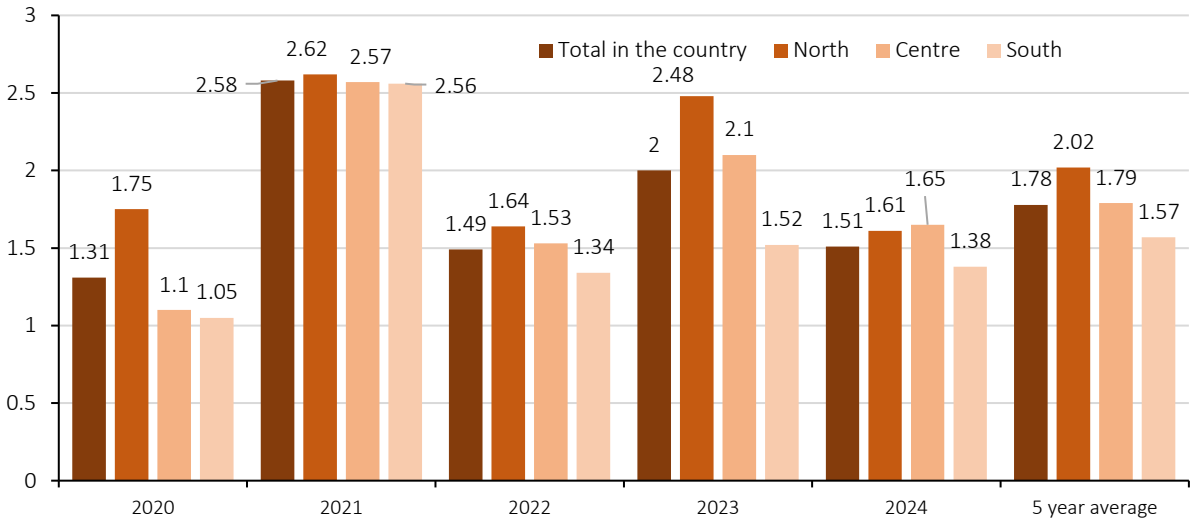


FIGURE 2-6. AVERAGE YIELD PER HECTARE OF SUNFLOWER BY REGIONS, 2016 – 2024, TONS
Source: NBS database, 2025

In terms of efficiency, overall, yields of sunflower in agricultural enterprises and peasant farms exhibited notable fluctuations over the period, with a general upward trajectory in the early years peaking around 2019–2021, followed by declines in subsequent seasons, particularly in 2020 and 2022–2024. Agricultural enterprises consistently achieved the highest yields, averaging approximately 2.0 tons per hectare across the span, while rural households recorded the lowest, underscoring structural differences in scale, technology adoption, and resource access among producer types. By 2024, yields across all categories had converged somewhat, stabilizing around 1.3–1.5 tons per hectare, potentially reflecting broader challenges such as climate variability or input constraints.

For agricultural enterprises, yields ranged from a low of 1.3 tons per hectare in 2020 to a high of 2.6 tons in 2021, with values of 2.01, 2.22, 2.24, and 2.29 tons in 2016–2019, respectively, before dropping to 1.48 tons in 2022, 1.98 tons in 2023, and 1.49 tons in 2024. Peasant farms displayed a similar pattern, starting at 1.61 tons in 2016, rising to 2.28 tons in 2019 and 2.20 tons in 2021, but falling to 1.36 tons in 2020 and 2022, and settling at 1.88 tons in 2023 and 1.49 tons in 2024. Rural households, operating on a smaller scale, achieved yields from 0.96 tons in 2016 to a peak of 1.91 tons in 2019, with subsequent figures including 1.23 tons in 2020, 1.57 tons in 2021, 1.28 tons in 2022, 1.66 tons in 2023, and 1.30 tons in 2024. These variations suggest that larger enterprises benefited from economies of scale and better resilience to adverse conditions, while smaller holdings were more susceptible to annual shocks.

The observed trends in sunflower seed yields per hectare illustrate the sector's sensitivity to external factors, including weather patterns, pest pressures, and agronomic practices, with pronounced dips in 2020 likely attributable to drought or pandemic-related disruptions.

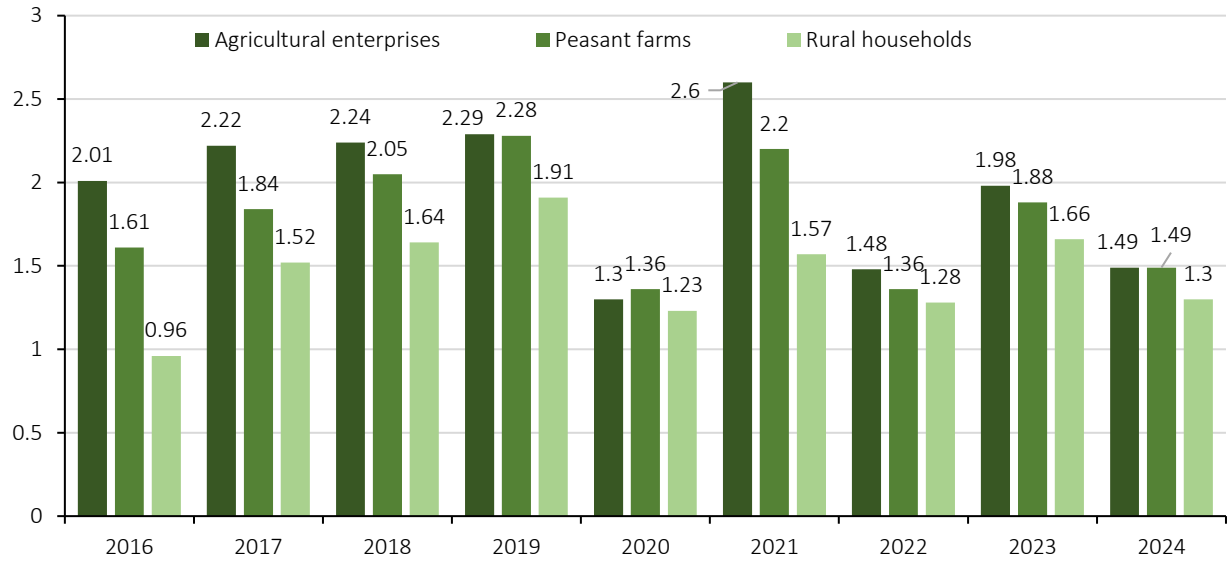


FIGURE 2-7. AVERAGE YIELD PER HECTARE FOR SUNFLOWER IN AGRICULTURAL ENTERPRISES AND PEASANT FARMS, BY TYPES OF OWNERSHIP, TONS

Source: NBS database, 2025

Nationally, production volumes in agricultural enterprises and peasant farms exhibited substantial interannual variability, ranging from a low of 425,757.2 tons in 2020 to a peak of 892,645.2 tons in 2021, before declining to 562,133.1 tons in 2024, yielding a five-year average of 628,257.36 tons. This volatility likely stems from climatic fluctuations, such as droughts in 2020 and favourable conditions in 2021, compounded by socioeconomic factors affecting planting areas and input availability in Moldova's agrarian economy.

In absolute terms, the North region consistently led production, contributing between 219,751.1 tons (2024) and 337,794.6 tons (2021), with a five-year average of 266,610.72 tons, reflecting its advantageous soil and precipitation regimes. The South followed as the second-largest producer, with outputs varying from 125,178.3 tons in 2020 to 355,663.4 tons in 2021, averaging 215,448.96 tons, though showing greater susceptibility to aridity in drier years. The Centre region recorded the lowest volumes, ranging from 78,334.7 tons in 2020 to 199,188.6 tons in 2021, with an average of 146,197.96 tons, influenced mainly by urban encroachment and diversified cropping patterns around Chisinau. These regional disparities highlight the North's dominance in sunflower cultivation, accounting for roughly 40–50% of annual output, while the South and Centre contributed approximately 30–40% and 20–25%, respectively, underscoring Moldova's agro-ecological zoning.

The percentage distribution further elucidates shifting regional contributions, with the North's share fluctuating from 52.2% in 2020 to 37.8% in 2021, averaging 42.4% over five years, indicating its relative stability amid national swings. The Centre's proportion rose gradually from 18.4% in 2020 to 26.5% in 2024, averaging 23.3%, suggesting adaptive growth possibly driven by infrastructural improvements or market access. In contrast, the South's share varied widely, peaking at 39.8% in 2021 and dipping to 27.7% in 2023, with a five-year average of 34.3%, reflecting its vulnerability to environmental stressors.

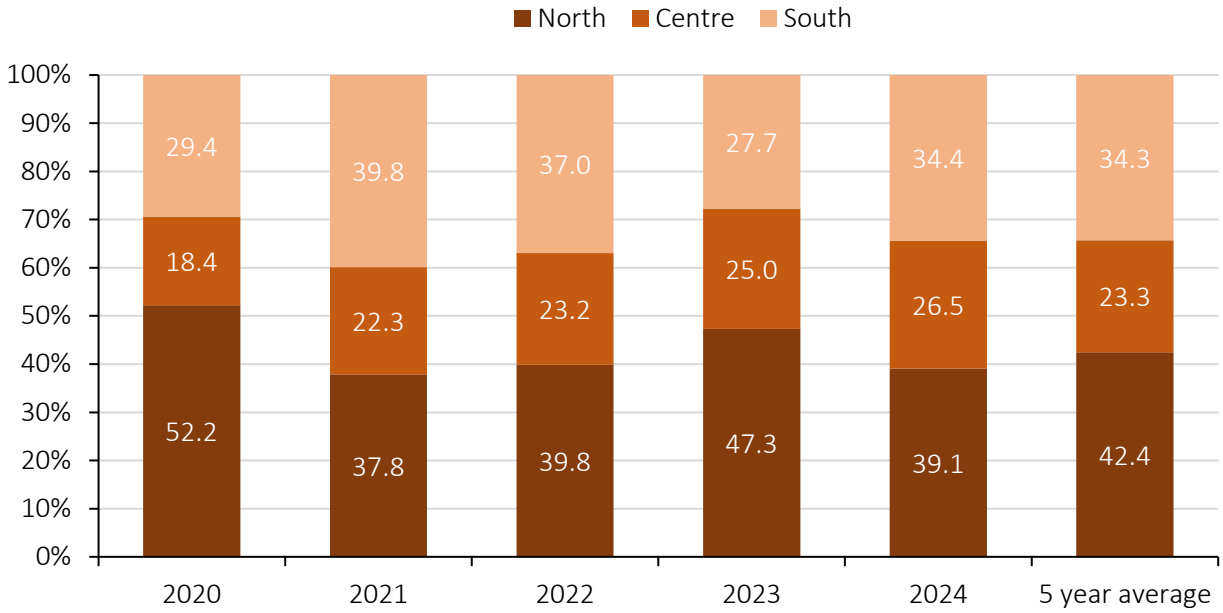


FIGURE 2-8. PRODUCTION OF SUNFLOWER IN AGRICULTURAL ENTERPRISES AND PEASANT FARMS BY DEVELOPMENT REGIONS, %
Source: NBS database, 2025

2.3. Sunflower food balance

In the framework of the balance of food resources and their use for sunflower, the supply side comprises domestic production of approximately 691.2 thousand tons and a negative stock variation of –9.9 thousand tons, resulting in total available resources of roughly 711.4 thousand tons after accounting for minor imports estimated at 30.1 thousand tons. This balance reflects a production-dominated supply structure typical of Moldova, where domestic output constitutes the overwhelming majority of resources, supplemented modestly by imports and strategic stock adjustments.

On the utilization side, exports represent the dominant outlet at approximately 394.0 thousand tons, accounting for more than half of total resources and underscoring the crop's role as a key agricultural export commodity for the country. Domestic uses remain comparatively limited: human consumption is estimated at 3.5 thousand tons, seed requirements (for sowing the following season) at 2.5 thousand tons, animal feed at 3.6 thousand tons, and post-harvest losses at 7.9 thousand tons. [3]

The sum of these domestic resources totals roughly 17.5 thousand tons, implying that the residual balance – after exports and accounted uses – aligns closely with the reported resource figure, suggesting minimal unallocated quantities or rounding effects in the presented data.

[3] Litvin, A., Scerbacov, E.. Analysis of the degree of sufficiency with sunflower production in the Republic of Moldova. Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development Vol. 25, Issue 3, 2025 PRINT ISSN 2284-7995, E-ISSN 2285-3952.
https://managementjournal.usamv.ro/index.php/scientific-papers/current/8-administrative/3959-scientific-papers-series-management-economic-engineering-in-agriculture-and-rural-development-vol-25-issue-3

Overall, the balance illustrates Moldova's position as a net exporter of sunflower seeds, with exports absorbing a substantial share of production amid relatively modest internal demand for direct food use, feed, or replanting. The low figures for human consumption and feed indicate that most seeds are destined either for export (likely in raw form or after minimal processing) or for crushing into oil domestically (300 thousand tons on average for 5 years).

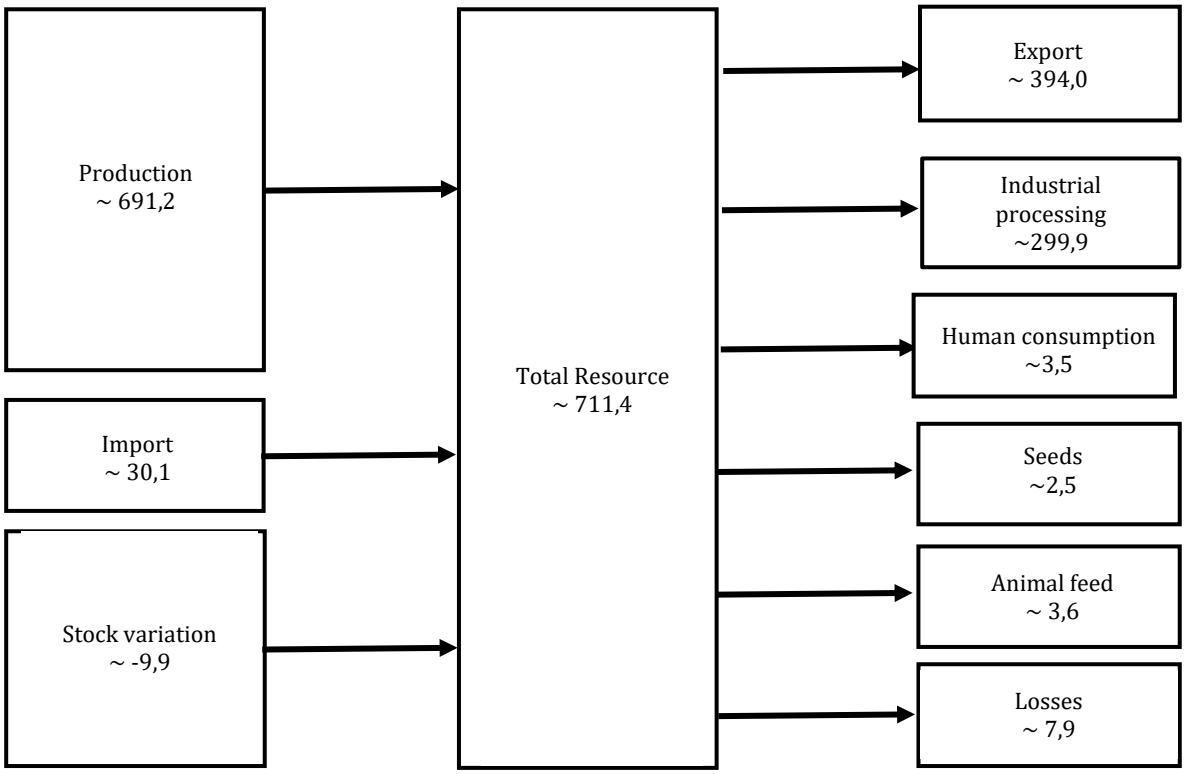


FIGURE 2-9. BALANCE OF FOOD RESOURCES AND THEIR USE, SUNFLOWER, AVERAGE VALUES FOR 2020-2024, TONS
Source: NBS database, 2025

2.4. Actors Considered in the Moldova Sunflower Value Chain

2.4.1. Farmers

The agricultural sector plays an important role in combating poverty and food insecurity in the Republic of Moldova. Micro and small-scale agricultural holdings represent 95% of all agricultural holdings and provide 71% of total agricultural production in the country. Due to insufficient technical equipment and lack of entrepreneurial education and agricultural skills, a large part of this land is leased to large agricultural producers, and those who retain the land engage in subsistence agricultural activities. Women, the elderly and those with a lower level of education report lower incomes and are the most economically vulnerable.

According to the General Agricultural Census (2011) and academic analyses: 99.6% of agricultural holdings are households without legal personality (households and peasant households); 0.4% are agricultural enterprises with legal personality; **95% of farms are considered smallholders** (small farms, subsistence or semi-subsistence).

The structure is extremely fragmented: 71% of holdings have <1 ha, but use only ~10% of the agricultural area

0.3% of holdings (>100 ha) control ~63% of the utilized agricultural area. This duality explains the imbalance between the large number of small producers and their lower share in commercial production.

The average level of production remains below the genetic potential of available hybrids, mainly due to the low use of modern inputs, extensive cultivation technologies, limited access to capital and irrigation.
The role of household and peasant farms in the sunflower value chain is quite significant (Table 2-3). Smallholder farms (<10 ha) use almost half of the agricultural land, but portions are dispersed. Sunflower is the dominant crop in these farms but production is predominantly non-commercial or sold through short channels (local markets).

Yields are lower than in large farms. The root cause is limited mechanization, low use of certified seeds, reliance on manual labour. In the Republic of Moldova, households and peasants numerically dominate the agricultural sector and contribute approximately 40% of sunflower production, but on small areas and with low yields. Large agricultural enterprises, although few, control most of the land and produce the majority of commercial sunflower. This dual structure limits the efficiency of the sunflower value chain and requires differentiated policies for the integration of smallholders into the economy.

During the interviews, it was discovered that some peasant farms operate on thousands of hectares, while some agricultural enterprises can be relatively small. Thus, the Cabinet of Ministers of the Republic of Moldova approved the draft amending the conditions for the exercise of entrepreneurial activity by peasant households. "The concept of the peasant household is based on the idea of developing family businesses in agriculture, based on the personal work of its members. To support them, a number of facilities have been granted through normative acts, in relation to other forms of entrepreneurial activity, such as the income tax rate, the accounting system, and social security contributions.

Analysing the area of agricultural land declared by peasant households in the applications for subsidies, it was found that **around 8% of them own land with an area greater than 150 ha**, with households being registered with a land area exceeding 10,000 ha. Owning such land areas indirectly indicates that they have exceeded the scope of a business in which the work of family members is used and special protection from the state would not be justified," the information note states.

Considering the shortcomings of the current situation, a survey was conducted among farmers to identify and accurately characterize the archetypes of farms. 165 producers from different production regions, who represented the classical farming entities (PF + AE), were questioned. Additionally, farmers practicing a no-tillage system (n=10) and organic producers (n=9) were interviewed. Information collected provided a possibility to characterise archetypes of producers.

We identify three base archetypes of classical producers, aligning with the official division into peasant farms (PF), agricultural enterprises (AE) and Smallholders (SHs). Following the survey results, it was established that on average, PFs are much smaller than AEs, and on average, they are characterised by lower yields. This base division is further subdivided by region where farms operate (south, centre, north). This, in total, creates 9 farm types. Additionally, we add a typical example of a farmer who practices conservational agriculture in the form of a no-tillage system. Lastly, we consider a typical organic producer.

All farm archetypes used in this report are shortly described below, and their summary statistics are provided in Table 2-3.

TABLE 0-3. DISTRIBUTION OF SUNFLOWER PRODUCTION AMONG TYPICAL FARMS

Archetypes			Total Sunflower production (K t)1	Total hectares - sunflower, (K ha)3	Yields (t/ha)[2]	Average sunflower (ha)[5]	Per farm production (t)[4]	Number of Farms4
Conventional	North	PF	78.2	37.3	2.1	55	115	683
		AE	245.5	111.6	2.2	186	409	601
		SHs	36.2	18.1	2.0	3	5	7,249
	Central	PF	50.3	31.4	1.6	88	141	357
		AE	118.0	73.8	1.6	184	294	402
		SHs	18.8	11.8	1.6	5	8.4	2,244
	South	PF	38.1	22.4	1.7	43	73	524
		AE	151.8	108.4	1.4	205	288	528
		SHs	21.3	16.4	1.3	1	5	30,365
Total | Average			**758**	**431.2**	1.8	10.0	17.66	42,952

Source: Own calculations based on the National Bureau of Statistics (NBS) of the Republic of Moldova, survey conducted. Notes: [1] NBS of Moldova, regional statistics of production. [2] Data are based on a survey conducted. [3] Derived from yields and production statistics. [4] Based on information derived from Payment Agency (AIPA) and information on green diesel support in 2023 and microdata provided by NBS. [5] Deducted from information from AIPA, surveys, and NBS.

The sunflower sector in Moldova produces approximately 758 thousand tonnes from 431 thousand hectares, with an average yield of 1.8 t/ha. Production is highly concentrated in large agricultural enterprises (AEs), which account for about 68% of total output, demonstrating the importance of economies of scale and better access to technology and markets.

Northern Moldova is the most productive region, contributing nearly half of national production and achieving the highest yields (2.0–2.2 t/ha). In contrast, Southern Moldova records lower productivity due to recurrent droughts and water scarcity.

Although small households represent the majority of farms, their contribution to total production remains limited, reflecting land fragmentation and lower production capacity.

TABLE 0-4 COMPARATIVE ANALYSIS OF BUSINESS PERFORMANCE BY REGION

Region	Farm type	Comments
North	Smallholders (SHs)	small farms, low inputs, low productivity
	Peasant farms (PFs)	medium-sized family farms, medium technologies
	Agricultural enterprises (AEs)	large, fully mechanized farms
Central	Smallholders (SHs)	lack of irrigation, high costs
	Peasant farms (PFs)	mixed farms, average results
	Agricultural enterprises (AEs)	moderate investments, partial infrastructure
South	Smallholders (SHs)	affected by severe drought
	Peasant farms (PFs)	low productivity, limited inputs
	Agricultural enterprises (AEs)	degraded soils, local irrigation

Source: survey conducted.

The qualitative analysis of this table reveals a direct correlation between the scale of production, access to resources and climate resilience in Moldovan agriculture. The North is the only region where agricultural enterprises (AE) are described as "fully mechanized". Productivity here is supported by technology, not just soil.
The Centre faces a paradox of high costs and lack of infrastructure (irrigation), which caps results at an "average" level. The South is marked by soil degradation and severe drought. Production here depends on survival, not performance, being the only region where devastating climate impacts are explicitly mentioned.

Smallholders (SHs - Subsistence): Defined by "low inputs" and "low productivity". In all regions, they represent the most fragile segment, being the first to be affected by drought and lack of capital.
Peasant Farms (PFs - Transition): Represent family farms that use average technologies. These are the "bridge" between subsistence and business, but their results are mixed/average.
Agricultural Enterprises (AEs - Industrial): They are the only entities capable of investment (mechanization, infrastructure). However, even they are limited in the South by soil quality, which suggests that technology cannot fully compensate for the degradation of natural resources without regenerative practices (such as No-Till).

The table suggests that to increase national profitability, Moldova needs to solve two structural problems:
1. Mechanization and consolidation of small producers (SHs) to exit the "low productivity" zone.
2. Soil rehabilitation in the South, where the classic mechanization of large enterprises (AEs) is no longer sufficient due to advanced degradation.

TABLE 0-5 QUANTITY OF SUNFLOWER FOR OWN CONSUMPTION, GIFT, BONUS FOR EMPLOYEES (TONES) IN THESE CATEGORIES.

Farm type	North	Centre	South	Total
Smallholders (SHs)	4 100	3 200	3 500	10 800
Peasant farms (PFs)	1 560	1 000	660	3 220
Agricultural enterprises (AEs)	120	80	100	300
TOTAL	**5 780**	**4 280**	**4 260**	**14 320**

Source: survey conducted.
According to the survey data, a fairly large amount of sunflower is used for own consumption, especially that obtained in smallholders and peasant farms.

Agricultural enterprises

Agricultural enterprises play a dominant role in the cultivation of sunflower, Moldova's principal oilseed crop and one of its most important agricultural export commodities. During the nine-year analyzed period (2016 – 2024), sown area under sunflower in agricultural enterprises displayed a clear upward tendency. Area fluctuated between 247.3 thousand hectares (2018) and 304.2 thousand hectares (2022), averaging 267.3 thousand hectares. Following relatively stable levels around 248–271 thousand hectares in 2016–2021, a notable expansion occurred in 2022, after which the area moderated but remained above the early-period average (262.4 thousand ha in 2023 and 285.9 thousand ha in 2024). This gradual increase reflects the crop's profitability, favourable market conditions for oilseeds, and the structural advantages of larger commercial units in responding to export demand.

Average yields ranged from a low of 1.30 t/ha in 2020 to a high of 2.60 t/ha in 2021, with a period average of 1.96 t/ha. Strong performance was recorded in 2017–2019 and especially 2021, while depressed yields occurred in the drought-affected years 2020, 2022, and 2024 (1.49 t/ha). Meteorological conditions – particularly rainfall distribution and temperature extremes during flowering and seed-filling – remain the primary driver of yield variation.

Total production closely followed yield movements. Output reached its maximum of 703.9 thousand tons in 2021 and its minimum of 341.9 thousand tons in 2020, yielding a nine-year average of 515.3 thousand tons.

The dataset portrays a sub-sector that has successfully expanded planted area while remaining subject to climatic risk. The exceptional 2021 season combined near-average area with record yield to produce more than double the output of the severe 2020 drought year. The overall pattern indicates resilience derived from commercial scale and varietal selection, yet persistent vulnerability to extreme weather events that continue to generate substantial year-on-year output swings.

TABLE 2-6. SUNFLOWER PRODUCTION, AGRICULTURAL ENTERPRISES, MOLDOVA (2016 - 2024)

	Agricultural enterprises	2016	2017	2018	2019	2020	2021	2022	2023	2024
Area	K hectares	248.3	264.9	247.3	250.3	271.4	271.2	304.2	262.4	285.9
Yield	t/ha	2.0	2.2	2.2	2.3	1.3	2.6	1.5	2.0	1.5
Production	K tonnes	497.4	585.9	551.2	569.2	341.9	703.9	446.2	517.8	423.9

Source: National Bureau of Statistics (2025)

Peasant farms

The sunflower crop is particularly attractive to peasant farms due to its relatively low input requirements, greater tolerance to drought compared with cereals, and reliable demand from domestic oil processors and export markets. Over the nine-year observation period, sown area under sunflower in peasant farms exhibited moderate but noticeable growth after an initial contraction. Planted area ranged from a low of 96.1 thousand hectares in 2019 to a high of 127.0 thousand hectares in 2022, with a period average of 113.0 thousand hectares. Following a decline to the series minimum in 2019, area recovered steadily, surpassing 110 thousand hectares from 2021 onward and stabilizing at 119–124 thousand hectares in the final two years. This gradual expansion likely reflects the crop's economic advantages for smallholders – comparatively stable market prices, lower Labour and fertilizer demands relative to sunflower, and suitability for crop rotation in rain-fed systems.

Average yield per hectare, reported in tons varied between 1.36 t/ha (recorded in both 2020 and 2022) and 2.28 t/ha in 2019, yielding an overall mean of 1.79 t/ha. The strongest performances occurred in 2019 and 2021, while drought-impacted seasons produced the lowest results.

Production peaked at 242.5 thousand tons in 2021 – the best year in the series – and reached its lowest level of 137.2 thousand tons in 2020, for a nine-year average of 198.4 thousand tons. Thus, while peasant farms have increased their sunflower acreage over the period, output remains highly sensitive to weather extremes, with drought years producing contractions of 30–40% relative to peak seasons. Compared with larger agricultural enterprises, peasant holdings achieve lower average yields, reflecting constraints in access to improved seed material, mechanization, and fertilizer application.

TABLE 2-7. SUNFLOWER PRODUCTION, PEASANT FARMERS, MOLDOVA (2016 - 2024)

	Peasant farms	2016	2017	2018	2019	2020	2021	2022	2023	2024
Area	K hectares	108.2	113.0	112.7	96.1	104.8	112.1	127.0	119.0	123.9
Yield	t/ha	1.6	1.8	2.1	2.3	1.4	2.2	1.4	1.9	1.5
Production	K tonnes	174.0	207.2	230.6	218.9	137.2	242.5	169.5	223.1	182.4

Source: National Bureau of Statistics (2025)

Smallholder household

Over the nine-year period, sown area under sunflower for grain in rural households stayed very limited and displayed moderate fluctuation without a clear directional trend. Planted area ranged from a low of 4.2 thousand hectares in 2018 to a high of 12.2 thousand hectares in 2019, averaging 8.8 thousand hectares. The small scale and relative stability reflect the constrained land base and traditional, low-intensity cropping practices characteristic of this category.

Average yield per hectare varied between 0.96 t/ha in 2016 and 1.91 t/ha in 2019, yielding a period mean of 1.45 t/ha. Relatively higher yields were recorded in 2018–2019 and 2023, while markedly lower results occurred in 2016, 2020, and 2022.

Global harvest volumes remained correspondingly modest, closely tracking yield movements given the small and stable planted area. Production attained its maximum of 23.3 thousand tons in 2019 and its minimum of 5.7 thousand tons in 2016, for a nine-year average of 12.9 thousand tonnes.

While rural households have maintained a consistent presence in sunflower cultivation, output remains highly vulnerable to weather extremes, with production capable of varying by a factor of four between best and worst years. Compared with peasant farms and agricultural enterprises, this category records the lowest average yields, underscoring the limitations of minimal technical inputs and rain-fed systems on very small plots.

TABLE 2-8. SUNFLOWER PRODUCTION, RURAL HOUSEHOLDS, MOLDOVA (2016 - 2024)

	Rural households	2016	2017	2018	2019	2020	2021	2022	2023	2024
Area	K hectares	5.9	7.0	4.2	12.2	11.1	8.8	9.0	10.5	10.2
Yield	t/ha	0.96	1.5	1.6	1.9	1.2	1.6	1.3	1.7	1.3
Production	K tonnes	5.7	10.7	6.9	23.3	13.4	13.7	11.4	17.5	13.3

Source: National Bureau of Statistics (2025)

Organic Producers

Only 1.4% of the agricultural land in the Republic of Moldova is cultivated using organic farming methods. Organic sunflower production remains particularly low, covering just 6,400 hectares. While yields in organic systems are typically lower than in conventional agriculture, this is partially offset by reduced costs – mainly due to the elimination of expensive plant protection products. However, total production figures remain unclear, and organic farming warrants further investigation as a potential growth area.

One key barrier to the development of organic agriculture in Moldova exists at the production level: the lack of certified organic seed material. Nevertheless, both national and EU legislation permit the use of conventional seeds under certain conditions – provided they are untreated with pesticides and are not genetically modified.

Another obstacle is limited consumer awareness regarding the value and benefits of organic products. Although interest in organic food is gradually growing among Moldovan consumers, price remains the dominant factor in purchasing decisions, with lower-cost products generally preferred regardless of quality or certification.

No-Tillage Practices

Conservation agriculture is of particular importance to Moldovan farmers, who regularly face drought conditions and must manage soil to mitigate water scarcity and degradation. Approximately 50,000 hectares of sunflower are currently cultivated using conservation techniques, particularly no-tillage.

This approach offers multiple benefits: significantly lower diesel consumption, reduced Labour requirements (fewer man-days), and improved resilience to drought and soil erosion. These advantages also contribute to reduced production costs over time.

2.4.2. Landowners

Landowners are generally rural households or private individuals who do not personally carry out agricultural activities. Although they obtained their land through the land reform process, many decided not to pursue farming themselves. Instead, they lease their plots to active farmers, who compensate them through an annual rental payment.

Lease contracts, which clearly define the rental terms, are usually concluded for a five-year period and may provide for payment either in cash or in agricultural products. According to the survey results, most landowners prefer payment in kind. Under this system, the owner receives a predetermined quantity of agricultural goods, as specified in the contract. Table 2.9 illustrates an example of the compensation structure for a single land quota (the standard unit used in lease arrangements). It should be emphasized that the size of these quotas differs, since they were established based on the number of shares distributed during the land reform and the subsequent division of former collective farms (kolkhozes).

TABLE 0-9 EXAMPLES OF CONTRACTUAL AGREEMENTS FOR IN-KIND PAYMENTS FOR LAND LEASE

Land quota (Ha)	Annual rent agreement for in kind payment
1.54 ha	500 kg of wheat, 100 kg of sunflower, 500 kg of maize
1.10 ha	400 kg of wheat, 130 kg of sunflower, 250 kg of maize
2.00 ha	600 kg of wheat, 200 kg of sunflower, 300 kg of maize, 200 kg of barley
1.3 – 1,5 ha depending on quality	600 kg of wheat, 150 kg of sunflower, 50 kg of sugar, 100 kg of maize

Source: own survey conducted

The persistence of payments in kind can be explained by several factors. **First of all**, a large part of the land owners are elderly people from rural areas, who prefer to receive agricultural products for their own consumption or for animal feed. **Second,** this practice reduces the immediate need for liquidity for farmers, which is important in the context of limited access to finance and high volatility in agricultural markets. **Third**, payment in kind is a tradition inherited from the post-privatization period of agricultural land and continues to be accepted by many landowners.

From an economic point of view, in-kind payments contribute to the distribution of benefits generated by the value chain to rural households that own agricultural land, even if they do not directly participate in production activities. Thus, the lease in kind constitutes an important mechanism for the transfer of economic value to the rural population and **explains the significant share of the "Landowner share" category in the cost structure** (Table 3-13) and in the analysis of the distribution of income from the sunflower value chain.

Input supply

Mineral fertilizers are largely imported. As highlighted in Figure 2.6, both the volume and value of fertilizer imports have increased steadily over time. The total volume of imports increased from approximately 150 thousand tons to over 267 thousand tons in 2018, and in the reference year 2023 it was around 250 thousand tons. The main suppliers are the Russian Federation, Bulgaria, Turkmenistan, Greece, Romania, Egypt and Belarus. A significant trend in the use of mineral fertilizers emerged after 2010, when there was an accelerated increase in the consumption of nutrients N, P and K (Figure 2.7), mainly associated with the expansion of areas cultivated with corn and sunflower and the intensification of agricultural production systems.

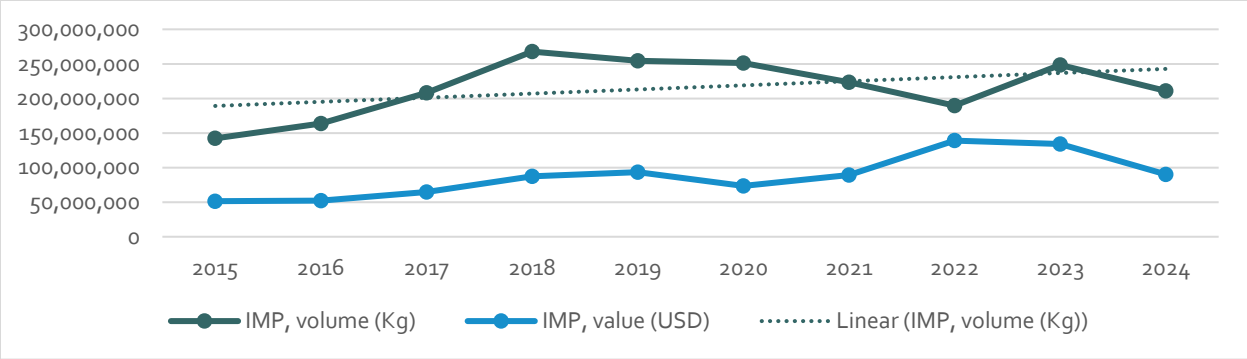


FIGURE 0-6: TRENDS OF FERTILISERS IMPORTS (HS 31), REPUBLIC OF MOLDOVA, VOLUME IN KG, VALUE IN USD, 2015 – 2024.
Source: UN Comtrade (2025)

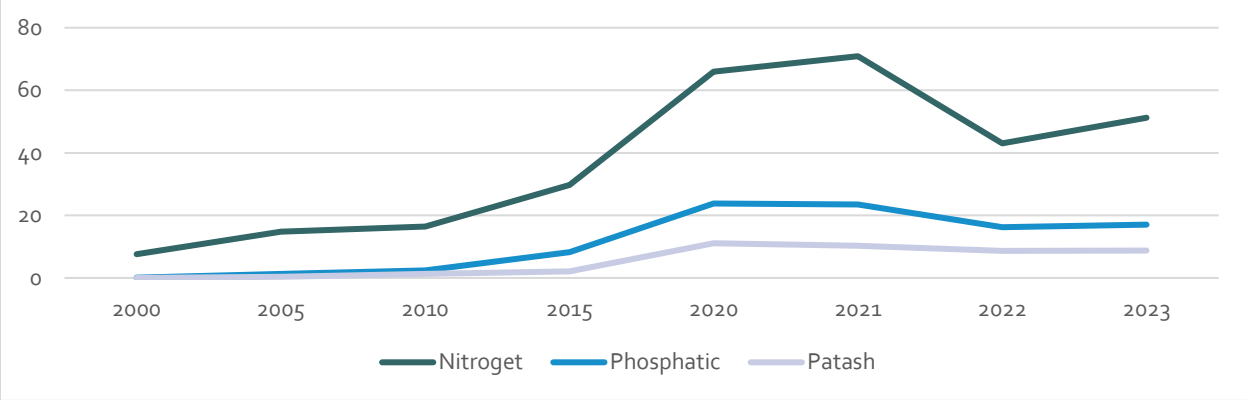


FIGURE 0-7: MINERAL FERTILISERS USED IN AGRICULTURAL ENTERPRISES AND IN FARMS WITH MORE THAN 50HA (THOUSAND TONNE OF ACTIVE SUBSTANCES).
Source: National Bureau of Statistics - Statistical Yearbook 2023 (National Bureau of Statistics of the Republic of Moldova, 2025c)

A similar development can be observed in the case of pesticide application, which has increased since 2010, with a rapid growth since 2020 (Figure 2-8). Like fertilisers, pesticides are also imported (Figure 2-9), showing the ever-growing importance of input providers in the agricultural value chains in Moldova, including the sunflower value chain. As there is no domestic production of the most crucial agricultural inputs, the relationship between farmers and input providers plays a significant role. Based on interviews with input providers, we estimate that they offer technical credits to approximately 95% of their clients, providing inputs through a deferred payment scheme.

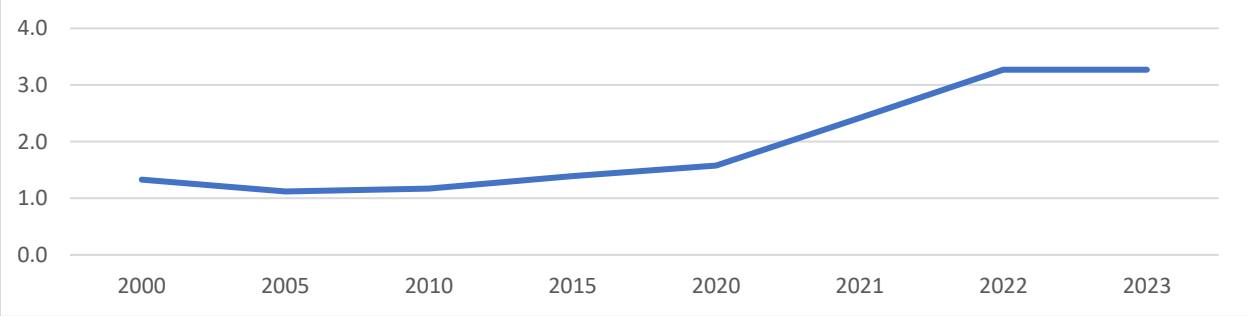


FIGURE 0-8 PESTICIDE USE IN MOLDOVA IN KG PER HA OF CROPLAND
Source: FAOstat (2025)

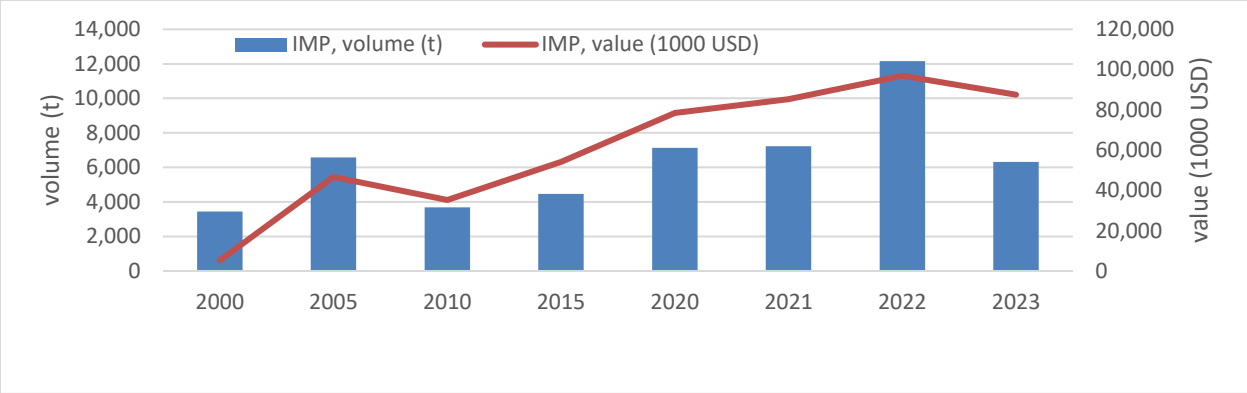


FIGURE 0-9 VOLUME AND VALUE OF PESTICIDE IMPORTS IN MOLDOVA
Source: FAOstat (2025)

The fertilizers used for growth of sunflower capture a broad spectrum of inputs – from bulk nitrogen sources like ammonium nitrate to specialty micronutrient and starter fertilizers – reflecting real-world practices among agricultural enterprises and larger peasant farms. All but one product are applied using own technology, indicating widespread access to modern spreaders or sprayers, while prices span from 9 MDL/kg (EU ammonium nitrate) to 512 MDL/kg (Cellerate MoZn), revealing a stark divide between commodity and high-value specialty inputs.

The majority of entries are nitrogen-heavy or balanced NPK formulations, underscoring sunflower's high demand for nitrogen (N) and phosphorus (P). Ammonium nitrate and urea (46% N) appear multiple times, sourced from Russia, Romania, Uzbekistan, and the EU, with doses ranging from 80–120 kg/ha and prices between 9–14 MDL/kg. NPK complexes (e.g., Diamofos 10:26:26, Nitroamofos) are applied at 47.5–115 kg/ha, typically at 13–15.5 MDL/kg, and originate mainly from Russia and Moldova.

Russia is the most frequent origin, followed by Uzbekistan, Romania and EU/Europe, as well as Moldova. This distribution reflects post-Soviet supply chains and proximity logistics. The heavy reliance on imported inputs – especially from geopolitically volatile sources (Russia, Ukraine) – poses supply risks, while the near-universal use of own application technology signals mechanization progress but also input intensity. Table 2-11 presents information on fertilizers, type, quantity, price and country of import. The data were obtained from the survey conducted.

TABLE 0-10 MOSTLY MENTIONED FERTILISERS, THEIR DOSES AND PRICES SOLD TO FARMERS BY INPUT PROVIDERS.

Fertiliser name, type	Dose (kg/ha)	Price range MDL/kg (2022)	Price range MDL/kg (2023)	Country of origin
Ammonium nitrate	80 - 120	8.5 - 21	9 - 11	Russia / EU
Urea 46%	105	7 - 17.7	13 - 14	Russia / Uzbekistan / Romania
NPK	80 - 90	221	10.7 - 13	Moldova / Russia
Amofos (N:P 12:52)	75	13.5	14.5	Russia
Bombardier	1.8	80.1	84.5	Spain
Cellerate MoZn	0.5	495	512	Uzbekistan
Diamofosca 10.26.26	47.5	14.8	15.51	Russia
Harbest	11.68	48	50	Uzbekistan
Harvest Tech 20-20-20	7	48	49	Uzbekistan
Nitroamofos NPK	60	11 - 12	11 - 12	Ukraine
Nitroplus	3.25	47.5	49.23	Romania
Starter Mn Platinum	0.9	118	122	Uzbekistan
Diamofos 10-26-26	115	12	15	Russia

Source: Survey among farmers

The hybrid seed market in Moldova is strongly integrated into the European system, with high dependence on imports. International suppliers dominate through research capacity, marketing and distribution networks. The Moldovan market is mainly operated by multinational companies such as Syngenta, Corteva, Limagrain, KWS and Lidea, along with local distributors and national research institutions. Clearfield and Clearfield Plus hybrids are the most widely used due to their effective weed control. For small farms, there are also more acceptable domestic options.

TABLE 2-11. MOSTLY MENTIONED SEED TYPES, THEIR DOSES AND PRICES SOLD TO FARMERS BY INPUT SUPPLIERS.

Company	Sunflower hybrids	Dose (seeds per ha)	Price 2023	Technology (Own/service)	Country of origin
Syngenta	SY Experto, NK Neoma, Talento	55.000–65.000	180–240 € / bag (150.000 seed)	Clearfield, CLP, conventional	Switzerland
Corteva (Pioneer)	P64LE25, P63LE113, P64HE144	55.000–65.000	200–260 € / bag	Clearfield, ExpressSun	USA
Limagrain (LG)	LG 54.78, LG 56.63	55.000–65.000	190–250 € / bag	Clearfield Plus	France
Euralis (Lidea)	ES Agora, ES Bella	55.000–65.000	180–230 € / bag	Clearfield	France
Maisadour	MAS 89.IR, MAS 92.CP	55.000–65.000	170–220 € / sac	Clearfield, CLP	France
Saaten-Union	Barolo, NK Kondi	55.000–65.000	160–210 € / bag	Conventional, CL	Germany
Agroselect / Institute of Phytotechnics	Native hybrids	50.000–60.000	90–150 € / bag	Conventional	Moldova

Source: Survey among farmers, own calculation

For Moldova, the optimal density is generally between 55,000–60,000 plants/ha, adjusted according to the climatic zone. Conventional technology remains dominant, but no-till technology is increasingly used, especially on large farms and in areas with moisture deficit, such as the centre and south of the country. (Table 2-11)

TABLE 2-12. THE STRUCTURE OF INPUTS PER 1 HECTARE OF SUNFLOWER

Inputs	MDL without VAT	MDL with VAT	Share, %
Seeds	1,460	1,577	11,19
Fertilizers	3,125	3,750	23,95
Foliar protection and fertilization	884	1,060,2	6,77
Total inputs	**5,469**	**6,387**	**41,91**
Unforeseen expenses (5-10%)	496		

Source: Survey among farmers

This level of costs indicates an average crop technology, with sufficient inputs to ensure stable production, without entering the area of an intensively expensive technology. Seeds have a share in costs: 11.19%. From an economic point of view, they have a level corresponding to the use of certified hybrids and ensure a good balance between genetic potential and production cost. The share is appropriate for hybrid sunflower. It suggests the use of certified hybrids, possibly of medium-high productivity. The share of fertilizers in costs is 23.95%. It is the dominant input, which is normal for sunflower. The analysed costs (41.91% of the total estimated costs per hectare) suggest that the remaining costs are generated by mechanized work, fuel, labour, irrigation and depreciation of machinery. Unforeseen expenses fall perfectly within the recommended range (5–10%). It is a prudent level, which covers price fluctuations, additional treatments, minor operational losses.

2.4.3. Foreign trade

In foreign trade with sunflower, exports constitute the dominant component and exhibit an overall upward trend, with notable fluctuations. From 2016 to 2019, export values increase steadily, followed by a decline in 2020 and partial recovery in 2021. A pronounced surge is observed in 2022, after which exports drop sharply in 2023 before rebounding strongly in 2024. This pattern suggests sensitivity to external economic conditions or structural changes affecting trade volumes during the observed period. In contrast, imports remain comparatively modest

but display greater volatility, particularly from 2020 onward, with a substantial peak in 2022 that coincides with the export surge.

The trade balance remains positive throughout the entire period, indicating a consistent trade surplus. While the surplus generally mirrors export performance, its magnitude varies significantly, reaching its highest level in 2022 and its lowest in 2023.

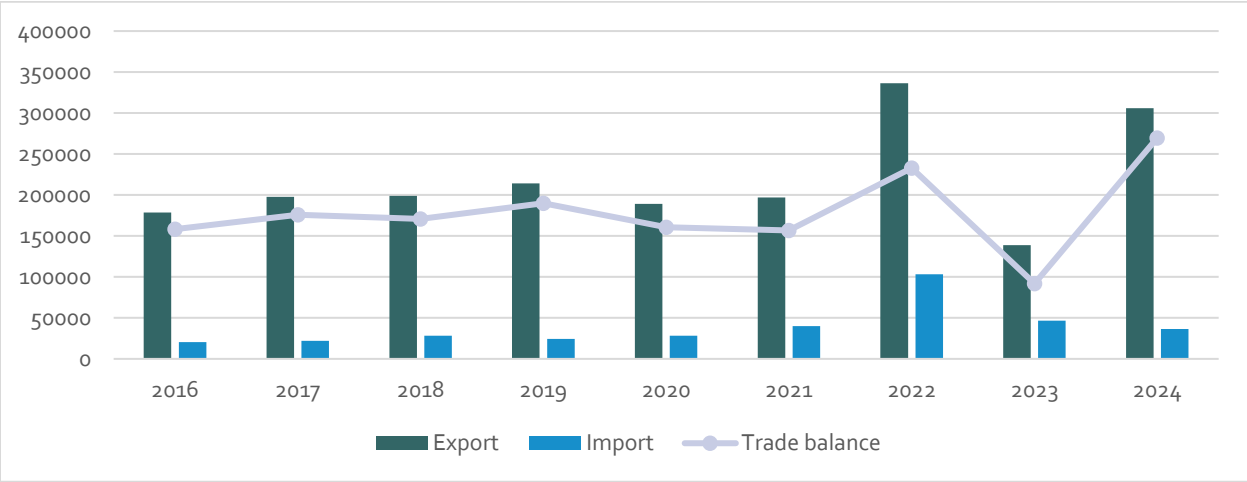


FIGURE 2-10. FOREIGN TRADE WITH SUNFLOWER SEED (HS 1206), 2016 – 2024, MIL. USD
Source: UN Comtrade database

For sunflower seeds (HS 1206), import prices displayed greater variability, fluctuating from 0.983 USD/kg in 2022 to highs exceeding 8.918 USD/kg in 2018 and 8.140 USD/kg in 2024, indicative of sporadic reliance on foreign supplies during domestic shortfalls or quality-specific demands. Export prices remained relatively stable and lower, ranging from 0.371 USD/kg in 2019 to 0.775 USD/kg in 2022, with a modest upward trajectory post-2020, averaging around 0.45–0.55 USD/kg.

The consistent gap where import prices substantially exceeded export prices – often by a factor of 5–10 – suggests Moldova's exports are primarily bulk, lower-value seeds, while imports may target premium or specialized varieties. Overall, the dataset illustrates the sunflower sector's exposure to price instability, with implications for Moldova's trade balance, agricultural profitability, and policy needs to enhance value addition through processing and market diversification.

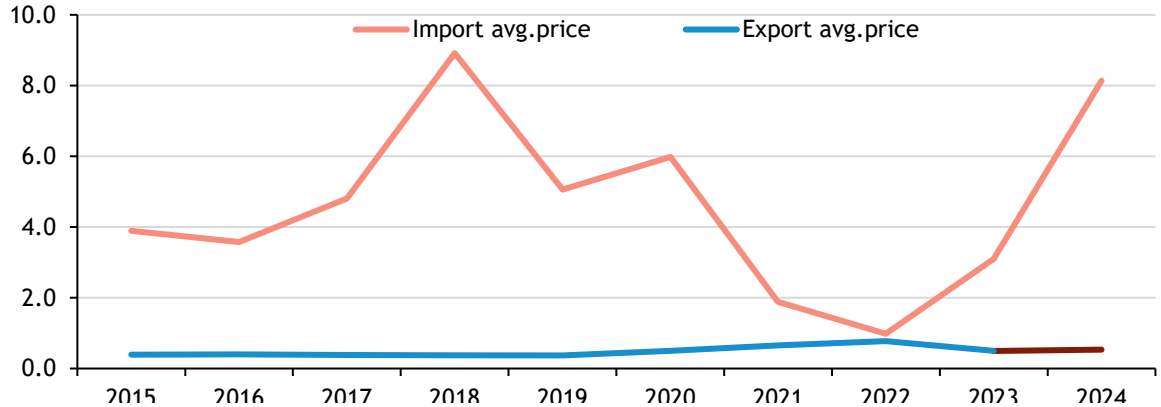


FIGURE 2-11. AVERAGE IMPORT AND EXPORT PRICE OF SUNFLOWER SEED (HS 1206), REPUBLIC OF MOLDOVA, USD/KG
Source: UN Comtrade database

Republic of Moldova has a major role in trade with sunflower seeds, with a domination of exports to Romania, Turkey, Bulgaria and Greece. As for imports, less amounts were imported from Turkey, France, Spain and Romania.

TABLE 2-13. IMPORT AND EXPORT DESTINATIONS FOR MOLDOVA SUNFLOWER SEEDS (HS 1206), 2023 – 2024

Export	Quantity (tons)		Average price (USD/kg)		**Import**	Quantity (tons)		Average price (USD/kg)	
	2023	2024	2023	2024		2023	2024	2023	2024
Romania	185,095	290,367	0.45	0.50	Türkiye	1,081	1,832	5.95	6.13
Türkiye	13,040	136,921	0.51	0.50	France	334	567	19.46	16.76
Bulgaria	40,190	92,533	0.46	0.56	Spain	70	271	16.96	15.42
Greece	3,032	15,809	0.45	0.50	Romania	303	250	17.83	15.77
World	279,320	572,461	0.50	0.53	World	15,101	4,457	3.10	8.14

Source: UN Comtrade database

The trade export concentration of sunflower seeds from the Republic of Moldova displays a persistently high – and in several years extreme – degree of geographic concentration over the period 2018–2024.

Unlike patterns observed in some other Moldovan agricultural commodity exports, sunflower seed shipments have remained heavily oriented toward a narrow set of neighbouring and regional markets throughout the entire timeframe. Romania has consistently ranked as the leading or co-leading destination, with its share fluctuating between a low of 25.3% (2021) and a peak of 59.9% (2023). Turkey occupied the top position in 2019 (40.9%) and 2021 (36.5%), but experienced a sharp contraction after 2022, falling to 4.8% in 2023 before partially recovering to 22.5% in 2024. Bulgaria has maintained a stable secondary role, with shares ranging from 7.5% (2018) to 22.7% (2022), averaging around 15–16% in most years.

The combined share of the three largest destinations remained elevated across the period, typically capturing 80–89% of total export value. It reached particularly high levels in 2022 (88.4%) and 2024 (86.9%), reflecting limited effective diversification even in years of partial rebalancing. The residual category "other countries" declined markedly after 2018 (from 12.8% to an average of ≈4–6% thereafter), indicating a structural reduction in the importance of distant or smaller markets.

A clear intensification of concentration occurred after 2021. In 2022–2023, Romania's share rose dramatically – from 25.3% in 2021 to 49.2% and then 59.9% – while Turkey's role diminished sharply. This shift coincided with well-documented regional geopolitical and logistical upheavals following the escalation of the Russia–Ukraine conflict in 2022, which severely constrained traditional Black Sea export corridors and increased reliance on EU land routes, particularly via Romania. The 2024 data show a partial correction, with Romania's dominance easing to 47.6% and Turkey regaining relevance (22.5%), yet the overall structure remained highly concentrated.

Several structural and external factors likely contributed to the observed pattern:

- geographical proximity and established land-based trade infrastructure favouring Romania and Bulgaria;
- disruptions to maritime export routes through Ukrainian ports and the Black Sea, redirecting large volumes toward EU neighbours;
- differing demand dynamics in Turkey versus more stable EU absorption capacity;
- Moldova's position as a landlocked origin, amplifying dependence on transit countries.

The sustained high concentration of sunflower seed exports exposes Moldova's sector to substantial risks, including counterparty dependence, transit bottlenecks, phytosanitary or regulatory changes in principal markets, and asymmetric price shocks.

TABLE 2-14. TRADE EXPORT CONCENTRATION OF THE SUNFLOWER SEEDS (HS 1206), 2018 – 2024, %

	2018	2019	2020	2021	2022	2023	2024
Romania	37.0	26.8	35.8	25.3	49.2	59.9	47.6
Turkey	21.2	40.9	30.9	36.5	16.5	4.8	22.5
Bulgaria	7.5	14.5	16.8	20.1	22.7	13.5	16.8
Poland	3.3	2.4	2.4	1.9	1.6	4.1	2.3
Germany	1.7	1.7	2.5	1.8	1.8	3.0	1.7
Czech Republic	0.2	0.9	2.9	2.2	1.4	1.7	2.5
Ukraine	5.0	2.2	0.3	0.2	1.1	2.3	0.1
Greece	2.3	2.5	0.2	0.0	0.0	1.0	2.6
Serbia, FR(Serbia/Montenegro)	0.2	0.2	0.5	5.8	0.3	1.2	0.3
Lithuania	1.0	0.8	1.0	0.6	1.0	1.8	0.6
United Kingdom	5.1	1.1	0.6	0.0	0.0	0.0	0.0
Switzerland	2.8	1.3	1.2	0.3	0.6	0.3	0.1
Other countries	12.8	4.7	5.0	5.2	3.7	6.4	3.0

Source: UN Comtrade database

2.4.4. Industry

For crude sunflower oil (HS 151211), import prices exhibited considerable volatility, ranging from a low of 0.657 USD/kg in 2024 to a peak of 1.785 USD/kg in 2021, with an overall upward trend in the early 2020s driven by supply disruptions and elevated global energy costs. Export prices followed a similar pattern, starting at 0.711 USD/kg in 2015, dipping to 0.632 USD/kg in 2019, and surging to 1.572 USD/kg in 2022 before moderating to 0.811 USD/kg in 2024. The premium of import over export prices persisted throughout the period, averaging approximately 0.15–0.20 USD/kg, potentially reflecting quality differentials, transportation costs, or market segmentation. These trends align with broader commodity market shifts, including the impacts of the COVID-19 pandemic in 2020 and subsequent inflationary pressures, which amplified price spikes in 2021–2022, followed by stabilization amid increased global supplies.

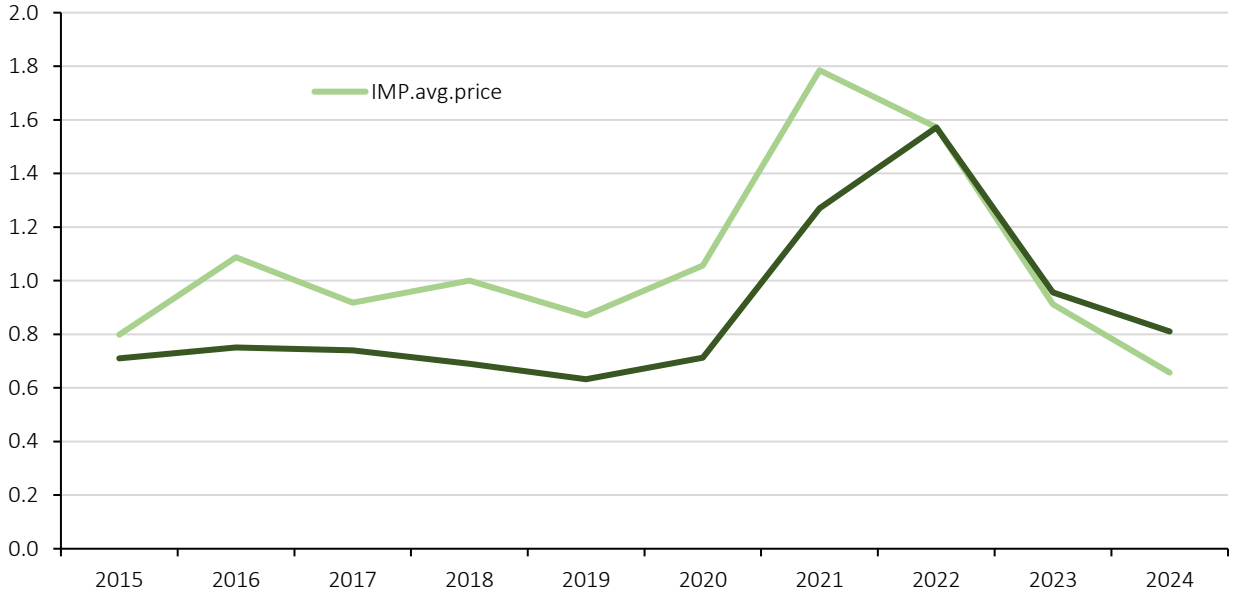


FIGURE 2-12. AVERAGE IMPORT AND EXPORT PRICE OF SUNFLOWER OIL (HS 151211), REPUBLIC OF MOLDOVA, USD/KG
Source: UN Comtrade database

On the export side of crude sunflower oil, total world exports declined markedly from about 247.6 thousand tons in 2023 to approximately 134.6 thousand tons in 2024, indicating a substantial contraction in export activity.

Romania, which dominated export direction in 2023 with nearly 199 thousand tons, experienced a sharp reduction in 2024, importing only about 29.1 thousand tons. In contrast, Egypt increased its import volumes from roughly 12.5 thousand tons to about 29.3 thousand tons, partially offsetting the decline observed in Romania. Spain's imports decreased between the two years. Average export prices also fell from around 0.96 USD/kg in 2023 to about 0.81 USD/kg in 2024, suggesting weaker price conditions alongside reduced volumes.

Regarding imports, the data present a pronounced increase in total imports of crude sunflower oil, from approximately 9.2 thousand tons in 2023 to over 69.0 thousand tons in 2024. This rise is largely driven by Ukraine, whose exports of oil to Moldova expanded significantly from about 9.2 thousand tons to nearly 68.9 thousand tons over the same period. Other exporters recorded relatively minor volumes, with some appearing only marginally in one of the two years. This pattern points to a growing concentration of import demand in a limited number of markets.

Import prices display a clear downward trend similar to that observed for exports. The average import price declined from about 0.91 USD/kg in 2023 to approximately 0.66 USD/kg in 2024.

TABLE 2-15. IMPORT AND EXPORT DESTINATIONS FOR MOLDOVA SUNFLOWER OIL (HS 151211), 2023 – 2024

Export	Quantity (tons)		Average price (USD/kg)		**Import**	Quantity (tons)		Average price (USD/kg)	
	2023	2024	2023	2024		2023	2024	2023	2024
Romania	198,810	29,078	0.95	0.88	Ukraine	9,207	68,850	0.91	0.66
Egypt	12,501	29,259	0.96	0.82	Areas. nes	0.00	175	0.00	0.61
Spain	29,752	18,189	1.06	0.79	Netherlands	0.66	0.51	0.44	0.44
Italy	0.00	17,129	0.00	0.76	Romania	0.00	0.10	0.00	1.33
World	**247,627**	**134,557**	**0.96**	**0.81**	**World**	**9,208**	**69,026**	**0.91**	**0.66**

Source: UN Comtrade database

The industrial processing tier of Moldova's sunflower value chain is characterised by an extraordinary degree of centralisation, driven almost entirely by the Trans-Oil Group. Controlling over 90% of the country's industrial oilseed crushing capacity, this corporate entity effectively dictates the domestic market through its three primary processing units: Floarea Soarelui SA in Bălți, Danube Oil Company SRL in Giurgiulești, and IM Trans-Oil Refinery SRL. As a result, the industrial processing of the nation's dominant oilseed crop is concentrated within a single holding. During periods of regional commodity shocks, this near-monopolistic structure acts as a bottleneck, directly exposing the domestic value chain to tensions between industrial actors, independent farmers, and national regulatory institutions.

This structural vulnerability was clearly illustrated during the 2023/2024 marketing year, which was marked by a severe economic deadlock between primary producers and industrial crushers. Following a sharp decline in global vegetable oil prices, Trans-Oil reduced its domestic purchasing prices for raw sunflower seeds to approximately 7,000 MDL per tonne[4]. Local farmers and smallholder households, already burdened by post-pandemic inflation and elevated production costs, strongly resisted these price levels, instead demanding a break-even threshold of between 8,000 and 10,000 MDL per tonne. To maintain operations amid this domestic supply shortfall, Trans-Oil attempted to import lower-cost raw seeds from neighbouring Ukraine. However, under significant political pressure from agricultural stakeholders, the Moldovan government introduced a strict import licensing regime, repeatedly denying the necessary permits. This regulatory barrier effectively paralysed the industrial processing sector, leading to several complete shutdowns at the Floarea Soarelui plant in Bălți during January and March 2024. For an extended period, the country's industrial infrastructure operated at approximately 20% capacity utilisation.

[4] With lower price in North and higher price in South.

A significant structural and economic adjustment occurred as the market moved through the 2025 harvest and into early 2026, resulting in the stabilisation of Trans-Oil's industrial operations. To reduce its dependence on a volatile domestic sunflower supply, the company implemented a major strategic shift by commissioning a modern, 1,000-tonne-per-day rapeseed processing facility at the Floarea Soarelui site in Bălți. By processing approximately 45,000 tonnes of rapeseed ahead of the autumn harvest, the company was able to extend its operational cycle and stabilise cash flow, before transitioning back to sunflower seed crushing by mid-September 2025. This recovery triggered a substantial increase in downstream export values: between July 2025 and February 2026, Moldova's sunflower oil exports to the European Union increased.

Despite this recovery, a fundamental dichotomy persists within Moldova's sunflower value chain, which remains divided between domestic processing and raw material export. While high-capacity processing is effectively monopolised by Trans-Oil, independent agricultural traders continue to account for a substantial share of outward trade, exporting large volumes of unprocessed sunflower seeds to crushers in Turkey and the Balkan region. Consequently, the sector operates along two parallel commercial channels: a vertically integrated, corporate-led system producing high-value refined oil for EU markets, and a raw commodity export stream that bypasses domestic value addition. At the same time, small-scale village oil presses (*oloinițe*) continue to process an estimated 5–7% of the national crop[5], supplying local consumption and providing feed by-products to rural households. Going forward, optimising Moldova's sunflower economy will require addressing this structural imbalance and gradually shifting away from low-value raw exports towards a more diversified and resilient model centred on domestic value addition.

[5] This would be about 40K Tonnes with about 200 tonnes capacity per entity, it would result into about 200 mills all around the MD.

Flow chart

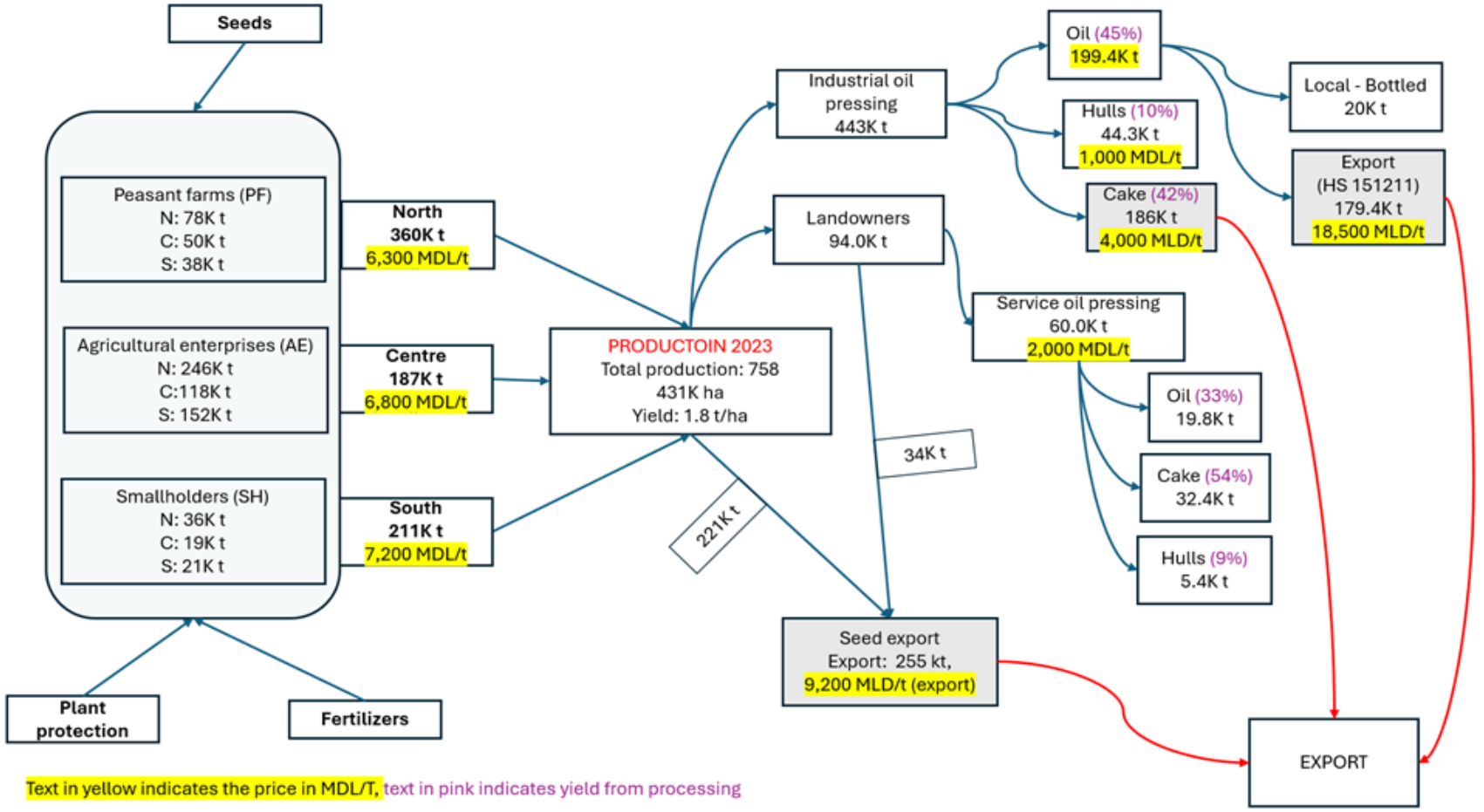


Figure 2-13. sunflower flow chart of Moldova, 2023

2.5. Governance

2.6.1. Institutional landscape along the chain

- **Ministry of Agriculture and Food Industry (MAFI)** – policy design and implementation for agriculture, food industry and rural development; oversight of research, education, irrigation and sustainable soil management.
- **Agency for Intervention and Payments in Agriculture (AIPA)** – national paying agency that administers Moldova's National Fund for Agriculture and Rural Development (FNDAMR/NARDF) and implements donor-financed measures; leads project-level monitoring and evaluation (M&E).
- **National Food Safety Agency (ANSA)** – food safety, veterinary, plant health, seed control, feed and consumer protection **across the whole chain**.
- **State Hydrometeorological Service (SHS)** – drought/early-warning services and agrometeorology; Special Service of Hydrometeorology and Active Influence on Atmospheric Phenomena protects crops against hail.
- **Agency for Land Relations and Cadastre; Apele Moldovei** – land administration/soil protection and hydro-improvement/irrigation programs.
- **State Commission for Variety Testing; State Inspectorate "Intehagro"** – seed/variety approval and machinery/operator certification.
- **Local Action Groups (LAGs)** – community-led LEADER structures increasingly financed from the national fund to implement local development strategies affecting rural services and logistics.
- **Development partners** – EU, World Bank, IFAD, FAO, USAID and others support policy implementation, institutional capacity and investments.
- **Research institutions:** Public Institution "National Centre for Seed Research and Production"; Technical University of Moldova (UTM); Institute of Genetics, Physiology and Plant Protection (IGFPP, SUM)
- **Banks:** Joint-Stock Commercial Bank "EXIMBANK"; MAIB; Commercial Bank "Moldindconbank" JS; etc.

Access to finance is a crucial factor shaping the development of Moldovan agriculture, yet the frequency and ease with which farmers borrow remain uneven across farm sizes and subsectors. Larger and more formalized producers, particularly those engaged in cereal cultivation, have relatively wide access to bank financing. One of the country's largest agricultural banks reports that agriculture accounts for more than one-third of its total loan portfolio, with thousands of outstanding loans directed to crop producers. Within this group, cereal growers alone account for many agricultural loans, representing close to two-thirds of the value of agricultural lending. In recent years, data for cereal-producer loans indicate a contraction in both the number of loans and the average loan size. The number of loans decreased steadily from 2022 to 2024, while the average loan amount fell from approximately 0.57 million lei in 2022 to 0.53 million lei in 2024. This means that not only are fewer loans being issued to cereal producers, but individual loans are also becoming smaller in value. From the most recent data available for 2025, this downward trend appears to be continuing. This decline is partially driven by deteriorating financial condition of farms, which has reduced their capacity to service debt and limited their ability to qualify for new financing. Seasonal borrowing remains important, as banks continue to align repayment schedules and grace periods with harvest cycles. Access to finance, particularly bank loans, presents considerable challenges for small farmers. In addition, external resources channelled through international development programmes play an important role in supplementing domestic bank funds, ensuring longer maturities and somewhat lower interest rates for agricultural investment loans.

Overall, agriculture accounts for a modest share of total lending in the financial system, typically no more than 7 to 8 percent of all outstanding loans in recent years. However, within the sector itself, the prevalence of credit is relatively high among medium and large farms, with many enterprises taking on several loans per year. Smaller producers, including family farms and backyard operations, participate far less in the credit market. Limited collateral, weak formal accounting, and reliance on cash-based transactions continue to restrict their access, leaving them more dependent on remittances and self-financing.

An important role in bridging this gap is played by non-bank credit institutions, which have expanded rapidly in rural areas. Institutions such as microfinance companies provide loans to more farmers every year, including those who may not qualify for traditional bank credit. These organizations often have simpler procedures, faster approvals, and more flexible collateral requirements, which make them attractive for small and medium-sized farms needing quick access to seasonal financing. Savings and credit associations also contribute to this ecosystem, pooling local resources to meet the working capital needs of their members. While the scale of lending by non-bank institutions remains smaller than that of banks, their outreach has grown steadily, making them an increasingly important source of credit for rural households and agricultural producers.

International initiatives play an equally vital role. Credit lines supported by the International Fund for Agricultural Development, the World Bank's Rural Investment and Services Project, and joint schemes with European and German development banks continue to channel dedicated resources to agriculture. These facilities often combine loans with grant elements, technical assistance, and more favourable repayment terms, targeting especially small and medium-sized producers. Recent operations under the Capacity Enhancement for Rural Transformation Project have extended credit and grants to youth and women farmers, with average agro-production loans close to EUR 90,000. In addition, some banks have developed tailored agricultural products, such as seasonal loans with grace periods of up to eight months or credit lines of up to 2.5 million lei without collateral, to better match the financing cycle of crop production. Together, these programmes supplement domestic bank funds, provide longer maturities, and lower effective interest rates, helping sustain investment in the sector even during periods of tighter financial conditions. Despite their rare involvement in the wheat value chain, women farmers can access financial resources and training provided by farmer associations. These associations, supported by international organizations, implement projects designed to enhance rural farmers' access to finance and machinery.

The frequency of borrowing is also shaped by the macroeconomic environment. During 2024, interest rates on new loans declined significantly, stimulating an increase in credit volumes, with new disbursements across the economy exceeding 5 billion lei in a single month. By early 2025, however, the central bank raised policy rates, which began to increase borrowing costs again. To ease these fluctuations, national programmes have subsidized interest payments and provided partial guarantees, reducing effective rates for investment loans and encouraging banks and non-bank lenders alike to expand lending to farmers.

National Agricultural Policy

The national agricultural policy of the Republic of Moldova is coordinated by the Ministry of Agriculture and Food Industry (MAIA) and implemented through the Agricultural Intervention and Payments Agency (AIPA). The current strategic framework is defined by a set of documents and programs that aim to modernize the agricultural sector, sustainable development of the rural environment and alignment with European Union standards. The National Strategy for Agricultural and Rural Development (NSARD) 2023–2030 represents the main pillar of agricultural policy. It aims to modernize agriculture, reduce poverty in rural areas and increase economic and environmental sustainability. The strategy promotes the transition to a resilient, competitive and ecological agriculture, in line with the principles of the European Green Deal. An essential implementation tool is the National Program for Subsidies to Agriculture and Rural Environment, managed by AIPA. Through this program, farmers benefit from financial support for investments in machinery, irrigation systems, post-harvest infrastructure and conversion to organic farming. The National Food Safety Strategy 2023–2030 aims to harmonize phytosanitary and veterinary standards with EU regulations, strengthening the competitiveness of agri-food exports and the safety of domestic consumers. Current policy instruments include: subsidies (grants and direct payments per area or head of animal), post-investment and advance support for agricultural start-ups, as well as financing the purchase of agricultural machinery, anti-freeze and anti-hail systems, small irrigation, rural infrastructure and farm modernization. Recent national policies reflect a clear orientation towards the values and objectives of the European Union: sustainability, rural development, environmental protection and adaptation to climate change. The reforms announced for 2025 are based on the model of the Common Agricultural Policy (CAP), aiming for greater predictability, transparency and fairness in the allocation of financial support. At the same time, sectoral

consultations, adaptation of secondary legislation and technical cooperation projects with European partners demonstrate Moldova's commitment to full institutional alignment with EU standards.
The extension service under the ministry is relatively newly established and at this stage it has minimal influence of the development of sunflower value chain.

Legal and regulatory instruments shaping sunflower production

A subsidy framework under Law 71/2023 (with further changes) is implemented via Government Decisions for: investment subsidies (GD 491/2023), direct payments (GD 492/2023), advanced payments (GD 465/2023), complementary subsidies (GD 464/2023), LEADER (GD 277/2022), and land-improvement subsidies (GD 985/2020). Eligible applicants include farmers (micro- to large), LAGs, research/education bodies and local authorities, subject to transparency and fiscal compliance conditions. For the sunflower chain specifically, relevant investment windows include:

- SP_2.8 – Plant sector processing/marketing infrastructure: financing for cereal conditioning, drying, storage, and packaging; up to 50% of eligible costs (≤ 7.0 million MDL per beneficiary).
- SP_2.10 – Tillage technologies: 25–35% for tractors/combines (higher for young/"GT" farmers), 50% for soil-conservation equipment and crop-protection drones (set ceilings).
- SP_2.2 – Irrigation systems & equipment and SP_2.3 – Water storage basins: 50% for farmers and 75% for Water Users' Associations (AUAI), with annual ceilings; renewable-energy components are eligible.

Targeted top-ups increase authorization amounts for young/women farmers and returned migrants (+10%); for domestic machinery (+20%); and for Producer Groups (GP)/Entrepreneurs' Cooperatives (CI) (+25%). NFSA regulates feed/food safety, plant health and seeds. Moldova is progressively approximating EU acquis, including sanitary-phytosanitary (SPS) measures and organics. Recent steps include the Organic Production Law 237/2023 (partially harmonized with EU Regulation 2018/848) and GD 253/2024, transposing key EU acts on organic rules and inputs. NSARD calls for an Integrated Agricultural Information System, a national agromarketing centre, farmer cooperation, and hubs/clusters – measures that directly address price discovery, logistics and bargaining power for cereals.

Governance priorities for 2025–2030

1. Professionalize aggregation and storage for sunflower. Use SP_2.8 to co-finance dryers, cleaners, silos, and quality-testing at the cooperative/cluster level; apply top-ups for Producer Groups/Cooperatives (+25%) and for young/women farmers (+10%).
2. Scale water security in wheat zones. Prioritize SP_2.2/2.3 for sprinkler/drip systems and farm/community reservoirs; favour AUAI (75%) where feasible to spread operation and maintenance costs.
3. Accelerate land consolidation pilots around grain clusters. Pair consolidation with shared machinery, conservation tillage (SP_2.10) and precision tech (drones) to stabilize yields and cut costs.
4. Institutionalize price transparency. Stand up the Integrated Agricultural Information System and the National Agromarketing Centre to publish weekly farm-gate/wholesale/retail cereal prices and logistics indices; link to NFSA quality grades.
5. Tighten risk governance. Update drought-loss protocols for smallholder inclusion, expand early-warning from SHS into operational advisory, and pre-define relief triggers to avoid ad-hoc decision making.
6. Keep closing the SPS gap. Resource NFSA and labs to EU-compliant cereal testing; consolidate the 2023–2024 organics/legal advances into practice (inspection, certification, lab methods).
7. Embed bottom-up planning. Use LEADER to co-finance local grain logistics (feeder roads, weighing points, drying nodes) identified in LAG strategies.
8. Measure what matters. Track NSARD result indicators most relevant to wheat (irrigated share; soil-conservation area; storage capacity; quality-certified producers) in MAFI/AIPA's public dashboards.

The role of local leaders

National strategies like NSARD 2030 set ambitious goals, but their impact hinges on feedback loops from local leaders, associations, and cooperatives. Policies on irrigation, storage, and subsidies need to be communicated through these local intermediaries who translate bureaucratic language into actionable decisions for farmers. This is especially evident in Moldova, where local leaders emerged from land consolidation reforms in the 1990s, having important roles in rural communities. These entrepreneurs consolidated fragmented agricultural land into larger plots, usually by renting or purchasing land from rural residents. These leaders have become the main

economic drivers in rural areas, providing much of the investment in modern machinery, storage, and production practices. They are also key beneficiaries of government subsidies, due to their larger farm structures and higher formalization levels. From a governance perspective, these leaders are not only farmers but de facto coordinators of the local agricultural economy. They aggregate land, mobilize capital, and connect local production with markets. However, this also concentrates economic power and public support in their hands. These leaders frequently contribute to community development beyond their primary roles, actively participating in efforts such as reforestation and infrastructure improvements, either by providing funding or through lobbying municipal and central governments.

2.6. SWOT ANALYSIS

TABLE 2-16. SWOT ANALYSIS FOR SUNFLOWER, MOLDOVA, 2023

Strengths	Weaknesses
1. Sunflower is a well-established strategic export crop in Moldova. 2. Strong domestic self-sufficiency and established export channels. 3. High level of mechanization and widespread hybrid seed adoption. 4. Presence of large processing capacities and industrial crushers. 5. Relative drought tolerance compared with cereals. 6. Existing local leadership and successful examples of cooperation and collective storage.	1. High dependence on rainfall and near-absence of irrigation infrastructure. 2. Low and unstable productivity compared with EU benchmarks. 3. Strong concentration of profits in processing and trading activities. 4. Ageing rural workforce and weak generational renewal. 5. Weak producer cooperation and limited bargaining power. 6. Export dependence on raw material and limited value addition. 7. Dependence on input suppliers and limited access to finance and risk-management tools.
Opportunities	**Threats**
1. EU accession process and access to modernization funds. 2. Expansion of climate-smart, digital and precision agriculture. 3. Investments in irrigation and water management. 4. Strengthening producer organizations and cooperatives. 5. Investment in vocational training and generational renewal. 6. Growing demand for vegetable oils and certified sustainable products.	1. Increasing frequency and severity of droughts and heat waves. 2. Soil degradation and declining fertility. 3. Global market volatility and price fluctuations. 4. Geopolitical disruptions affecting trade and inputs. 5. Continued rural depopulation and labour shortages. 6. Dependence on imported seeds, fertilizers, and other inputs.

Survey results

Major identified problems

Climatic instability dominates the responses, mentioned in 33 out of 49 valid replies (67%). Farmers repeatedly cite “drought”, “lack of rainfall during critical periods”, “lack of water/irrigation”, “climate change”, “heat”, and “unfavourable climatic conditions” as the primary yield-limiting factor. Typical statements include: “Drought and lack of irrigation systems → yield decrease below 1.5 t/ha” and “Frequent drought leading to low yields”. These

observations align precisely with national data showing sunflower yields collapsing to 1.3–1.5 t/ha in drought years (2020, 2022, 2024) versus 2.2–2.6 t/ha in favourable seasons.

The second most frequently cited issue is low selling prices and weak market positioning, appearing in 24 responses (49%). Farmers complain of "low prices offered to producers", "price drops sharply during harvest", "selling at too low prices", "intermediary traders", and "the production price is dictated by some companies". This perception of price suppression is compounded by the absence of local collection and storage infrastructure, forcing immediate post-harvest sales at depressed levels. High costs of agricultural inputs rank third, noted in 19 responses (39%). "High prices for agricultural inputs", "expensive seeds and fertilizers", "high prices for chemicals/pesticides/herbicides", and "exaggerated prices for quality seeds" are recurrent. Several respondents link this directly to profitability erosion: "High production costs and low selling prices".

Lack of machinery and skilled labour is mentioned less often (5 responses) but remains relevant for timely harvesting and operations. Other niche concerns include poor seed quality, soil degradation from sunflower monoculture, non-payment by buyers, and regulatory barriers for organic inputs.

TABLE 2-17. SURVEY RESULTS FOR SUNFLOWER SECTOR, MOLDOVA

Rank	Problem	Frequency	% of Respondents	Representative Quote
1	Climatic factors (drought, lack of water/irrigation, climate change, heat)	33	67%	"Drought and lack of irrigation systems → yield decrease below 1.5 t/ha"
2	Low selling prices / weak market access / intermediaries	24	49%	"Low prices for sunflower production... absence of local collection and storage centres"
3	High prices for inputs (seeds, fertilizers, pesticides, machinery)	19	39%	"High prices for agricultural inputs. Expensive seeds and fertilizers"
4	Lack of machinery / skilled labour	5	10%	"Lack of agricultural machinery... shortage of labour"
5	Other (soil impact, regulatory barriers, non-payment)	8	16%	"The negative effects of sunflower on the soil"

Source: Survey among farmers

Farmers' proposed solutions

The solutions offered are remarkably consistent and practical. Irrigation infrastructure emerges as the clear priority, suggested in 17 responses (35%). Farmers call for "construction of centralized water irrigation systems", "investments in local irrigation systems (drip or sprinkler)", "water storage reservoirs", and "access to irrigation systems". This directly addresses the dominant climatic problem. Financial support ranks equally high, proposed in 13–14 responses. The phrase "subsidies per hectare" appears repeatedly, alongside "financial support from the state", "favourable loans", and "increase in state subsidies". Quality seeds and drought-resistant hybrids are advocated in 13 responses: "Promotion of drought-tolerant hybrids", "using high quality and certified seeds", and "sowing drought-resistant sunflower hybrids". Price-related measures (regulation of minimum selling prices, involvement of authorities in price setting, or limiting imports) are suggested in 8 responses. Additional ideas include creation of storage and collection centres (3), formation of agricultural cooperatives (1), short training courses for machinery operators (2), and modern technologies/precision agriculture (2).

TABLE 2-18. POTENTIAL SOLUTIONS FOR THE SUNFLOWER SECTOR, MOLDOVA

Rank	Problem	Frequency	% of Respondents	Representative Quote
1	Development of irrigation systems / water reservoirs	17	35%	"Construction of centralized water irrigation system by the state"
2	State subsidies (per hectare) / financial support / low-interest loans	14	29%	"Subsidies per hectare"
3	Use of high-quality / drought-resistant hybrids and seeds	13	27%	"Promotion of drought-tolerant hybrids… Use high quality and certified seeds"
4	Price regulation / higher selling prices / authority involvement	8	16%	"Involvement of authorities in setting prices"
5	Storage/collection centres / cooperatives	4	8%	"Creation of collection and storage centres… Association in agricultural cooperatives"

Source: Survey among farmers

The survey reveals a coherent narrative: climatic risk is the overriding production constraint, amplified by economic pressures (high costs, low prices) that erode margins and discourage investment. Farmers' solutions are pragmatic and mutually reinforcing – irrigation would mitigate drought, quality seeds would raise baseline yields, subsidies would improve affordability of inputs, and storage/cooperatives would strengthen market power. Notably, the most frequently proposed measures directly target the top problems, indicating high awareness and realism among respondents.

Several gaps and opportunities emerge. While irrigation is prioritized, only a few mention conservation agriculture (no-till, strip-till) or crop rotation, practices already expanding nationally and proven to conserve soil moisture. Cooperatives and collective marketing are under-emphasized despite their potential to reduce intermediary margins and access EU funds. Organic producers raise specific concerns (low premiums, regulatory barriers for inputs), signalling a niche with growth potential under EU accession.

3. WHAT IS THE CONTRIBUTION OF THE VALUE CHAIN TO ECONOMIC GROWTH?

The economic analyses rely on the VCA4D methodological brief, which clearly outlines the objectives of the economic analyses and defines the main framing questions.
For the economic part, the data used are coming from various resources.

- Moldovan statistical office (National Bureau of Statistics of the Republic of Moldova, NBS) and its information on national accounts, production quantities, average prices, and total wheat production.
- Microdata provided on producers of wheat from the statistical survey, which is conducted annually by NBS, among all farmers with the area of land greater than 10 hectares.
- The financial accounts of companies, which are made available through the platform of NBS at the Public Repository of Financial Statements
- Discussion with stakeholders, producers, and processing companies, made during 3 personal visits to Moldova.
- Survey conducted among farmers, which collected 165+81 surveys from 3 regions, aiming to target small farms (of size between 10 and 50 ha), medium farms (between 50 and 300 ha), and larger than 300 ha. Among those, we collected 10+8 surveys of organic producers.

The accounts for the sunflower farms are constructed based on the surveys conducted. Information from surveys, as well as from market consultations, has been used. The costs, if applicable to the whole farm, have been recalculated based on the cultivation area of the main commodity. The basic financial account was determined for a one-hectare sunflower production at the farm level. For the processing industry, the accounts are created for one ton of sunflowers input. Financial accounts for other actors are based on secondary data, interviews, available financial reports, and I-O tables.

Depreciation is typically not reported separately in a company's financial statements, as it is embedded within the overall cost structure. Therefore, estimates were derived from Input-Output tables, applying average sectoral amortization rates. For agriculture, depreciation was estimated at 7 % of the sector's value added, while for food processing, a rate of 5% was applied.

Land rent estimates were derived from survey responses on the share of leased land compensated in kind and in cash. Based on the quantities of products received by landowners, the real value of in-kind payments was calculated, providing an estimate of the per-hectare cost of land tenure.

3.4. Profitability & Sustainability of actors

Economic analysis of the value chain is a systematic process of evaluating all the stages a product goes through – from the supply of inputs to the final consumer – to understand where value is created, how revenues are distributed, what the costs are, and where there are blockage or opportunities for growth.

3.1.1. Agricultural input suppliers (providers)

In the Republic of Moldova, advisory services to farmers on the products used are usually provided by agricultural input suppliers. They provide recommendations on the choice of oilseed varieties and hybrids, as well as on cultivation technologies, fertilization rates and pest control strategies. However, these recommendations are often influenced by the suppliers' commercial objectives and do not always reflect the long-term economic interests of farmers. Their influence is particularly visible in the regional distribution of seeds, fertilizers and plant protection products, especially for dominant crops such as sunflower.

In the value chain, the role of input suppliers goes beyond simply providing inputs. In some contractual arrangements, they also act as commercial intermediaries or direct traders. Farmers are usually obliged to deliver their products – often sunflower seeds – at a pre-agreed price and within a pre-established deadline at the end of the farming season. These deliveries are used to repay so-called "technical credits" resulting from the early provision of certified seeds, fertilizers and plant protection products. According to discussions with farmers, late deliveries are often sanctioned by penalties in the form of price reductions per tonne. In most cases, the production collected by input suppliers, especially sunflowers, is intended for export to international markets.
Table 3-1 shows the main actors in import of sunflower seeds. In figure 3-1 its present the analysis of added value for sunflower seed importers.

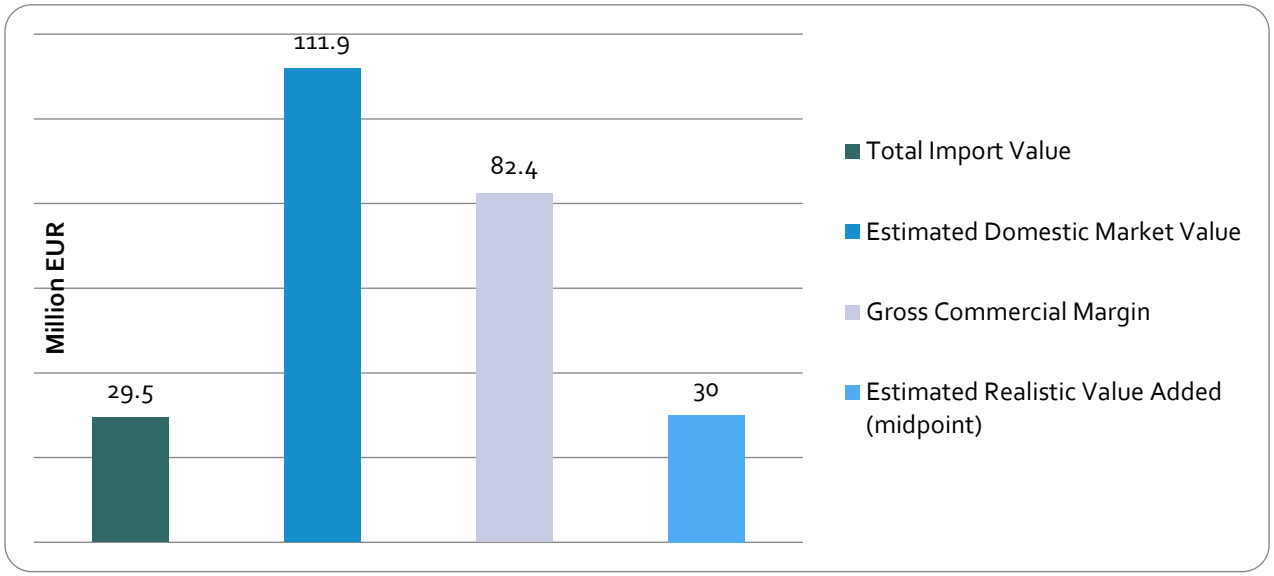


FIGURE 3-1. ESTIMATED VALUE ADDED IN SUNFLOWER SEED DISTRIBUTION, MILL. EUR. (MOLDOVA, 2023)
Source: Survey among farmers, own calculation

The figure 3-1 highlights that the value added in the distribution of sunflower seeds is significant but needs to be analysed realistically. The difference between the import value (EUR 29.5 million) and the estimated value of the domestic market (EUR 111.9 million) suggests a gross trade margin of EUR 82.4 million. However, the actual value added for the economy is estimated at around EUR 30 million, after deducting logistics, wage, financial and tax costs.

For companies, importing seeds is commercially efficient, as it allows for a consistent margin and the provision of integrated services (consulting, trade credit, distribution). However, efficiency depends on the volatility of external prices, the exchange rate and the purchasing power of farmers. Thus, although the sector is profitable, it remains dependent on external factors and the stability of the agricultural market in the Republic of Moldova.

Interviews indicate that input suppliers have considerable bargaining power. Farmers' options are limited, as a small number of companies control significant market shares for hybrid seeds, fertilizers and plant protection products. Farmers' precarious financial situation, compounded by poor agricultural years – especially for drought-sensitive crops such as sunflowers – further reduces their ability to negotiate favourable contractual terms. Low yields and insufficient income can, in some cases, lead to the loss of agricultural land, which is transferred to input suppliers, some of whom become large landowners at the national level.

Fertilizer is an essential source of income and a major cost for all farmers, especially those growing sunflowers, a crop with high nutrient needs. Moldova does not produce chemical fertilizers in relevant quantities – over 90% are imported. The main fertilizer importing companies are presented in Table 3-1.

TABLE 3-1. MAIN FERTILIZER IMPORTERS AND DISTRIBUTORS, MOLDOVA

Company	Type of Fertilizers	Countries of Origin	Role in the Value Chain
Agro-Nova Prim LLC	Urea, NPK, ammonium nitrate	Romania, EU	Importer & distributor
Agrochimtrade LLC	Nitrogen and compound fertilizers	Romania, Poland, EU	Direct importer
Imexagro LLC	NPK, foliar fertilizers	EU	Importer & distributor
Agrostoc LLC	Nitrogen fertilizers, NPK, micronutrients	Romania, EU	Importer
Elitagrotehnologie LLC	Specialized fertilizers	EU	Distributor
Agarista Agricola LLC	Compound fertilizers	EU	Distributor
Trans-Oil Group (subsidiaries)	Fertilizers for contract farming	EU	Vertically integrated operator
Agrosem	Fertilizers and seeds	EU	Distributor

Source: Survey, own calculation

The figure 2-14 highlights the relationship between the total value of imports, the total value of sales and the estimated value added. It is observed that the difference between sales and imports generates an added value of approximately 7,500, which represents about 20% of the imported value. This margin reflects the capacity of importing companies to create value through distribution, logistics, warehousing and commercial services.

From the perspective of economic efficiency, the indicators suggest a profitable activity, since sales significantly exceed import costs. However, the real efficiency depends on the level of operational expenses, taxes and financial costs. If these costs are well managed, importing companies can maintain stable profitability. Thus, the graph indicates a viable business model, but sensitive to fluctuations in external prices and agricultural market dynamics.

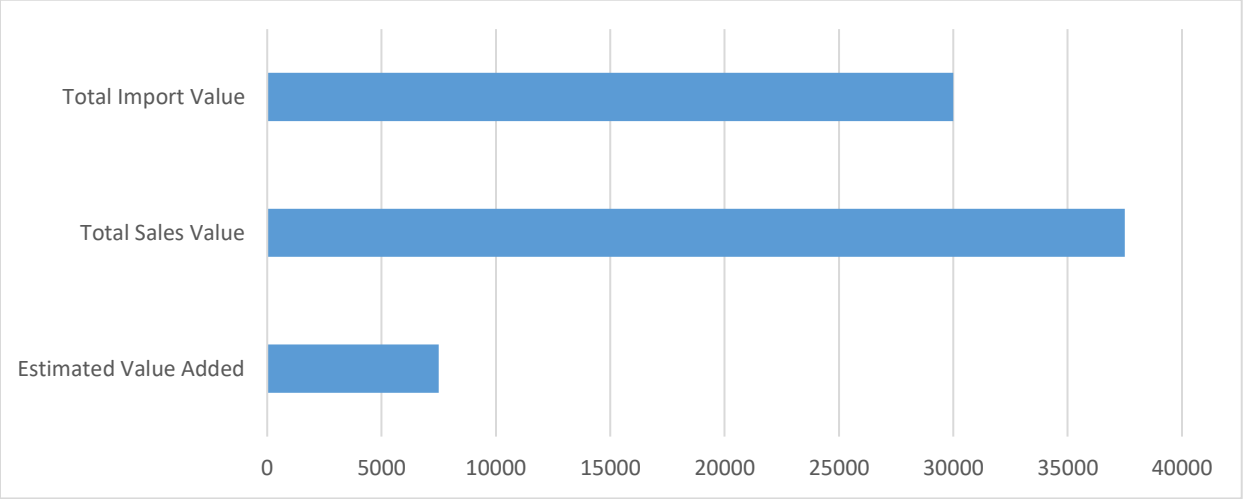


FIGURE 3-2. ESTIMATED VALUE ADDED IN FERTILIZER IMPORTING COMPANIES, MILL. EUR. (MOLDOVA, 2023)
Source: Survey among farmers, own calculation

The analysis of fuel value added highlights the important role of distributors in the agricultural value chain, including for sunflower cultivation. As a rule, the gross margin in the distribution of diesel is lower compared to other agricultural inputs, often ranging between 10% and 20%, depending on market conditions and the level of excise duties. Value added does not only reflect the company's profit, but also includes operational costs such as transportation, storage, station infrastructure, salaries and financial services. The efficiency of importing companies depends on the ability to optimize the logistics chain and manage the volatility of international oil prices. Although margins are moderate, the large volume traded generates a significant economic contribution, both through taxes and excise duties, and by supporting agricultural activities at the national level, Figure 2-15.

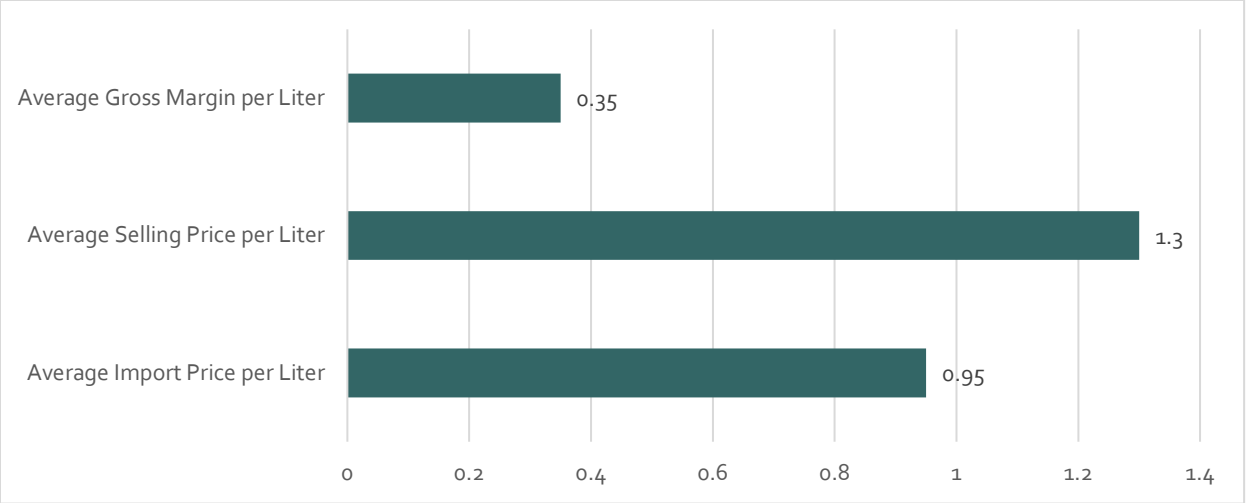


FIGURE 3-3. ESTIMATED VALUE ADDED IN FUEL DISTRIBUTION, EUR (MOLDOVA, 2023)
Source: Survey, own calculation

The sunflower input supply chain in Moldova represents an economic segment with a total estimated value of between EUR 130–170 million annually, generating an added value of approximately EUR 30–40 million. Although inputs are largely imported, distribution and associated services create significant domestic economic benefits. However, import dependence exposes the sector to external risks (international prices, exchange rate, geopolitical crises).

3.1.2. Farmers

Farmers are the main actors in the sunflower production value chain in the Republic of Moldova. In the economic analysis process, all prices are linked to the considered reference year (2023). **Diesel** prices were rounded to the nearest whole Moldovan leu per litter. **Seed** input prices varied across the farmers surveyed; therefore, only the price range is presented below. A similar situation applied to **fertilizers**. For analytical purposes, the **exact values used were calculated as weighted averages of all survey responses, giving lower weights to small farmers who typically faced higher prices**.

Electricity prices were obtained from the NBS, showing that retail tariffs for households and small entities are higher than those for larger users. Since peasant farms (PF) generally operate as household farms, the higher retail tariff was applied. Electricity consumption was assumed for general agricultural operations, such as workshops, storage, drying and internal handling. Insurance is mandatory mainly for machinery used on public roads (tractors and combine harvesters). Since only a few farmers provided data on insurance, a uniform flat rate was applied to all farms.

Organic certification, which is mandatory for organic producers, includes both initial and annual fees. Based on survey data, initial certification costs were estimated at approximately 58 lei/ha, while annual certification costs were on average 46 lei/ha.

TABLE 3-2 CONSIDERED PRICING FOR THE ECONOMIC ANALYSES, MOLDOVA, REF. YEAR 2023.

	Price (MDL)	Unit
Diesel	20	per litre
Seed inputs	2,300 - 3,300	per bag
- Seed inputs (per ha)	1,000 – 2,100	per ha
Fertilisers	10 - 18.5	per Kg
- Fertilisation per ha	500 – 3,500	Per ha
Plant protection	250 – 1,000	Per ha
Electricity (NBS, Enterprises / Individual users)	2.80 / 3.40	per kWh
Insurance as a flat rate	89	per Ha
Organic certification, which can reach several hundred euros per entity, is recalculated per hectare. (Initial / Annual certification)	58 / 46	per Ha
Labour		
- Technical staff (administration, accounting, management)	10,000–15,000 (12,500)	per month
- Mechanizers	11,000–15,000 (13,000)	per month
- Others (cleaning, cooking, others unqualified)	5,500 - 7,000 (6,300)	per month
Value of the land rent provided in kind or in cash	1,140 –2,800[6]	MDL / ha

Source: NBS (2025), surveys, and other relevant sources.

Labour costs are presented as ranges, with the values in brackets indicating those used in the calculations. For family labour, which is common on smaller farms, opportunity cost was applied - farmers were assigned a remuneration equivalent to what they could earn in an alternative job. For each officially employed worker, the employer is required to pay an additional percentage of income as a contribution to the social and health system. According to data from the NBS (2025), companies' labour costs are higher than the wages paid, as they also include social and health contributions.

Farm-level production is clear: the farm produces part of the sunflower, part for its own consumption and part for commercial use. Sunflower seed production in Moldova is a strategic sector, focused on high-performance hybrids and industrial processing. Sunflower seeds are imported. Subsidies are also considered in the financial account. Although subsidy programs are varied, it is necessary to mention that we asked farmers how much they received in the form of subsidies in the last five years and divided this amount between the hectares cultivated. This includes all the public money they received from the national paying agency, AIPA. The supports considered include investment support, support for the purchase of diesel and support for areas affected by natural disasters, among others. The smallholder farmers usually do not really receive any subsidies on operation, but they might be eligible for investment support. Our sample is rather small to include the proper value of subsidies for Smallholders.

[6] This value excludes the in-kind value of sunflower, only include in-kind value of other commodities provided to landowners. The sunflower is included in VC and material flows, hence presented price here is lower from what we received from the market.

TABLE 3-3 PRODUCTION COSTS OF SUNFLOWER AMONG FARMERS IN MOLDOVA, PER HA VALUES, 2023

Production	Smallholders			Peasant farms			Agri Enterprises		
	North	Centre	South	North	Centre	South	North	Centre	South
Yield	2.0	1.6	1.3	2.1	1.8	1.7	2.2	1.6	1.4
Price	6,300	6,800	7,200	6,300	6,800	7,200	6,300	6,800	7,200
Subsidies (5y average)	0	0	0	1,000	640	944	430	455	453
Total production	**12,600**	**10,880**	**9,360**	**14,230**	**12,880**	**13,184**	**14,290**	**11,335**	**10,533**
Consumables									
Fuel (VAT 20%)	1,125	1,125	1,125	1,750	1,625	1,500	1,750	1,375	1,500
Seeds (VAT 8%)	1,000	1,000	1,000	1,420	1,260	1,420	1,440	1,400	1,460
Fertilisers (VAT 20%)	1,000	1,000	1,000	2,326	1,800	1,300	2,110	1,800	1,300
Plant protection (VAT 20%)	339	285	255	850	800	400	850	800	400
Services									
Electricity (VAT 20%)	18	18	18	140	28	17	44	28	30
Insurance (VAT 20%)	89	89	89	89	89	89	89	89	89
Repair (VAT 20%)	200	200	200	310	310	310	330	330	330
Field service (1.7 times per ha)	1,700	1,700	1,700	0	0	0	0	0	0
Financial charges									
Interest paid (1.25% of sales)	158	136	117	178	161	165	179	142	132
Land									
Rent	0	0	0	2,100	2,025	1,800	2,800	2,700	2,400
Land Tax	120	120	120	166	134	206	150	133	170
Labour									
skilled and unskilled labour	450	450	450	3,022	2,781	3,420	3,073	2,737	2,468
Labour indirect contrib. (tax) [7]	0	0	0	195	180	221	199	177	159
Depreciation (7% from VA)	548	382	278	514	488	570	537	386	380
Total costs	**6,747**	**6,505**	**6,352**	**13,060**	**11,680**	**11,418**	**13,550**	**12,096**	**10,818**
Benefit from production	**5,854**	**4,375**	**3,008**	**1,170**	**1,200**	**1,766**	**740**	**-761**	**-285**
Taxable income**	5,854	4,375	3,008	1,170	1,200	1,766	740	-761	-285
Tax (12%)	702	525	361	140	144	212	89	0	0
Net income	5,151	3,850	2,647	1,029	1,056	1,554	651	-761	-285
Net margin	41%	35%	28%	7%	8%	12%	5%	-7%	-3%
Value added	7,129	5,463	3,973	7,345	6,968	8,148	7,677	5,513	5,424

Source: Own calculations

The economic analysis of sunflower production highlights that profitability is not determined exclusively by the level of production, but also by the ability of farms to control costs and to effectively capitalize on production factors.

Smallholders (SHs) operate with the lowest total costs, ranging from 6,352 to 6,747 MDL/ha, due to the predominant use of family labour, the absence of rent payments, and the low level of mechanization. In contrast, peasant farms and agricultural enterprises bear much higher costs, determined by rent, wages, technological inputs, and depreciation expenses.

Despite differences in profitability, all categories of producers contribute significantly to the creation of added value. The highest levels of added value are found in peasant households in the South (8,148 MDL/ha) and in agricultural enterprises in the North (7,677 MDL/ha), which demonstrates that these farms play an important role in generating income for the economy.

[7] The contributions to social and health insurance are 19%. However, based on the findings of ILO, the agricultural sectors have about 64% of undeclared labour. Hence the contributions are calculated as 19% from Labour costs* (100% - 64%).

The analysis also highlights the impact of the subsidy system, however, subsidies fail to fully compensate for the high costs of agricultural farms. This suggests that support measures contribute to maintaining economic activity, but do not eliminate the structural vulnerabilities of the sector.

The comparative analysis of the economic performance for sunflower cultivation highlights significant structural differences between the three types of farms analysed: peasant households (PF), agricultural enterprises (AE) and smallholders' producers (SHs). The main indicators analysed are production, total costs, value added and net profit/income.

Overall, the analysis demonstrates that the sunflower value chain remains profitable for most producers, but the economic performance of the sector largely depends on increasing productivity, reducing production costs and strengthening resilience to climate change.

At the aggregate level, agricultural enterprises (AE) register the highest values for all economic indicators. This performance reflects the advantages of economies of scale, better access to technologies, mechanization and the possibility of absorbing subsidies. In addition, the cost structure is optimized by distributing fixed costs over larger areas. (Figure 3-4). Peasant farms (PF) present an intermediate level of performance. Although in some regions production is relatively high, profitability varies significantly depending on the region, which suggests a greater vulnerability to climatic factors and yield variations. (Figure 3-5). Smallholders (SHs) register the lowest absolute values of production and profit. However, in the North region, the net margin is relatively high compared to other regions, indicating good efficiency in relation to the size of the farms. However, the lack of subsidies and the lower level of mechanization limit the potential for expansion. From the perspective of economic size and aggregate performance, both in terms of production, value added and profit, the order is as follows:

AE > PF > SH

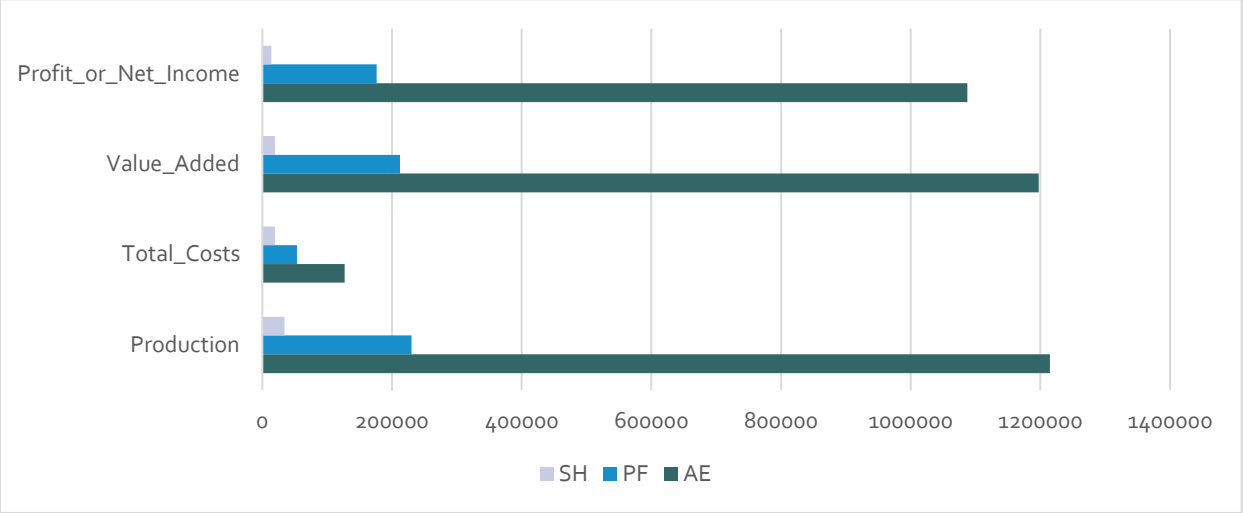


FIGURE 3-4. ESTIMATED GROSS VALUE ADDED BY TYPE OF ENTERPRISES, MD LEI. (MOLDOVA, 2023)
Source: Own calculations

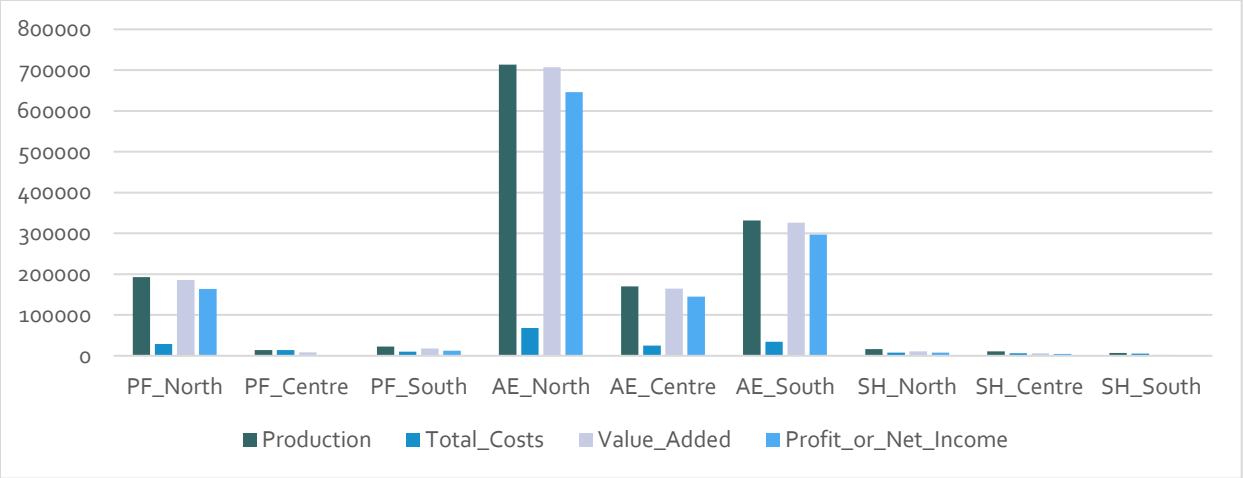


FIGURE 3-5. ESTIMATED GROSS VALUE ADDED BY TYPE OF ENTERPRISES AND REGION, MDL. (MOLDOVA, 2023)
Source: Own calculations

Moldovan farmers face a major challenge with VAT, as they pay more VAT on inputs than they collect on sales. Most agricultural inputs, such as imported fuel, consumables, and equipment, are taxed at the standard rate of 20%, while products sold by farmers are often taxed at a significantly lower rate. Local sales of key agricultural goods, such as bread, dairy products, and other products, are taxed at just 8%, and exports are taxed at 0%.

If the output VAT is higher than the input VAT, the farmer simply pays the difference to the state budget. However, when the input VAT exceeds the output VAT (which is often the case in Moldovan agriculture due to lower rates and export sales), the farmer ends up with an excess credit. **This negative balance can be carried forward, used to offset other tax liabilities or, under certain conditions, claimed as a VAT refund.**

TABLE 3-4 BALANCE OF VAT PAYMENT FROM ONE STANDARD SUNFLOWER HECTARE, MOLDOVA, 2023.

Production (MLD/ha)	Smallholders			Peasant farms			Agri Enterprises		
	North	Centre	South	North	Centre	South	North	Centre	South
Production	6,300	6,800	7,200	6,300	6,800	7,200	6,300	6,800	7,200
Seeds to Landowners (no VAT)	0	0	0	630	680	720	945	1,020	1,080
Seeds to market	6,300	6,800	7,200	5,670	6,120	6,480	5,355	5,780	6,120
Input VAT	0	0	0	420	453	480	396	428	453
Output VAT	537	528	523	1,018	870	709	970	842	717
VAT Balance	-537	-528	-523	-598	-417	-229	-574	-414	-265

Source: Own calculations Note: Numbers in red shall be refundable (VAT payers shall call for refunds)

The VAT payment balance has been plotted for sunflower hectares in Moldova in the table below (Table 3-4). The table clearly shows that farmers are facing a negative VAT balance, which increases the cash flow in sunflower production. This negative balance is partly due to the fact that a significant part of the production is transferred to landowners in the form of rent in kind, for which VAT is neither charged nor eligible for refund. **To improve this situation, the Government of the Republic of Moldova has decided that farmers will be able to deduct the amount of land tax paid for the years 2023–2025 from the amount of VAT** that the state is to reimburse, as a result of amendments to the Tax Code, which entered into force on 1 January 2026. The new provisions cover, in addition to land tax, other adjustments related to income tax, VAT, excise duties and local taxes. According to the explanations provided by the Ministry of Finance, the measure aims to improve farmers' liquidity and increase their ability to finance agricultural works and investments. In this regard, the calculation basis used to determine the amount of VAT subject to reimbursement for the period July 2023 - June 2026 has been increased, by including the land tax for 2025 in the algorithm. At the same time, a more advantageous ceiling has

been established for the total amount that can be reimbursed, and the new mechanism will also consider the VAT amounts already accepted for reimbursement in previous fiscal periods. The changes come in a context in which the agricultural sector has been affected in recent years by climate instability, late frosts, drought and increased input costs, factors that have reduced the self-financing capacity of farms.

The analysis of the balance of payment of VAT highlights a differentiated impact on the types of enterprises and the regions analysed. The difference between Input VAT and Output VAT determines the final fiscal position of each farm, directly influencing the cash flow and the economic result.

In the scenario with full refund, (Table 3-4) some farms (e.g. PF North and AE Centre) **record a negative VAT balance**, which implies a right of recovery and a positive effect on liquidity. On the other hand, where the VAT payment is positive (AE North, PF Centre), enterprises must transfer resources to the budget, reducing the income available for reinvestment.

The differences become more pronounced in the scenarios with partial refund (50%) or no refund. In the absence of refund, Net VAT becomes an additional cost in full, significantly reducing After-VAT Income. The impact is more severe for farms with low margins or negative initial income (e.g. PF North, AE Centre), where VAT amplifies the financial pressure. Therefore, the VAT refund regime decisively influences the economic sustainability of agricultural holdings, affecting competitiveness, investment capacity and the stability of financial flows, especially in conditions of production volatility.

3.1.3. Small mills

The analysis of the financial account for the service milling of one ton of sunflower seeds highlights an economic activity with very high profitability and an important contribution to the rural economy. This segment of the value chain is specific to the Republic of Moldova and mainly serves rural households and landowners who receive sunflower seeds as payment in kind for rent. The total income generated from the processing of one ton of seeds reaches 4,580 MDL, consisting of the processing fee charged by the mill (2,000 MDL/t), to which is added the value of the products resulting from the processing. The main products obtained are oil, meal and hulls. Oil represents the most important source of economic value, generating approximately 1,440 MDL, which represents almost a third of the total value of production. The meal contributes another 1,050 MDL, and the shells add approximately 90 MDL. This demonstrates that the **economic value of the activity is not determined exclusively by the pressing service, but also by the efficient valorisation of the by-products resulting from the transformation process.**

TABLE 3-5 THE FINANCIAL ACCOUNT FOR THE SERVICE MILLING OF 1 TON OF SUNFLOWER INPUT, MOLDOVA, MDL, 2023

	UNIT PRICE	UNITS	TOTAL
SERVICE FEE	2,000	1	2,000
OIL	18,000	0.08	1,440
MEAL	7,000	0.15	1,050
HULL	1,000	0.09	90
PRODUCTION			4,580
IGS			
OTHER OPERATIONAL			180
TRANSPORTATION			50
VA			
WAGES			481
CONTRIBUTION			31
TAX	3838	12%	461
PROFIT			3,405

Source: Survey, Own calculations

However, profitability is the most remarkable element of this activity. The operating profit reaches 3,405 MDL for each ton processed, representing approximately 74% of the total value of production. Even after paying income tax, in the amount of 461 MDL/t, the activity remains extremely profitable. Such a level of profitability is significantly higher than that observed at the level of primary agricultural production and even higher than in some segments of industrial processing.

The **milling service segment demonstrates that local processing, even on a small scale, can generate added value and profit**. Although **its contribution to the total volumes processed nationally is modest compared to industrial processors**, the local economic impact is important, as income and profits largely remain in rural communities. This segment thus contributes to diversifying income sources, developing the local economy and increasing the resilience of rural households involved in the sunflower value chain.

Based on our investigation, some mills operate on a cash basis and may not accurately report their incomes and revenues. Hence, VAT is not a significant issue when operating partially in the shadow economy.

3.1.4. Industrial mills

In 2023 and today, the industrial oil mill sector in Moldova is dominated by Trans-Oil Group, which controls most of the processing and export capacities. Moldova in processes approximately 1 million tons of seeds annually, generating over 400,000 tons of oil and over 550,000 tons of meal, most of which is destined for export. The industrial model is strongly externally oriented, and the competitiveness of the sector directly depends on access to raw materials and the evolution of international vegetable oil markets.

The analysis of the financial account of the industrial processing of a ton of sunflower seeds (Table 3-6) highlights the fact that the processing segment represents one of the most important sources of added value creation within the value chain. Compared to primary production, where profitability is strongly influenced by climatic conditions and price volatility, industrial processing allows the transformation of a relatively cheap raw material into products with superior economic value, contributing significantly to the competitiveness and economic performance of the sector.
The income structure demonstrates that the main source of value is represented by sunflower oil for export.

The processing of a ton of seeds results in income ranging from **8,232 to 8,820 MDL** from the sale of oil, depending on the region of origin of the raw material. This product generates over 75% of the total production value and is the main factor determining the profitability of the processing activity. Secondary products also contribute to the economic result. Cakes, mainly used in the livestock sector, generate additional income of approximately 2,400–2,600 MDL/t, while the dust and residues resulting from processing add marginal income, but contribute to the full valorisation of the raw material.

Production costs are dominated by the purchase of sunflower seeds, which represent between 77% and 81% of the total processing costs.

TABLE 3-6 INDUSTRIAL MILL ACCOUNT FOR 1 TONNE OF SUNFLOWER SEEDS, MOLDOVA, MDL, 2023

Production (t of seed)	North	Centre	South
Oil export (20 MDL/kg, no VAT)	8,652	8,232	8,820
Cake (4.5 MDL/kg, VAT incl.)	2,549	2,426	2,599
Dust (1.5 MDL/kg)	46	44	47
Consumables			
Sunflower seed (1 tonne input, 8%VAT)	6,300	6,800	7,200
Packaging (20% VAT)	250	250	250
Others (20% vat)	200	200	200
Services			
Electricity (120 kWh)	360	360	360
Others	180	180	180
Financial charges	120	120	120
Depreciation (6.6% of VA)	261	192	216
Labour			
Wages	210	210	210
Social insurance	40	40	40
Profit before tax	3,326	2,349	2,690
Income tax (11.5%)	383	270	309
Profit after tax	2,944	2,079	2,380
Margin rate	**26%**	**19%**	**21%**
VA (per tonne)	3,958	2,912	3,276

Source: Survey, Own calculations

A key indicator for assessing the economic contribution of processing is the added value created. Processing one ton of seeds generates between 2,912 and 3,958 MDL of added value, with the highest levels recorded in the North. Part of this added value is distributed in the form of wages and social contributions, another part is transferred to the public budget through taxes, and most of it is retained as profit.

Industrial processing represents the segment with the highest value-added generation capacity and one of the main drivers of economic growth within the sunflower value chain. The results suggest that expanding processing capacities and focusing on the export of processed products, instead of raw material exports, could significantly increase the value added generated at the national level and the contribution of the sector to the country's economic development.

TABLE 3-7 SCENARIO OF VAT PAYMENT AND BALANCE IN THE MILLING OF SUNFLOWER SEEDS, MOLDOVA

Scenario (per tonne of wheat)	North	Centre	South
Revenues (MDL)	11,201	10,658	11,419
IGS incl. VAT (MDL)	7,290	7,790	8,190
Input VAT	554	592	622
Output VAT (20%)	426	405	434
Net VAT refund	-128	-187	-188

The VAT analysis (Table 3-7) shows a negative VAT balance (Output VAT > Input VAT), which means an obligation to pay to the budget. Since exports are taxed at zero rate, but domestic sales are taxed at 20%, cash flow is significantly influenced. VAT becomes an important factor of financial pressure, affecting the liquidity and working capital of industrial mills. In conclusion, the profitability of large processors critically depends on the difference between the price of seeds and international oil quotations, and the VAT regime directly influences financial stability and reinvestment capacity.

3.1.5. Traders

Traders and transport companies play a key role in the sunflower value chain in the Republic of Moldova, facilitating the transfer of raw materials from farmers to external markets, especially Romania and the Port of Constanta. Similar to the situation with wheat, the farm gate price differs significantly from the FOB export price.

In 2023, the average FOB export price of sunflower seeds was estimated at approximately 9,200 MDL/ton, while farm gate prices ranged between 7,000 MDL (North and South) and 7,500 MDL (Centre). The gross trade margin difference was between 11% and 15%, but this margin is considerably reduced by transport costs (450–720 MDL/ton), energy, diesel and financial expenses. (Figure 3-6).

The analysis of the financial account shows that, after including all operating costs (transport, interest, wages, social contributions and depreciation), the net operating profit is reduced and even negative in some regions. The North region is the most affected due to the greater distance from the port.

Thus, in 2023, the sunflower trading activity was characterized by moderate commercial margins, but high pressure on profitability, determined by logistics costs and the volatility of international prices. The sector remains viable, especially for vertically integrated companies, which combine processing and export activities.

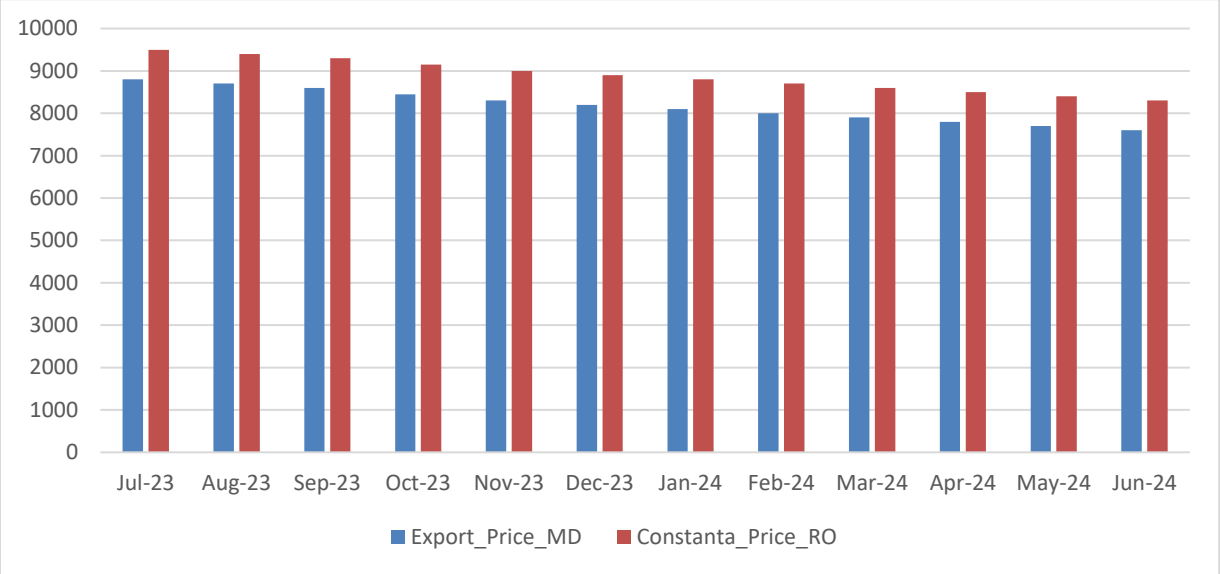


FIGURE 3-6 EXPORT PRICE OF SUNFLOWER SEED VS. CONSTANTA PRICE (RO), JULY 23 – JUNE 24.

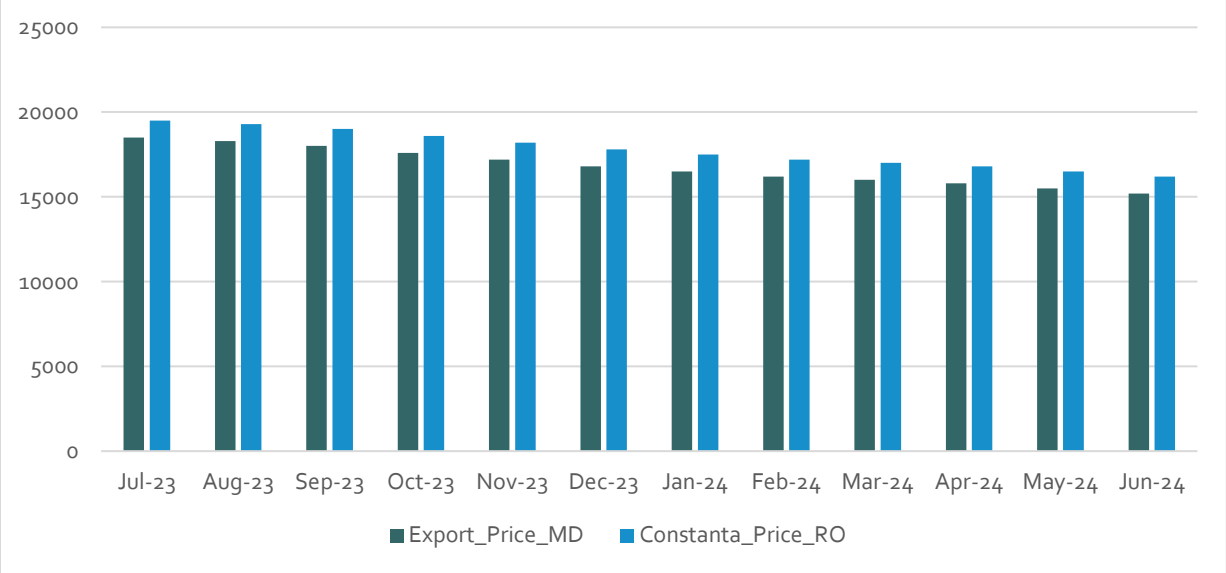


FIGURE 3-7 EXPORT PRICE OF OIL VS. CONSTANTA PRICE (RO), JULY 23 – JUNE 24.

FIGURE 3-8 EXPORT PRICE OF CAKE VS. CONSTANTA PRICE (RO), JULY 23 – JUNE 24.

The comparative analysis of prices for sunflower seeds, oil and meal highlights regional differences. In the case of seeds, the difference between the farm gate price and the FOB price generates a gross margin of approximately 18–24%, higher in the North and South regions due to the lower level of the purchase price. However, transport costs to the Port of Constanta significantly reduce this margin, especially in the North, where the distance is greater.

For oil (Figure 3-7), the percentage margin is lower, reflecting a more competitive market and a stronger integration into the regional export chain. In the case of cake (Figure 3-8), the price differences are more moderate, and the absolute value is lower, but the product contributes to stabilizing the income of processors. Overall, the competitive advantage is more pronounced in the South region, where logistics costs are lower. The profitability of the sector critically depends on the purchase price of raw materials and international market dynamics, and vertical integration remains essential for maintaining commercial margins.

As presented in *TABLE 3-*, 3-9, 3-10 the margin of Traders differs in different regions; however, those margin differences are attributed to transportation costs. While the north region is the farthest from the destination market, the prices are the lowest.

TABLE 3-8 SUNFLOWER SEED PRICES (SELLING, EXPORT AND PORT) AND TRADERS' GROSS MARGIN, MOLDOVA, 2023

2023/2024	**Farm-gate price** (MDL/t)	**Export price** (FOB, MDL/t)	**Gross margin** (1 - Farm/Export)	**Transportation costs to Constanta** (MDL/t)*	**Selling price Constanta Port,** RO
North	6,300	9,200	32%	723	10,000
Centre	6,800		26%	584	
South	7,200		22%	445	

* Average consumption of 30l/truck and 100km, load of 21tonnes, total transportation costs of 21 MDL/truck and km.

TABLE 3-9 SUNFLOWER OIL PRICES (SELLING, EXPORT AND PORT) AND TRADERS' GROSS MARGIN, MOLDOVA, 2023

2023/2024	**Farm-gate price** (MDL/t)	**Export price** (FOB, MDL/t)	**Gross margin** (1 - Farm/Export)	**Transportation costs to Constanta** (MDL/t)*	**Selling price Constanta Port,** RO
North	17,500	18,500	5%	723	19,500
Centre	17,800		4%	584	
South	18,000		3%	445	

* Average consumption of 30l/truck and 100km, load of 21tonnes, total transportation costs of 21 MDL/truck and km.

TABLE 3-10 SELLING, EXPORT AND PORT PRICE OF CAKE (MDL/TONNE), GROSS MARGIN OF TRADERS, MOLDOVA, 2023

2023/2024	Farm-gate price (MDL/t)	Export price (FOB, MDL/t)	Gross margin (1 - Farm/Export)	Transportation costs to Constanta (MDL/t)*	Selling price Constanta Port, RO
North	3800	4,200	9.5%	723	4,500
Centre	3900		7.1%	584	
South	4000		4.8%	445	

* Average consumption of 30l/truck and 100km, load of 21tonnes, total transportation costs of 21 MDL/truck and km.

Other costs incurred by traders, in addition to purchasing sunflower from farmers, include storage, electricity, interest payments (representing approximately 1% of sales), wages (approximately 8% of sales), and various additional expenses. (Table 3-11)

TABLE 3-11 FINANCIAL ACCOUNT FOR THE SUNFLOWER TRADERS (MDL/TONNE), CENTRAL MOLDOVA, 2023

Production (Central region)	Unit price	Volume	Total	Share (%)
sunflower / export	9,200	1	9,200	
IGS				
sunflower	6,800	1	6,800	74%
Storage costs (about 6m)	300	1	300	3%
Transportation[8] (MDL/t/km)	584	1	584	6%
Energy consumption	2.8	25	70	1%
VA				
Labour costs	300	1	300	3%
Social insurance	87	1	87	1%
Interest paid	70	1	70	1%
Depreciation	80	1	80	1%
Profit Before Tax			909	9.9%
Tax paid (12%)			109	1.2%
Profit After Tax			**860**	**8.7%**

The analysis of the financial account of sunflower traders highlights the strategic role of this segment in the functioning of the value chain and in the integration of Moldovan agricultural production on international markets. Traders ensure the collection, storage, financing, transport and export of production, activities that allow the transfer of seeds from farmers to processors and external buyers. Although they do not physically transform the product, traders generate economic value by organizing trade flows and assuming market risks.

The value of the traded production is 9,200 MDL/t, representing the average export price of sunflower seeds in 2023. The largest part of this value is represented by the cost of purchasing raw materials from producers, which amounts to 6,800 MDL/t and represents approximately 74% of the total export value. This high share demonstrates that trading activity is characterized by relatively low trade margins and depends largely on the difference between the purchase price and the export price. Transport costs reach 584 MDL/t, representing approximately 6% of the export value, while storage costs amount to 300 MDL/t or approximately 3% of the total value. These two categories of expenses constitute the main factors influencing the competitiveness of Moldovan exports. In the context of the Republic of Moldova's dependence on regional transport infrastructure and trade corridors through Romania, logistics costs have become a determining element of traders' profitability.

The trading segment contributes significantly to the external competitiveness of the sunflower value chain, facilitating the export of production surplus and the generation of foreign exchange income. However, **the analysis highlights that the added value created by traders is inferior to that generated by industrial processing.** This confirms that the export of raw seeds, although profitable, generates lower economic benefits for the national economy compared to the transformation of raw material into processed products, such as sunflower oil and meal. Consequently, the development of domestic processing capacities remains one of the

[8] Transportation to Constanta (RO).

main opportunities for increasing added value and the contribution of the value chain to the economic development of the Republic of Moldova.

3.2. Total effects within the national economy

The consolidated account of the sunflower value chain highlights the sector's significant contribution to the Moldovan economy in 2023. The total value of production generated by the value chain amounted to MDL 7.32 billion, while direct value-added reached MDL 3.94 billion, representing approximately 54% of total production value. This result demonstrates the capacity of the sector to transform intermediate inputs into income, employment, profits, and economic growth.

TABLE 3-12 TOTAL CONSOLIDATED ACCOUNT FOR MOLDOVA SUNFLOWER (THOUSANDS OF MDL), MOLDOVA, 2023

Actor, K MDL	Production	Total Subsidy	IGS	Wages	Total Taxes	Interest on loan	Land Fee	Deprec.	NOP	VA	VA / Product
PF_North	492,660	38,579	256,384	112,534	18,656	6,628	78,200	19,140	39,696	236,276	48
AE_North	1,546,650	47,984	737,951	342,919	45,399	19,975	312,455	59,924	76,012	808,699	52
SH_North	228,060	0	86,355	8,145	23,592	2,860	0	9,919	97,189	141,705	62
PF_Centre	342,040	17,884	165,208	77,714	13,860	4,499	56,588	13,637	28,420	176,832	52
AE_Centre	802,400	36,121	429,373	201,854	22,863	10,473	199,125	28,468	-53,633	373,027	46
SH_Centre	127,840	0	55,425	5,288	11,774	1,598	0	5,064	48,692	72,415	57
PF_South	274,320	21,157	112,866	76,648	18,777	3,698	76,648	21,717	-14,877	161,454	59
AE_South	1,092,960	49,118	553,962	267,602	38,964	14,313	260,229	41,203	-34,193	538,998	49
SH_South	153,360	0	76,795	7,373	4,775	1,917	0	5,358	57,143	76,565	50
LO_Centre	154,564	0	154,564	0	0	0	0	0	0	0	0
LO_North	281,264	0	281,264	0	0	0	0	0	0	0	0
LO_South	191,376	0	191,376	0	0	0	0	0	0	0	0
Milling Small	758,236	5,185	512,425	33,526	34,502	0	0	0	182,968	245,811	32
Milling Large	4,306,062	323,139	3,581,625	93,047	69,564	53,170	0	124,062	707,734	724,437	17
Trader	2,257,864	0	1,875,362	73,626	50,551	17,179	0	19,634	221,512	382,503	17
VALUE CHAIN	**7,322,163**	**539,168**	**3,383,439**	**1,300,274**	**353,276**	**136,309**	**983,244**	**348,126**	**1,356,664**	**3,938,724**	**54**

Sources: Own calculation

Intermediate consumption accounted for MDL 3.38 billion, representing the largest cost component throughout the chain. At the same time, the sector generated more than MDL 1.3 billion in wages, confirming its importance for employment creation in both primary agriculture and downstream processing and trading activities. Landowners received approximately MDL 983 million in rental payments, underlining the important role of sunflower production in supporting rural household incomes.

At the farm level, Agricultural Enterprises in the North were the largest contributors to primary production, generating more than MDL 808 million in value added. Smallholders demonstrated the highest value-added-to-production ratios, reaching 62% in the North, largely due to lower cash costs and the extensive use of family labour.

The strongest contribution to value creation originates from post-harvest activities. Industrial processors generated approximately MDL 724 million in value added and more than MDL 707 million in net operating profits, making processing the most profitable segment of the value chain. Traders contributed an additional MDL 383 million in value added, playing a key role in linking domestic production to export markets.

Overall, the sunflower value chain is one of the most important agri-food sectors in Moldova. It generates substantial income for farmers, landowners, employees, processors, and traders, while also contributing to public revenues and export earnings. The results indicate that expanding domestic processing and increasing the share of higher value-added sunflower products would offer the greatest opportunity to strengthen the sector's contribution to national economic growth and rural development.

Figure 3-9 illustrates the breakdown of intermediate goods and services consumed along the value chain. While farm-level data provide a detailed overview of the inputs used, the composition of items becomes more diverse and less clearly defined downstream. However, fertilizer and protection represent a key component of consumption in the value chain (30%), followed by fuel (19%). The third largest category is seeds (17%), used mainly for agricultural machinery and transportation.

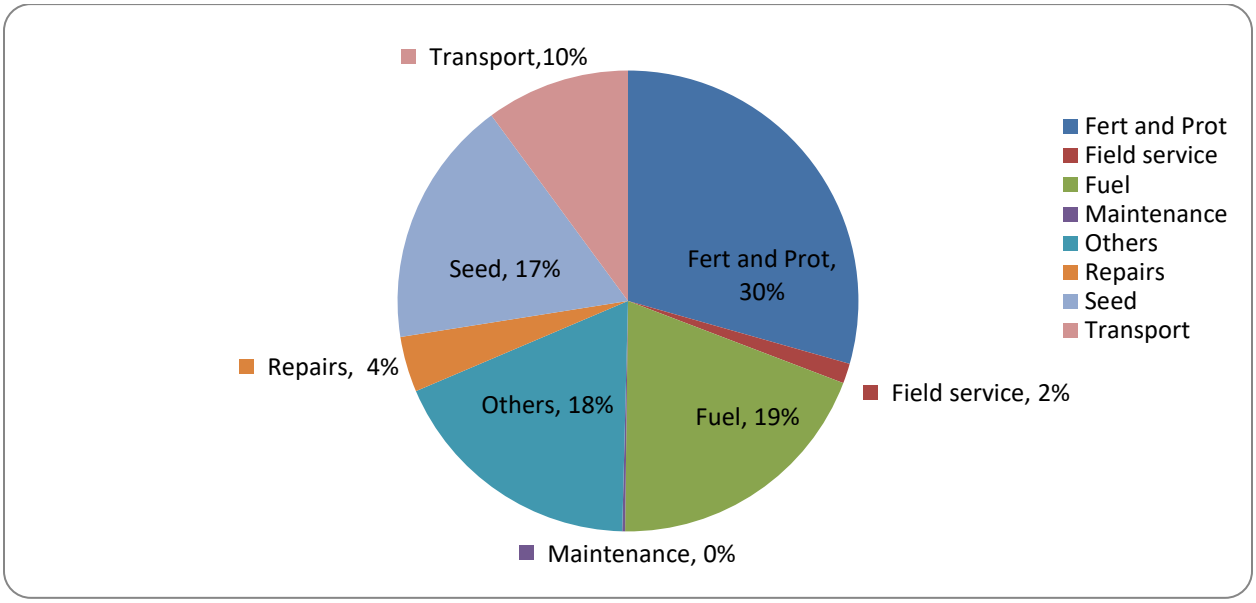


FIGURE 3-9 INTERMEDIATE CONSUMPTION (IGS) BREAKDOWN, 2023, MOLDOVA SUNFLOWER

TABLE 3-13 COST STRUCTURE OF SUNFLOWER VALUE CHAIN, 2023, MOLDOVA

Category	Group/Item	Value (K MLD)	Percentage
1.Consumable	Fert and Prot	995,309	16.55
1.Consumable	Fuel	655,541	10.90
1.Consumable	Others	383,729	6.38
1.Consumable	Seed	588,394	9.78
2.Service	Others	277,864	4.62
2.Service	Repairing	141,570	2.35
2.Service	Transport	341,032	5.67
3.Wages	Crushing Wages	126,573	2.10
3.Wages	Farm Wages	1,100,075	18.29
3.Wages	Labour trader	73,626	1.22
6.Property Income	Landowner share	983,244	16.35
7.Depreciation	Depreciation	19,634	0.33
7.Depreciation	Equipment	144,403	2.40
7.Depreciation	Equipment	184,089	3.06

The analysis of the cost structure of the sunflower value chain highlights the main categories of expenses that determine the competitiveness and economic performance of the sector in the Republic of Moldova in 2023. Total costs are dominated by intermediate consumption and remuneration of production factors, reflecting the intensive nature of the crop and the importance of resources used throughout the value chain.

A particularly important aspect is **the very high share of the Farm Wages category**, which reaches 1.1 billion MDL (18.29%), representing the largest individual cost component in the entire value chain. At first glance, this value may seem surprising in the context in which wages in agriculture in the Republic of Moldova are relatively low compared to other economic sectors.

The explanation lies in the VC4D methodology for calculating costs. The "Farm Wages" category reflects not only monetary wages paid to permanent and seasonal employees, but also includes remuneration for family labour and the farmer's own labour, valued at opportunity cost. Thus, even if the individual wage level is low, the total volume of labour used along the entire value chain generates significant economic value. In addition, sunflower cultivation occupies large areas in the Republic of Moldova, which amplifies the aggregate value of labour costs. **The high share of agricultural wages suggests that a significant part of the value created within the value chain is distributed to the labour factor.**

From a VC4D perspective, this is **a positive indicator of the sector's contribution to employment and income generation in rural areas**. At the same time, **the high level of labour costs may also reflect the difficulties of farmers** in attracting and retaining qualified personnel, given the migration and labour shortage in rural areas.

Another important finding is the significant share of land rent (16.35%), which indicates that a significant part of the value generated by the chain is transferred to landowners. In contrast, processing costs (Crushing Wages – 2.10%) and depreciation of fixed assets (below 6% cumulatively) have a relatively small contribution, suggesting that most of the economic value and costs are concentrated in the primary agricultural production stage.

Overall, the cost structure reflects a production system that is highly dependent on agricultural inputs and labour, with financial and land-related costs also playing a notable role.

It should be noted that land-related costs are usually covered by in-kind payments, whereby landowners are compensated with goods. Depreciation seems to play a relatively minor role, as some machinery and technology are already depreciated. At the same time, many farmers were able to invest in new equipment and technology with the support of the national paying agency (AIPA), although detailed data on these investments were not available.

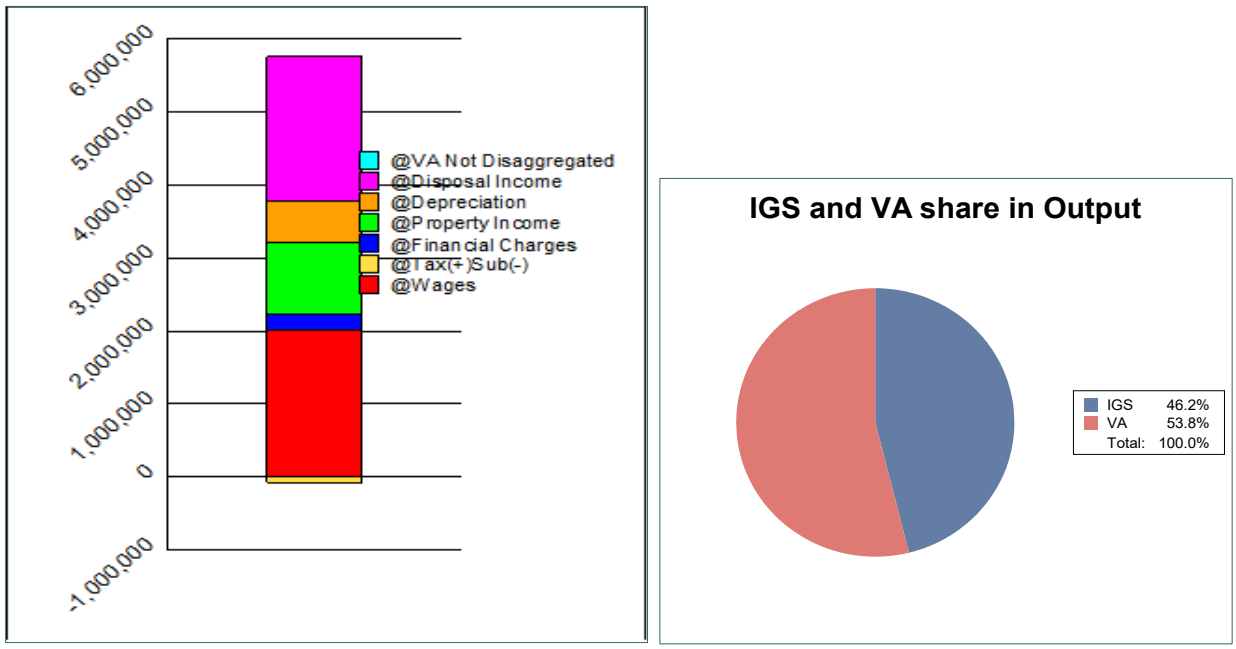


FIGURE 3-10 VALUE ADDED (VA) DISTRIBUTION OF THE VC (DIRECT), 2023, MOLDOVA SUNFLOWER

The VAT balance itself amounts to approximately -150 to -200 million MDL (to be refunded), remaining effectively locked within Moldovan fiscal institutions.

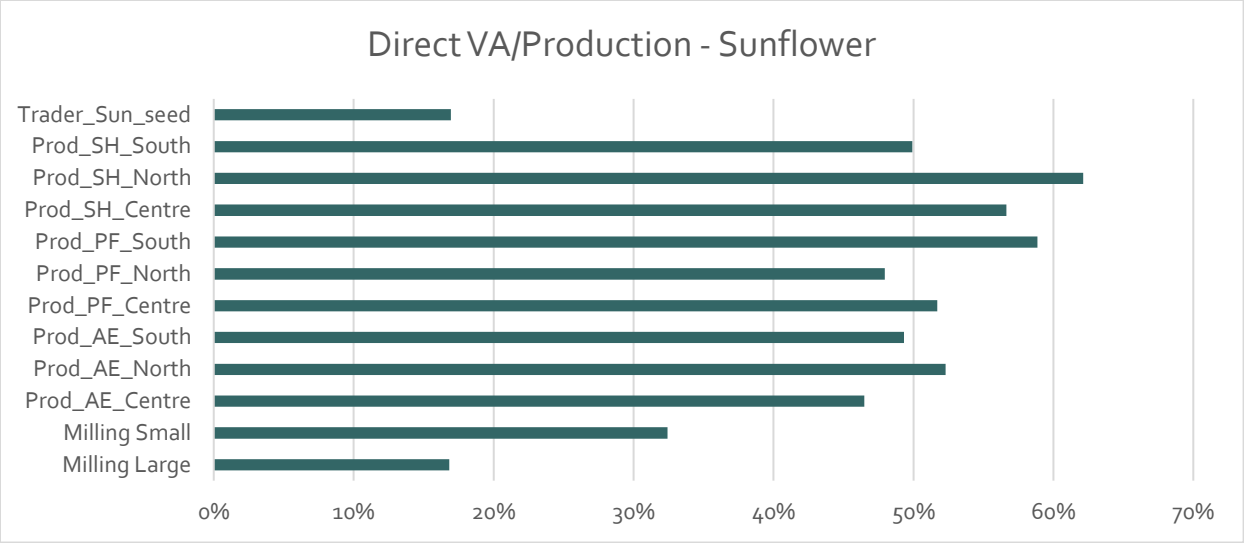


FIGURE 3-11 DIRECT VALUE ADDED OVER PRODUCTION, MOLDOVA SUNFLOWER, 2023

Figure 3.11 presents the ratio of direct value added to production for the main actors of the sunflower value chain in Moldova in 2023. This indicator measures the capacity of each actor to generate economic value from its activities, with higher values indicating a greater contribution to the domestic economy. The results show that Smallholders (SH) generate the highest value-added-to-production ratios, particularly in the Northern region, where value added represents approximately 62% of production value, followed by the Centre (57%) and South (50%). These results are largely explained by lower production costs and the extensive use of family labour.

Peasant Farms (PF) and Agricultural Enterprises (AE) display intermediate levels, with ratios ranging from 46% to 59%. The strongest performance is observed among PFs in the South and AEs in the North, while Agricultural Enterprises in the Centre record the lowest ratio among commercial producers.

Among downstream actors, small service mills generate value added equivalent to approximately 32% of production value, whereas industrial crushers and traders exhibit the lowest ratios, around 17%. Although these segments create substantial value added in absolute terms, their activities are characterised by high raw material costs and lower margins relative to total output value.

Overall, the figure demonstrates that primary sunflower production, particularly among smallholders and peasant farms, generates the highest relative value added. In contrast, processing and trading contribute through larger economic volumes and play a crucial role in integrating domestic production into national and international markets.

TABLE 3-14 MOLDOVA SUNFLOWER VC - DIRECT AND INDIRECT EFFECTS (THOUSANDS MDL)

Category	Direct effects	Indirect effects	Total effects
Imports	0	1,591,724.34	1,591,724.34
IC not disaggregated	—	53,795.53	53,795.53
Wages	1,300,273.74	710,305.62	2,010,579.36
Taxes	—	—	—
Subsidy	—	—	—
Tax (+) Sub (−)	-185,891.96	113,616.45	-72,275.50
Interest on loan	136,309.03	73,514.10	209,823.12
Land Fee	983,243.90	15,180.55	998,424.45
Depreciation	348,125.77	198,791.17	546,916.94
Net Operating Profit	1,356,663.61	626,510.79	1,983,174.40
VA not disaggregated	—	0	0
VA Total	**3,938,724.09**	**1,737,918.68**	**5,676,642.77**

The computation of indirect effects (Table 3-14) highlights the total economic impact of the sunflower value chain on the national economy. Direct value added is generated by farmers, processors and traders, while indirect value added comes from the input supply, financial services, logistics and energy sectors.

While the value chain directly generates MDL 3.94 billion in value added, indirect linkages with upstream suppliers and service providers create an additional MDL 1.74 billion, bringing total value added to approximately MDL 5.68 billion. The strongest multiplier effects are observed in income generation. Direct wages amount to MDL 1.3 billion, while indirect employment effects generate a further MDL 710 million, resulting in total labour income exceeding MDL 2.0 billion. Similarly, net operating profits increase from MDL 1.36 billion in direct effects to nearly MDL 1.98 billion when indirect effects are included, demonstrating the significant economic spill overs generated by the sector.

Landowners also benefit substantially, receiving almost MDL 1.0 billion in total land rental income. Depreciation and interest payments generate additional demand for financial and capital-related services, contributing to wider economic activity. The value chain relies on imported inputs worth approximately MDL 1.59 billion, reflecting its dependence on imported seeds, fertilisers, crop protection products, fuel, and machinery. Nevertheless, the overall economic benefits significantly outweigh import costs.

The analysis demonstrates that the sunflower value chain creates substantial multiplier effects throughout the economy. Beyond its direct contribution to production and exports, it supports employment, rural incomes, business profits, and economic activity across numerous interconnected sectors, making it an important driver of economic growth in Moldova.

3.3. Competitiveness and viability within the international economy

Since October, 2023, Moldova has applied a licensing regime for imports of sunflower seeds, requiring economic operators to obtain government authorization before importing raw material. The measure was introduced in response to concerns from domestic producers regarding the potential impact of lower-priced imports, particularly from Ukraine, on local farm-gate prices.

While the licensing system aims to protect domestic farmers from market distortions and unfair competition, it may also constrain the supply of raw material available to processors during periods of domestic shortages, potentially affecting processing capacity utilization and export performance. As a result, the measure has become a key factor influencing the balance between producer protection and the competitiveness of the sunflower processing industry. The assessment of the viability of the sunflower value chain in the Republic of Moldova

through the Nominal Protection Coefficient (NPC) highlights the degree of competitiveness of national exports in relation to international parity prices.

Based on UN Comtrade data (2025), Moldova's average export price for sunflower seeds (HS 120600) in the period 2021–2023 is approximately 520 USD/ton. Compared to the unweighted average of the main exporters, the international parity price is at a slightly higher level. At the same time, the weighted average of the top five exporters provides a benchmark closer to the real structure of the global market.

The calculated NPC coefficient (the ratio of the domestic price to the parity price) is slightly sub-unitary (NPC < 1). This indicates that **Moldova exports at a price lower than the international average**, suggesting competitiveness based on relatively low costs, but also a possible positioning in market segments with lower added value.

A sub-unit NPC reflects the absence of excessive protection of the domestic market and confirms the relatively effective integration of the sector into international trade. However, the difference with premium exporters (Argentina, USA, Turkey) indicates potential for growth through improved quality, certification and diversification of processed products.

In conclusion, the sunflower value chain is viable and competitive, but predominantly oriented towards cost advantage, not towards maximizing unit export value.

TABLE 3-1 AVERAGE EXPORT OF SUNFLOWER SEEDS (HS 120600), PER COUNTRY, 2021 – 2023 (EXPORT QUANTITY, AVERAGE PRICE)

No.	Country	Average export price (USD/ton)	Export share, %	Average Export quantity (K ton)	Index (Moldova price = 100%)
1	Ukraine	480	22,5	5400	92,3
2	Romania	505	12,4	2900	97,1
3	Bulgaria	498	9,1	2100	95,8
4	France	540	6,3	1500	103,8
5	Hungary	515	5,8	1380	99
6	Argentina	560	4,2	1000	107,7
7	Turkey	575	3,7	880	110,6
8	USA	590	3,1	740	113,5
9	Kazakhstan	470	2,8	660	90,4
10	Rep. of Moldova	520	2,5	600	100

The international competitiveness of Moldovan sunflower is defined by the **Domestic Resource Cost (DRC) ratio, calculated at 0.13, is below the 1.0 threshold for efficiency**. This figure suggests Moldovan sunflower operates under competitive advantage.

3.5 Answer to the Framing Question 1

TABLE 3-9 HOW PROFITABLE AND SUSTAINABLE ARE THE VC ACTIVITIES FOR THE ENTITIES INVOLVED? SUNFLOWER - MOLDOVA, 2023

Framing Question 1: What is the contribution of the VC to economic growth?		**INDICATORS**	**RESULTS**
CQ1.1	How profitable and sustainable are the VC activities for the entities involved?	**Operating Accounts of every type of actor**	see tables above
		Net operating profit by type of actor	North SH 15,453 MDL Centre SH 19,245 MDL South SH 2,647 MDL North PF 56,595 MDL Centre PF 92,928 MDL South PF 66,822 MDL North AE 121,086 MDL Centre AE -140,024 MDL South AE -58,220 MDL Small mill 680,000 MDL Trader seed 8,000,000 MDL Industrial mill 655,200,000 MDL
		Return on turnover (operating profit/production)	North SH 40.9% Centre SH 35% South SH 28% North PF 7.2% Centre PF 8.2% South PF 11.8% North AE 4.6% Centre AE -6.7% South AE -2.7%
		Benchmarks for farmers' net income (minimum wage, livelihood needs, job opportunities...)	Minimum wage: - **4,000 MDL** Average gross wage in Agriculture: - **7,952 MDL** Average gross wage in Economy: - **12,209 MD**L
CQ1.2	What is the contribution of the VC to the GDP?	**Value of final VC production**	7,322,163 K MDL
		Total VA and components	3,938,724 K MDL
		Total VA in percentage of the GDP	1.9% of national GDP
		Rate of integration into the Economy (total VA/VC production)	77.5%
CQ1.3	What is the contribution of the VC to the agriculture sector GDP?	**VC agricultural actors' Value Added in percentage of the agriculture sector GDP**	12%
CQ1.4	What is the contribution of the VC to the public finances?	**Public Funds Balance**	-72K MDL (-0.1% of public budget)
CQ1.5	What is the contribution of the VC to the balance of trade?	**VC exports**	6 408 900 K MDL
		VC total imports	1,591,724 K MDL
		Balance of trade of the VC	4,817,176 K MDL
CQ1.6	Is the VC viable in the international economy?	**Nominal Protection Coefficient (NPC)**	**0.98**
		Domestic Resource Cost Ratio (DRC)	**0.13**

4. IS THIS ECONOMIC GROWTH INCLUSIVE?

Social Inclusiveness of Economic Growth in the Sunflower Value Chain

This section examines whether economic growth in Moldova's sunflower value chain (VC) is socially inclusive. In the VCA4D framework, social inclusiveness refers to the extent to which the benefits of growth – income, employment, access to resources, and social protection – are equitably shared among small holders (SHs), peasant farms (PFs), agricultural enterprises (AEs), and their employees.

Sunflower production in Moldova reflects the strong polarisation of the national agricultural structure. At one end of the spectrum are a relatively small number of large agricultural enterprises that operate on extensive areas, using modern machinery, limited but technically skilled permanent staff, and seasonal labour during peak periods. At the other end, a large majority of rural households practise semi-subsistence farming, relying on self-employment and unpaid family labour.

Between these two poles lies an increasingly visible category of medium and small commercial farms, which rent or own certain types of agricultural equipment, apply agronomic knowledge, and sell part of their output on the market – either immediately after harvest to local traders at spot prices, or later in the season at contracted or market prices, when they have access to storage facilities.

Upstream, input and mechanization supply is concentrated among a few distributors linked to multinationals. Downstream, the chain is dominated by industrial processors and exporters capturing a large share of final profits. While small producers often lack organizational capacity, successful cooperative experiences – such as Agrostoc and the Criuleni cooperatives – show that collective storage and marketing can enhance efficiency, bargaining power, and resilience to market volatility and climate risks (Field Notes 2025; Ignat et al. 2017; Savga & Savga 2024).

Figure 4–1 presents the distribution of net operating profits (NOP) across actors in the sunflower value chain. The waterfall chart reveals marked disparities in profitability between production and downstream stages. While some farm categories—notably agricultural enterprises in the Centre and South—experience negative returns, most producer groups generate only modest profits. By contrast, profits increase sharply downstream, with processing and trading accounting for the largest gains. In particular, large sunflower mills and seed traders capture a disproportionate share of total NOP. Overall, the figure highlights the strong concentration of profits in downstream activities, while primary producers bear most production risks and capture relatively limited returns.

4.1. Distribution of Income and Value Added among Value-Chain Actors

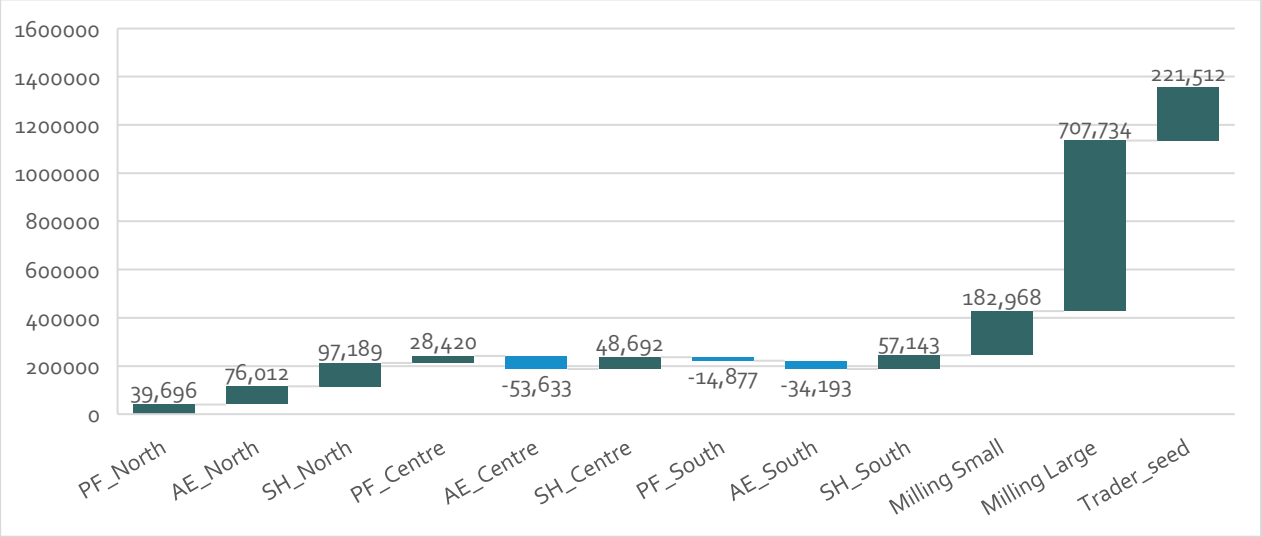


FIGURE 4-1. NET OPERATING PROFIT DISTRIBUTION BY ACTORS, SUNFLOWER, MOLDOVA, THOUSANDS MDL, 2023

Benchmark data from Kotyza et al. (2025) suggest that, in cereal value chains, farms generate most value added and wages but capture only a limited share of total net operating profit. In the sunflower value chain, profit concentration is even stronger: while farms account for 66% of value added and 85% of wages, sunflower mills capture two-thirds of total NOP.

TABLE 4-1: DISTRIBUTION OF WAGES AND CREATION OF LABOUR (IN AWU), MOLDOVA, THOUSAND MLD, 2023

Thousand MLD	Value added	%	Wages	%	Tax	%	NOP	%
Farms	2,585,973	66%	1,100,075	85%	198,660	56%	244,449	18%
Traders	382,503	10%	73,626	6%	50,551	14%	221,512	16%
Sunflower mill	970,248	25%	126,573	10%	104,065	29%	890,703	66%
Total	**3,938,724**	100%	**1,300,274**	100%	**353,276**	100%	**1,356,664**	100%

Table 4–1 shows that sunflower farms generate most value added (66%) and wage income (85%), confirming their central role in employment creation. However, net operating profits are captured mainly downstream: sunflower mills account for two-thirds of total profits (66%), while farms retain only 18%. This pattern reflects the higher capital intensity and value capture of processing activities, whereas labour benefits remain concentrated at the farm level. Within primary production, larger agricultural enterprises enjoy advantages in capital, storage, and liquidity, while peasant farms and smallholders contribute disproportionately to employment and wage generation.

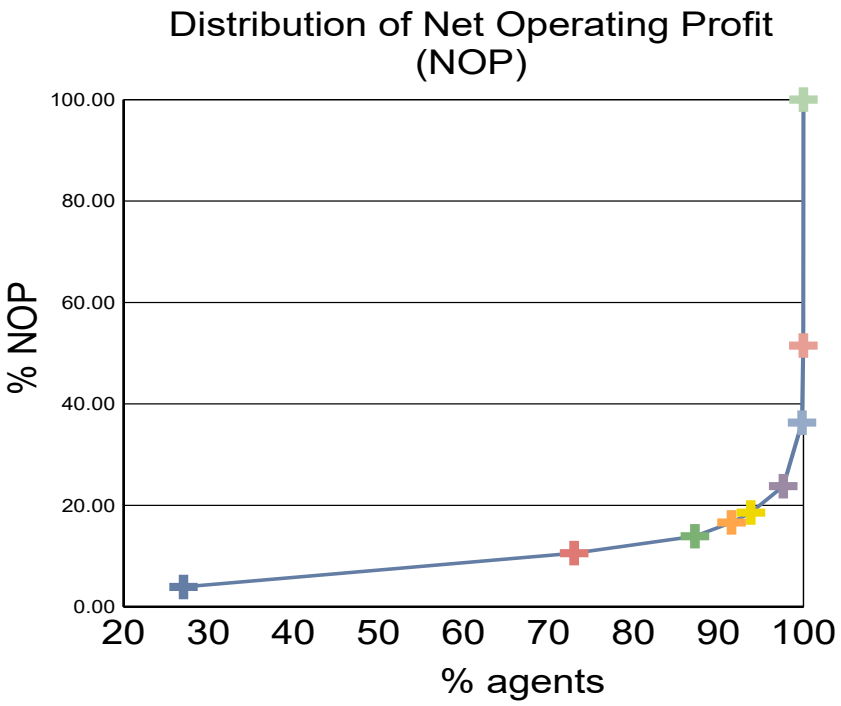


FIGURE 4–2. NET OPERATING PROFIT, GINI COEFFICIENT, SUNFLOWER VC, 2023

The Gini curve of net operating profits (Gini = 0.84) reveals a highly unequal distribution of value capture in the sunflower value chain (Figure 4-2). For most actors—primarily smallholders and peasant farms—profit shares are modest, with nearly 98% of agents accounting for only about one-quarter of total NOP. By contrast, a handful of downstream actors, especially traders and large processors, capture the overwhelming majority of profits. In particular, the largest sunflower mill alone accounts for almost half of total NOP (48.5%), highlighting the strong concentration of value capture in processing activities. This pattern reflects the high capital intensity and market concentration of downstream stages, whereas the numerous producers generate most employment and value added but capture only a limited share of profits.

Benchmark evidence from Kotyza et al. (2025) indicates that labour and wage payments are concentrated upstream, while downstream activities are more capital intensive and generate relatively little employment. Larger AEs account for most skilled jobs, whereas PFs and SHs rely more heavily on temporary and unskilled labour. Gender segmentation also persists.

Land distribution confirms this structural polarization. In 2024, 68% of sunflower area was cultivated by AEs, 29% by PFs, and only 2–3% by SHs, illustrating the strong capital bias of this crop (BNS 2024a).

Recent input-price dynamics have further shaped inclusiveness. Diesel costs rose sharply in 2022 (+57%) and fertilizer prices quadrupled, before easing in 2023–2024 yet remaining high for small and mid-sized farms, which often relied on lower-quality substitutes (PECO.md; ANRE; Mold-Street 2022; FAO 2022; Crivoi 2024). The 2025 Fertilizer Law aims to align Moldova with EU standards, simplify recognition of EU-certified products, and improve labeling and quality control, potentially broadening access to affordable, higher-quality inputs (Parliament of the RM, 2025).

Sunflower prices rose by +23.3% in 2024, but benefits were uneven: AEs, with superior liquidity, storage, and delayed-sales capacity, captured a larger share of the gains, while PFs and SHs remained vulnerable to low farm-gate prices (BNM 2025; MAIA 2024). Productivity differences mirror these financial asymmetries – yields ranged between 26 q/ha and 15 q/ha for AEs and 16–13 q/ha for SHs, highlighting sunflower's relative resilience but persistent structural gaps (BNS 2025).

Access to storage is a key determinant of market behaviour and profitability in the sunflower value chain. The updated survey data show a clear structural divide. Smallholders (SHs) have no storage capacity (0 tonnes on average) and must therefore sell virtually all their sunflower immediately after harvest (≈62%). Peasant farms (PFs) have only very limited storage (around 250 tonnes on average), which allows little flexibility; they sell more than half of their crop immediately (≈59%). In contrast, agricultural enterprises (AEs) are far better equipped, with substantially larger storage capacities (around 1,370 tonnes on average), enabling them to postpone sales – reflected in a much lower share sold immediately after harvest (≈30%) (Survey 2025, see Table 4–2).

TABLE 4–2: STORAGE CAPACITY, SALES TIMING, AND SUBSIDIES BY FARM CATEGORY – SUNFLOWER VALUE CHAIN

Farm category	Average sunflower storage capacity (t)	Average share sold immediately after harvest (%)	Average total subsidies received (2019–2023, MDL)
PF – Peasant Farms	251.8	58.6%	1,076,303
AE – Agricultural Enterprises	1,368.8	29.8%	2,078,153
SH – Smallholders	0	61.8%	138,045

Source: VCA4D field survey conducted in August–September 2025 (n = 48). *Note:* Values are rounded for clarity. Subsidies include investment support and drought-related payments.

These disparities translate directly into market outcomes. With greater liquidity and storage capacity, AEs can time sales strategically, capturing better seasonal prices and protecting themselves from periods of low farm-gate prices. PFs occupy an intermediate position, while SHs remain the most vulnerable, fully exposed to immediate-sale pressures and lacking the ability to negotiate better terms. Overall, storage and liquidity constraints shape profitability and value capture within the sunflower chain, reinforcing the advantages of larger, capitalised farms.

A similar pattern emerges for access to public support. Although AIPA's reports do not disaggregate subsidies by farm size, its 2024 schemes structurally favour capital-intensive farms. Survey results confirm this tendency: Survey results confirm this tendency: AEs capture around 63% of subsidy flows reported in the sample, compared with 33% for PFs and only 4% for SHs (Table 4–2).

Overall, the sunflower value chain exhibits a clear asymmetry between where value and employment are created and where profits are captured. Farms generate most value added and wage income, but downstream processors and traders capture a disproportionate share of total profits. Within primary production, agricultural enterprises enjoy advantages in capital, storage capacity, liquidity, and access to subsidies, whereas peasant farms and especially smallholders face tighter financial constraints, earlier sales, and greater exposure to climate and price volatility. Regional disparities and the shocks of 2022–2024 reinforced these inequalities without fundamentally altering the structure of value capture.

4.2. Labour Share and Structural Barriers to Inclusivity

As in wheat and maize, most wage payments and employment in the sunflower value chain are concentrated at the farm level, while the overall labour share in value added remains relatively low, reflecting the capital intensity of production and processing and the prevalence of informal and unpaid family labour among smallholders (SHs) and peasant farms (PFs). Agriculture remains one of Moldova's lowest-paid sectors, with average monthly earnings (7,952 MDL) well below the national average (12,209 MDL) (BNS 2024a).

Skilled workers in agricultural enterprises (AEs)—mechanisers, agronomists, and technicians—can earn 10,000–22,000 MDL per month during peak seasons under formal contracts, whereas seasonal and casual workers are frequently paid informally (≈50 MDL/hour) and lack social insurance. Wage delays and "no yield, no pay" practices were reported during drought years (FGs & Interviews, June 2025).

Table 4–3 shows that employment is overwhelmingly concentrated in agricultural enterprises, which account for around two-thirds of all jobs and most permanent skilled positions. Peasant farms also provide substantial employment, whereas smallholders rely primarily on family labour. Downstream activities—crushing, milling, and

trading—generate comparatively few jobs due to higher capital intensity. Permanent unskilled positions dominate the labour structure, followed by skilled jobs and a smaller number of temporary workers.

TABLE 4–3: DISTRIBUTION OF WAGES AND CREATION OF LABOUR (IN FTE), MOLDOVA, SUNFLOWER, 2023

Value of wages per category of jobs (FTE)	Total Temp.	Total Perman. Unskilled	Total Perman. Skilled	Total Male	Total Female
Peasant farm	673	2,106	1,103	2,129	1,266
Agricultural enterprise	2,200	6,411	3,048	6,258	3,636
Smallholder	293	0	0	102	48
Industrial crushing	0	949	452	737	505
Small mil	0	278	137	342	121
Trader	0	505	530	875	438
Total	3,166	10,249	5,271	10,443	6,014

Gender segmentation remains pronounced. Men dominate mechanised and higher-paid occupations, while women are concentrated in manual post-harvest activities and auxiliary functions. Nationally, women account for 42% of the agricultural workforce but only one-third of salaried employees, resulting in a gender pay gap of 15–17% (BNS 2024a; ILO 2024b). In sunflower production, women account for approximately 27% of workers in SHs, 30% in PFs, and 21% in AEs, underscoring their underrepresentation in larger and more mechanised enterprises. Limited access to machinery, technical education, and training reinforces these inequalities (FAO 2022b).

The workforce is also ageing. Among the 48 sunflower farms surveyed, 42 reported no employees younger than 29. On average, youth represent only around 5.5% of workers in AEs, 1.7% in SHs, and are virtually absent from PFs. Focus groups linked this to perceptions of physically demanding work, unstable earnings, and limited opportunities for professional advancement. As a result, older workers—often employed informally—remain essential during peak periods.

Overall, economic growth in the sunflower value chain remains only partially inclusive. While farms generate most employment and wage income, persistent informality, gender segmentation, limited access to skills, and demographic ageing constrain equitable participation and the long-term resilience of the sector.

TABLE 4–3. SUMMARY TABLE OF INDICATORS FOR FRAMING QUESTION 2

Framing Question 2: Is this economic growth inclusive? *(To be completed with Social Analysis results)*		**INDICATORS**	**RESULTS**
CQ2.1	How is income distributed across actors of the VC?	**Disaggregated Value Added**	Farms generate 66% of value added; processing accounts for 25%; traders 10%.
		Total farm income	Farms retain only 18% of total NOP; large mills capture 66%.
		Total wages and salaries	Farms account for 85% of wages and employment.
		Total income accruing to marginalized and vulnerable groups	SHs and PFs generate employment but capture limited profits; women concentrated in lower-paid jobs.
CQ2.2	What is the impact of the governance systems on income distribution?	**Income distribution among actors**	Profits are highly concentrated downstream (NOP Gini = 0.84).
		Share of farm gate price in the final price (%)	Primary producers capture a limited share of final value; processing and trading dominate value capture.
CQ2.3	How is employment distributed across the VC?	**Number of jobs (family, self- and formal employment) at different VC stages (permanent/ temporary, skilled/unskilled…)**	Employment concentrated upstream; AEs provide most permanent skilled jobs; PFs and SHs rely more on temporary and family labour.
		Employment of women	Women account for ~42% of agricultural labour force but remain underrepresented in mechanized and managerial positions; gender pay gap 15–17%.

5. IS THE VALUE CHAIN SOCIALLY SUSTAINABLE?

Social Analysis

Introduction

The social analysis of the sunflower value chain in Moldova follows the VCA4D Social Profile model, which assesses social sustainability across six domains: working conditions, rights and access to land and water, gender equality, food and nutrition security, social capital, and living conditions. Each domain is further divided into 22 sub-domains and 63 guiding questions that evaluate both positive contributions and potential risks. Scores derived from the Social Profile tool are then visualized in a radar diagram showing overall performance across the six dimensions.

This framework enables a systematic, evidence-based assessment of whether the sunflower value chain in Moldova is socially sustainable. The analysis goes beyond income and production indicators to examine how opportunities and risks are distributed among different actor groups—especially women, youth, seasonal workers, and smallholders. In line with the VCA4D methodology, it addresses two core questions: whether growth in the sunflower value chain is socially inclusive and whether it contributes to long-term social sustainability.

To answer these questions, the research team used a mixed-methods approach, combining a review of national and international literature and legal frameworks with interviews and focus groups involving policymakers, farmer organizations, unions, agribusiness representatives, and farm workers. These qualitative findings were complemented by statistical and survey data on employment, wages, gender, education, and living standards.

This chapter is structured in three parts: first, findings and analysis for each of the six domains; second, a summary and radar-chart visualization of the overall Social Profile; and third, the main conclusions and policy recommendations for EU Delegations, national authorities, and other stakeholders. Applying this methodology provides an integrated picture of the social dynamics in Moldova's sunflower sector—its contributions to inclusive development and the challenges that must be addressed to ensure lasting social sustainability.

5.1. Working conditions

Respect of Labour Rights

Moldova has ratified all eight fundamental ILO Conventions and is a party to the ICESCR, ICCPR, and ILO Convention No. 190 on Violence and Harassment, ratified in March 2024 (ILO NORMLEX 2024). The national framework is broadly aligned with international standards, guaranteeing freedom of association, non-discrimination, protection against forced and child labour, and the right to fair and safe working conditions. In practice, however, enforcement remains uneven, constrained by post-Soviet legacies, weak institutional capacity, and socio-economic inequalities (Eurofound 2023; UN Moldova 2023).

Agriculture is covered by sectoral collective agreements, yet in sunflower farming – especially within large, mechanised enterprises – unionisation is rare. Agroindsind, the main agricultural union, estimates about 40,000 people employed in the sector, including seasonal workers, but notes that most cereal and sunflower producers "do not belong to a trade union" (Field Notes, March 2025). Wage setting therefore tends to be individualised, with collective approaches largely informal (Eurofound 2023; FG mechanisers, Centre, June 2025). Union leaders acknowledge limited leverage: modest benefits such as sanatorium vouchers remain, more as a Soviet-era remnant than an effective protection mechanism. Employers often avoid social dialogue, while subsidies favour large agro-holdings over small and medium producers (Field Notes, March 2025). Workers in focus groups similarly reported low expectations for negotiation, viewing unions as weak or outdated (FG employees, Centre, June 2025; FG canteen workers, South, June 2025).

The National Trade Union Confederation (CNSM), which includes Agroindsind, periodically reviews collective-bargaining frameworks and concluded 21 sectoral agreements between 2004 and 2024, though Agroindsind's role appears largely passive (Sclifos 2025; Agroindsind 2022).

The Labour Code requires written contracts, yet informality remains pervasive – about two-thirds of agricultural employment in 2023 (RM Labour Code 2003/2019; ILO 2024a; BNS 2024a). A dual system persists: permanent mechanisers in large farms typically have contracts, health insurance, and earn 10,000–20,000 MDL per month, while seasonal workers are paid in cash without benefits. A medium-sized farm in the Centre reported paying skilled mechanisers ≈ 140 MDL/hour, double the minimum wage, while harvesters were paid by weight (Field Notes, March 2025). Focus groups confirmed recurrent wage delays, especially in drought years: "No production means no wages – or at least delays" (FG mechanisers, Centre, June 2025). Such vulnerability increases dependency and reduces bargaining power for rural households.

Risks of Forced and Child Labour

Forced labour is prohibited by law, and no systemic cases have been identified in sunflower farming (RM Labour Code 2003/2019; ILO 2021a; US DOL 2024; Field Notes, March 2025). However, risks of exploitation persist. Focus groups revealed that some mechanizers' wages depend directly on harvest yields and weather conditions: "The cost per hectare was 12–14,000 lei, but we harvested only 800 kg. If there's no yield, we get no pay" (FG mechanizers, Centre, June 2025). Older workers often continue beyond retirement age out of necessity, as one 77-year-old mechanizer explained: "I have nothing to do at home; I'll keep working as long as I can" (FG employees, Centre, June 2025).

Although discrimination is prohibited, structural inequalities remain (Council of Europe 2024). Agriculture is among Moldova's lowest-paid sectors, with women concentrated in seasonal or auxiliary jobs—canteens, livestock care, or cleaning—representing up to 70 % of seasonal staff in some enterprises (Field Notes, March 2025). While focus groups reported equal pay for the same tasks, women remain underrepresented in mechanized, better-paid positions (FAO 2022). Female participants described a persistent "double burden" of paid and domestic work, with some doubting they would reach retirement age.

The minimum working age is 16, and hazardous work is banned under 18, yet enforcement remains partial. About 97 % of working children in Moldova are in agriculture, mostly on family farms (IPEC, NBS & Dayioğlu 2010; US DOL 2024). The Labour Inspectorate has identified only isolated cases of minors aged 15–16 in day labour, mainly in orchards and smallholder cereal plots (Field Notes, March 2025). Medium and large mechanized sunflower farms generally comply with child-labour prohibitions, though youth and women are occasionally involved in auxiliary activities such as cleaning or food services.

Despite high school enrolment (100 % at primary and secondary levels; BNS 2025), some adolescents continue to assist families during harvests or school vacations. Combining studies with fieldwork exposes them to fatigue and increases the risk of absenteeism or early dropout (ECRI 2024; Field Notes, March 2025). The Labour Code explicitly bans minors from hazardous activities—pesticide application, heavy loads, or machinery operation—but these rules are only partly effective since most child labour occurs informally. In 2022, only 18 child-labour violations were officially recorded, a figure far below the likely reality (US DOL 2022). Overall, children engaged in informal agricultural work, including smallholder sunflower farms, remain insufficiently protected.

Job Safety

Moldova's sunflower value chain is regulated by a solid legal framework on occupational safety and health (OSH), yet implementation remains uneven. The Labour Code and Law No. 186/2008 require employers to ensure safe working conditions, rest periods, training, and personal protective equipment (PPE). Government Decision No. 353/2010 details minimum OSH requirements in contracts, overseen by the State Labour Inspectorate.

Although the legislation is clear, enforcement capacity is weak. The Inspectorate employs only 55 inspectors nationwide and faces restrictions on unannounced visits (Field Notes, March 2025; ILO 2021b; ILO 2024a). Farm managers acknowledged that PPE is provided but inconsistently used. Workers reported avoiding masks in hot weather, with one noting: "We used to wear them, but in the heat it's hard to keep them on" (FG mechanizers, medium farm, Centre, June 2025). Gloves are common, but respirators and masks are often ignored—especially during pesticide mixing, when exposure risk is highest. Workers also recalled the disappearance of post-exposure protections once common under the kolkhoz, such as milk rations (Interview, mechanizer, South, June 2025).

Some larger enterprises have labour protection specialists and regular training sessions, with employees noting improvements in spraying precision and packaging safety, though enforcement remains inconsistent (Field Notes, March 2025; FG employees, Centre, June 2025). Fieldwork confirmed that long hours during harvests often compromise safety: mechanizers and auxiliary staff work up to 12-hour shifts, six or seven days per week, undermining compliance with rest and overtime rules.

When asked about incidents, focus group participants were ambivalent—some denied hearing of serious injuries, while others joked that "a little poison makes you stronger" (FG animal-farm employees, South, June 2025). Official data report low accident rates—fewer than 1 per 1,000 employees, with fatalities under 10%—but these figures likely mask significant underreporting linked to informality and limited oversight (BNS 2024a; ILO 2024a).

Labour inspectors emphasize that protection is strongest in large, formal enterprises, where OSH committees are active and modern machinery reduces risk. By contrast, seasonal and smallholder workers remain most vulnerable, often beyond inspection reach. Day-labour arrangements usually exclude medical insurance, leaving many workers without effective coverage (Prohnițchi & Lupușor 2021).

In response to these shortcomings, an amendment to the law entered into force on 1 June 2026, establishing the "e-Zilieri" registry, which digitally records day labourers' work and counts working hours toward seniority and social protection entitlements. As the reform had only just been introduced when this study was completed, its impact on the formalization of day labour remains unclear (Busuioc 2026).

Overall, job safety in sunflower production is moderate but uneven. A solid legal base exists, but enforcement gaps persist, especially in informal and seasonal work, chemical handling, and during long harvest shifts. Economic pressures, particularly in drought years, encourage corner-cutting on safety. Stronger seasonal inspections, heat-adapted PPE, and simplified day-labour formalization would be key steps toward safer, more sustainable working conditions.

Salaries and Job Attractiveness

Agriculture remains one of Moldova's lowest-paid sectors (Eurofound 2023; BNS 2024a). Yet in sunflower production, some categories—particularly mechanizers, agronomists, and administrative staff—earn salaries comparable to or higher than the national average of 13,170 MDL/month gross in 2024 (≈ 687 EUR) (BNS 2024). Fieldwork confirms that mechanizers and permanent staff may receive up to 20,000 MDL/month (≈ 1,040 EUR) during peak seasons, especially when hourly rates and performance bonuses are included (Field Notes, March 2025; FGs & Interviews, June 2025). However, these peaks are seasonal: wages fall sharply in winter or low-activity periods, and delays are common. Seasonal and casual workers, typically paid informally, earn much less—around 50 MDL/hour—and are most exposed to income instability in drought years (FGs & Interviews, June 2025).

A farm leader from a large cooperative (2,100 ha, Centre) confirmed these patterns: administrative staff earn around 20,000 MDL/month, mechanizers about 14,000 MDL, and seasonal workers 50 MDL/hour. Salaries have reportedly increased by 10–15% annually, with reserves to cover winter wages. Wage levels depend on productivity, market prices, and access to skilled workers. While no gender-based pay gaps were observed, women remain underrepresented in technical jobs (Interview, Centre, September 2025).

Despite relatively competitive wages for skilled staff, agricultural work in sunflower remains unattractive to youth. Only about 21% of the 15–24 labour force works in agriculture (BNS 2024a). Focus groups highlight widespread perceptions of farm work as physically demanding, poorly paid, and offering limited prospects (FGs & Interviews, June 2025). Young women are especially scarce in mechanized or technical roles due to training gaps and gendered expectations (FAO 2022).

The ageing of the rural workforce is striking. Youth (15–24) represent just 2% of total agricultural employment, while workers aged 65+ make up 5%, more than double the share of youth (BNS 2024c). Fieldwork confirmed that most brigades consist of older workers, many continuing beyond retirement age. Among the 48 sunflower farm leaders interviewed, 42 reported having no employees under 29. Agricultural enterprises (AEs) employ a modest share of young workers— in average around 5.5%—while smallholders (SHs) employ about 1.7%, and peasant farms (PFs) reported none at all (Survey 2025).

Labour migration further erodes job attractiveness. Many young Moldovans prefer work abroad or in urban services, viewing agriculture as unstable and exhausting. As one 36-year-old mechanizer put it: "Young people today aren't into tractors like we are" (FG mechanizers, Centre, June 2025).

Working Conditions in Moldova's sunflower value chain are **moderate to low**. Labour legislation is broadly aligned with international standards, but informality, weak labour inspection, and limited enforcement of occupational safety continue to undermine decent work, particularly for seasonal and casual workers. Permanent employees in larger agricultural enterprises benefit from formal contracts, higher wages, and social protection, while women remain overrepresented in lower-paid and informal occupations. Although no evidence of systemic forced or child labour was found, the sector faces persistent challenges related to an ageing workforce, low youth participation, and limited attractiveness of agricultural employment. Strengthening labour formalization, occupational safety, and vocational training would improve both social sustainability and long-term labour resilience.

1. WORKING CONDITIONS	
1.1 Respect of labour rights	Substantial
1.2 Child Labour	Substantial
1.3 Job safety	Moderate/Low
1.4 Attractiveness	Moderate/Low
Average	Moderate/Low

5.2. Land and water rights

Adherence to VGGT and Other International Standards

Moldovan agribusinesses involved in sunflower production rarely make explicit reference to the *Voluntary Guidelines on the Responsible Governance of Tenure (VGGT),* which promote secure tenure, transparency, participation, equity, and sustainability. Nonetheless, both government institutions and private actors broadly follow the spirit of these principles. FAO's 2015 national workshop helped map Moldova's tenure framework and stimulated gradual policy alignment (FAO 2015). Since then, sectoral reforms and corporate practices have increasingly converged with international standards, even if not framed under the VGGT label. Companies tend instead to emphasize compliance with market certifications such as GLOBALG.A.P. and GRASP , while national strategies pursue sustainable land and water management in line with the EU agricultural acquis (GLOBALG.A.P. 2023a; Moldpres 2024; Field Notes, March 2025).

The National Strategy for Agriculture and Rural Development 2023–2030 reinforces this approach, setting objectives for sustainable soil and water use (GRM 2023a). In practice, land access in sunflower production relies mainly on leasing from numerous smallholders, with consolidation occurring gradually and mediated by local leaders linked to farm entrepreneurs (Calancea & Horjan 2006; Field Notes, March 2025). Landowners usually prefer to rent rather than sell, ensuring cash income while preserving long-term rights (FGs & Interviews, June 2025). These informal and personalized leasing practices underpin stability but remain outside formal VGGT frameworks.

International standards on due diligence, such as the Guide to Due Diligence of Agribusiness Projects that Affect Land and Property Rights (2014), are recognized but rarely applied systematically. Moldova's agrarian transformation has evolved through incremental lease-based consolidation rather than large-scale land acquisitions, limiting the relevance and visibility of formal due-diligence procedures (ACSA & FAO 2015). Donor-financed projects, including those supported by EBRD or AFD, may apply such standards, though project-level disclosures remain scarce.

Equity, Compensation and Justice

Locally applied rules in Moldova's sunflower value chain offer a baseline of security for landowners, though equitable access to land and water remains uneven. Production depends largely on lease arrangements between large enterprises and smallholders, who are typically paid in kind. Fieldwork in the South confirmed standard grain rents: "They give 500 kilograms per hectare, even if the harvest is bad" (Plot Owners Discussion, Căușeni, August 2025). Such predictability is valued by owners who depend on grain for flour, feed, or oil, and often use it for informal barter. In Căușeni, landowners reported exchanging part of their in-kind rent for services such as house or yard repairs (Plot Owners Discussion, August 2025).

Payment is more often made in produce than in cash, particularly in rural areas, where grain and sunflower seeds underpin household self-sufficiency. Villagers emphasized the importance of having grain, while absentee or urban owners prefer cash (FG mechanizers, Centre, June 2025). Typical rents range from 400 kg on small farms to 1.3 tons per hectare on large holdings, sometimes supplemented with flour or oil for holidays (FGs & Interviews, June 2025). Grain rents are viewed as fair when contracts are honoured, though they entail storage costs, while cash payments carry inflation risks.

Land remains a vital safety net and inheritance asset. Most households are reluctant to sell, citing attachment, symbolic value, and the need to preserve land for their children: "Land is for the children—we don't sell" (FG employees, Centre, June 2025). Those who do sell are generally heirs abroad or families facing urgent expenses. Sales occur mainly "to survive," with market prices between 50,000–100,000 MDL/ha (~2,500–5,000 EUR). Meanwhile, larger enterprises steadily accumulate plots, reinforcing gradual land concentration at the expense of smallholders.

Gender disparities exacerbate these inequalities: women hold about 36% of farm titles but control only 19% of farmland, usually smaller and less mechanized plots. Despite equal property rights under law, practical and cultural barriers still limit women's effective control over land (FAO 2022).

Alongside leased plots, most rural households maintain backyard gardens crucial for food security, cultivating vegetables, fruit trees, and vines, and raising small livestock. These gardens demand significant labour— "*In the village, even after work, you go home and there's always something to do—the garden, the animals, the house*" (FG employees, Centre, June 2025)—but are considered indispensable sources of food and resilience.

Land access is generally voluntary and contract-based, but dependence on local leaders to mediate leases and payments concentrates power and reduces transparency. While this system ensures stability, it leaves smallholders reliant on personalized, trust-based relations rather than transparent mechanisms (ACSA & FAO 2015; Bajura 2018; Field Notes, June 2025). Disputes are rarely addressed formally through courts; instead, farm leaders—who often double as informal community authorities—handle conflicts, sustaining order but limiting accountability.

In sum, Moldova's sunflower value chain demonstrates stable but unequal systems of equity and justice. Predictable in-kind rents and secure leases provide food security and income stability, yet equity is undermined by land concentration, gender gaps, and a reliance on informal, leader-mediated arrangements rather than transparent and inclusive institutions.

Accessibility of Water for Daily Use and Irrigation

Access to water in Moldova remains uneven between urban and rural areas and between smallholders and large agricultural enterprises. Access to water resources is regulated by Law No. 272/2011, aligned with the EU Water Framework Directive, treating water as a public good. Irrigation and industrial use require permits from the Environment Agency, while domestic wells are freely used under sanitary norms. Large systems are managed by the Agency for Land Improvements and Irrigation or by Water Users Associations (WUAs), yet only 10–12% of arable land is irrigated due to degraded infrastructure (Overcenco, Arhip & Traistă 2021). Most sunflower and maize farms rely on wells, ponds, or small pumps, with local farm leaders mediating access. Focus groups, especially in southern districts, reported severe shortages: "There's no water. The spring channel is dry; even the pond is dry" (FG animal farm, South, June 2025).

Data from the ICJPS 2025 Social Resilience Survey confirm these disparities: nearly half of urban respondents rate piped water services as "rather high" or "very high" quality (49.6% and 24.9%), while only about one quarter of rural respondents share this view. In rural areas, 21.9% report no piped service, and 12.1% rate quality as "very low", compared to just 2.9% and 4.8% in urban zones (ICJPS Survey 2025).
Focus group data illustrate these contrasts. Some central villages rely on artesian wells: "We have water from an artesian well—the whole village uses it" (FG mechanizers, Centre, June 2025). Others trust deep groundwater despite unclear testing: "We use artesian water—from over 100 meters deep. The best filter is the earth itself" (FG pig-farm employees, South, June 2025). Yet inequalities persist: while some communities have sufficient clean water, others face chronic shortages (FGs & Interviews, June 2025).

For agriculture, about 217,000 ha are equipped for irrigation, but far less is irrigated annually due to degraded Soviet-era systems and high pumping costs (GRM 2023a; Overcenco, Arhip & Traistă 2021). Farmers consistently note dependence on rainfall: "We do everything on time, but still… it all depends on nature" (FG animal farm employees, South, June 2025). Survey results confirm this pattern: climate and irrigation constraints were the most cited production challenges (28 mentions across 48 respondents), and irrigation improvements the top proposed solution (13 mentions). Larger, better-capitalized farms near major rivers retain greater irrigation access, while smallholders in central and southern areas rely on wells, ponds, or informal pumps, leaving them highly exposed to drought (World Bank 2023a).

These water deficits amplify tenure-related challenges. Chronic droughts, limited irrigation, and poor infrastructure continue to constrain productivity and investment, directly affecting the value of leased land and discouraging long-term improvements (GRM 2023a; ACSA & FAO 2022; Field Notes, March 2025). Despite strong policy intentions, a significant gap persists between national water management goals and local realities in Moldova's sunflower-producing regions.

Despite supportive legal provisions and international programs (FAO, AFD, Swedish Environment Institute), significant inequalities persist. Larger farms benefit from established irrigation networks, whereas smallholders remain dependent on groundwater and rainfall—making them particularly vulnerable to climate variability.

Land and Water Rights in Moldova's sunflower value chain are **substantial**, supported by secure land tenure, predictable lease arrangements, and a legal framework broadly aligned with international standards. In-kind lease payments provide an important source of household income and food security, while land remains a key family asset. However, gradual land concentration, gender disparities, and informal, leader-mediated leasing limit equity and transparency. Water access remains the main constraint: irrigation infrastructure is underdeveloped, leaving most farms dependent on rainfall and exposing smallholders to recurrent droughts. Improving irrigation and water governance is therefore essential for the sector's long-term resilience.

2. LAND & WATER RIGHTS	
2.1 Adherence to VGGT	Substantial
2.2 Transparency, participation and consultation	Substantial
2.3 Equity, compensation and justice	Substantial
Average	Substantial

5.3. Gender equality

Economic Activities: Women's Participation and Risks of Exclusion

Despite a comprehensive legal framework supporting gender equality, significant disparities persist in Moldova's agricultural sector, particularly in the sunflower value chain. Women are visible across production stages but their work remains largely informal, low-paid, and offers limited advancement. Informality, task segregation, and

restricted access to training and machinery continue to reinforce structural inequalities. National data show that women represent about 42% of the agricultural workforce. Their participation is highest in family-based farming, where over 70% of unpaid family workers are women, underscoring their essential yet undervalued role. By contrast, they account for only one-third of salaried employees, reflecting unequal access to formal, better-paid jobs. Among farm owners, women remain a minority (BNS 2024c), mirroring broader gaps in land access, decision-making, and mechanized farming.

Historically, women were underrepresented among registered farm managers—only 14.3% in 2011 (494 of 3,446). They were also less likely to hold higher agricultural education (28.9% vs. 44% of men) and more likely to have none (42.9% vs. 29.7%) (BNS 2011). These patterns reveal enduring barriers to education, leadership, and professionalization in formal agriculture. Survey data confirm the gendered division of labour. In sunflower production, women represent roughly 27% of workers in SHs, 30% in PFs, and 21% in AEs, showing persistent underrepresentation in larger, mechanized enterprises (Survey 2025 – see Table 5–1). Technical roles—tractor driving, spraying, combine operation—are almost exclusively male, while women perform manual and auxiliary tasks (Field Notes, March 2025; FGs & Interviews, June 2025). The Gender Equality Programme (2023–2027) aims to close these gaps, but field evidence shows limited progress (MMPS RM 2023; FAO 2022).

TABLE 5–1: EMPLOYMENT STRUCTURE BY FARM CATEGORY – SUNFLOWER VC

Farm category	Technical staff (avg. no.)	Mechanizers (avg. no.)	Other employees (avg. no.)	Women (%)	Youth <30 (%)
PF – Peasant Farms	1.59	1.59	1.24	29.9%	0%
AE – Agricultural Enterprises	4.25	6.25	25.88	20.9%	5.53%
SH – Smallholders	0.70	0.57	0.20	26.7%	1.67%
Total (sample)	**2.20**	**2.82**	**9.13**	**25.9%**	**2.36%**

Source: VCA4D field survey conducted in August–September 2025 (n = 48). Values are rounded for clarity.

Vocational education continues to reproduce gender inequalities. In 2023/24, women made up *15–20%* of students in agricultural specializations (BNS 2024d). As one worker observed: *"If a woman trained for tractors and combines, she could do the job as well as a man. But in that class, there were no girls"* (FG employees, Centre, July 2025). National data (BNS 2024c) show that women form a majority (53%) of skilled agricultural workers with higher education, but remain a minority among those with secondary or vocational training (25–40%), reflecting men's dominance in technical fields.

While equal pay for equal work is generally respected, access to better-paid positions remains limited. Employees in a southern farm confirmed equal wages for identical tasks but noted that *"there are fewer women who are trained, and that makes the difference"* (FG, South, June 2025). FAO (2022) describes this as a *skills pipeline problem*: cultural and structural barriers discourage women from technical training, reinforcing occupational segregation. The gender pay gap in agriculture remains around 15–17% (ILO 2024b; BNS 2024a), roughly matching the national average.

Informal and precarious employment also heightens exclusion. The Labour Force Survey shows that 83.7% of women in individual agricultural enterprises work without contracts, compared to 44% of men. Even in larger enterprises, over 50% of female employees remain informal (BNS 2024e; FAO 2022). The 2017 Day Labourer Law was designed to regulate short-term contracts, but seasonal female workers rarely benefit from social or medical insurance (Prohnițchi & Lupușor 2021). A recent amendment to the law aims to further formalize day labour and extend social protection coverage to day labourers (Busuioc 2026).

Despite these barriers, women play vital roles in sunflower production. As smallholders, they diversify crops for household food security and local sales. Smallholders overall contribute about one-third of sunflower yield but only 5% of sunflower output (BNS 2024a). Female landholdings are 60–70% the size of male-headed farms, pushing women toward mixed or vegetable farming (FAO 2022; Field Notes, June 2025). Women make up about 70% of seasonal workers in large sunflower farms, typically employed as day labourers (Field Notes, June 2025).

Women are also concentrated in post-harvest processing and trade, mostly in low-paid sorting or cleaning jobs and local markets, while men dominate bulk trade and export. However, women are increasingly visible in administration and accounting, particularly in medium and large enterprises, earning around 11,000 MDL/month (€570) with formal contracts and partial financial responsibility (Field Notes, March 2025). National data indicate that women hold about half of administrative posts in agricultural enterprises and over 75% in rural public administration (BNS 2024c), underscoring their important yet under-recognized contribution to rural governance.

Access to Resources and Services

Women in rural Moldova own very few productive assets beyond land. According to FAO's national gender profile, they hold less than 12% of agricultural machinery overall and only 8% of irrigation equipment; 92% of holdings with irrigation systems are male-headed (FAO 2022). These disparities limit productivity and adaptation to recurrent droughts. Smallholders in general use outdated machinery and rarely invest in new equipment, a disadvantage particularly acute for women, who already have lower asset control (FAO 2019; FGs & Interviews, June 2025). Some female employees noted that while backyard plots enhance food security, they also increase workloads when combined with paid employment (FGs & Interviews, June 2025). The male-dominated technical workforce, with women concentrated in non-mechanized roles, perpetuates unequal access to productive assets.

Moldova's legislation guarantees gender equality and non-discrimination in agriculture (MMPS RM 2023; GRM 2023a), yet women remain disadvantaged in land control. Although roughly one-third of farm holders are women, they manage only 19% of total farmland, with significantly smaller plots (FAO 2022). This limits their ability to use land as collateral, weakens bargaining power, and constrains access to higher-value segments of the sunflower chain.

Agricultural credit remains costly and collateral-based, restricting many smallholders (FAO 2022). A MAIB consultant reported that women and men formally have equal access to loans, and the share of female business borrowers has grown from 8.8% to 22–25% in recent years, reflecting gradual shifts in mentality and stronger state support (Field Notes, March 2025). Local authorities in one central district also promote women's entrepreneurship through initiatives like the "Made in Moldova" exhibition (Field Notes, March 2025).

Despite this progress, structural barriers persist. Mechanized and capital-intensive agricultural activity is still perceived as a "male" occupation, leading more men to apply for loans (FGs & Interviews, June 2025). Field and survey data show mixed uptake: some farms modernize via credit or subsidies, while others remain cautious due to debt risk (Field Notes, March 2025; Survey 2025). Donor and state programs—such as AIPA, MAFI, IFAD, and ODIMM schemes—target women and youth but have limited reach (FAO 2019; FAO 2022; AIPA 2025).

Women farmers also participate less in extension and training, representing under one-third of all attendees (FAO 2022; BNS 2024a). Many find the advice infrequent or overly general, relying instead on informal networks (FGs & Interviews, June 2025). While several advisory programs target small producers, gaps remain in gender-sensitive content and accessibility, constrained by time, travel, and communication barriers (Eurofound 2023; DTDA 2023).

Access to agricultural inputs remains a persistent challenge. Most inputs are imported, expensive, and scarce locally—a burden affecting all farmers but especially women, who possess fewer assets and weaker market networks (FAO 2022; FGs & Interviews, June 2025).

Leadership, Decision Making, and Empowerment of Women

Women in Moldova participate in local groups and some producer or worker structures, but membership in farm unions or associations remains limited compared to sectors such as education or health. Union presence in cereal and sunflower enterprises is generally weak, leaving few formal channels for women's collective voice (Eurofound 2023; DTDA 2023). Instead, women often rely on informal mutual-aid networks or engage through administrative and financial teams that connect them to organizational processes even without union membership (FAO 2022; Field Notes, March 2025; FGs & Interviews, June 2025).

At the enterprise level, women are mainly employed in administrative and financial roles—accounting, payroll, and HR. In 2024, they held about half of administrative positions in agricultural enterprises, despite representing

only 42% of the total agricultural workforce (BNS 2024c). These posts can involve small-team coordination and sometimes serve as entry points to leadership, yet management of producer groups, farm associations, and mechanized operations remains overwhelmingly male. Partial data from the National Bureau of Statistics show that women farm or cooperative leaders are almost absent (BNS 2024c).

According to FAO (2022), women's access to leadership in agriculture is constrained by structural barriers—limited ownership of assets, underrepresentation in training, and time poverty linked to unpaid care work. Field evidence confirms that few women advance into senior posts tied to mechanized production, irrigation, or marketing. A notable exception is the Agrostoc cooperative, where women make up about 30% of the marketing department. Local authorities have also promoted female agricultural entrepreneurs at national events (Field Notes, March 2025).

Women's influence within enterprises is often indirect. Accountants and administrators contribute to budgeting and compliance, shaping financial decisions, but strategic calls on irrigation, input purchases, or marketing remain in male hands (FAO 2022; Field Notes, March 2025). In public programs such as irrigation and land consolidation, women—especially smallholders—are underrepresented where co-financing and technical skills are required (FAO 2022; FGs & Interviews, June 2025).

Women are active in workplace and community discussions on welfare and HR issues and join informal solidarity networks, yet remain less visible in technical and investment forums where key production choices are made. This limited presence reflects structural and cultural barriers: weak unions, unequal access to training, and "double-shift" responsibilities that restrict time and confidence to engage in decision-making (Eurofound 2023; FAO 2022; FGs & Interviews, June 2025).

At the community level, women's civic participation slightly exceeds men's. The ICJPS 2025 survey shows that 23.6% of women (vs. 20.5% of men) sometimes attend community meetings, while 9.6% (vs. 5.4%) participate very frequently. In voluntary activities, 17.8% of women (vs. 12.0% of men) report occasional involvement, with rural women more active than urban ones (35.1% vs. 21.7%) (ICJPS 2025).

Women play a tangible organizational role in administration and finance within the sunflower chain, particularly in larger enterprises. Yet leadership and agenda-setting power remain concentrated in male-dominated technical domains. Expanding women's access to machinery and irrigation training, stronger women-focused producer groups, and inclusive consultation mechanisms could enhance their influence across agricultural enterprises and rural communities.

Hardship and Division of Labour

Field evidence consistently highlights the "double shift" borne by rural women in Moldova—combining agricultural work with household and care duties. Time-use surveys confirm this imbalance: women spend on average 4.6 hours per day on unpaid domestic and care work (3.8 among employed women), while men spend less time on such activities and more on paid work (Palihovici 2021). Earlier analyses found women devote substantially more time than men to unpaid work, reinforcing a persistent gender gap (BNS 2013; Palihovici 2021). National statistics also show that women represent about 75% of unpaid family farm workers, underscoring their concentration in invisible labour (BNS 2024c).

In sunflower enterprises, women's roles cluster in administration, canteens, livestock care, and seasonal post-harvest tasks. These jobs align with family schedules but add to workloads and reduce rest. As canteen workers explained: "We work both at home and at the canteen… We do both men's and women's work. Everything. But we grew up during tougher times" (FG canteen workers, June 2025).

Mechanization has reduced some heavy manual labour, yet women remain underrepresented in mechanized posts, where physical strain is lower. They more often perform repetitive or physically demanding tasks—cleaning, canteen work, sorting—where ergonomic risks and fatigue are high (Field Notes, March 2025; FGs & Interviews, June 2025).

Moldova's OSH legislation requires safe working conditions and training (ILO), but enforcement is uneven, especially in seasonal and informal work. This results in gaps in protective equipment, safe lifting practices, and

heat-stress prevention. Interviews reveal that some small farms hire informally "on the black market," bypassing contracts and OSH safeguards (Field Notes, March 2025). Limited access to machinery training and irrigation-user groups further restricts women's adoption of labour-saving technologies (Field Notes, March 2025; DTDA 2023).

In sum, women in sunflower production face cumulative burdens: heavier workloads due to the "double shift," concentration in low-status and physically demanding jobs, and weaker OSH protection. Expanding women's access to mechanization training, formalizing seasonal work, and strengthening OSH enforcement would help reduce risks and improve wellbeing across the chain.

Gender Equality in Moldova's sunflower value chain is **moderate to low**. Women make an essential contribution across production, processing, and administration, yet remain concentrated in lower-paid, informal, and auxiliary occupations, with limited representation in mechanized work and leadership positions. Despite a comprehensive legal framework, structural barriers continue to restrict women's access to land, agricultural machinery, irrigation equipment, vocational training, finance, and decision-making. Informality and the gender pay gap remain significant, while many women also carry a disproportionate burden of unpaid household and care work. Strengthening women's access to productive assets, technical training, leadership opportunities, and formal employment would improve both gender equality and the long-term resilience of the sunflower value chain.

3. GENDER EQUALITY	
3.1 Economic activities	Substantial
3.2 Access to resources and services	Moderate/Low
3.3 Decision making	Moderate/Low
3.4 Leadership and empowerment	Substantial
3.5 Hardship and division of labour	Moderate/Low
Average	Moderate/Low

5.4. Food and nutrition security

Availability of Food

At the national level, food availability is not a critical issue. Moldova's production of cereals (wheat, maize) and sunflower has consistently met domestic demand, even amid external disruptions (WFP 2022; WFP 2024). However, output remains highly climate-sensitive. Managers and workers described 2020–2024 as repeated "dry years"; enterprise data show maize yields fell in 2024 versus 2023, while sunflower proved the most drought-resilient crop (FGs & Interviews, June 2025; Field Notes, March 2025). Short lease horizons and extensive, low-value rotations continue to limit investment, especially in irrigation, despite government strategies promoting rehabilitation, storage upgrades, and logistics modernization (GRM 2023a; UN Moldova 2023; Bajura & Gandacova 2023).

WFP (2024) notes that 57% of Moldovans depend on climate-sensitive agriculture; agriculture's GDP share dropped to 8% in 2022, and the country faces 4–5 severe droughts and 1–2 major floods per decade. Field data from March 2025 confirm this pattern (sunflower yields ~2–2.5 t/ha), with managers systematically planting sunflower in rotations as a hedge against drought (Field Notes, March 2025).

Despite repeated shocks, staple availability has been largely maintained. FAO and WFP (2022) confirm that domestic cereals covered consumption needs even as prices spiked during the war-related logistics crisis. WFP (2024) highlights market inefficiencies and climate risks but supports government interventions through social food services, vouchers, and cash transfers to sustain access to staples. At community level, in-kind lease payments (wheat, maize, sunflower) remain a crucial buffer—typically 500–800 kg grain/ha, used for household flour, oil, and feed (Field Notes, March 2025). As one focus group noted: "Some grind the wheat into flour; others press sunflower seeds into oil—it's more convenient to make your own" (FG employees, Centre, June 2025).

Contribution of sunflower to daily diets

Sunflower, particularly sunflower oil, remain central to the Moldovan food system both nationally and in rural households. Although sunflower is generally more drought-resilient than maize, its yields also fluctuate in dry years, and seed quality may be compromised by poor weather conditions, albeit to a lesser extent (Duca, Boian, & Domenco 2022).

Sunflower has a prominent dietary role, primarily through sunflower oil. It is an everyday cooking fat, found in soups, fried dishes, preserves, and salads. Processing is often local: many families press sunflower seeds obtained through lease payments at local oil presses for household consumption (FGs & Interviews, June 2025). According to FAOSTAT food balance data, the food supply quantity of sunflower oil in Moldova was about 7.8 kg per capita per year in 2022, below Romania (12.4 kg) but slightly above Ukraine (6.1 kg) and France (5.4 kg). At the same time, Moldova's overall vegetable oil supply is relatively modest—around 10.9 kg/capita—compared to Romania (18.6 kg), Ukraine (18.0 kg), or developed European countries such as France (21.2 kg) (FAOSTAT 2022). This contrast suggests that sunflower oil accounts for a disproportionately high share of total vegetable oil consumption in Moldova, far more than in neighbouring or Western countries, where diets are more diversified across other oils (rapeseed, olive, soybean).

Sunflower continue to underpin Moldova's food security and dietary patterns, especially in rural areas where home-pressed sunflower oil remains an everyday staple. FAOSTAT data confirm a relatively low overall vegetable oil supply, but with sunflower oil accounting for an unusually high share. This reliance secures caloric sufficiency, yet it also reflects a diet heavily weighted toward cereals and oils, with implications for nutritional balance and resilience in the face of climate and market shocks.

Accessibility of Food

Since 2022, food accessibility in Moldova has been constrained by declining real incomes and rising living costs. Poverty has deepened: nearly one in three Moldovans now lives below the poverty line, with 14% in extreme poverty. Rural households—especially those headed by women, pensioners, or persons with disabilities—are most affected (WFP 2024; UN Moldova 2023). Food represents a major expense, accounting for 41% of household budgets, rising to 57% among the poorest quintile and nearly 50% among large families (WFP 2024; BNS 2025). Energy poverty, affecting around 60% of households, further limits disposable income for food (WFP 2024).

Agriculture remains central to rural livelihoods, yet wages are among the lowest in the economy. Smallholders produce 62% of national output, but agricultural pay averages 34% below the national mean (WFP 2024). Field research reveals strong disparities: skilled mechanizers earn 15–22,000 MDL/month in peak seasons, while canteen staff, livestock keepers, and seasonal workers earn far less, often facing winter gaps or delayed payments (Field Notes, March 2025; FGs & Interviews, June 2025). Only a minority of rural workers secure stable incomes; most remain highly vulnerable to inflation and food price shocks.

The war in Ukraine, rising energy costs, and recurrent droughts have driven up prices for bread, cereals, and edible oils (UN Moldova 2023; WFP 2022). To cope, rural households rely on non-cash mechanisms, especially in-kind lease rents of wheat, maize, and sunflower, which ensure secure access to staples and function as barter during price volatility (Field Notes, March 2025). These rents are often processed locally into flour or sunflower oil, maintaining household availability even in poor harvests (FGs & Interviews, June 2025). Remittances from family members working abroad also represent a crucial source of income and survival for many rural households, cushioning food insecurity and enabling occasional investment in housing or farm inputs (Crivellaro & Vittuari 2025). Backyard gardens and poultry further supplement food access, though at the cost of significant time and labour (Sturza & Moșanu 2021).

The sunflower value chain supports food access by supplying staples, wage income, and in-kind payments. Yet its seasonal and mechanized structure, coupled with persistent wage gaps, leaves many rural workers price-exposed and income-insecure. In the long term, greater formalization of agricultural work, targeted skills training, and better integration of local producers into social food services are needed to turn participation in these chains into more stable and equitable food access (DTDA 2023; Eurofound 2023; UN Moldova 2023).

Utilization and Nutritional Adequacy

Moldova's food supply generally meets caloric needs but remains nutritionally unbalanced. Diets are dominated by cereals, bread, and sunflower oil, while protein-rich foods, fruits, and vegetables are consumed less frequently (GRM 2023b; UN Moldova 2023). Anaemia affects about 26% of women of reproductive age and young children, reflecting poor dietary diversity and limited micronutrient intake (WFP 2024). At the same time, obesity affects roughly 19% of adults and is rising—evidence of a double burden of malnutrition combining undernutrition with diet-related chronic diseases (Sturza & Moșanu 2021).

Sunflower oil remains central to Moldovan diets, reflecting historical patterns and limited diversification. Compared to neighbouring countries, Moldova's vegetable oil supply is relatively low, making sunflower oil a disproportionately important fat source. Around 77% of households use sunflower oil as their main cooking fat, while animal fats play a minor role (Chirsanova et al. 2020). Although sunflower oil provides unsaturated fatty acids and vitamin E, its high omega-6 and low omega-3 content makes exclusive reliance nutritionally imbalanced (Nakonechna et al. 2024). Traditional practices reinforce these trends: many households continue to press sunflower oil locally from leased quotas or garden plots (FGs & Interviews, June, August 2025).

Climate and plant-health risks further constrain sunflower supply. Though more drought-resilient than maize, severe droughts in 2007, 2012, and 2020 cut yields by up to half nationwide, revealing the crop's ongoing vulnerability despite technological progress (Duca et al. 2022; WFP 2024).

Protein access has declined with the long-term fall in small-scale livestock production. Between 1990 and 2024, livestock numbers in Moldova—particularly cattle, pigs, and sheep—declined several-fold, with the most pronounced reductions occurring in the 1990s. Cattle experienced the sharpest decline (by more than three to four times), followed by pigs and sheep (by around two to three times). At the same time, production shifted from agricultural enterprises to household farms, which became the main holders of livestock. This dual structure has persisted through 2024, despite a modest recovery in the commercial sector (BNS, 2025d). Dairy output now meets only two-thirds of demand, with the cattle herd four times smaller than two decades ago (Apostu 2024). Field evidence confirms: "People don't keep cows or pigs anymore, not even goats" (FGs & Interviews, June 2025). Backyard poultry persists, but the loss of household livestock has reduced access to milk, meat, and barter income, increasing dependence on cereals, oil, and gardens.

Policy frameworks promote better dietary quality through more fruit, vegetables, and protein (GRM 2023b; UN Moldova 2023). The WFP 2024–26 plan includes nutrition education via school meals, community kitchens, and food vouchers to diversify diets while sourcing from local producers.

Nationally, the sunflower value chain secures caloric supply through oils; locally, in-kind lease payments stabilize access but entrench grain- and oil-heavy diets. Without improved access to protein and micronutrient-rich foods, these patterns risk perpetuating Moldova's existing nutritional imbalances (WFP 2024; Chirsanova et al. 2020; Sturza & Moșanu 2021; Field Notes, March 2025).

Food Stability

Outright caloric shortages are now uncommon, as domestic cereal output and in-kind lease payments from sunflower provide a baseline of staple access even in poor harvest years (WFP 2024; FGs & Interviews, June–August 2025). Focus groups described leased plots as a critical safety net, while land sales are widely resisted, underscoring their role as long-term security assets (FGs & Interviews, June 2025). Backyard gardens further supplement leased plots with vegetables, fruit, and preserves, though they require significant labour (FGs & Interviews, June 2025).

This safety net, however, is increasingly strained by climate volatility. Recurrent droughts have reduced sunflower yields (Duca et al. 2022), while changing humidity and temperatures heighten risks of fungal contamination and mycotoxins (Grajdieru et al. 2024). These hazards compound seasonal instability, affecting both the quantity and safety of staples consumed directly and indirectly via feed. The WFP 2024–26 plan integrates shock-responsive cash transfers and local food-service investments to stabilize access during lean and crisis periods (WFP 2024).

Since 2022, spikes in food and energy prices—exacerbated by war-related disruptions and drought—have driven sharp volatility in bread, cereals, and oils (UN Moldova 2023; WFP 2022). Low-paid and seasonal workers are especially exposed, often depending on in-kind rents to offset unaffordable prices (FGs & Interviews, June 2025). Government strategies aim to expand storage, modernize grain conditioning, and promote domestic processing to curb import dependence and price swings (GRM 2023b).

The sunflower value chain plays a stabilizing role nationally and locally. It keeps staples on markets, provides in-kind rents that buffer rural households during lean months, and generates seasonal jobs. Yet this stability remains fragile and depends on investment in irrigation, storage, logistics, and adaptive social protection (Field Notes, March 2025; FGs & Interviews, June 2025; WFP 2024).

Moldova's food availability is broadly sufficient—cereals and sunflower meet domestic demand—but production is fragile, repeatedly hit by drought and food-safety risks. Accessibility is the key constraint: poverty, energy costs, and seasonal wages push households to rely on in-kind rents and backyard plots. Utilization remains imbalanced—diets dense in sunflower oil but low in protein and micronutrients—while stability, supported by sunflower flows, depends on stronger irrigation, storage, quality control, and responsive protection systems.

Food and Nutrition Security in Moldova's sunflower value chain is **substantial**. Domestic sunflower production contributes significantly to national food security by ensuring a stable supply of edible oil and providing rural households with in-kind lease payments that support food access and resilience. Compared with maize, sunflower is relatively drought-tolerant, although recurrent droughts, climate change, and food-safety risks continue to threaten production stability. Accessibility remains constrained by rural poverty, seasonal employment, and rising food and energy prices, making many households dependent on remittances, backyard production, and in-kind rents. While sunflower oil is a staple of Moldovan diets, excessive reliance on cereals and vegetable oils, combined with limited consumption of protein- and micronutrient-rich foods, contributes to persistent nutritional imbalances.

4. FOOD AND NUTRITION SECURITY	
4.1 Availability of food	Substantial
4.2 Accessibility of food	Moderate/Low
4.3 Utilisation and nutritional adequacy	Substantial
4.4 Food stability	Substantial
Average	Substantial

5.5. Social capital

Strength of Producer Organisations

Cooperative producer organizations in Moldova's sunflower value chain remain fragile and unevenly developed. Field missions revealed that many farms—especially peasant farms (PFs)—prefer individual machinery leasing and rely on vertical ties with farm operators rather than horizontal cooperation. As one mechanizer from a medium-sized farm in the Centre region explained: "We helped another company that had land but not enough equipment in 2022, but once they bought their own machines, we went back to working just for our boss" (FG mechanizers, Centre, July 2025). Such short-lived initiatives illustrate Moldova's weak cooperative culture.

Farmer managers frequently noted that local producers "do not get along with each other" and tend to compete rather than cooperate (Field Notes, March 2025; FGs & Interviews, June 2025). Survey data confirm this: when asked about main problems in sunflower production, respondents cited access to inputs, storage, markets, and credit, but only one of 48 mentioned cooperation. This underscores the limited role of formal collective action. The reluctance of small farms to join larger structures may also represent a form of "tacit resistance" or quiet food sovereignty—a strategy to safeguard local autonomy and food security (Visser et al. 2015; Piras et al. 2021).

Despite this reluctance, a notable share of legal holdings are organized as cooperatives. The 2011 Agricultural Census recorded cooperatives as 5.9% of registered holdings, managing 11.7% of total farmland (BNS 2011).

Interviews suggest these units show relatively higher efficiency and productivity, and their role may be expanding. Models like the Agrostoc cooperative, with over 150 members managing 130,000 ha, provide joint access to inputs, silos, seed production, and advocacy. Similarly, Hîrtop Mare pools resources for shared storage. While cooperatives still face distrust due to associations with kolkhozes and weak management, studies show strong potential to rebuild trust and resilience if well governed (Ignat 2017; Moraru et al. 2018; Savga & Savga 2024; Hejkrlík & Chaloupková 2021). This view was echoed by a large-farm manager in Criuleni, who argued that "well-organized cooperatives could counter market volatility" (FGs & Interviews, June 2025).

Inclusivity remains uneven. Larger, better-capitalized enterprises (AEs) are more likely to join cooperatives, while smallholders—and especially women—remain under-represented. AEs benefit from easier access to storage, bargaining platforms, and export markets, whereas PFs often lack sufficient output for collective sales. As one smallholder in Criuleni put it: "For us the problem is not producing, but selling. We have no one to cooperate with, not enough quantity to reach the market" (Field Notes, March 2025).

Leadership practices remain highly personalized, with workers depending on direct managers. This vertical dynamic recurred across focus groups (FGs & Interviews, June 2025). Yet cooperative governance models—such as Agrostoc's board structure—demonstrate that more accountable leadership is possible. Research also highlights transformational leadership as key to building trust and inclusiveness, helping cooperatives move beyond Soviet-style management (Hejkrlík & Leon 2021).

Market power remains limited for individual smallholders but strengthens under collective action. Agrostoc reduces costs by pooling demand for fertilizers and seeds, while Hîrtop Mare improves bargaining power by aggregating output. In contrast, many farmer unions are seen as weak or politicized: "Farmers' Force destroys more than it does—they play politics, not agriculture," remarked one manager (Field Notes, March 2025).

Overall, producer organizations in Moldova's sunflower chain show low cooperation but high potential. Despite persistent distrust and practical barriers, successful cases such as Agrostoc and Hîrtop Mare demonstrate that cooperatives can enhance inclusivity, bargaining power, and social capital.

Information Access and Knowledge Practices

Access to agricultural information among sunflower producers is uneven and shaped by farm size and leadership. Larger enterprises benefit from direct ties with banks, processors, or cooperatives, while peasant farms and households rely on local leaders or informal networks. During focus groups, many workers said their main source of knowledge remained the farm manager: "Mostly from our manager. He's proactive—he looks into things, learns, and passes the info to us" (FG mechanizers, Centre, July 2025).

Workers in auxiliary roles (e.g. canteens) depend more on traditional knowledge, combining home recipes with occasional external tips: "What I learned at home… dumplings, meatballs, schnitzels. Here, everything is from home. They say it tastes like mom's cooking" (FG canteen workers, South, July 2025). When seeking information independently, farmers often turn to the internet or social media, though time and resources limit consistent use (Field Notes, March 2025).

Survey data (ICJPS 2025) confirm that community meetings, local authorities, and local media remain key information sources, with persistent rural–urban gaps. These findings mirror broader research highlighting weak institutional advisory systems and farmers' reliance on personalized, informal knowledge networks (Ignat et al. 2017; Moraru et al. 2018).

Trust Between Actors

Trust in the sunflower value chain is largely personal and localized. Farmers and workers express confidence in their immediate peers or leaders but little in wider institutions: "We trust our boss and each other—but beyond that, trust is zero" (FG mechanizers, Centre, July 2025). This reflects vertical trust centred on farm leaders, who often maintain ties with local authorities, mayors, or police—relationships that reinforce authority but not broader inclusiveness or horizontal networks.

The ICJPS Survey (May 2025) confirms low levels of generalized trust in Moldova: only 7.6% of respondents agreed that "most people can be trusted," while 39.1% believed that "one must always be cautious," with rural residents

being notably more distrustful than urban ones. Against this background of broadly low social trust, our VCA4D survey shows moderate, domain-specific confidence in key institutions among sunflower producers. Farmers reported average trust scores of around 3.5–3.7 for banks, 3.2–3.3 for processing companies, and 3.3–3.4 for government authorities, while trust in other farms was slightly lower (2.9–3.5). Although agricultural enterprises tend to express somewhat higher trust in banks and authorities than peasant farms, and smallholders the lowest, overall differences between categories remain modest (Survey 2025).

Field visits indicate that trust grows through repeated personal interactions. One southern farm leader, who initially "did not trust anyone," later listed trusted partners—farmers, landowners, banks, processors, and the Farmers' Force association (Field Notes, March 2025). This shows both caution and selective, experience-based trust-building.

Survey data on credit access (ICJPS 2025) highlight structural barriers: high collateral, bureaucracy, and rigid loan terms. Participants contrasted distrust of microfinance institutions with growing confidence in major banks like MAIB, praised for flexible repayment (FGs & Interviews, June 2025).

Overall, trust networks in Moldova's sunflower chain remain narrow and person-centred. Farm leaders act as main brokers of both knowledge and trust, while cooperatives, unions, and government retain limited credibility. Yet medium trust in banks and processors—and examples of stable partnerships—show that confidence can gradually be strengthened.

Social Involvement

Participation in formal decision-making around sunflower agriculture remains limited. Lease contracts with farm leaders are the main interface, ensuring continuity but leaving little room for genuine community input. Focus groups confirmed that farm managers make production decisions, while villagers are merely informed. Workers described themselves as "told what to do," with only rare chances to suggest alternatives before final decisions (FG animal farm, South, July 2025).

ICJPS survey data confirm low civic participation: only about 25% of respondents attended community meetings frequently in the past three years, while 40.3% never did and another 15% "rarely" (ICJPS Survey 2025). Rural residents are slightly more active, but overall engagement remains weak.

Traditional practices—seed saving, small livestock care, food preservation, and barter—continue to complement wage work in sunflower farms. Women, in particular, combine seasonal labour with household processing and animal care. As one worker explained, their recipes rely on skills "learned at home" (FG canteen workers, South, July 2025). Yet no systematic policies integrate such knowledge into agribusiness governance. Climate stress, especially drought, further limits local water management practices like ponds or wells. Traditional knowledge thus persists informally rather than institutionally.

Voluntary collective action is also modest: 51.6% of respondents said they never took part in community activities in the past three years, while only 8% participated frequently (ICJPS Survey 2025). Field evidence echoes this decline. Older mutual-aid practices of *clacă*—helping with harvests or construction—have mostly vanished. "That sense of community used to be stronger—people would come help, make *plăcinte* together. Now everyone hires workers" (Interview employees, Centre, June 2025). Solidarity now centres mainly on family or kinship.

Some agricultural enterprises still act as social anchors. One southern farm, for instance, cooperated with the village council to provide daily free lunches to over ten elderly villagers (FG canteen workers, June 2025). Employees saw this as part of the farm's role in maintaining community cohesion, with the director often doubling as an informal leader.

Overall, social involvement in the sunflower value chain remains weakly institutionalized. Participation in governance and voluntary activity is low, and traditional knowledge survives mainly at household level. Where solidarity exists, it is mediated by enterprises or kin networks. Yet both field evidence and literature agree: well-governed cooperatives and transformational leadership can mobilize collective action, strengthen bargaining power, and reinforce rural cohesion (Visser et al. 2015; Moraru et al. 2018; Hejkrlík et al. 2023).

Social Capital in Moldova's sunflower value chain is **moderate to low**. Cooperation among producers remains limited, with most farmers relying on personalized relationships rather than formal producer organizations or collective action. Successful cooperatives such as Agrostoc demonstrate the potential to improve bargaining power, access to inputs, storage, and markets, but participation remains uneven, particularly among smallholders and women. Information and trust are concentrated around farm leaders and informal networks, while confidence in public institutions and producer associations remains relatively weak. Strengthening well-governed cooperatives, advisory services, market transparency, and inclusive participation would enhance resilience, innovation, and collective capacity across the sunflower value chain.

5. SOCIAL CAPITAL	
5.1 Strength of producer organisations	Substantial
5.2 Information and confidence	Substantial
5.3 Social involvement	Moderate/Low
Average	Moderate/Low

5.6. Living conditions

Health Services

Over the last decade, Moldova's health system has made notable progress in expanding medical coverage and infrastructure. The mandatory insurance scheme (CNAM) now covers most citizens, while optimization reforms have modernized facilities, improved equipment in district hospitals, and strengthened the family medicine network. These changes aimed to ensure quality care within reasonable distance rather than maintaining under-resourced local clinics (Mosca & Richardson 2022). The family doctor model has become the main tool for delivering primary and preventive services nationwide.

Despite progress, rural–urban gaps in access and quality persist. Many villages lack permanent doctors, relying instead on medical assistants, and patients often arrange private or community transport to reach hospitals (Field Notes, March 2025; FGs & Interviews, June 2025). While 90.6% of respondents in 2019 reported having a family doctor nearby, and 74.2% could reach them within 30 minutes, these averages mask serious staffing shortages (Danii et al. 2020; BNS 2022). Migration and ageing have worsened the imbalance in family medicine personnel.

These deficits contribute to unequal health outcomes: rural residents have higher mortality from cardiovascular, digestive, and respiratory diseases, and from work-related accidents among men (Penina 2022; Pahomii & Stîrba 2023). Reforms have improved district-level care, yet many rural households face long waits, limited diagnostics, and distance barriers. BNS (2022) reports that 88% of urban patients are seen within 20 minutes of their appointment, compared to 76.7% in rural areas.

ICJPS 2025 survey data show mixed evaluations of public health services, with satisfaction and dissatisfaction nearly balanced. Perceptions are shaped by expectations—rural residents, long accustomed to shortages, report only moderate dissatisfaction. Communication gaps persist: only 54.5% of inpatients signed consent forms, and one-third accessed their medical files, with rural residents less informed (BNS 2022).

Out-of-pocket (OOP) payments and informal fees remain a major barrier. Although their share fell from 48% of total health spending in 2000 to about 31% in 2020, Moldova still records one of the highest rates of catastrophic health spending in Europe—around 17% of households, mostly rural and low-income (WHO & European Observatory 2023). Outpatient medicines are the main driver. Despite broader coverage, the system remains hospital-centred, with over half of CNAM's budget going to hospitals and only a quarter to primary care.

Urban households spend 5.7% of total consumption on health versus 3.1% in rural areas (BNS 2025), though the lower rural share reflects reduced purchasing power and deferred care. Consequently, rural families remain more exposed to catastrophic expenses. Field interviews confirm that sunflower workers often self-medicate or turn to private consultations when public services are unavailable, with medical costs hardest to bear during off-season months (Field Notes, March 2025; FGs & Interviews, June 2025).

In sum, Moldova's health sector has improved coverage and infrastructure through CNAM and reform efforts, yet territorial and social disparities persist. Staff shortages, limited diagnostics, and high OOP costs continue to restrict equitable access, especially in rural areas. While insurance reforms have curbed informal payments, many households still delay treatment or resort to self-medication due to financial and geographic barriers.

Quality of Housing

Most rural households in Moldova live in privately owned houses—a legacy of post-Soviet privatization that left ownership rates among the highest in Europe: around 99% in rural areas versus 95% nationally (IOM 2024). The ICJPS Survey (2025, Q66) shows moderate satisfaction: 43.2% rated their housing as "sufficiently good," 32.5% as "good," and 10.2% as "very good," while 14.1% considered it "bad or very bad."

Field evidence from 2025 confirms this diversity: villages display clear contrasts between renovated homes—often financed by remittances—and older, deteriorated dwellings. Participants linked these differences to income inequality, migration, and limited credit access (Field Notes, March 2025; FGs & Interviews, June 2025).

Although much of the housing stock dates from after 1960, its physical condition and energy performance remain weak due to deferred maintenance and low investment capacity (Sîrbu & Cujbă 2022; IOM 2024). Energy inefficiency and wood- or coal-based heating drive fuel poverty in rural areas. Peri-urban and district centres show better standards, while remote northern and southern communes remain the least equipped, underscoring territorial inequality.

Rural homes also lag behind in infrastructure. Only 42% of rural dwellings are connected to piped water and sewerage (vs. ~90% and ~86% in urban areas), and just 32–35% have indoor toilets and 40–45% a bathroom, compared to 86–89% in cities (BNS 2024a; Sîrbu & Cujbă 2022). About one-third of rural residents rely on shallow wells, many contaminated (FAO 2022; IOM 2024). While water-supply expansion achieved 94% of planned projects (2016–2020), sewerage progress lags at 67%, hindered by high costs and locality fragmentation (Sîrbu & Cujbă 2022).

Access to natural gas remains uneven: it supplies about 59% of heating fuel, concentrated in central Moldova, while most rural homes still use biomass stoves. Only 18.3% of dwellings are connected to district heating, virtually absent in villages—about 94% rely on individual stoves (World Bank 2023b; Renergy.md 2024).

The ICJPS Survey (2025) shows mixed satisfaction with housing and local infrastructure; rural respondents are nearly evenly split, reflecting a normalization of deprivation, as long-standing deficits temper dissatisfaction. Qualitative evidence aligns: rural residents value housing security but cite frustration with poor sanitation, heating costs, and maintenance burdens. Vulnerable groups—especially older and low-income agricultural households—face the toughest conditions (Field Notes, March 2025; FGs & Interviews, June 2025).

Overall, rural households—including many in sunflower farming—enjoy secure tenure but modest housing quality, limited by outdated infrastructure and low energy efficiency. Modernization has improved peri-urban housing, yet rural–urban gaps in water, sanitation, and heating persist. The evidence reveals a dual reality: high housing security but systemic underinvestment that continues to constrain rural living standards.

Education and Skills Development

Over the last decade, Moldova has maintained near-universal access to primary education, despite demographic decline and rural depopulation. In 2023/24, there were 1,201 primary and general secondary institutions, enrolling 334,400 pupils (BNS 2024b). The number of learners per population increased—from 1,640 to 1,803 per 10,000 inhabitants—reflecting a smaller population rather than fewer students.

Enrolment exceeds 100% at both primary and secondary levels (BNS 2025), and dropout remains minimal: only 0.020% of children aged 7–16 were out of school, with a 0.085% semester dropout rate (MEC 2025a; MEC 2025b). These figures confirm near-universal participation in compulsory education, consistent with earlier UNICEF & NBS (2014) findings.

Reforms have aimed to optimize the school network through better-equipped hub schools and improved teacher quality (MEC RM 2022). Continuity between levels remains high: 98.7% of pupils advance to lower-secondary and 88% continue further—split evenly between lyceum (45%) and vocational schools (43%) (BNS 2024b).
Yet rural disparities persist in infrastructure and staffing. Teacher numbers fell from 28,588 to 25,994 between 2017/18 and 2023/24, with shortages in STEM and foreign languages. Rural schools often operate with multi-grade classes and fewer qualified staff. The average pupil–teacher ratio is 12.8, but small rural schools struggle with specialization (BNS 2024b).

Digital readiness has improved, though urban–rural divides remain. In 2023/24, schools used 14.3 computers per 100 pupils, up from 7.6 in 2017/18; rural schools increased from 6.1 to 10.8, still below urban levels (18.7). Teaching devices doubled to 47,883, supported by national and donor programs (BNS 2024b). Yet, connectivity and digital literacy remain uneven—rural students excel at content creation but lag in problem-solving, showing the need for guided, in-person teaching (Bărbuță, Ghețău & Iovu 2024).

After lower-secondary school, long commutes and relocation costs limit access for rural youth. Education spending averages only 0.5–0.6% of rural household consumption, versus 1.9% in urban areas (BNS 2025). City families invest more in tutoring and digital tools, while rural households spend mainly on materials and transport, widening the quality gap.

In vocational education, participation expanded—from 171 to 190 students per 10,000 inhabitants (2017–2023)—though completion slightly declined (51 to 49 graduates per 10,000). The VET network now includes 38 vocational schools, 37 colleges, and 13 centres of excellence, enrolling 46,100 students (BNS 2024b). Facilities improved with EU and GIZ support, but many workshops remain outdated, especially in agricultural profiles (Jin et al. 2019; Vodita et al. 2022). Digital infrastructure rose to 21.5 computers per 100 students, yet alignment with market needs—particularly in cereal and sunflower farming—remains weak. Employers report graduates lack practical experience, as few join dual or work-based programs (Jin et al. 2019; Vodita et al. 2022).

Gender patterns persist: women represent 49% of pupils but only 46% of VET students, concentrated in service fields, while men dominate technical specializations (BNS 2024b). Still, rural girls perform equally or better in ICT tasks, suggesting the gender gap stems from access and social expectations (Bărbuță, Ghețău & Iovu 2023).

The merger of the Agrarian State University (UASM) with the Technical University (UTM) addressed long-term decline in agrarian education—shrinking cohorts, ageing staff, and weak practical training (Certan & Certan 2022). The reform aimed to modernize infrastructure and integrate agriculture with IT and engineering (MEC RM 2025c). Yet, without sustained investment and stronger employer links, it risks improving efficiency on paper more than practice.

In the sunflower value chain, in-service and lifelong learning remain sporadic. Large firms such as Floarea Soarelui, Bioprotect, or Agrostoc organize short workshops on machinery or pesticide safety, but these are isolated (Field Notes, June 2025; Floris.md 2025). Over 60% of rural SMEs lack formal training, and 40% of employees report no professional development in three years (Gîrneț et al. 2023). Barriers include limited funds, managerial awareness, and digital skills (Sârbu & Cimpoieș 2022).

Emerging digital capacity-building programs—such as Digitalization of Entrepreneurship Capacity Building for Rural Areas (Babin et al. 2024)—show promise: pilot ICT workshops in Cahul, Soroca, and Ungheni improved efficiency in small farms, though half of rural SMEs still rely on manual systems.

Overall, Moldova's education system ensures broad but uneven access. Primary schooling is universal, but rural schools face teacher shortages and weaker infrastructure. Secondary and vocational participation has grown, yet quality and inclusiveness remain uneven. The VET sector, despite modernization, struggles with limited employer engagement and gender segregation. Revitalizing agricultural education and expanding practice-based, digital, and lifelong learning are essential to align skills with labour-market needs in Moldova's sunflower value chain.

Living Conditions in Moldova's sunflower value chain are **substantial**, supported by broad access to education, healthcare, and secure housing. However, significant rural–urban disparities persist in the quality of public services, infrastructure, and economic opportunities. Rural communities face shortages of medical personnel, high out-of-pocket healthcare costs, limited access to water, sanitation, and energy-efficient housing, as well as weaker educational infrastructure and vocational training. While home ownership, remittances, and social insurance contribute to household resilience, ageing, depopulation, and fragmented lifelong learning continue to constrain rural wellbeing and the availability of skilled labour for the sunflower value chain.

6. LIVING CONDITIONS	
6.1 Health services	Moderate/Low
6.2 Housing	Substantial
6.3 Education and training	Substantial
Average	Substantial

5.7. Social Profile Analysis of the Sunflower Value Chain in Moldova

The social performance of Moldova's sunflower value chain is moderate to substantial overall, combining relatively secure access to productive resources and basic services with persistent labour-market vulnerabilities and social inequalities (Figure 5–1). The chain contributes significantly to rural livelihoods, household resilience, and food systems through oil production, wage employment, and in-kind lease payments, yet social benefits remain unevenly distributed across gender, age groups, and farm categories.

The Social Profile assessment shows a differentiated pattern:

- **Working Conditions** (*moderate to low*) – Labour legislation is broadly aligned with ILO standards, yet informality, weak labour inspection, limited collective representation, and an ageing workforce constrain decent work outcomes. OSH enforcement remains uneven, while seasonal workers often lack adequate protection.
- **Land and Water Rights** (*substantial*) – Land tenure is generally secure, lease arrangements are predictable, and access to agricultural land is broadly equitable. Although irrigation infrastructure and participation in resource-related decision-making remain uneven, overall access rights are well established.
- **Gender Equality** (*moderate to low*) – Women play an important role throughout the value chain but remain concentrated in lower-paid and auxiliary positions, with more limited access to land ownership, agricultural machinery, irrigation equipment, managerial functions, and decision-making roles.
- **Food & Nutrition Security** (*substantial*) – Sunflower production contributes significantly to household resilience and national food security through edible oil production, in-kind lease payments, and income generation. While dietary diversity remains limited and climate risks threaten future stability, overall food security outcomes are positive.
- **Social Capital** (*moderate to low*) – Producer organizations and cooperative structures remain relatively weak, and civic participation is limited. Trust tends to operate through personal and informal networks rather than through collective institutions, constraining coordinated action and collective bargaining.
- **Living Conditions** (*substantial*) – Access to education, healthcare, housing, and basic infrastructure is generally widespread, while tenure security is nearly universal. Nevertheless, important disparities persist between urban and rural areas in service quality, transport connectivity, and economic opportunities.

Overall, the sunflower value chain performs strongest in land and water rights, food and nutrition security, and living conditions, while working conditions, gender equality, and social capital remain the principal areas requiring further improvement.

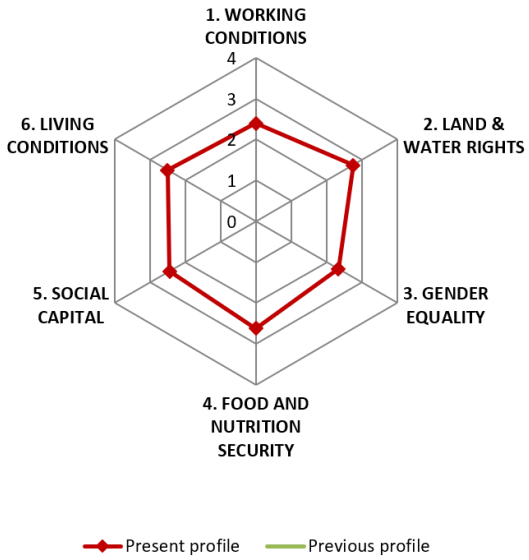


FIGURE 5-1: SOCIAL PROFILE RADAR DIAGRAM –SUNFLOWER VALUE CHAIN IN MOLDOVA

5.8. Answer to Framing Question: Is the VC socially sustainable?

Sunflower remains a cornerstone of Moldovan agriculture, combining strong market relevance with deep social roots in rural communities. Its drought resilience makes it especially valuable under growing climate stress. Production relies on a small number of skilled, mainly male, mechanized workers with formal contracts and job security, alongside a much larger group of seasonal or informal workers—mostly women—employed daily, often without contracts or social protection.

At the other end of the system, family farms, usually unregistered, depend on self-employed or day labourers, typically relatives or neighbours. Their labour relations are entirely informal but play a vital social role: by leasing land from numerous small owners created through post-Soviet privatization, they anchor production locally and directly contribute to rural food security.

Cooperation and trust among producers—and between farmers and the state—remain limited. Still, several successful cooperatives demonstrate the potential of collective action for improving efficiency and market access. Unionization and wage negotiation are weak, reflecting Soviet-era legacies, though new professional associations representing agricultural producers, including oilseed farmers, are gradually revitalizing collective representation despite scepticism about politicization.

Gender barriers continue to influence participation. Women remain underrepresented in technical and mechanized roles due to entrenched perceptions and low enrolment in agricultural training. Yet they are well represented in administrative and accounting positions and increasingly visible as farm owners and entrepreneurs—a promising sign of emerging female leadership. Expanding women's access to training, finance, and decision-making roles could further enhance inclusion and equality.

Overall, Moldova's sunflower value chain is socially embedded, economically vital, and institutionally coherent, yet still marked by selective inclusiveness and structural inequality. Its social sustainability rests on a paradox: informal trust compensates for weak institutions but also constrains transformation. More inclusive development will require sustained investment in people—education, occupational safety, gender equality, and collective capacity—so that the sunflower chain not only sustains livelihoods but also fosters equitable and resilient rural communities.

By becoming more deeply and fairly embedded in local life, sunflower-producing enterprises can improve rural living standards and vitality. This depends on local employment of skilled labour, stronger cooperation among small and medium producers, and closer links with public and private financing, processing, and marketing institutions—strategies that would enhance competitiveness and build the human and social capital on which Moldova's agricultural sustainability ultimately depends.

6. IS THE VALUE CHAIN ENVIRONMENTALLY SUSTAINABLE?

6.1. Introduction

The objective of the environmental analysis of this VCA4D study was to identify the main environmental issues and to assess the environmental sustainability of the sunflower value chain in Moldova to support policy decisions aimed at improving the overall sustainability of the value chain through quantified and evidence-based information.

The field missions provided valuable insights into the environmental issues associated with the sunflower value chain in Moldova. Key challenges raised by stakeholders include soil degradation, climate change impacts, and the depletion of natural resources. These issues are connected to the changes that occurred in decades after privatization of the land which over the years has led to soil compaction, loss of soil structure, reduction of organic matter, and to decreased fertility.
Many environmental issues are already well recognized by farmers and other stakeholders, and a growing number are actively adopting their practices in response to changing agricultural conditions. However, both stakeholder discussions and current research highlight a critical gap: efforts remain fragmented, and much more is needed to ensure that the entire agricultural value chain becomes environmentally sustainable.

The environmental analysis is undertaken based on LCA inventory, environmental issues observed in the field, literature review and undertaken interviews with stakeholders.

The environmental analysis of the VC addresses also the **potential risk to biodiversity**. In this regard, a GIS-based spatially-explicit analysis to evaluate risks for biodiversity in areas of special conservation interest. Complementary biodiversity risk assessments conducted through stakeholder interviews and review of official documentation was carried out to investigate the actions in place for the management of biodiversity conservation.
The sections of this chapter are the following:

- Section 6.2: Life cycle assessment (LCA)
- Section 6.3: GIS-based evaluation of risks for biodiversity
- Section 6.4: Synthesis of the environmental aspects.

6.2. Life Cycle Assessment (LCA)

An LCA of the sunflower value chain in Moldova was conducted to quantify the environmental impacts associated with the production of sunflower seeds and oil extraction. The assessment focused on **three areas of protection** (**mineral and fossil resources depletion, ecosystems quality**, **human health**) and on the impact of the VC on **climate change**.

The methodological framework consists of four phases:

1. Definition of objectives, functional unit (the unit to which impacts are referred) and system boundaries.
2. Life Cycle Inventory (LCI): description of the data used in the assessment.
3. Impact assessment: Based on LCI data.
4. Discussion of the LCA results.

6.2.1. Resources, ecosystem, health

Natural resource depletion

Field mission findings indicate that soil degradation – particularly erosion and the loss of soil organic matter – is among the most significant environmental concerns in Moldova's sunflower value chain. More than 80% of arable land is situated on slopes, and sunflower is commonly cultivated using conventional tillage practices. This method leaves the soil surface exposed and highly susceptible to both water and wind erosion. Moreover, deep and

intensive tillage accelerates the mineralisation of organic matter, leading to resource depletion, increased CO_2 emissions, and contributing to climate change. Farmers are generally aware of these challenges and are actively seeking sustainable solutions.

It is well established that Moldova's arable soils suffer from a deficient nutrient regime, primarily due to the insufficient application of fertilisers (Andrieș, 2016; Lungu, 2024). Discussions with farmers revealed that most apply mineral fertilisers at lower-than-recommended doses. This is driven by both the economic burden of rising input costs and the impact of prolonged droughts, which reduce the perceived return on investment in fertiliser. Moreover, farmers noted that they do not apply manure to maintain soil fertility because livestock farming is not practised. Field crop production in Moldova is no longer integrated with animal husbandry, as the livestock sector has been in long-term decline. Traditionally, sunflower stalks were used as a source of heating material in rural areas. At present, farmers leave sunflower crop residues in the field after harvest, contributing to the maintenance of soil organic matter. A few individual farmers have also begun to experiment with cover crops to improve soil health, though such cases remain rare.

Many studies have reported long-term depletion of organic matter, nutrient depletion, and an overall decrease in fertility (FAO, 2012; Andries et al., 2012; Boincean & Dent, 2019; Andries, 2022; Iluşca, 2023; Boincean, 2025).

TABLE 6-1: INPUTS, REMOVAL AND BALANCE OF NUTRIENTS IN SUNFLOWER VC (BASED ON LCI AND CALCULATIONS)

Zone	Enterprises	Inputs with fertilizers, kg/ha			Nutrient removals with grain yield, kg/ha			Balance: -depletion +overfertilizations		
		N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
North	SHs	17	8	19	112	34	202	-95	-26	-183
	PF	34	11	11	118	36	212	-84	-25	-201
	AE	17	6	6	123	37	222	-106	-31	-100
Centre	SHs	5	5	5	90	27	162	-85	-22	-157
	PF	28	22	22	90	28	162	-62	-6	-140
	AE	10	10	10	90	28	162	-80	-18	-152
South	SHs	33	9	9	73	22	131	-40	-13	-122
	PF	38	5	5	83	29	172	-45	-24	-167
	AE	22	13	13	78	24	141	-56	-11	-128
Mean for conventional		23	10	11	95	29	174	-72	-19	-163
No till		14	0	0	129	39	132	-115	-39	-132
Organic		25	8	30	106	33	192	-81	-25	-162

The Life Cycle Inventory shows that, across all agro-ecological zones and production systems, nutrient removal with harvested sunflower seeds exceeds nutrient inputs from fertilisers. This results in consistently negative nutrient balances, indicating progressive depletion of soil nitrogen, phosphorus, and potassium stocks, particularly in higher-yielding systems where fertiliser application rates remain low relative to crop uptake. Overall, sunflower seed production in the assessed value chain relies on soil nutrient mining, contributing to natural resource depletion and undermining long-term soil fertility and sustainability.

In a no-till system, improved soil health can enhance nutrient availability and uptake efficiency, supporting higher yields, but this does not offset the observed negative nutrient balances and therefore does not eliminate the risks of long-term nutrient depletion.

Although organic management practices may enhance soil biological activity and internal nutrient recycling, these processes mainly redistribute existing soil nutrients and do not fully compensate for nutrient exports. Consequently, organic production in the assessed value chain relies on the depletion of inherent nutrient stocks, contributing to the depletion of natural resources and posing risks to long-term soil fertility and sustainability.

Fertiliser use recommendations are primarily provided by input supply companies, whose guidance is driven by the sale of fertiliser products rather than to site-specific soil conditions. In recent years, recurrent drought events and increasing fertiliser prices have compelled sunflower seed producers to reassess their fertilisation strategies,

primarily by reducing application rates. Field-level stakeholder consultations indicate that only around 5% of field-crop farmers in the Republic of Moldova base fertiliser applications on soil testing results. For most producers, soils are never analysed for nutrient status, and fertiliser application decisions are therefore not grounded in scientific assessment or structured nutrient management practices.

Diesel fuel consumption represents a significant component of fossil energy use in crop production and varies substantially across farming systems depending on soil management intensity. Conventional agriculture, along with conventional tillage systems, exhibits the highest diesel demand due to repeated operations such as disking, ploughing, seedbed preparation, mechanical weed control, harvesting, and in-field transport. Each additional pass increases fuel consumption and contributes to higher non-renewable energy use and associated greenhouse gas emissions.

No-tillage - conservation agriculture systems demonstrate the lowest diesel consumption per hectare. The elimination of ploughing and secondary tillage significantly reduces the number of machinery passes, resulting in lower fuel use, reduced fossil energy depletion, and decreased CO_2 emissions.
Across the sunflower value chain, diesel use for post-harvest operations, particularly grain harvesting, transport, cleaning, drying and storage, contributes to total energy demand. Reducing diesel consumption through optimised field operations and the adoption of conservation practices represents a key opportunity to mitigate fossil resource depletion and climate impacts within the agricultural value chain.

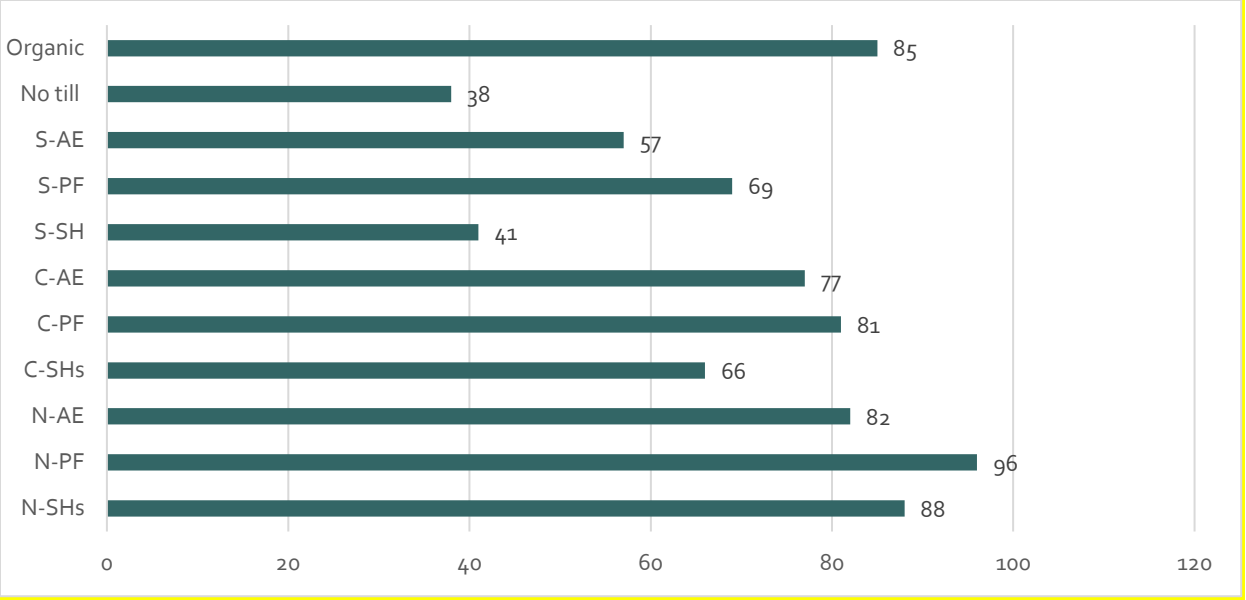


FIGURE 6-1: DIESEL CONSUMPTION AT THE CULTIVATION STAGE OF SUNFLOWER VC, L/HA

To reduce natural resource depletion in Moldova's sunflower value chain, priority should be given to conserving soil, water, and energy resources that underpin long-term agricultural productivity. This can be achieved by expanding no-tillage conservation agriculture, including reduced tillage systems, with reduced tillage serving as a short-term transitional practice and no-till as a long-term objective, alongside permanent soil cover and diversified crop rotations. These measures slow the depletion of soil organic carbon and preserve soil productivity.
Promoting balanced nutrient management based on farm-level nutrient budgets, site-specific fertilization, and greater integration of organic amendments and legumes is essential to prevent long-term nutrient mining.

Reducing dependence on non-renewable energy inputs through fewer machinery passes and optimised fertiliser use, together with measures that stabilise yields through crop diversification, can significantly lower natural resource depletion across the value chain.

Soil Degradation

Soil erosion is a serious problem for approximately one-third of all agricultural land in the Republic of Moldova. In a country where most of the poor rural population cultivates land to secure food, soil quality is crucial[9].

Sunflower represents the main cash crop in the Republic of Moldova and a key driver of farm income in field crop production. Farmers widely perceive sunflower as the most resilient field crop, particularly under conditions of increasing climatic variability. Cultivated as a row crop with wide spacing, sunflower relies on fertile chernozem soils to achieve stable yields. From an environmental perspective, conventional sunflower production systems exert significant pressure on soil resources, as intensive tillage operations and spring periods with uncovered soil increase susceptibility to erosion and the decline of soil organic matter.

As most arable land is located on sloping terrain and traditional farming relies on intensive soil tillage, soils are highly exposed to water and wind erosion. Significant topsoil loss has already occurred, and without changes in land management practices, this degradation process is likely to continue.

Soil erosion has been identified by the scientific community as a major environmental concern (Leah & Leah, 2015; Leah, 2017; Cojocaru & Bacean, 2018; Bejan et al., 2020; Popov, 2022; Crîşmaru, 2022; Eco-TIRAS, 2023).
No tillage Conservation Agriculture (CA) has been promoted for a long time, and the team has observed that some farmers are applying that type of agriculture, and many farmers and stakeholders are familiar with its principles and advantages. However, there appear to be several reasons why this type of farming has not seen wider adoption.[10] Despite the progress made in the sector, a number of serious gaps persist related to methodological aspects of applying conservation agriculture technologies and practices**,** which are of particular importance for the success of this type of agriculture.

Two FAO studies (FAO, 2022; *Favre, 2024)* emphasize the success of farmers who have adopted sustainable agricultural practices, reporting both lower production costs and more stable yields. Additionally, a national climate change adaptation program targets the crop production sector, focusing specifically on the promotion of conservation agriculture. Despite these initiatives, the adoption of such practices remains limited across the country.

Notably, recent policy developments include the adoption of a new *Land Code* (April 2025) and a Government Decision on "Soil Protection Measures within Agricultural Practices" (May 2025). However, these policies appear to reintroduce older frameworks dating back to the 1990s, raising concerns about the long-term effectiveness of current soil protection strategies. They have made many efforts toward conservation agriculture, but recent documents show old approaches reappearing.
Between 2011 and 2015 a policy of promotion of Conservation Agriculture (CA) in the Republic of Moldova began at the national level. The initiative focused on reducing fuel consumption in crop production, limiting soil degradation from water and wind erosion, and increasing the agricultural sector's resilience to climate variability and climate change. These measures were introduced in a context of declining soil quality and increasing climatic pressures affecting crop-based value chains, including sunflower.

The development and promotion of CA in Moldova were initiated and supported with the assistance of international development partners, particularly IFAD, FAO, World Bank, EU, the GEF Small Grants Program, the Austrian Government, and the Government of Japan.

Since 2011, the Unit for the Implementation of IFAD Programs (UCIP-IFAD) has included a Conservation Agriculture (CA) component in every IFAD-supported project, promoting climate-resilient and sustainable farming practices across Moldova. With IFAD's support, over 11 demonstration plots were established, more than 3,700

[9] https://www.worldbank.org/ro/results/2013/08/08/moldova-more-trees-means-more-food
[10] Government of the Republic of Moldova. UNDC of Republic of Moldova. https://unfccc.int/sites/default/files/NDC/2022-06/MD_Updated_NDC_final_version_EN.pdf.

farmers were trained through field schools, over 500 grants were awarded, and key publications and an international CA conference were funded. Under the World Bank's *Moldova Agriculture Competitiveness Project (MAC-P)*, 192 grants were awarded from 2012 to 2020 to support sustainable land management, including Conservation Agriculture (CA), covering 58,649 ha with over 45.6 million MDL (≈2.4 million USD). Most funds were used for no-till equipment, with additional support for irrigation and water storage. In 2021, the Fourth Additional Financing allocated 3.4 million USD to further soil productivity investments (Study_CCB 2023).

FAO has supported Moldova through multiple climate change adaptation and resilience initiatives, including a GCF readiness grant of USD 685,000 to mainstream adaptation into agricultural planning and establish a climate-smart platform (including Conservation Agriculture) in 2022[11].

EU contributed to the development of many development initiatives, including support for the National Program of Conservation Agriculture 2020–2025[12]. The GEF – UNDP Small Grants Program (2012–2017) funded local CA initiatives. Austria supported the "Support for Sustainable Agriculture and Climate Adaptation" project (2013–2017), while Japan provided $4.8 million for "Sustainable Land and Soil Management" project[13].

In 2016, the Ministry of Agriculture approved Order No. 79, establishing the technical requirements for the application of Conservation Agriculture systems. On this basis, dedicated agricultural machinery for Conservation Agriculture became eligible for subsidies[14]. In parallel, two programmes aimed at the development and promotion of Conservation Agriculture were designed; however, neither programme was effectively implemented.

The National Fund for the Development of Agriculture and Rural Environment (FNDAMR) began providing subsidies for CA machinery. Until 2022, the subsidy policy provided 30% cost compensation, with a ceiling of 500,000 lei per unit of machinery. Starting from 2023, the subsidy mechanism was updated to allow 50% compensation, with a maximum of 1 million lei per unit. According to AIPA reports, in 2021, subsidies were provided for 290 machinery units, covering approximately 55,000 hectares. In 2023, 233 machinery units were subsidized, covering about 32,643 hectares[15],[16].

The IFAD study (Study _CCB 2023), which constitutes the only existing assessment and serves as the basis for official data, indicates that Conservation Agriculture is practised on a limited share of Moldova's farmland, covering about 21,112 ha, with an average of roughly 300 ha per farm.

Experts consider the officially reported area under Conservation Agriculture to be underestimated. Their estimates suggest that *60,000–70,000 ha* is managed using CA practices, including *30,000–40,000 ha* cultivated by members of the Community of Practice. *Assuming a total CA area of 70,000 ha and considering that sunflower accounts for 24.6% of Moldova's 1,596,000 ha of cropland, an estimated 17,220 ha of sunflower were cultivated under CA systems in 2023.*
Although two FAO missions have observed that the no-till farmers are doing better than conventional farmers, the methodological issues persist[17]*. Moldova is using an alternative concept, CA, called 'conservative agriculture', that is inconsistent with international norms. This adaptation includes land preparation practices such as disk ploughing, locally referred as 'mini-till', which cannot achieve climate change adaptation and mitigation as well as land degradation*

[11] https://www.fao.org/europe/news/detail/Moldovan-agriculture-set-to-become-more-resilient-against-climate-change-/en
[12] https://enlargement.ec.europa.eu/system/files/2017-03/eni_2014_c2014_5140_final_annual_action_program_for_moldova_agriculture_and_rural.pdf
[13] Fourth National Communication of the Republic of Moldova under the United Nations Framework Convention on Climate Change. / on line: https://unfccc.int/sites/default/files/resource/Moldova_CN4_En_web_070218.pdf
[14] https://www.legis.md/cautare/getResults?doc_id=92067&lang=ro
[15] https://maia.gov.md/ro/content/evaluation-national-fund-development-agriculture-and-rural-environment-years-2017-2021
[16] //aipa.gov.md/sites/default/files/Raport%20gestionare%20FNDAMR%20pentru%20anul%202023.pdf
[17] https://openknowledge.fao.org/items/5d5b73c2-f69f-40ad-bd7f-e86625babd16 FAO. 2022. ***Special report – FAO Crop and Food Supply Assessment Mission (CFSAM) to the Republic of Moldova***. Rome.

goals. This nomenclature variation also leads to a variety of interpretations of the actual practices covered by the terms, often resulting in misunderstandings amongst stakeholders (Favre, 2024; Zbanca et al. 2025)

The study (Study _CCB 2023), included two groups of respondents: a general sample of farmers and a sample of companies practicing Conservation Agriculture. Regarding the reasons for refusing to adopt Conservation Agriculture (CA) practices, respondents from the general sample most frequently cited a lack of confidence in these practices (25%) and insufficient financial resources (25%), while a lack of the necessary knowledge was mentioned by 8% of respondents. Among the companies practicing Conservation Agriculture, insufficient financial resources emerged as the main constraint, being identified by 50% of respondents.

In many of the reviewed documents, Conservation Agriculture is not clearly defined and is often equated with no-till and minimum tillage technologies. Subsidies were likewise allocated separately for no-till and minimum tillage, although both were grouped under Conservation Agriculture. As a result, many farmers favored minimum tillage, as it was perceived as easier to adopt due to reduced soil disturbance and the absence of moldboard ploughing.

The adoption of no-till Conservation Agriculture was a revolutionary and largely spontaneous process. In 2008, the first farmer, V. Ceornii, adopted it to reduce soil erosion and costs, later observing improved soil structure and the appearance of earthworms. Since 2014, UTM has run a Master's programme in Conservation Agriculture, whose graduates actively apply and promote these practices.

Frequent droughts, particularly in 2020, prompted farmers to seek viable climate adaptation solutions. Current Conservation Agriculture adopters have been influenced by practices from Ukraine, including exposure to no-till educational content and occasional technical consultations.

The promotion of Conservation Agriculture (CA) in Moldova has been gradually incorporated into the country's strategic documents on agriculture, rural development, and climate change adaptation[18], [19],[20],[21],[22].

Despite long-standing technical knowledge and sustained efforts to promote Conservation Agriculture, soil degradation remains a persistent environmental pressure in Moldova's sunflower value chain, indicating that existing institutional and policy responses have not yet translated into widespread changes in land management practices.

By the mid-1960s, the first soil erosion control practices based on scientific research began to emerge, including contour tillage, non-inversion tillage, interrupted furrowing, deep strip loosening, soil fissuring, strip cropping, and the establishment of buffer strips with perennial grasses, among others (Andrieș, S., & Filipciuc, V., 2016). Later, in the 1980s, these measures were incorporated into academic publications and into the developed agricultural systems.

[18]Updated Nationally Determined Contribution of the Republic of Moldova https://unfccc.int/sites/default/files/NDC/2022-06/MD_Updated_NDC_final_version_EN.pdf

[19] Government Decision No. 1009 of 10-12-2014 on the approval of the Strategy of the Republic of Moldova for adaptation to climate change until 2020 and of the Action Plan for its implementation https://www.legis.md/cautare/getResults?doc_id=49220&lang=ro#

[20] Government DECISION No. 409 of 04-06-2014 on the approval of the National Strategy for Agricultural and Rural Development for 2014-2020 https://www.legis.md/cautare/getResults?doc_id=76222&lang=ro#

[21] Government Decision No. 624 of 30-08-2023 on the approval of the National Climate Change Adaptation Program until 2030. https://www.legis.md/cautare/getResults?doc_id=140163&lang=ro

[22] Government DECISION No. 56 of 17-02-2023 on the approval of the National Strategy for Agricultural and Rural Development for 2023-2030 https://www.legis.md/cautare/getResults?doc_id=136318&lang=ro

In 2003, the Government adopted first program with the main objective of conserving and enhancing soil fertility, particularly in degraded soils with low productive potential[23],[24]. A second initiative, the *Program for the Conservation and Enhancement of Soil Fertility (2011–2020)***,** included objectives to address soil degradation on *877 thousand hectares of arable land*. According to evaluations of the action plans for *2011–2013* and *2014–2016*, implementation activities mainly targeted *pond rehabilitation and riverbed cleaning***.** *The evaluations concluded that overall results were considered symbolic*[25],[26].

A new Program for Land Improvement 2021–2025 was adopted, with objective is to implement measures to halt land degradation and enhance soil fertility through the modernization and expansion of land improvement systems, as well as the adoption of modern technologies and environmentally friendly agricultural practices. Estimated costs reached 4.27 billion lei, with most funding expected from external sources[27].Implementation difficulties included a lack of specialists, weak uptake of projects, insufficient modern service providers, lack of forest planting material, and difficulties in securing beneficiary contributions[28]. Information campaigns were conducted in almost every district; however, advance subsidies from AIPA had not been granted by mid-2025.

Recently adopted the Land Code introduced specific chapters on soil protection, covering obligations for landholders (Article 64), protection measures (Article 65), territorial-organizational measures (Article 66), agro-, silvo-, and hydro-ameliorative measures (Articles 67–69), and anti-erosion soil protection (Article 70)[29]. The Law on the Use, Conservation, and Protection of Soils, adopted in June 2025, reinforced these provisions, requiring agricultural landowners to undertake measures in accordance with Articles 64–71 of the Land Code[30]

Technical regulation "Measures for Soil Protection within Agricultural Practices" (Government Decision No. 265/2025)[31] presents detailed obligations for landowners for soil protection, the document in question replaced the previous measures adopted in 2008[32]. A comparison of the section on erosion control measures for arable land shows an almost 100% alignment.

23 Government Decision No. 728 of June 16, 2003 on the Approval of the Program for the Utilization of New Lands and the Enhancement of Soil Fertility in the Year 2003 https://www.legis.md/cautare/getResults?doc_id=78461&lang=ro#

24 PROGRAM FOR THE UTILIZATION OF NEW LANDS AND THE ENHANCEMENT OF SOIL FERTILITY (Part II: Enhancement of Soil Fertility) https://www.legis.md/cautare/getResults?doc_id=28339&lang=ro

25 The expected results according to the indicators established in the Program for the Conservation and Enhancement of Soil Fertility for the Years 2011–2020 (for the period 2011–2018).https://maia.gov.md/sites/default/files/PressReleas/Documente%20Atasate/Comunicat%20Indicatori%20de%20rezultat%20Program%202011-2018.pdf

26 REPORT of the Performance Audit Have the Measures Provided in the Program for the Conservation and Enhancement of Soil Fertility for the Years 2017–2020 Achieved the Expected Results?"https://www.ccrm.md/ro/decision_details/1077/hotararea-nr-70-din-21-decembrie-2020-cu-privire-la

27GOVERNMENT Decision No. 864 of 09-12-2020 on the approval of the Land Improvement Program for the purpose of ensuring the sustainable management of soil resources for 2021-2025 and the Action Plan for 2021-2023 on its implementation https://www.legis.md/cautare/getResults?doc_id=125027&lang=ro

28 Informative note to the draft Government decision on the approval of the Action Plan for 2024-2025, on the implementation of the Land Improvement Program for the purpose of ensuring sustainable management of soil resources for 2021-2025 https://particip.gov.md/index.php/ru/document/stages/anunt-privind-initierea-consultarilor-publice-asupra-proiectului-hotararii-de-guvern-pentru-aprobare/11638?utm_source

29 Land Code No. 22/15.02.2024 https://www.legis.md/cautare/getResults?doc_id=142192&lang=ro#

30 Low on the use, protection and conservations of soil. https://gov.md/sites/default/files/media/documents/sedinte-de-guvern/2025-06/NU-317-MAIA-2025_0.pdf

31 *Government Decision 265/2025* of 07.05.2025 regarding the approval of the Technical Regulation "Measures for Soil Protection within Agricultural Practices" https://www.legis.md/cautare/getResults?doc_id=148867&lang=ro

32 Government decision No. 1157 of 13-10-2008 regarding the approval of the Technical Regulation "Measures for Soil Protection within Agricultural Practices" https://www.legis.md/cautare/getResults?doc_id=24317&lang=ro#

In recent years, efforts have been made to promote and implement Conservation Agriculture; however, these efforts have not been fully embedded within national soil management policies. Consequently, the coexistence of multiple soil protection paradigms and the incomplete integration of Conservation Agriculture into the core soil management framework continue to limit the effectiveness of erosion control measures and undermine the long-term sustainability of the sunflower value chain.

Human Health

The life-cycle impacts of the sunflower value chain on human health are primarily associated with *occupational exposure during the cultivation stage***.** Based on the interpretation of Life Cycle Inventory (LCI) data and field mission observations, potential human health risks arise mainly from the *handling and application of mineral fertilizers and plant protection products.*

Mineral fertilizer use within the assessed sunflower value chain is generally low. As a result, the potential human health impacts related to fertilizer application are considered limited, particularly given the absence of intensive fertilization practices across most production systems. Diesel consumption was not assessed from a human health perspective, as the analysis focuses on direct occupational exposure rather than indirect emissions pathways

Among plant protection products, herbicides, fungicides and insecticides were used in sunflower cultivation. Herbicides represented the main category in terms of application quantity. Fungicide use was limited, while insecticides were reported by only four interviewed farmers. These farmers applied insecticides at the recommended application rates; however, because most respondents did not use insecticides, the average quantity calculated across the full sample was very low. The highest application rates were observed under no-till conservation agriculture systems, reaching up to 3.4 kg/ha of herbicides and 0.2 kg/ha of fungicides in commercial products, while substantially lower quantities were applied in other production systems. According to the Life Cycle Inventory data, treatment frequency did not differ across systems; therefore, the observed differences in application rates reflect variations in the concentration of active substances in commercial formulations rather than increased application frequency. All herbicides and fungicides used belong to toxicity classes III and IV, indicating relatively low acute toxicity.

TABLE 6-2: MINERAL FERTILIZERS AND PESTICIDES USED IN VALUE CHAIN (BASED ON LCI AND CALCULATIONS)

Zone	Enterprises	Mineral fertilizers, kg/ha	PPP, Kg/ha	
			Herbicides	Fungicides
North	SHs	25	0,50	0
	PF	140	0,75	0
	AE	70	0,94	0
Centre	SHs	30	1,84	0
	PF	155	0,55	0
	AE	65	2,00	0
South	SHs	120	0,25	0,25
	PF	145	0,04	0
	AE	100	1,32	0,30
No - till		40	3,4	0,20
Organic		0	0	0

The Republic of Moldova aligns its pesticide regulatory framework with EU legislation, and products classified as posing high risks to human health or the environment are not authorised for use. Within this regulatory context, potential human health risks are therefore primarily linked to *exposure during handling and application***,** rather than to the intrinsic toxicity of the products used**.**

Field missions and stakeholder consultations revealed that the *use of Personal Protective Equipment (PPE)* including gloves, respiratory and eye protection, and protective clothing is infrequent during the handling of agricultural inputs. The absence of PPE in stock at several input suppliers further suggests limited demand, reflecting low awareness and weak implementation of basic occupational safety practices at farm level. This constitutes the most relevant human health concern identified within the sunflowers value chain.
Overall, based on LCI data and field observations, human health risks in the sunflowers value chain are *low in terms of input toxicity and quantities*, but *potentially significant at the level of occupational exposure*, particularly due to inadequate use of protective equipment during routine farm operations.

6.2. 2. Climate change

The evaluations of the global warming potential associated with sunflower value chain are based on interpretation of Life Cycle Inventory (LCI) data. The climate change analysis focuses primarily on the cultivation stage, where the main climate-related pressures are generated. Post-harvest stages, including storage, transport, and processing, contribute additional climate-related pressures through fuel and electricity use but do not fundamentally alter the relative performance of production systems established at farm level. In this regard nitrogen fertilization levels and diesel consumption at the cultivation stage are used as proxy to provide insight into the effect of climate change of sunflower cultivation.

Nitrogen input intensity is analyzed as the main climate-related driver since soil emissions of nitrous oxide (N_2O), resulting from nitrogen fertilization, is a potent anthropogenic greenhouse gas. Nitrogen input refers to the total amount of nitrogen applied to soils. Irrespective of fertiliser type, including nitrogen from ammonium nitrate, urea, compound fertilizers (NPK), and organic fertilizers.
In Table 6-3 sunflower seeds yield of each production system are put in relation to nitrogen fertilization levels and diesel consumption (nitrogen values represent total applied nitrogen calculated from fertilizer inputs for internal comparative purposes only).

TABLE 6-3: DISEL CONSUMPTION, APPLIED NITROGEN AND YIELD ACROSS PRODUCTION SYSTEMS

Production system	Applied nitrogen (kg N/ha)	Diesel consumption (L/ha)	Grain yield (t/ha)
North Conventional	23	88	2.1
Centre Conventional	14	75	1.6
South Conventional	31	63	1,5
Mean Conventional	23	75	1,7
No-till	14	38	2,3
Organic	25	85	1,9

Diesel consumption for mechanical operations represents a transparent indicator of climate-related pressure at the cultivation stage. It reflects the intensity of mechanization, number of field operations, and degree of soil disturbance. Differences in diesel use across production systems are therefore interpreted as technology-driven variations in direct energy-related climate pressure.

Diesel consumption levels are classified as low, medium, or high strictly on a relative basis within the analyzed LCI, without reference to external benchmarks.

TABLE 6-4: GROUPING OF PRODUCTION SYSTEMS BY DIESEL CONSUMPTION (LCI-BASED)

Criterion	Group 1Low diesel consumption	Group 2 Medium diesel consumption	Group 3 High diesel consumption
Technological characteristics	Minimal soil disturbance; reduced number of mechanical operations; typically, no-till or minimum-operation systems	Partial soil preparation; combination of reduced tillage and conventional operations	Intensive tillage: multiple soil preparation passes; conventional mechanization patterns
Indicative LCI range (internal)	~38–60 L/ha	~60–80 L/ha	~80–96 L/ha
LCI-based climate interpretation	Lowest direct energy-related climate pressure	Moderate climate pressure	Highest direct climate-related pressure

Diesel consumption groups are defined exclusively based on relative differences observed within the Life Cycle Inventory.
The comparison shows that reductions in diesel consumption within conventional systems do not necessarily coincide with reductions in nitrogen input or higher yields. No-till systems achieve the highest productivity with substantial fuel savings while maintaining nitrogen inputs comparable to conventional systems (Centre Conventional). Organic systems significantly reduce nitrogen input but exhibit high diesel consumption and medium yields, reflecting increased mechanical operations and moderate productivity. Organic systems reduce nitrogen input and exhibit high diesel consumption, reflecting increased mechanical operations.

Systems combining reduced diesel consumption with stable yields are likely to improve climate efficiency. Conversely, systems with low nitrogen input but high diesel consumption and reduced yields may experience lower climate efficiency, despite reduced fertiliser-related pressure.

Overall, climate change implications in the sunflower value chain are primarily shaped by farm-level technology choices. Interventions targeting cultivation practices therefore represent the most effective leverage point for reducing climate-related pressure, while improvements in logistics and processing efficiency provide complementary benefits.

The analysis indicates that the most effective strategy to reduce climate-related pressure in the sunflower value chain is to promote reduced-tillage and no-till production systems that significantly lower diesel consumption while maintaining nitrogen inputs and yields at levels comparable to conventional systems, with the additional benefit of having the lowest level of soil disturbance. This balanced configuration offers the greatest potential for climate-smart performance at farm level, which dominates climate-related impacts along the value chain.
In the long term, reducing climate-related pressures along the value chain would require a transition towards no-till production systems, complemented by the use of leguminous cover crops.

Climate Change Impact

Although water use was not quantified within the Life Cycle Inventory, water availability remains a critical environmental factor for sunflower production. Under conditions of increasing climatic variability, declining precipitation, and recurrent droughts, water availability is becoming an increasingly important factor affecting sunflower productivity in Moldova. Therefore, water availability and soil moisture conservation are important considerations when assessing the long-term sustainability of the sunflower value chain. These considerations are particularly relevant in the context of ongoing climate change.

Climate change is increasingly affecting the Republic of Moldova, causing rises in average annual temperatures and intensifying extreme phenomena such as frequent droughts and heavy rainfall. National climate assessments indicate a clear trend of aridization (Nedealcov, 2018).

It is projected that climate change will significantly impact the climatic and hydrological regime of the Republic of Moldova, resulting in a reduction of surface water flows by approximately 16–20% by 2030. There will be a gradual increase in the annual average temperature of about 2°C over the period 2010–2040, along with a decrease in total annual precipitation of around 13%, confirming the trend towards increased climatic instability and a higher frequency of extreme events[33].

Droughts represent the most severe climatic hazard affecting agricultural production in Moldova. Since the beginning of the 21st century, recurrent drought events have caused repeated yield losses, with particularly affected years including 2000, 2003, 2007, 2011, 2016, 2020, 2022, 2023 and 2024. These events have significantly impacted production variability across agricultural value chains[34].

Sunflower, together with maize and winter wheat, is the main crop cultivated (by cultivated area) in Moldova. The harvests of these crops vary annually in a similar pattern and are strongly influenced by changing climatic conditions.

TABLE 6-5 : AREA, YIELD AND SHARE IN TOTAL ARABLE AREA ON MAIN CROPS PRODUCED IN MOLDOVA

Crops / Unit		2020	2021	2022	2023	2024
Sunflower	Area of cultivation, thousands of hectares	387.3	392.1	440.2	391.9	419.8
	Yield, t/ha	1.3	2.5	1.4	1.9	1.5
	Share in total arable area, %	25.2	25.2	27.9	24.6	26.8
Maize	Area of cultivation, thousands of hectares	546.4	522.3	526.0	489.1	462.5
	Yield, t/ha	1.9	5.7	1.7	2.8	1.6
	Share in total arable area, %	35.5	33.5	33.3	30.6	29.5
Wheat	Area of cultivation, thousands of hectares	311.4	341.7	332.0	377.0	269.0
	Yield, t/ha	1.9	4.6	2.6	4.1	3.2
	Share in total arable area, %	20.3	21.9	21.0	23.6	23.5

Source: National Bureau of Statistics of the Republic of Moldova: Agriculture.

Climate change, drought and weather instability were the most frequently mentioned problems farmers faced during sunflower cultivation in 2023.

Year 2023 was the second warmest year on record, with an average annual temperature of +11.0 to +13.3°C, exceeding the long-term norm **by 2.2–2.9°C**. In Chișinău, an average temperature of +12.7°C was recorded, representing an absolute record over 129 years of observations. The summer was characterized by extreme heat, with a **maximum temperature of +39.5°C** recorded in August in Fălești (the northern part of Moldova). Annual precipitation totals were below average: 330–510 mm (65–85% of the norm) in the northern zone, 335–515 mm (65–95% of the norm) in the central zone, and 385–450 mm (75–90% of the norm) in the southern zone.

The September–October drought resulted in only 10–40 mm of precipitation across approximately 70% of the territory. In addition to drought and heatwaves, extreme events such as late-spring snowfall, torrential rainfall,

[33] https://unfccc.int/sites/default/files/resource/NAP_Moldova_2024.pdf

[34] https://www.meteo.md/

hailstorms, and strong wind gusts of up to 27 m/s were reported in April and July, causing damage to the national economy[35].

Although considered moderately drought tolerant, sunflower is highly sensitive to drought and heat stress during reproductive stages, which directly affects yield formation and oil quality. Water deficit during flowering and grain filling can reduce grain yield by approximately 30%, mainly through declines in grain number per head and thousand-seed weight, accompanied by reductions in oil content. Drought stress also modifies fatty acid composition, increasing palmitic and linoleic acids while reducing oleic acid concentration (Ghaffari et al., 2023). Elevated temperatures during seed development further reduce seed set and alter oil accumulation processes (van der Merwe et al., 2015). Physiological analyses indicate that water deficit impairs photosynthesis, alters plant water relations, and reduces growth and yield formation (Hussain et al., 2018).

Together, the scientific evidence presented above and observations from processors during field interviews indicate that increasing drought frequency and thermal extremes under climate change may reduce productivity and lower oil extraction rates.

FIGURE 6-2: YIELD OF SUNFLOWER SEEDS ACCORDING TO THE INTERVIEW, T/HA, 2023

Overall yields were low despite the high yield potential of the cultivated hybrids, reflecting strong climate-related constraints. Reduced precipitation, combined with increased heat stress (high temperatures), was the main limiting factor, increasing the environmental impact intensity per functional unit due to lower output levels. The highest average yield was recorded in the northern zone (2.2 t/ha), while the southern zone, characterised by the lowest rainfall, showed the lowest yields. No-till conservation agriculture achieved higher yields (2.3 t/ha) than conventional agriculture (1.7 t/ha), indicating partial mitigation of climate stress.

Sunflower is a versatile crop for farmers in the Republic of Moldova and can be cultivated under conventional, conservation, and organic farming systems. Conservation agriculture and organic systems may offer advantages for soil biological functioning and long-term soil health.

Conventional tillage disrupts arbuscular mycorrhizal fungal (AMF) hyphal networks, reducing fungal continuity and colonization (Kabir, 2005). Reduced and no-tillage systems preserve soil biological structure and support greater AMF abundance and activity (Bowles et al., 2017). Preserving mycorrhizal functioning through reduced

[35] https://www.meteo.md/images/uploads/clima/anul_2023.pdf

soil disturbance may therefore improve nutrient efficiency, soil aggregation, and drought resilience in sunflower-based systems.

During the interviews, farmers acknowledged that current crop rotation practices are not optimal and recognized that the share of sunflower in their cropping structure is excessive. Statistical data show that sunflower occupy 24.6% of total arable land. Current technical recommendations[36] and expert opinions indicate that sunflowers should not exceed 17% of arable land in the northern zone and 14% in the central and southern zones (Boincean,2025).
Practically, sunflower should return to the same field only after a minimum interval of 6–7 years, rather than after 3–4 years (Boincean, 2016).

The arguments supporting these recommendations are primarily related to the impact of climate change, which results in reduced yields and lower production quality; increased pressure from diseases, parasitic weeds and pests, potentially leading to higher pesticide use; and progressive depletion of natural resources, as sunflower is a crop with high nitrogen and potassium demand. Persistently low yields and declining quality signal increasing stress on soil and water resources within the production system.

Promote longer crop rotations and a progressive reduction in sunflower saturation within cropping systems to improve climate resilience and long-term resource sustainability. Support the transition towards no-till systems and the integration of leguminous cover crops in order to enhance soil biological nitrogen supply and reduce dependence on mineral nitrogen inputs.

6.3. Biodiversity

A GIS-based analysis was carried out using Corine[37] land use and land cover map (full legend of the Corine is shown in **Error! Reference source not found.**) along with the map of protected areas showing the Emerald Network of Areas of Special Conservation Interest[38]. These two geographically-explicit databases were used to identify any overlap between annual crop-growing regions and protected natural reserves. Emerald sites cover 8.1% of the Moldovan territory, covering 2,744.6 km^2. By 2022, Moldova had designated 61 Emerald sites.

Error! Reference source not found.6-3-A shows the resulting eLabouration, in which land use and land cover categories from Corine are shown exclusively for the areas of special conservation interest. The vast majority of these areas are covered by forest or areas in conversion to forest (categories 311, 312, 313, 324) of Corine land cover map, shown in shades of green in the figure. In particular, the presence of category 324 – areas undergoing conversion to forest –, corresponds to information received from stakeholders, according to which there is a very low risk of agricultural encroachment into non-agricultural land and a process of natural reforestation of areas previously cultivated is even taking place. Nevertheless, according to stakeholders, there are some cultivated plots inside small, protected areas, but the phenomenon is not observed in large national parks. Management plans for some protected areas are in place, but they are not sufficiently updated, nor appropriately enforced.

Also, wetlands, water basins and rivers (411, 511, 512, shown in blue and light blue in **Error! Reference source not found.**6-3-A are widespread within the conservation areas. **Error! Reference source not found.**6-3-B shows arable land within Emerald sites (category 211, mostly concentrated in the Gagauzian region and to a lesser extent in the north-eastern national border).

[36] https://maia.gov.md/ro/content/recomand%C4%83ri-privind-la-zonarea-culturilor-agricole
[37] Corine Land-Cover in Eastern Partnership Countries.
[38] Emerald Network data (vector) - the Pan-European network of protected sites version 2024.

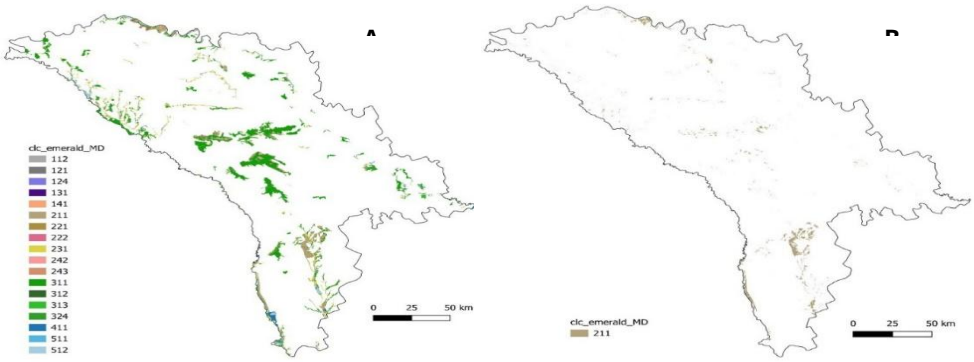


FIGURE 6-3 (A,B) GEOGRAPHICALLY-EXPLICIT BIODIVERSITY RISK ASSESSMENT.
A-land use and land cover categories from Corine within the Emerald Network of Areas of Special Conservation Interest, B-Corine category 211 (non-irrigated arable land) within the Emerald sites.
Source: own GIS eLabouration using Corine land-cover map and Emerald Sites map.

Although direct pressure on protected areas appears limited, the high share of sunflower in Moldova's arable land may affect agro-biodiversity within agricultural landscapes. Excessive sunflower saturation and short crop rotations can contribute to more homogeneous fields, reduced crop diversity and fewer semi-natural habitats, such as field margins, buffer strips and hedgerows. Progressively reducing the share of sunflower and promoting longer, more diversified crop rotations would therefore help improve ecological connectivity, reduce pressure on soil and water resources, and strengthen the long-term sustainability of the sunflower value chain.

Moldova is committed to align the Emerald network sites management to Natura 2000 standard[39], transforming the Emerald sites into Natura 2000 sites. This process is expected to improve the management of the existing Emerald Network sites by establishing new management strategies, in line with the EU conservation standards.
Biodiversity in agricultural landscapes is also influenced by the limited presence of natural vegetation patches and landscape elements within cultivated areas. The size, continuity, and diversity of these features, such as hedgerows, grassy strips, riparian buffers, and tree belts, play a critical role in supporting pollinators, natural pest enemies, and farmland bird populations. In many parts of Moldova, these structures are sparse or fragmented, which reduces ecological connectivity and habitat quality.

6.4. Synthesis of the environmental aspects

Natural resource depletion is closely associated with **soil degradation**, particularly **soil erosion and nutrient mining**, as well as the intensive use of soil resources. Life Cycle Inventory (LCI) data indicate consistently negative nutrient balances across all production systems, demonstrating that nutrient removals with harvested sunflower seeds substantially exceed nutrient inputs from fertilisers. This situation is further aggravated by the widespread use of simplified crop rotations and the excessive share of sunflower in cropping systems, which exceeds

[39] LIFE23-PRE-EL-LIFE-RENATA/101148675

recommended agronomic limits in the country. **Human health** does not appear to represent a major environmental constraint within the value chain. The assessment indicates that the principal concern is not the intrinsic toxicity of authorised agricultural inputs, but rather the level of occupational exposure associated with pesticide handling and application. Stakeholder consultations revealed limited use of personal protective equipment and insufficient implementation of basic safety procedures, suggesting that human health risks are driven primarily by exposure rather than by the quantities or toxicity of agricultural inputs used.

Climate-related pressures are primarily influenced by **nitrogen fertilisation**, associated greenhouse gas emissions from agricultural soils, and **diesel consumption** during field operations. The assessment indicates that no-till conservation agriculture achieves the most favourable balance between productivity, fuel consumption and climate performance. Production systems that **reduce soil disturbance** while maintaining yields therefore offer the greatest opportunities for reducing climate-related pressures within the value chain. Climate change represents one of **the most significant environmental challenges** affecting sunflower production in Moldova. Increasing drought frequency, heat waves and climatic variability directly influence yields, oil content and production stability. The assessment indicates that systems capable of conserving soil moisture, improving soil biological functioning and maintaining productivity under water stress, particularly no-till systems combined with cover crops and diversified crop rotations, are likely to play an increasingly important role in ensuring the long-term sustainability of sunflower production.

Biodiversity does not appear to be under substantial direct pressure from sunflower cultivation within protected areas. However, the ecological quality of agricultural landscapes remains important for maintaining biodiversity and ecosystem services. Maintaining field margins, buffer strips, hedgerows, riparian vegetation and other semi-natural landscape elements would strengthen ecological connectivity and improve habitat quality within agricultural regions.

Overall, **the environmental sustainability of the sunflower** value chain depends on its ability to reduce soil degradation, prevent long-term nutrient depletion and improve resilience to climatic stress. Expanding no-till conservation agriculture, improving nutrient management through site-specific fertilisation and nutrient budgeting, reducing sunflower saturation within crop rotations, and strengthening ecological infrastructure within agricultural landscapes represent the most effective pathways for improving the long-term environmental performance of the value chain.

7. SYNTHESIS & RECOMMENDATIONS

7.1. Answering the framing questions

The sunflower value chain is one of the most important contributors to economic growth in the Republic of Moldova, generating substantial value added, employment, rural incomes, business profits, and export revenues. In 2023, the value chain generated a total production value of approximately MDL 7.32 billion and created MDL 3.94 billion in direct value added, equivalent to about 54% of total production value. When indirect effects generated through upstream suppliers and service providers are included, total value-added increases to MDL 5.68 billion, highlighting the strong multiplier effects of the sector throughout the national economy.

At the farm level, **sunflower production remains economically viable for most producers**, although profitability varies significantly across farm types and regions. Smallholders achieved the highest net margins, benefiting from lower production costs and extensive use of family labour. Peasant Farms remained profitable across all regions, while Agricultural Enterprises faced profitability challenges in the Centre and South due to higher production costs and lower yields. Nevertheless, primary production remains the foundation of the value chain and a major source of income in rural areas.

The processing segment generates the highest economic returns and value addition. Industrial crushing facilities create significant value through the transformation of sunflower seeds into oil, cake, and by-products, generating high levels of profit and contributing substantially to employment and tax revenues. Small-scale service mills also provide important income opportunities within rural communities. Traders play a key role in linking domestic production to export markets and generate stable commercial margins despite relatively high transportation and storage costs.

The value chain is also an important source of income distribution. In 2023, it generated more than MDL 2.0 billion in labour income, including both direct and indirect effects. Landowners received nearly MDL 1.0 billion through land rental payments, while net operating profits across the chain exceeded MDL 1.98 billion when multiplier effects are considered. These results demonstrate the significant contribution of sunflower production and processing to household incomes, business development, and rural economic activity.

The sunflower sector also contributes positively to Moldova's external trade performance. Exports of sunflower seeds, sunflower oil, and sunflower cake generate substantial foreign exchange earnings and strengthen the national trade balance. Although the sector depends on imported inputs such as seeds, fertilisers, plant protection products, and fuel, the economic value created domestically significantly exceeds the value of imports.
So, the sunflower value chain represents a strategic sector for Moldova's economy. It contributes to GDP growth, supports employment and rural livelihoods, generates export revenues, and creates strong linkages with other sectors of the economy.

Sunflower remains a cornerstone of Moldovan agriculture, combining strong market relevance with deep social roots in rural communities. Its drought resilience makes it especially valuable under growing climate stress. Production relies on a small number of skilled, mainly male, mechanized workers with formal contracts and job security, alongside a much larger group of seasonal or informal workers—mostly women—employed daily, often without contracts or social protection.

At the other end of the system, family farms, usually unregistered, depend on self-employed or day labourers, typically relatives or neighbours. Their labour relations are entirely informal but play a vital social role: by leasing land from numerous small owners created through post-Soviet privatization, they anchor production locally and directly contribute to rural food security.

Cooperation and trust among producers—and between farmers and the state—remain limited. Still, several successful cooperatives demonstrate the potential of collective action for improving efficiency and market access. Unionization and wage negotiation are weak, reflecting Soviet-era legacies, though new professional associations representing agricultural producers, including oilseed farmers, are gradually revitalizing collective representation despite scepticism about politicization.

Gender barriers continue to influence participation. Women remain underrepresented in technical and mechanized roles due to entrenched perceptions and low enrolment in agricultural training. Yet they are well represented in administrative and accounting positions and increasingly visible as farm owners and entrepreneurs—a promising sign of emerging female leadership. Expanding women's access to training, finance, and decision-making roles could further enhance inclusion and equality.

Overall, Moldova's sunflower value chain is socially embedded, economically vital, and institutionally coherent, yet still marked by selective inclusiveness and structural inequality. Its social sustainability rests on a

paradox: informal trust compensates for weak institutions but also constrains transformation. More inclusive development will require sustained investment in people—education, occupational safety, gender equality, and collective capacity—so that the sunflower chain not only sustains livelihoods but also fosters equitable and resilient rural communities.

By becoming more deeply and fairly embedded in local life, **sunflower-producing enterprises can improve rural living standards and vitality.** This depends on local employment of skilled labour, stronger cooperation among small and medium producers, and closer links with public and private financing, processing, and marketing institutions—strategies that would enhance competitiveness and build the human and social capital on which Moldova's agricultural sustainability ultimately depends.

Natural resource depletion is closely associated with **soil degradation**, particularly **soil erosion and nutrient mining**, as well as the intensive use of soil resources. Life Cycle Inventory (LCI) data indicate consistently negative nutrient balances across all production systems, demonstrating that nutrient removals with harvested sunflower seeds substantially exceed nutrient inputs from fertilisers. This situation is further aggravated by the widespread use of simplified crop rotations and the excessive share of sunflower in cropping systems, which exceeds recommended agronomic limits in the country.

Human health does not appear to represent a major environmental constraint within the value chain. The assessment indicates that the principal concern is not the intrinsic toxicity of authorised agricultural inputs, but rather the level of occupational exposure associated with pesticide handling and application. Stakeholder consultations revealed limited use of personal protective equipment and insufficient implementation of basic safety procedures, suggesting that human health risks are driven primarily by exposure rather than by the quantities or toxicity of agricultural inputs used.

Climate-related pressures are primarily influenced by **nitrogen fertilisation**, associated greenhouse gas emissions from agricultural soils, and **diesel consumption** during field operations. The assessment indicates that no-till conservation agriculture achieves the most favourable balance between productivity, fuel consumption and climate performance. Production systems that **reduce soil disturbance** while maintaining yields therefore offer the greatest opportunities for reducing climate-related pressures within the value chain.

Climate change represents one of **the most significant environmental challenges** affecting sunflower production in Moldova. Increasing drought frequency, heat waves and climatic variability directly influence yields, oil content and production stability. The assessment indicates that systems capable of conserving soil moisture, improving soil biological functioning and maintaining productivity under water stress, particularly no-till systems combined with cover crops and diversified crop rotations, are likely to play an increasingly important role in ensuring the long-term sustainability of sunflower production.

Biodiversity does not appear to be under substantial direct pressure from sunflower cultivation within protected areas. However, the ecological quality of agricultural landscapes remains important for maintaining biodiversity and ecosystem services. Maintaining field margins, buffer strips, hedgerows, riparian vegetation and other semi-natural landscape elements would strengthen ecological connectivity and improve habitat quality within agricultural regions.

Overall, **the environmental sustainability of the sunflower** value chain depends on its ability to reduce soil degradation, prevent long-term nutrient depletion and improve resilience to climatic stress. Expanding no-till conservation agriculture, improving nutrient management through site-specific fertilisation and nutrient budgeting, reducing sunflower saturation within crop rotations, and strengthening ecological infrastructure within agricultural landscapes represent the most effective pathways for improving the long-term environmental performance of the value chain.

7.2. From SWOT to TOWS: Strategic Priorities for the Sunflower VC

Taking into consideration the SWOT analysis presented in the economic, social, and environmental assessments, the TOWS matrix identifies strategic actions that build on the strengths of Moldova's sunflower value chain, address its weaknesses, capitalize on emerging opportunities, and mitigate potential threats. The proposed strategies aim to enhance the long-term economic viability, social inclusiveness, and environmental sustainability of the sector while strengthening its resilience to climate variability, market volatility, and external shocks.

The sunflower value chain combines a strong production base and significant processing capacities with persistent challenges related to productivity, water scarcity, demographic ageing, and the concentration of value capture in downstream segments. In this context, the TOWS matrix identifies strategies to: (a) use strengths to maximise opportunities (SO); (b) overcome weaknesses by capitalising on opportunities (WO); (c) use strengths to mitigate threats (ST); and (d) minimise weaknesses to reduce vulnerability to threats (WT).

TABLE 4-2 THE TOWS MATRIX FOR THE SUNFLOWER VC IN MOLDOVA

	Strengths (S)	**Weaknesses (W)**
	1. Sunflower is a well-established strategic export crop in Moldova. 2. Strong domestic self-sufficiency and established export channels. 3. High level of mechanization and widespread hybrid seed adoption. 4. Presence of large processing capacities and industrial crushers. 5. Relative drought tolerance compared with cereals. 6. Existing local leadership and successful examples of cooperation and collective storage.	1. High dependence on rainfall and near-absence of irrigation infrastructure. 2. Low and unstable productivity compared with EU benchmarks. 3. Strong concentration of profits in processing and trading activities. 4. Ageing rural workforce and weak generational renewal. 5. Weak producer cooperation and limited bargaining power. 6. Export dependence on raw material and limited value addition. 7. Dependence on input suppliers and limited access to finance and risk-management tools.
Opportunities (O)	**SO Strategies**	**WO Strategies**
1. EU accession process and access to modernization funds. 2. Expansion of climate-smart, digital and precision agriculture. 3. Investments in irrigation and water management. 4. Strengthening producer organizations and cooperatives. 5. Investment in vocational training and generational renewal. 6. Growing demand for vegetable oils and certified sustainable products.	• Use Moldova's strong sunflower production base and processing capacity to attract EU modernization funds and investments in value-added processing, traceability, and Farm-to-Fork systems. • Scale up conservation agriculture, precision farming, and climate-smart technologies through existing mechanized enterprises and targeted subsidy programmes. • Strengthen producer organizations, cooperative storage, and joint marketing models based on successful local experiences. • Increase domestic value addition through refining, branding, and the development of traceable, certified, and sustainable sunflower products for EU markets. • Use established agricultural and processing enterprises as hubs for vocational training, advisory services, and technology transfer. • Support circular-economy approaches linking sunflower production with livestock, bioenergy, and by-product utilization.	• Prioritize irrigation rehabilitation and integrated water-resource management to reduce dependence on rainfall. • Strengthen producer organizations, improve market transparency, and enhance farmers' bargaining power vis-à-vis traders and processors. • Expand extension services and strengthen research–extension linkages to accelerate the adoption of climate-smart and sustainable production practices. • Promote women's and youth participation through targeted access to land, training, machinery, finance, and leadership positions. • Improve storage infrastructure, market information systems, and marketing opportunities for small and medium farms. • Expand access to tailored financial products, agricultural insurance, and climate-risk management tools.
Threats (T)	**ST Strategies**	**WT Strategies**
1. Increasing frequency and severity of droughts and heat waves. 2. Soil degradation and declining fertility. 3. Global market volatility and price fluctuations. 4. Geopolitical disruptions affecting trade and inputs. 5. Continued rural depopulation and labour shortages. 6. Dependence on imported seeds, fertilizers, and other inputs.	• Expand conservation agriculture, crop rotation, cover crops, and soil-moisture conservation practices to strengthen resilience to drought and climate extremes. • Use mechanization, digital technologies, and technological modernization to compensate for labour shortages and improve productivity. • Diversify export markets and promote higher-value, traceable, and certified sunflower products. • Strengthen domestic processing capacities and local food-oil supply chains to reduce vulnerability to external market disruptions. • Encourage collective storage, joint marketing, agricultural insurance, and risk-sharing mechanisms to improve resilience to market and climate shocks. • Promote sustainable soil fertility management, efficient input use, and nutrient recycling to reduce exposure to rising input costs.	• Accelerate irrigation development and strengthen drought-risk management systems. • Improve soil restoration and reduce dependence on imported fertilizers through precision nutrient management, conservation agriculture, and nutrient recycling. • Strengthen advisory services, research–extension linkages, and environmental monitoring systems. • Support machinery-sharing, land cooperation, collective storage, and joint marketing initiatives among small and medium producers. • Improve rural living conditions, vocational education, and employment opportunities to slow depopulation and attract younger workers. • Strengthen producer representation, market transparency, and social dialogue to improve farmers' bargaining power and adaptive capacity during market and geopolitical crises.

7.3. The risk analysis

The risk analysis presents the identified risks, which are partly derived from the SWOT analysis and partly identified by the experts based on the information collected. The probability column ranks risks according to their likelihood (**1 = least probable, 3 = most probable**), while severity is measured on a scale from 1 to 4 (**least severe to most severe**). Severity is assessed across the four components of the VCA4D methodology: economic growth, inclusiveness, social sustainability, and environmental sustainability. The resulting values are defined by the expert panel.

The highest risks concern: *(a) increasing drought frequency and climate stress, (b) declining yields due to soil degradation and insufficient nutrient management, (c) demographic ageing and youth outmigration, and (d) geopolitical disruptions and volatility in export and input markets.*

TABLE 4-3 THE RISK ANALYSES OF THE SUNFLOWER VALUE CHAIN IN MOLDOVA.

Risk description	Probability	Economic Growth	Inclusiveness	Social Sustainability	Environmental Sustainability
Increasing frequency and intensity of agricultural droughts and heat waves, causing severe yield losses and lower oil content.	3	3	2	2	3
Volatility of international vegetable oil and sunflower seed markets affecting producer prices and export revenues.	3	3	2	2	1
Shortage of skilled labour for operating modern machinery, precision agriculture, and digital technologies.	2	2	3	3	2
Insufficient storage, drying, and processing capacities limiting farmers' ability to delay sales and capture value.	2	3	2	2	1
Limited access to finance due to high indebtedness and rising borrowing costs.	3	3	3	2	2
High concentration of market power in processing and trading reduces producers' bargaining power.	3	3	3	3	1
Declining yields due to soil degradation, poor nutrient management, and climate stress.	3	3	2	2	3
Weak producer cooperation and limited collective action constrain innovation and risk-sharing.	3	3	3	3	2
Ageing workforce and continued outmigration of young people from rural areas.	3	3	3	3	2
Dependence on imported hybrid seeds, fertilizers, and crop protection products.	3	3	2	2	2
Geopolitical disruptions affecting trade routes, logistics, and agricultural input supply chains.	3	3	3	3	2
Slow adoption of conservation agriculture and insufficient irrigation development increase climate vulnerability.	3	3	2	2	3

	1	2	3	4
Severity	Low	Moderate	High	Extreme
	1	2	3	
Probability	Low	Moderate	High	

7.4. Recommendations

Based on surveys, interviews, and field observations, the team formulated a set of recommendations grouped into five areas: (I) Financial Stability and Market Structure; (II) Social Inclusion and Labour Conditions; (III) Environmental Sustainability and Climate Adaptation; (IV) Modernisation, Capacity Building and Value Addition; and (V) Governance and Institutional Alignment.

Pillar	Focus Area	
I. Financial Stability & Market Structure	Addressing fiscal issues, improving liquidity, and enhancing market transparency.	Facilitate affordable credit and working capital to reduce dependence on input suppliers and technical credits.
		Support the development of transparent commodity exchanges and contract mechanisms.
		Support collective storage facilities and warehouse receipt systems to improve farmers' bargaining power and marketing flexibility.
		Strengthen financial management and risk analysis capacities of agricultural enterprises.
		Providing differentiated subsidies for farmers who implement efficient irrigation systems and digital crop monitoring.
		Support investments in post-harvest infrastructure and quality preservation.
		Provide zero-tax incentives for profits reinvested in farm modernization, including the purchase of machinery, irrigation systems, digital technologies, and post-harvest infrastructure.
		Harmonizing the VAT rate for actors involved in the sunflower value chain, while streamlining the VAT refund mechanism.
II. Social Inclusion & Labour Conditions	Improving worker welfare, safety, and addressing the aging workforce and emigration.	Expand vocational training and dual education in agri-mechanics, precision agriculture, and oilseed processing.
		Improve occupational safety training.
		Promote women's access to land, credit, machinery training, and leadership positions.
		Support youth entrepreneurship and succession schemes.
		Strengthen producer organizations and collective bargaining.
III. Environmental Sustainability & Climate Adaptation	Promoting climate-smart practices and efficient resource use.	Promote conservation agriculture and diversified crop rotations to maintain soil fertility.
		Improve nutrient management and optimize fertilizer use.
		Promote cover-crops – sunflower rotation to reduce pest pressure and sustain yields.
		Restore shelterbelts and encourage agroforestry practices.
		Promote biodiversity conservation and Natura 2000 alignment.
		Support irrigation development and water-efficient technologies where economically feasible.
		Encourage integrated soil fertility management and the use of organic amendments.
IV. Modernization, Capacity & Value Addition	Enhancing competitiveness, R&D, and moving up the value chain.	Promote precision agriculture and digital advisory platforms.
		Provide an e-agricultural platform for a wide range of information (market data, weather forecasts, advisory services).
		Strengthen extension services and research–farmer linkages.
		Support the use of sunflower by-products in livestock feed and bioenergy applications.
		Promote higher value addition through refining, packaging, and certified sustainable sunflower oil products.
		Encourage producer cooperation and collective storage to reduce dependence on traders and improve price negotiation.
V. Governance and Institutional Alignment	Streamlining public administration and ensuring alignment among stakeholders.	Establish a working group of key stakeholders (Ministries, associations, international experts) to update soil conservation legislation in accordance with international standards.
		Strengthen labour inspection and OSH control during peak seasons, and tie employer incentives to compliance with contracts, insurance, and safety standards.
		Push for the digitalisation of the government agenda, mainly the agenda related to the Agency of Interventions and Payments in Agriculture (AIPA).
		Improve rural services and wellbeing. Continue rural investment in health, sanitation, and digital infrastructure to reduce disparities and retain skilled populations.
		Digitalization and simplification of administrative procedures related to activities in the sunflower value chain, including in the areas of subsidies, certification, reporting and trade.

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8. APPENDIX TO ENVIRONMENTAL ANALYSES (LCA)

APPENDIX 8-1. LIFE CYCLE INVENTORY LIST OF SUNFLOWER (CULTIVATION)

		North			Centre			South			No-till	Organic
		SHs	PF	AE	SHs	PF	AE	SHs	PF	AE		
Inputs/ha	Unit											
Land occupation	m2	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Seed	kg	4,3	4,8	6,0	4,6	4,1	4,8	4,2	5,5	5,4	3.2	4.4
Ammonium Nitrate	kg	0	70	30	0	20	0	45	25	0	40	
UREA 46%	kg	0	0	0	0	0	0	20	90	20	0	
NPK	kg	25	70	40	30	135	65	55	30	80	0	
Organic fertilizer (organic compost)	kg	2500	0	0	0	0	0	0	o	0		5000
Diesel, mechanical operations	L	85	96	82	66	81	77	62	69	57	38	85
Herbicide	kg	0,50	0,75	0,94	1,84	0,55	2,0	0,25	0,04	1,32	3.4	
Fungicide	kg	0	0	0	0	0	0	0,25	0	0,30	0,2	
Water (Well)	L	400	400	400	400	400	400	400	400	400	400	
Transport of inputs to local warehouse*	kg.km	91,380	270,930	154,764	88,464	283,890	147,780	247,440	262,224	188,412	86,880	53,640
Transport of inputs to farm	kg.km	1767	3623	2384	1536	3609	2232	2485	3293	2460	1272	1341
PP bags (seed, fertilizers)	kg	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.2
Outpus/ha	Unit											
Grain (at commercial moisture)	t	2.0	2.1	2.2	1.6	1.6	1.6	1.3	1.7	1.4	2.3	1.9
Inert waste disposal (PP seed&fert bags)	kg	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0,2

* transport of fertilizers and pesticides from plant to local warehouse (assumed 1,500 km Russian origin, 600 km other origins).

APPENDIX 8-2. LIFE CYCLE INVENTORY LIST OF SUNFLOWER(STORAGE AT WAREHOUSE), FUNCTIONAL UNIT: 1 KG OF SEEDS AT WAREHOUSE GATE

input/output	material	unit	amount	description
INPUT	sunflower seeds	kg	1.03	sunflower grain from warehouse, transported oil processing plant (pre-cleaned grains)
INPUT	transport of seeds from farm	kg.km	10	assuming 10 km from farm to warehouse
OUTPUT	sunflower seeds	kg	1	considering 3% loss at warehouse

APPENDIX 8-3. LIFE CYCLE INVENTORY LIST OF SUNFLOWER (TRANSPORT), TRANSPORT TO OIL PROCESSING PLANT (INDUSTRIAL, LOCAL). UNIT: 1 KG OF TRANSPORTED SEEDS

input/output	material	unit	amount	description
INPUT	transport of seeds to industrial oil processing plant	kg.km	75	assuming 15 km from household to mill
INPUT	transport of seeds to local oil processing plant	kg.km	15	assuming 75 km from warehouse to oil processing plant (1 to 150 km)

APPENDIX 8-4. LIFE CYCLE INVENTORY LIST OF SUNFLOWER (TRANSPORT), TRANSPORT TO EXPORT. UNIT: 1 KG OF TRANSPORTED SEEDS

input/output	material	unit	amount	description
INPUT	transport of seeds to port of export	kg.km	450	assuming transport distance to the port of Constanta (RO)

APPENDIX 8-5. LIFE CYCLE INVENTORY LIST OF SUNFLOWER , FUNCTIONAL UNIT: 1 KG OF SEEDS IN (OIL PROCESSING PLANT)

input/output	material	unit	amount	description
INPUT	sunflower seeds	kg	2.38	seeds from warehouse, transported to oil processing plant (pre-cleaned grains)
INPUT	electricity	Wh	238	100 Wh/kg of seeds
OUTPUT	oil	kg	1	extraction rate 42% (allocated by mass) in dry year even 30%
OUTPUT	Oil cake	kg	0.48	48% (allocated by mass)
OUTPUT	screenings	kg	0.1	10 % cleaning loss (different)

APPENDIX 8-6. LEGEND OF THE CORINE LAND COVER MAP (LAND USE AND LAND COVER CATEGORIES).