VALUE CHAIN ANALYSIS FOR DEVELOPMENT

for

European Commission

Value Chain Analysis of wheat in Moldova

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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
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
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

DEFINITION OF ECONOMIC TERMS

Economic terms	Definition
Net operating profit (NOP) (without valuing unpaid family labour)	(Revenues – Expenses) – Depreciation
Direct value added (VA)	The sum of the VA generated by all the actors operating within the VC limits (i.e. actors producing, processing or channelling the VC product)
Indirect VA	The sum of the VA generated by all the suppliers external to the VC (i.e. actors providing intermediate goods and services to the VC actors, therefore not handling nor processing the VC products)
Total VA	The sum of the direct and indirect VA
Rate of integration within the domestic economy	The portion of the value of the VC production which eventually remains within the national economy Rate of integration = Total VA / Production of the VC
Driving effect ratio	It informs on the involvement of domestic business in supporting the activities of the VC. Driving effect ratio = Indirect VA / Direct VA
Public funds balance	Impact on public funds= Benefits [*Total taxes + Total OP of public companies*] - Costs [*Subsidies + other public outlays*]
Balance of trade	Impact of the VC on balance of trade = VC exports – VC Total imports (inputs/ good and services/intermediate consumptions)
Nominal Protection Coefficient (NPC)	It compares the national and international prices of every VC product. NPC= Domestic price of the product / International parity price of the product
Domestic Resource Cost Ratio (DRC)	It compares (i) the actual internal cost for the economy given by the actual remuneration of the domestic non-tradeable factors (e.g. labour, capital, land, environmental goods) mobilised in the VC, and (ii) the net value created within the economy: estimated using international parity prices (of IC and production), i.e. from the opportunity standpoint of international markets. DRC= Non-tradeable domestic factors at market price (excluding transfers) / (Production at international price – Tradeable intermediate goods and services at international prices)

Exchange rate 2023
1 EUR = 19.6431 Moldovan Leu (MDL)
1 USD = 18.1607 Moldovan Leu (MDL)

EXECUTIVE SUMMARY

Functional Analysis

The Functional Analysis section of the report provides a comprehensive descriptive and contextual overview of the Moldovan wheat value chain (VC) by detailing the global and historical context of wheat production, mapping the flow of the commodity, identifying the key actors involved, and outlining the governance structures that shape the sector. This analysis serves as the foundational layer for the subsequent economic, social, and environmental assessments. The section begins by positioning Moldova within the global wheat market, discussing recent volatility caused by geopolitical disruptions (such as the war in Ukraine) and climatic instability, noting how global production volumes, utilization patterns (food, feed, other uses), and price trends have evolved between 2022 and 2025. It establishes Moldova's position as a strategically niche regional exporter that is highly exposed to climatic risks (especially drought) and geopolitical shifts, noting that Moldovan wheat prices are typically discounted compared to international benchmarks.

The second key area of the Functional Analysis delves into the history of wheat production in Moldova, covering the period from the Soviet Union's collectivisation efforts (post-1944) through to recent developments in private farming. This historical context explains the current structural challenges, detailing the shift from large state and collective farms (kolkhozes and sovkhozes) to the small-scale, fragmented landownership pattern resulting from the post-1991 land reforms. It documents the dualistic agrarian structure that now exists, where small household plots coexist with large corporate operations that maintain scale through extensive land leasing. Furthermore, this historical review examines recent trends in production, including the significant annual variability in yields related to climatic factors, and the dominance of wheat, maize, and sunflower in the overall sown area.

The third core element involves mapping the flow, balance, and key actors within the Moldovan wheat VC. The analysis confirms that Moldova is typically highly self-sufficient in wheat (over 160% in most years), maintaining a positive food balance that allows for substantial exports, while also meeting local consumption needs. **The key actors identified include Farmers** (categorised into Peasant Farms and Agricultural Enterprises, including No-Till and Organic archetypes), **Landowners** (primarily rural households who receive in-kind rent payments), **Input Providers** (who often act as de facto extension services and commodity traders via technical credit schemes), **Traders** (focused on export, mainly through Romania since 2022), **Flour Milling** (divided into industrial and small local service mills). The report also examines the operations of Bakeries, Feed manufacturers, and Retailers, which are not fully included in the analysis. Nevertheless, the authors attempt to explain market trends and basic characteristics. This section describes the typical operations, geographic concentration, and key characteristics of each actor, including regional disparities in farm size and yield.

Finally, the Functional Analysis addresses governance, the institutional landscape, and sectoral performance through a SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis. The governance subsection maps the institutional framework, including the roles of the Ministry of Agriculture and Food Industry (MAFI), the Agency for Intervention and Payments in Agriculture (AIPA), and the National Food Safety Agency (ANSA). It reviews the national strategy (NSARD 2030) and the legal instruments (subsidies, taxes, and licensing) that shape the sector, noting the crucial role of bank and non-bank credit institutions, as well as local leaders who consolidate land and drive investment.

The SWOT analysis summarises the primary internal strengths (e.g., **established expertise, EU access**) and weaknesses (e.g., **fragmented land, high climate vulnerability**), against external opportunities (e.g., **EU accession funding, climate-smart practices**) and threats (e.g., **war in Ukraine, labour shortages**) facing the Moldovan wheat value chain (VC).

Figure 0-1 presents a flow chart of the Moldovan wheat VC for the **2023 reference year**. The **left side of the diagram illustrates** the production stage and associated prices (denoted in MDL/kg with a '*'). The **tables embedded within the arrows** indicate the flow of wheat (thousand tonnes) from producers to various recipients, including traders, landowners, input providers, industrial mills, and for self-consumption and feed use. Downstream flows from these recipients are categorized into **export** (green-filled cells) and **local use** (white-filled cells).

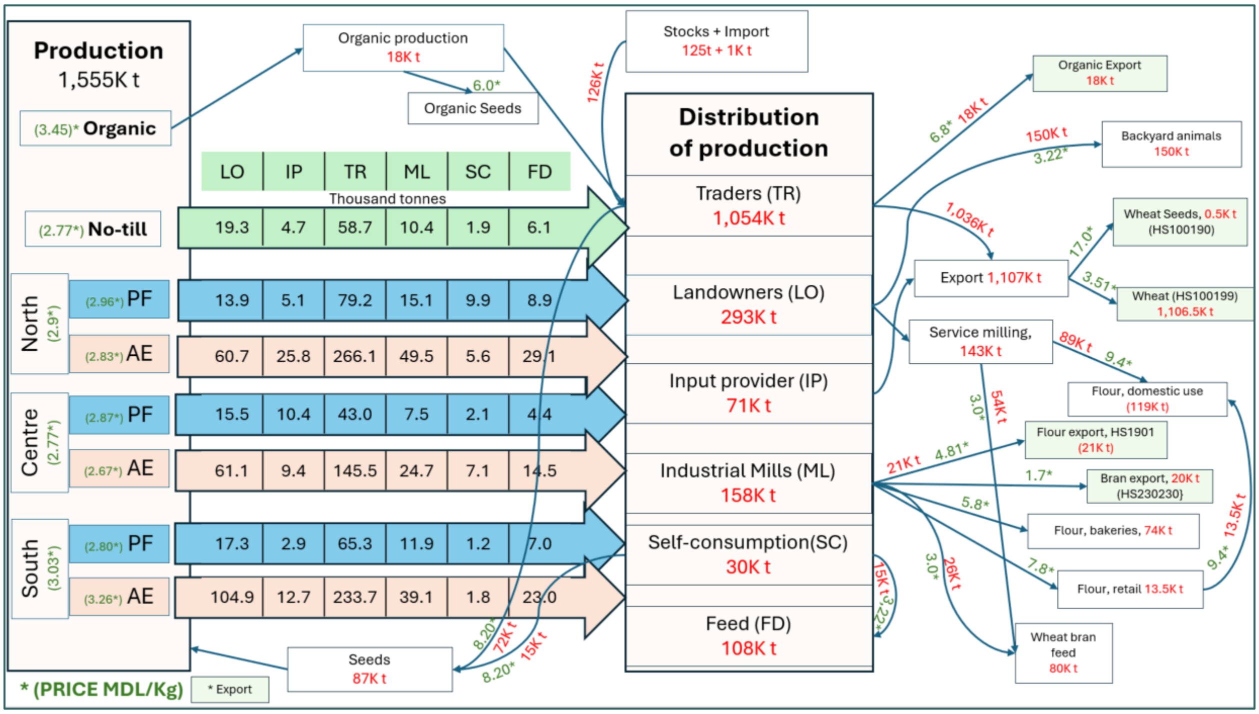


Figure 0-1 Flow chart for wheat in Moldova, reference marketing year 2022/2023 (wheat production, K tonnes)

Note: **PF** – Peasant farmers, **AE** – Agricultural enterprises, **LO** – landowners, **IP** – input providers, **TR** – Traders, **ML** – Industrial mills, **SC** – Self-consumption, **FD** – Feed.

Source: own elaboration based on data from own survey, National Bureau of Statistics of Moldova, UN Comtrade, EU COMEXT database, interviews, and other literature available.

Economic and Inclusive Analysis

The economic analysis of the Moldovan wheat VC was conducted using 2023 reference data, integrating official statistics, financial accounts, and extensive surveys of farmers. This study aimed to assess the profitability, the contribution to the national economy, and the international viability of the Moldovan wheat sector. The research segmented conventional producers into Peasant Farms (PF) and Agricultural Enterprises (AE) across the North, Centre, and South regions, alongside specific archetypes for No-Till and Organic farmers to accurately capture the sectoral diversity.

Profitability and Sustainability of Value Chain Actors

The financial assessment for primary producers (farmers) in 2023 revealed a year of considerable financial pressure, primarily driven by prevailing low global wheat prices. This stress resulted in significant net losses across key segments of conventional farming. For instance, Peasant Farms in the South and in the Centre (PF-South, PF-Centre) recorded a loss on production of -**20 and -19%** respectively, while northern and conservative farms were able to record the benefits.

Sectoral financial data corroborated this trend, showing that 40% of farming enterprises operated at a loss, with the overall profit-to-sales ratio standing at a marginal 0.55%.

Despite these widespread challenges, certain farm archetypes demonstrated greater resilience and profitability. ***farmers in the North*** **(PF, AE),** ***no-till farms*** **and** ***organic farms*** **successfully achieved positive net margins.** This resilience is often linked to lower operating expenses, as the lowest production costs are typically observed in Organic and No-Till systems, benefiting from reduced consumption of industrial inputs, such as fuel, seeds, and fertilisers.

A major structural issue undermining farmer sustainability is the imbalance in the Value Added Tax (VAT). Farmers are obligated to pay the standard 20% VAT on inputs (e.g., fuel and supplies) but are only allowed to charge a lower 8% VAT on local sales or 0% on exports. This differential creates an excess credit (negative VAT balance) that is not automatically refunded and remains "locked within Moldovan fiscal institutions". This negative balance is a serious problem because it drains the farms' cash and pushes those near failure closer to bankruptcy.

The profitability of downstream actors presented a mixed picture. Industrial Mills operated with narrow margins that were highly sensitive to regional wheat prices, achieving the highest margin in the Centre (7.8%) and the lowest in the South (3.1%). Like farmers, mills face a persistent VAT issue where funds also stay with national fiscal authorities. As observed, the industrial milling seems to be underdeveloped with many old-style facilities. There are **2 or 3 main local flour brands[1]** which reflects low competitive nature of Moldovan milling. Other available brands are produced either in Ukraine, Romania or Russian Federation. Interesting fast is, that the largest state-owned bakery group does not possess any milling and large quantities tender in the market[2].

Small (Service) Mills are traditional operations serving landowners paid in kind, operating with lower processing efficiency (60–65% flour yield vs. industrial 70–78% yield) and often functioning in a cash regime, suggesting a high potential for informal activity. Conventional Traders were affected by a **negative Net Operating Profit** (NOP) for pure wheat trading in 2023[3]. Analysing financial results of the largest wheat exporters we observed their net margin to average between 1% (2023) and 5% (2024). Traders' positive overall financial balance is maintained through diversification, as they earn compensating profits from distributing agricultural inputs (seeds, fertilisers, etc.) and selling different agricultural products (mainly sunflower). The main costs item (after price of wheat) for traders is a transportation to foreign markers[4]. Organic Traders, dominated by a single key company, also reported a negative profit before tax for its wheat exports in 2023. Organic wheat is rather not very interesting for the market, spelt is preferred and more beneficial.

Contribution to the National Economy

The economic impact of the wheat value chain in 2023 was substantial. The total final production value generated by the chain reached 6.2 billion MDL (≈ € 318 million), with the activity primarily focused on capturing the export market. The total Value Added (VA) generated by the VC was almost 4.6 billion MDL (≈ € 235 million), translating into a significant contribution to the national economy:

- The entire VC contributed 11% to the agricultural GDP and 1.5% to the total national GDP.
- The VC maintained a robust positive trade balance of 2.4 billion MDL (≈ € 122 million) and accounted for 5.6% of Moldova's total exports.
- Public finances show a positive balance, meaning that the VC contributes significantly to state budget through the taxes collected.

[1] While one out of the 3 comes from Transnistrian region.
[2] Online digital tenders, calls and results are available here: achizitii.md and Mtender.gov.md
[3] The 2023 loss was also significantly affected by the release of wheat stocks that had been accumulated in 2022. These stocks were created under conditions of market uncertainty and at a higher price level. Selling wheat that was stored at a higher cost into a market defined by low current prices automatically resulted in a loss on every tonne released.
[4] Interviews indicated mainly export by using trucks, which are expensive mean of transport for export (border waiting lines, limited capacity during harvest, etc). Water transportation may not always be reliable due to appearing droughts and low water levels in the rivers.

An analysis of the Intermediate goods and services (IGS) consumption highlighted the VC's heavy reliance on industrial inputs. **Fertilisers and protective chemicals and seeds constituted the largest share of total costs at 32%.**

International Competitiveness and Viability

Viability analysis, using international benchmarks, confirmed that the Moldovan wheat sector operates at a comparative advantage but with persisting macroeconomic and policy distortions. The sector suffers from a structural pricing discount. **Moldovan wheat is typically traded at a price 15–21% lower than the weighted global average of comparable exporters, and wheat flour is discounted even more steeply, by 25–35%.**

Key viability indicators for 2023 underscore the severity of this cost-price squeeze:

- The calculations indicate that Moldova **has comparative advantage in wheat production** (Domestic resource cost ratio is 0.69).
- Macroeconomic and policy distortions are driven by an overvalued nominal exchange rate (estimated to be around 10 % above its real equilibrium[5]), combined with significant factor cost distortions, mainly in the labour market, where labour shortages are pushing wages up. Together, these factors create financial difficulties for farmers and traders.

Comparison of Sub-Chains

The analysis identified a critical dual structure within the wheat value chain: the Export VC and the Processing VC. **The Export VC dominates in volume, handling approximately 979 million tonnes[6]**, but financially, it reported a significant net operating loss of -16%. In sharp contrast, the **Processing VC handles a lower volume, at 0.6 million tonnes, yet it achieves a higher value addition** (2,230 MDL/ton versus 1,202 MDL/ton in the Export VC) and registers a strong positive margin[7]. This comparison highlights that while the sector is dominated by the lower-return export activities, expanding and supporting the domestic processing segment offers a significantly more viable and profitable pathway for enhancing domestic value creation.

Inclusiveness analysis

The analysis in Chapter 4 assesses the distribution of profits, value added, employment, and social inclusion within the Moldovan wheat VC. The findings confirm that while the VC is a crucial source of rural employment, the economic benefits are distributed highly asymmetrically, and the employment structure faces significant disparities and structural challenges.

Disparity in Value and Profit Retention

The wheat VC exhibits a fundamental imbalance between value creation and profit retention. Farmers, as primary producers, generate the bulk of economic activity, accounting for 76% of total Value Added (VA) and provide 84% of all labour compensation, which underscores their indispensable role in both production and employment.

However, this pattern reverses sharply when examining net operating profit (NOP). Despite bearing the highest labour and input costs, wheat production was not profitable in 2023. The largest shares of NOP are retained

[5] See Stratan, et al (2024).
[6] Of 2023 harvest. We did not include in the calculations the stocks which remained from previous year (about 125K tonnes).
[7] The strong margin is supported by the in-kind deliveries of wheat to landowners who process the commodity into flour or use for back yard animal feeding.

downstream by landowners, even though their direct contribution to value creation is comparatively smaller. Among landowners, the concept of “profit” does not fully reflect their economic reality, as landowners are often compensated in kind. The land ownership benefits strengthen household food security rather than generating monetary income. In this sense, the recorded “profit” represents more the opportunity cost of what would otherwise be spent on purchasing equivalent quantities of flour and feed at market prices.

This imbalance between farms and downstream reflects broader structural problems in the VC. Farmers create most of the value but capture only a small share of the profit, while landowners / millers, and usually also traders, benefit more from downstream activities. Such a pattern suggests that farmers have limited bargaining power and that prices along the chain are not transmitted fairly. At the same time, access to land and income opportunities remains uneven. **The largest 10% of farms control about 40% of the arable land, while half of all land users operate on less than one-fifth of the land. This concentration reduces opportunities for smaller producers and contributes to inequality within rural areas.** This imbalance puts pressure on small farmers who, being weakly organised, may face difficulties in negotiating with dominant traders. At the same time, farmers surveyed indicated that they tend not to maintain relationships with a single trader, instead seeking the best market opportunities in a given year.

Employment Challenges

The wheat VC is a vital rural employer, creating nearly 8,400 full time equivalent jobs in 2023, with over 7,400 jobs generated directly on farms. Nevertheless, the workforce structure reveals significant disparities. **A pronounced gender pay gap is evident**, with male qualified workers earning approximately 14.2% more than their female counterparts (700 MDL/day versus 600 MDL/day). This gap is largely driven by the male dominance in mechanizer roles (operators of farm machinery), resulting in male workers receiving about 60% of total wage expenditures. The workforce is also generally aging due to high emigration rates among the younger population, who are seeking opportunities abroad, posing a long-term challenge to the labour supply.

In terms of social inclusiveness, the VC is geographically uneven. Northern farmers are more resilient, and their activities are more profitable due to climatically favourable conditions, while Southern farmers face greater viability risks from frequent droughts. While most permanent workers benefit from formal contracts, seasonal workers are predominantly hired verbally, creating a vulnerability in labour rights. On a positive note, the VC strongly supports rural food security through the traditional practice of in-kind land rent payments (in wheat, maize, etc.) and standard free lunch for workers, ensuring direct access to commodities for food and feed.

Social Analysis

The social analysis offers a reflection on Moldova's wheat agricultural VC from a social perspective, focusing on six social domains including working and living conditions, land and water rights, gender equality, social capital, food and nutrition security, living conditions, and also describes the challenges faced during farming activities. The data stem from field research, surveys, and interviews with farmers, workers, landowners, and sector stakeholders.

Working Conditions

Farmers and seasonal workers operate under conditions influenced by climate change, with extended working hours (particularly during heavy seasons) that often lack clear regulations regarding compensation. While formal contracts are common for permanent staff, seasonal workers are typically hired informally, with wages that vary seasonally. Safety measures, especially during fertilization and pesticide application, are insufficient in many farms. Recommendations include implementing clear regulations on working hours and safety protocols and enhancing the capacity of labour inspection agencies.

Land and Water Rights

Land ownership in Moldova reflects post-Soviet reforms, with most farmers leasing or purchasing land, while many landowners retain ownership for social, emotional, and heritage reasons. Land prices are steadily increasing, and landowners prefer holding onto property until market conditions are favourable. Water scarcity, exacerbated by climate change and infrastructure gaps, poses a significant threat. Droughts and natural disasters, also intensified by climate change, have a profound impact on yields and farmers' incomes. The current irrigation infrastructure is limited. The groundwater resources are not being utilized, and there is ongoing discussion to revise groundwater legislation to make it easier for farmers to access. Climate shocks sometimes lead to breaches in financial commitments, affecting workers' wages and farm sustainability.

Gender equality and inclusion

Gender equality in Moldova has shown notable progress in recent years, with women actively engaging in education, the workforce, and politics. According to the 2023 Global Gender Gap Index, Moldova ranks approximately 58th out of 146 countries, reflecting moderate advancement in closing gender gaps across economic participation, education, health, and political empowerment. However, the gender wage gap remains substantial, with women earning approximately 70-75% of men's earnings for similar roles, indicating ongoing economic disparities.

In the agriculture sector, women play a vital yet often marginalized role, particularly within smallholder farms. Despite their contributions, women face significant barriers, including limited access to land, credit, technology, and training, alongside social and cultural restrictions that hinder their decision-making power and ownership rights. These challenges are especially evident in the wheat VC, which is predominantly gendered. Most farm jobs, particularly those involving heavy labour and mechanization, are performed by men, while women are typically involved in administrative roles, supporting services such as managing canteens, or working in low-value, less mechanized tasks. Salaries in administration tend to be similar for men and women, but women's roles are often limited to lower-value activities mainly suited for those over 50 years old.

A notable exception is a woman farmer from northern Moldova who, after her husband's death, successfully manages a large farm and actively participates in training programs organized by farmers' associations and supported by international and government funding. Her case exemplifies how women can significantly contribute to rural development and economic empowerment, often driven by necessity following the loss of male relatives involved in farming. However, many women's daughters have emigrated, highlighting ongoing demographic and social challenges impacting women's participation in agriculture.

Food and Nutrition Security:

Wheat plays a crucial role in Moldova's food security. Farmers all confirmed that they do not face problems with food availability within their families or communities. Farmers often pay in kind for land rental, and cereals such as wheat are primarily used to feed household animals and poultry. This contributes additional protein and dairy products to household diets.

Social Capital and Education:

Social capital varies, being higher in agricultural enterprises, where strong trust-based relationships exist between farmers and input suppliers, and active farmer associations advocate for farmers' rights and capacity building to a certain extent. Knowledge transfer largely relies on inherited practices, input suppliers, social media, and limited extension services, which need to be strengthened to support the modernization of wheat farming.

Living Conditions:

Most rural households own their homes, equipped with basic amenities such as electricity and water. However, sewerage, heating, and infrastructure remain inadequate in many areas. Remittances from emigrants are vital for house renovations, and rural infrastructure inherited from the Soviet era needs significant upgrades, especially roads and public utilities.

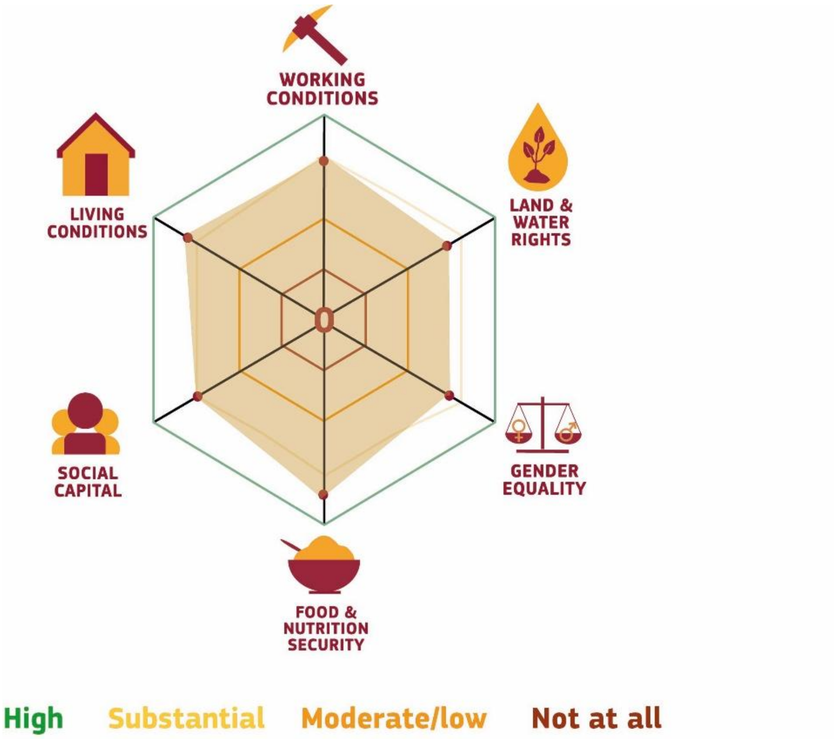


FIGURE 0-2 THE SOCIAL RADAR

Environmental Analysis

The environmental analysis presents a comprehensive assessment of the environmental performance and biodiversity risks associated with the wheat VC in Moldova. The study integrates Life Cycle Assessment (LCA), Geographic Information System (GIS) analysis, and stakeholder consultations.

The Life Cycle Assessment evaluated the full environmental impact of wheat flour production, from cultivation to milling, using 1 kg of domestic flour production at the mill gate as the primary functional unit. A second functional unit (1 kg of wheat grain at the export port) was used to assess the export sub-chain. The assessment focused on three key areas of protection: **mineral and fossil resource depletion**, **ecosystem quality**, and **human health**, as well as the additional impact category of **climate change**.

In terms of **resource depletion**, the wheat VC in Moldova performs well, with notably lower resource use in no-till systems compared to conventional practices. Indeed, **to reduce the VC's contribution to long-term resource depletion, resource-efficient practices should be adopted**. These include **precision fertilization**, which also reduces nitrogen-related soil emissions, and **reduced tillage**, which simultaneously lowers fuel use and contributes positively to other environmental areas, such as emissions and soil health. No-till practices resulted in around 40% reduction in resource depletion, primarily due to reduced fuel use and more efficient fertilization.

Regarding **ecosystem quality**, most impacts stem from land use during the cultivation phase, particularly where yields are low, fuel consumption for field operations is high, and nitrogen use is inefficient. Cultivation efficiency (higher yields with low levels of input use, including fertilisers and pesticides) is key to reducing ecosystem impacts. No-till practices can achieve a lower impact on ecosystems while maintaining good crop yield performance by improving soil factors such as water retention, soil temperature, and organic matter.

Human health impacts across the VC are relatively low. The total burden from wheat grain and flour production is minimal when compared to other national health risks. However, LCA does not account for direct exposure to hazardous agrochemicals. Stakeholder consultations revealed widespread neglect of safety protocols, with farmers rarely using Personal Protective Equipment (PPE). This indicates a clear gap in occupational safety awareness and enforcement.

On **climate change**, greenhouse gas emissions from wheat grain production range between 0.21 and 0.40 kg CO_2eq per kg of grain, placing Moldova at the lower end of the European range and below the weighted EU average of 0.61–0.65 kg CO_2eq per kg of grain. Again, no-till systems perform better due to lower fertiliser and fuel use. Improving fertiliser management and nitrogen use efficiency by adopting precision fertilization protocols based on soil analysis, switching from conventional granular urea to enhanced-efficiency fertilisers and better timing of application are key strategies for further reducing emissions.

Downstream stages (transport, storage, and milling) contribute only modestly to overall impacts. Although rural service mills typically have a lower grain-to-flour conversion efficiency (and therefore lower overall environmental performance), they play a critical role in supporting local food systems and livelihoods. Their ongoing decline risks undermining food security in affected communities, suggesting that efforts should focus on preserving and modernizing these operations through appropriate support programs.

The biodiversity assessment showed minimal overlap between wheat cultivation and protected areas. Conservation zones are mostly forested or undergoing natural reforestation. Moldova's transition to the EU's Natura 2000 network is expected to further strengthen biodiversity protection enforcement and management.
The wheat VC in Moldova has a low to moderate environmental impact when compared to international benchmarks, particularly with respect to climate change. However, targeted interventions at the **cultivation stage**, including improved fertiliser management, scaling-up of **no-till and other conservation agriculture practices**, **reintegrating livestock** into farming systems, and supporting **rural milling infrastructure**, can further reduce environmental impacts while enhancing resilience, productivity, and food system sustainability. In addition, **increasing, restoring and maintaining agricultural landscape elements such as hedgerows, riparian buffers and tree belts, alongside the implementation of agroforestry practices** were identified as strategies to enhance biodiversity that can also provide improvements in terms of erosion reduction and landscape resilience. Also, aligning protected natural areas to Natura 2000 standard is expected to further strengthen biodiversity.

1. INTRODUCTION

The Republic of Moldova is a landlocked country in Eastern Europe, situated between Romania to the west and Ukraine to the north, east, and south. With a territory of about 33,800 square kilometres. Its capital, Chișinău, serves as the country's political, cultural, and economic hub. Moldova declared its independence from the Soviet Union on 27 August 1991. It was fully recognized and became a member of the United Nations on 2 March 1992. The constitution establishing the current state and political system was adopted in 1994.

Moldova is a small country by population and lightly settled: the average annual population declined from about 2.60 million in 2021 to 2.46 million in 2023, with a population density of roughly 82 people per square kilometre. This shrinking demographic base sets the backdrop for the recent economic story. In the economy, the dominant influence has been the war in neighbouring Ukraine, which began in 2022, disrupting trade routes, raising energy and food costs, and adding uncertainty for households and firms.

Price dynamics followed the global pattern. Moldova's inflation is typically contained, but pressures intensified in 2022–2023 amid regional turmoil: consumer prices rose sharply in 2022 and remained elevated in 2023 before easing. In 2024, inflation fell back below 5%, signalling a return toward price stability. In real terms, Gross Domestic Product (GDP) grew strongly in 2021, fell in 2022, and posted only a slight gain in 2023. By 2023, overall real GDP was slightly below its 2021 level (3 - 4% lower). Measured at current international prices, Moldova's economy in 2023 was valued at $51.4 billion in Purchasing Power Parity (PPP). At the same time, GDP per capita stood at $20,910 in PPP. Taken together, these indicators describe an economy that absorbed a major external shock and is now moving toward greater price stability, with the near-term challenge of rebuilding real incomes and growth in a context of a declining population.

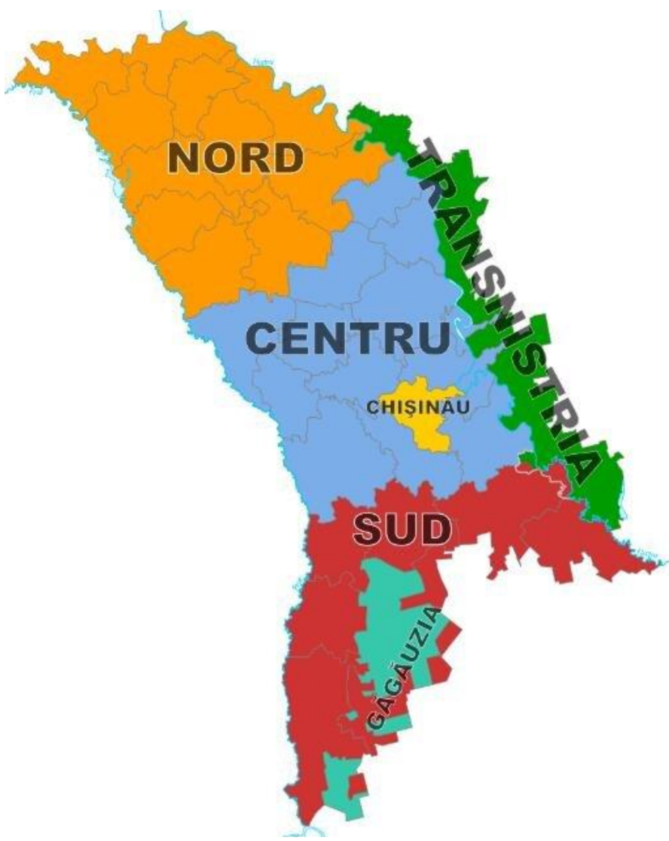


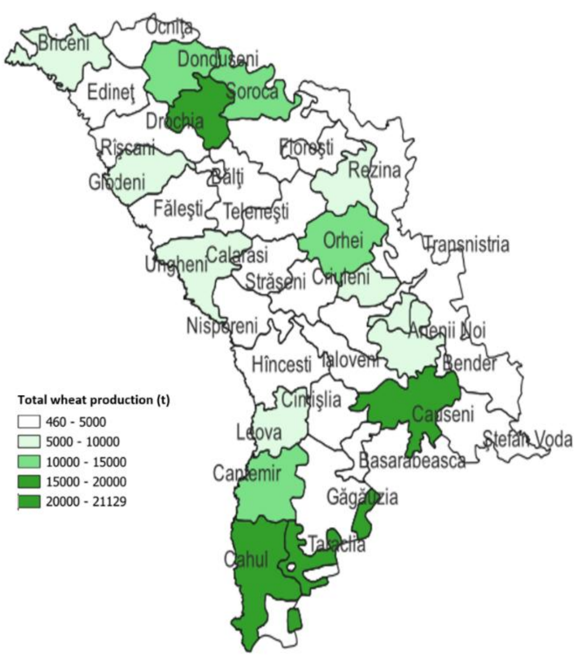
Figure 1-1 Moldova and its territorial division. Source: Scutariu and Udovenco (2018).

Geographically, Moldova is often divided into three main regions - North, Centre, and South (Figure 1-1). Even though these are not administrative units, this division is based on the municipalities' frontiers used in official statistics but mainly reflects agro-ecological zones that echo differences in climate, soil, and farming practices.

In the report, we also considered the autonomous territorial unit of Gagauzia as a part of the southern region and the municipality of *Chișinău as a part of the central region. We do not consider the separatist region of Transnistria as part of the study (more on that can be found in Chapter 2.2.4). Therefore, the Northern region consists of the following municipalities: Balti, Briceni, Donduseni, Drochia, Edinet, Falesti, Floresti, Glodeni, Ocnita, Riscani, Singerei, and Soroca. The central region consists of Anenii Noi, Calarasi, Criuleni, Dubasari, Hincesti, Ialoveni, Nisporeni, Orhei, Rezina, Straseni, Soldanesti, Telenesti, Ungheni, and the* municipality of *Chișinău. The southern region consists of Basarabeasca, Cahul, Cantemir, Causeni, Cimislia, Leova, Stefan Voda, Taraclia,*

The *northern region* is slightly cooler and receives more rainfall, making it favourable for cereals and oilseeds. The *central region*, characterized by the hilly area, supports vineyards, orchards, and mixed farming systems. The *southern region* is warmer and more arid, more exposed to drought, yet well-suited for sunflowers, grapes, and other crops that thrive in dry, sunny conditions. This north-south gradient is critical for understanding the diversity and vulnerability of Moldovan agriculture.

Agriculture has long been the backbone of Moldova's economy and rural livelihoods. The country benefits from fertile black soils (chernozems), which cover around three-quarters of its territory. Nearly 74 percent of the land is used for agricultural purposes. The sector contributes around 10 percent of national GDP, but its importance is even greater in rural regions, where agriculture can account for up to one-third of local economic output. In terms of employment, about 22 percent of the formally employed population works in agriculture, although informal and subsistence farming are widespread and increase the real share. The food industry is also heavily dependent on domestic agriculture, with agricultural products forming the basis of nearly one-third of total manufacturing output.



Moldova remains vulnerable to external shocks and climate variability. Droughts, in particular, frequently reduce yields, especially in the south, where water availability is limited and irrigation infrastructure remains insufficient. Despite these challenges, agriculture continues to play a vital role in Moldova, not only as a source of income and export revenues, but also as the cornerstone of rural life, food security, and the country's broader economic resilience.

Wheat is one of the most important crops in Moldova's agricultural system, both for domestic food security and for export earnings. Together with maize, it is the country's *largest cereal*, grown across all three regions, with the *north and south* traditionally contributing the largest shares, while the *south* faces more variability due to recurrent droughts. Wheat is not only a staple for bread and flour production but also a key commodity in Moldova's agri-food trade. The spatial distribution of production highlights these regional contrasts, as illustrated in Figure 1-2

FIGURE 1-2 TOTAL WHEAT PRODUCTION FROM THE REGIONAL PERSPECTIVE.

Wheat plays an important role in crop rotation systems by delivering agronomic and economic benefits. **As a winter crop, it helps break pest, disease and weed cycles** associated with rotations dominated by spring crops, thereby reducing pressure on subsequent crops and the need for chemical inputs. **Its dense root system improves soil structure, enhances water infiltration and limits erosion during winter**, while crop residues contribute organic matter and support soil fertility. Wheat also enables more balanced nutrient management by utilising residual nutrients and spreading fertiliser use over time. From an economic perspective, it supports risk diversification, and it often functions as a **strategic rotation crop that improves the yields and profitability** of subsequent, higher-value crops.

2. FUNCTIONAL ANALYSIS

2.1 Overview of the global wheat market

2.1.1 Production

Wheat is one of the most strategically significant agricultural commodities globally, serving as a staple food for more than 35% of the world's population and constituting around 20% of global calorie consumption (FAO, 2025). Over the past years, the wheat sector has undergone considerable fluctuations shaped by geopolitical disruptions, climatic instability, and evolving trade dynamics. Recent years have brought increased volatility to the wheat sector, shaped by ongoing geopolitical conflicts, climate-induced shocks, and trade realignments. Despite stable overall production volumes, the wheat market has undergone structural adjustments in response to changing global dynamics.

Table 2-1 Wheat Production in Leading Producing Countries, 2022–2025 (in million tonnes)

Country	2022	2023	2024	2025 (forecast)	Change (2025/2024)
China	136.6	140.1	140.1	140.5	+0.3%
European Union	133.7	133.7	119.8	135.3	+12.9%
India	110.6	110.6	113.3	115.4	+1.9%
Russian Federation	92.8	92.8	82.6	83.5	+1.1%
United States	49.1	49.1	53.7	52.3	-2.6%
Canada	32.9	32.9	35.0	35.0	0.0%
Australia	26.0	26.0	34.1	30.5	-10.7%
Pakistan	28.2	28.2	31.4	27.9	-11.3%
Ukraine	22.5	22.5	22.4	19.5	-12.9%
Türkiye	22.0	22.0	20.8	19.5	-6.3%
Kazakhstan	12.1	12.1	18.6	15.3	-17.7%
Argentina	15.9	15.9	18.5	20.5	+10.8%
Iran (Islamic Rep.)	16.6	16.6	16.8	13.5	-19.4%
United Kingdom	14.0	14.0	11.1	13.0	+16.6%
World Total	**791.9**	**791.9**	**797.7**	**800.1**	**+0.3%**

Source: FAO Food Outlook, June 2025.

The Russian invasion of Ukraine in 2022 disrupted the global grain trade, particularly in the Black Sea region, which had previously accounted for nearly 30% of global wheat exports. Ukraine, once among the top five wheat exporters globally, saw its capacity to cultivate, harvest, and export grain severely hindered by direct conflict, logistical blockades, and infrastructure destruction. As a result, Ukraine's wheat production fell by at least 20% in 2022-2023 compared to the previous 5-year average, and export volumes dropped to historically low levels, impacting food-importing nations in North Africa and Asia that relied heavily on Ukrainian grain (Euromonitor, 2023). Simultaneously, climate change has introduced irregularities into global production. Droughts in Australia and Central Asia, and heavy unseasonal rainfall in China and India, caused yield variability and localized shortages. The European Union – typically the second-largest wheat producer – experienced erratic weather across 2022 and 2023, which reduced its output and compelled temporary reliance on external imports, a notable shift from its traditional exporter status.

Despite significant market and climatic disruptions, global wheat production has shown relative resilience in recent years. In 2022, global wheat output stood at approximately 791.9 million tonnes, followed by a slight increase to 797.7 million tonnes in 2023, as production stabilized after the initial shocks caused by the war in Ukraine (FAO, 2025). However, climatic stresses – such as persistent droughts in Central Asia and erratic rainfall in Europe and Asia – continued to suppress output in key producing regions. The 2024 season saw only marginal gains due to persistent challenges, but projections for 2025 suggest a cautious rebound to 800.1 million tonnes, led by a strong recovery in the European Union and stable production levels in China and India. The detailed production data for leading producers is given in Table 2-1.

Global wheat production is shaped by two primary factors: the area harvested and the yield per hectare. While total global output has remained relatively stable between 2022 and 2025, this apparent consistency masks substantial regional variation in both area and yield dynamics. In some countries, like India and Argentina, recent production increases are largely the result of expanded planted area, driven by strong domestic prices and favourable market conditions. For example, India's record sowing area in 2025 supported its all-time high production forecast of 115.4 million tonnes. Similarly, Argentina increased its wheat area in response to improved weather forecasts and price incentives, pushing projected yields and production upward.

In contrast, the European Union's recovery in 2025 is not driven by expanded area (which remained constant) but by a significant rebound in yields after two consecutive years of rain-related field losses. The average yield in the EU is expected to return to over 5.3 tonnes per hectare, matching historical norms. Other major producers, such as China, have maintained relatively stable area under wheat cultivation but rely heavily on technological inputs and irrigation to sustain moderate yield growth – estimated at 5.72 t/ha in 2025. Meanwhile, in drought-prone countries like Kazakhstan, Iran, and Australia, even when the area is constant or slightly reduced, yields fluctuate significantly, revealing the vulnerability of rain-fed systems (Table 2-2).

TABLE 2-2 ESTIMATED WHEAT AREA AND YIELD IN SELECTED COUNTRIES (2023–2025) (AREA IN MILLION HA, YIELD IN TONNES PER HECTARE)

Country	Area (2025)	Yield (2023)	Yield (2024)	Yield (2025) (forecast)
China	24.6	5.7	5.7	5.7
India	32.2	3.5	3.6	3.6
European Union	25.5	5.3	4.7	5.3
Russian Federation	29.8	3.0	2.8	2.8
Ukraine	6.0	4.2	4.2	3.8
Kazakhstan	6.5	1.6	2.5	2.1
Australia	9.5	2.8	3.9	3.2
Argentina	6.6	2.4	2.7	3.1

Source: FAO Food Outlook, June 2025; derived estimates based on national data.

These trends highlight a critical point: expanding wheat production requires either more land or higher productivity per hectare. As climate uncertainty grows and land constraints tighten in some regions, yield improvement – through better seed, water management, and agronomic practices – will become increasingly central to global wheat supply stability.

2.1.2 Utilization and Trade

Wheat is primarily consumed as a food staple, but it also plays a significant role as animal feed and in industrial applications (e.g., starch, alcohol, seed). In 2025/26, total wheat utilization is expected to reach 805.4 million tonnes, up by 1.3% from the previous season, of which 68% (approx. 548 million tonnes) is consumed directly as human food (Table 2-3), especially in Asia, the Middle East, and Europe. 20% (approx. 162 million tonnes) is used as animal feed, primarily in countries with large livestock industries such as China, the EU, and the USA. The remaining 12% (approx. 95 million tonnes) accounts for seed use, industrial processing, and estimated post-harvest losses.

Global wheat exports stood at approximately 194 million tonnes in 2022/23 (Figure 2-1), as logistical disruptions following Russia's invasion of Ukraine in early 2022 temporarily constrained volumes. Although Ukraine's export capacity was severely hindered by the closure of traditional seaports, the Black Sea Grain Initiative – in force from July 2022 to July 2023 – enabled the shipment of over 33 million tonnes of grain to more than 45 countries, partially stabilizing global flows and cushioning food-importing nations from more severe supply shocks.

TABLE 2-3 GLOBAL WHEAT UTILIZATION BY CATEGORY, 2025/26 (FORECAST)

Use Category	Volume (Mt)	Share (%)
Food	548.3	68.1
Feed	161.7	20.1
Other uses	95.3	11.8

Source: FAO Food Outlook, June 2025.

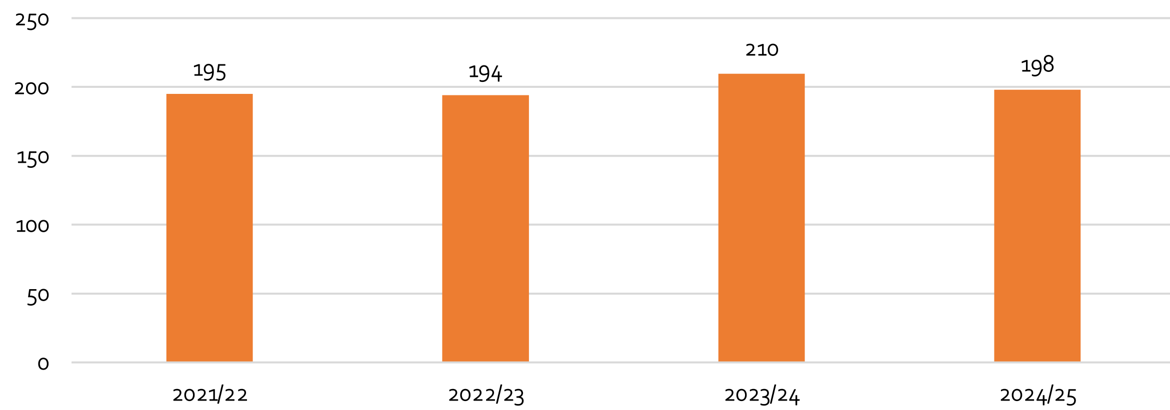


FIGURE 2-1 GLOBAL WHEAT TRADE OVERVIEW BY MARKETING YEAR (2021/22 – 2024/25) IN MILLION TONNES
Source: FAO, USDA.

In the subsequent 2023/24 marketing year, global wheat trade rebounded strongly, reaching an estimated 209.6 million tonnes, marking the highest volume on record. This recovery was supported by improved export capacity in Ukraine, steady production in Russia, and sustained demand from Africa and Asia. Ukraine, despite ongoing conflict, managed to expand its export footprint, particularly in North Africa, where shipments to Algeria nearly tripled and exports to Tunisia increased by over 50% compared to the previous year. This success was largely due to the rerouting of Ukrainian grain through Romania's Port of Constanța and overland logistics networks.
At the same time, Russia leveraged its production capacity and logistical resilience to consolidate its position as the world's top wheat exporter, commanding nearly 50% of North Africa's wheat market and supplying over 70% of Egypt's imports. Its wheat exports reached nearly 48 million tonnes in 2023/24. Russia's ability to offer competitively priced wheat – enhanced by a favourable exchange rate and state-supported logistics – enabled it to displace traditional suppliers like the EU and the United States in several strategic markets.

However, by 2024/25, global wheat exports contracted by 7.8%, falling to an estimated 198 million tonnes, driven primarily by reduced production and softening demand in key markets. Nonetheless, Russia and Ukraine maintained a strong presence. Russia retained leadership in North Africa, becoming the dominant supplier not only to Egypt but also to Libya, Tunisia, and Morocco, largely due to waning EU exports. Meanwhile, Argentina and the United States capitalized on favourable crop conditions and exported aggressively to Latin America and Asia.

Import patterns between 2022 and 2024 evolved in parallel with changes in domestic production, inflationary pressures, and government food policies. In 2022/23, global wheat import demand was buoyed by food security concerns, particularly in the Middle East and North Africa, where nations like Egypt, Algeria, Nigeria, and Tunisia increased their reliance on external supply due to stagnant or declining domestic harvests. At the same time, China surged to become the world's largest wheat importer, with purchases estimated at over 12.5 million tonnes, driven by domestic crop damage from heavy rains and strategic stockpiling to offset geopolitical risks.

However, the picture shifted significantly in 2024/25, when global import volumes declined, pulling overall wheat trade down. Notably, China reduced its wheat imports by approximately 32%, dropping from the top importer position to fourth place globally. The decline was attributed to a combination of improved domestic yields, high stock levels, and tighter currency controls, which made large-scale imports less economically viable.

Similarly, Türkiye, Pakistan, and several EU countries reduced their wheat import volumes due to increased local production, government interventions to stabilize prices, and inflation-related demand compression. In Europe, countries such as France and Germany witnessed a contraction in wheat imports for the first time in several years, as the 2023 and 2024 harvests recovered modestly and input subsidies supported domestic supply.

Meanwhile, import demand in North Africa remained robust. Egypt, the single largest importer in Africa, continued to procure over 13 million tonnes annually, while Algeria, Nigeria, and Ethiopia maintained consistent import levels to meet bread subsidies and household consumption needs. A similar trend was visible in parts of Southeast Asia, where countries like Indonesia and the Philippines maintained steady imports, driven by strong demand in their milling and feed sectors.

2.1.3 Prices

Following historic highs in 2022, wheat prices entered a deflationary cycle in 2023 (Table 2-4). The price drop reflects market adaptation following the 2022 shock. Supply chains were realigned, new trade routes were established, and countries began stockpiling grain to hedge against future disruptions (Euromonitor, 2023).

TABLE 2-4 GLOBAL AND MOLDOVA WHEAT PRICES, 2022–2024 (USD/TONNE)

Year	Average global Price (USD/t)	YoY Change (%)	Average Moldova FOB price (USD/t)	YoY Change (%)
2022	360	+ 35.5	293	+ 23.1
2023	272	- 24.4	211	- 28.0
2024	201	- 26.1	202	- 4.3
Total (2022-2024)		**- 44.1**		**- 31.1**

Source: International Monetary Fund, Global price of Wheat [PWHEAMTUSDM], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/PWHEAMTUSDM, July 16, 2025. UN Comtrade.

Global wheat prices and Moldovan export prices followed the same general direction over the period 2022–2024, but the magnitude and timing of price changes differed. In 2022, both price series increased, although the rise in Moldova was less pronounced than at the global level. Overall, the data indicate that Moldovan export prices were generally lower than global average prices, although by 2024 the price level had converged to the global benchmark. While the average global wheat price increased by 35.5% year-on-year, the average Moldovan export price rose by 23.1%, indicating a partial transmission of the global price shock to Moldova. In 2023, prices declined in both cases, but the price correction was stronger in Moldova. Global prices fell by 24.4%, whereas Moldovan export prices decreased by 28.0%, suggesting a sharper adjustment at the country level. In 2024, the downward trend continued, though at different intensities: global prices declined by 26.1%, while Moldovan prices fell by only 4.3%, indicating a relative stabilisation of export prices in Moldova compared with the global market.

2.1.4 Position of Moldova

Although modest in scale compared to global wheat powerhouses, Moldova holds a strategic niche in the regional wheat economy, particularly within Eastern Europe and the Black Sea trade corridor. The country benefits from its fertile soils, logistical proximity to key importers such as Romania and the broader EU. However, Moldova's international presence remains constrained by its small production base, limited infrastructure, and high exposure to climatic and geopolitical volatility.

In 2023, Moldova produced approximately 1.56 million tonnes of wheat, which makes 2023 one of Moldova's strongest wheat harvests in recent memory. According to National Statistics data, Moldova's wheat area has fluctuated between 311 and 377 thousand hectares. Yields have fluctuated significantly, ranging from a low of

1.9 t/ha in 2020 to a record 4.6 t/ha in 2021. The 10-year trend shows a slow upward trajectory in productivity, although this is punctuated by sharp year-to-year variability.

Research confirms that drought is a major determinant of wheat yield variability in Moldova. A study using the Standardized Precipitation-Evapotranspiration Index (SPEI) found that SPEI explained up to 62% of yield variability, particularly during late-season droughts (Potopová et al., 2016). Persistent regional droughts have repeatedly caused significant yield shocks. This climate trend is long-standing: historically, droughts occur every 3–10 years, with patterns expected to intensify under climate change (FAO, 2024). The Moldova National Adaptation Plan underscores that wheat production declined by over 30% in 2022 due to severe moisture deficits (UNFCCC, 2024).

Despite its small scale, Moldova has emerged as a notable wheat exporter regionally. In 2023, wheat exports reached USD 254 million, or roughly 1.06 million tonnes. These levels placed Moldova 22nd globally, capturing 0.39% of world wheat exports. Romania dominates Moldova's export markets, receiving USD 150 million in 2023 (UN Comtrade, 2025). This trade channel benefits from shared border infrastructure, EU trade facilitation, and Romania's position as both an importer and a transshipment point for wheat into the EU. However, Moldova's wheat is typically exported in raw form with minimal processing, making it competitive mainly on price, which limits value added potential and exposes exporters to commodity price volatility.

Moldova plays a minimal role in global wheat imports, with total wheat import value typically reaching less than 0.01% of global wheat imports. The country imports only small volumes of wheat to address specific quality or timing gaps in domestic supply. In response to growing concerns about regional oversupply and low prices, the Moldovan government introduced mandatory import licensing for wheat, starting in November 2023. This measure was officially extended in June 2025, prolonging the licensing regime until December 31, 2025. The Ministry of Agriculture justified the move as necessary to support local producers, avoid market distortions, and counter the risk of falling farm-gate prices amid abundant regional supply. In practice, the licences have led to a situation in which wheat imports to Moldova do not take place.

2.2 History of wheat production in Moldova

2.2.1 Collectivisation of agriculture under Soviet Union

The process of collectivization in Moldova began in earnest following the Soviet re-annexation of Bessarabia in 1944. The Moldavian SSR underwent a rapid and forceful process of agricultural collectivization. The transformation was particularly profound on the western side of the Dniester River, where collectivization had not previously been implemented during the interwar period under Romanian administration. As noted by Carrière (1979), land collectivization west of the Dniester began only in the late 1940s, making it a recent and abrupt shift for much of the republic's population.

The collectivization process unfolded with high intensity between 1947 and 1950, culminating in a system dominated by large-scale socialized farms – namely, collective farms (kolkhozes) and state farms (sovkhozes). This campaign was not merely administrative – it entailed the wholesale reorganization of rural society. Private landholders were dispossessed, rural elites and clergy were deported, and traditional village structures were dismantled. The collectivization drive in western Moldova – where land had previously been held privately under Romanian law – was especially disruptive and often resisted by the peasantry.

Quantitatively, the transformation was immense. According to Carrière (1979), the number of kolkhozes rose from 233 in 1940 to 1,636 by 1950, a sevenfold increase. During this same period, cereal crops remained the dominant land use within kolkhozes, representing 69.8% of their cultivated area in 1940 and 73.9% in 1950. While the area of cereals grew significantly in absolute terms – from 146,200 ha to 1,172,600 ha – this increase should be interpreted primarily as a reflection of the massive expansion of the kolkhoz sector, not necessarily as a proportional increase in national cereal cultivation. As kolkhozes became the principal agricultural structure by

1950, their cropping patterns offer insight into state-directed production priorities, particularly the emphasis on grain.

According to Gorton (2001), the total cultivated area in kolkhozes and sovkhozes in Soviet Moldova stood at approximately 2.1 million hectares (Table 2-5). Comparing this with kolkhoz land figures from Carrière (1979), it can be estimated that 75.5% of this land was operated by kolkhozes, while the remaining 24.5% was under the control of sovkhozes at that time. As Crowther (1991) emphasizes, Moldova entered the Soviet system with no native communist cadres, no tradition of cooperativism, and a largely peasant-based, Romanian-oriented rural population. This made the region particularly resistant to collectivization and necessitated a greater ideological and institutional effort to restructure both agriculture and rural society. In the Moldovan SSR, kolkhozes were the primary vehicle for collectivizing the peasantry – a population that, until the Soviet annexation, was deeply embedded in private landholding traditions under Romanian law.

Table 2-5 The structure of agricultural land ownership in Moldova between 1980-1990

Year	State farm (sovkhozes)			Collective farm (kolkhozes)		
	Number	Average size (ha)	Total area (1000 ha)	Number	Average size (ha)	Total area (1000 ha)
1980	353	2,203	778	392	3,414	1,338
1982	435	1,998	869	367	3,300	1,211
1984	427	2,065	882	368	3,300	1,214
1986	484	1,811	877	369	3,272	1,207
1988	470	1,855	872	375	3,222	1,208
1990	400	na	na	534	na	na

Source: USDA (1993).

Kolkhozes were nominally cooperatives, in which land and production assets were formally owned by the collective of farmers. Workers in kolkhozes were not salaried. They were compensated through the work-day system, receiving in-kind and monetary rewards based on seasonal output and administrative discretion. In practice, decisions were often heavily controlled by party officials and farm directors. While kolkhozes were subject to central planning, they retained a modicum of autonomy compared to state farms (Stewart, 2019).

Sovkhozes, by contrast, were fully state-owned enterprises, where agricultural workers were state employees paid a fixed wage. Sovkhozes had no cooperative ownership; the state owned all land and means of production. Their structure was more industrial, and they were directly managed by the Ministry of Agriculture or branch-specific authorities (e.g., fruit or tobacco ministries). Sovkhozes were used to professionalize and industrialize agriculture, particularly in regions targeted for specialized production or export-oriented sectors (Gorton, 2001).

2.2.2 Performance of wheat production under Soviet Union

The Moldavian SSR was integrated into the Soviet agro-economic complex as a specialized agricultural republic, with a strong focus on crop production, including grains, fruits, vegetables, and industrial crops. Agricultural production was driven by a dual framework of kolkhozes and sovkhozes, underpinned by centralized planning, input allocation, and production quotas. Within this system, grain cultivation – especially wheat – held a strategic position, serving both local consumption and all-Union redistribution.

The evolution of wheat production in Moldova is best captured through its yield performance. According to a long-term statistical study by Corobov (2002), winter wheat yields rose significantly between 1961 and 1990, increasing from approximately 1.2 tonnes per hectare in the early 1960s to 3.6–4.2 t/ha by the late 1980s, before plateauing near the end of the Soviet period. This more than threefold increase reflected the impact of agronomic intensification: improved seed varieties, mechanization, expanded fertiliser use, and better weed and pest control practices.

Despite this progress, wheat productivity in Moldova remained highly variable, and strongly influenced by climatic factors. Corobov's regression analysis of Soviet-era data indicates that up to 75% of the interannual variability in wheat yields could be explained by fluctuations in temperature and precipitation, particularly during the crop's critical growth stages. Drought events, such as those observed in 1972, 1976, and 1986, led to substantial drops in output, revealing the vulnerability of Moldova's production system to environmental stress (Corobov, 2002).

In terms of comparative performance, Moldova's cereal yields ranked among the higher-performing republics of the USSR, though still significantly below Western European levels. The centralized nature of production planning limited local autonomy, and weak incentives for efficiency constrained further productivity growth. Moreover, the prioritization of physical output volumes over product quality or environmental sustainability created additional inefficiencies. Despite the systemic limitations, Soviet Moldova succeeded in building a highly cultivated agricultural economy. However, this performance came at the cost of heavy input dependency and growing ecological vulnerability, trends that would become even more visible after the dissolution of the Soviet Union.

Despite notable improvements in output and yield throughout the Soviet period, agriculture in the Moldavian SSR remained constrained by structural inefficiencies inherent to the Soviet economic system. The collective and state farm structures that dominated Moldova's rural economy were products of Stalinist centralization and postwar collectivization, which prioritized control and uniformity over productivity and innovation. These large-scale entities, averaging over 2,000 hectares and staffed by about 1,000 workers each, operated within a highly centralized planning system. Decision-making authority was concentrated at the republic and union level, with little autonomy left to farm managers, leading to bureaucratic rigidity and limited responsiveness to local agro-climatic conditions (Csaki et al., 1997).

A critical limitation of this system was the lack of incentives for individual effort. In kolkhozes, remuneration was based on work units rather than output, and sovkhoz workers were salaried civil servants. This discouraged initiative and risk-taking among workers, while also limiting responsiveness to fluctuating environmental conditions (Lerman & Cimpoieş, 2006). Productivity remained dependent not on efficiency or innovation, but on state subsidies, extensive land use, and the mobilization of human labour.

While Moldova's natural endowments – especially its fertile chernozem soils – should have offered comparative advantages in grain and wheat production, these were undermined by the inefficient allocation of resources. Investments favoured capital-intensive sectors like grapes and fruit, particularly for export, while cereal production was often relegated to secondary status (Gorton, 2001). Moreover, fixed procurement prices and mandatory delivery quotas discouraged specialization or crop diversification, leading to monocultures vulnerable to climatic variability.

Moreover, the centralized allocation of inputs such as fertiliser, seed, and fuel often arrived late or in suboptimal quantities. This undermined planting and harvesting schedules, reducing potential yields. Efforts to introduce technological modernization were uneven and limited by chronic underinvestment and poor maintenance of machinery (Csaki et al., 1997). In essence, while aggregate output increased during certain decades – particularly in the 1960s and 1970s – this growth was largely the result of input intensification rather than productivity gains. As such, it was not sustainable. The structural flaws of the system – lack of individual incentives, rigid bureaucracy, underinvestment, and climatic vulnerability – left Moldovan agriculture particularly fragile during the systemic crisis of the late 1980s and the post-Soviet transition that followed.

2.2.3 Land Reform and Private Farming

The centralized Soviet model prioritized agro-industrial integration and state-directed resource allocation, which left Moldova with weak market institutions and an underdeveloped private farming culture (Csaki et al., 1997). In 1991, after claiming independence from the Soviet Union, Moldova passed a new land code aimed at dismantling the collective farming system by transferring land and asset shares to 1.2 million members of these farms.

Moldova implemented two major types of land reform initiatives. The first involved a “small-scale” privatization strategy in which rural households were each granted a minimum of 0.3 hectares of land. Families with more than three members were eligible to receive an additional 0.1 hectares per person, up to a total of 0.75 hectares. By 1999, this scheme had resulted in the allocation of approximately 344,500 hectares.

The second reform track targeted the restructuring of state and collective farms. This effort was formalized through key legal frameworks, including the Land Code of December 1991 and the Law on Peasant Farms of January 1992. The Land Code established the legal basis for privatizing collective and state farmland and defined the eligible recipients of land shares. These beneficiaries included current and former farm employees – ranging from manual workers and pensioners to administrative personnel and those working in social services affiliated with the farms (Lerman et al., 1998).

Importantly, the legislation prioritized distribution to existing farm workers rather than restoring land to families dispossessed during the collectivization campaigns of the early 1950s, following Moldova’s incorporation into the Soviet Union. The Law on Peasant Farms provided the legal framework for individuals to leave collective farms and claim a share of land for private agricultural activity. However, despite granting the right to exit the collective system, land sales remained restricted under a legal moratorium. The Law on Normative Price of Land and Procedure for Sale and Purchase of Land, enacted in July 1997, formally ended the moratorium on land sales. However, it introduced a restriction prohibiting the resale of agricultural land for a period of five years following its initial acquisition (Gorton, 2001).

The implementation of land reforms was initially hindered by political resistance, bureaucratic inertia, and fear of uneconomically small plot sizes (Stewart, 2019). For several years, less than 10% of rural inhabitants broke away from the old system, while productivity stagnated and rural living standards declined (Csaki et al., 1997). Recognizing these issues, Moldova – with strong support from USAID – launched the National Land Program (NLP) in 1995. The U.S.-financed initiative aimed to fully privatize land across the country by breaking up former state and collective farms into private holdings (Stewart, 2019). Between 1995 and 2000, the NLP privatized 836 collective and state farms, issuing land titles to over 900,000 Moldovans. The acceleration of the reform progress in 1995 is perfectly illustrated by the changes in the number of entities in the agricultural sector (Table 2-6).

Table 2-6 Number of farms by type of ownership in Moldova between 1994-1998

Farm type	**Number of farms**					
	1994	**1995**	**1996**	**July 1997**	**Jan 1998**	**Approx. average size (ha) (1998)**
State and partial state	358	281	236	150	84	400
Collective farms (kolkhozes)	535	438	395	260	111	2000
Joint stock companies	36	80	160	261	228	2000
Co-operatives	65	131	194	396	490	670
Individual farms	3,058	13,958	16,064	74,464	98,724	1.5
Associations of farmers	7	67	146	260	264	90
Limited Liability Companies	58	6	11	24	63	n. a.
Entities founded by kolkhoze**s** and co-ops	44	37	34	22	17	n. a.
Total	**4,161**	**14,998**	**17,240**	**75,837**	**99,981**	

Source: Gorton, (2001).

The process involved detailed land surveying, asset valuation, and the formal demarcation of individual land parcels. The program also utilized innovative approaches such as the "leader-entrepreneur" model, allowing individuals to lease parcels from others to create viable farm units (Stewart, 2019). While this marked a significant departure from the command economy, Moldova’s reform was notable for its smallholder focus. Most beneficiaries received plots averaging 1.5 hectares, reflecting an egalitarian distribution model but also laying the foundation for significant land fragmentation (Gorton, 2001). The shift in farming from state-controlled entities to market-oriented firms is evident by comparison of the land use structure (Table 2-7).

TABLE 2-7 STRUCTURE OF AGRICULTURAL LAND BY TYPE OF OWNERSHIP IN MOLDOVA IN 1990 AND 2003 (IN %)*

Ownership / Year	1990	2003
State sector (of which):	**32.1**	**27.4**
Reserve land	0.6	16.4
State farms	31.4	11.0
Corporate forms*	**59.5**	**32.5**
Collectives	59.5	0.5
New corporate forms	0.0	31.9
Individual sector	**8.5**	**40.1**
Peasant farms	–	27.6
Household plots	8.5	12.5
Total land (1000 ha)	**2,562.2**	**2,528.3**

* 2003 figures include the Transnistria region; Corporate forms: kolhozes in 1990, private sector in 2003.
Source: Lerman & Cimpoieş, (2006).

Gorton & White (2003) argue that land reforms were legally efficient but structurally flawed, as they neglected the institutional and infrastructural needs necessary to support a productive private farming system. One of the unintended consequences was excessive land fragmentation, which has had profound negative effects on agricultural productivity (see Table 2-8) and rural development. The failure to anticipate and manage the post-reform agrarian structure has left Moldova with a subsistence-based sector that lacked scale, investment, and competitiveness (Gorton & White, 2003).

*TABLE 2-8 COMPARISON OF AGRICULTURAL PRODUCTIVITY IN MOLDOVA IN 1990 AND 2000 (INDIVIDUAL AND COLLECTIVE SECTORS)**

Productivity	1990	2000	1990=100
Labour productivity (value of output per person employed)	9,700	4,226	44
Land productivity (value of output per hectare)	2,594	1,408	54

* Results given in lei (MDL - Moldovan currency) constant prices.
Source: Own calculation based on (Gorton & White, 2003).

After the reform in Moldova, agricultural land is primarily managed by three categories of landowners: agricultural enterprises, peasant farms (households) (*gospodării țărănești*), and household plots. **Agricultural enterprises (AE)** – such as limited liability companies (SRLs) or joint stock companies (SAs) – are formal legal entities engaged in commercial-scale farming, often operating on leased or consolidated lands and subject to corporate taxation and standard accounting. **Peasant farms (PF)** are individual or family-based farms registered as natural persons; they can benefit from simplified taxation and administrative procedures, provided they adhere to strict conditions related to production provenance, labour contribution, and legal compliance. Members bear full liability, and the household must meet obligations spanning land use, labour law, environmental protection, and tax compliance. Broadly, this reflects a hybrid enterprise model – semi-formal, family-managed, yet anchored in the national framework for agriculture. Lastly, **household plots (HP)** are small land parcels owned by rural residents for subsistence farming or garden production; these are not considered commercial farms and are usually exempt from business registration, taxation beyond local property tax. Also, household plots, or farmers with less than 10 ha, are exempt from the full statistical monitoring. The production in the household plots and smaller farms is derived from the separate, annual survey processed by the National Bureau of Statistics.

Although the privatization process caused land ownership to become fragmented, in practice, land usage has remained largely consolidated, with corporate farms leasing land from smallholders. According to the General Agricultural Census (2011), less than 1% of agricultural holdings (from with and without the juridical status holdings) cultivated nearly 68% of Moldova's farmland. As a result, Moldova's agriculture exhibits a dualistic structure: large corporate operations coexist with small farms. While small farms once played a key role in household food security, they are now seen as barriers to land market development, productivity, and competitiveness. Despite the privatization process concluding in 2000, the fragmented pattern of ownership has persisted, although land use itself has remained relatively consolidated (World Bank, 2014).

Such a structure translates also to the current state of the art; According to the National Bureau of Statistics, in 2024, agricultural land covers around 2.4 million ha (73% of the country's area), of which arable land is more than 75%. 12.5% of agricultural land is used for pastures, and around 11% consists of perennial plantations. According to the same source, nearly 11% of arable land is provided with irrigation. According to the Centralized Cadastral Register of Moldova, as of 1st of January 2025, 28.5% of agricultural land is state-owned (60% of it is owned by administrative-territorial units and 40% directly by the state). The structure of agricultural land ownership is given in Table 2-9.

TABLE 2-9 STRUCTURE OF AGRICULTURAL LAND OWNERSHIP IN MOLDOVA AS OF JANUARY 2025

Type of Ownership	% of agricultural land
State owned	**28.5**
Privately owned	**71.5**
Agricultural enterprises	39.2
Peasant farms	15.9
Household plots	13.0
Others	3.4

Source: Own calculation based on the Centralized Cadastral Register of Moldova.

According to the same register, there are more than 1.2 million landowners. However, more than 57% of privately owned agricultural land is rented. Typically, in Moldova, the lease contracts are valid up to 5 years, offering medium-term stability yet allowing for periodic renewal. Based on the cadastral data, we can estimate that only around 5% of all land rent agreements are signed for more than 5 years. Nevertheless, it shows that the concentration of production is maintained through land rents.

Agricultural land use in Moldova is traditionally dominated by grain production. The structure of sown areas each year is dominated by three crops: wheat, grain maize, and sunflower. In recent years, their shares circulated around 20-25%, 30-35%, and 22-28%, respectively (National Bureau of Statistics, 2025). Compared to the first years after decollectivisation, there has been an increase in the share of technical crops in the sown area, mainly due to the increased share of sunflower. At the same time, vegetables (including potatoes) and forage crops record a lower share in the structure (Table 2-10).

TABLE 2-10 SOWN AREA OF AGRICULTURAL CROPS IN MOLDOVA

Crops / Unit		2000	2005	2010	2015	2020	2021	2022	2023	2024
Cereals and leguminous crops	1000 ha	987.6	1034.7	919.6	949.6	957.1	971.1	953.0	969.7	946.1
	% of area	64.7	67.2	63.0	63.2	62.2	62.4	60.3	60.8	60.3
Industrial crops	1000 ha	330.4	358.0	388.3	434.9	462.1	474.5	521.4	521.8	518.0
	% of area	21.6	23.2	26.6	29.0	30.1	30.5	33.0	32.7	33.0
Vegetables (including potatoes)	1000 ha	124.8	79.8	77.1	57.3	69.4	67.1	69.0	70.1	69.5
	% of area	8.2	5.2	5.3	3.8	4.5	4.3	4.4	4.4	4.4
Forage crops	1000 ha	84.5	67.8	75.3	60.8	48.9	44.8	37.1	34.3	35.6
	% of area	5.5	4.4	5.1	4.0	3.2	2.8	2.3	2.2	2.3

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

2.2.4 Recent developments in wheat production

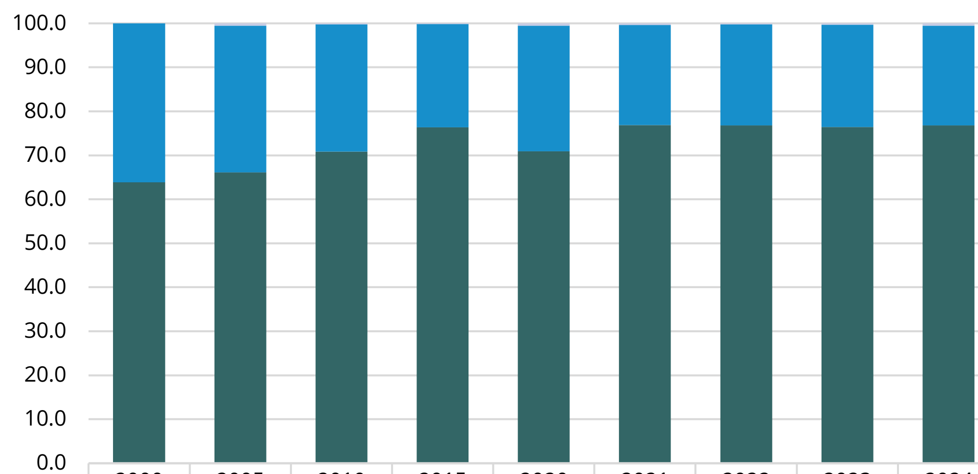
As mentioned before, wheat, maize, and sunflower dominate the structure of arable land use in Moldova. For this reason, we present the recent harvest data for all three crops (Table 2-11), as they all show significant variability, mainly related to climate change: soil erosion, drought, etc. Moreover, in the same table, we present the average selling prices of these crops. In general, prices are dependent on the global price trends. However, some variability can also be explained by the yields and total harvest (if low, prices tend to be higher and vice versa). Wheat and maize are characterized by the same price range in the analysed years, whereas sunflower price is much higher, sometimes even two and a half times higher than wheat and maize.

TABLE 2-11 HARVEST AND SELLING PRICES DATA ON MAIN CROPS PRODUCED IN MOLDOVA

Crops / Unit		2000	2005	2010	2015	2020	2021	2022	2023	2024
Wheat	Gross harvest (1000 t)	727.7	1056.7	744.2	922.3	569.7	1565.2	855.0	1555.0	1195.3
	Yield (t/ha)	2.0	2.6	2.3	2.7	1.9	4.6	2.6	4.1	3.2
	Price (MDL/tonne)	1,039	961	1,600	2,430	3,012	3,309	4,179	2,732	2,905
Grain maize	Gross harvest (1000 t)	1031.2	1492.0	1419.8	1076.8	785.2	2792.7	752.3	1351.5	717.8
	Yield (t/ha)	2.3	3.3	3.5	2.2	1.9	5.7	1.7	2.8	1.6
	Price (MDL/tonne)	1,024	1,163	2,257	2,674	3,128	3,463	3,855	2,831	2,945
Sunflower	Gross harvest (1000 t)	268.6	331.1	382.3	484.8	492.5	960.1	627.1	758.4	619.6
	Yield (t/ha)	1.2	1.2	1.5	1.5	1.3	2.5	1.4	1.9	1.5
	Price (MDL/tonne)	1,364	2,348	4,552	6,532	7,418	9,287	10,568	6,554	7,916

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

All three major corps show similarity in the yield trend, which shows that most of the variability can be explained by the external factors, like weather conditions. However, there are some exceptions related to the different sensitivity of specific crops to these factors. In general, all three crops are connected through the crop rotation system used in Moldova, in which they all play a significant role. However, there are differences in the structure of production by the category of producer, namely, roughly 1/3 of maize is produced on household plots, whereas in the case of sunflower and especially wheat, household plots play a marginal role. Shares of wheat harvest by the category of producer are presented in Figure 2-2.



	2000	2005	2010	2015	2020	2021	2022	2023	2024
Household plots	0.0	0.5	0.2	0.2	0.5	0.4	0.2	0.3	0.6
Peasant farms	36.1	33.4	29.0	23.4	28.5	22.7	23.0	23.3	22.7
Agricultural enterprises	63.9	66.1	70.8	76.4	70.9	76.9	76.8	76.4	76.8

FIGURE 2-2 STRUCTURE OF WHEAT HARVEST BY THE CATEGORY OF PRODUCER IN MOLDOVA (%)
Source: National Bureau of Statistics of the Republic of Moldova: Agriculture.

The near absence of wheat production by household plots is due to the lack of technical and economic sense of growing on a small parcel of land, which does not allow economies of scale. In contrast, the overall share of household plots in the sowing area of cereals and leguminous crops in 2024 was more than 22% (and almost 12% in harvest share). The significantly higher share of agricultural enterprises in wheat production than peasant farms is mainly due to differences in the size of sown areas. At the same time, there is also an advantage in the yields obtained by agricultural enterprises (Figure 2-3). In recent years, the only exception was 2020 (the year of the worst drought to hit Moldova in its recent history) and, to a lesser extent, 2024.

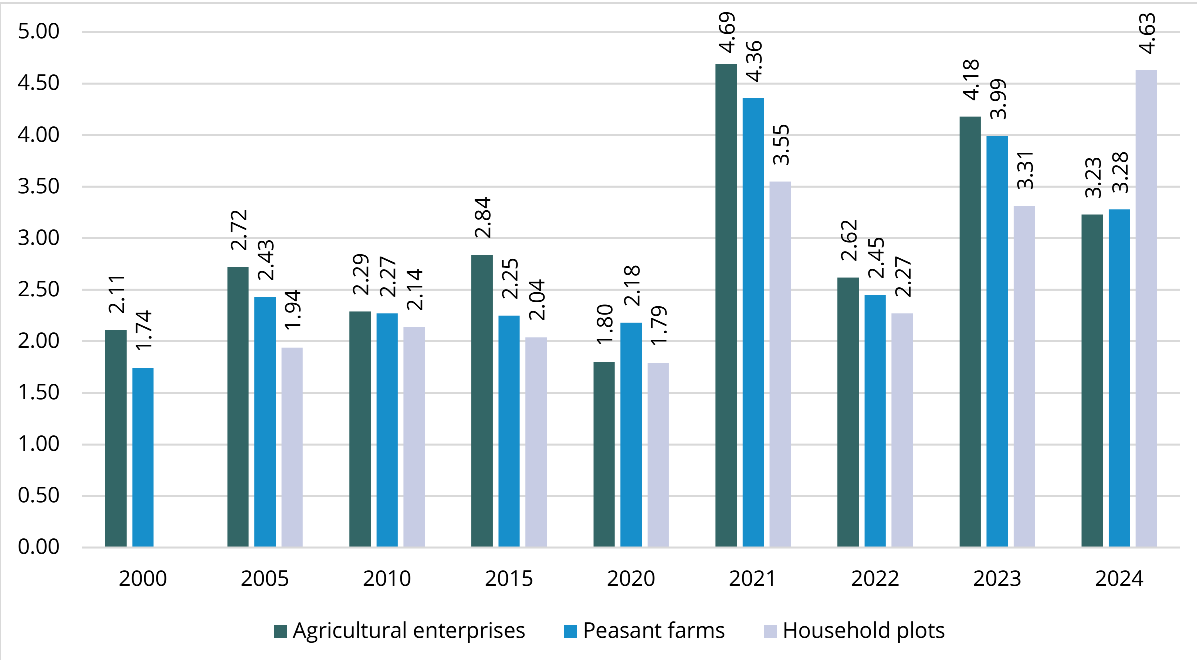


FIGURE 2-3 YIELDS OF WHEAT BY CATEGORIES OF PRODUCERS (T/HA)
Source: National Bureau of Statistics of the Republic of Moldova: Agriculture.

More importantly, in Moldova, the regional differences in wheat yields can be observed (Figure 2-4, Figure 2-5). The southern region, being most affected by droughts, is characterized by the lowest yield in recent years. The northern region has the highest yields, while the central region has middling yields. In 2023, the yields for the Northern, Central, and Southern regions were 5.1t/ha, 4.2t/ha, and 3.5t/ha, respectively. It shows that the difference in yields can be as high as 30%. However, in previous years, and more importantly in 2024, it was less significant.

The southern region has on average, around 15% higher wheat sown area than the northern region in the last five years, but it does not always translate to a higher production (Figure 2.5). The main differences in yields and harvest are caused by natural factors. The northern region, particularly around the Bălți Steppe, is characterized by a moderately continental climate with relatively high annual precipitation. The region's chernozem soils, among the most fertile in Europe, are deep, well-structured, and rich in humus, ideal for cereal cultivation. The combination of relatively reliable rainfall and high soil fertility makes northern Moldova the most favourable zone for stable wheat yields under rainfed conditions. The central plateau exhibits a transitional climate between the wetter North and the drier South. The rainfall is irregular, and droughts are increasingly frequent, especially in late spring and summer. The terrain is hillier, and the soils include both typical chernozems and Gray forest soils, with the latter being shallower and slightly more prone to erosion. While central Moldova still provides suitable conditions for wheat, yield is more variable. In the southern part of the country, such as the Bugeac Plain, the climate becomes markedly drier and warmer, with annual precipitation often dropping below 400 mm. Summers are hot and dry, with high evapotranspiration rates and a greater risk of prolonged droughts, especially during grain-filling periods. The soils there are often calcareous chernozems or steppe soils, which are moderately fertile but suffer from low moisture retention and are more vulnerable to degradation under intensive farming. These conditions demand adaptive cultivation strategies.

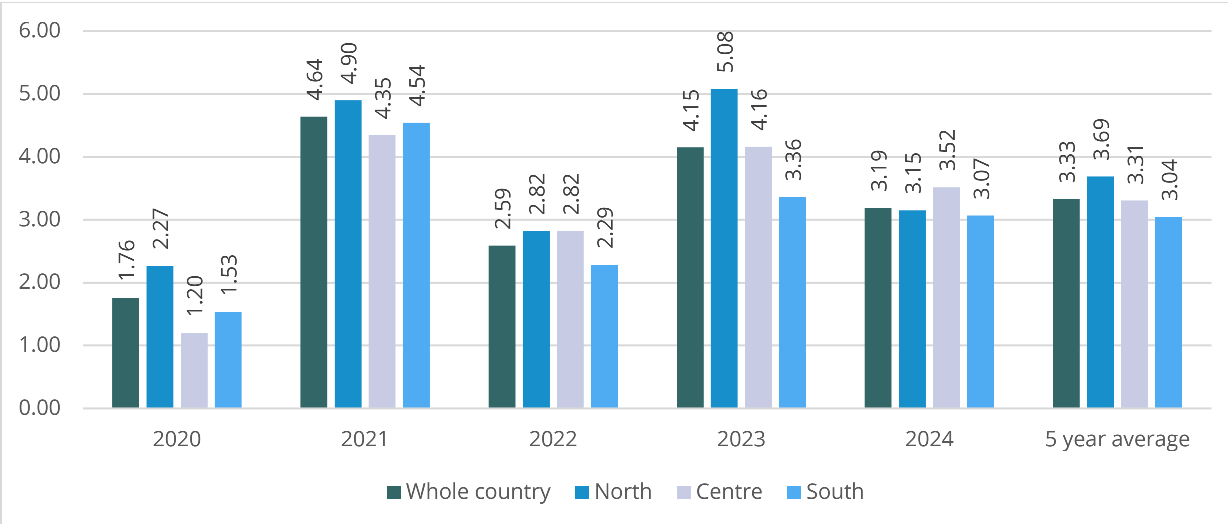


FIGURE 2-4 YIELDS OF WHEAT BY REGION (T/HA)

Source: Own calculation based on the National Bureau of Statistics of the Republic of Moldova.

* The Centre region includes Municipality Chisinau, and the South region includes T.A.U. Gagauzia.

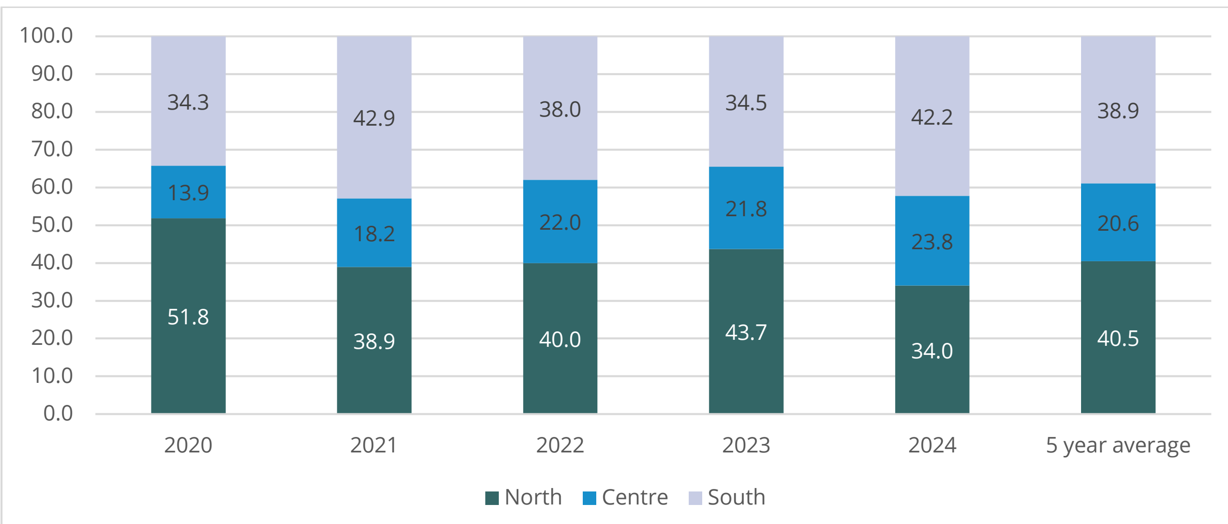


FIGURE 2-5 SHARE OF WHEAT HARVEST IN MOLDOVA BY REGION.

Source: Own calculation based on the National Bureau of Statistics of the Republic of Moldova.

* The Centre region includes Municipality Chisinau, and the South region includes T.A.U. Gagauzia.

Additionally, one more region exists in Moldova, which is not considered above. The right bank of the Dniester River and the municipality of Bender are under the rule of an unrecognized separatist government forming the **Pridnestrovian Moldavian Republic** (Transnistria or PMR). From a production perspective (Table 2-12), the PMR's production statistics are not included in the National Bureau of Statistics of Moldova. However, based on discussions and available literature, it is known that part of the Transnistrian production is available on the Moldovan market and contributes to part of the export flows. From the export perspective, the export procedure of Transnistrian wheat must be recorded under an entity registered in the RoM and must originate on the territory of the Republic of Moldova. The Transnistrian region in the period from 2016 – 2021 (when data was available[8]) usually produced from 14% (2020) to 28% (2016) of the wheat quantity produced on the left bank of

[8] After the beginning of the full-pledged war in Ukraine, the Pridnestrovian Moldavian Republic – Transnistria, stopped to publish any data. Data for the period of 2016 – 2021 reached by using the WaybackMachine by Archive.org. Available here.

the RoM. This value enabled the estimation of the production for 2022 – 2024, i.e., for years PMR does not present any data. In 2023, the reference year for this study, the total wheat production in the territory of RoM exceeded 1,900 thousand tonnes, encompassing both banks of the River Dniester. However, this study will not consider the production quantity produced in Transnistria, as data and survey collection would be complicated and uncertain.

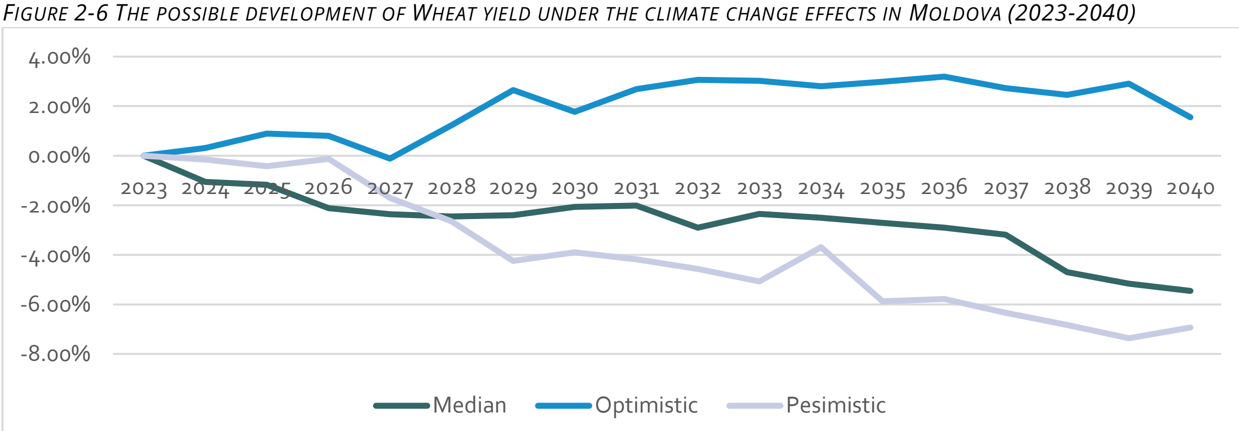
Table 2-12 Harvest of wheat produced on the whole territory of the Moldova

	2016	2017	2018	2019	2020	2021	2022	2023	2024
	Republic of Moldova, excluding PMR-Transnistria								
Area (K ha)	371.3	335.6	373.1	352.7	311.4	341.7	332.0	377.0	369.2
Total production (K tonnes)	1,293	1,251	1,163	1,148	570	1,565	855	1,555	1,195
Yield (t/ha)	3.5	3.7	3.1	3.3	1.8	4.6	2.6	4.1	3.2
	PMR-Transnistria								
Area (K ha)	81	72	80	84	48	85	N/A	N/A	N/A
Total production (K tonnes)	362	290	300	296	78	385	*209	*381	*293
Yield (t/ha)	4.5	4.0	3.8	3.5	1.6	4.5	N/A	N/A	N/A
Production of PMR to RoM (%)	28%	23%	26%	26%	14%	25%	*24.5%	*24.5%	*24.5%
	Moldova, Total								
Wheat production	1,655	1,541	1,463	1,443	648	1,950	*1,064	*1,935	*1,488

*Values of production estimated based on long term relationship between production in RoM and PMR (24.5%) (in red).
Source: The National Bureau of Statistics of the Republic of Moldova, Statistical information from PMR

The most recent information from the Europan Joint Research Centre and pilot studies based on sentinel sensing may indicate a discrepancy between registered land dedicated to wheat production and real amount of land used for wheat production. Based on interviews, stakeholder (NGOs mainly) estimated that there could be up to 20% more land harvested with wheat to official numbers.

Figure 2-6 The possible development of Wheat yield under the climate change effects in Moldova (2023-2040)



Source: IFAD CARD (2021) tool[9]

The projected development of wheat yields under climate change is illustrated across three uncertainty settings (median, optimistic and pessimistic) each reflecting different percentile aggregations of underlying crop models. The median scenario, representing the "best-guess" outcome, shows a gradual but persistent decline in yields over time, with losses becoming more pronounced after 2035. The pessimistic scenario, based on the 10th percentile of model results, indicates a much steeper downward trend, with yield reductions accelerating from

https://web.archive.org/web/20240820073353/https://mer.gospmr.org/deyatelnost/gosudarstvennaya-sluzhba-statistiki-gosstat/informacziya/zhivotnovodstvo/rastenievodstvo/itogi-uborki-urozhaya.html
[9] To find more on the CARD model (Climate Adaptation in Rural Development) see the following link https://www.ifad.org/en/w/publications/climate-adaptation-in-rural-development-card-assessment-tool.

the late 2020s and reaching declines of around 7–8% by 2040, reflecting conditions close to the worst-performing models. In contrast, the optimistic scenario, based on the 90th percentile, presents a more favourable outlook yields initially fluctuate but generally rise above baseline levels, peaking in the early 2030s before stabilising slightly above zero. Together, these scenarios highlight substantial uncertainty in future wheat production, but they consistently signal increasing climate-related pressure, with only the most optimistic conditions preventing long-term yield losses.

2.3 Wheat food balance

The level of wheat self-sufficiency in Moldova is typically high, reaching, on average, more than 160% over the last ten years. Only in 2020 was it less than 100%, which means that storage supplies and imports had to be used to cover the entire demand. Such a situation was caused by the extreme drought and can be present from time to time in Moldova. The previous year in which self-sufficiency was not met was in 2012. In recent years, the internal market has been capable of absorbing around 450 thousand tonnes of wheat for final consumption, 120-130 thousand tonnes for fodder, and 70 thousand tonnes for seeds. Around 5 thousand tonnes of wheat are lost, and the rest is exported. Depending on production, export numbers vary significantly, up to more than 1 million tonnes in 2023 (the best year in this regard). However, the Moldovan market can absorb around 650-665 thousand tons of wheat in total, with only a small portion being imported (less than 6% in recent years). The average food balance of wheat in Moldova is presented in Figure 2-7.

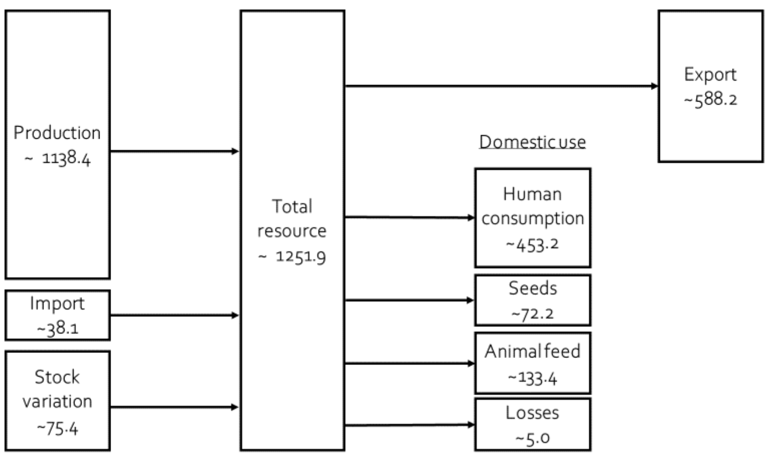


FIGURE 2-7 FOOD BALANCE OF WHEAT IN MOLDOVA - AVERAGE 5-YEAR VALUES FROM 2019 TO 2023 (IN THOUSAND TONNES)
Source: Own calculation based on Balanțele resurselor alimentare și utilizării lor (the National Bureau of Statistics of the Republic of Moldova).

2.4 Actors Considered in the Moldova Wheat Value Chain

The production and distribution of wheat in Moldova can be analysed as a VC involving several key actors and stages. Initially, agricultural input providers supply farmers with the necessary inputs for cultivation, including fertilisers, seeds, and plant protection materials. Farmers then undertake wheat production, utilising their primary resources: land, labour, and capital. The harvested wheat is subsequently channelled to various actors within the sector, such as landowners, traders, industrial mills, and feed producers. A share of the production is retained at the farm level for on-farm consumption, primarily as animal feed or as seed for subsequent planting cycles. A detailed analysis of the individual actors in this VC is provided in the sections below.

The VC analysis aims to provide a detailed definition of the actors, their operations, and answers to the questions set out by the VCA4D methodology. To ensure accurate and representative analysis, it is essential to define the boundaries of the VC.

Given that bakeries produce a wide range of products differing in type, technology, price, and labour requirements, they were not included in the core VC mapping. A similar situation was observed among compound feed producers and feed millers. Each producer operates with a unique typology and recipe; different animal species require different feed compositions, which also vary according to the age of the animals. Including this entire component in the VC mapping would either make the analysis overly complex or result in findings that are not truly representative.

For this reason, both industries, bakeries and feed producers, were excluded from the core VC mapping and analysis. However, to provide a more comprehensive picture, they were included in the functional analysis to illustrate the situation and trends related to these actors.

2.4.1 Farmers

As defined above, farming practices are determined by the historical development, collectivization during the Soviet era, and subsequent privatization. At the same time, various divisions of farm types are included in national statistics. Initially, for statistical purposes, the National Bureau of Statistics distinguishes between Peasant Farms (PF), Agricultural Enterprises (AE), and Household Plots. The Paying Agency and the Ministry of Agriculture characterise farms based on their number of employees and total turnover. This creates division into micro, small, medium, and large enterprises/farms. Neither division is perfect; for example, they do not consider the number of hectares. During interviews, it was discovered that some peasant farms operate on thousands of hectares, while some agricultural enterprises may be relatively small.

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 two base archetypes of classical producers, aligning with the official division into peasant farms (PF) and agricultural enterprises (AE). 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 6 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 2-13.

TABLE 2-13 DISTRIBUTION OF WHEAT PRODUCTION AMONG TYPICAL FARMS

Archetypes			Total wheat production (K t)[1]	Total hectares - wheat (K ha)[3]	Yields (t/ha)[2]	Average farm size (ha)[5]	Average wheat cultivation (ha)[5]	Per farm production (t)[4]	Number of Farms[4]
Conventional	North	PF	132.0	26.56	4.97	114	36	181	730
		AE	436.8	83.84	5.21	382	131	680	642
	Central	PF	83.1	20.42	4.07	152	54	218	381
		AE	262.3	61.43	4.27	403	143	611	429
	South	PF	105.7	32.13	3.29	160	57	189	560
		AE	415.2	120.70	3.44	710	214	735	565
Organic			18.7	7.48	2.5	855	299	748	25
No-Till			101.2	24.50	4.13	603	211	872	116
Total | Average			**1,555**	**377**	**4.12**	**331**	**109**	**451**	**3,448**

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 AIPA, surveys, and NBS.

Based on the data available from the AIPA payment agency, specifically data on support for excise duty on diesel[10], which indicated farms that received support and their locations, the distribution of farms to regions and the division of peasant farms and agricultural enterprises were possible. Table 2-14 presents the distribution of farms among regions and the share of peasant farms and agricultural enterprises.

TABLE 2-14 DISTRIBUTION OF FARMS TOWARDS REGIONS AND SHARE OF PEASANT FARMS AND AGRICULTURAL ENTERPRISES (2023)

Region	All Farms	PF (%)	AE (%)
North	41%	22%	19%
Central	25%	12%	13%
South	34%	17%	17%
Total	**100%**	51%	49%

Source: AIPA payment agency, specifically data on support to excise duty on diesel (2023).

Peasant Farms

According to Article 2 of Law No. 1353-XIV on *Gospodării țărănești,* Peasant Farm is an individual enterprise based on private ownership of agricultural land and other property, relying on the personal labour of the members of one family (members of the household), with the goal of producing agricultural goods, primary processing, and primarily marketing its own agricultural production. A peasant farm is not a legal entity, but rather an individual enterprise (a natural person conducting business activity in agriculture). It can be established by a single individual or a family; its land can be privately owned or leased. The main features of a peasant farm are the following:

- The majority of the labour must be carried out by household members.
- The majority of the production must be marketed by the household itself (not through intermediaries or third parties).

If these conditions are no longer met, the household must rectify the situation within 3 months, or cease its activity, or lose the benefits and exemptions provided by law.

The peasant farm is registered at the local public administration (mayor's office). Moreover, it must be registered with the State Tax Service, it receives a fiscal code, but remains a natural person (not a company). The main benefit of its legal status is simplified taxation rules for agricultural activity. Due to its legal status and obligations, peasant farms are typically smaller than agricultural enterprises, and they have constraints on using the full economies of scale.

TABLE 2-15 WHEAT PRODUCTION, PEASANT FARMERS, MOLDOVA (2016 - 2024)

Peasant farms		2016	2017	2018	2019	2020	2021	2022	2023	2024
Area	K hectares	105.0	98.7	107.1	84.9	80.2	82.8	80.6	91.1	83.2
Yield	t/ha	3.15	3.35	2.93	3.09	2.18	4.36	2.45	3.99	3.28
Production	K tonnes	329.9	331.3	312.9	260.9	162.4	355.8	196.3	362.3	270.9
	% of national production	25.5%	26.5%	26.9%	22.7%	28.5%	22.7%	23.0%	23.3%	22.7%

Source: National Bureau of Statistics (2025)

As observed (Table 2-15), the share of PF production on total national wheat production slightly declines over time, as well as the cultivation area of wheat. With annual weather fluctuations, the yield also fluctuates. Between 2016 and 2024, the lowest yield was recorded in 2020 (2.18 t/ha), due to a significant drought, and the highest yield was achieved in 2023 (3.99 t/ha).

[10] Government decision no. 466/20223 on granting subsidies complementary for excise duty on diesel

The characteristics of peasant farmers are detailed in Table 2-16 which shows clear regional differences among peasant farms. Southern farms are the largest on average (160 ha), yet wheat yields are highest in the North (4.97 t/ha) and lowest in the South (3.29 t/ha), reflecting both input use and agro-climatic conditions. Fertiliser application and diesel consumption are also lower in the South.

Mechanisation levels remain modest, with most farms owning only one or two tractors and limited harvesting equipment, often more than six years old. In-kind land lease payments predominate, with cash leases accounting for only a small share. Overall, the data highlight structural constraints and regional diversity, with the South showing lower input use and yields compared with the North and Centre.

TABLE 2-16 CHARACTERISTICS, PEASANT FARMERS, MOLDOVA (2023)

Peasant farmers	Units	PF North	PF Centre	PF South
Size of farm	Ha	114	152	160
Wheat area	Ha	36	54	57
Yield	t/ha	4.97	4.07	3.29
Diesel consumption	l/ha	91.8	80.3	76.2
Seeding rate	kg/ha	225	239	200
Fertiliser use	kg/ha	275.5	270.4	155.1
Electricity usage	(kWh/ha)	45	14	16
Share of land leased paid in cash	%	13%	5%	N/A
No of tractors	no. per farm	2	2	1
- average age	years	8	6	7
No of harvesters	no. per farm	1	1	0
- average age	years	3	5	5
No of additional equipment	no. per farm	9	6	7
- average age	years	7	6	8
Light ploughing	%	86%	68%	64%
Units surveyed	no.	29	34	25
Average labour	no.	5.4	4.7	2.3
- share of woman	%	19.3%	20%	31%
- share of young	%	2.5%	3%	0%

Source: Survey conducted (2025)

Agricultural Enterprises

An agricultural enterprise in Moldova is a business entity, normally a legal person (company, cooperative, etc.), that performs agricultural activities, operating under legal registration and subject to business enterprise regulations. They must follow the rules for registration, licensing, or permits (depending on the type of activity). They are subject to a National Accounting Standard (SNC 6) “Particularities of accounting for agricultural enterprises” which defines how biological assets are treated, and how revenues from agricultural production are recognized. Agricultural enterprises are subject to corporate or enterprise taxation, regulatory oversight, etc., as any business entity. In practice, agricultural enterprises on average operate on a larger scale than peasant farms, being characterized by higher yields and lower unit direct production costs.

TABLE 2-17 CHARACTERISTICS, AGRICULTURAL ENTERPRISES, MOLDOVA (2023)

Agricultural enterprises	Units	AE North	AE Centre	AE South
Size of farm	ha	382	403	710
Wheat area	ha	131	143	214
Yield	t/ha	5.21	4.27	3.44
Diesel consumption	l/ha	69.7	55.5	61.2
Seeding rate	kg/ha	226	231	215
Fertiliser use	kg/ha	269.2	247.9	153.9
Electricity usage	(kWh/ha)	16	7	19
Share of land leased paid in cash	%	23%	N/A	13%
No of tractors	no. per farm	7	4	3
- average age	years	8	7	8
No of harvesters	no. per farm	2	1	1
- average age	years	9	5	5
No of additional equipment	no. per farm	18	8	16
- average age	years	9	6	7
Light ploughing	%	69%	67%	57%
Units surveyed	no.	26	21	30
Average labour	no.	17.1	12.1	11.8
- share of woman	%	17%	16%	23%
- share of young	%	2.5%	7.1%	3.1%

Source: Survey conducted (2025)

No-Till farms

No-till cultivation is an agricultural method that minimises soil disturbance by sowing seeds directly into untilled soil using specialised equipment that creates a narrow furrow for both seeds and fertiliser. The number of farmers adopting this technology in Moldova has steadily increased, particularly after the 2020 drought, which marked a turning point in awareness and adoption[11].

Farmers practising no-till methods are typically well-informed and often have access to external knowledge sources, such as Ukrainian farming practices or local farmer networks[12]. Their motivation is driven by the need for greater resilience and efficiency, especially in the context of increasing climate variability and economic pressures. The introduction of no-till practices is usually not inexpensive, as farmers need to purchase a specialized seeding machine.

In the reference year 2023, wheat grown under no-till techniques covered approximately 24,500 hectares, out of a total of 70,000 hectares under no-till cultivation[13]. According to the survey, no-till farmers use 50–60% fewer inputs - fuel, seed, and fertiliser per hectare - compared with the average use of these resources by conventional farmers at the national level.

Characteristics of no-till farms are defined below in Table 2-18. Characteristics were obtained from a survey conducted among 10 farmers from all three production regions, with a total wheat cultivation area of 2,100 ha

[11] Some farmers applied the no-till as crises respond to drought.

[12] The Technical University of Moldova offers a programme on conservation agriculture; however, the available materials and farmers' knowledge remain somewhat limited. Some farmers reported relying on Ukrainian YouTube channels to obtain additional information.

[13] There was no specific database of conservational agriculture or farmers who perform no-till. Data collected are available for conservation agriculture, which also include mini-till practices. Based on the discussion with administration, local experts and international organisations, the area under mini-till was estimated between 60 – 80 thousand hectares. Considering average share of wheat on arable land (35%), the wheat area under no-till practices equals to 24,500 ha.

(8.5% of no-till wheat land). Based on that, we can confirm that the no-till producers are rather larger enterprises[14]. The average yield was very close to the national average (4.12 t/ha), but significantly better yields were observed in drier regions of southern Moldova (4.1 t/ha compared to 3.2–3.4 t/ha among conventional farmers). Other differences observed are related to a lower amount of fertilisation applied, significantly lower diesel consumption (45.6 l/ha), and all of which led to lower production costs.

TABLE 2-18 CHARACTERISTICS, NO-TILL FARMER, MOLDOVA (INFORMATION RELATED TO YEAR 2023)

	Units			Units	
Size of farm	ha	603	No of tractors	no. per farm	7
Wheat area	ha	211	- average age	years	9
Yield	t/ha	4.13	No of harvesters	no. per farm	2
Diesel consumption	l/ha	45.6	- average age	years	5
Seeding rate	kg/ha	140	No of additional equipment	no. per farm	19
Fertiliser use	kg/ha	116	- average age	years	8
Electricity usage	(kWh/ha)	23	Light ploughing	%	N/A
Share of land lease paid in cash	%	26%	Units surveyed	no.	10

Source: Survey conducted (2025)

Organic farms

Organic agriculture is a farming approach that avoids the use of synthetic fertilisers, pesticides, and genetically modified organisms, focusing instead on ecological balance, soil health, and biodiversity. The adoption of organic farming practices in Moldova has been gradually increasing, driven by both growing consumer demand for organic products and interest in accessing premium export markets. Mixed or parallel production (i.e., the combination of organic and non-organic production) is permitted, but not for the same commodity. Crops produced under organic and non-organic standards must be clearly distinguishable at first sight.

Farmers practising organic agriculture are often motivated by environmental sustainability, market opportunities, and the potential for higher product prices and alternative markets. However, as displayed in Figure 2-8, the cultivation area fluctuates significantly. For the reference year of 2023, the land cultivation was exceptionally large, reaching 18 thousand hectares, while the standard area of wheat cultivated fluctuated between 4 – 6 thousand hectares between 2019 and 2022. The expected value for 2024 seems to be again much smaller, although the full data is not yet available. In 2023, one enterprise declared harvesting more than 7,000 ha of wheat, contributing to an increased area. The data mentioned above includes the entire Republic of Moldova, including production data from the Transnistrian region. While this study does not consider the production of PMR, we consider only production from the districts on the right side of the river Nistru (7.5 thousand hectares).

As mentioned above, the cultivated area of organic wheat reached a record in 2023, which also affects the importance of the organic sector in the VC mapping. From an average area of 4 – 6 thousand hectares, in 2023 the cultivated area rose to about 7,500 ha (in the right bank of the Dniester, excl. Transnistria) and production reached close to 18.7 thousand tonnes (Table 2-19). The yield in organic farming is lower (by about 1 tonne/ha)[15] than the national average, averaging around 2.5t/ha. The seeding rate is also smaller (210 kg/ha compared to about 220–230 kg/ha among conventional farmers). Organic farming is mainly based on natural fertilisation (manure) or liquid certified fertilisers like Biovit or Bioefect.

Moldova provides specific support to organic producers. There are 3 measures implemented. First, the measure for the conversion period. Payment per ha is provided on annual crops (for 2 years) and for multi-annual commodities for 3 years. Second, the support is determined by the volume of marketed produce. Third, organic producers are supported via measures to improve soil fertility. Each beneficiary is limited to receiving no more than 1.5 million MDL per year.

[14] With some exceptions. The team met a small farmer who is doing no-till activities on limited land (about 12ha, changing 2 field plots 6h each).
[15] In some production regions (Northern region) the yield of organic and conventional is almost the same.

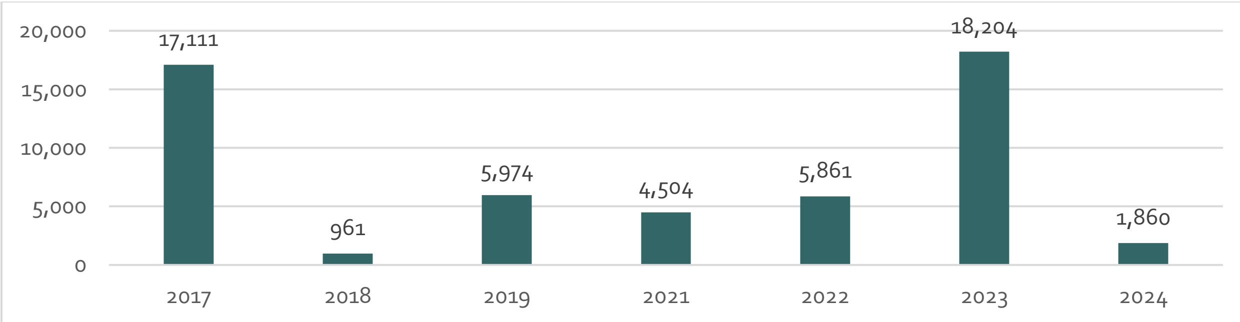


FIGURE 2-8 ORGANIC AREA (HA) OF WHEAT CULTIVATION IN MOLDOVA (INCL. PRODUCERS FROM TRANSNISTRIA).
Source: FiBL Statistics (2025) and Ministry of Agriculture (2025)
Note: 2024 – preliminary, incomplete data.

TABLE 2-19 CHARACTERISTICS, ORGANIC FARMER, MOLDOVA (2023)

	Units			Units	
Size of farm	ha	855	No of tractors	no. per farm	4
Wheat area	ha	299	- average age	Years	9
Yield	t/ha	2.5	No of harvesters	no. per farm	1
Diesel consumption	l/ha	80	- average age	Years	6
Seeding rate	kg/ha	210	No of additional equipment	no. per farm	5
Fertiliser use	kg/ha	80l	- average age	Years	5
Electricity usage	(kWh/ha)	43	Light ploughing	%	56%
Share of land lease paid in cash	%	19%	Units surveyed	no.	9

Source: Survey conducted (2025).

The main markets for exporting wheat are the EU and certain other countries, such as Israel. While conventional wheat producers have the potential to select from a wide range of traders, the organic market is facing a market oligopsony[16]. There exists only one company, which is a dominant trader and subcontractor to organic producers, and subsequently processes the commodity (since 2024) or exports it.

Generally, organic producers expect to receive a price premium for their organic wheat. However, in some years, as identified in the surveys and during the meetings, farmers reached the same price. Some applied a strategy to store and wait until the price increases, but longer storage decreases the quality and does not really lead to price improvement.

2.4.2 Landowners

Landowners are typically rural households or individual landowners who do not engage in agricultural production themselves. These owners received their land during the land reform but chose not to continue agricultural activities. Instead, they rent out their land to farmers, who pay them an annual lease.

Lease contracts, which specify the lease price, are typically signed for a period of five years and may stipulate payment in either cash or in kind. The survey conducted found that most owners prefer payment in kind. This arrangement ensures that the owner receives a specified quantity of agricultural commodities, as defined in the contract. Table 2-20 provides an example of a payment scheme for one land quota (the unit used for lease payments). It is important to note that quotas vary in size, as their dimensions were determined by the number of shares allocated during the land reform and the division of kolkhozes. Landowners receive combination of different commodities, but maize, wheat and sunflower are basically the standard which could be combined with other commodities such as sugar, barley, honey etc.

[16] A market situation which many producers and few buyers. Here the buyers have a market power to define conditions or settle price.

TABLE 2-20 EXAMPLES OF CONTRACTUAL AGREEMENTS FOR IN-KIND PAYMENTS FOR LAND LEASE PER 1 QUOTA

Land quota (Ha)	Annual rent agreement for in kind payment (sum of different commodities)
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

Note: the contractual renumeration for the landowners is very diverse and differs from contract to contract. Information in the table shall present the system of renumeration, rather than the most common in-kind payments.
Source: own survey conducted

At the time of collection, landowners receive the commodities as agreed in the lease contract. Larger landowners, who lease out greater areas of land, often choose to receive the market price equivalent of the agreed commodities[17]. In contrast, owners of smaller plots typically receive the commodities themselves. These commodities are then used for household purposes: wheat used as animal feed or wheat is milled into flour at small local mills, with the bran retained for use as animal feed; maize is used to feed livestock; and sunflower seeds are pressed into oil, with the remaining cake also fed to animals.

In total, landowners collect around **293 thousand tonnes of wheat** - almost 19% of national production - from farmers, as most of the agricultural land is leased rather than owned by the farmers themselves. Approximately half of this amount is allocated for milling services, while the other half is utilized as animal feed, primarily for pigs and poultry (see the footnote for further details).

TABLE 2-21 NUMBER OF ANIMALS AMONG HOUSEHOLDS, MOLDOVA (2020 - 2024), THOUSAND HEADS

	2020	2021	2022	2023	2024	% change 20/24
Cattle	105.3	90.3	81.8	76.3	72.2	-31%
Pigs	167.2	142.9	130.4	123.7	120.2	-28%
Sheep	513.5	457.7	416.8	396.0	387.1	-25%
Goats	143.8	140.8	137.2	132.5	127.6	-11%
Horses	25.8	22.4	19.4	17.6	16.2	-37%
Poultry	..	..	..	..	..	N/A
Bee families, thousand pieces	179.8	182.5	188.4	200.3	203.9	13%

Source: National Bureau of Statistics (2025b)

Table 2-21 presents the number of animals kept by households. The decline in cattle, sheep, goats, and horses has a minimal impact on the total amount of wheat consumed, as wheat is not a significant component of their diet. In contrast, pigs[18] (-28% between 2020 and 2024) and poultry (N/A) are significant consumers of wheat. Unfortunately, national statistics do not provide any information on the number of poultry kept. It only specifies the number of eggs produced at the household level (332 million in 2023[19]).

If the declining trend in livestock numbers continues, it is likely that landowners will either sell the commodities they receive on the local market or that in-kind payments will increasingly be replaced by cash payments, because the commodities will no longer be efficiently utilised by mainly rural households.

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[17] Given by the contract, usually it is a mix of amount of wheat, sunflower and maize, with some additions like apples, sugar, barley, etc.

[18] An estimated 123 thousand pigs could consume around 57 thousand tonnes of wheat, assuming an average feed ration of 2.5 kg per pig per day, with 50% wheat content.

[19]Assuming 150–200 eggs per hen annually, the estimated number of laying hens is between 1.8 and 1.9 million. For broiler chickens, the number could be even higher. With a feed ration of 160 g per bird per day, containing 60% wheat, the total wheat requirement would be close to 50 thousand tonnes

2.4.3 Flour milling

Although Moldova produces more wheat than it needs and exports a considerable surplus, it also imports flour from Ukraine, Romania, and Russia. Exporting raw wheat while importing processed flour highlights a structural weakness in the grain VC. It suggests that Moldova's milling industry may lack the capacity to fully meet domestic demand, or that locally produced flour does not always meet the quality requirements for certain products.

Moldova's flour milling industry operates as a dual system, comprising commercial mills and a network of small village-level mills. The commercial sector is centralised, modernised, and geared towards large-scale production, supplying bakeries, retailers, and a limited export market. By contrast, village-level mills form a decentralised and resilient network of traditional operations, many of which play a vital role in the rural economy.

Flour mills are registered with the National Food Safety Agency (ANSA), which is responsible for implementing state policies to ensure food safety and quality. ANSA's published list of operators includes 98 entities, of which 80 hold valid permits. What remains unclear, however, is the registration status of small village mills. **Neither of the small mills we visited was listed as a registered milling operator.**

From a regional perspective, milling is mainly concentrated in the northern and southern parts of Moldova. The improved position of the northern region is primarily due to the success of a flour milling plant in Drochia; this facility exports its flour to the EU and holds a significant position in the national market, which likely led to increased production in 2024. The Drochia District (Rajon) increased flour production from 12,000 tonnes in 2015 to 52,000 tonnes in 2024. A slight decline was observed in the central region, where production fell from 27,000 to 18,000 tonnes by 2024. Conversely, the southern region and Gagauzia were on the rise until 2023.

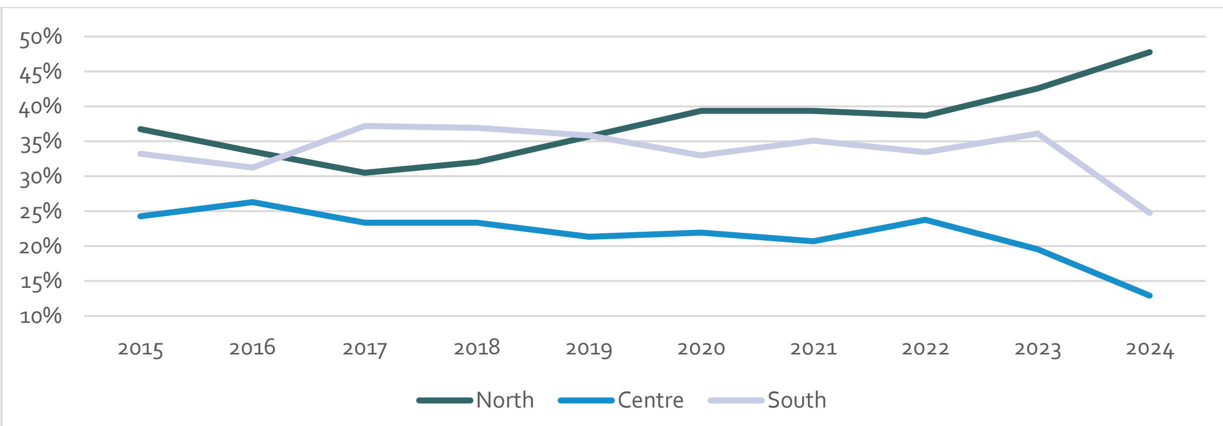

FIGURE 2-9 SHARE OF REGIONAL FLOUR MILLING ON TOTAL NATIONAL FLOUR PRODUCTION
Source: National Bureau of Statistics of the Republic of Moldova (2025a)

The price of flour reflects the price of wheat, its quality (during bad and dry years, the flour yield from grain decreases), and the global wheat supply.

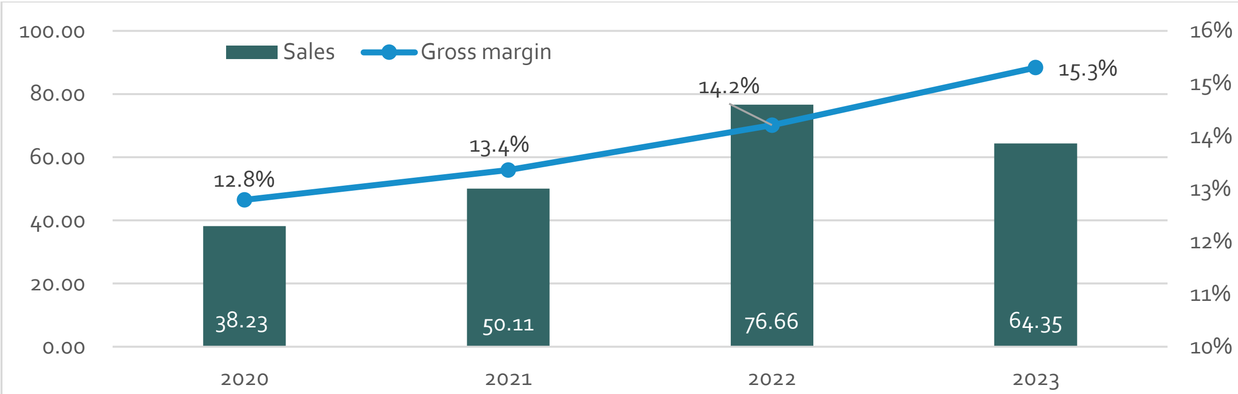

FIGURE 2-10 MILLING INDUSTRY SALES (MIL. OF EUR) AND GROSS MARGIN (%)

Source: Financial accounts of producers registered in the NACE category C1061 (National Bureau of Statistics of the Republic of Moldova, 2025a)

An analysis of the milling industry's financial performance[20] between 2020 and 2023 shows two trends (Figure 2-10). Total sales revenue increased significantly from EUR 38.23 million in 2020 to a peak of EUR 76.66 million in 2022, before experiencing a notable decline to EUR 64 million in 2023. The high revenues of 2022 reveal the situation on the global market, reflecting the price of wheat, which increased in 2022 due to the beginning of the war in Ukraine.

In contrast, the industry's gross margin demonstrated consistent improvement throughout the entire period. It rose steadily year-on-year, from approximately 12.8% in 2020 to 15.3% in 2023. The divergence of these trends in 2023, where sales fell whilst profitability continued to rise, suggests an enhancement in operational efficiency or pricing power within the sector.

Industrial mills

Large industrial mills process wheat into flour for commercial purposes. The main channel of flour leads to bakeries[21], retail, and in limited amounts to export. Technology differs significantly from old-style Soviet-type milling (with very old-school control panels) to modern mills with full automation and remote control. Table 2-22 presents some technological characteristics of the Moldovan wheat flour milling industry.

TABLE 2-22 CHARACTERISTICS OF INDUSTRIAL MILLS, MOLDOVA

Entrance capacity of wheat	50 – 100 t/day, 15 – 30K t annually
Yield of flour	70 – 78% of flour
Yield of bran	22% - 30%
Impurities	2 – 10%
Conditioning	50 – 70 litres of water/ton of grain milled
Energy consumption	75 kWh/ton of grain milled
Paper packaging	5.4 kg/ton of grain milled
Wheat sourced	From maximum diameter of approximately 150 km from mill

Source: information collected based on interviews and data collected.

[20] The sample of the milling industry (as defined by NACE category C10.61) covers all types of milling, including products other than wheat. However, as wheat remains the key commodity, the data largely reflect the situation of wheat flour mills. The figures are based on around 100 entities whose main business activity falls under C10.61 and which reported data on sales and gross margins. The financial reports indicate that both large industrial mills as well as local mills are included.

[21] surprisingly, the largest state-owned bakery in Moldova purchase wheat flour through tenders published on tender web achizitii.md and Mtender.gov.md.

Table 2-23 illustrates the development of milling industry output as recorded by national statistics. Between 2015 and 2023, flour production remained relatively stable, fluctuating around 110 thousand tonnes. In 2023, production of 118 thousand tonnes of flour[22] equals to wheat input of about 150 - 170 thousand tonnes. Imports averaged about 30 thousand tonnes, with only minor variations. In contrast to the stability of production and imports, exports increased sharply: between 2020 and 2024, they rose tenfold, reaching 26 thousand tonnes.

TABLE 2-23 PRODUCTION, IMPORT, EXPORT OF FLOUR OF INDUSTRIAL MILLS (THOUSAND TONNES)

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Production*	113.2	103.8	112	105.8	120.9	108.9	100.4	116.1	118.2	141.0
Import	35.7	33.1	39.9	41.8	33.6	35.2	23.6	30.0	32.8	27.3
Export	5.3	1.4	1.7	4.3	4.5	2.5	2.1	10.1	20.2	26.3
- % of production	4.7%	1.3%	1.5%	4.1%	3.7%	2.3%	2.1%	8.7%	17.1%	18.7%

Source: National Bureau of Statistics, Comtrade (2025), own processing
* We assume this includes only industrial milling output.

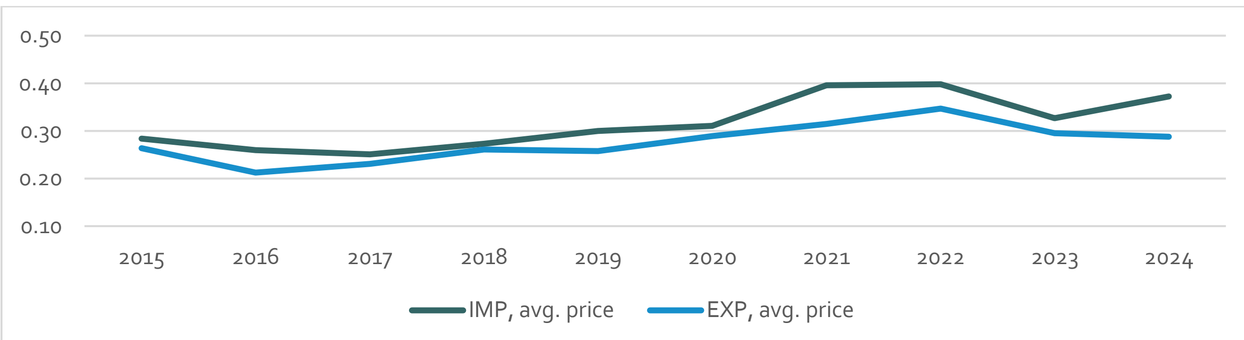

FIGURE 2-11 AVERAGE IMPORT AND EXPORT PRICE OF WHEAT FLOUR (HS 1101), REPUBLIC OF MOLDOVA, USD/KG.
Source: UN Comtrade (2025), own processing

Most flour imports originate from Ukraine (27 thousand tonnes in 2023, representing 84% of total imports), while exports are directed primarily to Romania. Recent innovations have enabled exports to become a significant component of Moldova's flour industry: in 2023 and 2024, they accounted for 17.1% and 18.7% of total production, respectively. It is also notable that the import price of flour is higher than the export price (Figure 2-11). In international markets, this typically indicates that Moldova imports either higher-quality flour or flour packaged for consumer use, which is more expensive compared to the bulk flour it exports. Romania is the principal export market for Moldovan flour and has become the main destination for these exports. Other destinations, including Israel, have emerged, but in 2024, they remain less significant in terms of overall export volumes. Some producers indicated that exporting to the EU market is their leading strategy, focusing on finding new customers in Western European Countries.

Surveys and store research indicated that Ukrainian flour has a higher content of gluten, which makes it better for traditional "plăcintă"[23] production. This is largely determined by the quality and genetic characteristics of the wheat[24]. In shops, consumers can find flour produced in Russia, Ukraine, and Romania, while a HoReCa-oriented retail chain was even observed offering specialised Italian flour for pizza production purposes.

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[23] is a traditional pastry dish with different filling (cheese, potatoes, cabbage, cherries, etc.)
[24]A local miller explained that he accepts only seeds of Western European varieties and works with farmers who can grow them, as this improves the quality of his products. In his view, Moldovan varieties are not competitive, does not have quality and yields he needs.

Table 2-24 Import and Export destinations for Moldova wheat flour (HS1101), 2023 – 2024.

Export	Quantity (tonnes)		Average price (USD/kg)		Import	Quantity (tonnes)		Average price (USD/kg)	
	2023	2024	2023	2024		2023	2024	2023	2024
Cuba	43	95	0.52	0.37	Italy	978	1,113	0.91	0.89
Israel	906	6,913	0.39	0.37	Romania	2,275	2,416	0.62	0.60
Romania	19,039	19,118	0.29	0.26	Russian Fed	435	609	0.55	0.57
United Kingdom	3	97	0.55	0.31	Ukraine	27,283	21,380	0.27	0.31
World	**20,091**	**26,255**	**0.29**	**0.29**	**World**	**31,273**	**25,701**	**0.32**	**0.37**

Source: UN Comtrade (2025), own processing

Table 2-25 Import and export of wheat Bran (HS230230), Moldova, 2023 – 2024.

HS 230230	2016	2017	2018	2019	2020	2021	2022	2023	2024
IMP, volume (tonnes)	100.7	14.8	4.2	6.2	277.5	120.3	3,561.4	1,272.8	70.3
EXP, volume (tonnes)	27,933	23,104	30,608	40,372	32,507	40,812	53,363	39,774	49,485
IMP, value (thous. USD)	185.3	25.2	9.0	14.1	53.3	83.5	859.6	329.7	63.0
EXP, value (thous. USD)	2,958.1	2,347.4	3,493.8	5,045.8	4,416.7	6,744.2	8,151.9	5,103.5	5,765.2
IMP, avg. price (USD/kg)	1.84	1.70	2.13	2.26	0.19	0.69	0.24	0.26	0.90
EXP, avg. price (USD/kg)	0.11	0.10	0.11	0.12	0.14	0.17	0.15	0.13	0.12

Source: UN Comtrade (2025), own processing

Table 2-26 Moldova export of Bran (HS code 230230), volume, value, average unit price.

	thousand tonnes	thousand USD	unit price (USD/kg)
Turkey	18,196	1,938	0.11
Romania	2,025	165	0.08
Total	**20,221**	**2,103**	**0.10**

Source: UN Comtrade (2025), own processing

Flour produced in Moldovan mills is typically classified into three quality grades: superioara (000, superior), calitate I (00, quality I), and calitate II (0, quality I). Based on tender data from September 2023 (mtender.gov.md), prices for calitate I were on average 2–4% lower than those for superioara, while prices for calitate II were 5–8% lower. Total quantities requested in the tender reached 5,000 tons for superioara, 1,200 tons for calitate I, and 600 tons for calitate II. The price does not include 20% VAT. Additionally, based on the survey and interviews, the packed flour in paper packaging costs usually 80–100 EUR (approximately 2000 MDL) more per ton. Based on those assumptions, the price going in bulk to bakeries would be about 5.8 MDL per kg, and packed flour would be about 7.8 MDL per kg (Table 2-27).

Table 2-27 Price of flour offered for flour in total quantity of 6,800 tons (MDL/kg excl. VAT, 9/2023).

Quality of flour	Company 1	Company 2	Company 3	Company 4	Company 5
Superioara (superior, 000), 5K t	4.13	4.67	4.13	4.583	4.60
calitate I (quality I, 00), 1.2K t	4.0	-	-	4.417	4.50
calitate II (quality II, 0), 0.6K t	3.9	-	3.80	-	4.35

Source: Own collection from Mtender (mtender.gov.md), (Ministry of Finance of the Republic of Moldova, 2025), own processing

Small local mills

Small-scale regional mills are an integral part of the local processing infrastructure, with an annual capacity ranging from 1,000 to 3,000 tonnes, or approximately 5 tonnes per day. Their operational season typically runs from September/October to April/May. These facilities generally operate with a small labour force, estimated at two to three employees per establishment. Small mills can sometimes also provide other services, such as sunflower oil pressing, in addition to milling. Those mills are often owned by local farmers who have had the opportunity to diversify their farming activities into milling or oil pressing.

The primary business model is toll milling, but it operates on an exchange basis. Instead of processing the specific grain a customer brings, the mill assesses the quality and quantity of the delivery and provides an equivalent amount of flour and bran from its existing stock. This system enables immediate service and offers flexibility; customers can request different ratios of flour to bran, in which case the exchange quantities are recalculated to meet their specific needs.

FIGURE 2-12 SMALL AND LOCAL SERVICE MILL, MOLDOVA, 2025

These mills are characterised (Table 2-28) by lower processing efficiency. For each tonne of wheat input, the standard output consists of approximately 600-650 kg of flour, 250-350 kg of bran, and 50-100 kg of impurities, which have minimal commercial value. The service fee for this processing has risen from MDL 1,200–1,300 per tonne in 2023 to between MDL 1,400 and MDL 1,600 per tonne in 2025[25].

The total national capacity and the number of mills is difficult to assess. Nevertheless, small mills are integral components of rural food security, enabling local residents to access affordable flour. At the same time, it is highly possible that those mills are part of the informal economy. Viability of small mills is crucial; it not only supports food security but also can provide jobs and additional services (animal feed pellet processing, for example).

TABLE 2-28 CHARACTERISTICS OF SMALL SERVICE MILLS, MOLDOVA

Entrance capacity of wheat	2 – 5 t/day, 1 – 3K t annually
Yield of flour	60 – 65 % of flour
Yield of bran	30%
Impurities	Up to 10%
Conditioning	40 - 60 litres of water/ton of grain milled
Energy consumption	50 kWh/ton of grain milled
Wheat sourced	From local landowners (diameter of 30 – 50 km).
Service price (MDL)	1,200 – 1,300 per tonne (2023), 1,400 – 1,500 per tonne (2025),

Source: Information collected based on interviews and data collected.

The estimations are that local mills could process roughly 143 thousand tonnes of wheat originating from the households of landowners.

[25] Some might accept in kind payment rather than payment in cash. But question to this practise was not raised during interview, however appeared in news (https://moldova1.md/p/54338/reviving-the-village-mill-and-creating-jobs-chistol-family-s-story-from-carpineni)

2.4.4 Input providers

In a country where the extension service faces challenges in effectiveness and collaboration between universities and practitioners is not widespread, input providers often act as de facto extension specialists. They recommend suitable cereal varieties, farming technologies, fertilisation rates, and pest management practices. However, their advice is shaped by sales strategies and may not always serve the best interests of farmers. The influence of input providers is particularly evident in the regional distribution of fertilisers, seeds, and plant protection products.

Within the VC, their role extends beyond supplying inputs. In some contract schemes, input providers also act as traders. While their operations and product portfolios may differ, they typically require farmers to deliver commodities at an agreed price and within an agreed timeframe at the end of the season. These deliveries serve to settle so-called **"technical credits"** arising from the earlier provision of seeds, fertilisers, and crop protection products. Discussions with farmers suggest that late deliveries are often penalised through price reductions per tonne of commodity supplied. The commodities obtained by input providers are, in most cases, exported to international markets[26].

Interviews indicated that input providers hold considerable negotiating power. **Farmers have limited options when choosing among providers, as some companies control a significant share of the market.** The financial situation of farmers - particularly after poor harvest years - further reduces their ability to negotiate favourable terms, as they must often accept the conditions imposed to secure essential inputs. Persistently low yields and constrained revenues can even result in the transfer of land ownership to input providers, some of whom have become major landholders across the country.

Fertilisers are a crucial cost and input item for all farmers (for more see the chapter 3.1.1, page 72). Industrial fertilisers are mainly imported. As observed in Figure 2-13, both the volume of fertilisers imported as well as their value increased with time. The total volume of imports increased from 150 thousand tonnes to more than 267 thousand tonnes in 2018. In the reference year of 2023, imports were close to 250 thousand tonnes. Main suppliers are the Russian Federation, Turkmenistan, Azerbaijan, Greece, Romania, and others. In 2023, imports increased due to exceptional circumstances. The year 2022 was highly exceptional, marked by the outbreak of the war and the energy crisis. Farmers and importers reacted with concern, as more than 70 % of fertiliser imports had traditionally originated from Russia. As a result, they sought to secure any fertiliser supplies available. The main trend in the usage of mineral fertilisers started after 2010, when a rapid increase in the usage of N, P, and K substances was observed (Figure 2-14 and Figure 2-15).[27]

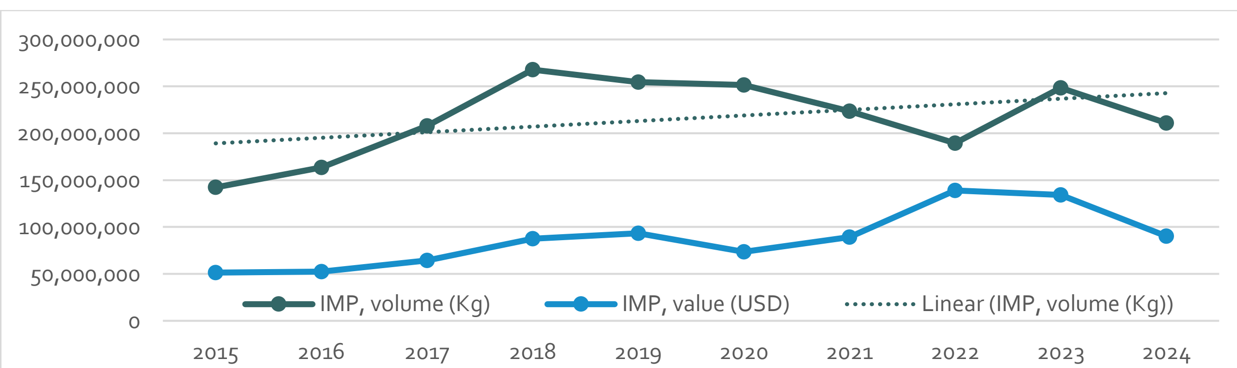

FIGURE 2-13 TRENDS OF FERTILISERS IMPORTS (HS 31), REPUBLIC OF MOLDOVA, VOLUME IN KG, VALUE IN USD, 2015 – 2024.
Source: UN Comtrade (2025)

[26] More on this will be defined in the chapter "Traders", page 55.
[27] The usage of mineral fertilisers fluctuates in the last years. Statistics indicates that the usage increased steadily between 2000 and 2024. However, the usage of mineral fertilisers has been relatively high in 70s and 80s. After the collapse of the Soviet Union, the total usage of mineral fertilisers declined to very small quantities (Leah et al, 2013).

Fertiliser import volumes increased strongly from 2015 and peaked around 2018, while fertiliser use per hectare in Moldova (N, P and K) also rose markedly in the second half of the 2010s, reaching its highest levels in 2017–2019, depending on the nutrient. After 2019, import volumes declined and fertiliser use per hectare stopped increasing, instead fluctuating and falling from earlier peaks. In 2022, a clear divergence emerged between import volume and value, with values rising sharply despite lower volumes, reflecting price effects rather than higher application. Consistently, use-per-hectare indicators show no spike in nutrient application in 2022, with nitrogen remaining below its 2018 peak and phosphate and potash below 2017–2019 levels. In 2023, import volumes recovered compared with 2022, accompanied by an increase in nitrogen use per hectare, while phosphate and potash recovered only partially.

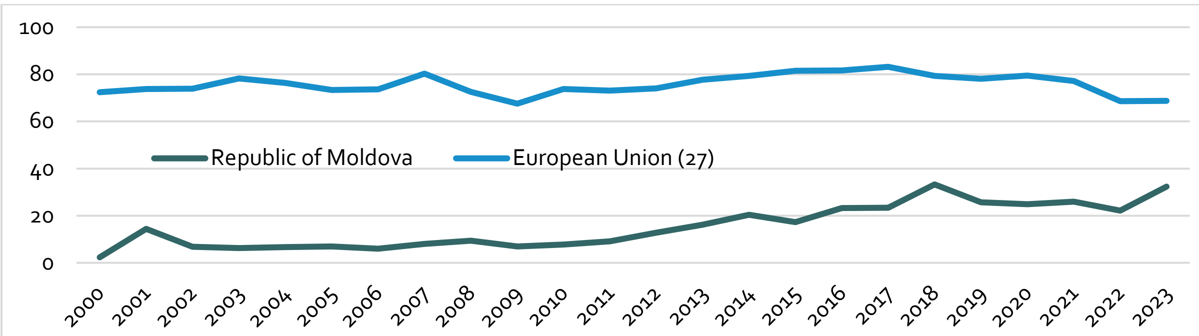

FIGURE 2-14 NITROGEN FERTILIZERS USE (KG/HA OF CROPLAND), THE EU AND REPUBLIC OF MOLDOVA
Source: FAOstat (2025)

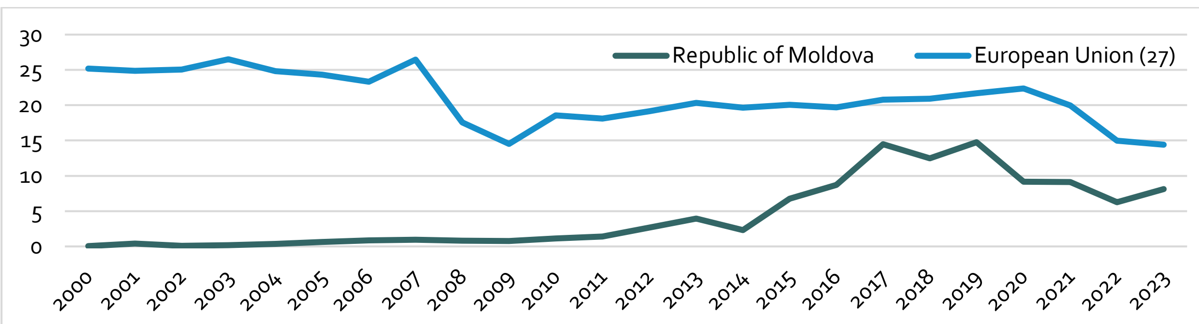

FIGURE 2-15 NITROGEN FERTILIZERS USE (KG/HA OF CROPLAND), THE EU AND REPUBLIC OF MOLDOVA
Source: FAOstat (2025)

Throughout the period, fertiliser use per hectare in Moldova remained well below EU-27 levels for all nutrients. Although usage increased from the mid-2010s, the gap with the EU persisted even in peak years, indicating that import changes mainly influenced input use within a structurally low-input production system[28].

A similar development can be observed in the case of pesticide application, which has increased since 2010, with a rapid growth since 2020 (Figure 2-17). Like fertilisers, pesticides are also imported, showing the ever-growing importance of input providers in the agricultural VCs in Moldova, including the wheat VC.

Pesticide imports and pesticide use per hectare in Moldova show a relatively close relationship, particularly in recent years. Periods of increasing imports generally coincide with higher application rates, suggesting a direct link between supply and on-farm use. This alignment was especially strong in 2021–2022, when import volumes peaked and pesticide use per hectare reached its highest level (around 3.2–3.3 kg/ha). In 2023, imports declined

[28] It should be noted that, for the comparison of nutrient use between the EU and Moldova, FAOSTAT data were used, as they provide information for both territories. Both values are reported as estimates. According to FAOSTAT, approximately **40 kg of nutrients are applied in the form of mineral fertilisers in Moldova**. By contrast, data from the National Bureau of Statistics indicate a higher use of mineral fertilisers in cereal production, at **around 80 kg in 2023, down from about 110 kg in 2020**.

from the 2022 peak, but application rates remained high, indicating a delayed adjustment to lower import volumes.

Compared with the EU, pesticide use per hectare in Moldova remained well below the EU average until 2019 but increased sharply after 2020. By 2021–2023, application rates in Moldova had converged with, or slightly exceeded, the EU average, which declined modestly in the most recent years.

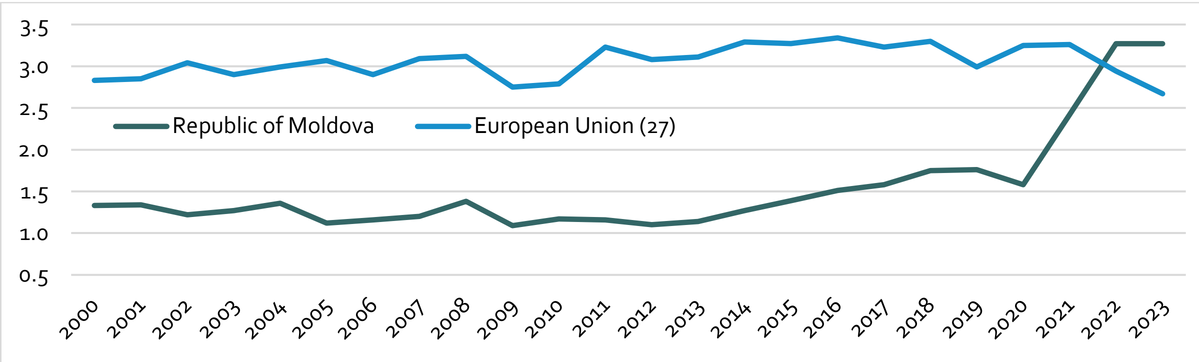

FIGURE 2-16 PESTICIDE USE IN MOLDOVA AND THE EU27 (IN KG PER HA OF CROPLAND)
Source: FAOstat (2025)

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.

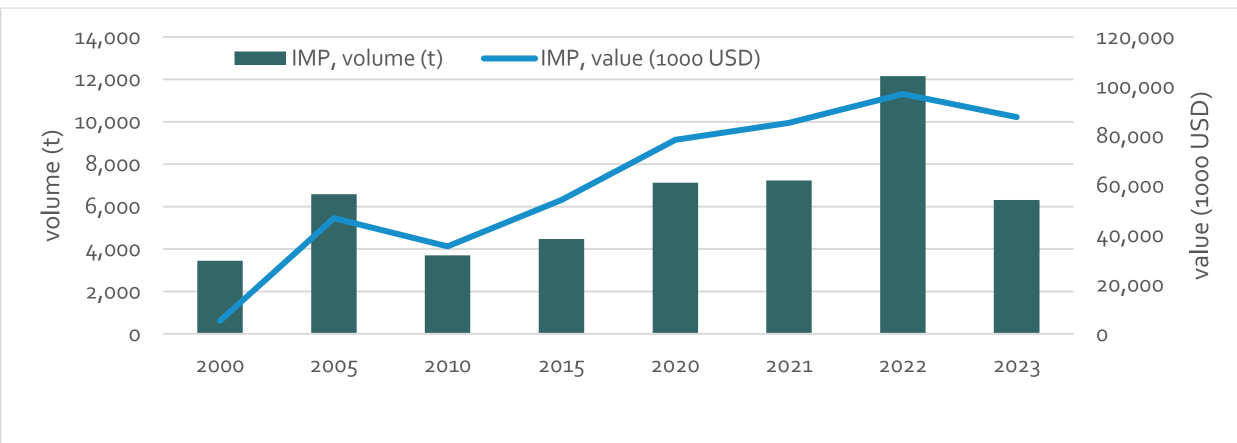

FIGURE 2-17 VOLUME AND VALUE OF PESTICIDE IMPORTS IN MOLDOVA
Source: FAOstat (2025)

A slightly different situation can be observed in the seed market, where domestic wheat multiplication is carried out by a state-owned research and production centre. Its market share is about 20%, while the remaining seed material is developed by foreign plant breeders. However, according to international statistics, seeds are not significantly imported; instead, they are multiplied locally. The quality of the seed material, particularly the number of times it has been multiplied, often affects its price.

The two tables (Table 2-29 and Table 2-30) provide an overview of the main agricultural inputs used by farmers, namely fertilisers and wheat seeds, along with their average doses, price ranges, and origins. The data illustrate a relatively wide variation in both prices and application rates across products and years. For fertilisers, the differences in price levels between 2022 and 2023 may reflect not only market volatility and changes in supply conditions but also the varying quality and composition of products. In many cases, inputs originate from multiple countries, suggesting that farmers rely on diverse supply sources, often from Russia, Ukraine, or other neighbouring regions. Seed types also exhibit considerable variation in prices, which is partly dependent on their origin, productivity potential, and adaptability to local conditions. The dose per hectare remains relatively consistent across varieties, though minor differences indicate differing yield expectations or agronomic recommendations. Overall, the data confirm that both fertiliser and seed markets are characterised by significant diversity in prices and sources. This diversity likely mirrors variations in product quality, transportation costs, and farmers' access to input suppliers.

TABLE 2-29 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	129.35	8.5 - 21	8 - 44.5	mostly RU
Ammonium sulfate	125.87	7 - 17,7	6,9 - 10	Russia/Romania
Algomax Forte	2.63	221	219	Africa
Amofos	103	8,2 - 15	10	Ukraine/Russia
Carbamid	129	0	13,37 - 18,91	Russia/Belarus
Cas	210	0	8,7 - 16,5	Russia
Diamofos	115	12 - 21,15	0	Russia
Urea	121.47	8,4 - 24	8 - 50	Russia/Ukraine
Lignohumate mark AM	0.36	0	480 - 482	Europe
Nitroammophos	140	11 - 12	9 - 11	Russia
NPK	112.49	5.5 - 21,58	7,5 - 22	Mostly Russia
sulfammo	122.95	6,5 - 18,6	8,5 - 16,3	Mostly Russia

Source: Survey among farmers

TABLE 2-30 MOSTLY MENTIONED SEED TYPES, THEIR DOSES AND PRICES SOLD TO FARMERS BY INPUT PROVIDERS.

Wheat type	Dose (kg, per ha)	Price 2022	Country of origin
Cuialinic	224	4 - 18	Mold / Ukraine
Odessa	247	3 - 22	Moldova / Ukraine
Blagodarka	225	3.1 - 9	Ukraine/Moldova
Pibrac	225	1,4 - 54,45	France
Mudrosti	226	4 - 14,5	Moldova / Ukraine
Alexeici	232	2 - 12,8	Moldova / Russia
Bezostaia	220	4 - 12,8	Moldova
Pandia	211	2 - 8,64	Moldova
Glosa	232	4 - 30	Romania
Zolotocolosa	233	5 - 9,37	Ukraine, Moldova
Catrusea	223	3 - 2,8	Ukraine
Katrusea Odesska	220	2,5 - 9	Ukraine
Meleag	220	4 - 9	Moldova
Reform	180	7,25 - 8	France

Source: Survey among farmers

2.4.5 Traders

Wheat is a very important export product for Moldova. Until the start of the war in Ukraine, most exports were routed through the Ukrainian port of Odessa, which offered sufficient capacity and relatively low transport costs. However, since the outbreak of the war in 2022 and the closure of the border with Ukraine, Moldova has faced major logistical challenges. The country's only direct access to international maritime trade is through the Giurgiulești International Free Port on the Danube River, which plays a crucial role in exporting agricultural commodities, including wheat[29]. The distance to port (Giurgiulești or Constanta) directly affects the prices farmers can reach for their products. Prices in the north are mostly lower as transportation costs are higher.[30]

Yet its operations are increasingly constrained by fluctuating and often low water levels caused by prolonged droughts, which limit the ability of large cargo vessels to dock and force the use of smaller, less efficient barges. This significantly reduces throughput and raises transport costs, undermining the port's profitability and reliability. Consequently, most Moldovan wheat exports have since been redirected to Romania, either for domestic use or onward shipment through the port of Constanța. However, Constanța lies much farther from Moldova, which further increases transportation costs and complicates export logistics.

TABLE 2-31 AVERAGE DISTANCE FROM CHISINAU TO MAIN PORTS

Chisinau to	Odesa, UA	Giurgiulești, MD	Constanța, RO
Km	200	218	435

Source: Mapy.com (2025)

Transportation issues are reflected in the structure of Moldovan wheat exports (Table 2-32), **which shifted from 4% of exports going to Romania from 2019 to 2021, to more than 65% starting from 2022**. On the one hand, transport costs have risen significantly, while on the other hand, the global price of wheat has fallen sharply, which may indicate a decline in the overall margin in the wheat VC in Moldova after 2022.

TABLE 2-32 TRADE EXPORT CONCENTRATION OF THE WHEAT, 2018 – 2024 (HS1011)

% export volume, HS1001	2018	2019	2020	2021	2022	2023	2024
Egypt	0%	0%	0%	1%	0%	0%	5%
Greece	6%	14%	27%	9%	10%	6%	13%
Indonesia	8%	12%	19%	4%	0%	4%	2%
Italy	39%	27%	14%	9%	0%	2%	4%
Lebanon	0%	1%	8%	6%	0%	1%	2%
Malaysia	6%	9%	6%	2%	0%	3%	1%
Romania	11%	4%	4%	4%	65%	69%	68%
Switzerland	12%	17%	5%	24%	0%	0%	0%
Syria	0%	5%	0%	0%	0%	0%	0%
Türkiye	0%	3%	12%	34%	24%	10%	3%
United Kingdom	6%	0%	0%	2%	0%	0%	0%
Others	13%	8%	5%	6%	1%	4%	3%
Number of other countries traded:	11	0	10	23	5	9	8

Source: UN Comtrade (2025)

International wheat trade in Moldova is highly concentrated. In recent years, the ten largest exporters have accounted for approximately 65-70% of total exports. Paradoxically, the difficult logistical situation since 2022 has caused this concentration index to fall from over 80% in 2021. During the interviews, traders estimated that transportation costs had tripled due to the war in Ukraine, through which 90% of their exports were conducted. Now, most exports go through Romania, but there is insufficient infrastructure to send products there at a low cost. Typically, traders have some storage capacity, and they operate a fleet of trucks to deliver products to ports. In the case of Moldova, it is not easy to distinguish between input providers and traders, since companies there are involved in comprehensive activities at the beginning and end of the supply chain. Therefore, some of the

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[29] The port reported that in 2023 and 2024 it handled around 900 thousand tonnes of grains and seeds (not specified by commodity). Wheat is assumed to be included, although the port's presentation indicated that maize is the main grain exported via the Giurgiulești International Free Port (General Presentation available here https://gifp.md/en/downloads/).

[30] The unstable river water levels and the underdeveloped rail infrastructure, including outdated grain export wagon, force producers and traders to rely on road transport. While trucks are efficient over short distances, they are not well suited for direct exports. Vehicle shortages during harvest and peak periods and long waiting times at border crossings further increase the cost of truck-based exports.

exports come from the payment in kind for technical credits given to farmers in the form of inputs (fertilisers, pesticides, etc.). However, the rest is bought at market price. **In practice, farmers tend to maintain relationships with various traders (input providers) and sell their products to multiple buyers.**
Romania is the main outlet of the Moldovan wheat, namely the Constanta port.

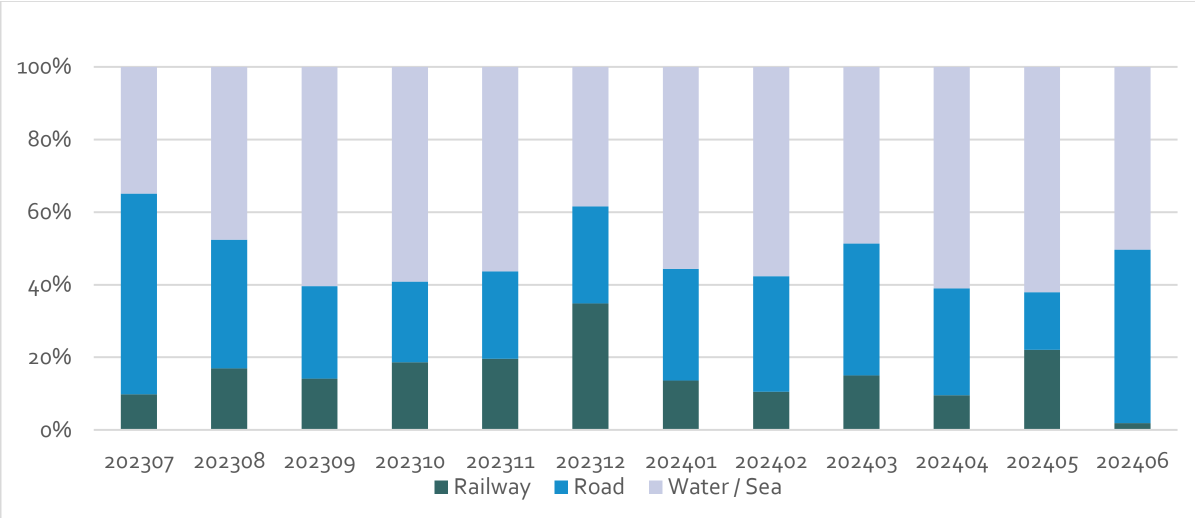

FIGURE 2-18 MEANS OF TRANSPORT FOR THE WHEAT EXPORT FROM MOLDOVA (HS 100199) AFTER THE HARVEST IN 2023 (07/2023 – 06/2024).
SOURCE: SOURCE: UN COMTRADE (2025)

The financial information (Figure 2-19) presents the development of Sales and Gross margin among wholesale of grain, unmanufactured tobacco, seeds, and animal feeds (NACE 46.21). The information indicates that sales ranged between 451 and 773 million EUR with the Gross margin fluctuating between 8 to 15%. This gross margin is a difference mainly between the costs of good purchases and the revenues from sales. Gross margin shall cover the fixed costs and overheads related to wholesale activities.

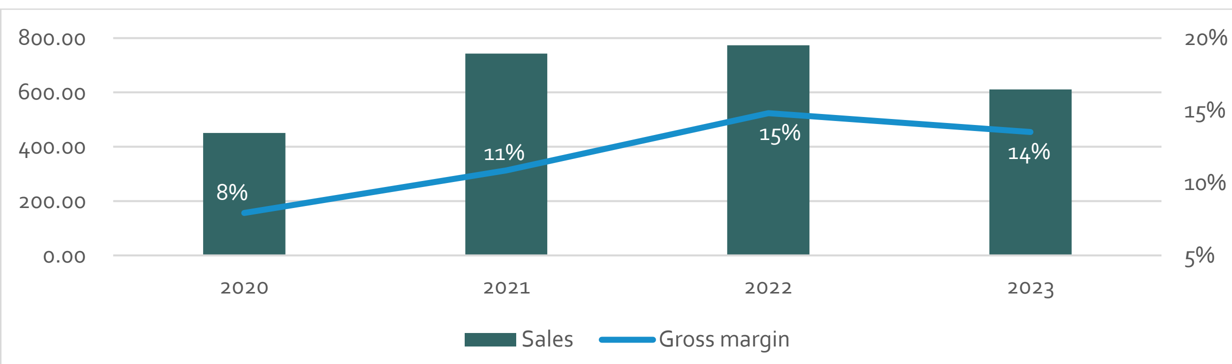

FIGURE 2-19 SALES OF THE WHOLESALE WITH AG PRODUCTS (NACE 46.21), MIL. EUR, 2020 – 2023.
Source: Financial accounts of producers registered in the NACE category 46.21 (National Bureau of Statistics of the Republic of Moldova, 2025a)

2.4.6 Bakeries

Bakeries, both local and the largest ones, are important customers of the milling industry. The main commodities used in bakeries are cereal flours, with wheat being the most important.

The output of the bakery industry in Moldova has remained relatively stable over the past decade (Figure 2-20). Bread production clearly dominates, amounting to around 110 thousand tonnes in 2024, although it shows a slight downward trend, declining by 11% between 2013 and 2024. The production of flour confectionery has remained steady at approximately 35–40 thousand tonnes. Other bakery products account for a much smaller share of total output but have shown a strong upward trend, growing by 61% between 2013 and 2024.

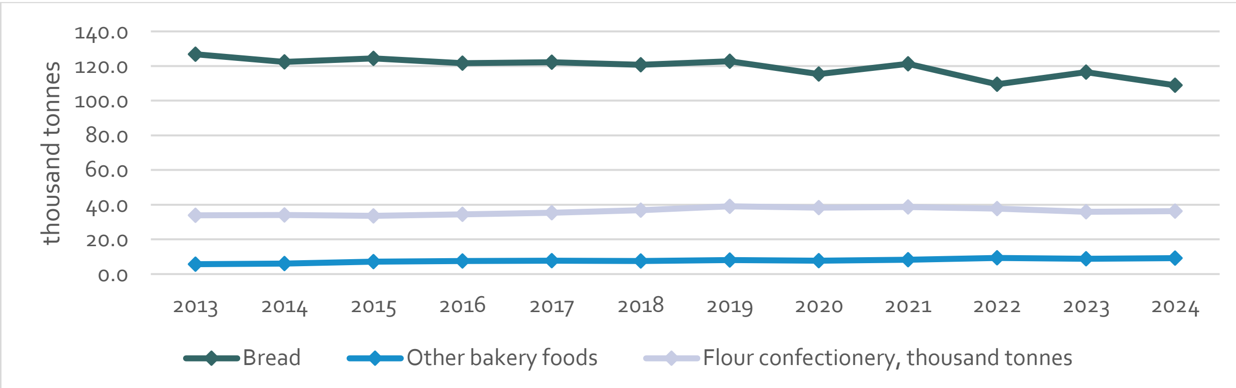

FIGURE 2-20 OUTPUT OF BAKERY INDUSTRY IN MOLDOVA, 2013 - 2024
Source: National Bureau of Statistics (2025)

Table 2-33 presents the sales figures of companies operating in the production of bakery products, classified under NACE categories 10.71–10.73[31]. Category 10.71 accounts for the majority of sales and has experienced significant growth between 2019 and 2023. While inflation has certainly contributed to this increase, observations and discussions indicate that the bakery market is genuinely expanding. A particularly strong growth is observed in the sector of ready-made street pastries (such as *plăcintă*), which are becoming increasingly popular. The rise in retail sales of bakery products is further illustrated in Table 2-33, which shows rapidly increasing trends among companies engaged in this specific economic activity.

TABLE 2-33 SALES OF BAKERY PRODUCTS (EUR) IN MOLDOVA (2019 - 2023)

	NACE	2019	2020	2021	2022	2023
Sales (EUR)						
Bakery - Fresh	*10.71	325,491,943	361,663,730	463,612,526	604,772,175	743,587,774
Bakery - Others	*10.72	7,398,544	8,230,186	10,883,769	14,943,648	19,322,652
Bakery - Flour products	*10.73	2,005,667	2,312,991	2,427,371	3,524,211	3,575,991
Gross margin (%)						
Bakery - Fresh	*10.71	0%	25%	27%	26%	27%
Bakery - Others	*10.72	0%	29%	27%	30%	30%
Bakery - Flour products	*10.73	0%	21%	22%	18%	31%

Source: Financial accounts of producers registered in the NACE category C10.71, C10.72 and C10.73.

[31] NACE rev. 2. Category **10.71** - Manufacture of bread; manufacture of fresh pastry goods and cakes, **10.72** - Manufacture of rusks and biscuits; manufacture of preserved pastry goods and cakes, **10.73** - Manufacture of macaroni, noodles, couscous and similar farinaceous products.

FIGURE 2-21 PLĂCINTĂ FILLED WITH CHERRIES AND TRADITIONAL MOLDOVAN BRÂNZĂ CHEESE, MOLDOVA 2025

Due to the wide variety of products in the bakery sector, this part of the VC was excluded from the analysis, as it would add unnecessary complexity to the model. The results would also be too general to accurately reflect the sector's reality. However, several site visits were conducted, and based on these, it can be noted that, for example, the **production costs of plăcintă shall** approximately consist of 40% material costs and 60% other costs. Within the material costs, flour accounts for 31%, oil for 36%, filling for 30%, and other materials for about 3%. The remaining 60% comprises labour, overheads, and related expenses.

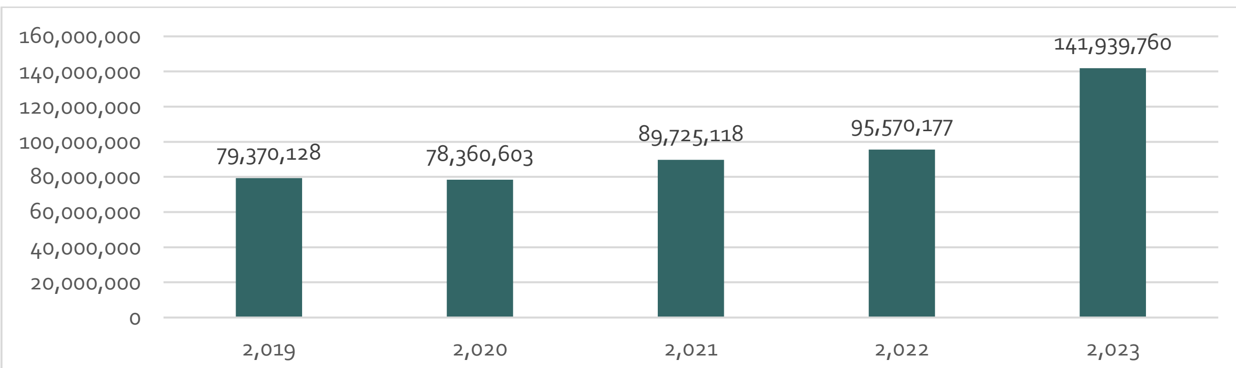

FIGURE 2-22 SALES IN THE RETAIL OF BAKERY PRODUCTS (NACE 47.26), EUR, 2019 – 2023.
Source: Financial accounts of producers registered in the NACE category 47.26 (National Bureau of Statistics of the Republic of Moldova, 2025a)

The plăcintă, being frozen, has export possibilities. Products with a long shelf life, which can be transported over longer distances, are well-suited to be an export item. With large communities of Moldovans and Romanians throughout the EU, some producers are leveraging these diasporas to find potential wholesale and retail customers. That trend is evident in the export data. Between 2019 and 2024, the export of the commodity group (HS 19059070), which also includes plăcintă, increased from 66 thousand EUR in the pre-pandemic setup to 195 thousand EUR in 2024 (Table 2-34).

TABLE 2-34 EXPORT OF MOLDOVAN PLĂCINTĂ TO THE EU MARKET (HS CODE 19059070[32])

	2019	2020	2021	2022	2023	2024
Value EUR	66,154	45,652	96,804	32,359	76,139	195,855
Volume Kg	39,772	31,364	50,682	13,735	32,356	53,418
EUR/Kg	1.7	1.5	1.9	2.4	2.4	3.7
USD/kg*	1.9	1.7	2.2	2.5	2.6	4.0

Source: EU COMEXT database (Eurostat, 2025), * the original values were in EUR, recalculated by average annual exchange rate.

[32] Fruit tarts, currant bread, panettone, meringues, Christmas stollen, croissants and other bakers' wares containing by weight >=5% of sucrose, invert sugar or isoglucose (excl. crispbread, gingerbread and the like, sweet biscuits, waffles and wafers, and rusks).

The **VAT** issue does not seem to bother producers, as bakeries are entitled to get VAT returns easily[33]. According to the interview, bakeries can receive VAT reimbursement a few days after submitting the application, which can be sent on a monthly or quarterly basis. This gives the sector a real advantage against other sectors in this VC.

2.4.7 Feed and compound feed manufacturers

Although the livestock sector is not included in the VC mapping and analyses, it remains a crucial customer and consumer of wheat production. The main consumers are considered to be the pig and poultry sectors. However, as the feed produced is highly diversified (similarly to the bakery sector), the sector was not included in the main analyses. Nevertheless, some basic information is included here to provide context on the sector's current situation.

The number of animals in the main wheat-consuming sectors (pigs and poultry) has been increasing over the observed period (Figure 2-23), contrary to the number of animals kept by households. The increasing number of animals in farms leads to an increased demand for compound feed. However, as shown in Figure 2-24, the total animal stock, expressed in LCU (Livestock Units), has increased much faster than the production of ready-made feed. This can only indicate that the Moldovan ready-made animal feed industry is not keeping pace with the trends in animal husbandry.

During the interviews, it was found that animal feed production in Moldova faces competition from cheaper Ukrainian imports. Feed is typically sold in medium-sized packages of 20–25 kg or transported in bulk, either by truck or in big bags. In general, two types of feed producers operate in Moldova: large industrial feed mills, which are professional operations often integrated within major agricultural holdings, and small local millers, who produce feed for local users, including households, or offer milling services on demand, similar to small flour mills.

Producers have their own recipes, produce feed in different mixtures, and some add specific minerals, vitamins, and other substances, which makes the whole sector very diversified.

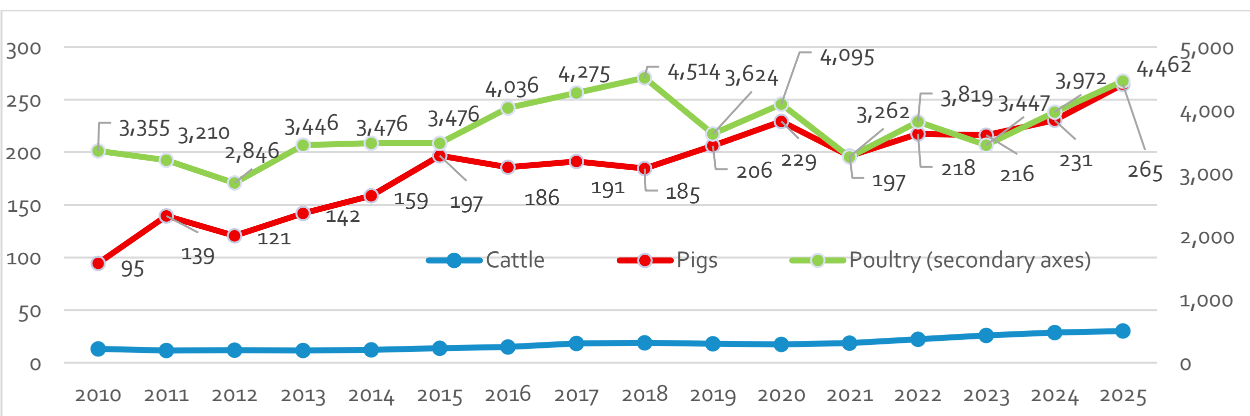

Figure 2-23 The number of animals at farms (excl. households), thousand pieces as of 1 January, Moldova, 2010 – 2025.
Source: National Bureau of Statistics (2025)

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33 If a company's deductible input VAT exceeds its output VAT, the excess can be refunded only for certain activities such as exports, international transport, or the **production of bakery and dairy products**. Otherwise, the surplus VAT is carried forward and offset against future VAT liabilities

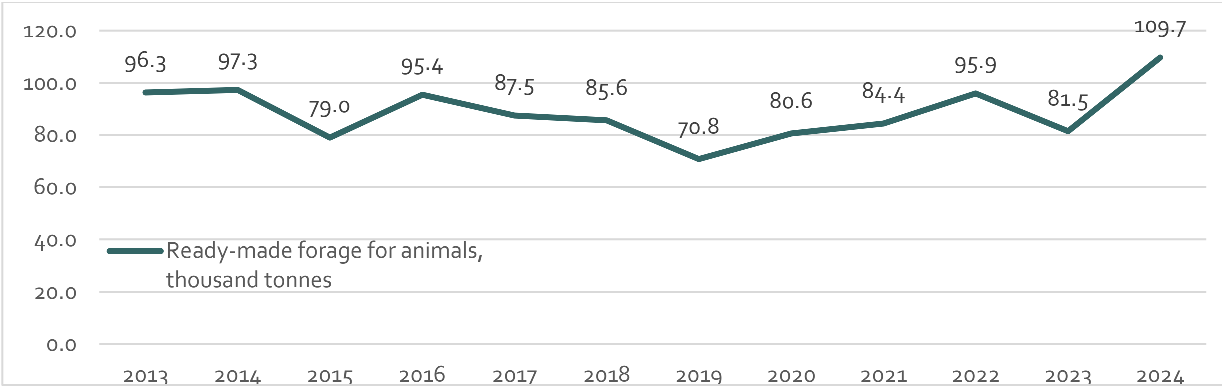

Figure 2-24 Production of readymade forage for animals, thousand tonnes, Moldova, 2013 – 2024
Source: National Bureau of Statistics (2025)

2.4.8 Retail

Retailing of wheat products within Moldova occurs through a mixture of modern and traditional outlets. Large supermarket chains stock various brands of packaged wheat flour, often produced domestically but occasionally imported from neighbouring countries, particularly Romania and Ukraine (or Russia). These outlets cater mainly to urban consumers and offer a relatively standardized and quality-controlled product. Flour is sold in small packages (typically 1–2 kg), medium bags (5–10 kg), mainly in paper bags. Sometimes in larger quantities for institutional buyers (25 kg packaging mainly in plastic bags). Prices vary depending on the brand, grade (e.g., “00” or “000”), and packaging type. In 2025 (when the market research was conducted), the price of flour in retail was between 8 MDL/kg and 15 MDL/kg.

FIGURE 2-25 CHISINAU AGRICULTURAL MARKET SELLING FLOUR PACKED, JUNE 2025
Note: (from 12 MDL/kg), in bulk (10 MDL/kg), and bran in bulk (7 MDL/Kg),

In rural areas and smaller towns, local markets and small-scale shops continue to play a dominant role. There, flour may be sold in bulk or in unbranded packaging, often sourced from small or medium-sized mills. Some households also buy wheat directly from farmers or are paid in kind for on-farm work and rely on local mills for grinding. This informal or semi-formal market remains an important part of the food system, particularly for lower-income families. While this form of retail may lack standardized labelling or modern packaging, it offers affordability and accessibility to a large segment of the population.

TABLE 2-35 STRUCTURE OF RETAIL TRADE WITH GOODS BY GROUPS OF COMMODITIES AND YEARS (%), ALL RETAIL = 100%

	2006	2007	2008	2009	2010	2011	2012	2013
Food retail (%)	31.5	32.5	33.2	35.4	32.1	28.9	31.1	32.2
Bread and pastry products (%)	3.6	3.9	4	3.9	3.7	3.1	3.2	3.5
Flour (%)	0.2	0.3	0.3	0.4	0.3	0.2	0.3	0.4

Source: National Bureau of Statistics (2025)

The retail of flour constitutes a stable share of retail trade, standing at around 0.2 - 0.4% (Table 2-35) and around 1% of foodstuff retail. As a staple product, flour is not subject to sudden fluctuations or short-term consumption trends. Unfortunately, the data collected by the NBS has been discontinued, and we cannot verify how much flour is purchased in the retail market. However, considering the staple characteristic of flour, the share of 0.2 – 0.4% of the retail value, we were able to estimate the volume sold in retail to be approximately 10 - 15 thousand tonnes.

Total overview of food retail can be observed in Figure 2-26. Food retail sales increased and exceeded € 350 million in 2023. The increased food retail performance can be explained by modernisation and the development of the retail store network[34], inflation, and changing purchasing habits among the Moldovan population.

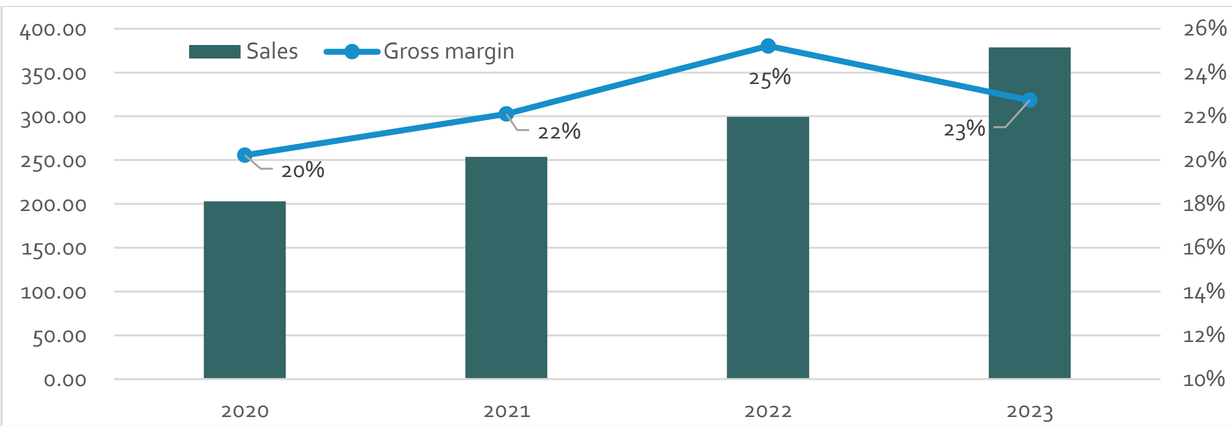

FIGURE 2-26 SALES (MILL. EURO) AND GROSS MARGIN (%) OF FOOD RETAIL IN MOLDOVA (NACE CATEGORY 472)
Source: Financial reports (National Bureau of Statistics of the Republic of Moldova, 2025a)

In recent years, online retail channels have emerged in Moldova, particularly in larger cities such as Chișinău. E-commerce platforms and delivery services increasingly offer packaged flour products for home delivery, appealing to younger and digitally connected consumers. While this trend is still in its early stages, it indicates a diversification of retail formats and presents potential opportunities for brand development, product differentiation (e.g., organic or specialty flours), and value-added services.

[34] As an illustration of this trend, consider the Linella retail chain, owned by the Moldovan company Dragan Group. According to its official website, Moldova's largest retail network expanded from 100 stores in 2020 to around 190 stores in 2025. This growing presence in regional areas has influenced consumer behaviour, with more people shifting from local shops to modern retail chains. Other major retail operators include Imensitate (Bonus, Local, Primul Discounter), Nr.1, Metro, and Kaufland.

2.5 Flow chart

Figure 2-27 presents a flow chart of the Moldovan wheat VC for the **2023 reference year**. The **left side of the diagram illustrates** the production stage and associated prices (denoted in MDL/kg with a '*'). The **tables embedded within the arrows** indicate the flow of wheat from producers to various recipients, including traders, landowners, input providers, industrial mills, and for self-consumption and feed use. Downstream flows from these recipients are categorized into **export** (green-filled cells) and **local use** (white-filled cells).

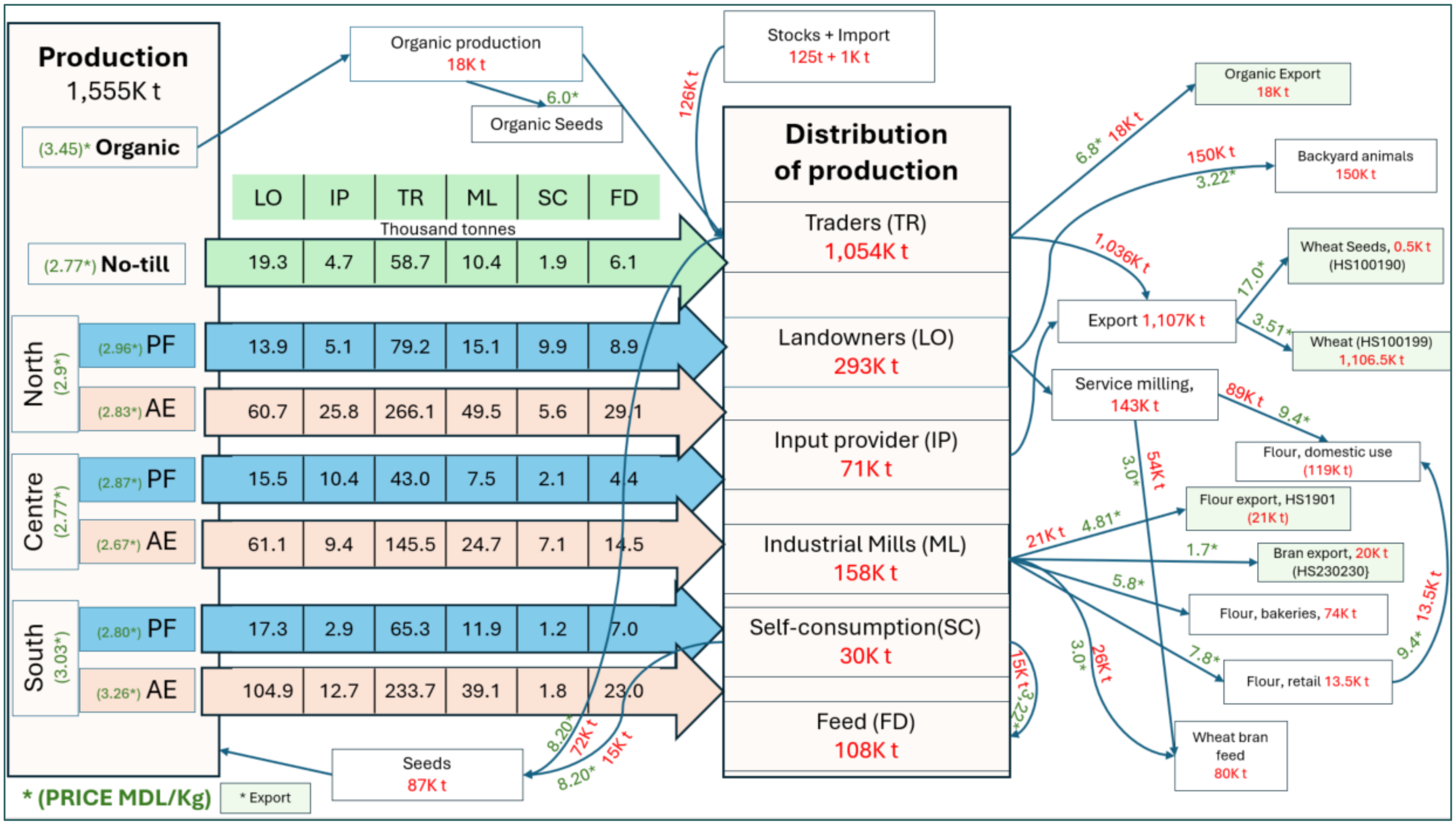

Figure 2-27 Flow chart for wheat in Moldova, reference marketing year 2023/24 (wheat production)

Note: **PF** – Peasant farmers, **AE** – Agricultural enterprises, **LO** – landowners, **IP** – input providers, **TR** – Traders, **ML** – Industrial mills, **SC** – Self-consumption, **FD** – Feed. Source: own elaboration based on data from own survey, National Bureau of Statistics of Moldova, UN Comtrade, EU COMEXT database, interviews and other literature available.

2.6 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).
- **Agency for the Development and Modernization of Agriculture (ADMA)** – Moldovan state institution that facilitates farmers' access to modern machinery and technology through favourable financial leasing and instalment-based purchase programs. It specifically supports small and medium-sized enterprises.
- **Livada Moldovei** is a credit line project worth 120 million euros, financed by the European Investment Bank to modernize and restructure Moldova's agricultural sector. It provides farmers and agricultural entrepreneurs with access to low-interest loans and technical assistance for investments in equipment.
- **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.
- **Development partners** – EU, World Bank, IFAD, FAO, and others support policy implementation, institutional capacity and investments.
- **Research institutions** – **"Selectia" Research Institute Of Field Crops** (Balti), **"Porumbeni" National Center for Research and Seed Production** (mainly maize), **Technical University of Moldova**
- **Banks and non-banking institutions** – MAIB, ProCredit Bank, VICTORIABANK, optbank, and Microinvest as important non-banking institution.

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 VC, 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.

2.6.2 National Strategy

Moldova's agri-food policy is anchored in the **National Strategy for Agricultural and Rural Development 2023 - 2030** (**SNDAR**), which provides the overarching framework for transforming the sector into a competitive, climate-resilient and sustainable component of the national economy. The strategy is fully aligned with the objectives of the EU Common Agricultural Policy and pursues a vision based on high-potential VCs, enhanced food security and progressive alignment with the EU acquis.

Key priorities include

- investment in primary agricultural production and on-farm infrastructure (**no-till and minimum-till**),
- development of post-harvest infrastructure and food processing, strengthening of food safety systems,
- revitalising livestock and aquaculture production
- promotion of knowledge, innovation and advisory services, and
- inclusive rural development through a LEADER-type approach.

Agriculture remains a central pillar of Moldova's economy, accounting for around 7 % of gross value added and employing a significant share of the population. Since the entry into force of the Association Agreement and the Deep and Comprehensive Free Trade Area, agri-food exports have increasingly shifted towards the EU market, which represented more than half of total exports in 2020. Despite this reorientation, the sector remains characterised by a strong dependence on low value-added primary products. **In response, the strategy places particular emphasis on local processing, post-harvest infrastructure and integrated VCs to increase export value**[35] **and competitiveness by 2030.**

The strategy also addresses the growing impact of climate change and environmental degradation on agricultural production. Recurrent droughts, land degradation and soil erosion pose significant risks to productivity and rural livelihoods. Measures therefore focus on improving irrigation infrastructure, promoting sustainable land management practices, expanding protective forest belts and **increasing the share of organic farming**[36], in line with EU environmental and climate objectives.

Persistent socioeconomic challenges in rural areas, including limited economic diversification, outward migration and insufficient infrastructure, are tackled through targeted rural development measures. These include support for Local Action Groups (LAGs)[37], **entrepreneurship and job creation**, with particular attention to **young people and women**, with the aim of improving living conditions and strengthening rural communities.

Institutional strengthening is a key component of the strategy in the context of EU integration. Modernisation of the Agency for Intervention and Payments for Agriculture and the development of effective administration and control systems are essential to ensure compliance with CAP requirements. Increased public and private investment and productivity gains are expected to contribute to improved food security and to Moldova's gradual integration into the European single market.

2.6.3 Legal and regulatory instruments shaping wheat 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) 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 wheat 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).

[35] Goal is to increase the value of agricultural export by 15%
[36] 10% goal for 2030
[37] Minimum 60 LAGs created

- 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 wheat. 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. 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.

2.7 SWOT ANALYSIS

Strengths	Weaknesses
• Established cereal production base and know-how • Agronomic and soil-health benefits of wheat within diversified crop rotations • Preferential access to the EU via DCFTA/trade agreements • Competitive production costs • Policy momentum for modernization and alignment • No-till cultivation is growing, offering improved soil health, lower environmental impact, and stable yields through climate resilience • Access to agricultural machinery through different government subsidised programmes	• Fragmented land ownership • High climate vulnerability and yield risks • External input dependency and poor nitrogen use efficiency reduce yields and increase emissions • Limited local value addition in post-harvest and processing due to insufficient quality storage, drying, and quality testing infrastructure • Unclear and questionable statistics related to incorrect reporting from farmers • Heavy reliance on a few exports' destinations and expensive truck transportation. • Insufficient governance of Conservation Agriculture (limited access to no-till equipment, training, and support) • Unsafe agrochemical handling and use (Poor safety practices pose health risks) • Limited Extension Services
Opportunities	**Threats**
• Scaling-up of climate-smart and resilient practices • EU accession (external modernization funds) and access to the single market • Enhancing export routes and market diversification • Infrastructural investments in linking to Romanian Constanța could reduce export costs and risks • Expanding local compound feed manufacturing could absorb part of the wheat crop • Reintegration of mixed crop-livestock systems can enhance soil fertility and reduce external input dependency by closing nutrient loops through manure use	• High climate vulnerability and yield risks • Ongoing war in Ukraine • Overdependence on chemical fertilisers and herbicides undermines both environmental goals and long-term soil health • Demographic and labour constraints, a high level of migration from rural areas • Rising debt burden and credit dependency • Ongoing loss of rural milling services could weaken food system resilience and local economies • Currency appreciation lowering competitiveness producers.

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. The outputs presented here were generated with the assistance of the AFA software.

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[38]
- Discussion with stakeholders, producers, and processing companies, made during 3 personal visits to Moldova.
- Survey conducted among farmers, which collected 165 surveys from 3 regions, aiming to target small farms (of size between 10 and 50 ha)[39], medium farms (between 50 and 300 ha), and larger than 300 ha. Among those, we collected 10 surveys of organic producers and 10 surveys of no-till producers.

The accounts for the wheat 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 wheat production** at the farm level. For the processing industry, the accounts are created for **one tonne of inputted wheat**.

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 amortisation rates. For agriculture, depreciation was estimated at 7.48% of the sector's value added, while for food processing, a rate of 6.60% 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.

[38] Public Repository of Financial Statements, https://depozitar.statistica.md/

[39] Farms and households who farm on less than 10 ha of agricultural land contribute to total production only marginally, hence those were not considered in the study.

3.1 Profitability & Sustainability of actors

3.1.1 Farmers

Farmers are the backbone of the wheat production VC in Moldova. For the account statement preparation, the following prices were used in these economic analyses. All prices are related to the reference year considered (2023).

Diesel prices were rounded to the nearest whole MDL per litre. Seed input prices varied among surveyed farmers; therefore, only the price range is presented below. A similar situation applied to **fertilisers**. **For analytical purposes, the exact values used were calculated as weighted averages across all survey responses, giving smaller weights to smallholders who typically faced higher prices**. **Electricity** prices were sourced from the NBS, showing that retail rates for households and small entities are higher than those for larger users. As peasant farms (PF or GT) generally operate as household farms, the higher retail tariff was applied. Electricity consumption was assumed for general farm operations, such as workshops, storage, drying, and internal handling. **Insurance** is mandatory mainly for machinery used on public roads (tractors and harvesters). As only a few farmers provided data on insurance, a uniform flat rate was applied to all farms. **Organic certification**, which is obligatory for organic producers, includes both initial and annual fees. Based on survey data, initial certification costs were estimated at about 58 MDL/ha, while annual certification costs averaged 46 MDL/ha**.**

Labour costs are presented as ranges, with the values in brackets indicating those used in the calculations. Total labour reported by farmers was monetized using average sectoral wage rates. This procedure served as a proxy to value overall labour use in the cost calculations. For each officially employed labourer, the employer is required to pay an additional % of income as a contribution to the social and health system. According to data from NBS[40] (2025), companies' labour costs are higher than the salaries paid, as they also include social and health contributions.
Total labour reported by farmers was monetized using average sectoral wage rates. This procedure served as a proxy to value overall labour use in the cost calculations.

Table 3-1 Considered pricing for the economic analyses, Moldova, ref. year 2023.

	Price (MDL)	Unit
Diesel	20	per litre
Seed inputs	5.81 - 12.32	per Kg
Fertilisers	10 - 18.5	per Kg
Plant protection	10% of production value	
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
- Tractor, truck and machinery operators	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 –2,777[41]	MDL / ha

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

The production at the farm level is clear: the farm produces some wheat, some for its own consumption, and some for commercial use. Additionally, seeds are being produced at the national level, as seed imports are very

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[40] Social Statistics – Labour force and earnings – The structure of labour force expenditures by Economic activities, Components and Years, 2013-2024. Direct expenditures accounted for 81.2% of total labour costs, while indirect expenditures represented the remaining 18.8%. However, the ILO (2024) study indicates that in agriculture about 64% of labour has informal working relations.

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

limited. **We are aware that seed production may be subject to royalty payments**, but there was insufficient information on this issue. The subsidies are also considered under the financial account. While the subsidy programs are varied, it is necessary to mention that we asked farmers how much in subsidies they received over the last five years and divided that amount among the hectares under cultivation. Those include all public money they received from the **national paying agency, AIPA.** Considered supports include investment support, support for purchasing diesel, and support for areas affected by natural disasters, among others.

TABLE 3-2 PRODUCTION COSTS OF WHEAT AMONG FARMERS IN MOLDOVA, PER HA VALUES, 2023

Production	**North**		**Centre**		**South**		**No-till**	**Organic**
	PF	**AE**	**PF**	**AE**	**PF**	**AE**		
Wheat delivered[42]	12,915	13,844	10,903	10,592	8,661	10,548	10,694	7,245
Self-consumption	549	95	150	154	51	24	110	0
Subsidies (5y average)	1,017	430	640	455	944	453	880	444
Self-consumption seeds	1,098	191	297	328	103	42	226	1,260
Seed sold	1,396	1,426	947	1,064	913	1,077	1,077	1,140
Total production	**16,975**	**15,986**	**12,936**	**12,594**	**10,671**	**12,144**	**12,987**	**10,089**
Consumables (G)								
Fuel	1,836	1,394	1,606	1,110	1,524	1,224	912	1,600
Seeds	299	1,122	1,815	2,139	1,057	1,391	506	0
Fertilisers	4,575	3,487	3,511	2,504	2,379	2,860	1,863	750
Plant protection	1,350	1,585	1,350	1,585	1,150	1,585	1,585	0
Services (S)								
Electricity	158	46	48	20	54	53	65	122
Insurance	89	89	89	89	89	89	89	89
Repair	550	587	452	380	380	345	340	616
Organic certification	-	-	-	-	-	-	-	104
Total costs G + S (IGS)	**8,857**	**8,310**	**8,871**	**7,827**	**6,633**	**7,547**	**5,360**	**3,281**
Value added (Production – Consumables - Services)								
Value added (production - IGS)	8,117	7,676	3,445	4,768	4,037	4,597	7,626	6,807
Financial charges								
Interest paid (1.25% of sales)	179	191	148	146	120	145	147	105
Land								
Rent	2,496	2,856	3,142	2,742	1,814	2,394	3,679	2,029
Tax	166	150	134	133	206	170	154	301
Labour								
Skilled and unskilled	3,022	3,073	2,781	2,737	3,420	2,468	2,930	3,522
Labour indirect contributions[43]	195	199	180	177	221	159	189	228
Depreciation[44]	607	574	258	357	302	344	570	509
Total costs	**15,524**	**15,352**	**15,559**	**14,117**	**12,716**	**13,228**	**13,031**	**9,974**
Production - Costs	1,452	634	-2,624	-1,523	-2,045	-1,084	-43	114
Income tax (12%[45])	11	0	0	0	0	0	0	14
Net margin (%)	9%	4%	-20%	-12%	-19%	-9%	0%	1%
Price – Break Even	2,650	2,750	3,660	3,100	3,830	3,680	2,880	3,400
- Change (%)	-10.5%	-2.8%	27.5%	16.1%	36.8%	12.9%	4.0%	-1.4%
Yield – Break Even	3.95	4.75	4.75	4.55	4.15	3.65	4.00	2.10
- Change (%)	-9.5%	-2.9%	25.0%	14.7%	34.2%	12.8%	3.6%	0.0%

[42] The delivery to traders or landowners

[43] Out of 100% of total labour expenses, 18.8% are indirect costs and 81.2% are direct costs, but only about 34% of labour has an official employment contract.

[44] As depreciation is not recorded in the financial accounts and was not reported by farmers, the rate of **7.48% of value added**, as indicated in the Input–Output tables for the agricultural sector, was applied.

[45] Although the PWC Worldwide Tax Summaries identifies the agriculture as a sector with lower corporate tax rate (7% for farming enterprises), the macro data of the NACE 01.11 (Cultivation of cereals (except rice), leguminous crops and oil seeds) of 2023 identified the effective tax rate to be 12%. This percentage was calculated from the difference between profit before tax and profit after tax. At the same time, the profit tax is calculated from the taxable income, i.e. income which is sold to traders.

Production cost (Table 3-2) reflects the expected harvest outcomes. Farmers in the north tend to invest more in production and therefore face slightly higher expenditures, while those in the south, being more aware of climatic risks, invest less in the production process. **The prices differ from regional perspective. Due to lower transportation costs, the farmers in south are able to receive higher per tonne price**. The price and farmers profitability is linked to market power and market competition. The survey indicated that most of the farmers have different buyers and do not have links to one single trader. This suggests that farmers actively seek price opportunities and choose buyers offering the best conditions. The survey also showed that farmers are aware of storage benefits, they tend to store part of their production for later sale. According to the sample, 33% of production was sold directly from the field, 64% was stored for a period of 3–5 months and about 6% was returned to input providers. Some wheat **producers take advantage of contracting transport companies and delivering wheat directly to Romania** for sale on the local market or through ports. Transport costs during the harvest season can be up to twice as high as outside the harvest period. As a result, storage can be a useful strategy to obtain higher prices and reduce transport costs.

Overall, no strong economies of scale are observed, except perhaps among agricultural enterprises in the central region, which report somewhat lower costs compared to peasant farms. In other regions, cost differences are marginal, likely because peasant farms are not particularly small.

Across all farmers, the lowest production costs are observed in organic and no-till systems. No-till production benefits from reduced diesel consumption and lower seeding rates, while organic production relies heavily on farm-saved seeds and has lower fertilisation costs. The results indicate that during periods of low wheat prices (case of selected reference year 2023), farmers face considerable financial pressure, and unless certain yield levels are achieved, production may become unprofitable. Nevertheless, at the farm level, crop rotation practices mean that overall farm economics depend on the combined income from all cultivated crops, and the total farm results could be positive.

The break-even calculation presents that the northern peasant farms are the most resilient while operating 10% above the break even. At the same time, the most vulnerable seems to be peasant farms in the central and southern region, where they operate between 25 and 35% below the below the break-even in price and yield.

Sectoral financial data (NACE 01.11) show that 40% of farming enterprises operated at a loss in the 2023 financial year and 38% in 2024, while the sectoral profit-to-sales ratio stood at only 0.55% (2023) and 2.05% (2024), respectively. However, the negative results from the wheat farming and low taxation are a result of contractual relationships between landowners and farmers. Farmers need to deliver wheat to landowner for all land they lease, and this generally decrease monetary income of farmers and taxation base.

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

Scenario (per ha production costs)	North		Centre		South		N-T	ORG
	PF	AE	PF	AE	PF	AE		
Revenues of wheat sold (MDL)	12,800	13,150	9,634	8,943	8,005	8,688	9,529	8,385
IGS incl. VAT (MDL)	7,409	7,028	7,560	6,720	5,626	6,419	4,514	2,734
Value Added (MDL)	5,390	6,122	2,073	2,223	2,379	2,270	5,015	5,651
Input VAT (0 + 8 + 20%)[46]	1,449	1,281	1,310	1,106	1,008	1,129	847	547
Output VAT (8%)	1024	1052	771	715	640	695	762	671
Net VAT - Full Refund	-425	-229	-540	-391	-367	-434	-84	124

Source: Own calculations

[46] The standard VAT rate in Moldova is 20%, applied to most goods and services, including imports. Certain supplies, such as bread, dairy products, energy, and specific agricultural products, benefit from a reduced 8% rate. More about the VAT rates on the PWC Worldwide tax summaries (2025, https://taxsummaries.pwc.com/moldova)

Not only the wheat deliveries to landowner, but also possible activities in the **unobserved economy** leads us to the VAT issue, which was widely discussed among farmers.

Farmers in Moldova face a major challenge with VAT, because they pay more VAT on their inputs than they collect on their sales. Most farm inputs, such as fuel, supplies, and imported equipment, are taxed at the standard 20% rate, whereas the products farmers sell are often taxed at a significantly lower rate. Local sales of key agricultural goods, such as bread, dairy, and other produce, are charged only 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 the 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 back as a VAT refund[47].**

The balance of VAT payment was designed for the wheat hectares in Moldova in the table below (Table 3-3). The table clearly shows that farmers face a **negative VAT balance**, which increases the cash outflow in wheat production. This negative balance is partly because a significant share of production is transferred to landowners as in-kind rent, for which VAT is neither charged nor eligible for reimbursement.

3.1.2 Landowners

Landowners receive wheat and other commodities as a benefit from land ownership. Once landowners are modelled as economic actors who use and transform these commodities, a simplified representation of the wheat received is included in the economic calculations. As shown in the flowchart, approximately 51 % of the wheat is used for animal feed (mainly poultry and pigs), while the remaining share is processed into flour. Small service mills typically yield about 60–65 % flour from wheat, with the remainder consisting of bran and processing losses. The service milling fee was usually between 1,200 – 1,300 MDL per tonne.

Using an opportunity cost approach, the retail price of flour was around 9.4 MDL per kg in 2023, while the market price of bran was about 3 MDL per kg (with higher prices observed in urban agricultural markets, for example around 7 MDL per kg in Chisinau in 2025; see Figure 2-25). Based on these assumptions, the estimated economic benefit from one tonne of wheat received by landowners is **approximately 4,148 MDL**. Products are mainly used at the household, self-consumed.

TABLE 3-4 ACCOUNT FOR LANDOWNER, MOLDOVA, PER TONNE OF WHEAT RECEIVED, MDL

per tonne of received wheat	Unit price	Volume	Total value
Wheat used for feeding	2,770	0.51	1,418
Wheat used for milling	0.49		
- Flour self-used	9,400[48]	0.30	2,852
- Bran self-used	3,000	0.15	540
Service			
Service milling (1,350 per tonne)	1,250	0.49	662
Benefit from 1 tonne of wheat received	4,148		

[47] This is exactly where the main problem lies from the farmers' point of view. VAT refunds are not returned automatically and often remain with the state. Farmers can use the accumulated VAT credit to cover social and health contributions, income tax, or other obligations to the state budget. However, as mentioned above, employment remains informal and many farms struggle with profitability, most farmers are unable to recover the VAT that stays locked within the state treasury. VAT refund was made possible since April 2022 to face the problem related to war in Ukraine. As understood, the law shall motivate farmers to be transparent in their taxes and labour contributions. Those who operate (partially) in unobserved economy cannot benefit from the returns.

[48] Opportunity costs of buying flour in the retail store.

3.1.3 Small mills

From an economic perspective, small mills primarily serve landowners by processing the wheat they receive into flour. The milling service is charged per tonne and ranged between 1,200 and 1,300 MDL in 2023. After milling, landowners receive flour and bran, or an equivalent combination based on the agreed value (for example, more flour and less bran, or vice versa). A small mill is typically operated by the owner and two workers, who run it for about ten months a year- around eight months during the milling season and two months for maintenance. During the remaining two months, they may engage in other activities. Since most mills are owned by farmers, some undeclared work is likely present in this activity.

On the other hand, long-term relationships with workers suggest that they are usually paid at least the minimum wage, often with additional cash bonuses. Considering an annual capacity of around 3,600 tonnes, the labour cost is estimated at about 115 MDL per tonne, including both wages and social contributions. Most of the mills observed are rather depreciated, having been built or purchased in the early 2000s. As the annual sectoral depreciation (received from I-O tables) equals 7.8%, the maintenance costs are estimated to range from 70 - 90 MDL per ton of inserted wheat.

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.

Table 3-5 The Financial account for the service milling of 1 ton of wheat input, Moldova, MDL, 2023

Production (annual capacity 3,600t)	Unit price	Volume	Total
Dust / Residuals	200	0.1	20
Service fee (charged mainly to landowners)	1,250	1	1,250
Total production			**1,270**
Consumables			
Water[49]	0.1	6.5	6.5
Maintenance	80	1	80
Bag for flour (25kg each)	3	24	72
Services			
Electricity (kWh)	2.8	45.00	126.0
Labour			
Owner (Opportunity costs, 13,000 per month)	36	1.0	36
Others (10,000 per worker)	28	2.0	56
Labour indirect contributions[50]			24
Depreciation	Depreciated		
Total costs	399.5		
Net Income	870.5		

3.1.4 Industrial mills

The data on the industrial milling sector in Moldova indicate a relatively standardised production structure across regions, with each mill processing wheat into flour, bran, and minor by-products such as dust. The cost structure reveals that wheat is by far the most significant input, with its price varying slightly across regions, being lowest in the north and highest in the south. Other consumables such as water, packaging, and auxiliary materials are uniform across regions, implying either centralised procurement or stable market prices. Energy use and service costs are also comparable.

49 Usually from own well.

50 21% from total costs are indirect contributions to social and health security. 64% of undeclared labour

Despite this uniformity in cost components, profitability varies significantly between regions. The central mills achieve the highest after-tax profit and margin rate (7.5%), while profitability declines progressively towards the north (5.3%) and the south (3.1%). This difference is largely explained by regional variations in wheat prices, which directly affect margins in an industry with limited flexibility in setting selling prices. The analysis therefore suggests that the milling sector in Moldova operates with narrow profit margins and remains highly sensitive to fluctuations in input prices, particularly wheat. Energy, labour, and service costs are relatively fixed and thus offer limited scope for cost reduction.

TABLE 3-6 INDUSTRIAL MILL ACCOUNT FOR 1 TONNE OF WHEAT INPUT, MOLDOVA, MDL, 2023

Production	North	Centre	South
Flour export (4.81 MDL/kg, no VAT)	639	639	639
Flour bakeries (5.8 MDL/kg, VAT incl. + transport)	2,714	2,714	2,714
Flour retail (7.8 MDL/kg, packaged)	664	664	664
Bran (3 MDL/kg, VAT incl.)	882	882	882
Dust (0.5 MDL/kg)	10	10	10
Consumables			
Wheat (1 tonne input)	2,900	2,770	3,030
Water (50l)	5	5	5
Packaging	436	436	436
Others	500	500	500
Services			
Electricity (75 kWh)	210	210	210
Others	363	363	363
Financial charges	54	54	54
Depreciation (6.6% of VA)	33	41	24
Labour			
Administrative	20	20	20
Operation	72	72	72
Social insurance	22	22	22
Profit before tax	294	416	173
Income tax (11.5%)	34	48	20
Profit after tax	260	368	153
Margin rate	5.3%	7.8%	3.1%

Prices and products vary depending on whether the flour is destined for export, local retail, or local bakery use. Products for local retail are mostly pricier, as packaging costs are a significant expense that must be added to each kilogram of flour. Paper packaging could increase the price by around 2,000 MDL per tonne, while plastic or large paper bags do not significantly raise the price once the package size reaches about 20–25 kg. These larger bags typically cost only 3–5 MDL per piece (i.e. 200 MDL per tonne).

Based on field interviews, it is evident that some technologies are outdated, and investment in modern equipment would increase both the value added in the sector and its export potential. However, the milling industry faces several constraints that are critical to its future development.

1. The inflow of the cheaper or better-quality Ukrainian flour (comparing the received quality for the given price[51]).
2. Lower quality of wheat used for milling. The quality of wheat determines the quality of flour and its final success on the national market.
3. Technological and production constraints.

[51] As indicated below in the section 3.3 page 64, the export price of Ukrainian wheat is almost the same as export price of wheat produced in Moldova. At the same time, from interviews we received the information that some characteristics of Ukrainian wheat outperform the local milling produce.

The VAT situation does not appear to be as problematic as it is for farmers. Their VAT balance is positive, meaning they are required to remit the difference to the fiscal authorities.

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

Scenario (per tonne of wheat)	North	Centre	South
Revenues (MDL)	4,910	4,910	4,910
IGS incl. VAT (MDL)	4, 414	4, 284	4,544
Input VAT (8%)	456	446	467
Output VAT (20%)	747	747	747
Net VAT refund	**291**	**301**	**280**

3.1.5 Traders

Traders and transportation companies play a crucial role in the wheat trade in Moldova. Farmers, who typically sell their grain directly from the field, are dependent on trading intermediaries that channel the commodity towards international markets. Among the most frequently mentioned destinations are Romania and the Port of Constanța, from which purchase prices for wheat used in breadmaking over time can be obtained. These price data are published by the EU market monitor. While international statistics provide information on Moldova's average export prices, the EU Agri-food market service[52] offers monthly quotations for the Port of Constanța.

The EU Agri-food price service makes possible to identify price differences between breadmaking wheat and feed wheat. Based on Banat silo data (Romania – Banat – DEPSILO), the average price difference between feed wheat and breadmaking wheat was 5.5 % over the period 2019–2025. In 2024, the difference was 5.2 %, while in 2023 it was higher, at 6.4 %.

Economic analyses clearly show that Moldovan wheat does not reach the Romanian Constanța (FOB) price level. The difference ranges between 28 and 12 percent over the 2023/2024 season. Part of this discrepancy can be attributed to transportation costs, which vary between 720 and 440 MDL per tonne. However, even after accounting for these costs, the price gap would only be reduced from an average of 22 percent to approximately 5 – 11 percent, depending on the transport distance. **The remaining difference can likely be attributed to variations in quality, as wheat exported from Moldova is not always of milling/breadmaking grade[53].**

[52] The all data sets are available here (https://agridata.ec.europa.eu/extensions/DashboardCereals/ExtCerealsPrice.html).
[53] Information from Logos news indicates that low values of the W coefficient, a key grain quality parameter reflecting dough strength and flexibility, led to complaints from some European buyers. As a result, Moldovan wheat exports faced price discounts in certain EU markets (https://logos-pres.md/en/news/wheat-is-getting-more-expensive-regardless-of-quality/).

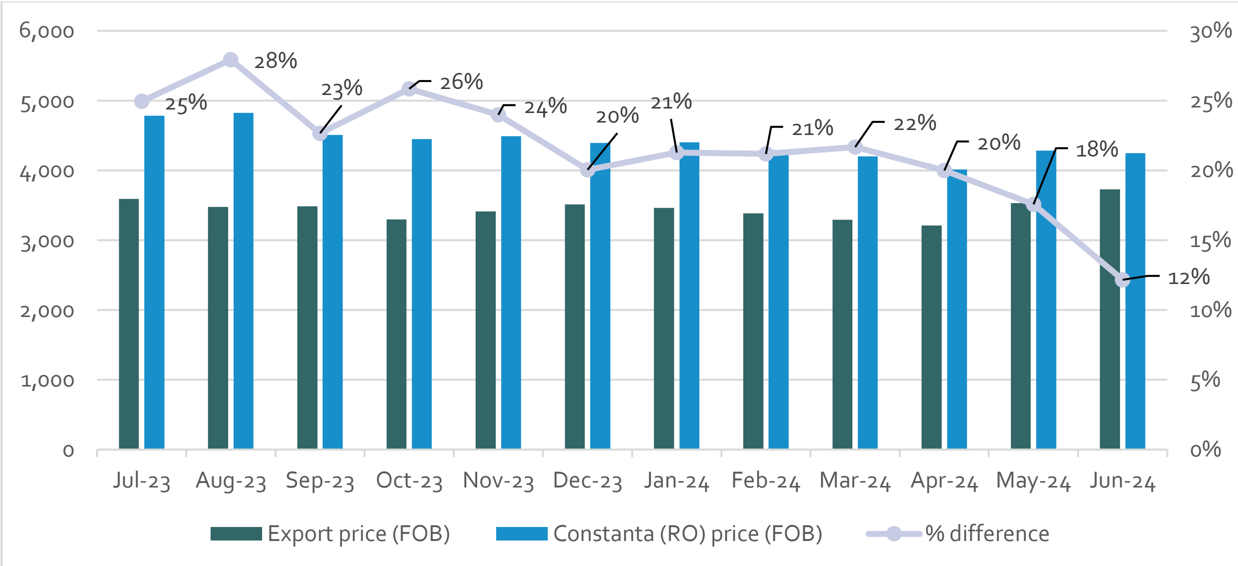

FIGURE 3-1 EXPORT PRICE VS. CONSTANTA PRICE (RO), JULY 23 – JUNE 24.

Total costs are the highest in the northern region and the lowest in the southern region, except for organic farming, which has the lowest production costs among all categories or producers.

As discussed with producers, wheat is not every year profitable. To be profitable, there is always a necessary combination of yield (which was sufficient in 2023) and a good price. Unfortunately, in 2023, the global wheat price was relatively low as stored Ukrainian capacity was released to the market. From this perspective and under the price conditions, the positive producers were those with larger yields (Northern region). In other regions, the price and yield were not sufficient to lead farmers to a profit from production.

As presented in Table 3-8, 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 SELLING, EXPORT AND PORT PRICE (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	2,770	3,510	21%	723	4,422**
Centre	2,900		17%	584	
South	3,030		14%	445	

* Average consumption of 30l/truck and 100km, load of 21tonnes, total transportation costs of 21 MDL/truck and km. ** breadmaking wheat, feeding wheat could be purchased with 5 – 6% discount.

Other costs incurred by traders, apart from the purchase of wheat from farmers, include diesel for grain handling, electricity, interest payments (amounting to around 0.7% of sales), wages (approximately 2.5% of sales), and various additional expenses. Taking all these factors into account, it is evident that the gross margin achieved was insufficient for traders to generate a profit and to cover all trading-related costs. **It is therefore assumed that in 2023, wheat trading activities could not yield any profit for trading companies delivering to Constanta (RO), except in cases where they were able to handle and sell higher-quality wheat, such as breadmaking qualities.**

Table 3-9 Financial account for the wheat traders (MDL/tonne), Moldova, 2023

Production	**North**	**Centre**	**South**
Wheat sold (Export FOB price)	3,510	3,510	3,510
Consumables			
Wheat	2,900	2,770	3,030
Diesel (export + 2l for handling)	188	160	131
Others	54	54	54
Services			
Electricity (kWh), (15kWh/tonne)	42	42	42
Transportation to Constance + local	575	464	354
Financial charges (0.7% of sales) *			
Interest paid	25	25	25
Labour (2.5% of sales) *			
Wages (79% of labour costs)	68	68	68
Social contribution (21% of labour costs)	18	18	18
Depreciation (5% of sales) *			
Depreciation	176	176	176
Net operating profit (NOP)	-535	-267	-387
Margin rate	5.3%	7.8%	3.1%
Breakeven price	4,045	3,777	3,897
- Change (%)	15%	8%	11%

* the % presented are average values of the sector NACE 46.21

At the same time, it should be clarified that the financial account presented here (Table 3-9) refers only to the trading of pure wheat. In practice, however, trading companies are often engaged in a wider range of activities, including the distribution of seeds, fertilisers, and other agricultural inputs, as well as the trade of additional commodities. Consequently, the overall financial balance of the sector remains positive, as input suppliers and trading companies continue to maintain a strong position in the agricultural VC. Data from financial reports

As mentioned earlier, 2023 was a special year for the market. As shown in Table 3-10, wheat exports create periods in which traders' profit margins become more favourable, as well as years in which profitability is lower or may even turn negative. Gross margins fluctuate around 20 %, while net margins vary by year. Based on data from the largest wheat trading companies for 2022–2024, **net margins ranged from about 1 % in 2023 to around 5 % in 2024**. However, these figures reflect overall trading activities across multiple commodities and are not attributable solely to wheat.

The discrepancy between results in the Table 3-9 and average net margin of traders may indicate that our sample interviews did not capture the practices correctly. Although we spoke to traders, who mainly export to Constance, RO (farmers confirmed), which is connected to higher financial costs of transportation, it is highly possibly that costs of transportation and depreciation might be optimised (the two most significant cost categories after wheat purchase) by traders using the port in Giurgiulesti or using trains. Export data indicated that water (sea) transportation from Moldova reached about oscillate between 31% in 2022 and 68% in 2024.

In addition to the negative Net Operating Profit generated by wheat distribution, it is evident from the flow chart and the national balance table that existing stocks were either released to the domestic market or exported. Even if this important aspect is not captured in the financial account Table 3-9, **the situation when traders purchased expensive wheat of 2022 and sold during low prices in 2023 (over 120K tonnes of wheat) naturally generates financial loss.**

TABLE 3-10 AVERAGE EXPORT PRICE OF WHEAT (HS 100199), FOB 2020 – 2024, FARM GATE PRICE AND GROSS MARGIN – COUNTRY AVERAGE

	2020	2021	2022	2023	2024
Wheat Export FOB price (100199)	3,505	4,214	5,517	3,510	3,587
Farmer gate price	2,990	3,296	4,159	2,724*	2,891
Gross margin	14.7%	21.8%	24.6%	22.0%	19.4%

Source: UN Comtrade and National Bureau of Statistics (2025)
*Country average as presented by NBS, hence slightly different from data reached by survey.

3.1.6 Organic traders

Organic traders represent a distinct category of market participants that warrants individual analysis. The particularly dominant position of one organic trading company provides a strong justification for presenting policymakers with a separate financial account for this entity, as its activities significantly influence the overall performance and structure of the organic grain trade in Moldova. The company is highly active in the commercialisation of organic products and, as of 2024, also offers consumer products made from wheat, such as flour and wholegrain flour. However, production was not yet fully operational in 2023 and was therefore not included in the analysis. The flour is produced through service milling, as the company does not operate its own milling facilities.

Based on the interviews, organic wheat appears to be less profitable, while spelt production is considered more promising. Following 2022, the market for organic wheat weakened, leaving volumes in storage. In the absence of adequate storage conditions, quality deteriorated and prices declined. By contrast, interviews indicate that organic spelt benefits from a more stable demand and more stable prices, mainly among the EU purchasers.

TABLE 3-11 FINANCIAL ACCOUNT FOR THE ORGANIC WHEAT TRADER (MDL/TONNE), MOLDOVA, 2023

Sales per tonne	Unit price	Volume	Total
Organic Wheat / export 350 euro/tonne	6,825	0.84	5,733
Organic seed / sold locally	8,700	0.16	1,392
Consumables			
Wheat Organic	3,450	0.84	2,898
Seed Organic	6,000	0.16	960
Storage Costs	20	8.0	160
Administrative costs (4% of sales) *	200	1	200
Services			
Export transport (¬115 EUR/t to Europe)	2,243	0.84	1,884
Other transportation	100	1	100
Labour*			
Labour costs	540	1	540
Labour social and health insurance (19% of labour)	100	1	100
Interest paid (6% of sales) *			
Interest paid	428	1	428
Depreciation (5% of sales) **	356	1	356
Profit before tax		-500	

*Data reached from financial statement or **industry average (NACE 46.21)

The account presented in Table 3-11, similarly to conventional commodity trader, indicated that organic trader also does not make any profit on delivering the wheat to international markets which are the main outlets of Moldovan organic wheat.[54]

[54] However, it is necessary to state that loans are largely granted within companies that are connected or have ownership relations, hence the interest paid remains within the holding or related companies.

3.2 Total effects within the national economy

Figure 3-2 illustrates the breakdown of intermediate goods and services consumed along the VC. While the farm-level data provide a detailed overview of the inputs used, the composition of items becomes more diverse and less clearly defined further downstream. Nevertheless, it is evident that fertilisers, protective substances and seeds represent a key component of VC costs (32%), followed by farm wages (16%). The third most significant category is Lease "payments" (14.4%) towards the landowners[55]. Fuels and transportation services represent about 10% and 7% of the total VC costs.

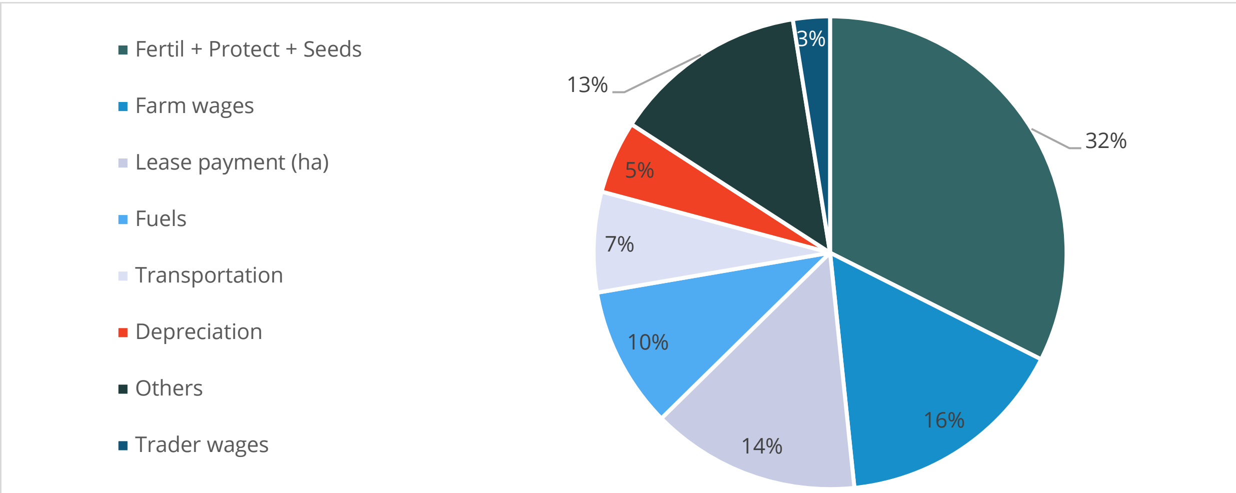

FIGURE 3-2 COST STRUCTURE OF WHEAT VALUE CHAIN, 2023, MOLDOVA

Depreciation appears to play a relatively minor role, as some machinery and technologies are already depreciated. At the same time, many farmers have been able to invest in new equipment and technologies with support from the national paying agency (AIPA), although detailed data on these investments were not available.

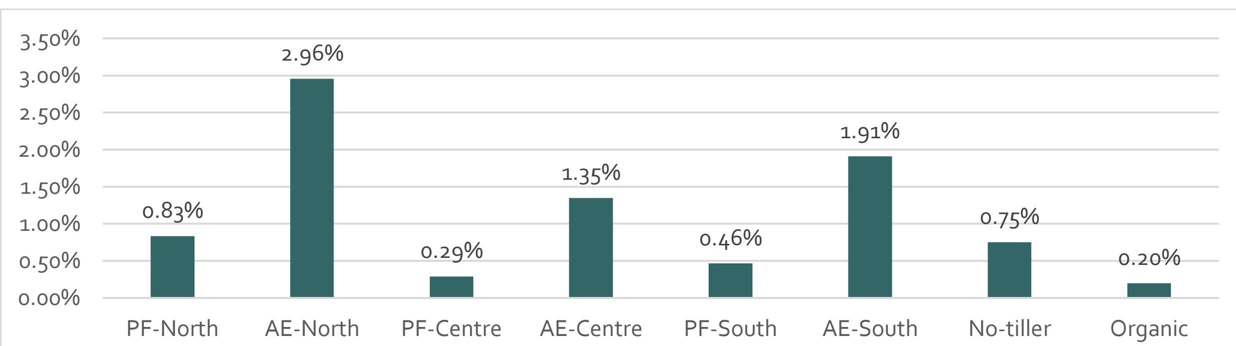

FIGURE 3-3 VALUE ADDED CONTRIBUTION TO AGRICULTURAL GDP OF MOLDOVA, 2023

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

It is also important to assess the contribution of wheat production to agricultural gross national product. Figure 3-3 presents the distribution of VA among actors across the VC. Larger farms generate higher VA due to their scale of operations. In northern regions, even though wheat prices are somewhat lower, higher yields result in greater VA per hectare. No-till farms also perform well in terms of per-hectare VA, as lower production costs enable them to achieve better profitability.

55 This includes monetary payments and the value of commodities delivered to landowners in kind.

TABLE 3-12 MOLDOVA WHEAT VC - DIRECT AND INDIRECT EFFECTS (THOUSANDS MDL)

	Direct effects	Indirect effects	Total effects
Imports		1,691,163	1,691,163
IC not disaggregated		46,146	46,146
Value added			
Wages	1,268,126	697,778	1,965,905
Taxes	569,365		
Subsidy	313,737		
Tax (+) Sub (-)	255,627	134,848	390,475
Financial charges (paid interest)	99,336	92,431	191,767
Property income (lease payment)	156,328	96,259	252,586
Depreciation	333,970	224,519	558,489
Net Operating Profit	345,470	881,978	1,227,448
VA not disaggregated	0	8,415	8,415
VA Total	**2,458,857**	**2,136,230**	**4,595,086**

As visible in the Table 3-12, most of the VA is generated both directly and indirectly. Direct VA is created within the VC itself (by farmers, traders, landowners, and processing or milling companies) while indirect VA originates from the suppliers' providing inputs to the VC. As noted above, the main inputs include fuels, protection chemicals and fertilisers, as well as wheat inputs such as seeds.

Due to unfavourable market conditions, the VC recorded small net operating profit. As presented above, low-yield farmers could not achieve a positive net operating income when prices declined. Under these circumstances, the direct and indirect components of VA are nearly balanced, resulting in a total VC effect of almost 4.6 billion MDL and a VC profit of 1.2 billion MDL.

Overall, the VC contributed 1.5% to national GDP. **Its contribution to public finances has positive balance** (255 million MDL). This means, that the public budgets receive more taxes from wheat productions than the VC can benefit from subsidies. In addition, the chain maintained a positive trade balance and the export of wheat and other wheat products in the **VC contributed to 5.6% of the Moldovan export**.

The rate of integration into the economy, estimated at 73.6%, indicates that almost three quarters of the VC's outputs are effectively absorbed and circulated within the economy. This reflects a relatively solid level of market linkage and interaction with other sectors, although a significant share (around one-third) remains outside and needs to be sourced from other markets.

The total VC output is created from 62% by usage of intermediate goods and services, while 38% is attributed to VA. The main sources of VA are wages, depreciation, and profits. Other components of VA generation play a less significant role (Figure 3-4).

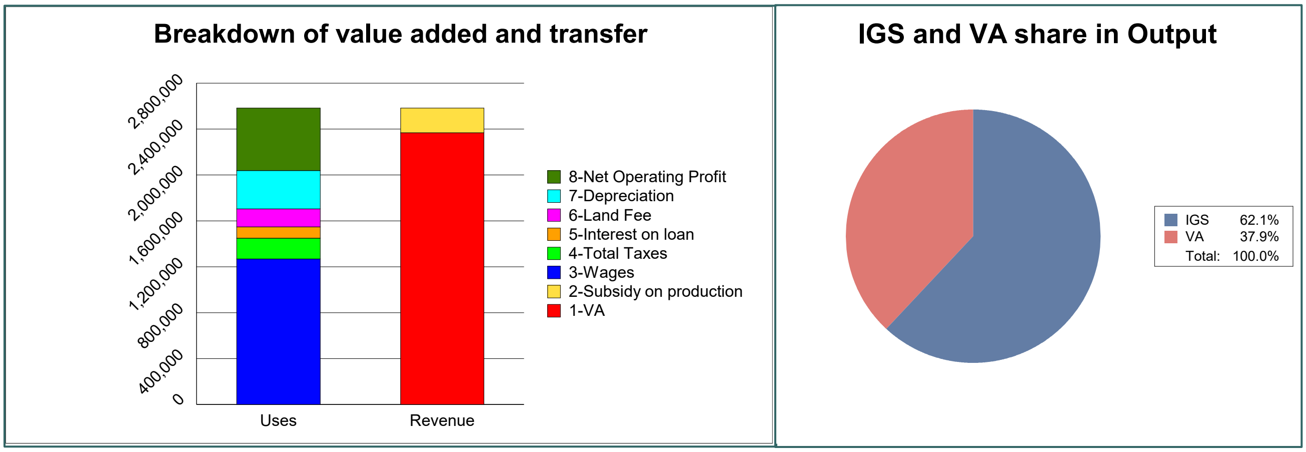

Figure 3-4 Value added distribution – Wheat value chain, 2023, Moldova

3.3 Competitiveness and viability within the international economy

The viability of the VC can be assessed by comparing the export price of Moldova in comparison to other exporters. The table below presents the wheat exporters aligned by average export quantities (2021 - 2023). Moldova, being the 20th most significant exporter of wheat (HS 100199), performs low export price in comparison to other traders.

TABLE 3-13 AVERAGE EXPORT OF WHEAT (HS 100199) PER COUNTRY, 2021 – 2023 (AVERAGE EXPORT QUANTITY, AVERAGE PRICE)

No.	Country	Average export price (USD/ton)	Export share	Average Export quantity (K ton)	Index (Moldova price = 100%)
1	Australia	312.8	15.1%	27,585	127%
2	USA	349.2	11.2%	20,486	142%
3	Canada	348.8	9.7%	17,726	141%
4	Ukraine	221.5	8.5%	15,488	90%
5	France	308.5	8.2%	15,078	125%
6	Russian Federation	266.4	14.7%	26,928	108%
7	Argentina	306.4	4.6%	8,419	124%
8	Romania	300.9	3.7%	6,746	122%
9	Germany	308.8	3.7%	6,693	125%
10	Kazakhstan	262.3	3.3%	6,013	106%
11	Bulgaria	293.2	2.8%	5,102	119%
12	India	300.6	2.4%	4,321	122%
13	Poland	313.5	2.3%	4,225	127%
14	Lithuania	298.2	1.8%	3,234	121%
15	Latvia	301.7	1.3%	2,376	122%
16	Hungary	290.0	1.2%	2,198	118%
17	Brazil	291.3	1.2%	2,185	118%
18	Czechia	288.4	0.7%	1,372	117%
19	Serbia	272.7	0.4%	804	111%
20	Rep. of Moldova	246.6	0.4%	687	100%
21	Uruguay	297.5	0.4%	687	121%
22	Austria	382.3	0.3%	611	155%
23	Croatia	289.6	0.3%	515	117%
24	Estonia	313.2	0.3%	503	127%
25	Sweden	307.1	0.3%	487	125%

Source: UN Comtrade (2025)

Since the analysis covers the VC at the national level, border prices are applied as parity prices. The parity price for international competitors can be calculated from two perspectives:

- An unweighted average price of the ten largest wheat exporters (Australia, the United States, Canada, Ukraine, France, Russia, Argentina, Romania, Germany, and Kazakhstan) results in an average price of **USD 298.7 per tonne**, suggesting that Moldova's wheat price is **approximately 21% below the global average** among major exporters.
- A weighted average based on the export shares of the five leading exporters (Australia, Russian Federation, the United States, Canada, and Ukraine) yields an average price of **USD 284 per tonne**, indicating that Moldova's price is around **15% below the global benchmark**.

If Moldova were exporting wheat at parity with the average international price of comparable exporters, the parity export price would range between USD 280 and 300 per tonne.

TABLE 3-14 AVERAGE EXPORT OF WHEAT FLOUR (HS 110100) PER COUNTRY, 2021 – 2023 (EXPORT QUANTITY, AVERAGE PRICE)

No.	Country	Average Export quantity (K ton)	Export share	Average export price (USD/ton)	Index (Moldova price = 100%)
1	Türkiye	3,253	24.7%	419	134%
2	Kazakhstan	1,787	13.6%	328	105%
3	Germany	1,022	7.8%	503	162%
4	Uzbekistan	863	6.5%	419	135%
7	Egypt	391	3.0%	620	199%
8	Belgium	293	2.2%	521	167%
9	Italy	292	2.2%	828	266%
10	Russian Federation	259	2.0%	332	106%
16	Hungary	173	1.3%	413	133%
18	Serbia	142	1.1%	378	121%
21	France	130	1.0%	648	208%
22	Netherlands	128	1.0%	700	225%
24	Poland	117	0.9%	474	152%
25	Ukraine	108	0.8%	316	101%
26	Slovakia	107	0.8%	451	145%
27	Spain	104	0.8%	510	164%
38	Bulgaria	53	0.4%	471	151%
42	Czechia	39	0.3%	546	175%
43	Latvia	37	0.3%	456	146%
45	Greece	36	0.3%	543	174%
56	Croatia	17	0.1%	449	144%
58	Bosnia Herzegovina	17	0.1%	502	161%
60	Lithuania	15	0.1%	477	153%
63	Denmark	13	0.1%	652	209%
68	Romania	11	0.1%	488	157%
72	Rep. of Moldova	11	0.1%	311	100%
73	Slovenia	11	0.1%	546	175%
Others		9,430	72%		
Total		**13,187**	**100%**		

Source: UN Comtrade (2025)

The competitiveness of Moldova's wheat **flour exports** can be evaluated by comparing its average export prices with those of other major exporting countries. Between 2021 and 2023, Moldova exported an average of 11 thousand tonnes of wheat flour annually at an average price of USD 311 per tonne, which serves as the reference point (index = 100%). This price level is noticeably below that of most competing exporters. Only a few countries, such as Ukraine (USD 316 per tonne, 101%) and Kazakhstan (USD 328 per tonne, 105%), achieved comparable or slightly higher prices. By contrast, most European exporters sell at substantially higher values, for instance, Germany (USD 503 per tonne, 162%), Belgium (USD 521 per tonne, 167%), and Italy (USD 828 per tonne, 266%)[56], indicating a considerable premium associated with quality or branding.

Globally, the export market for wheat flour remains concentrated, with Türkiye (24.7%), Kazakhstan (13.6%), and Germany (7.8%) together accounting for nearly half of total global exports. Moldova's share is marginal at 0.1%, underscoring its limited presence and small-scale production relative to major competitors, while lacking the quality milling technologies.

If Moldova were to align with the international average of comparable exporters, the parity export price would range between USD 400–500 per tonne.

This suggests that **Moldovan wheat flour is traded at a discount of around 25–35% compared to key international peers**. The lower price likely reflects differences in flour quality, production technology, market access conditions, and smaller export volumes, which reduce Moldova's bargaining power and market visibility.

An analysis of the policy and macroeconomic environment for the Moldovan wheat VC reveals significant challenges to the sector's competitiveness.

The international competitiveness of Moldovan wheat is defined by **the Domestic Resource Cost (DRC)** indicator, calculated at 0.69, is below the 1.0 threshold for efficiency. **This figure suggests Moldovan wheat operates under competitive advantage.**

Nevertheless, Moldova is on the track to Dutch disease, maybe not via the export of valuable commodities, but mainly due to inflow of remittances. The inflow of foreign currency make pressure on MDL exchange rate. The Stratan (2024) indicates overvaluation of the Moldovan Leu, stating '*These developments have significantly eroded Moldova's cost competitiveness compared to other countries in the region and its economic partners in the Eurozone*' (Stratan et al., 2024). **Overvaluation acts as a direct tax on all exporting sectors, as producers receive less in domestic currency for their goods than they would under a market-aligned rate.**

[56] The data presented are related to HS chapter HS 110199, which includes soft wheat and exclude seeds and durum wheat.

3.4 Comparison of sub-chains

The following section compares the 2 sub-chains that appear in Moldova. We identified an **export sub-chain**, which primarily consists of traders who export wheat out of the country. The second sub-chain includes **local consumption** (by the landowner and animal husbandry) **and processing** (in our case, milling).

The comparison of wheat sub-chains in Moldova reveals notable structural differences between the Export and Processing chains (Figure 3-5). Across most cost components – such as inputs, wages, subsidies, and depreciation – the export VC accounts for a larger share, typically around 60–70% of the total, indicating its dominant role in value creation and cost absorption. In contrast, the processing VC shows relatively higher shares in direct value added (52%) reflecting the additional transformation and domestic market activities that occur beyond the farm gate. **The higher direct VA in processing highlights its greater contribution to domestic value generation, while the export VC remains more input-intensive and exposed to price fluctuations on international markets.**

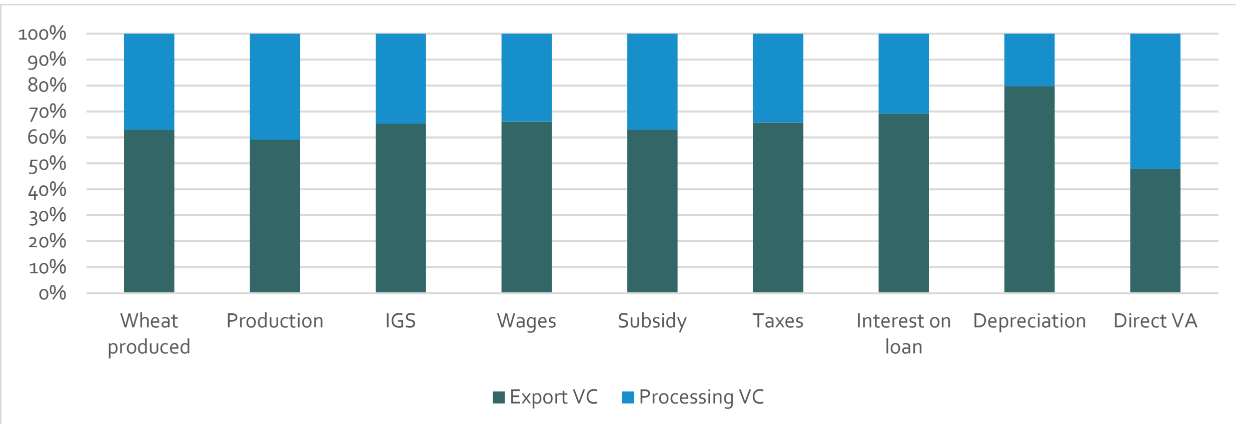

FIGURE 3-5: COMPARISON OF WHEAT SUB-CHAINS IN MOLDOVA, 2023

Overall, these results suggest that expanding the processing segment could enhance local value retention and resilience within the Moldovan wheat sector.

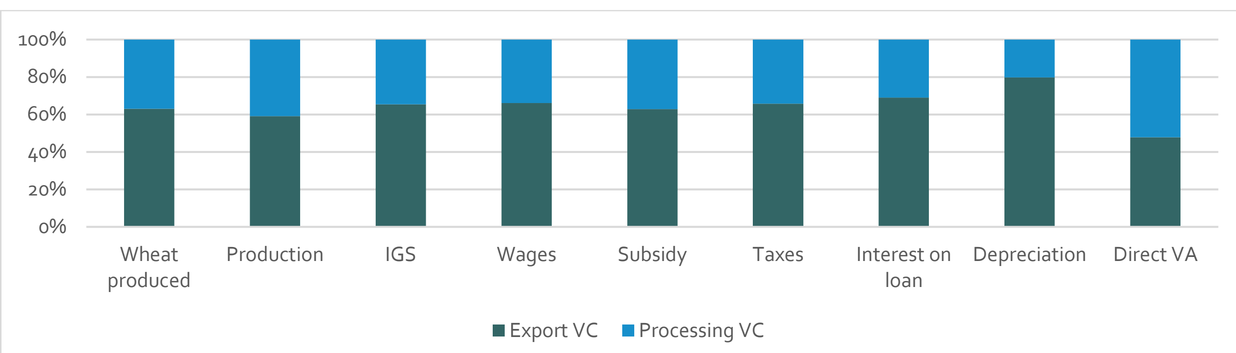

FIGURE 3-6 WHEAT SUB-CHAINS CHARACTERISTICS, MOLDOVA, 2023

Table 3-15 highlights the structural and economic differences between Moldova's export-oriented and processing-oriented wheat VCs in 2023. The export VC dominates in volume terms (

Table 3-15), handling nearly twice as much wheat as the processing VC (almost 1 million vs. 0.6 million tons), yet it generates a lower value per unit of input[57] (**3,774 MDL/ton compared to 4,431 MDL/ton**) and **lower VA per 1 tonne of wheat** (1,202 compared to 2,230 MDL/tonne). This indicates that the processing chain achieves higher value addition per ton of wheat, reflecting the economic benefits of domestic transformation. The export VC also bears higher absolute costs in inputs, wages, and land fees, showing its greater scale but lower efficiency. Importantly, profitability sharply diverges: the export VC reports a net operating loss (-16% of production), while the processing VC shows a positive margin (48%)[58]. Consequently, the processing VC achieves a much higher direct value added (50% of output versus 32% in exports), underscoring its stronger capacity to retain value within the country. Overall, the data confirm that Moldova's wheat sector remains dominated by export activities, but deeper processing offers significantly better returns and a more sustainable path for enhancing domestic value creation.

TABLE 3-15 CHARACTERISTICS OF WHEAT SUB-CHAINS IN MOLDOVA, 2023

	Unit	Export VC	Processing VC	VC total
Wheat input	thousand tons	979	575	1,555
Production	thousand MDL	3,694,294	2,547,850	6,242,144
Production to input	MDL/ton	3,774	4,431	4,014
IGS	thousand MDL	2,533,288	1,340,251	3,873,539
Wages	thousand MDL	839,496	428,630	1,268,126
- wages on production	%	23%	17%	20%
Subsidy	thousand MDL	134,745	79,268	214,013
- Subsidy on production	%	4%	3%	3%
Taxes	thousand MDL	118,984	61,796	180,780
- taxes on production	%	3%	2%	3%
Interest on loan	thousand MDL	68,536	30,799	99,335
- Interest to production	%	2%	1%	2%
Land fee	thousand MDL	602,977	-446,650	156,327
Depreciation	thousand MDL	266,388	67,581	333,969
- Depreciation to production	%	7%	3%	5%
Net Operating Profit	thousand MDL	-584,870	1,219,200	634,330
- NOP to production	%	-16%	48%	10%
Direct VA	thousand MDL	1,176,764	1,282,093	2,458,857
- VA on production	MDL/tonne	**1,202**	**2,230**	**1,581**
VA/Product	%	32%	50%	39%

3.5 Answer to the Framing Question 1

The tables below summarise the main findings from the economic and financial analysis of the Moldovan wheat VC. **The results indicate that the VC is not fully economically profitable particularly at the level of primary producers and exporters.** However, profitability improves further up the processing chain, where more efficient processors generate stronger economic results. **The conservative agriculture (**no-till and organic farming**) proves to be resilient even in the times of lower prices** and this showcase shall be further promoted and communicated towards farmers.

The information provided could suggest that the wheat VC is not economically sustainable or viable, given that both farmers and traders may operate at a loss. However, such an interpretation would oversimplify the results. Farmers and traders do not operate in an isolated "wheat-only" environment. Agricultural production follows

[57] 1 ton of wheat

[58] This number is highly affected by the landowners, who receive wheat from farmers and further process into other commodities.

crop rotation[59], and traders typically handle multiple commodities rather than a single product. Moreover, weather conditions affect global production and lead to price fluctuations, meaning that some years are profitable while others are not. **Managing risk through production and trade diversification across several commodities is therefore a key strategy for maintaining the long-term viability and sustainability of farms and trading companies.**

Also, good practices we have seen indicates how successful processing industry may transform the sector. Successful processors usually demanding quality deliveries, it leads to innovations among farmers (focus on quality varieties, proper management etc.) which further may be reflected in higher prices. **Overall, the greater the efficiency of the processing industry** (milling and bakeries)**, the more beneficial the wheat VC becomes for the Moldovan economy.** Hence, the industrial innovations and food processing industry success on international markets is seen as key element to improve the Moldovan wheat production economic viability.

TABLE 3-16 HOW PROFITABLE AND SUSTAINABLE ARE THE VC ACTIVITIES FOR THE ENTITIES INVOLVED? WHEAT - 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)	Farms: Table 3-2 Service mill: Table 3-5 Mills: Table 3-6 Trader Table 3-9 Organic trader Table 3-11
		Net operating profit by type of actor (Thousand MDL)	PF-N: 52.8 AE-N: 82.7 PF-C: -140.5 AE-C: -218.3 PF-S: -117.5 AE-S: -231.6 No-till: -9.2 Organic: 34.2
		Return on turnover (operating profit/production)	PF-N: 8% AE-N: 4% PF-C: -20% AE-C: -12% PF-S: -19% AE-S: -9% No-till: 0% Organic: 1% Industrial mills: 3 – 8% Wheat trading: -8 to -15%, but normally net margin between 1 – 5%. Organic trader / wheat (-7%), spelt is probably more profitable.
		Benchmarks for farmers' net income (MDL/month, 2023)	Minimum wage: - 4,000 MDL Average gross wage in Agriculture: - 7,952 MDL Average gross wage in Economy: - 12,209 MDL

[59] Wheat in crop rotation improves soil health, breaks pest and weed cycles, and optimises nutrient use. Its residues enhance fertility and structure, while as a winter crop it reduces erosion.

Table 3-17 presents the indicators to answer the question, what is the contribution of the wheat VC to the economic growth of Moldova? To remind, the information is related to the reference year of 2023. Results indicate that total VC production is equal to 6.24 billion MDL, while most of the production captures the export market. The largest portion of the VA is generated by wages and followed by Net Operating Profit. The production of wheat among farm entities captures **8.75% of the national Agricultural GDP**.

TABLE 3-17 WHAT IS THE CONTRIBUTION OF THE VC TO ECONOMIC GROWTH? WHEAT – MOLDOVA, 2023

Framing Question 1: What is the contribution of the VC to economic growth?		INDICATORS	RESULTS
CQ1.2	What is the contribution of the VC to the GDP?	Value of final VC production (Million MDL)	VC: 6,242 Export VC: 4,137 Processing VC: 2,548
		Total VA and components (Million MDL)	Wages: 1,965 Tax (+)/Subsidy (-): 390 Interests: 191 Land fee: 252 Depreciation: 558 Net Operating profit: 1,227 VA total: 4,595 million MDL
		Total VA as a percentage of the GDP	1.5%
		Rate of integration into the Economy (total VA/VC production)	73.6%
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	2,269 million MDL 11% (incl. landowners)
CQ1.4	What is the contribution of the VC to the public finances?	Public Funds Balance	-33,2 million MDL (+ unreturned VAT 150 – 200 million MDL)
CQ1.5	What is the contribution of the VC to the balance of trade?	VC exports	4,090 million MDL (5.6% of total export)
		VC total imports	1,691 million MDL (1.1% of total imports)
		Balance of trade of the VC	2,399 million MDL

The VC have a positive contribution to public finance. Main sources of public budget revenues are VAT, income taxation, and contributions to social and health insurance, which are paid by companies (but still in agriculture a lot of shadow work exists). Additionally, to this amount, there is approximately 150–200 million in VAT, which is paid to fiscal agencies and has not yet been reimbursed to farmers. Total export of the VC is positive and contributes to 5.6% of national exports.

Table 3-18 presents the indicators to answer the question whether the Moldovan wheat production is viable in the international economy. Comments on the results are provided above. In short, the VC has a comparative advantage (**DRC 0.69**) but the overall viability of the VC is vulnerable in international market conditions, especially related to quality. Production is 10% below the international parity price (for more details, see Table 3-13 and Table 3-14).

TABLE 3-18 IS THE VC VIABLE IN THE INTERNATIONAL ECONOMY? WHEAT – MOLDOVA, 2023

Framing Question 1: What is the contribution of the VC to economic growth?		INDICATORS	RESULTS
CQ1.6	Is the VC viable in the international economy?	Nominal Protection Coefficient (NPC)	0.92
		Domestic Resource Cost Ratio (DRC)	0.69

4. IS THIS ECONOMIC GROWTH INCLUSIVE?

4.1 Distribution of the profit and value added

As depicted in the Figure 4-1, majority of the Net operating profit is generated by the landowners as they receive profits based on the land ownership, which has only limited risks. The land was distributed to population during the land reform. But, due to the fact that landowners receive wheat as payment in kind, they are indicated as actors and users of the commodity. Others, farms on the north gain positive profit as well as mills and services milling entities. Other actors, as identified below, were not generating any profit with the 2023 prices on the market.

Figure 4-1 represented by the waterfall chart presents the distribution of Net Operation Profit by actors. The Northern region farmers benefit from the positive climatic conditions, while in centre and south the activities were not profitable in wheat farming in 2023. No-tillers and organic producers operated at almost at break even. Industrial mills follow the international price of flour, which is correlated to the wheat prices.

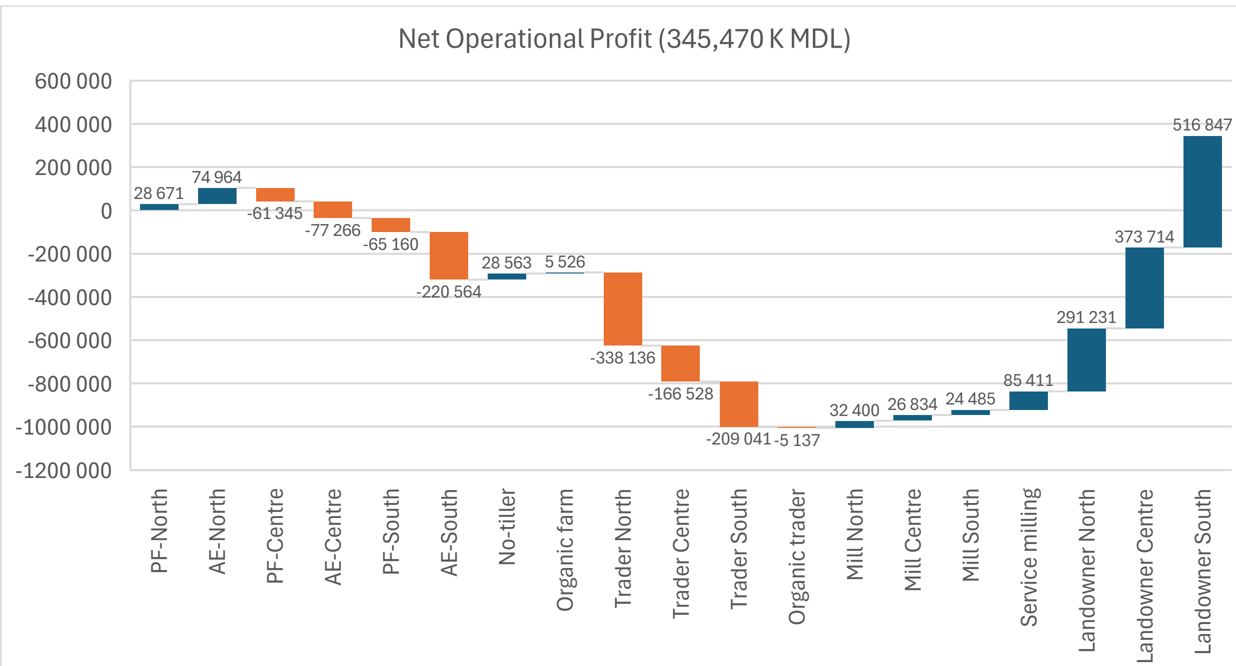

FIGURE 4-1 NET OPERATING PROFIT DISTRIBUTION BY ACTORS, WHEAT, MOLDOVA, THOUSANDS MDL, 2023

TABLE 4-1 DISTRIBUTION OF VALUE ADDED, WAGES, TAXES COLLECTED, AND NET OPERATING PROFIT BY ACTOR, MOLDOVA, 2023

Thousand MDL	Value added	%	Wages	%	Tax	%	NOP	%
Farmers	1,889,912	76%	1,068,470	84%	139,382	77%	-286,611	-83%
Traders	-1,468	0.1%	169,267	13%	31,561	17%	-718,841	-208%
Mills	187,826	7.6%	24,805	2%	9,837	5%	169,130	49%
Landowners	379,650	15.4%	0	0%	0	0%	1,181,792	342%
Total	**2,458,856**	**100%**	**1,268,126**	**100%**	**180,780**	**100%**	**345,470**	**100%**

The distribution of VA and wages across different segments of the wheat VC reveals a pronounced concentration of economic activity and labour income at the primary production level, while profits are more heavily captured downstream. Farmers generate most of the VA, around 76%, which highlights their central role in the overall creation of value within the chain. Landowners and processing (milling) activities contribute smaller shares, at 15% and 8.0% respectively. The dominance of farming is even stronger when examining wages: farmers distribute approximately 84% of total labour compensation. This distribution highlights the sector's significant reliance on agricultural labour and the crucial role of farmers in sustaining economic activity throughout the chain.

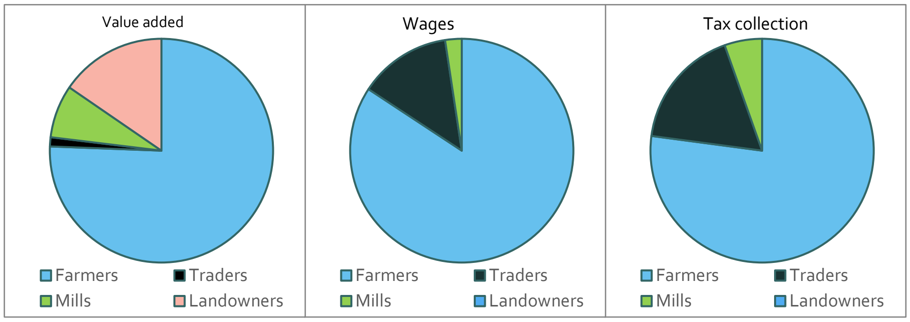

FIGURE 4-2 DISTRIBUTION OF VALUE ADDED, WAGES, TAXES COLLECTED BY ACTOR, WHEAT, MOLDOVA, 2023

However, this pattern changes markedly when examining the distribution of **net operating profit**. Although farmers remain the primary generators of value and employment, the sector in 2023 did not generate many direct benefits to the farmers (among delivering commodity which was provided to landowners). From the macro perspective the whole wheat production sector was in loss (-286 thousand MDL). Similar situation was observed among traders. The calculations, based on assumptions of truck deliveries to Constanta port, Romania, leads us to negative numbers. **Here, readers must be very careful with reading** and understanding what the numbers means. **Our assumptions are based on interviews and observed prices in one particular year.** At the same time, it is highly possible, that the sector finds a way, how to generate profits (otherwise the traders would not operate in the business)[60].

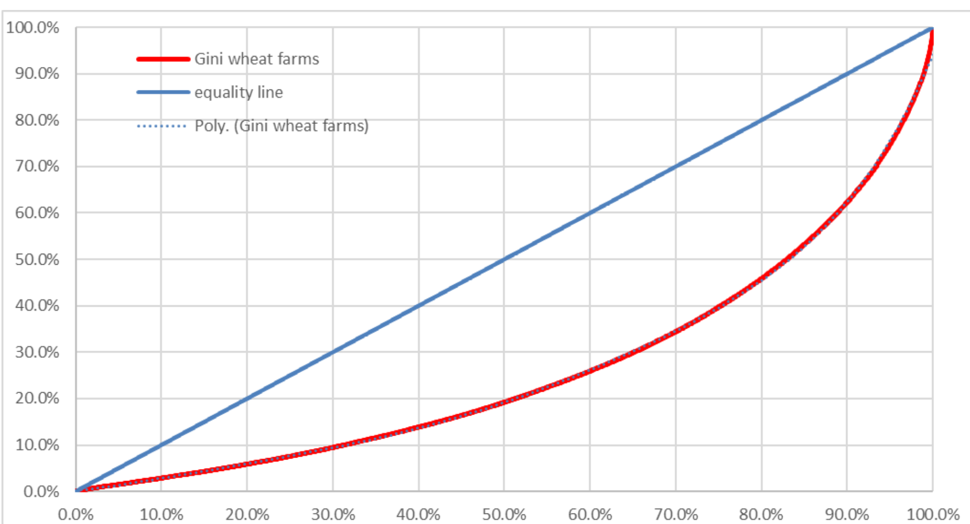

FIGURE 4-3 THE GINI COEFFICIENT OF LAND USAGE DISTRIBUTION AMONG WHEAT GROWERS, MOLDOVA, 2023

[60] Probably additional survey or interviews would be needed to clarify those. There exist probably explanations why the trading continues even if the situation on the market is not favourable. I) To assure deliveries of other commodities from farmers, or to keep farming partners, traders need to accept negative profit margin. II) There exists optimisation of transportation costs (most significant costs of trader after purchase of commodity), which we were not informed about.

Landowners seem to act as an important player in the VC. Via their land ownership rights, they can capture considerable benefits and later transform those benefits into own consumption in the form of flour and animal feed. The VC profitability is clearly supported by the landownership benefits.

Among others, Moldova is facing inequality in land access. The farms which produced wheat (and were more than 10 ha in all grown commodities) reported their wheat areas to the statistical office. The distribution of land usage is depicted in Figure 4-2, with the Lorenz curve (red) and the equality curve (blue). **The Gini index of land usage distribution equals 0.44**, which rather indicates a larger inequality in land distribution. Research conducted in five European countries found that the Gini index of land usage among young farmers[61] ranges from 0.25 in Lithuania and Hungary, 0.32 in the Czech Republic, 0.38 in Poland, and 0.41 in Slovakia (Czubak, 2023). In Moldova, 50% of land users (farmers) cultivating wheat on holdings larger than 10 hectares operate less than 20% of the arable land, while the top 10% of such farms manages around 40%. This distribution differs from the broader 2011 agricultural census, which included very small holdings; the figures presented here refer specifically to wheat-producing farms above 10 hectares.

4.2 Distribution of wages and employment creation

The wage data within Moldova's wheat VC reveals a pronounced gender pay gap across all labour categories, mirroring the national trend in which women earn less than men, even when controlling for qualifications. Specifically, the analysis shows that male qualified workers earn 700 MDL/day, compared to 600 MDL/day for their female counterparts, representing an approximate 16.6% difference, which is consistent with the gap found among unqualified staff. The largest absolute disparity occurs in the temporary worker category, where the male wage (650 MDL/day) is almost double the female wage (350 MDL/day), though this is partially attributed to the employment of higher-salaried mechanisers (tractor and machinery operators). Addressing this systemic disparity, which is rooted in labour market gender segregation and societal norms, is essential for ensuring inclusive growth, improving livelihoods in rural areas, and aligning the wheat sector with broader EU gender equality standards.

The data illustrate (Table 4-3) the structure of labour expenditures and employment creation within Moldova's wheat VC in 2023, distinguishing between farm types, levels of skill, and gender composition. Total labour expenditures reached 1.2 billion MDL, corresponding to the creation of approximately 8,300 full time equivalent jobs (FTE), each representing 247 working days per year. Farms accounted for most of both labour spending and employment, absorbing nearly 1.0 billion MDL and generating over 7,400 FTEs.

Table 4-2 The table with information on salaries we considered in the employment analyses

Labour type	Daily wage (MDL / day)	Monthly wage (20 days)	Pay gap	Note
Male temporary	650	13,000		Mostly mechanisers with higher salaries, hence jobs are not comparable
Female temporary	350	7,000		
Male unqualified	490	9,800	14.2	
Female unqualified	420	8,400		
Male qualified	700	14,000	14.2	
Female qualified	600	12,000		

Within the farm segment, the highest outlays were concentrated in larger commercial enterprises, especially in the South, where both wage levels and labour intensity are elevated. By contrast, peasant farms and organic farms accounted for a smaller share of total employment and wages. **On average, monthly remuneration in**

[61] With the age below 40.

the VC amounted to around 12,077 MDL. Male workers earned approximately 13,100 MDL per month, while female workers received a lower average of about 9,900 MDL per month[62].

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

Acronym (K MDL)	Temporary	Permanent Unskilled	Permanent Skilled	Male	Female	Total
Peasant farm North	32,908	21,671	25,684	56,184	24,079	80,263
Enterprise North	113,323	69,539	74,690	182,862	74,690	257,552
Peasant farm Centre	29,516	5,676	21,569	44,841	11,920	56,761
Enterprise Centre	82,372	36,983	48,751	126,079	42,026	168,105
Peasant farm South	51,627	2,197	56,021	90,072	19,772	109,844
Enterprise South	131,052	92,332	74,461	208,492	89,354	297,846
No-till farm	33,01	12,917	25,834	53,103	18,658	71,761
Organic farm	7,375	14,222	4,741	14,749	11,589	26,338
Farms	448,173	255,537	331,751	776,382	292,087	1,068,469
- Jobs (FTE)	**2,791**	**2,358**	**2,031**	**4,893**	**2,478**	**7,371**
Traders	0	68,721	100,546	118,487	50,780	169,267
- Jobs (FTE)	**0**	**544**	**578**	**749**	**374**	**1,123**
Industrial mills	0	9,595	4,112	9,595	4,112	13,707
- Jobs (FTE)	**0**	**82**	**26**	**109**	**50**	**159**
Service mills	0	10,843	5,839	13,346	3,336	16,682
- Jobs (FTE)	**0**	**92**	**35**	**100**	**27**	**127**
Total (K MDL)	448,173	344,696	442,248	917,810	350,315	1,268,125
- Jobs (FTE)	**2,791**	**3,076**	**2,670**	**5,851**	**2,929**	**8,780**

The composition of employment indicates that most jobs in the wheat sector are either temporary or linked to permanent unskilled labour, together representing more than half of the total labour costs. However, a significant portion (410 million MDL) is allocated to permanent skilled positions, particularly in southern enterprises and processing-related activities, signalling a growing need for technically trained workers in mechanised and management functions. This distribution underscores a gradual but meaningful shift from traditional, labour-intensive farming towards more professionalised and skill-demanding operations, especially in regions with higher levels of capitalisation.

In terms of gender dynamics, male workers receive about 72% of the total wage expenditures, reflecting their predominance in mechanised field and enterprise-level operations. In the sector, we observe lower position of females in total employment on the more sophisticated positions. Females are given only about 34% FTE positions and receive about 33% of salaries. This disparity is given by the fact, that females are not performing sophisticated jobs, at the farm level they either provide services (food) and cleaning with very low compensations, or they can serve as accountants or other administration.

[62] Those values seem to be higher than values in the Moldovan economy. Agricultural average gross salary was 7,952 MDL/month, while in food manufacturing the average was slightly higher 10,508 MDL/month. The difference in VC values and national average values is most probably attributed to undeclared salaries, not officially reported to national statistics.

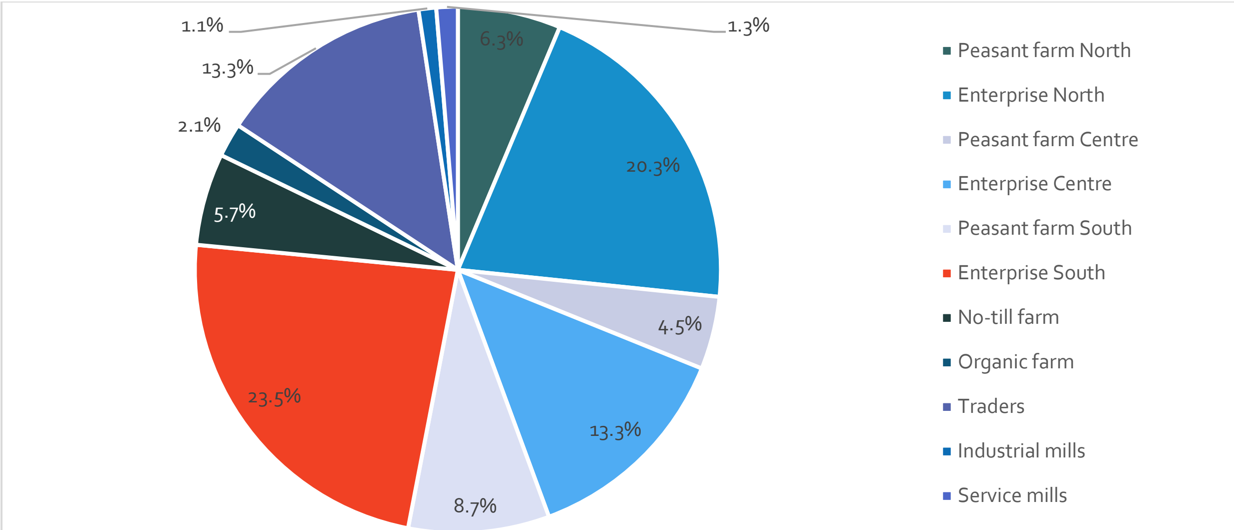

FIGURE 4-4 DISTRIBUTION OF WAGES, WHEAT, MOLDOVA, 2023

The overall wage and labour structure suggests that Moldova's wheat sector remains a major rural employer, but with marked regional disparities and a concentration of higher-paid, skilled jobs in larger enterprises. Strengthening training systems and ensuring more balanced participation across skill levels and genders could enhance both productivity and inclusiveness in the sector.

The Figure 4-4 presents the distribution of wages in the VC. As identified, majority of wages is distributed among the farming entities as there are the most numbered. Also, we can observe that the larger farms provide most of the wages in the VC. Processing industry (milling) and trading is marginal in wages distributed. Even if the milling can contribute to the VA more than export, due to the mechanical automatization the labour numbers are not as high. Larger labour needs were observed in the larger bakeries or bakeries retail, but those are not part of the VC studied.

The market operates under labour distortions. Pressure on wages is exacerbated by large-scale international migration, which results in an unhealthy labour market characterized by low unemployment and labour shortages. Based on Stratan et al (2024), the wage increase goes faster than labour productivity. Between 2015 and 2023, nominal wages per employee rose by an average of 13% per year, while real productivity grew at an average annual rate of just 1.7%.

4.3 Answer to the Framing Question 2

The inclusiveness of the VC is not certain. Labour in agriculture, mainly in crop production, is dominated by males, specifically at the level of temporary labour, which is mainly related to mechanisation work (driving tractors and harvesters). Females have been observed mainly in low-skilled jobs (e.g., preparing lunches for employees), while they have also been conducting skilled jobs related to finance, accounting, and HR. Even in the processing industry, women are often associated with more sophisticated, administrative, and skilled jobs, while men are also involved in labour-intensive and manual activities that require more physical strength (in the milling sector, for example, this involves handling full bags).

The study did not observe a very strong/dominant power of any market player. Although the industrial milling sector appears to be relatively concentrated (as evidenced by the market, where we found only a few local flour brands), the alternative service milling sector counterbalances the situation. In the wheat trading market, there is also no dominant trader; farmers have a wide range of possible traders with whom they can cooperate. The problem is that, despite market competition, the price of commodities exported is still low compared to other wheat-exporting countries. The territorial perspective does not support inclusiveness. In the northern region, where climatic conditions are more favourable, farmers can generate a profit even under a lower world wheat price. On the contrary, lack of water and unfavourable farming practices suppress southern productivity and endanger the profitability/viability of the sector. With more frequent climatic events, the endangered regions will require increasing public assistance; hence, investment in alternative farming approaches may lead to future benefits. Wheat production is also highly inclusive from the perspective of food security. Because land rent is paid in kind, the rural and urban populations have access to wheat, barley, corn, and sunflower, which are further used for food preparation (flour and sunflower oil) or for feeding purposes (chickens and pigs, mainly).

Framing Question 2: Is this economic growth inclusive?		**INDICATORS**	**RESULTS**
CQ2.1	How is income distributed across actors of the VC?	**Disaggregated Value Added**	Total VA: 4,595 million MDL
		Total farm income	Total farms (NOP): -9.4 million MDL PF-North:45.1 million MDL AE-North: 132.3 million MDL PF-Centre: -36.5 million MDL AE-Centre: -4.5 million MDL PF-South:-43.5 million MDL AE-South: -117.2 million MDL No-tiller: 14.6 million MDL Organic: 0.3 million MDL
		Wages and salaries (distribution of wages among actors)	Peasant farm North: 6.3% Enterprise North: 20.3% Peasant farm Centre: 4.5% Enterprise Centre: 13.3% Peasant farm South: 8.7% Enterprise South: 23.5% No-till farm: 5.7% Organic farm: 2.1% Traders: 13.3% Industrial mills: 1.1% Service mills: 1.3% For more details see the Figure 4-4
CQ2.2	What is the impact of the governance systems on income distribution?	**Income distribution among actors**	Share of Net Operating Profit: • Farms (-83%) • Traders (-208%) • Milling (49%) • Landowners (342%)
		Share of farm gate price in the export price (%) - Organic export 6.8 MDL/kg - Conventional export 3.5 MDL/kg	• North (2.90 MDL/kg): 83% • Centre and no-till (2.77): 79% • South (3.03): 86% • Organic (3.45): 51%
		Share of **wheat (3.22)** in the **price of flour**	• Flour export (66%) • Flour to bakeries (55%) • Flour retail (41%)
CQ2.3	How is employment distributed across the VC?	**Number of jobs (VC)**	Full-time equivalent: 8,378 Permanent workers (FTE): 6,990 (70%) Temporary workers (FTE): 2,997 (30%)
		Employment of women (FTE)	34% of FTE, receiving 28% of salaries - 9,900 MDL/month

5. IS THE VALUE CHAIN SOCIALLY SUSTAINABLE?

5.1 Working conditions

Are working conditions throughout the wheat value chain socially acceptable and sustainable?

Employment Arrangements

Moldova has ratified eight fundamental conventions of the International Labor Organization (ILO), as well as the International Covenant on Civil and Political Rights (ICCPR) and the International Covenant on Economic, Social, and Cultural Rights (ICESCR). However, discussions with farmers and workers on farms indicate that there are deviations between workers' actual conditions and international standards.

The Labour Code of Moldova largely aligns with these conventions; it defines various aspects of employer-employee relations, such as labour relations, minimum wage, maximum working hours, and rest periods. Nonetheless, there are limitations in the implementation of these provisions. Recent findings from ILO/UN/Council of Europe observations highlight obstacles to the practical enforcement of these standards.[63] Additionally, high informality among employees and coverage gaps limit the effective protection of workers. During field research, the team also identified informal agreements with seasonal workers and some permanent staff of the farms as well. Overall, working conditions within Moldova's wheat VC are relatively better compared to other post-soviet countries.

The Labour Code of Moldova applies to all types of workers within the country. Regarding daily workers in the agricultural sector, a specific law (No. 22/2018) was adopted in 2018 to regulate daily work arrangements. The State Labour Inspectorate (SLI) is vested with the authority to monitor and report on the implementation of this legislation.

Moldova has ratified ILO Convention 129 on labour inspection in the agricultural sector, and the SLI conducts inspections accordingly. However, mismatches exist between international conventions and national laws. For instance, Conventions 81 and 129 permit unannounced inspections at any time and as frequently as necessary. In contrast, Moldovan Law 131 specifies that inspections should be planned based on identified sector- and company-specific risks, requiring prior proof of risk. This contradiction can be partially managed if complaints originate from employees, but workers often show reluctance to submit such petitions. Key informant interviews with representatives of the Labour Inspection Office in Moldova reveal that the institution's human and financial resources are limited, which constrains the monitoring of working conditions, including safety issues in the agricultural sector – including the wheat VC. The number of monitoring missions is very low, and in some years, inspections have been absent. Inspection office is understaffed: only 55 inspectors in the whole country to cover 155,000 enterprises (5 to cover 80,000 enterprises in Chisinau district). Mostly the state of working conditions almost fully depends on the farmers will and decisions. FGDs with workers also revealed a lack of awareness regarding procedures or practices for approaching the State Labour Inspectorate.

[63] Diagnostic report of the undeclared work in Moldova, Copyright © International Labour Organization 2024 (ILO, 2024). https://www.ilo.org/sites/default/files/2024-12/UDW%20Report%20ENG.pdf

The status of workers' unions reflects the legacy of the Soviet Union[64] era. KIIs (Key Informative Interviews) with worker union representatives indicate that they have little direct contact with workers in the agricultural sector, including those involved in cereal VCs. AgroInSid is a trade union that advocates for workers' rights in Moldova's agricultural sector. According to AgroInSid, Moldova's agricultural sector comprises 40,000 workers, of whom 6,000 are union members. This represents a significant decline from its Soviet Union origins, when membership stood at 900,000. Membership fees are set at 1% of members' gross salaries. Seasonal and informal agricultural workers, however, are not typically union members. AgroInSid representatives indicate that daily workers earn 1,000 MDL, significantly less than the 5,000 MDL paid to full-time employees. The institution elaborated the convention of labour rights but only 2 out of 18 employers signed the document. The employers respect the minimum salary, but it is very low according to the representatives of institutions. Overall, significant out-migration from Moldova's rural areas has led to a labour shortage. Consequently, farmers are increasingly transitioning from labour-intensive sectors like horticulture and viticulture to the less labour-intensive cereal sector. The union's power to negotiate wages with farmers is limited, and there is a general lack of direct cooperation between farmers and AgroInSid. Furthermore, during focus group discussions (FGDs) with workers, none reported any engagement or cooperation with the union. As a result, concerns raised by farm workers are not always known to unions. Conversely, workers are largely unaware of union activities due to their minimal cooperation. Union membership among workers in the wheat VC is also low. Overall, there is a lack of active workers' unions in the agricultural sector in Moldova.

Child labour is prohibited for individuals under 15 years of age. Children between 15 and 18 years old are permitted to work a maximum of 30 hours per week and are explicitly barred from certain sectors, such as tobacco production and similar domains. During field visits, no instances of child labour were observed in the wheat sector, a finding corroborated by KIIs with representatives from the Ministry of Labour and Social Protection. Forced labour, specifically unpaid labour, is forbidden by law, and no cases were identified in the wheat sector. However, instances of unpaid labour among shepherds have been documented within the livestock VC.

Overall, one of the key challenges in the agricultural sector is the high prevalence of undeclared work and employment. This widespread informality prevents the government from accurately identifying work-related incidents and effectively monitoring the implementation and enforcement of legal requirements concerning working conditions, including safety issues and the use of protective equipment.

Occupational safety and Health

Employers are legally obligated to provide health and safety training: manual workers must receive training every six months, while administrative staff require it annually. This training must be tailored to the specific activities of the enterprise, including the safe use of chemicals and protective equipment. Employers bear criminal liability for compliance with these provisions. Managers themselves must undergo eight hours of health and safety training, or if this responsibility is delegated, that individual must complete 40 hours of specialized training.

External companies involved in labour rights reporting are not required to hold a license. While such companies are formally mandated to conduct training, there is an implicit suggestion that their focus may sometimes lean towards circumventing regulations rather than ensuring genuine compliance. Conversely, companies providing health and safety training are legally required to be licensed and are coordinated by the Ministry of Education. Furthermore, enterprises are mandated by Law 186 to maintain a register of risks and to conduct regular risk assessments.

KIIs with farmers revealed that occupational safety training is infrequently provided, largely confined to a few large and medium-sized farms. Visible informational materials regarding safety rules and measures are also

[64] The Soviet Union (Union of Soviet Socialist Republics, USSR) was a federal socialist state that existed from 1922 to 1991, comprising multiple republics across Eurasia, with Moscow as its capital. It was characterized by centralized political and economic control under the Communist Party.

exceptionally rare in farm offices. Participants in FGDs rarely report receiving formal training, instead relying on their personal experience for occupational safety practices. A significant challenge for workers is the inconsistent use of protective measures and equipment during agricultural activities, particularly involving pesticides, fertilizers, and machinery. Field observations confirmed that most agricultural tasks are performed without the necessary personal protective equipment. Furthermore, the disposal of waste pesticides and their packaging is largely inadequate. However, some larger farms maintain special storage facilities, ensuring proper treatment of these materials.

Contracts and Social and Health Security

Contrary to many developing countries, most permanent workers in Moldovan agricultural enterprises engaged in the wheat VC have formal contracts. These contracts specify wages, vacation entitlements, and other employment conditions. Employers also contribute to workers' health and social security. Workers generally do not report misconduct related to contractual terms or delays in remuneration. However, wages fluctuate seasonally, being lower in January, February, and March – sometimes half or even less than usual. Nonetheless, during active seasons, workers such as machinery operators often receive bonuses for overtime work.

In enterprises that engage in multiple agricultural activities – such as cereal cultivation, orchards, and rural tourism – workers, both men and women, are employed year-round and are more financially secure. Workers like mechanizers (i.e., truck and machinery operators) in these multi-dimensional farms working on after harvesting the cereals working on orchards or post-harvest tasks are often insured and receive stable salaries throughout the year.

Seasonal Workers

Seasonal workers are predominantly employed during the wheat harvesting and storage periods. Most are hired verbally and paid daily. This applies to both agricultural enterprises and peasant farms when additional labour is required. Seasonal workers tend to perform tasks related to harvesting, storage, and other unskilled labour. The number of days and workers needed is limited compared to other VCs such as viticulture and horticulture. In addition to honorarium, farmers provide seasonal workers with facilities such as transportation and meals in many cases.

Seasonal workers are often from the same or neighbouring communities. Farmers report that in last years in some farms workers came from Central Asian countries. In upcoming future, the increase in labour migration can fill the worker shortage.

Remuneration

According to Moldova's National Bureau of Statistics (2024), the average gross monthly wage in agriculture is approximately MDL 7,400, which is below the national average of MDL 12,100. Interviews with farmers and workers indicate that technical staff – such as accountants, agronomists, and farm managers, mechanisations – typically earn between MDL 10,000 and MDL 15,000 monthly, depending on farm size and profitability. Peasant farm staff (Unqualified labour tend to earn closer to MDL 7,000–9,000 per month, often rely on outsourced accountants under contract.

Mechanizers, including tractor drivers and combine operators, earn around MDL 11,000–15,000 during peak seasons. Some farmers report paying these workers extra hours, with wages often above minimum wage, supplemented by overtime and hectare-based bonuses. Women mostly work in canteens or multifunctional roles in agricultural enterprises, earning about MDL 7,000 per month.

Environmental Shocks and Worker Financial Security

During field visits, farmers, experts and representatives of international organizations, and government representatives noted that climate change, particularly droughts, has significantly impacted agriculture, especially the cereal sector and wheat production. Even though some farmers started to seed some drought-resistant wheat seed varieties, many farmers suffered losses in 2024. The government provided some subsidies to farmers; however, these subsidies were reported to be insufficient to sustain farming operations. These circumstances have a direct impact on workers' income and remuneration, with some cases where farmers, due to losses, are unable to pay their workers. According to the research team's observations, such cases are relatively rare and tend to be exceptional rather than the norm. Nonetheless, the risks posed by climate change and its negative influence on farmers' capacities.

Geopolitical Shocks

Beyond the negative impacts on the wheat VC and workers' rights, geopolitical challenges have also considerably affected workers' remuneration within agricultural enterprises and peasant farms involved in the chain. The full-scale invasion of Ukraine by Russia in 2022 sharply influenced cereal prices in Moldova and disrupted traditional logistics for cereal sales. These factors contributed to a decline in cereal prices globally, while also increasing the cost (due to logistical re-arrangements caused by war) of cereals produced in Moldova, including wheat. This situation negatively affected farmers' incomes and created instability in workers' remuneration within the VC. Based on reports, many peasant farmers experienced very low cereal prices, sometimes selling wheat at no profit or at a loss.

Social and Health Security

Moldova has a mandatory public health insurance system administered by the National Health Insurance Company (CNAM). Enterprises, including those in agriculture, contribute financially to their employees' health coverage. Workers in agricultural enterprises reported that they have access to this insurance. Moldova also offers limited private insurance; however, no agricultural enterprise was found to provide private insurance services to their workers.

Who are the farmers?

Analysing the social profile of farm workers helps highlight current and future challenges faced by wheat farms. Age is a crucial variable reflecting both the state and prospects of agricultural enterprises and peasant farms. Most of the agricultural enterprises interviewed and observed indicate that workers, including farm managers and directors, are over 50 years old. The aging of the workforce presents a significant obstacle to farm development. Farmers noted that young people, including farmers' children, are generally not interested in working on farms, preferring to move to capital cities or abroad to pursue careers. This trend affects both men and women.

However, there are some exceptions: a few relatively young farmers (under 45 years old) are actively managing farms successfully. Two illustrative cases are described below:

Case 1: A Young Entrepreneur

One farmer, over 40 years old, graduated from university in Moldova and initially moved to work in the UK, building his career on an orchard farm. He developed an interest in modern farming techniques and saved to invest in farm development in his hometown in Moldova. Over time, he invested in establishing a cereal farm, leveraging his experience and modern management practices, which ensured the farm's success within his region. He received several awards, including "*Best Farmer of the Year.*" His approach, including risk management strategies, increased his farm's resilience to external shocks. Despite the droughts in 2024, which caused losses for many farmers and bankruptcy for some, he was able to pay all wages, sustain the farm, and continue operations. This case illustrates several analytical points: a) experience living and working in a developed country can motivate farmers to adopt modern management practices; b) implementing such practices enhances farm resilience; c) ambition and recognition motivate farm success.

Case 2: Young Farmer: Passion-Driven Farming

Another notable example is a farmer under 35 who, after secondary school, studied law in the capital city. He initially worked in an office but helped his father with a small peasant cereal farm. He soon realized that farming was more attractive and promising financially than his office job. Recognizing the potential for expansion - renting land from local owners and gradually increasing landholdings - he began investing in farm development and management.

Farmers from the Soviet Past

A common type of farmer in Moldova is those over 60 years old with experience from the Soviet era. During the Soviet period, many held prominent positions such as Kolkhoz[65] - collective farm - heads (collective farm): or local communality leaders. After the collapse of the Soviet Union, these individuals often privatized or rented land, becoming local community leaders. Their social and cultural capital remains significant at the local level, influencing elections and local politics – many of whom support candidates such as mayors.

The management practices in these farms tend to be traditional, combining old-style methods with some modernization. Machinery is often outdated, and decision-making is leader driven. For example, fertilization, pesticide, and herbicide use decisions are made primarily by the farmer, often via phone, increasing the risk of mistakes. Workers generally lack knowledge of proper practices, which hampers farm development.

Agricultural Enterprise Farm – Ergonomic

In cereal farms, the main location is typically the farmstead where the enterprise's central office is situated. This area usually includes a storage system, a kitchen, and a relatively large dining room. The farm also has designated spaces for agricultural machinery, and in some cases, special areas are allocated for repairing damaged equipment.

In more developed farms, especially in northern and central Moldova, dedicated facilities are available for storing empty pesticide, herbicide, and fertiliser containers. However, in many farms, these facilities are not well maintained. Many agricultural enterprises also operate animal farms, primarily pig farms, often alongside small varieties of chickens, geese, ducks, and other poultry and livestock for farm and household consumption.

In some cases, farmers have diversified their operations to include orchard production and rural tourism, developing guesthouses (cottages) or restaurants. These multifunctional farms require workers to handle a variety of tasks: for instance, one day they might work on fertilizing cereals, and the next day they might harvest plums in orchards.

It is also notable that working conditions and the environment in these farms are generally much better than in many developing countries, providing relatively higher standards of occupational safety and worker well-being. Most of the farms have office with meetings rooms, kitchen, dining room and other necessary facilities, although some of these facilities require renovation and enhancing cleaning standards.

Who Are the Workers?

It is important to understand who the workers employed in cereal farming are, as this sheds light on the existing working relations within the VC. According to key informant interviews (KIIs), most employees are local villagers or residents from neighbouring villages.

Seasonal workers are often recruited locally as well; however, in some cases, machinery operators, who are more difficult to recruit, come from farms in distant municipalities, with farmers covering transportation costs or fuel. Since cereal farms typically require relatively low numbers of hired labourers, foreign workers are rarely involved in this segment of the VC. Nonetheless, farmers have noted that emigrants, especially from Central Asian countries, often work informally in orchard VCs.

Most workers across all categories - administrative staff, skilled workers (such as machinery operators), and unskilled labourers - are over 50 years old. The aging workforce poses a significant obstacle to the future development of the VC. Farmers highlight that high emigration rates among young people, favour jobs in cities or abroad, making it increasingly difficult to attract young labour to farms.

[65] A kolkhoz was a collective farm in the Soviet Union where farmers worked the land together and shared the produce. It was owned and managed by the community under Soviet government control.

There are no policies specifically prioritizing the employment of vulnerable populations (such as people with disabilities or those living beyond the poverty line) within the farms. Such vulnerable groups are not typically represented within the current workforce, indicating a potential area for policy development to promote inclusive employment in the sector.

Among self-employed peasant farmers engaged in cereal production, hired labour is rarely used. When machinery is unavailable, farmers usually hire mechanizers on a per-hectare or per-hour basis.

Summary of employment arrangements

The working conditions within Moldova's wheat VC are relatively better compared to many post-soviet and developing countries, thanks to formal contracts, social security systems, and generally improved environmental standards. Most permanent workers have formal employment agreements that specify wages, benefits, and social security contributions, while seasonal workers are predominantly hired informally, usually on verbal agreements with daily remuneration and some added benefits like transportation and meals.

However, the sector faces several challenges. The workforce is aging, with most workers over 50 years old, and there is a low interest among youth to engage in farming, compounded by high emigration rates. This aging trend poses a significant obstacle to future sector development. The lack of policies aimed at including vulnerable populations such as people with disabilities or those living in poverty further limits inclusivity.

Environmental shocks, particularly droughts exacerbated by climate change, have adversely impacted farmers' productivity and income, occasionally affecting their ability to remunerate workers. Geopolitical events, such as the 2022 invasion of Ukraine by the Russian Federation, have also disrupted cereal prices and logistics, causing economic instability for farmers and workers alike.

Monitoring of working conditions remains limited due to resource constraints of governmental agencies, and the overall union presence in the sector is weak, reflecting the Soviet legacy. Despite these issues, workplace conditions - especially in multifunctional farms - are generally considered to be higher than in many developing contexts, with better infrastructure and occupational safety.

Overall, while Moldova's wheat sector demonstrates relatively good standards, addressing workforce aging, emigration, policy gaps, and climate impacts is crucial for sustainable development and improved working conditions.

Table 5-1 Working Conditions

Respect of Labour Rights	Substantial
Child Labour	High
Job Safety	Moderate/low
Attractiveness	Substantial

5.2 Land and water rights

Are land and water rights socially acceptable and sustainable?

The ways in which farmers gained agricultural land vary from case to case. However, it is possible to identify main categories of land ownership among both agricultural enterprises and peasant farms. During field visits, three key types of land ownership for farms were identified.

The most common category in both agricultural enterprises and peasant farms is farms with mixed landownership. This means farmers possess a certain amount of land outright, while the remaining land is rented from landowners. The second type involves farmers who work only their owned land, which is quite rare. The research team encountered such a peasant farm in the north of the country. The third category includes farmers who work exclusively on rented land. This is also rare, but the team observed this type in the central part of Moldova.

These land ownership types are deeply rooted in the land privatization reform conducted after the collapse of the Soviet Union. As detailed in previous chapters, households in rural areas – and beyond – received a certain amount of land (on average about 2 hectares per household, though this varies by municipality and other factors) from the government. The exact size depended on the municipality, land quality, and other considerations. Often, this land is divided into 4–5. Most farmers being over age 55 – particularly heads of agricultural enterprises- held key community positions (such as village head or kolkhoz leader during the Soviet era). They built their farms shortly after the Soviet Union's collapse, acquiring or leasing large amounts of agricultural land. Over time, some also began renting land from smaller landowners. Since most landowners have around 2 hectares, agricultural enterprises often have numerous contracts, sometimes around 400 with small landowners. Some enterprises have between 400 and 500 such contracts. The details of these contractual relationships are analysed further below.

Younger farmers sometimes invest savings – earned from abroad (often in Europe) – to acquire land. These farmers also attempt to rent land from local landowners, or, familiar with family members working abroad, they may have relatives who help finance farm development. Some young farmers prefer to gradually increase their landholdings through purchase rather than renting, as land prices are rising and many landowners prefer not to sell.

It is notable that most farmers aim to acquire land ownership gradually. Though procuring land quickly is challenging due to rising prices and reluctance to sell, all interviewed farmers (except one who only rents the land) report that their landholdings are increasing over time.

Regarding sustainable agricultural practices, a prevailing view among some experts suggests that large farms are better positioned to implement them, owing to enhanced access to modern methodologies and their capacity for more efficient and sustainable process management. Nevertheless, this hypothesis warrants further empirical investigation for conclusive validation.

Renting Contracts

Most rental agreements between farmers and landowners are of two types: cash payments or in-kind contributions, primarily cereals. Contract durations are generally 4–5 years. Landowners typically receive payment either in cash or in-kind (cereals) after harvest. In some cases, cereals are delivered directly to landowners via farm vehicles; in others, landowners collect the cereals themselves.

The in-kind contributions vary regionally and depending on land size, with typical per-hectare quantities including:

- Wheat: approximately 400 kg (small farms) up to 1.3 tons (larger, high-fertility land)
- Sunflower: around 150 kg of seeds or equivalent oil
- Maize: about 200 kg (where included)
- In Căușeni: 700 kg of wheat or corn per 1.2–1.5 hectares

In rural areas, in-kind payments – grain, sunflower seeds, maize, barley – dominate. Villagers often prefer grain for household use or animal feed. Urban landowners or those abroad tend to prefer cash payments, though exceptions exist.

Social Characteristics of Landowners

There are three key types of landowners:

1. **Owners who work in the personally with farmers:** They focus on production that can be directly consumed by the household and/or its livestock. They tend to be loyal and do not rent their land to others.
2. **Local landowners with small farms:** Often employed elsewhere (schools, local government, businesses), they rent land mainly for household use (grain, oil, cereals).
3. **Emigrants, either abroad or within the country:** They typically prefer monetary compensation, as they are less involved in rural life.

The future sale of rented land may be influenced by these rental relationships, though land sales are relatively rare.

Farmers and Landowners

The level of trust between farmers and landowners varies, being high in some cases and vulnerable in others. This trust depends largely on the farmer's ability to fulfil their responsibilities to landowners, such as paying rent on time either in cash or in kind. Climate change related shocks (e.g., droughts) and financial difficulties often lead to farmers incurring losses. While some of these losses are mitigated through government subsidies, these subsidies are sometimes insufficient to cover all expenses. Consequently, some farmers prioritize repaying bank or input supplier loans, which can result in an inability to meet rent obligations. In such cases, landowners may be unable to collect rent, thereby reducing trust in the relationship.

This dynamic can intensify competition among farmers, as those who are able to ensure stable and long-term rent payments tend to build social and cultural capital with landowners within their community, municipality, or neighbouring areas. This positive reputation can lead landowners to prefer renewing contracts with trustworthy farmers. Farmers who adopt advanced management practices – ensuring timely payments, covering expenses for landowners and workers, and fulfilling financial commitments – generally enhance their farm's reputation and facilitate development. This, in turn, positively influences the farmers' image and prospects for future growth.

Competition between Peasant Farms and Agricultural Enterprises

Small (peasant) farmers, especially those owning less than 100 hectares, face significant challenges related to land rental. Their limited capacity compared to larger agricultural enterprises restricts their ability to pay higher land rents. Additionally, peasant farmers are less resilient to environmental and financial shocks, leading landowners to prefer leasing land to larger enterprises. This serves as an obstacle to the future development of peasant farms.

The Role of Land

During the fieldwork, many farmers indicated that despite some gradually increasing landholdings over the decades, many landowners remain unwilling to sell their land. In rare cases where landowners have emigrated or continue to reside within their communities, they still choose not to sell.

FGDs with landowners revealed several reasons for this reluctance:

- The land's price has been steadily increasing each year, and landowners prefer to hold onto their land until market value rises further.
- Land is considered a form of social security; owners believe they can sell it in times of need – such as during health crises – to ensure financial stability.
- Emotional attachment, cultural identity, and the land's role as a heritage asset for future generations also motivate landowners to retain ownership.

Overall, despite leasing practices, land remains a highly valued social and economic asset for landowners in Moldova.

Water and Its Scarcity

Moldova faces significant challenges related to water scarcity, which is becoming more critical due to climate change. According to Sîrodoev and Knight (2007), water shortages are expected to intensify, particularly in vulnerable regions. Water scarcity and droughts are major obstacles for both agricultural enterprises and peasant farms, often leading to dramatic drops in yields and, in many cases, bankruptcy among small-scale farmers.

Moldova lacks modern irrigation infrastructure; there are no extensive irrigation channels, and systems such as pivot irrigation or other types of irrigation are absent. While the 1994 Water Code regulates water use requiring permits and licenses for groundwater extraction in practice, obtaining these documents is extremely difficult. Consequently, groundwater use is sporadic or non-existent, unlike neighbouring countries such as Romania and Ukraine, where groundwater exploitation is more common. Currently, there are discussions within decisions maker bodies and experts underway to amend the Water Code to facilitate easier access to groundwater, but these are still in the early stages.

Summary of land and water rights

Land and water rights in Moldova, emphasize post-Soviet landownership patterns. Most farmers expand their landholdings through leasing or purchasing, with rental agreements typically based on cash or in-kind payments. Landowners are categorized as those actively working their land. Trust levels influence contractual stability. Small peasant farmers struggle to compete with larger enterprises due to limited land and financial resources. Water scarcity, worsened by climate change and infrastructure deficiencies, remains a critical challenge for agriculture. Ongoing debates to simplify groundwater legislation aim to improve water access. Overall, land remains a vital social and economic resource for Moldova's rural communities.

TABLE 5-2 LAND AND WATER RIGHT

Adherence to VGGT	Substantial
Transparency, participation and consultation	Substantial
Equity, compensation and justice	Substantial

5.3 Gender and social inclusion

Is gender and social inclusion throughout the wheat value chain acknowledged, accepted, and enhanced?

Gender equality in Moldova has shown progress over recent years, with women actively participating in education, the workforce, and politics. According to the Global Gender Gap Index (World Economic Forum, 2025), Moldova ranks approximately 58th out of 146 countries, indicating moderate progress in closing gender gaps across economic participation, education, health, and political empowerment. The gender salary gap in Moldova remains significant, with recent data from the World Bank and OECD estimating it at around 25-30%. This means women typically earn approximately 70-75% of what men earn for similar work.

Moldovan legislation guarantees equal rights for women and men regarding land and property ownership. However, in practice, men exhibit higher rates of agricultural landownership. A 2014 census revealed that women owned 41 percent of registered land plots. Furthermore, the FAO's 'National Gender Profile of Agriculture and Rural Livelihoods' (2022) indicates that women own or manage slightly over one-third of agricultural holdings in Moldova. Women also constitute a larger proportion of farmers operating without formal legal status (36.4%). However, this figure is substantially lower than the number of women involved as unpaid family workers in agriculture.

The FAO report "National Gender Profile of Agriculture and Rural Livelihoods" (FAO, 2022) highlights that women play a key role in Moldovan agriculture, especially in smallholder farms. Despite their contributions, women face several challenges in rural areas, including:

a) Limited access to resources, women often encounter barriers to land, credit, technology, and training, which hamper their productivity and economic empowerment.
b) Social and cultural barriers, traditional gender roles and norms limit women's decision-making power and ownership rights over land and assets, restricting their capacity to fully benefit from agricultural activities.

These overall trends are reflected in the wheat VC, based on field visits conducted. The wheat VC is strongly gendered. Most jobs on farms are performed by men. However, women are involved in administrative roles within agricultural enterprises and often work in canteens providing food for workers. In rare cases, women serve as farmers or leaders, but such examples are exceptional and will be discussed in more detail below.

If we divide the structure of agricultural enterprises into two main dimensions, administration and farm work, the picture looks as follows:

a) Administration: Most farm managers are men; however, women often work as accountants or administrators, while agronomists (if present) tend to be men.
b) Farm work: Mechanization and physical tasks such as machinery operation, storage management, and heavy labour are predominantly performed by men. Women usually work in roles like managing the canteen or housekeeping. Women in these roles typically receive lower salaries than men engaged in mechanized or physically demanding work.

In the administration sector, reported salaries are generally similar between men and women. However, a study on women in Moldovan agriculture indicates that "*Women are typically found in lower value-added positions within the VC, most often associated with on-farm plant production. They undertake minimally mechanized physical labour, such as sowing, planting seedlings, weeding, harvesting, hand-spraying, and selling produce in small markets*" (Chemonics International, 2017). Most women involved in agricultural VCs are over 50 years old, with very few under 30, mainly working in canteens. In peasant farms, men typically perform heavy labour, while women support the household by providing food or doing bookkeeping.

In rare cases, women are farmers managing their farms successfully. One such case was identified in northern Moldova near the Romanian border. A biographical interview with a 70-year-old woman farmer revealed insightful social aspects. She was widowed about fifteen years ago after her husband's death, and she became the head of the household. During the Soviet era, she worked as a bookkeeper in a kolkhoz, where she met her husband. After the fall of the Soviet Union, her husband started farming cereals and orchards, running a relatively large farm. When he passed away suddenly, the household faced emotional and financial crises. They faced two options: sell the farm and emigrate to fund their daughters' education or continue managing it. They chose to remain and manage the farm, which is now a leading enterprise in their community.

The woman has participated in various training programs organized by farmers' associations and received funding from both international organizations and the government. Her involvement illustrates that women's participation in farming often arises out of necessity following the loss of male farmers. Despite challenges, active women farmers can contribute significantly to rural economic empowerment. The woman's daughters, however, have emigrated, one to the European Union and the other to the capital city and she is not optimistic about their future involvement in farming.

Summary of gender and social Inclusion

Women play a key role in Moldova's agriculture, mainly in smallholder farms and administrative roles, but face challenges such as limited access to resources and cultural restrictions. Most farm work is performed by men, with women often in supportive and lower-paid positions. Rarely, women manage farms independently, with examples showing their potential for economic empowerment. Overall, gender disparities persist, but active women farmers contribute significantly to rural development.

TABLE 5-3 GENDER EQUALITY AND SOCIAL INCLUSION

Economic activities	Substantial
Access to resources and services	Substantial
Decision making	Moderate/low
Leadership and empowerment	Substantial
Hardship and division of labour	Substantial

5.4 Food and nutrition security

Is food and nutrition stability socially acceptable?

According to the World Food Programme's 2022 report (World Food Programme, 2022), the invasion of Russia into Ukraine and the ongoing energy crisis have significantly affected food security in Moldova. The high number of refugees per capita from Ukraine, combined with energy shortages, has notably impacted the population's access to food especially for households living below the poverty line and those with multiple children. Before the war, approximately 25% of Moldovan households were living below the poverty line; this figure increased to 33.6% following the conflict.

Furthermore, climate change continues to threaten food security in Moldova, particularly for vulnerable groups. The UNDP/GCF 2025 report (Falaleeva, 2025) highlights that droughts, natural disasters, and rising temperatures disproportionately affect rural populations. Key informant interviews conducted with representatives of the FAO in Moldova revealed that food security was not frequently addressed within line ministries prior to the war. However, as the situation developed, discussions at the initial policy levels have started, enabling high-level decision-makers to begin working on measures to improve food security in the country.

Wheat plays a crucial role in Moldova’s food security. Farmers were asked about household food security issues, and all confirmed that they do not face problems with food availability within their families or communities. Farmers often pay in kind for land rental, and cereals such as wheat are primarily used to feed household animals and poultry. This contributes additional protein and dairy products to household diets. It should also be noted that the cereals produced by farms are important for household consumption; in peasant farms, cereals are sometimes used to feed small livestock, such as pigs or poultry, with the meat or milk produced serving as additional income sources.

In agricultural enterprises, many farmers manage small or large pig farms, poultry farms, and other agricultural activities. These farms provide a variety of dietary products, which play an important role in ensuring dietary security for workers. Additionally, some farmers give gifts of poultry or pork meat to workers during New Year, Christmas, or other celebrations, further supporting household food security.

Summary of food and nutrition security

The invasion of Ukraine and energy shortages have worsened food security in Moldova, increasing poverty levels. Climate change also threatens rural food access. Wheat is crucial, mainly used for household consumption and livestock, supporting diet and income. Recent policy discussions have started to address food security issues more actively.

TABLE 5-4 FOOD AND NUTRITION SECURITY

Availability of food	High
Accessibility of food	Substantial
Utilisation and nutritional adequacy	Substantial
Stability	High

5.5 Social capital

Is social capital enhanced and equitably distributed throughout the value chain?

Various forms of social capital have been identified in the field of wheat production in Moldova. The extent and nature of social capital vary depending on the type of farm within the VC. In peasant farms, both horizontal and vertical social capital are relatively limited, whereas in agricultural enterprises, social capital tends to be comparatively higher.

Within agricultural enterprises, social capital is very high both within the VC and at the community and municipality levels. At the community level, farmers involved in agricultural enterprises are among the most influential individuals. They tend to be relatively wealthier and are often the primary employers within their communities, playing a crucial role in local development. For instance, Moldova, being one of the countries with limited forestry resources, has seen many farmers initiate reforestation efforts within their communities. They also lobby to address infrastructural and other local obstacles. Furthermore, farmers within these enterprises hold significant influence during municipal elections, with candidates supported by them often winning. Overall, the social and cultural capital of these farmers at the community level is high.

The social capital of farmers within the VC is also relatively strong. Relationships between input suppliers and farmers are primarily based on trust. Farmers typically pay for seeds, fertilisers, pesticides, and other inputs after harvest, although droughts or other adverse conditions can negatively impact yields. Nonetheless, farmers work to ensure that input suppliers are reimbursed.

Several associations advocate for farmers' rights and communicate with the government. While some associations are viewed as tools in broader political struggles, although some farmers report that these organizations can successfully advocate for issues important to their members.

In addition, there are sector-specific associations and other associations supported by international organizations such as the EU, World Bank, USAID (previously), and IFAD. These associations focus on training VC members, providing machinery, and organizing competitions or support programs for farmers in need. For example, women leader and owner of the farm - discussed in earlier sub-chapter - have received machinery for farm development and participate in various trainings and workshops organized by these associations.

These activities demonstrate that farmer associations play a certain role in lobbying for cereal producers, capacity-building, and delivering targeted funding. As such, they significantly strengthen the social capital of farmers at the vertical level within the VC.

Summary of Social capital

In Moldova wheat production, social capital varies by farm type, with higher levels in agricultural enterprises compared to peasant farms. Farmers in enterprises are influential in their communities, often serving as employers and community leaders, which boosts their social and cultural capital locally. Relationships with input suppliers are based on trust, and farmer associations play a significant role in advocacy, capacity building, and securing funding, especially for vulnerable groups.

Table 5-5 Social capital

Strength of producer organisations	Substantial
Information and confidence	Substantial
Social involvement	High

5.6 Living conditions

What are the standards of health, education, and training infrastructure and services?

According to the Household Budget Survey of Moldova (National Bureau of Statistics of the Republic of Moldova, 2024), 99.2% of the rural population live in privately owned houses, while only 0.8% rent their dwellings. In urban areas, 89.8% of residents own their homes, and 10.1% rent. The survey also indicates that housing equipment in rural Moldova is relatively satisfactory. For instance, 100% of households have electricity, 62% have access to a central water system, 36% source water from wells, and 58% have their own hot water systems. Only 12% have a central heating system, while 87.2% use other heating methods – most likely gas-based facilities. Additionally, 58% of households have a bathroom or shower within the dwelling, and 47.6% have a water closet with water inside the house. These data suggest that there is a need to improve sewerage systems, water supply, heating infrastructure, and other aspects of rural household infrastructure.

Interviews with workers and farmers revealed that many households have emigrants living abroad, particularly in Europe. The savings sent by these emigrants are often used for house renovations, many of which were built during the Soviet era. Respondents mentioned that remittances are primarily used to improve their living conditions.

Rural infrastructure is inherited from the Soviet era and requires improvements in some villages. Additionally, roads within many rural areas also need development.

Education in the wheat value chain

Cereal production is a traditional activity among Moldovan farmers. As a result, knowledge related to cereal cultivation is largely inherited. For instance, older farmers recall the role of kolkhozes (collective farms) in cereal production, and agricultural machinery from the Soviet era is still visible in some farms. However, the current development of agriculture lacks structural updates and modern information dissemination to farmers. It is difficult to identify institutions that regularly provide updated, relevant knowledge in the cereal sector, particularly for wheat.

Farmers obtain information from several sources. Input suppliers are crucial, offering guidance on the use of new fertilisers and pesticides, including their benefits and risks – though this information might sometimes be biased. Social media and online agricultural channels also serve as important sources of knowledge, with many farmers mentioning that they rely on internet-based information. Additionally, some farmers attend training sessions organized by international organizations.

The extension services provided by the Ministry of Agriculture are still in the early stages of development. These services have limited human and financial resources, and since their establishment, activities related to wheat VC development have been minimal. Nonetheless, there is potential to enhance these extension services to support farmers better. Improving the capacity of extension officials could play a key role in disseminating knowledge to farmers involved in wheat production.

Overall, there is significant scope for expanding both extension services and structural educational facilities to improve farmers' knowledge in cereal cultivation, particularly wheat. Addressing the shortage of agronomists at the municipal level is also a crucial step towards strengthening the sector.

Summary of living conditions

Most rural households in Moldova (99.2%) own their homes, with adequate access to electricity and water, but there are significant gaps in sewerage, heating, and infrastructure. Urban households also predominantly own their homes. Many rural families rely on remittances from emigrants to fund house renovations, often built during the Soviet period. Overall, rural infrastructure inherited from the Soviet era needs improvement, particularly in roads and basic amenities.

Knowledge transfer in wheat farming is largely inherited, with some farmers relying on outdated Soviet-era machinery and practices. Modern information sources include input suppliers, social media, and international training programs. However, formal extension services from the Ministry of Agriculture are still developing and limited in capacity. Strengthening these services and expanding educational infrastructure could enhance farmers' knowledge and productivity in wheat cultivation.

TABLE 5-6 LIVING CONDITIONS

Health services	High
Housing	Substantial
Education and training	Substantial

5.7 Answer to Framing Question: Is the VC socially sustainable?

The wheat VC is structured, providing relatively stable employment opportunities for the rural population with acceptable salaries. However, climate change and associated droughts sometimes cause losses, leading to instances where farmers are unable to pay full salaries to their workers. Safety issues and protective measures during work, especially when applying fertilizers and pesticides, require significant improvement.

Moldova has limited water sources, and increased droughts due to climate change heighten the demand for effective water resource utilization. Difficulties related to accessing underground water necessitate policy changes to address these challenges.

Women farmers are rare in the VC; however, special programs targeting existing women farmers have shown relative success. Youth involvement in the VC requires more targeted programs from government and international organizations. No issues were reported related to food and nutrition security at the household level; however, geopolitical issues and the war in a neighbouring country prompted the government to initiate discussions on a national food security strategy. At the farm level, workers are typically provided lunch that includes quite a variety of meals.

Medium farmers and agricultural enterprises possess high levels of horizontal and vertical social capital, whereas small farmers have more limited resources. While basic living conditions in rural areas, including access to healthcare and educational services, are reasonable, significant infrastructure improvements are still needed. Extension services remain limited.

The radar below provides the key state of each domain in the VCs.

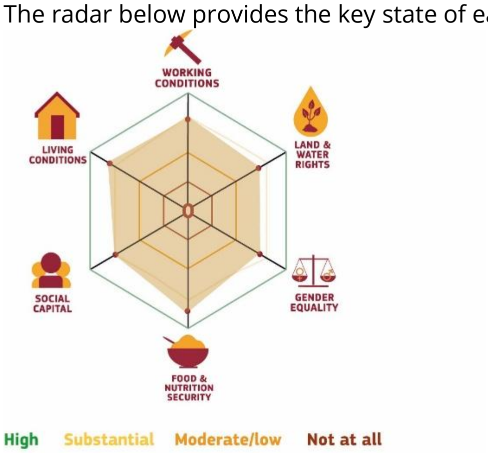

FIGURE 5-1 THE SOCIAL RADAR

The Table 5-7 below identifies some key issues in each social domain and briefly outlines some possible mitigation measures within each domain.

Table 5-7 The Key social issues identified in the Value Chain

	Key issues identified in the VC	Mitigation measures
Working conditions	A) Employees typically receive stable incomes; however, farm losses occasionally result in unpaid wages. B) relatively low usage of protection measures during agricultural activities	A) Enhance the financial sustainability of farms and improve the financial management practices of enterprises. B) Awareness raising of the workers about the use of protection measures. C) Enhance role of the labour inspection in the agricultural sector.
Land and Water Rights	Underwater use regulation makes burden farmers to use underground water.	Policy discussion and changes to enhance underground water usage.
Gender Equality	Youth are less represented in the farms.	Enhancement of special programmes to involve youth in farming.
Food and Nutrition Security	Workers are provided with good and diverse quality of food. Although, in same farms hygienic standards are relatively low.	Support to improve hygienic standards in farms to enhance food safety.
Social Capital	Vertical and horizontal organization of small farmers are relatively low.	Need for enhancing and strengthening of the associations working with small farmers.
Living Conditions	In some medium farms and agricultural enterprises. Building facilities for workers to rest, have lunch, kitchen and bathrooms is relatively low standards.	Increase farmers' awareness of the importance of improving working standards for their workers.

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 wheat VC in Moldova to support policy decisions aimed at improving the overall sustainability of the VC through quantified and evidence-based information.

Based on interviews with various actors and on literature review, the main environmental concerns were identified in the initial stage of the study. It emerged that among the primary environmental problems in the wheat VC in Moldova were issues of low soil fertility, soil degradation, erosion and run-off (which have been reported, for instance, by Summer et al., 2012, Leah, 2014, Daradur et al., 2018, Niacsu et al., 2021, Bejan et al., 2022 and Bunduc et al., 2022). These issues are connected to the widespread practice of conventional tillage, which over the years has led to soil compaction, loss of soil structure, reduction of organic matter, and therefore, to a decreased fertility (Boincean, 2013, Boincean et al., 2016, Daradur et al., 2018).
An issue related to the extensive use of nitrogen-based fertilisers in conventional wheat cultivation was also highlighted. This is a concern not only to the depletion of non-renewable resource, but also in relation to greenhouse gas (GHG) and the degradation of long-term soil fertility. Indeed, under conditions of frequent dry spells and of decreasing levels of precipitation in the period of the spring fertilization (especially if granular urea is applied), significant loss of nitrogen from fertilisers is likely to occur through atmospheric emissions of ammonia and nitrous oxide. This loss obviously also reduces the availability of synthetic nitrogen for the crop, negatively affecting crop yields (Guardia et.al. 2018).

In previous decades, the reliance on chemical fertilisers was comparatively lower, as animal husbandry was commonly integrated into mixed farming systems that included arable crop production. This integration supported soil fertility through the application of manure as an organic fertiliser. However, in recent years, a marked decline in livestock farming[66] has led to the near disappearance of this circular practice of returning animal manure to agricultural soils.

In parallel, there has been a notable increase in the adoption of beneficial practices such as the retention of crop residues on fields after harvest. Furthermore, awareness of the advantages associated with conservation agriculture has been promoted in recent years (see for instance, Leah, 2014, World Bank-CIAT, 2016, Robu, 2024). This has contributed to a wider uptake of conservation agriculture principles, particularly the implementation of no-tillage cultivation techniques[67], aimed at improving soil health and enhancing resilience of crops to climate variability.

In this context, to analyse the impact of the above issues on the sustainability of the wheat VC, the approach was to support information derived from interviews with actors, from surveys, official statistics and literature review, with a Life Cycle Assessment (LCA).

LCA is a methodological approach that **quantifies environmental impacts throughout the VC**. The impact assessment method adopted is ReCiPe[68], which covers all four core questions of the VCA4D methodology, regarding the potential impact of the VC **on three areas of protection**, namely **resource depletion, ecosystem quality, human health and on** the **climate change** impact category.

The environmental analysis of the VC also addresses 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

[66] https://statbank.statistica.md/
[67] Estimated at approximately 70,000 ha (out of which wheat is ca. 25,000 ha).
[68] Huijbregts et al., 2017.

documentation was carried out to investigate the actions in place for the management of biodiversity conservation.

6.2 Life Cycle Assessment (LCA)

An LCA of the wheat VC in Moldova was conducted to quantify the environmental impacts associated with the production of wheat grain and wheat flour. 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 analysis evaluated emissions, land use, and resource extraction across the entire VC, expressed per unit of product (1 kg of wheat grain harvested and 1 kg of wheat flour). The approach involves analysing all stages of wheat products life cycle, including cultivation, grain transport to storage facilities and to mills, milling (and packaging, where applicable) and, in the case of exported grain, transport to the port of export.

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: results of the calculation of the life cycle impacts.
4. Discussion of the LCA results.

6.2.1 Definition of objectives, functional unit and system boundaries

Objectives

The LCA study on the wheat VC in Moldova aims to:

- Assess the environmental impact of the VC on ecosystems quality, resource scarcity, human health and climate change.
- **Identify the environmental hotspot** (most relevant processes/phases) along the life cycle of wheat grain and wheat flour production in Moldova and evaluate the potential for improvement **by analysing**:
    - the **most relevant life cycle stages** (i.e. cultivation, storage, milling or, alternatively, export of grain).
    - the **most relevant impact categories** (e.g. **climate change, resource depletion, fine particulate emissions, freshwater eutrophication, land use**).
- Compare the environmental burden of wheat cultivation by different typologies of farmers in the regions of Moldova (North, Centre, South), classified as Peasant Farmers (PF) and Agricultural Enterprises (AE), practicing conventional tillage (the comparison includes the environmental performance of no-till farmers and organic farmers[69]);
- **Compare the environmental impact at full VC level, considering processing (flour production)** by the typologies of processes in place (including the processes from cultivation onwards by the typologies of farmers that supply grain to the industrial milling sector and for the local service milling);
- **Assess the environmental impact at full VC level considering export of grain**;
- Compare the environmental impact of the wheat VC in Moldova with the results of other studies referenced in the scientific literature to situate the performance of the wheat VC in Moldova in relation to other wheat VCs;

[69] Since wheat cultivation in all regions of Moldova and all typologies of farmers are represented, the geographical scope is considered to cover all production of wheat in Moldova.

- Provide elements for discussion on the overall environmental sustainability of the wheat VC in Moldova.

Functional Unit

The functional unit for the environmental impact assessment is 1 kg of wheat flour at mill gate, at standard moisture (13.5% moisture content) and 1 kg of wheat grain transported to the port of export (Constanta, RO).
An intermediate reference unit is 1 kg of grain harvested at farm gate (for the analysis of environmental impacts of the cultivation stage).

System boundaries

The system boundary in LCA establishes which processes are included in the analysis. The following life cycle stages are included in the wheat VC in Moldova:

A) wheat cultivation;
B) transport of grains to and from storage facilities and its handling at storage facilities;
C) milling for wheat flour production (and packaging, where applicable).

In addition to the processes from cultivation to milling (representing the **milling sub-chains**), export of grains (conventional and organic) was also considered. To do so, a transportation distance by road from storage facilities to the port of Constanta (RO) was added to the above stages A) and B). This resulted in **two export sub-chains: export of conventional wheat grain and export of organic wheat grain.**

The analysis included the extraction or production and transport of all relevant inputs (e.g. fertilisers, pesticides, packaging material, fuel, electricity) of the above stages, while the production and use of capital goods is excluded.

The transport to retailers of wheat flour and the consumption stage are not included since the environmental impact of these phases is highly dependent on assumptions and is typically very low.

Feed production was excluded since wheat grain and wheat bran are mixed (often through complex feed production processes) with other ingredients, used in various proportions. For this reason, these processes are considered outside the system boundaries, and the corresponding environmental burdens are allocated to the bran used for feed purposes.

A) **Regarding the wheat cultivation stage**, typologies of farmers were identified and then classified into eight categories. The criteria for defining these production system types included:

- Geographical zone: the three regions of Moldova (North, Centre and South, so forth referred to as, N, C, S), as environment and climate can significantly affect yields and system performance.
- Type of farm: farmers practicing conventional tillage, farmers cultivating under no-tillage and organic farming techniques.
- Farm orientation. Peasant farmers and Agricultural Enterprises (so forth referred to as PF and AE). These farmers categories differentiate, on average, in terms of crop yield and by intensity of field operations - and therefore fuel consumption- and fertilization rates.

Yields per hectare of the typologies of farmers practicing conventional tillage and no-till techniques, based on own calculations from data of the farmer's survey (165 conventional and 10 no-till producers interviewed) are shown in Figure 6-1. Regarding organic production, based on a combination of data from the farmer's survey (which included data on 10 organic farms) and information from stakeholders, grain yield was assumed to be 2.5 t/ha.

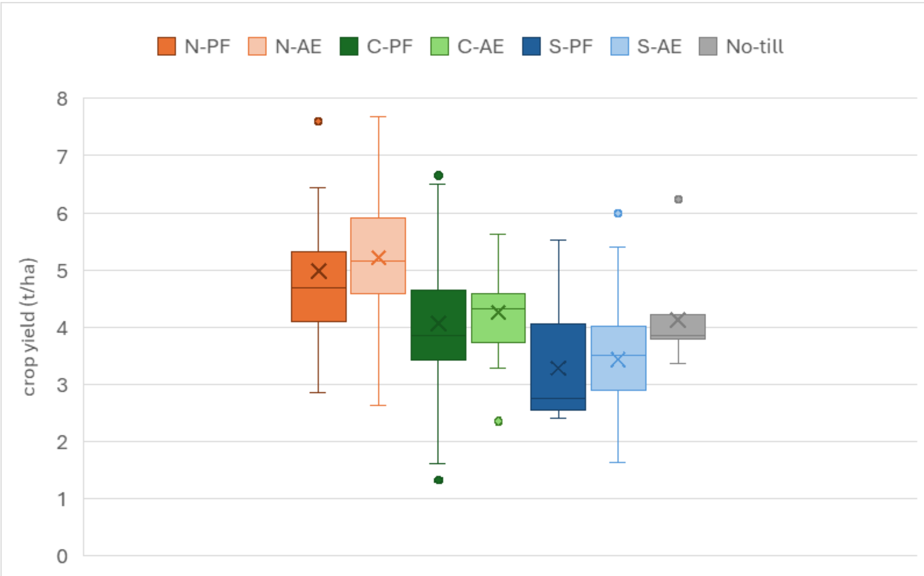

FIGURE 6-1 GRAIN YIELDS PER HECTARE AT STANDARD MOISTURE
Values are shown for North, Centre and South regions (N, C, S) of Peasant farmers (PF) and Agricultural Enterprises (AE) practicing conventional tillage and of no-till farmers.

The practice of leaving crop residues (straw) in the field is widespread in Moldova within both no-till systems and conventional tillage productions. Therefore, no allocation of environmental burdens to the residues was considered. This practice is beneficial in terms of soil health, especially combined with the no-till cultivation techniques, which avoid soil disturbance and therefore ensure a mulching effect of crop residues on the soil surface.

B) Regarding **transport and handling of grains to storage facilities**, an assumption was made about a typical distance from farm to a local storage facility, and about a typical rate of grain loss (spillage) during storage, based on interviews. These phases are not in place in the case of grain processed at local service mills and therefore they are excluded when analysing the local milling sub-chain.

C) Regarding **milling**, this sector is composed of industrial facilities and a network of small village-level mills. Industrial mills are centralised, use relatively up-to-date technologies and are focused on large-scale production. Village-level mills form a decentralised network of traditional operations, many of which play a vital role in the rural economy, although it has been reported that their number has been constantly decreasing over the recent years.

Based on the information received from millers, grain is not transported over long distances for the milling process. Therefore, it was assumed that in each region the grain milled into flour is produced locally (within the corresponding region). For this reason, based on interviews, a transport distance of 75 km was set, considering this value as a typical distance and the average between the minimum and maximum transport distance from warehouse to industrial mill 1 km and 150 km, respectively. In the case of local service mills, transportation was estimated over short distances (15 km).

Considering that milling occurs within the area of grain production, the contribution to each kg of grain processed in each of the three regions corresponds to the contribution of PF and AE to the total grain output (from farms practicing conventional tillage) within each region. Table 6-1 shows the contributions by PF, AE and no-till farmers to the grain output in the three regions.

TABLE 6-1 CONTRIBUTION OF PF, AE AND NO-TILL FARMERS TO THE GRAIN OUTPUT IN EACH REGION

		Share of grain output in the three regions		
		North	Centre	South
PF	North	21.9%		
AE		72.5%		
PF	Centre		21.9%	
AE			69.2%	
PF	South			19.1%
AE				74.9%
No-till		5.6%	8.9%	6.1%
Total		100%	100%	100%

Source: own elaboration based on Functional Analysis.

Since the total output of no-till farmers was not broken down according to the region, their contribution to the output within each region was assumed to be evenly distributed. Therefore, one-third of the national output of no-till farmers was attributed to each of the three regions and then added to the contribution of PF and AE (Table VWX). As a result, **six sub-chains of wheat processing (in North, Central and South regions – N, C, S –) were identified: industrial mill and local service mill (so forth referred to as N-ind. mill, C-ind. mill, S-ind. mill, N-local mill, C-local mill, S-local mill)** (Figure 6-2). Table 6-2 shows the percentage of grain uptakes by industrial and local mills in the three regions, based on the Functional Analysis.

TABLE 6-2 PERCENTAGE OF GRAIN UPTAKE BY MILLS IN THE THREE REGIONS

		Share of grain uptake by mills					
		North		Centre		South	
		Industrial mill	Local mill	Industrial mill	Local mill	Industrial mill	Local mill
PF	North	11.5%	10.4%				
AE		38.1%	34.4%				
PF	Centre			11.5%	10.4%		
AE				36.3%	32.9%		
PF	South					10.0%	9.1%
AE						39.3%	35.6%
No-till		2.9%	2.7%	4.7%	4.2%	3.2%	2.9%
Share industrial/local mill		52.5%	47.5%	52.5%	47.5%	52.5%	47.5%
Total (region)		100%		100%		100%	

Source: own elaboration based on Functional Analysis.

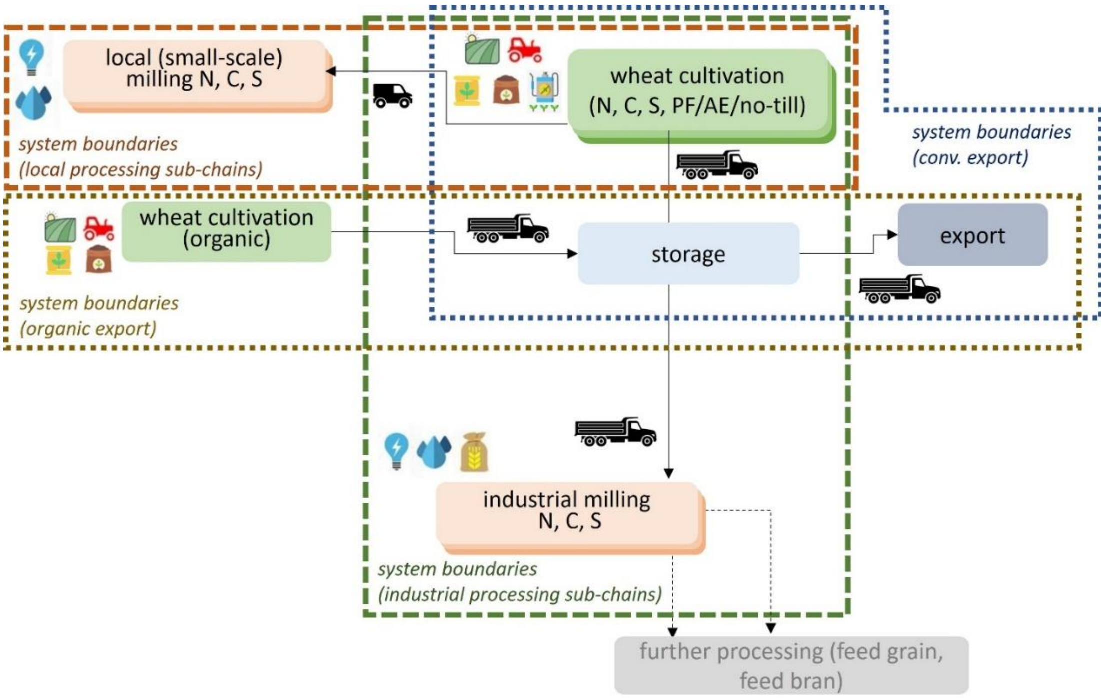

FIGURE 6-2 SYSTEM BOUNDARIES AND SUB-CHAINS
(N-ind. mill, C-ind. mill, S-ind. mill, N-local mill, C-local mill, S-local mill, conventional grain export and organic grain export).

6.2.2 Life Cycle Inventory (LCI)

Farm survey and data gathered during field missions, alongside elaborations of official statistics were used for the inventory of the cultivation stage. Information from field visits to storage and milling facilities was used as source for the inventories regarding the downstream phases. The inventories (LCI) of inputs and output of the different typologies of farmers and of the downstream stages, including the grain-to-flour extraction rates and co-product allocation, are reported in Appendix 9.2.1 Life cycle Inventory (page 144).

A summary of the main features of the LCI of the cultivation stage is represented in the box below.

- **Regional areas: N (North), C (Center), S (South).**
- Each region has **three profiles**:
    - **PF, Peasant Farmers**
    - **AE, Agricultural Enterprises**
    - **No-till**
    - (organic farmers are also included in the analysis).

Cultivation Systems:

1. **Conventional (PF and AE for North, Centre, South)**
2. **No-till: Conservation agriculture practice with lower fertiliser and fuel use.**
3. **Organic: Uses organic fertilisers, no synthetic inputs, lowest yields.**

Input intensity observations:

- **AE farms consistently use fewer inputs per hectare and achieve higher yields than PF counterparts.**
- **No-till reduces diesel use significantly, uses lower synthetic fertilisers.**
- **Organic eliminates synthetic inputs entirely, uses organic fertiliser, but yields are the lowest.**

6.2.3 Selection of Relevant Impact Categories and Life Cycle Phases

The detailed information about the ReCiPe midpoint and end point method is explained in the Annex 9.2.2.

Figure 6-3 presents the relative contribution of each VC phase to the total impact, as well as the distribution of the main impact categories. These values represent a weighted average, based on the contribution of each farmer typology to national conventional wheat output. For the milling stage, results reflect the weighted average between industrial mills and local service millers, accounting for their respective shares in grain uptake and flour production, as well as their specific grain-to-flour conversion efficiencies.

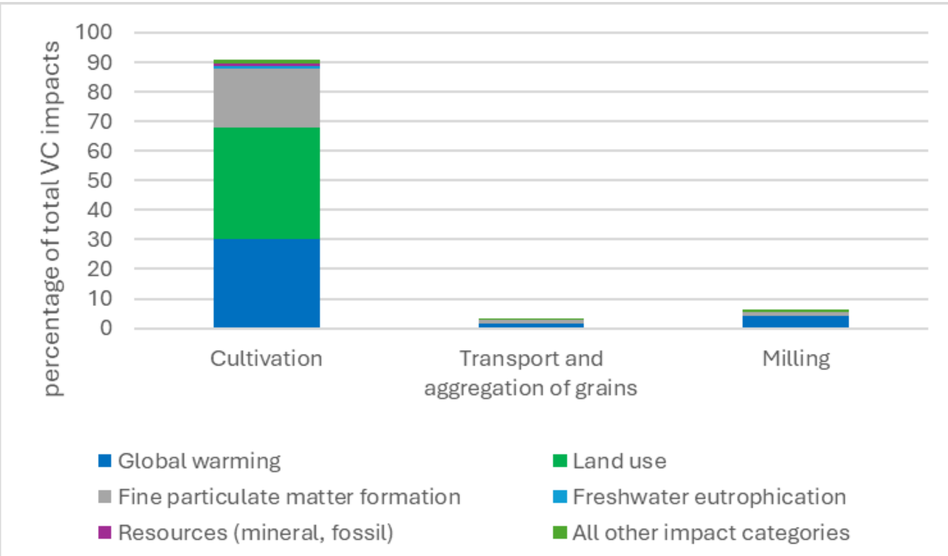

FIGURE 6-3 RELATIVE CONTRIBUTION OF THE MAIN IMPACT CATEGORIES ALONG THE VC STAGES
Values are shown as percentage of the total environmental impacts and contribution of the stages of the VC to the total impacts (Cultivation + Transport & aggregation + Milling = 100%). Listed Midpoint impact categories add to 98% of the total environmental impacts (remaining 2% merged together as "All other impact categories").

From a VC phase perspective, the cultivation stage accounts for the vast majority of environmental impacts, contributing approximately 91% to the total. In comparison, the transport and aggregation of grains contribute about 3%, while the **milling stage accounts for** the remaining **6%.**

From an impact category perspective, the dominant contributors are land use and global warming, which represent approximately 37% and 36% of the total impacts, respectively, both largely attributed to the cultivation phase. **These are followed by fine particulate matter formation** (23%, also mostly from cultivation), **resource depletion** (1%, including both fossil and mineral resource use), **and freshwater eutrophication** (1%). All other impact categories were aggregated and together account for the remaining 2%.

Given these findings, and **to enhance the clarity of the impact assessment at the Midpoint level, the discussion will focus exclusively on the above-mentioned impact categories**, **which collectively represent 98% of the total impacts from an impact category standpoint**. Additionally, **the discussion will be limited to the cultivation and milling phases, which together account for 97% of the overall environmental burden** across the VC. Therefore, processes involved in the phase of transport and aggregation of grains, which have negligible impacts, will not be further discussed for the sake of simplicity, except when presenting the overall results of the entire VC (in terms of climate change impact and per area of protection).

6.2.4 Environmental Impacts of the Cultivation Stage

The five impact categories that account for the majority of environmental impacts during the cultivation stage are driven by the following key factors:

1) **Land use** impacts are directly related to crop yield, as this category is quantified by the amount of land required to produce one unit of output (i.e., 1 kg of grain at standard moisture content).
2) **Global warming** potential is largely associated with nitrogen fertilization, including both the production of chemical fertilisers and field emissions of greenhouse gases (particularly nitrous oxide). Fuel combustion during field operations also contributes, though to a lesser extent.
3) **Fine particulate matter formation** is mainly driven by ammonia emissions resulting from nitrogen fertiliser application. Additional contributions arise from fuel combustion during field operations. To a much lesser extent it is derived also from the production and transportation of agricultural inputs.
4) **Resources depletion** reflects the extraction of fossil and mineral resources. Consequently, the use of fuels and chemical fertilisers significantly contributes to this impact category.
5) **Freshwater eutrophication** results from phosphorus (P) fertilization, which leads to phosphate runoff into groundwater and surface water. Soil erosion further exacerbates this impact by transporting phosphorus-bound soil particles into water bodies (phosphorus contained in soil particles that reach surface water).

Overall, wheat **grain production** in Moldova **has environmental impacts within the expected range**. For example, GHG emissions expressed as kg CO_2 eq per kg of wheat grain at farm gate ranged from 0.21 (no-till, organic) to 0.40 (PF, Centre) (Appendix 9.2.2 Midpoint Life Cycle Impact Assessment, page 146). These results are around the lower end of the range of LCA result on wheat production in other European contexts (0.25 to 1.07 kg CO_2eq per kg of wheat grain)[70].

However, **low yields per hectare**, **as in the case of both PF and AE in the South and** of **organic production** (Figure 6-4), **lead to larger land use**. In the Moldovan context, where arable land already covers over 50% of the total area of the country (with little room for a sustainable area expansion), crop yields are key for the sustainability of the agricultural production.

[70] For wheat cultivation, the following results in European contexts were reported in the literature: Camara-Salim et al. (2020) in Spain (0.64 kg to 0.95 CO_2eq per kg wheat grain), Pishgar-Komleh et al. (2020) in Poland (ranging from 0.25 to 0.67), citing also Wojcik-Gront (2018) In Poland (0.27 kg CO_2eq per kg wheat grain), Syp et al. (2015) in Poland (0.45 kg CO2eq per kg wheat grain), Noya et. al (2015), Fantin et al. (2017), Ali et al. (2017), Villani et al. (2017), in Italy (0.50, 0.44, 0.30 and 0.26 kg CO_2eq per kg wheat grain, respectively), Achten and Van Acker (2015), different European countries (0.30 to 1.07 kg CO_2eq per kg wheat grain) citing also Hayer et al. (2008) in Germany and in Denmark (0.53 and 0.36 kg CO_2eq per kg wheat grain, respectively) and Audsley et al. (2010) in UK (0.51 kg CO_2eq per kg wheat grain).

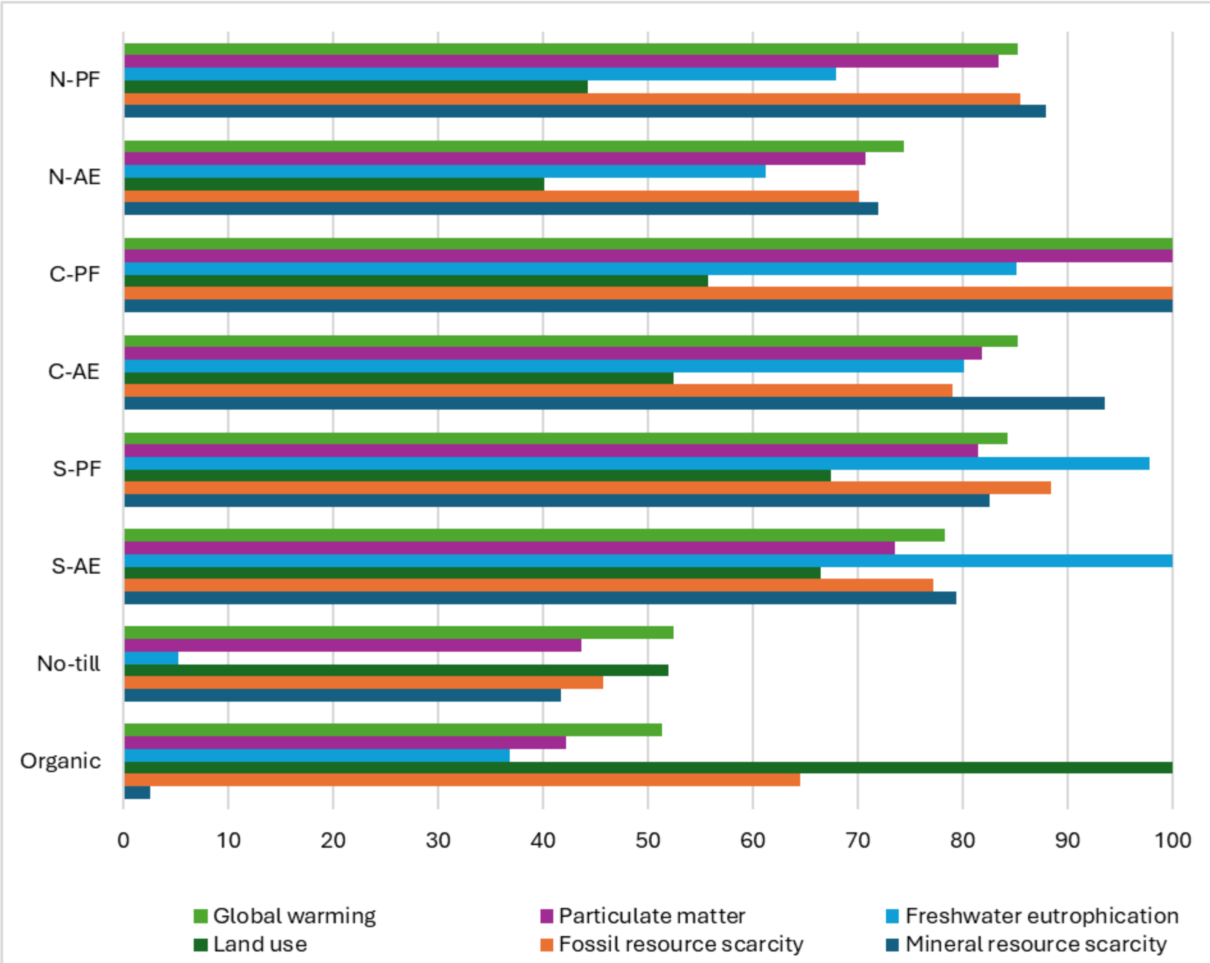

FIGURE 6-4 SELECTED ENVIRONMENTAL IMPACTS OF WHEAT PRODUCTION ACCORDING TO THE TYPOLOGIES OF FARMERS (PER KG OF GRAIN AT FARM GATE)

Original units of the impact categories are Global warming: kg CO2eq, Particulate matter: kg PM2.5 eq, Freshwater eutrophication: kg P eq, Land use: m2, Fossil resources: kg oil eq, Mineral resources: kg Cu eq). The highest score in the comparison is shown as 100%.

The comparison of the individual farmers typologies reveals higher environmental impacts in C-PF farms. Global warming, particulate matter formation and resources depletion are highest in this typology due to the combined effects of low crop yield, high fuel consumption for field operations and greater use of fertilisers, which are sources of GHGs, especially nitrogen-based fertilisers (largely used in Moldova).

PF and AE in the South have even lower yields, but in these cases, fertilisers were used at a lower level and fuel consumption is, on average, at the same level of that of C-PF. This results in impacts that are generally lower than those of C-PF.

All other conventional tillage systems (N-PF, N-AE, C-AE) have relatively similar overall environmental performances.

Regarding the no-till system, fertiliser and fuel consumption are used at much lower rates than under conventional tillage. This, combined with a crop yield which was close to the average value for all conventional tillage systems, results in lower overall environmental impacts for this typology. Compared to the yields obtained under conventional tillage in the dryer regions of southern Moldova, the performance of no-till systems is significantly better (+25%). The good performance of no-tillage systems, even under dry conditions, can be explained by the better soil conditions this system leads to in terms of moisture retention, soil temperature, organic carbon and other factors that help to support acceptable and stable yield levels.

Low impacts characterized also the organic system, except for the land use indicator, which had a higher value compared to in all other typologies due to the effect of low crop yield (40% lower than the average yield of all other typologies).

Appendix 9.2.2 shows the results per kg of grain at farm gate, of all farmers typologies, for the 18 Midpoint categories (Table Appendix 9-9) and for the selected Midpoint impact categories (Figures Appendix 9-10 to Appendix 9-15).

6.2.5 Environmental Impacts of the Milling Stage

As previously discussed, milling activities account for approximately 6% of the total environmental impacts across the VC. The primary impact categories at this stage are **global warming potential** and **fine particulate matter formation**.

Industrial mills exhibit larger direct environmental impacts primarily due to higher electricity consumption, driven by more complex processing operations, such as multiple stages of pre-cleaning, cleaning, and the use of automated packaging lines, which are absent in local mills. Fine particulate matter emissions arise from both electricity generation and the production of packaging materials; consequently, these emissions are higher in industrial settings. Water is also used for grain conditioning during milling, but consumption levels are minimal, ranging from approximately 50 mL/kg in industrial mills to 65 mL/kg in local mills, based on data obtained through stakeholder interviews.

However, despite the lower direct impacts of local milling operations, flour produced by small-scale mills exhibits a higher carbon footprint, and greater impacts in other environmental categories, due to a lower grain-to-flour conversion efficiency**.** Specifically, industrial milling yields over 0.7 kg of flour per kg of grain, while small service mills produce approximately 0.6 kg of flour per kg of grain. This difference is significant, as the majority of environmental impacts are generated during the cultivation stage; a lower conversion rate increases the grain requirement per unit of flour produced, thereby amplifying the overall environmental burden of the final product. Figure 6-5 shows the comparison of the two milling typologies (industrial and local) over the above impact categories.

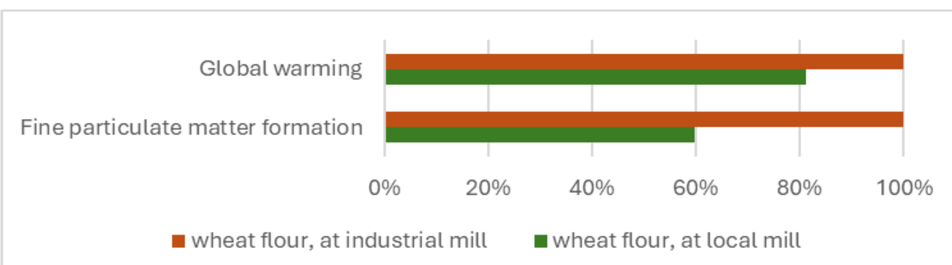

FIGURE 6-5 COMPARED SELECTED INDICATORS OF ENVIRONMENTAL IMPACTS WHEAT MILLING AT INDUSTRIAL AND LOCAL MILL PER KG OF WHEAT FLOUR AT MILL GATE

expressed as percentage of the highest score in the comparison (original units of the impact categories are Global warming: kg CO2eq, Particulate matter: kg PM2.5 eq).

Larger impacts were found in industrial mills due to higher use of electricity due to more complex processes, which may include, for instance, various phases of pre-cleaning and cleaning and packaging lines that are not in place in local mills. Fine particulate matter is emitted both for electricity production and packaging material production, for this reason, higher emissions are observed in industrial mills. Although there is a consumption of water in the milling process (for grain conditioning), this input is used at very low rates, ranging from 50 ml to 65 ml per kg of grains milled in industrial and local mills, respectively, according to data from the interviews held (Appendix 9.2.1, page 144).

6.3 Overall Environmental Impacts Across the VC

The overall impacts of the VC (weighted average across all sub-chains), calculated as proportions per each area of protection and of the climate change impact category, highlight where to focus attention for each environmental goal (Figure 6-6).

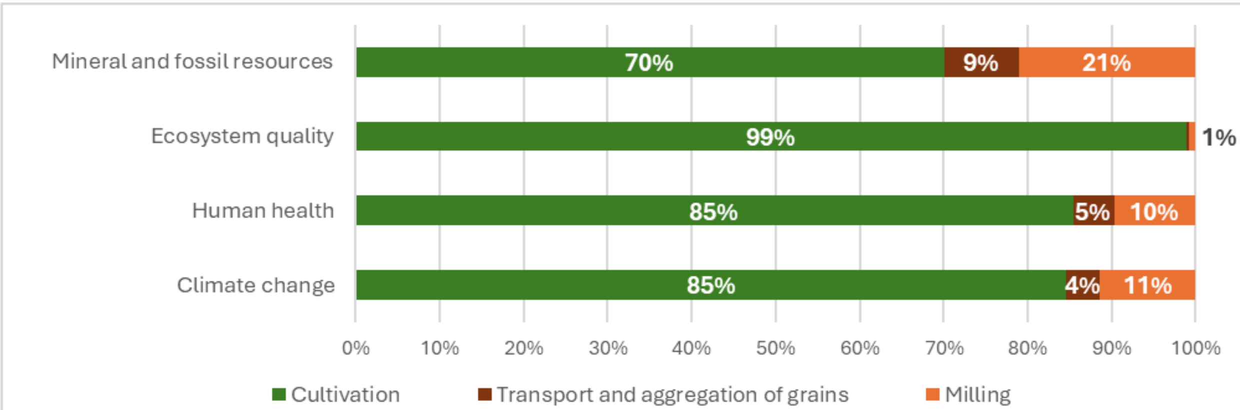

FIGURE 6-6 RELATIVE CONTRIBUTION (%) OF CULTIVATION, TRANSPORT AND AGGREGATION OF GRAINS, AND MILLING TO EACH SELECTED ENVIRONMENTAL AREA OF PROTECTION AND THE CLIMATE CHANGE IMPACT CATEGORY

Values represent the weighted average across all sub-chains of domestic wheat milling in Moldova. Functional unit: 1 kg of wheat flour at mill gate.

As previously discussed, the cultivation stage emerges as the main contributor to the three areas of protection, and to climate change.

This dominance is consistent both for domestic flour production and for exported grains (organic and conventional), where cultivation accounts for 70% to 99% of the impacts depending on the environmental indicator. Transport to storage facilities contributes modestly, while milling impacts vary more depending on the indicator but generally remain secondary. When considering the grain export sub-chains, impacts of the cultivation stage range from 83% to 92% depending on the sub-chain and on the indicator (see Appendix 9-16).

Impacts on resources, ecosystems, human health and climate change are presented for both wheat flour production (six sub-chains) and for grain transported to the port of export (Constanta). In addition**, a scenario of wheat flour production using grains from no-till farmers alone is presented in order to highlight the potential role of the no-till** conservation practices on the overall environmental impact of the VC. Non-processed grains have lower environmental impacts. These were determined assessing the stages of cultivation, transport to storage facility, storage, and transport to the port of export.

In the sub-chains that include processing, grain-to-flour conversion rates play an important role in determining the quantity of grain needed per kg of product and, therefore, also in determining the environmental performance of the system.

To illustrate the impact of long-distance transport for export (not for comparison purposes, since no comparison is possible between grain and flour), the environmental indicators were elaborated also for grain (conventional and organic) transported to the port of export.

Resource Depletion

Resource depletion, measured in USD2013 (increased cost of continued resource extraction), reflects the use of fossil fuels and minerals throughout the VC and provides a proxy for the long-term pressure that the VC exerts on global resource availability. Across all sub-chains, values are relatively similar but **slightly higher depletion is observed in local milling systems** due to their lower grain-to-flour conversion rates, which increase grain demand per unit flour (Figure 6-7). This is primarily due to **lower flour yield (0.6 kg flour/kg wheat)** in local mills, requiring more grain per kg of flour. Consequently, since the **cultivation stage is the largest contributor to resource depletion** in local systems (up to **92% of total** in local milling in the Centre), the level of inputs (mainly fertilisers and fuel) in relation to crop yield explains the greatest part of this indicator. Indeed, C-PF farms (contributing to 22% of the overall grain output in the Centre, as shown in Table 6-1) are characterized by low crop yield, high fuel consumption for field operations and greater use of fertilisers. C-AE farms, whose fertiliser use is the second highest after that of C-PF, contribute to 69% of the grain output in the Centre.

Transport contributes more significantly to industrial milling sub-chains due to longer transportation distances. Also milling impacts are slightly higher in industrial systems due to more complex and energy-intensive operations like cleaning and packaging, especially given Moldova's electricity mixes reliant on oil and natural gas (their combined share in the electricity supply mix of Moldova was 80% in the reference year).

The higher cultivation burden due to inefficient grain-to-flour conversion of local mill sub-chains outweighs their advantage in low transport-related and lower electricity consumption impacts. Despite the more energy-demanding milling processes, industrial systems perform slightly better overall in terms of resource efficiency.

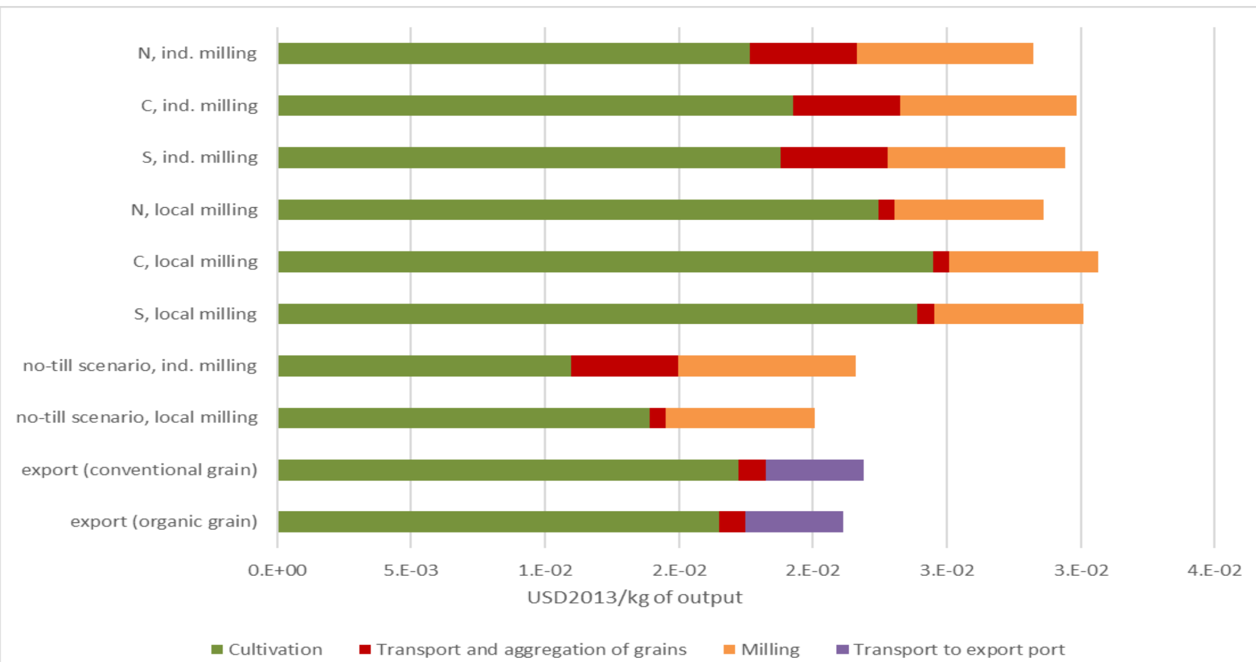

FIGURE 6-7 RESOURCE DEPLETION PER KG OF OUTPUT (FLOUR IN THE MILLING SUB-CHAINS AND IN THE NO-TILL CULTIVATION SCENARIOS, GRAIN IN THE EXPORT SUB-CHAINS)

Ecosystem Quality

Ecosystem degradation, expressed as fraction of species lost per year, is driven mainly by land occupation and by the use of agricultural inputs, mainly mineral fertilizers and, to a lesser extent, herbicides and fungicides. The quantities of these plant-protection products are generally low and do not indicate a substantial pressure[71].

[71] Available evidence from Central Moldova indicates that pesticide residues in soils, and across the bee–pollen–honey trophic chain, remain well below EU maximum allowable concentrations. A study held in 2016 evaluated organophosphorus compounds

Nevertheless, minimizing chemical inputs remains important to prevent cumulative effects on biodiversity and freshwater quality. This area of protection is overwhelmingly dominated by farming activities, with transport and milling impacts being negligible (Figure 6-8).

Among sub-chains, local milling in the South shows the highest ecosystem impacts, linked to low yields that increase land use per kg flour. Conversely, industrial mills in the North and Centre have the lowest impacts, benefiting from higher yields (and the more efficient flour production of the industrial facilities). **Cultivation efficiency (higher yields with low levels of input use**, including fertilisers and pesticides**)** is key to reducing ecosystem impacts. **No-till practices** were identified as a key solution, achieving **lower environmental impacts** while maintaining high yield performance, even under the dry conditions of the South.

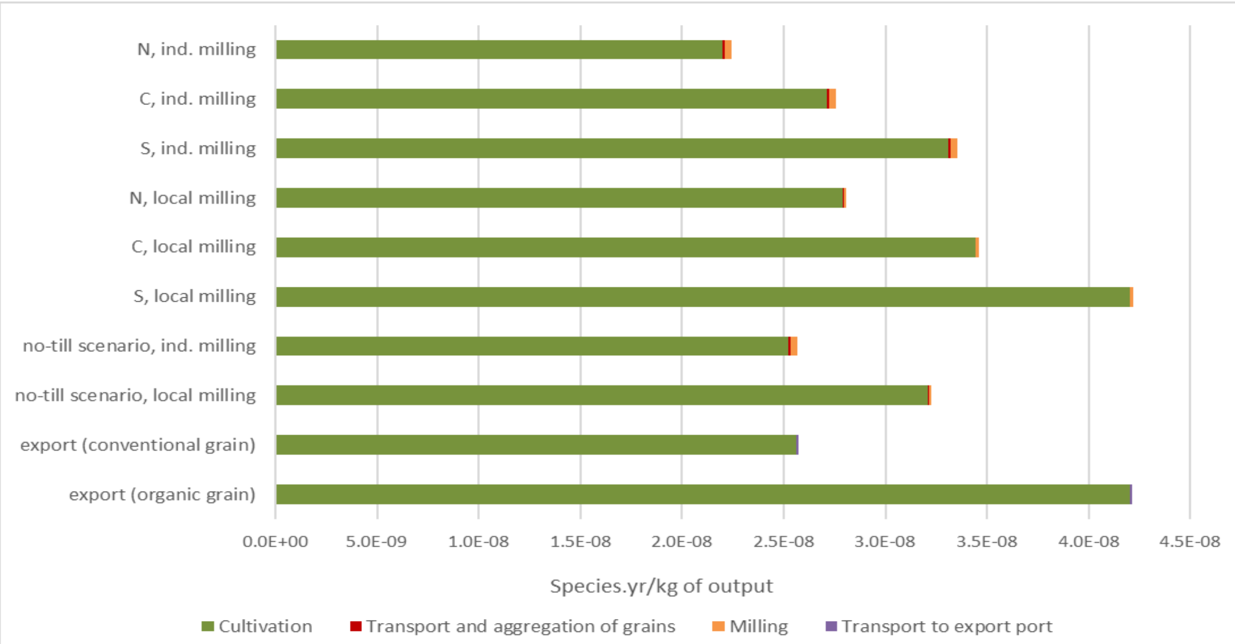

FIGURE 6-8 DAMAGE TO ECOSYSTEMS PER KG OF OUTPUT (FLOUR IN THE MILLING SUB-CHAINS AND IN THE NO-TILL CULTIVATION SCENARIOS, GRAIN IN THE EXPORT SUB-CHAINS)

Human Health

Human health impacts (DALY, Disability-Adjusted Life Years**,** a measure combining years lost due to illness, disability, or premature death) **derive largely from air emissions during cultivation.** This includes particulate matter, ammonia, nitrous oxides (the latter also driving global warming, which affects human health[72]). Fuel combustion for transport and energy use for milling also contribute but to a lesser extent.

Highest DALY values were registered in local milling systems due to less efficient grain-to-flour conversion requiring more grain[73]. This efficiency issue, adds to the negative effect of low crop yields that characterized farms in the Centre (especially C-PF, having higher GHG emissions from higher levels of N fertilization and of fuel use for field operations) (Figure 6-9).

Industrial milling sub-chains, despite higher energy use during processing, generally show lower human health impacts because of better conversion efficiency reducing grain demand and associated cultivation emissions.

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and pyrethroids residues in soil and across the bee–pollen–honey trophic chain in several Moldovan sites (*Apimonitoringul calitatii mediului ambient in zona de Centru a Reublicii Moldova*. Gliga Olesea, PhD Thesis in Biological Sciences, 2016).

[72]Climate change affects human health (i.e. rising temperatures cause heat stress, increase food insecurity through crop failures and worsen human respiratory issues diseases due to intensified air pollution).

[73] Larger volumes of grain required under lower grain-to-flour conversion rates, translates into increased upstream activities (field operations, fertiliser and pesticide use, transportation, etc), which cause higher levels of emissions affecting human health.

Transport impacts on human health are minor but higher in industrial milling sub-chains due to longer distances.

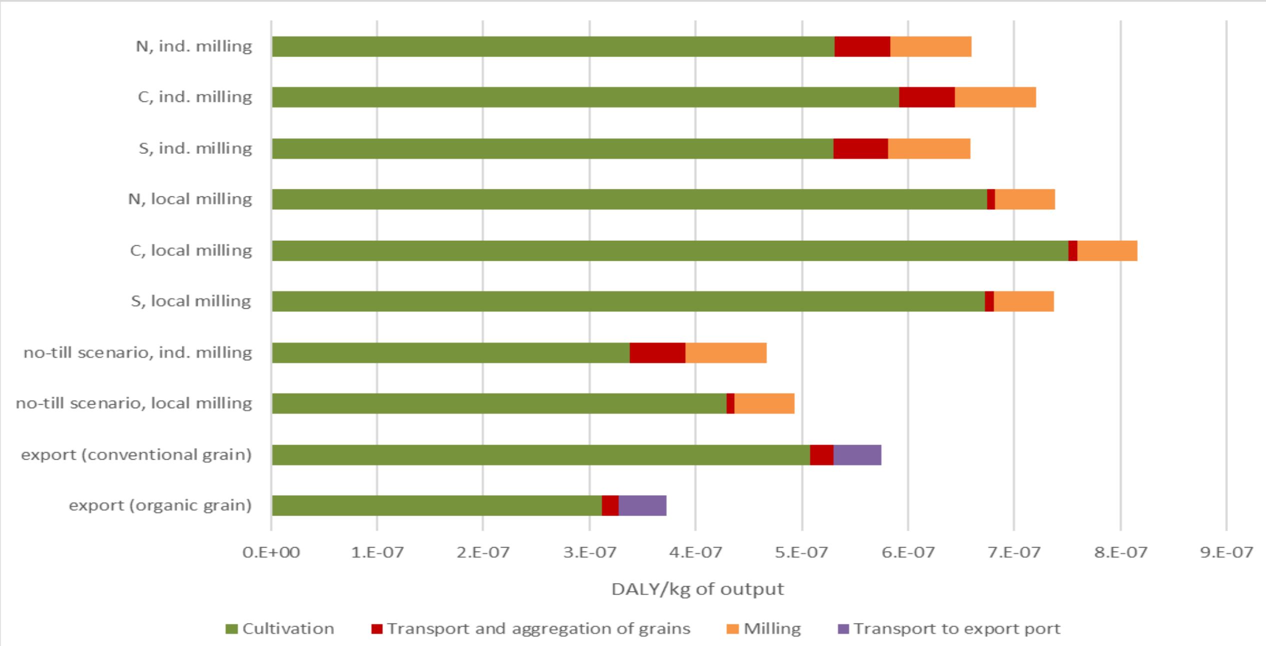

FIGURE 6-9 IMPACT ON HUMAN HEALTH PER KG OF OUTPUT (FLOUR IN THE MILLING SUB-CHAINS AND IN THE NO-TILL CULTIVATION SCENARIOS, GRAIN IN THE EXPORT SUB-CHAINS)

Climate Change

The climate change impact category is measured in terms of global warming potential (GWP), expressed as kg CO_2eq emissions. Figure 6-10 reveals that **cultivation is by far the dominant contributor** across all sub-chains. This is mainly due to **soil emissions of nitrous oxide (N_2O)** resulting from nitrogen fertilization. Additional emissions at the cultivation stage derive from fuel combustion for field operations, fertiliser production, seed production (which itself involves fertilization and associated soil emissions), transport of inputs to the farm (e.g., fuel, fertilisers, pesticides, seeds).

Under conditions of **low crop yields**, high emissions per unit of output were registered due to **low productivity combined with high input use.** This is particularly the case of C-PF farms (contributing to 22% of the overall grain output in the Centre), which are characterized by low crop yield, high fuel consumption for field operations and greater use of fertilisers. C-AE farms, whose fertiliser use is the second highest after that of C-PF, produce 69% of the grain output in the Centre.

Although milling processes consume significant energy, especially in industrial systems, their climate impact is overshadowed by cultivation emissions. Transport contributes modestly, with emissions rising along with distances travelled, notably for exported grain.

Across all environmental domains studied, **cultivation is the critical stage where intervention will yield the greatest sustainability gains** in the wheat VC. While transport and milling contribute variably depending on the indicator, their impacts are comparatively minor.

Strategies such as improving crop yields by adopting **no-till conservation practices** offer promising pathways to improve the environmental performance of the VC. Indeed, as illustrated in Figure 6-7 to Figure 6-10), no-till scenarios show consistently lower impacts, mainly due to better soil management, reduced input use, and improved energy efficiency.

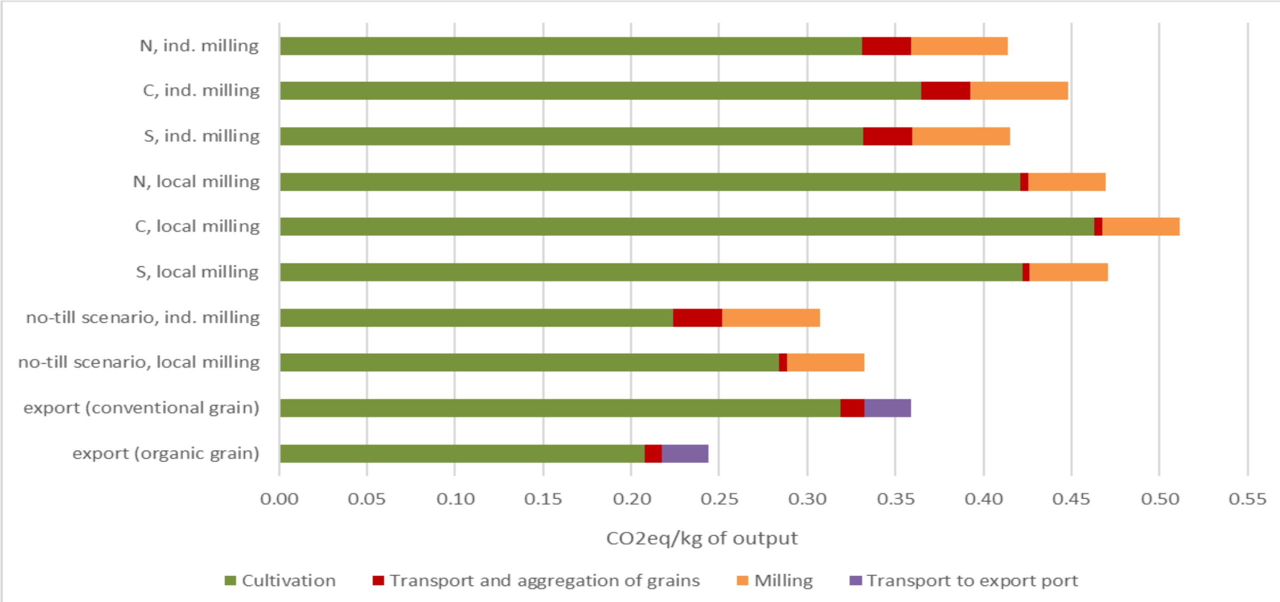

FIGURE 6-10 IMPACT ON CLIMATE CHANGE PER KG OF OUTPUT (FLOUR IN THE MILLING SUB-CHAINS AND IN THE NO-TILL CULTIVATION SCENARIOS, GRAIN IN THE EXPORT SUB-CHAINS)

Discussion of the LCA results

This study evaluated the environmental performance of the wheat VC in Moldova, from grain cultivation to flour production (and, alternatively, to grain export), across three areas of protection (**resources, ecosystems, and human health)**, along with the impact on **climate change**. (Table 6-3), identifying the contribution of each VC phase (milling sub-chains) to the total impacts (Table 6-4).
The analysis covered:

- **Total conventional wheat grain production** in Moldova (1,536 k t/year)
- The **exported share** of wheat grain (1,107 k t/year)
- **Domestic wheat flour production**, including both **industrial and local milling** (301 k t grain uptake)

TABLE 6-3 TOTAL IMPACT OF WHEAT GRAIN AND FLOUR PRODUCTION AT NATIONAL LEVEL ON THE THREE AREAS OF PROTECTION AND ON CLIMATE CHANGE

VC Stage	Resources (Million USD 2013)	Ecosystem Quality (species.yr)	Human Health (DALY)	Climate Change (k t CO_2eq)
Total wheat production (at farm gate)[1]	26.5	39	780	490
Sub-totals:				
Exported wheat (at farm gate)[2]	19.7	28	562	354
Total flour production (grain-to-flour)[3]	5.4	5.7	130	83

[1]Impacts of total wheat cultivation in Moldova (1,536 k t).
[2]Impacts of the cultivation of the exported share of conventional wheat grain (1,107 k t).
[3]Impacts of the overall flour production in Moldova (301 k t grain, domestic production, sourced to industrial and local mills). Including upstream phases (cultivation, transport, storage, milling), these impacts are not to be added to those of the cultivation stage.

TABLE 6-4 PHASE CONTRIBUTION TO TOTAL IMPACTS (WEIGHTED AVERAGE OF THE MILLING SUB-CHAINS)

VC Stage	Resources	Ecosystem	Human Health	Climate Change
Cultivation	70%	99%	85%	85%
Transport & Storage	9%	0%	5%	4%
Milling	21%	1%	10%	11%

Resource depletion reflects increased cost of continued resource extraction (mineral and fossil).
Ecosystems quality is expressed as number of potentially disappeared species over one year.
Damage to human health represents the reduction in potential healthy life years due to morbidity or premature mortality.
Climate change is expressed as the quantity of carbon dioxide equivalent released in the atmosphere.

When disaggregating the impacts per phase of the VC (Table 6-4), wheat cultivation clearly emerges as the primary driver, contributing to 70% of resource depletion, 99% of damage to ecosystems, 85% of health impacts, 85% of GHG emissions. Transport and storage have limited contribution (0-9%, depending on the impact category), while milling contributes from 1 to 21% of overall impacts (higher contributions to resource depletion and to climate change, mostly due to energy use).

This phase-based breakdown confirms that **any sustainability improvements must primarily target agricultural practices**. Impacts normalized per kg of product are the following:

- **Per kg of wheat grain**:
  - 0.017 USD (2013) in resource depletion.
  - 2.56E-8 species.yr.
  - 5.08E-7 DALY.
  - GHG emissions: 0.32 kg CO_2eq, ranging from 0.21 to 0.40 kg CO_2eq (lowest in no-till, organic systems; highest among peasant farmers in Central Moldova).
- **Per kg of wheat flour**:
  - 0.029 USD (2013) in resource depletion.
  - 3.06E-8 species.yr.
  - 7.02E-7 DALY.
  - GHG emissions: 0.44 kg CO_2eq ranging from 0.41 to 0.52 kg CO_2eq (depending on the sub-chain).

Answering to the four core questions: Contextualizing impacts

Resource Depletion

Resource depletion in this study refers to the increased cost of extracting fossil fuels and mineral resources, which serves as a useful indicator of long-term pressure on the planet's finite resources.

While the impact per unit of production is relatively low, 0.017 USD2013 per kg of wheat grain, and 0.029 USD2013 per kg of flour, when scaled up to Moldova's total wheat production, **the cumulative burden becomes substantial**: approximately 26 million USD2013 in marginal extraction costs.

The main drivers of resource use in the Moldovan wheat VC are diesel consumption (for field operations and transportation) and mineral-based fertilisers, especially nitrogen, phosphorus, and potassium, key nutrients that are both energy-intensive to produce and globally limited in supply. On a global scale, agriculture is responsible for around 15% of total energy use and consumes a significant share of mined phosphorus and potassium, both of which are non-renewable.

To reduce the sector's contribution to long-term resource depletion, resource-efficient practices should be adopted. These include **precision fertilization**, which also reduces nitrogen-related soil emissions, **reduced tillage**, which simultaneously lowers fuel use and contributes positively to other environmental areas, such as emissions and soil health.

Ecosystem quality

Ecosystem impacts are expressed as the fraction of species that may disappear due to land use, emissions, pesticide use and other pressures. Moldova's total wheat cultivation in the reference year was associated with a **cumulative pressure on the ecosystem** equivalent to 39 species.yr**.** For perspective, agriculture is a major driver of biodiversity loss: it is implicated in 86% of the 28,000 species currently threatened with extinction[74]. In absolute terms, the **biodiversity impact of Moldova's wheat sector is small at the global level**. **From a spatial analysis (see next section), it emerges that the risk of overlapping of agricultural land and ecologically sensitive areas is very low** in the country.

The fact that 99% of potential ecosystem damage occurs during cultivation reinforces the need of promoting low-impact agricultural practices such as reduced tillage, soil conservation techniques, crop diversification, combined with the promotion a gradual reduction of plant protection products such as herbicides and fungicides through improved crop management, better targeting of applications, and strengthened advisory services. While current use levels of these products in wheat production are not high, progressive reductions can further limit ecosystem pressures.

Human Health

The total burden associated with the wheat VC in Moldova was **780 DALYs for the national wheat grain output**, and **130 DALYs for the domestic wheat flour production** in the reference year. These impacts result primarily from GHG emissions, fine particulate matter and ammonia emissions, largely from fertiliser use and fuel combustion to contextualize, according to our elaborations from WHO estimates, the health burden of air pollution[75] in Moldova corresponds to approximately 40,000 DALYs per year, based on an average of 1,604 DALYs per 100,000 people. This means that **the wheat VC accounts for only about 2% of the health burden associated with a single major environmental risk factor** [76] (air pollution, from all sources) which translates into relatively **low health impact** of the wheat VC overall.

Climate Change

Climate change impacts are measured in terms of global warming potential (GWP), expressed as kilograms of CO_2 equivalent (CO_2eq) emissions. Moldova's total wheat production generated approximately 490.5 thousand tonnes CO_2eq, while flour production (including all upstream processes) accounted for 83.5 thousand tonnes CO_2eq.

At the product level:

- Emissions ranged from 0.21 to 0.40 kg CO_2eq/kg wheat grain, depending on production practices (lowest in no-till and organic systems, highest in peasant farms with lower input efficiency).

- Emissions for flour production ranged from 0.41 to 0.52 kg CO_2eq/kg flour, with emissions from the industrial milling sub-chains generally more efficient than the local ones.

For comparison:

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[74][74] https://www.unep.org/news-and-stories/press-release/our-global-food-system-primary-driver-biodiversity-loss.

[75]One of many single health risk factors reported in *Profile of Health and Well-being, Republic of Moldova, World Health Organization Regional Office for Europe.*

[76] In the list of the main health risk factors in Moldova (Profile of health and wellbeing – Moldova, WHO), for instance, the total effect of air pollution (from any source) has a value of 1,604 DALYs every 100,000 people (average between impact on both male and female populations). This figure can be converted to approximately 40,000 DALYs for the entire Moldovan population (1,604x2,500,000 inhabitants / 100,000 inhabitants = 40,100 DALYs.). The referred value of 729 DALYs for the total wheat flour production in the reference year, corresponds to 1.8% of the DALYs reported by the WHO for a single risk factor.

- Wheat production in other European contexts typically ranges between 0.25 and 1.07 kg CO_2eq/kg grain.
- Wheat flour production in international studies reports values of 0.67–0.80 kg CO_2eq/kg (temperate humid region of Brazil, Giongo et al., 2025), and 0.89 – 0.95 kg CO_2eq/kg (Spain and Italy, Camara-Salim et al., 2020; Kulak et al., 2015).

These **comparisons place Moldova's wheat VC at the lower end of the emissions range**, reflecting relatively efficient production systems, particularly in by certain typologies. Nonetheless, **scaling up** conservation agriculture practices, such as **no-till, cover cropping, and optimized nitrogen use, can further reduce emissions and strengthen resilience to climate risks**.

To summarize, wheat VC in Moldova presents a **relatively low environmental impact**. However, targeted policy measures, particularly around **fertiliser management** and **further promotion and support of no-till systems** can significantly enhance sustainability and resilience, especially under increasing climate pressures.

6.4 Biodiversity risks evaluation

A GIS-based analysis was carried out using Corine[77] land use and land cover map (full legend of the Corine is shown in Appendix 9-17) along with the map of protected areas showing the Emerald Network of Areas of Special Conservation Interest[78]. 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.

Figure 6-11-A shows the resulting elaboration, 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 Figure 6-11-A are widespread within the conservation areas.

Figure 6-11-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).

[77] Corine Land-Cover in Eastern Partnership Countries.
[78] Emerald Network data (vector) - the Pan-European network of protected sites version 2024.

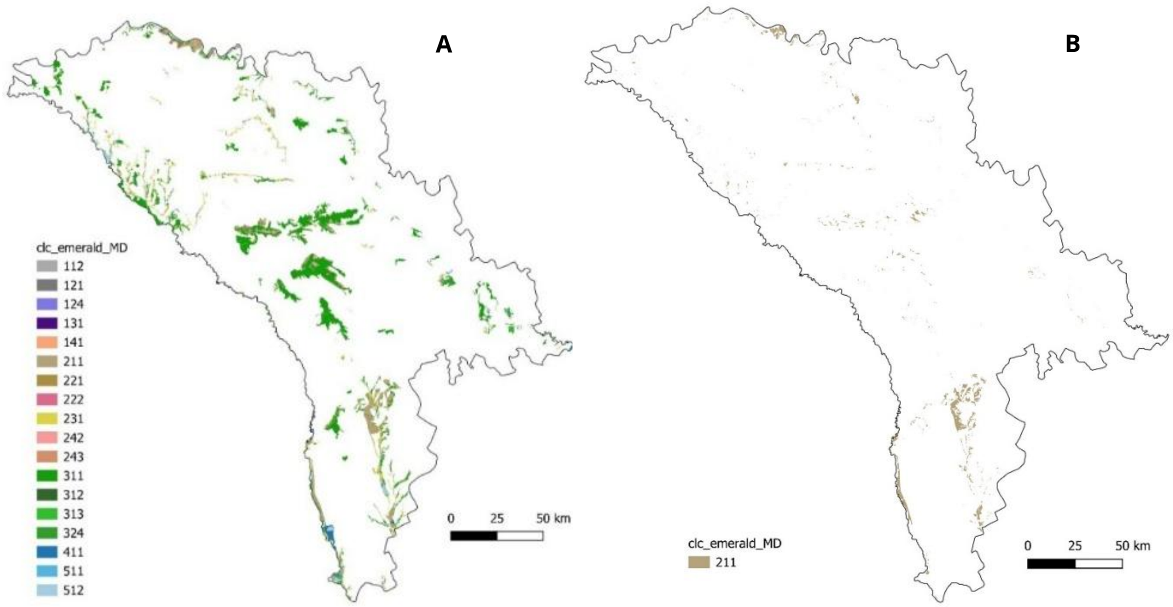

FIGURE 6-11 GEOGRAPHICALLY-EXPLICIT BIODIVERSITY RISK ASSESSMENT.

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 elaboration using Corine land-cover map and Emerald Sites map.

Moldova is committed to align the Emerald network sites management to Natura 2000 standard[79], 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.

6.5 Synthesis of the environmental aspects

The Life Cycle Assessment (LCA) conducted on the wheat VC in Moldova for the year 2023 reveals an overall **low environmental impact** of wheat flour production, from cultivation to milling. The findings indicate that, while no stage of the VC presents excessively high environmental burdens, the **cultivation phase remains the primary hotspot**, contributing the most to impacts in all key environmental areas assessed. Similar outcomes were identified for the export sub-chains.

The total impacts of the wheat VC considering resource depletion, ecosystem quality, human health and climate change, are relatively modest. Considering that most of the impacts are generated at the cultivation stage, the environmental performance of wheat cultivation in Moldova largely reflects the overall VC performance.

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Moldova's wheat production led to an increased cost of continued resource extraction in **mineral and fossil resource depletion**. **Grain production with no-till techniques can reduce the resource depletion due to more efficient use of fertilization and less intensive mechanical operations, while maintaining crop yields**. Indeed, the resource depletion per kg of wheat grain produced by no-till farmers is reduced from the average of 0.017 USD/kg for conventional tillage farmers to 0.01 USD/kg.

Ecosystem impacts are mainly generated by land use and to a much lesser extent by global warming and freshwater eutrophication. Cultivation efficiency (higher yields with low levels of input use including fertilisers and pesticides) is key to reducing ecosystem impacts. Notably, **no-till practices can achieve lower impact on ecosystems** while maintaining good crop yield performance under drier conditions (which is the case particularly in Southern Moldova), by improving soil factors such as water retention, soil temperature and organic matter. Regarding plant protection products, while their current use levels in wheat production are not high, progressive reductions can further limit ecosystem pressures.

The life-cycle impact of the wheat VC on human health is low. As discussed previously, the values of 729 DALYs or 130.5 DALYs referred to the total wheat grain and flour production in Moldova during the reference year, are much lower than that reported by the WHO for a single health risk factor. For instance, the total effect of air pollution (from all sources), is over 50 times greater than the impact of the total production of wheat grain in Moldova and over 300 times greater than the impact of flour production in the reference year. Nevertheless, the **risks to human health arising from direct exposure to hazardous chemical substances** (such as pesticides and herbicides) **are not addressed by the LCA approach**. To account for this limitation, the issue was examined separately through qualitative interviews with key stakeholders, including farmers, input suppliers, and representatives from institutions responsible for labour and environmental protection. **Findings consistently indicated that the use of Personal Protective Equipment (PPE)** including respiratory and eye protection, gloves, and protective clothing **is infrequent during the handling of hazardous substances**. Moreover, the absence of PPE in stock at the input suppliers visited suggests a very low demand, reflecting a lack of awareness and implementation of basic safety protocols on hazardous substances management on farms.

In terms of climate change, GHG emissions per kg of wheat grain ranged between 0.21 (no-till and organic) and 0.40 kg CO_2eq (Peasant farmers, Centre). Therefore, **Moldova is placed around the lower end of the range of result obtained through LCA studies on wheat production in other European contexts** (0.25 to 1.07 kg CO_2eq per kg of wheat grain), **and below the weighted average of 20 life cycle inventories** (on over 11 European countries) based on the production shares of these countries in the total European production, which resulted in emissions ranging from 0.61 to 0.65 kg CO_2eq per kg of wheat grain (Achten and Van Acker, 2015).
Regarding biodiversity risks at landscape scale, a geographically explicit analysis reveals low risk of extensive overlapping between cultivated plots and protected areas. Nevertheless, Moldova's transition from the Emerald Network to the EU Natura 2000 framework seems to be progressing at a slow pace. It must be pointed out that this transition would be key to align agricultural sustainability with biodiversity protection and ensure conservation areas are managed to EU standards.

The results clearly indicate that **improving the environmental performance of the wheat VC requires interventions at the cultivation stage**, particularly:

- **Improving fertiliser management and nitrogen use efficiency (NUE) to reduce emissions and enhance sustainability.** Effective fertiliser management, and in particular nitrogen management is critical for improving GHG emissions, particularly nitrous oxide (N_2O), as well as reducing ammonia volatilization, minimizing resource depletion, and supporting long-term soil fertility.

  These factors are essential for maintaining productive and sustainable cropping systems in Moldova. Strategies for better fertiliser management should include fertilization based on soil analysis, timely application of fertilisers and the substitution of granular urea with enhanced efficiency fertilisers (inhibitor-based fertilisers to reduce GHG and ammonia emissions).

In conventional wheat cultivation, the widespread use of nitrogen-based fertilisers, especially granular urea, is a growing concern. Under dry conditions at the time of spring fertilization, significant nitrogen losses can occur through ammonia volatilization, especially if granular urea is used, which is often the case (Figure 6-12). This not only contributes to air pollution and GHG emissions but also reduces the availability of nitrogen for crops, negatively impacting yields. As yields decline, land use per unit of output increases, placing additional pressure on land resources and posing risks to biodiversity and ecosystem quality. Given that arable land already covers over 50% of Moldova's territory, with limited scope for sustainable expansion, maintaining or increasing yields is essential.
Improving fertiliser management would be therefore not only a climate mitigation measure but also a key lever for increasing agricultural resilience and land-use efficiency in Moldova's wheat sector.

- **Promoting climate-smart farming, the case of no-tillage practices**. The LCA results highlight the advantages of no-tillage agricultural practices over conventional tillage, particularly in terms of global warming potential, resource depletion, and human health. These benefits are largely driven by the combination of relatively high yields and reduced inputs, specifically, lower fuel consumption due to fewer and less intensive mechanical operations, along with reduced use of synthetic fertilisers.

  Beyond the quantitative findings of the LCA, agronomic evidence further supports the advantages of no-tillage. These systems contribute to improved soil health by increasing soil organic matter and promoting the accumulation of soil organic carbon. As a result, soil structure and biological activity are enhanced, leading to better moisture retention, reduced erosion, and increased resilience to climatic stressors such as drought and heatwaves. The retention of crop residues on the soil surface also provides a mulching effect, which reinforces these benefits.

  Sustainable soil tillage is essential for contrasting soil erosion and enhancing maintaining soil fertility, water retention, and biodiversity, all key components of climate resilience and long-term productivity. However, concerns raised during stakeholder consultations, including focus groups, point to the increased reliance on herbicides within no-till systems. Addressing this challenge will require the development and promotion of integrated weed management strategies aimed at reducing chemical inputs without compromising the agronomic and environmental benefits of no-tillage.

  Moreover, while many farmers recognize the potential of no-till and reduced tillage systems, the transition is often hindered by limited access to appropriate machinery and equipment. Overcoming these barriers will be essential to scaling up climate-smart farming practices.

  The benefits of no-till farming can be further enhanced when combined with complementary agroecological practices such as diversified crop rotations, cover cropping, and contour farming (instead of up-and-down slope cultivation). Tailoring these strategies to local agro-climatic conditions across Moldova's diverse regions will be essential for maximizing long-term sustainability and productivity.

- Explore policies for **livestock reintegration to close nutrient loops through manure use**. Reintegrating livestock into crop production systems in Moldova can contribute to more circular and resilient farming by reintroducing manure as a valuable source of organic nutrients. This can help reduce dependence on synthetic fertilisers, improve soil fertility, and enhance long-term soil health through increased organic matter and biological activity.

  While mixed crop-livestock systems have declined in recent decades, targeted policies could support their reactivation, particularly through incentives for on-farm nutrient recycling, investment in manure management infrastructure, and technical guidance. Livestock reintegration can complement broader climate-smart strategies by helping close nutrient loops and support sustainable soil management. Reintegration must, however, be carefully managed to avoid nutrient overload and ensure alignment with environmental goals.

FIGURE 6-12 SPRING FERTILIZATION OF WINTER WHEAT ON POOR STRUCTURE SOIL USING GRANULAR UREA UNDER DRY CONDITIONS

- The **dominance of cultivation emissions makes this the most critical stage to address** in strategies aiming to lower the environmental impact of the wheat VC in Moldova. Indeed, **even with improvements at the downstream stages** (transport, storage, milling) **there would be little impact on the overall performance of the VC**.

  A downstream phase to address would be the traditional village-level milling process. Nevertheless, for this kind of operations, improving grain-to-flour conversion efficiency through process modernization may be challenging without targeted, centralized support. Moreover, the ongoing decline in the number of such mills is already resulting in reduced access to milling services, which remain essential to the functioning of rural economies. The critical role of village-level mills in sustaining rural food systems is exacerbated by the fact that landowners are paid in-kind (with grain) as part of land rental agreements, ensuring local food availability. However, the continued decline of traditional village mills jeopardizes the conversion of grain into consumable flour in rural areas, posing a potential threat to food security, particularly for landowners and communities reliant on these localized arrangements.

  Therefore, rather than placing pressure on small-scale millers to modernize and improve efficiency, the priority should be to ensure the continuity of these operations, given their vital role in supporting rural livelihoods, food security, and the broader social and economic fabric of local communities.

The GIS-based analysis of land use within Emerald Network sites in Moldova **revealed that the areas of conservation interest are predominantly covered by forests and other natural land cover types**, including water bodies and cropland undergoing conversion to forest. No evidence of agricultural land encroachment into natural areas has been detected. Although management plans for some protected areas are in place, they are not sufficiently updated, nor adequately enforced.
Moldova is committed to aligning with EU standards, through the progressive adoption of the Natura 2000 framework. It must be also pointed out that restoring and maintaining hedgerows and tree belts, and increasing their presence in agricultural landscapes would be an impactful measure to enhance biodiversity at land-scape level, reduce erosion, and improve landscape resilience. Moldova's historical system of tree

belts provides a foundation for such interventions. Agroforestry practices may also represent a viable opportunity to be considered in the medium to long-term.

7. SYNTHESIS & RECOMMENDATIONS

7.1 Answering the framing questions

The economic sustainability of the Moldovan wheat VC presents **both positive and negative aspects**. Production remains under pressure from climatic constraints, while international trade faces logistical barriers due to limited access to seaports. By contrast, the processing segment shows encouraging signs of development. Farmers operate under high production costs, largely driven by their dependence on imported fertilisers and crop protection products, as well as rising labour expenses that do not always translate into higher productivity. Many producers rely on local input suppliers offering technical credit, a form of in-kind financing that links future grain deliveries to input repayment. While this mechanism ensures farmers' access to inputs, it also creates dependency and exposes them to penalties in cases of delayed payment.

The wheat sector's progress is closely tied to the strength of its processing industry. Sustainable growth requires a well-functioning network of mills, bakeries, and feed producers equipped with modern technology capable of competing on domestic and export markets. Although milling itself is relatively low in labour intensity, downstream industries, particularly bakeries and specialised retail, can create additional employment opportunities. These sectors are expanding in Moldova and represent an important channel for value addition and job creation within the rural economy.

Currently, the Moldovan wheat VC is not internationally competitive, facing significant disadvantages due to macroeconomic distortions and policy constraints. This led to the implementation of wheat import licences, which basically block all imports of soft wheat from other countries. Key indicators from the 2023 analysis highlight this challenge. Results show that domestic producer prices are below world market parity. **The Domestic Resource Cost (DRC) ratio indicates efficiency, with less units of domestic resources required to generate one unit of foreign exchange, confirming a comparative advantage.** However, overvalued exchange rate and high factor costs in labour and capital, result in a severe "cost–price squeeze" for farmers. Financial results mirror these structural pressures: while the **export-oriented VC recorded a net operating loss of -16%, the processing VC achieved a positive margin of +13%,** producing higher value added per tonne. This dual structure demonstrates that strengthening domestic processing capacity offers a more profitable and sustainable development pathway. **Farmers' liquidity remains a persistent challenge, aggravated by negative VAT balances that accumulate within Moldova's fiscal institutions**.

From a social perspective, the wheat VC is only partially sustainable. Despite maintaining comparatively good labour standards, employment remains highly dualistic. Permanent workers in Agricultural Enterprises (AEs) generally benefit from formal contracts and social insurance, whereas seasonal workers are often employed informally and paid daily. Wages are below the national agricultural average, and the **gender pay gap** remains significant, with men earning considerably more than women, especially in mechanised field work. The sector also faces demographic challenges: an **ageing workforce** and high youth emigration threaten long-term viability. Land tenure fragmentation supports a measure of rural resilience, as landowners often view land as a heritage asset and receive **in-kind rent** (mainly cereals) used for household food and feed, reinforcing food security. However, this social stability is undermined by environmental and health risks. **Water scarcity** depresses yields, particularly in the South, while the unsafe handling of agrochemicals poses serious risks to workers' health. Overall, although large AEs contribute to social capital and community cohesion, the sector's dependence on informal labour, gender disparities, and high exposure to climate and **geopolitical risks constrain** its overall social sustainability.

The Moldovan wheat VC **demonstrates a relatively low environmental impact** compared to international benchmarks, though cultivation remains the dominant source of impact. Life Cycle Assessment (LCA) results show that farming accounts for 70% to 99% of total environmental pressure across categories such as resource depletion, ecosystem quality, human health, and climate change. Greenhouse gas (GHG) emissions (0.21–0.40 kg CO_2 eq per kg of grain) position Moldova at the lower end of the European range, with **no-till and organic systems** showing the best performance due to reduced input dependence. Nevertheless, low yields, especially in the arid South, translate into higher land use per unit of output, intensifying pressure on ecosystems. The sector's vulnerability is amplified by **severe water scarcity** and heavy reliance on mineral fertilisers and diesel. These factors highlight the need to **improve nitrogen use efficiency (NUE)** and promote sustainable input management. While the LCA indicates low human health impacts from emissions, stakeholder feedback confirms **widespread neglect of safety standards in agrochemical use**. Expanding climate-smart practices, particularly no-till cultivation, offers the most effective route for enhancing soil health, resource efficiency, and long-term environmental performance. In addition, **restoring and maintaining hedgerows, riparian buffers and tree belts in agricultural landscapes, alongside the implementation of agroforestry practices** would enhance biodiversity, reduce erosion and improve landscape resilience. Aligning protected natural areas to the Natura 2000 standard is expected to further strengthen biodiversity protection enforcement and management.

7.2 From SWOT to TOWS

Taking into consideration the SWOT matrix presented in the functional analyses, the TOWS matrix presents the actions and strategies[80].

TABLE 7-1 THE TOWS MATRIX, MOLDOVA WHEAT

	Strengths 1. Established cereal production and expertise 2. Preferential EU market access 3. Competitive production costs 4. Policy drives for modernisation and alignment 5. Expanding no-till farming improves soil, environment, and climate resilience 6. Access to modern farm machinery through different government programmes	**Weaknesses** 1. Fragmented land structure 2. High climate and yield vulnerability 3. Input dependency and low nitrogen efficiency 4. Questionable wheat quality 5. Limited post-harvest value addition and infrastructure 6. Reliance on few exports markets and truck transportation 7. Limited access to Conservation Agriculture tools and training 8. Unsafe agrochemical uses and poor safety practices 9. Limited extension service
Opportunities 1. Scaling-up of climate-smart, resilient practices 2. External modernization funds and access to the EU single market 3. Enhancing export routes and market diversification 4. Infrastructural investments in linking to Romania could reduce export costs and risks 5. Expanding local compound feed manufacturing could absorb part of the wheat crop 6. Reintegration of mixed crop-livestock systems can enhance soil fertility and reduce external input dependency by closing nutrient loops through manure use	• Redirect investment efforts into no-till, conservation agriculture • Build a consistent quality identity for Moldovan wheat and communicate it via economic diplomacy for capturing new markets with new products. • Taking advantage of modern machinery to integrate climate smart agricultural practices • Promote quality and price differentials for import substitution, especially for the local milling/bakery.	• Promote soil testing, balanced fertilization, and basic data tracking to improve yield per unit of input. • Invest in alternative roads, transport infrastructure to nearby ports • Build local value-added creation through processing (innovate milling + diversify into other than milling processing) • Support independent research and development and extension service.
Threats 1. Continued impact of the war in Ukraine 2. Overreliance on chemical inputs harming soil and environment 3. Demographic decline and labour shortages 4. Rising debt and credit dependence 5. Loss of rural milling capacity weakening food resilience and local economies 6. Currency appreciation lowering competitiveness producers.	• Institutionalize sampling and quality verification to avoid discounts on origin • Expand conservation practices to mitigate the impacts of drought and heat, highlighting their economic benefits	• Focus on moisture conservation and water. • Encourage the replacement of imports by improving the quality and price competitiveness of domestic products, especially for local milling and bakery industries. • Improving transportation infrastructure making deliveries less expensive (water and train to Moldova[81])

[80] Those are strategies to: a) Use strengths to maximise opportunities (**SO**), b) Reduce weaknesses to develop opportunities (**WO**), c) Use strengths to reduce threats (**ST**), d) Avoid threats by reducing weaknesses (WT).

[81] As a potential infrastructure development, it is proposed to extend the European standard gauge (1,435 mm) to a logistics hub in northern Moldova. This would facilitate direct rail connections with EU countries, offering an alternative to southern port routes and simplifying the transport of wheat to European markets, while potentially supporting higher prices in the north.

7.3 The risk analysis

The risk analysis presents the identified risks, which are partially being identified in the SWOT matrix and partially being identified by the experts based on information reached. The probability column identifies risks which are the most probable (1 least probable, 3 most probable). At the same time, the severity is being measured on the range from 1 to 4 (least severe to most severe). The severity is observing the 4 components of the VC methodology, the economic growth, inclusiveness, social sustainability and environmental sustainability. The resulting values are defined by the expert panel. The highest risks scored *a) climate resilience due to slow adoption of conservation agriculture* and *b) lower yields due to poor fertiliser management and climate stress*, *c) high migration of youth* and *d) prevailing geopolitical issues.*

TABLE 7-2 THE RISK ANALYSES OF THE WHEAT VALUE CHAIN IN MOLDOVA.

Risk description	**Probability**	**Severity**			
		Growth	Inclusiveness	Social sustainability	Enviro. Sustainability
Currency appreciation which decreases further competitiveness on the world market	1	2	2	2	1
Lack of skilled labour to manage farm enterprises	2	4	2	2	1
Land ownership transition towards investors and large landowners	2	2	3	3	2
Trouble getting loans due to excessive debt ratio among farmers	2	3	2	2	1
A reduction in local wheat usage and cultivation due to a decline in livestock numbers	2	3	2	3	3
Climate resilience risk due to slow adoption of conservation agricultural practices	3	2	1	2	3
Declining yields due to poor fertilizer management and climate stress	3	3	2	2	3
Loss of rural milling operations undermines rural economic resilience, food security	2	1	4	3	1
Applying the subsidy requirements (cross-compliance) will lead many farms to fail to meet these conditions.	2	2	2	2	3
Aging of the workers in value chain and high outward and inward migration of youth from rural areas	3	3	4	3	1
Influence of geopolitical issues (war in Ukraine) on the wheat price	3	4	2	3	2

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

7.4 Recommendations

Based on the surveys, interviews and own observations, the team formulated possible recommendations. They are divided into 5 sections: I) Financial issues; II) Social inclusion; III) Environmental sustainability; IV) Modernisation and value addition; V) Governance and institutions.

Pillar	Focus Area	
I. Financial Stability & Market Structure	Addressing fiscal issues, improving liquidity, and enhancing market transparency.	- **Find a solution to the VAT issues** that strain farm liquidity and cash flow.
		- Enable companies to gain **cheaper credits** and **cheap short-term loans**. Those would enable farmers to purchase inputs, reducing dependency on input providers (technical credits).
		- Support the development of a **real and transparent marketplace** (or purchase auctions).
		- Strengthen the **financial management** of agricultural enterprises (risk analysis, budgeting) to enhance financial governance.
II. Social Inclusion & Labour Conditions	Improving worker welfare, safety, and addressing the aging workforce and emigration.	- Establish clear regulations for **working hours, overtime, and compensation schemes**, especially during peak seasons.
		- Conduct individual discussions with workers about **salary structures and payment schemes** to foster transparency.
		- Implement **training and awareness campaigns for farmers and workers on safety procedures** (fertilization, pesticide application).
		- Build capacity within **labour inspection agencies** regarding safety standards and ensure regular supervision.
		- Implement targeted grant schemes, training, and incentives, and develop programs to support **youth to return** and start agricultural production.
III. Environmental Sustainability & Climate Adaptation	Promoting climate-smart practices and efficient resource use.	- Put pressure on the support of **Conservation Agriculture (CA)**, especially no-tillage practices for better soil and water management.
		- Improve **fertilisation management** to reduce emissions and enhance sustainability.
		- Explore policies for **livestock reintegration** to close nutrient loops through manure use.
		- Restore, maintain and **increase hedgerows and tree belts** in agricultural landscapes, alongside the **implementation of agroforestry practices.**
		- Further promote commitment to **align conservation areas to the Natura 2000 standard.**
IV. Modernization, Capacity & Value Addition	Enhancing competitiveness, R&D, and moving up the value chain.	- Implement investments into **precision farming,** given the size and scale of Moldovan farms.
		- Provide an **e-agricultural platform** for a wide range of information (market data, weather forecasts, advisory services).
		- Develop **capacity building** (education and mainly extension service centres).
		- Develop **Moldovan branding** and strengthen **phytosanitary standards**.
		- Support **diversification of agricultural production** and support **processing and market entry**.
V. Governance and Institutional Alignment	Streamlining public administration and ensuring alignment among stakeholders.	- Establish a working group of key stakeholders (Ministries, associations) to **update water legislation** in accordance with international standards.
		- Promote the successful farms adopting sound financial management practices as **role models** for the sector.
		- Push for the **digitalisation of the government agenda**, mainly the agenda related to the Agency of Interventions and Payments in Agriculture (**AIPA**).

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9. Appendix

List of Appendix items

9.1 Appendix to Economic analyses

Appendix 9-1 Coefficients used for disaggregation of IGS, Moldova Wheat VC study, reference year 2023

Category	Item	IGS0	IMP0	IMP1	VA1	Wag1	Tax1	Fin1	Pro1	Dep1	Net1
1.Consumable	Distribution costs	5,887	0.00	0.19	0.77	0.34	0.06	0.04	0.00	0.14	0.41
1.Consumable	Fertiliser and protection	1,671,328	0.00	0.58	0.35	0.36	0.06	0.02	0.00	0.13	0.40
1.Consumable	Fuel	497,619	0.00	0.58	0.35	0.36	0.06	0.04	0.00	0.13	0.40
1.Consumable	Operational costs	2,670	0.00	0.27	0.70	0.58	0.04	0.02	0.00	0.10	0.25
1.Consumable	Others	121,774	0.00	0.28	0.27	0.56	0.04	0.05	0.00	0.07	0.27
1.Consumable	Seed and wheat	1,115,202	0.00	0.14	0.84	0.05	0.10	0.06	0.00	0.07	0.71
1.Consumable	Storage costs	108,763	0.00	0.00	0.90	0.58	0.04	0.03	0.00	0.08	0.27
1.Consumable	Water	10,305	0.00	0.10	0.80	0.10	0.10	0.06	0.00	0.10	0.64
2.Service	Electricity	96,911	0.00	0.24	0.74	0.31	0.06	0.08	0.00	0.16	0.38
2.Service	Financial costs	34,335	0.00	0.14	0.79	0.06	0.09	0.02	0.00	0.20	0.63
2.Service	Maintenance	163,151	0.00	0.77	0.19	0.60	0.04	0.03	0.00	0.07	0.26
2.Service	Others	47,782	0.00	0.19	0.75	0.58	0.04	0.03	0.00	0.08	0.27
2.Service	Stocking	22,680	0.00	0.00	0.90	0.58	0.04	0.03	0.00	0.08	0.27
2.Service	Transportation	160,300	0.00	0.19	0.77	0.34	0.06	0.04	0.00	0.14	0.41

Source: Coefficients based on I-O tables Source: Lenzen M, Kanemoto K; Moran D, and Geschke A (2012) Mapping the structure of the world economy. Environmental Science & Technology 46(15) pp 8374–8381. DOI: 10.1021/es300171x
Note: Coefficients inputted into the AFA software to calculate the Effect method of the VC

9.2 Appendix to Environmental analyses (LCA)

9.2.1 Life cycle Inventory

Appendix 9-2 Life Cycle Inventory (Cultivation)

		North		Centre		South		No-till	Organic
		PF	AE	PF	AE	PF	AE		
Inputs/ha	Unit								
Land occupation	m2	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Seed	kg	225	225	240	230	200	215	140	250
Ammonium Nitrate	kg	125	125	125	115	70	70	55	
UREA 46%	kg	100	100	100	90	55	55	40	
NPK	kg	50	45	45	45	30	30	20	
Organic fertiliser (Bioefect+Biovit)	kg								85
Diesel, mechanical operations	L	95	70	80	55	75	60	45	80
Herbicide	kg	1	1	1	1	1	1	1	
Fungicide	kg	0.75	0.75	0.75	0.75	0.75	0.75	0.75	
Water (Well)	L	400	400	400	400	400	400	400	
Transport of inputs to local warehouse*	kg.km	546,000	505,000	481,000	556,000	271,000	339,000	301,000	175,000
Transport of inputs to farm	kg.km	9,940	9,640	9,440	10,400	6,040	7,540	7,040	2,340
PP bags (seed, fertilisers)	kg	0.55	0.55	0.55	0.55	0.55	0.55	0.55	
Outpus/ha	Unit								
Grain (at commercial moisture)	t	4.97	5.21	4.07	4.27	3.29	3.44	4.13	2.5
Inert waste disposal (PP seed&fert bags)	kg	0.55	0.55	0.55	0.55	0.55	0.55	0.55	

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

Field emissions

N_2O emissions are related to the amount of nitrogen supplied to the soil through nitrogen fertilization and to crop residues. The estimate of direct N_2O emissions is calculated as the product of such amount of nitrogen and the N_2O emission factor provided in the IPCC 2006 guidelines[82]. The estimation of the amount of nitrogen from crop residues in the aboveground and belowground biomass took into consideration the grain yields for each category of farm and was based on the IPCC equation 11.7A (Vol. 4, Chapter 11) "Alternative approach to estimate FCR (using Table 11.2)", which allows to calculate the annual amount of N_2O emission from crop residues for wheat (considering 100% of residues left on the fields).

NH_3 volatilization from synthetic fertilisers and indirect N_2O emissions from both NH_3 volatilization and from NO_3 leaching/runoff due to nitrogen fertilization were also calculated based on the IPCC 2006 guidelines.

Phosphorus and phosphate emissions were calculated using the approach developed by Nemecek and Kagi (2007). Thus, for phosphorus emissions to water the following was considered:

- Leaching of soluble phosphate to groundwater (phosphate to ground water): for this emission the value of 0.05 kg P/ha/year was used based on Zampori and Pant (2019).
- Erosion of soil particles containing phosphorus (phosphorus to river): this emission refers to the quantity of soil eroded, the P content in soil eroded, an enrichment factor and the fraction of eroded soil that

[82] N_2O emission from field application of N fertilisers is calculated as 1% of the mass of N applied through fertilization multiplied by 44/28 to convert kg of N-N_2O to kg of N_2O.

reaches the river, according to the equation by Nemecek and Kagi (2007). The quantity of soil eroded was assumed to be 9 t/ha/year (the average for agricultural soils in Moldova, reported by Ailinkai 2012 and Kuharut, n.d.) For no-till and organic typologies 10% of the national average was considered to account for the reduced erosion in these typologies of farms. It should be noted that the uncertainty associated with such estimation is high, considering that the emission factors of P highly depend on local conditions and also considering the unavailability of specific up-to-date soil erosion data referred to plots in the study area.

Appendix 9-3 Life Cycle Inventory (STORAGE AT WAREHOUSE), Functional unit: 1 kg of grain at warehouse gate

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

Appendix 9-4 Life Cycle Inventory (TRANSPORT), Transport to mill (industrial, local). Unit: 1 kg of transported grain

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

Appendix 9-5 Life Cycle Inventory (TRANSPORT), Transport to Export. Unit: 1 kg of transported grain

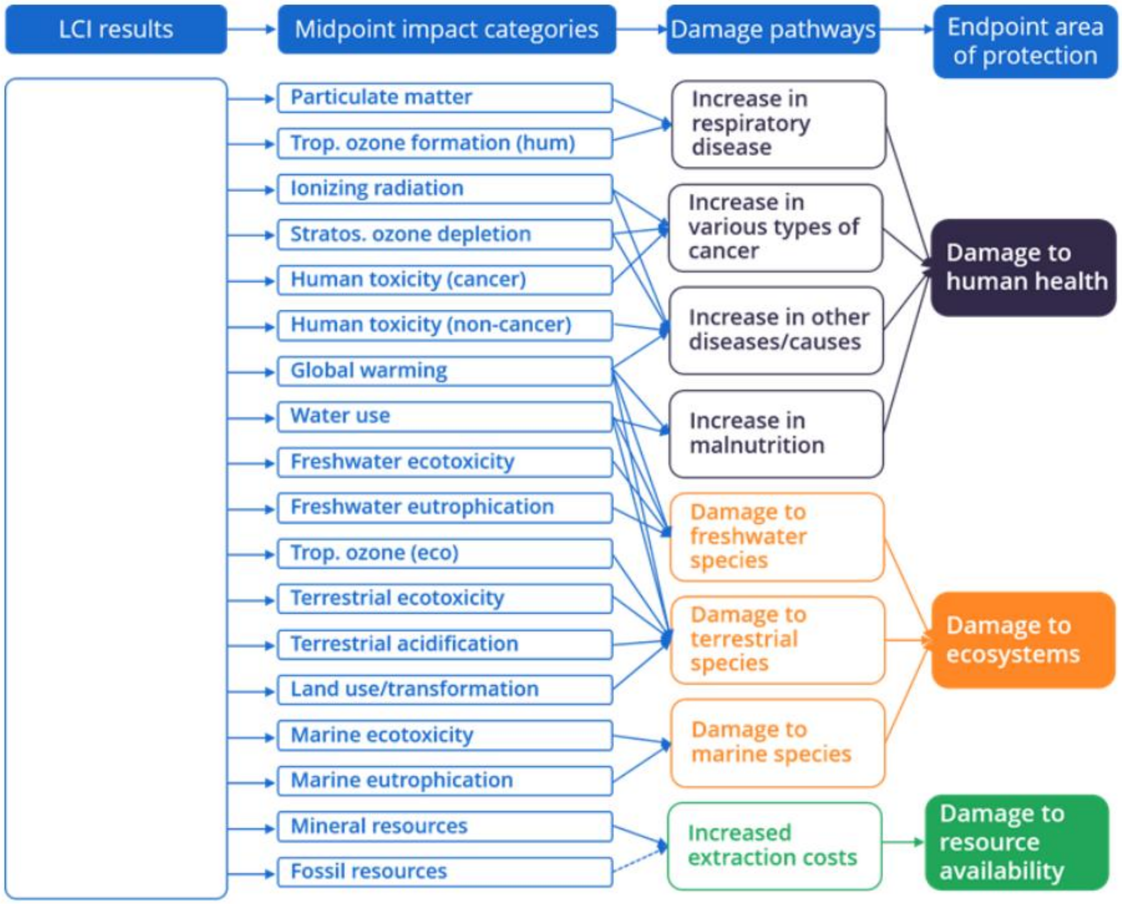
input/output	material	unit	amount	description
INPUT	transport of grains to port of export	kg.km	450	assuming transport distance to the port of Constanta (RO)

Appendix 9-6 Life Cycle Inventory (MILLING), Functional Unit: 1 kg of wheat flour in 2 kg package at mill gate (industrial mill)

input/output	material	unit	amount	description
INPUT	wheat grain	kg	1.43	grain from warehouse, transported to mill (pre-cleaned grains)
INPUT	well water	l	0.0715	50 l/ton of entering grains for conditioning
INPUT	electricity	Wh	107.25	75 Wh/kg entering grain
INPUT	paper package	g	8	kraft paper, 2 kg packaging (16 grams paper packaging per 2 kg flour)
OUTPUT	flour	kg	1.0	extraction rate 70% (allocated by mass)
OUTPUT	bran	kg	0.40	bran = 28% (allocated by mass)
OUTPUT	screenings	kg	0.03	2% cleaning loss

Appendix 9-7 Life Cycle Inventory (MILLING), Functional Unit: 1 kg of wheat flour at mill gate (local service mill)

input/output	material	unit	amount	description
INPUT	wheat grain	kg	1.7	wheat grain from warehouse, transported to mill (pre-cleaned grains)
INPUT	well water	l	0.11	65 l/ton of entering grains for conditioning
INPUT	electricity	Wh	75	45 Wh/kg entering grain
OUTPUT	flour	kg	1	extraction rate 60% (allocated by mass)
OUTPUT	bran	kg	0.5	bran = 30% (allocated by mass)
OUTPUT	screenings	kg	0.17	10% cleaning loss



APPENDIX 9-8A RELATIONSHIP BETWEEN LIFE CYCLE INVENTORY-LCI PARAMETERS (LEFT), MIDPOINT INDICATOR (MIDDLE) AND ENDPOINT INDICATOR (RIGHT) IN THE RECIPE 2016 METHOD OF LIFE CYCLE IMPACT ASSESSMENT.

9.2.2 Midpoint Life Cycle Impact Assessment

The ReCiPe **Midpoint method adopted includes 18 impact categories** covering a broad spectrum of environmental consequences associated with human activities (Appendix 9.2.2 Midpoint Life Cycle Impact Assessment, page 146). These Midpoint categories are further aggregated in the ReCiPe **Endpoint method** into three overarching **Areas of Protection**: **resource availability, ecosystems** and **human health**. This aggregation and normalization simplifies result interpretation and supports decision-making.

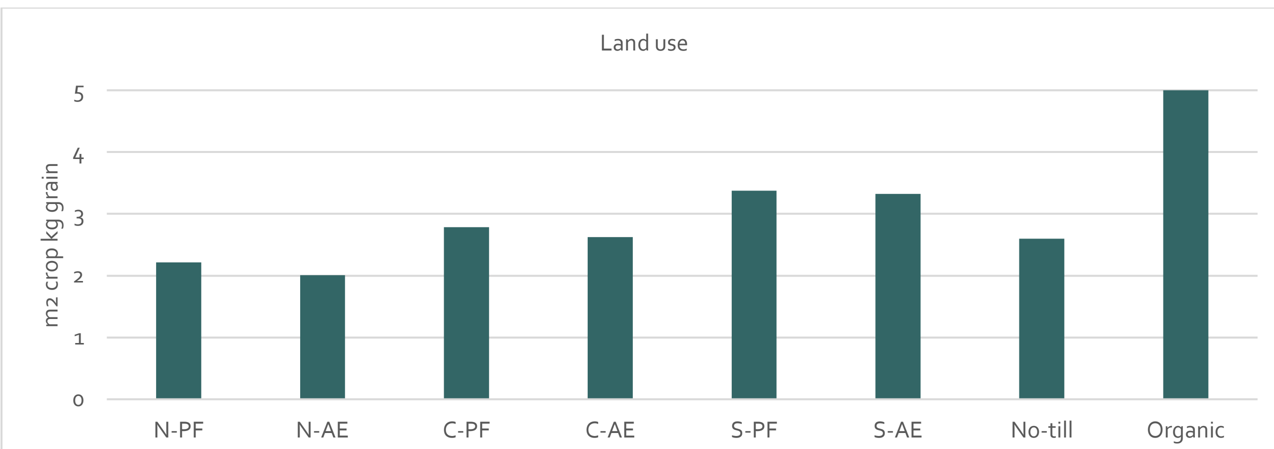
To identify the most relevant stages of the VC and the most influential impact categories, the total environmental burden, expressed as a percentage of the total VC impact from cultivation to processing, was analysed. For this purpose, the ReCiPe Midpoint single-score approach was applied. In this method, characterization, damage assessment, normalization, and weighting convert the original results (in different units) into a unified metric called the “Point”. Results were normalized to 100% to improve readability and comparability.

By calculating each phase’s and category’s share of the total environmental impact, it was possible to identify the key contributors to the overall environmental burden. This selection process allows the discussion to focus on those impact categories and VC phases that are most environmentally significant.

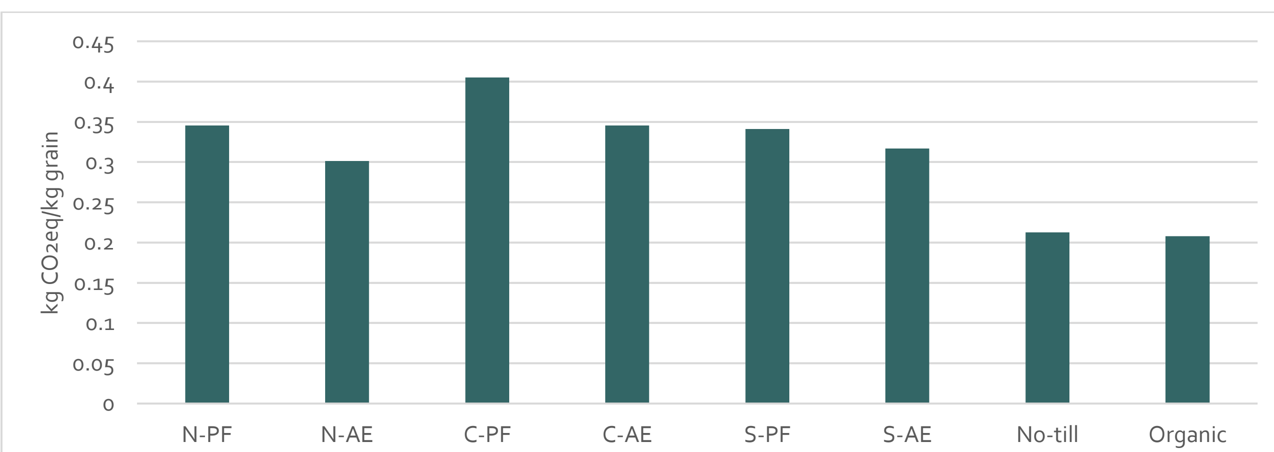
Appendix 9-9 Midpoint impact results per kg of wheat grain at farm gate.

Midpoint Impact Category	unit	N-PF	N-AE	C-PF	C-AE	S-PF	S-AE	No-till	Organic
Global warming	kg CO2 eq	0.35	0.30	0.40	0.35	0.34	0.32	0.21	0.21
Stratospheric ozone depletion	kg CFC11eq	8.20E-06	7.50E-06	9.73E-06	8.74E-06	7.68E-06	7.47E-06	5.31E-06	3.12E-06
Ionizing radiation	kBqCo60 eq	7.31E-04	6.43E-04	8.99E-04	8.07E-04	9.91E-04	9.28E-04	6.76E-04	1.45E-04
Ozone formation, Human health	kg NOx eq	6.93E-04	5.20E-04	7.59E-04	5.32E-04	7.94E-04	6.51E-04	3.82E-04	1.05E-03
Fine particulate matter formation	kg PM2.5 eq	3.64E-04	3.09E-04	4.36E-04	3.57E-04	3.55E-04	3.21E-04	1.91E-04	1.84E-04
Ozone formation, Terrestrial ecosys.	kg NOx eq	7.01E-04	5.26E-04	7.67E-04	5.37E-04	8.03E-04	6.59E-04	3.86E-04	1.06E-03
Terrestrial acidification	kg SO2 eq	2.27E-03	2.00E-03	2.79E-03	2.37E-03	2.09E-03	1.95E-03	1.15E-03	4.64E-04
Freshwater eutrophication	kg P eq	7.39E-04	6.67E-04	9.26E-04	8.73E-04	1.06E-03	1.09E-03	5.80E-05	9.67E-04
Marine eutrophication	kg N eq	8.75E-07	7.53E-07	1.06E-06	9.24E-07	1.15E-06	1.08E-06	7.77E-07	3.52E-07
Terrestrial ecotoxicity	kg 1,4-DCB	2.12E-02	2.08E-02	2.49E-02	2.05E-02	2.16E-02	1.97E-02	1.16E-02	1.16E-02
Freshwater ecotoxicity	kg 1,4-DCB	1.48E-05	1.43E-05	1.79E-05	1.55E-05	1.70E-05	1.61E-05	1.08E-05	4.64E-06
Marine ecotoxicity	kg 1,4-DCB	8.75E-05	7.12E-05	9.83E-05	7.37E-05	9.93E-05	8.43E-05	5.07E-05	1.03E-04
Human carcinogenic toxicity	kg 1,4-DCB	3.43E-05	3.41E-05	4.17E-05	3.62E-05	3.59E-05	3.42E-05	2.17E-05	7.99E-06
Human non-carcinogenic toxicity	kg 1,4-DCB	1.41E-03	1.29E-03	1.66E-03	1.38E-03	1.60E-03	1.46E-03	9.43E-04	8.06E-04
Land use	m2 crop eq	2.21	2.01	2.79	2.63	3.37	3.32	2.60	5.00
Mineral resource scarcity	kg Cu eq	1.33E-04	1.09E-04	1.52E-04	1.42E-04	1.25E-04	1.20E-04	6.33E-05	3.97E-06
Fossil resource scarcity	kg oil eq	4.84E-02	3.97E-02	5.66E-02	4.48E-02	5.01E-02	4.37E-02	2.59E-02	3.66E-02
Water consumption	m3	8.15E-05	7.22E-05	1.01E-04	9.13E-05	1.07E-04	1.03E-04	7.54E-05	1.08E-05

Selected Midpoint results per kg of grain at farm gate (Land use, Global warming, Fine particulate matter, Freshwater eutrophication, resource depletion) for all farmers typologies per kg of grain at farm gate.

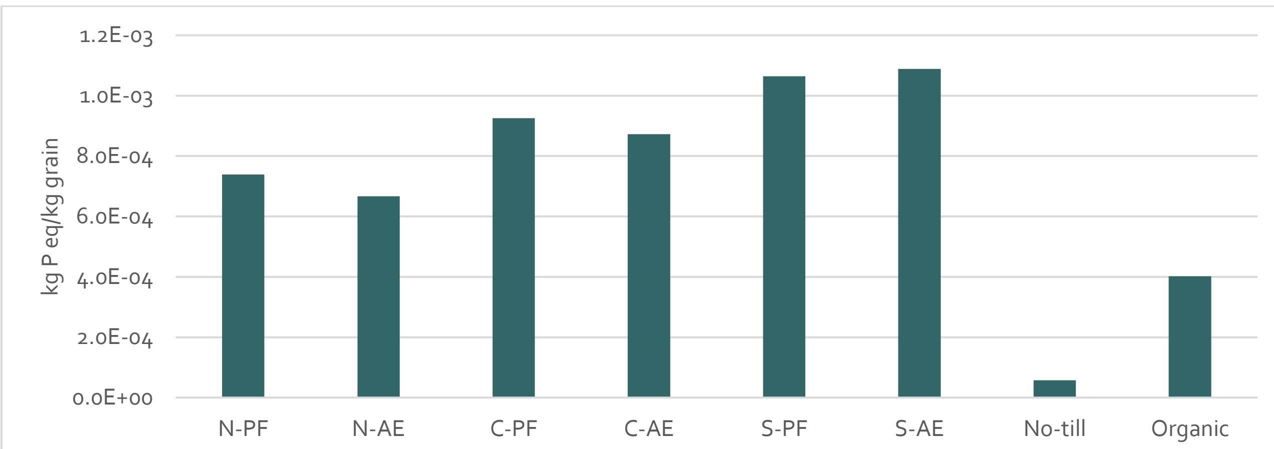


Appendix 9-10 Land use (m2 crop/kg grain at farm gate)

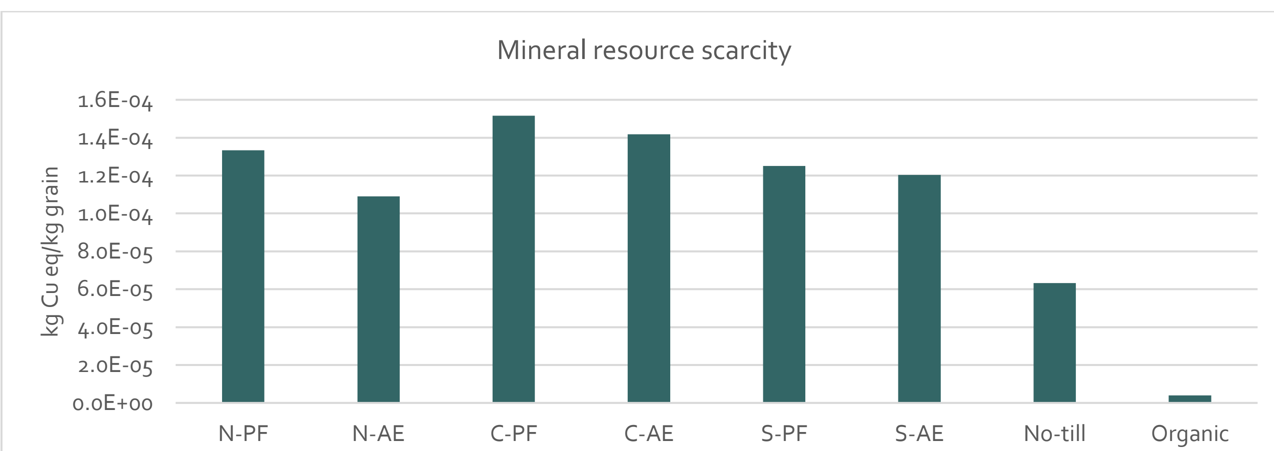


Appendix 9-11 Global warming (kg CO_2eq/kg grain at farm gate)

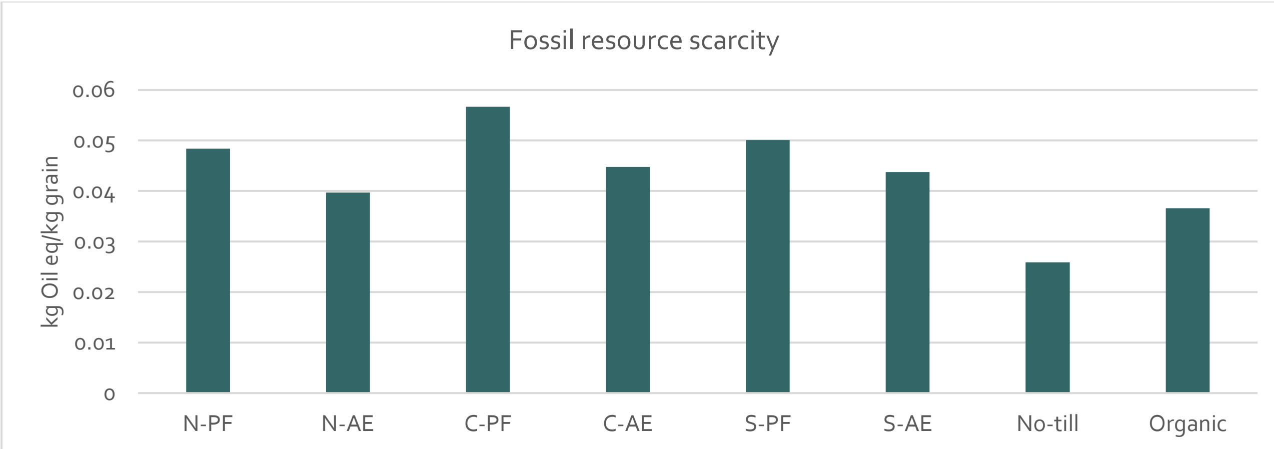
APPENDIX 9-12 FINE PARTICULATE MATTER FORMATION (KG PM2.5EQ/KG GRAIN AT FARM GATE)



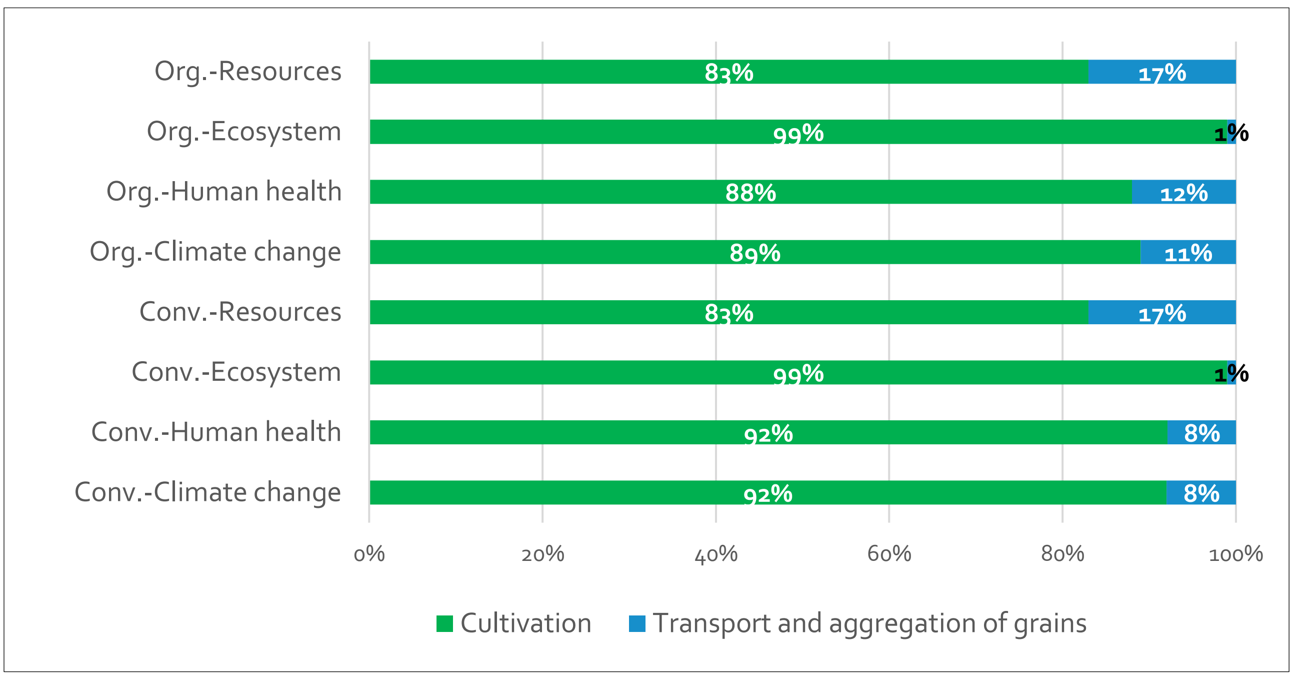
APPENDIX 9-13 FRESHWATER EUTROPHICATION (KG PEQ/KG GRAIN AT FARM GATE)



APPENDIX 9-14 MINERAL RESOURCES SCARCITY (KG CU EQ/KG GRAIN AT FARM GATE)



Appendix 9-15 Fossil resources scarcity (kg Oil eq/kg grain at farm gate)



Appendix 9-16 Relative contribution (%) of cultivation, transport and aggregation of grains, and milling to each selected environmental area of protection and the climate change impact category. Values represent the weighted average across all sub-chains of grain export. Functional unit: 1 kg of grain at export port.

APPENDIX 9-17 LEGEND OF THE CORINE LAND COVER MAP (LAND USE AND LAND COVER CATEGORIES).