VCA4D
VALUE CHAIN ANALYSIS FOR DEVELOPMENT

agrinatura for European Commission

Value Chain Analysis of maize in Georgia

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April 2026

Funded by the European Union

UNIVERSITY of GREENWICH
NRI | Natural Resources Institute

Georgian Farmers' Association

Value Chain Analysis for Development (VCA4D) is a tool funded by the European Commission / INTPA and is implemented in partnership with Agrinatura.

Agrinatura (http://agrinatura-eu.eu) is the European Alliance of Universities and Research Centers involved in agricultural research and capacity building for development.

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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The report was produced through the financial support of the European Union. Its content is the sole responsibility of its authors and does not necessarily reflect the views of the European Union.

The report has been realised within a project financed by the European Union (VCA4D CTR 2017/392-416).

Citation of this report: Yildirim, H., Shubitidze, G., Villani, R., Gelashvili, N., Kochlamazashvili, R. 2026. Maize Value Chain Analysis in Georgia. Report for the European Union, DG-INTPA Value Chain Analysis for Development Project (VCA4D CTR 2017/392-417), 145p + annexes.

VCA4D Project Management Unit Support

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Laura Felisatti, Giorgia Mei, Sara Baumgart | Project Management and Graphic Design

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ACKNOWLEDGMENTS

We would like to express our sincere appreciation to all value chain actors and stakeholders who generously shared their time, knowledge, and valuable information throughout this work. Our special gratitude goes to Mariam Kvilitaia and her family for their warm hospitality, patience, and openness in responding to our questions. We also extend our thanks to the local experts from Georgian Farmers Association for their continuous guidance, consultations, and readiness to provide advice whenever needed. In addition, we appreciate the constructive feedback and helpful comments provided by Denis Reiss from the European Union Delegation in Georgia on the presentations and draft reports. Finally, we would also like to express our sincere thanks to our colleagues in VCA4D Project Management Unit, especially to Frédéric Lançon, who kindly stepped in, ensuring continuity and smooth progress of the work.

ACRONYMS

ADB: Asian Development Bank
FAO: Food and Agriculture Organization of United Nation
FGD: Focus Group Discussion
FTE: Full time equivalent
Geostat: National Statistics Office of Georgia
ha: hectare
IGS: Intermediate goods and services
KII: Key Informant Interview
LCA: Life Cycle Assessment
t: tonne
M: million
MEPA: Ministry of Environmental Protection and Agriculture
NFA: National Food Agency
NGO: Non-governmental organization
PO: Producer organizations
RDA: Rural Development Agency
VA: Value added
VC: Value chain
VCA4D: Value Chain Analysis for Development
WB: Word Bank

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 channeling 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
1€=2,945516 GEL (average exchange rate in 2024) (Source: National Bank of Georgia[1])

[1] https://nbg.gov.ge/en/monetary-policy/currency

EXECUTIVE SUMMARY

Functional Analysis findings

The functional analysis aims to provide an overall description of the value chain (VC) system. It identifies and characterises the main actors and stakeholders involved, while also highlighting key strategic development challenges. From the outset of the study, it enables the VCA4D multidisciplinary team to develop a shared understanding of VC operations and to define the scope of analysis.

Key elements include establishing typology of actors, identifying sub-chains and defining the geographic and temporal scope. These elements form the basis for the three core analyses (economic, social, environmental) and help address the framing questions.

The VC system is structured around several core components: the sequence of products, the actors involved, the functions they perform, the flows linking them, and the overall organisation and governance of the VC.

Building on this framework, the findings of the Functional Analysis for the maize VC in Georgia are presented below.

Agriculture plays a major role in the Georgian economy with a contribution of 6.2% to GDP[2] and maize is one the major cultivated crops. Total sown areas of annual crops in 2024 was 191,500 ha[3], and According to National Statistics Office of Georgia, nearly 36% was dedicated to maize production (harvested area of maize 68,900 ha).

Maize area in Georgia shows a clear declining trend over the period 2021-2024. Sown area decreased from 79.4 thousand hectares in 2021 to 70.0 thousand hectares in 2024, while harvested area declined from 76.4 to 68.9 thousand hectares over the same period**. The national production of maize in the reference year 2024 was 211,500 tonnes, which gives average yield around 3t/ha.** Average yield has increased over the years but they are generally stated to be rather low and varied throughout the regions.

Maize is cultivated across the entire country but Kakheti, Imereti, Samegrelo-Zemo Svateni, Kvemo Kartli and Shida Kartli are the leading producing regions. Together they account for 90% of national production (with individual contributions of 29%, 23%, 20%, 9%, 9% respectively).

Western Georgia features distinct ecological characteristics with high rainfall and humidity and offers suitable conditions for agricultural production. These areas are characterized by high fragmentation of land into very small family-owned parcels (typically up to 0.5 ha), which are commonly used for subsistence or small-scale production. Thus, farming in this region typically involves smaller land plots, generally without irrigation (though drainage systems are sometimes used), and often focuses on white maize production, which is part of the local culinary tradition and serves as a staple food. In contrast, Eastern Georgia has a drier climate, but irrigation infrastructure has been expanding, contributing to increasing yields. The region also benefits from economies of scale, as farms tend to operate on larger land plots compared to those in Western Georgia.

[2] Source: https://www.geostat.ge/en/modules/categories/196/agriculture
[3] https://www.geostat.ge/en/modules/categories/196/agriculture

Silage production is also significant in Eastern Georgia in an estimated cultivated area of 2800 ha. The yield is 30 tonnes per hectare. Silage production is mainly on-farm and integrated with livestock activities.

The typology of maize farmers has been built on the basis of the average size of their farm, by relying on the 2014 Agricultural Census insight. They are grouped in 4 categories: micro farmers, small farmers, medium-scale farmers and large-scale farmers (Table ES *1*).

TABLE ES 1: TYPOLOGY OF MAIZE FARMERS AND PRODUCTION CHARACTERISTICS (2024)

	Micro farms	Small-scale farms	Medium-scale farms	Large-scale farms	Georgia
Estimated number of maize farms	172,155	44,877	839	75	217,947
Total agricultural land holding (ha)	17,216	40,389	7,552	3,743	68,900
Production (t)	41,432	108,555	34,387	27,127	211,500
Yield (t/ha)	2.4	2.7	4.5	7.2	3
Average area per farm (ha)	0.1-0.2	1	10	50	
Production share (%)	19.6	51.3	16.3	12.8	100

A **micro farm** refers to a very small agricultural holding, typically less than < 0.5 ha, particularly in the western part of the country. These are mostly subsistence farms, where households cultivate a mix of products (grains, vegetables) on small plots of land and keep small livestock. They are characterized by low input-use and limited mechanization, relying mainly on family labour.

Micro farms are generally highly diversified production systems in which maize cultivation is only one component of broader household livelihood strategies. In addition to maize, households commonly maintain small vegetable gardens, fruit trees and vineyards, while raising poultry, pigs and one or two cattle for household consumption and supplementary income. This diversification helps reduce production risks, supports food security and provides a continuous supply of food throughout the year. In addition to agricultural production, many micro-farm households diversify their livelihoods through off-farm activities such as seasonal wage labour, remittances from family members working in urban areas or abroad, small-scale trading, and public sector employment. As a result, household income is typically derived from multiple sources, with maize representing only one component of a broader livelihood strategy. The combination of crop production, livestock keeping, and non-farm income sources increases resilience to market fluctuations and climatic shocks while reducing dependence on a single agricultural commodity.

Micro farms cultivate mostly local white and, to a lesser extent also yellow hybrid maize. While a small portion of the white maize grain is stored as seed, the rest is sent for milling so that households can consume it in the form flour or bran. Yellow maize, on the other hand, is typically used by micro farmers to feed their small livestock such as poultry.

Small farms typically ranging from 0.5 to 4.99 ha, dominate much of the western lowlands, as well as parts of central and eastern regions. They account for 50% of total maize production, reflecting their importance alongside micro farms. They cultivate both white local and yellow hybrid maize.

Like micro farms, small farms in Western Georgia are often characterized by mixed farming systems that combine maize production with vegetables, fruit orchards, vineyards and livestock activities. Many households keep cattle, poultry and pigs, while producing vegetables and fruits primarily for self-consumption, with surplus products occasionally sold in local markets. As a result, maize plays an important role within diversified family farming systems rather than functioning as a stand-alone commercial crop.

Households combine maize production with dairy cattle, beef production, fruit growing, viticulture, vegetables, and in some cases small-scale processing activities. Income is therefore generated from a combination of crop sales, livestock products such as milk and cheese, occasional livestock sales, seasonal fruits and vegetables, and non-agricultural employment. The relative importance of each activity varies according to agroecological conditions, market access, and household resources. This diversification strategy contributes to household food security and helps stabilize farm income throughout the year. These farms participate in informal or semi-formal markets, selling part of their output, especially grains such as maize and vegetables.

Medium-scale farms range between 5 and 49.99 ha and are mostly located in Eastern Georgia. These farms are characterized by conditions that allow for monocropping on larger plots. Both white and yellow maize are cultivated, with yellow hybrid maize being dominant. Production is relatively diversified, including both grain and silage maize, with a significant share of grain intended for market sales. Silage is mainly used for livestock in integrated farming systems. Semi-commercial operations are often managed by family members. Irrigation practices may vary within this category, but furrow irrigation appears to be the most dominant.

Compared with smaller farms, medium-scale producers are generally more market-oriented and often operate integrated crop-livestock systems. Maize production is frequently linked to dairy and beef cattle farms, with grain marketed and silage retained for on-farm feed use. This integration creates synergies between crop and livestock production, supporting nutrient recycling and reducing dependence on purchased feed. Field observations indicate that medium-scale farms often represent transitional farming systems between traditional family farming and fully commercial operations. While maize remains a central activity, revenues are frequently generated through a combination of grain sales, livestock production, silage utilization, and, in some cases, other field crops such as wheat, barley, sunflower, or vegetables. This diversified commercial orientation allows farms to spread risks and optimize the use of machinery, labour, and land resources across different production activities.

Large-scale farmers cultivate in land ≥ 50 ha and like medium-scale farms, are mostly located in Eastern Georgia. Yellow hybrid maize is the predominant crop. Capitalization levels and access to equipment are the highest among large-scale farms. They exhibit higher yields, with some farmers reporting yields of 12-14 t/ha under furrow or pivot irrigation. VCA4D field missions have highlighted the significant presence of pivot irrigation systems on a few large farms in Eastern Georgia. A substantial portion of the grain production is marketed through traders while silage is mainly used on-farm for livestock consumption.

Many large-scale maize producers are closely linked to commercial livestock operations, particularly dairy and beef production, where maize serves as a strategic feed crop. As a result, production systems are often specialized around crop-livestock integration, combining irrigated grain and silage production with intensive livestock enterprises. In some cases, large agricultural enterprises also integrate other field crops, grain storage facilities, feed production, machinery services, or trading activities, generating revenue from multiple agricultural business segments and benefiting from economies of scale. Such farms are generally more integrated into formal markets and VC networks than smaller producers. This contrasts with the highly diversified subsistence-oriented systems observed among micro and small farms in Western Georgia.

Georgia also imports maize grain at cheaper price, mainly from Russia, which amounted to 71,000 tonnes in the reference year 2024.

Among the downstream actors, millers play an important role as they are the main recipients of white maize grain, which they process into flour. These are small-scale artisanal millers across the country. Compared to yellow maize, white maize flows less between farmers and traders, as it is, in most cases, sent directly by farmers to millers.

There are around 230 traders estimated to be involved in the maize trading in the country. A large number of them are estimated to be small-scale but with a significant capacity comparable to that of a medium-scale trader. Traders are more likely to purchase yellow maize grain from medium and large-scale farmers.

Figure ES *1* illustrates the main flows and actors for the maize VC in Georgia for the reference year 2024.

Both domestically produced and imported maize are primarily sold to domestic actors in Georgia. In 2024, only 10,563 tonnes of grain were exported (to Iran), while the remainder was marketed by traders to livestock, poultry and pig farms, as well as to feed millers.

The VCA4D team identified two main sub-chains based on regional characteristics and the maize varieties used for consumption purposes although the actors do not operate in isolation. The first is food-maize sub-chain, characterized by the cultivation of white maize in Western Georgia, primarily by micro and small-scale farmers. As this sub-chain is oriented toward human consumption, it is more closely linked to Georgian gastronomy and holds greater socio-cultural significance within overall maize production.

The second sub-chain is characterized by the production of yellow maize and silage for animal feed. It involves primarily medium and large-scale farms concentrated in the eastern regions. Traders play a significant role in this sub-chain, particularly in the import and distribution of maize.

These two sub-chains also differ in their farming practices, with lower input level and less intensive mechanization in the first sub-chain, and due to regional climatic and environmental conditions in the western and eastern regions. The western region is more humid, often requiring drainage of agricultural plots, and is characterized by smaller farm sizes, whereas the eastern region is drier, and therefore relies more heavily on irrigation.

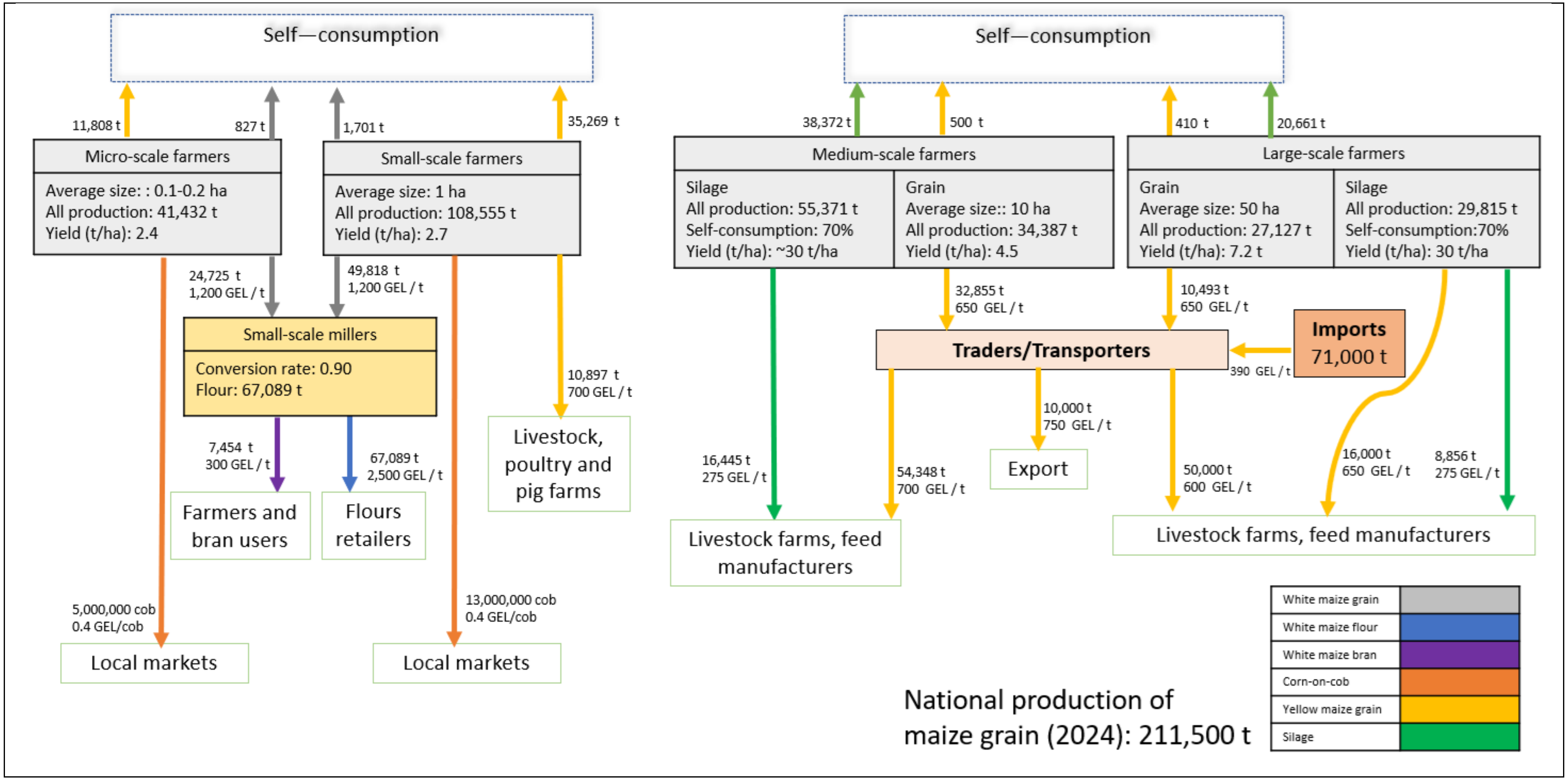

FIGURE ES 1: FLOW CHART OF THE MAIZE VC IN GEORGIA (2024)

The VC organization is primarily characterized by short, private marketing circuits, structured around semi-commercial relationships among farmers and other private actors. At the distribution level, a diverse range of small, medium and large-scale traders are involved in the marketing of flour and yellow maize grain. For imported maize, the marketing circuit is longer, as traders transport maize grain over long distances from farms in Russia to the domestic market.

Farmers' strategies are driven by the pursuit of high yields, both to ensure household consumption and to generate cash income, whenever climatic and soil conditions allow. However, most micro and small-scale farmers face challenges of access to inputs, agricultural machinery and extension services. Land fragmentation also remains an issue in these structures. Despite the significant potential to adopt improved cultivation techniques in medium and large-scale farms, there is also a strong emphasis on on-farm-storage and drying facility, to a lesser extent, on improving access to inputs and credits.

Horizontal coordination within the maize VC is mostly informal. While micro and small-scale farmers tend to operate individually and rely mainly on household labour and local networks, some forms of informal cooperation are observed among medium and large-scale farmers, particularly in joint procurement of inputs, shared use of machinery and coordinated access to service providers (e.g. irrigation or agricultural drones). Despite the presence of some associations (e.g. GFA, Elkana) formal farmer organizations and cooperatives are overall underdeveloped and the lack of strong and inclusive producer organizations constrains collective action, bargaining power and knowledge sharing across the VC. Vertical coordination is also weak as most exchanges between farmers, traders, processors and input suppliers are conducted through informal arrangements, often without written contracts.

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

The maize VC in Georgia, although facing challenges of dual structures of traditional and mechanized systems, provides positive operating profits for the actors involved and generate important macroeconomic impacts on a country with nearly 4 million inhabitants. According to our calculations based on 2024 data, it represents less than 1% of the national GDP but the activity of maize farmers alone accounts for 2.7% of the agricultural GDP.

Direct value added (VA) generated by the maize VC amounts to 155 million GEL (€ 52.6 million). Grain and silage farming generate 80% of this VA. Micro and small-scale farmers, together, account for 57% of the VA generation which shows that the maize VC is highly smallholder driven.

Total VA (direct and indirect VA) was estimated at 200 million GEL (€ 68 million) for the reference year 2024. This total VA is composed mainly of operating profits generated by direct and indirect actors, followed by wages paid to workers. Farmers, input suppliers and flour processors are the main contributors to total VA generation.

There are no direct subsidies or expenses on VC's operations by the State. However, the government has introduced a range of mechanisms to support agricultural actors and improve productivity and rural livelihoods. These mechanisms cannot be considered as direct subsidy program as it does not provide cash payments to VC actors nor guarantee any price support. The public finance balance is estimated to be positive, despite limited direct tax revenues and indirect support to the VC through the preferential agro-credit programme, under which the government co-finances part of the interest.

The VC can't escape the negative trade balance faced by the country (negative of 31.6 million GEL, (€ 10.7 million) as the value of exports of the VC is lower than the value of imported intermediate goods that are used in production operations. While a certain level of imports is necessary to sustain VC activities, continued reliance on imports may pose long-term risks. The situation has two sides. On the one hand, although imports required for maize-related activities are significant, these VC activities contribute to food security by supporting domestic production, thereby reducing the need for additional food imports. On the other hand, imports of yellow maize are mainly linked to the feed sub-chain, meaning that the food sub-chain is less affected and continues to support white maize as a staple for human consumption.

Yet, the integration rate within the national economy is relatively high (73%), meaning the VC offers potential to offset foreign exchange losses related to consumable imports. In other words, maize VC imports key inputs for its operations (yellow maize grain, fertilizers, seed, etc.) but a considerable part of the value-creating activities take place domestically.

Economic results by sub-chain illustrate that, both sub-chains can provide a basis for the development of the processing sector. Transformation creates added value at each stage, which leads to higher VA per tonne for the national economy. Both generate income and employment, support national economic growth, foster economic activity in remote areas, and show potential for social and environmental sustainability. Adopting differentiated strategies for each, while considering their complementarities, is essential to promote synergies, generate mutual gains and strengthen their roles in Georgia's food security.

Framing question 2: Is this economic growth inclusive?

Economic analysis showed that the VC distributes 77% of the direct VA as net profits to VC direct actors and 9% in wages. Vulnerable actors, such as micro and small-scale farmers, together receive nearly 60% of total VC profits. From this perspective, the economic growth generated by the maize VC is inclusive in the sense that income benefits small-scale actors although these actors are dispersed and lack collective organization.

This positive image of inclusiveness, however, changes when comparing per capita income by actors. While a large number of small actors earn relatively low profits, a limited number of large actors capture substantially higher returns from VC activities, indicating a remarkable level of inequality in income distribution. Consequently, while many micro and small-scale maize farmers dominate total share of profits, per capita income remains higher among larger-scale actors.

Employment in the maize VC is production stage driven at maize farms, although mechanization is also present. Micro farms primarily rely on family labour and therefore generate limited employment. In contrast, large-scale actors, provide both skilled and unskilled jobs. Most employment at the farm level is temporary, consisting of agricultural work during cultivation and harvest periods, yet some permanent positions for skilled workers also exist.

Women, as part of vulnerable groups, are actively involved in farming activities, particularly in micro farms. They also occupy skilled positions in medium and large-scale farms, although their representation remains lower than that of men. A notable wage gap exists between women and men, with average monthly earnings of approximately 1,770-1,780 GEL for women compared to about 2,650 GEL for men.

Overall, the maize VC generates 912 Full Time Equivalent (FTE) jobs in the reference year. Male employment accounts for nearly 80% of total FTE jobs.

Is value chain socially sustainable?

The social analysis of the maize VC in Georgia indicates a mixed performance, where the sector plays a significant role in rural livelihoods and food security but faces structural challenges affecting social sustainability and inclusiveness.

Working conditions are characterized by high levels of informality, relatively low wages and limited social protection. Most employment relationships are based on verbal agreements, resulting in weak labour protection, limited access to paid leave and absence of employer-based health insurance. Occupational safety standards remain low, with inadequate infrastructure and limited use of protective equipment. Although larger farms offer relatively better conditions, informal employment dominates across all farm types. The sector is also affected by an ageing workforce and increasing labour shortages.

Land and water rights are generally secure from a legal perspective; however, their effective use is constrained by structural factors. Land fragmentation increases production costs and limits the adoption of modern technologies, while informal and short-term rental practices discourage long-term investment. Access to irrigation and drainage infrastructure remains uneven, limiting productivity and sustainability across regions.

Gender disparities remain significant throughout the VC. Women play an important but often under-recognized role, particularly in labour-intensive and lower-paid activities, while men dominate mechanized operations, access to land and higher-value market segments. Women are also active in downstream activities such as processing and trade, although their participation remains more informal and less remunerated. At the same time, examples of female leadership demonstrate the potential for greater inclusion. Social inclusion challenges persist, particularly for ethnic minorities, who are largely concentrated in lower-skilled positions, with limited upward mobility.

Food and nutrition security remains a critical concern in Georgia, shaped by structural vulnerabilities including high dependence on food imports, low agricultural productivity and income inequalities. Maize plays a key role both as a staple food particularly white maize in western regions and as a major input for livestock production through yellow maize and silage.

Social capital within the VC is significant but unevenly distributed. Strong community-based networks support smallholder farmers, but access to institutional and market linkages is concentrated among medium and large farms. This creates inequalities in access to resources, services and opportunities. Formal farmer organizations remain weak, and cooperation is largely informal, limiting common action and VC coordination.

Living conditions in rural areas remain below those in urban areas, reflecting significant disparities in income, infrastructure and access to services. Rural households face higher poverty rates, lower-quality housing and limited access to water, sanitation, energy and transport infrastructure. While basic healthcare services are broadly available through universal coverage, access to specialized services is constrained by distance and cost. Education and training opportunities are also more limited, particularly in remote areas, contributing to higher rates of youth disengagement and weaker human capital development. These constraints disproportionately affect women and reinforce existing inequalities.

Overall, the maize VC can be considered only partially socially sustainable. While it contributes to employment, livelihoods and food security, improving labour formalization, strengthening occupational safety, addressing land fragmentation, enhancing gender equality, strengthening farmer organizations and improving rural infrastructure and service access will be essential for achieving more inclusive, resilient and sustainable development outcomes.

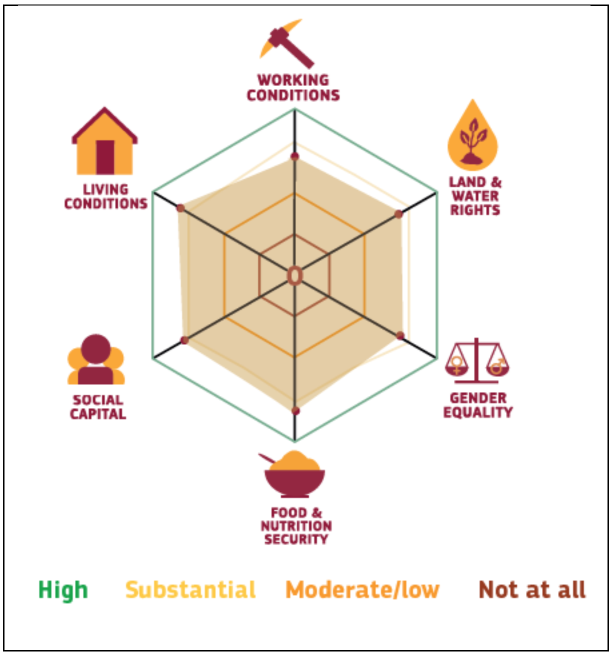

FIGURE ES 2: SOCIAL PROFILE OF THE MAIZE VALUE CHAIN IN GEORGIA

Framing question 4: Is the value chain environmentally sustainable?

The environmental analysis provides an assessment of the environmental performance and biodiversity risks associated with the maize VC in Georgia. The study integrates Life Cycle Assessment (LCA), Geographic Information System (GIS) analysis, and stakeholder consultations to identify the main environmental hotspots and potential areas for improvement.

The Life Cycle Assessment evaluated the environmental impacts of maize production and processing across the main VC outputs: maize grain for feed, maize silage for livestock feeding, and maize flour for human consumption. Environmental impacts were calculated using several functional units, including 1 kg of maize grain at farm gate, 1 kg of maize grain at the end user gate, 1 kg of maize silage at farm, and 1 kg of maize flour for human consumption. The assessment focused on three key areas of protection, namely **resource depletion**, **ecosystem quality**, and **human health**, and included the additional impact categories of **climate change** and **water consumption**.

Across all product streams analysed, the cultivation stage dominates the environmental profile of the maize VC, accounting for the vast majority of total impacts. Downstream stages such as transport and milling contribute only marginally to the overall environmental footprint. The most significant impact categories are land use, climate change, and fine particulate matter formation, largely associated with agricultural practices during the cultivation phase.

In terms of resource depletion, impacts are relatively moderate and are mainly associated with the use of diesel fuel for field operations and mineral fertilisers, particularly nitrogen fertilisers. Improving input efficiency, through better fertiliser management, precision fertilisation, and improved agronomic practices, would reduce pressure on finite mineral and fossil resources while also improving productivity.

Regarding ecosystem quality, impacts are driven primarily by land occupation and nutrient-related emissions from fertiliser use. Low yields observed in many smallholder systems increase land requirements per unit of output, leading to higher ecosystem impacts per kilogram of product. Improving crop productivity through better soil fertility management, improved seeds, and enhanced agronomic practices would reduce environmental impacts while increasing production efficiency.

The human health impact associated with the maize VC is relatively low when compared with other environmental health risks. Most of these impacts are linked to air emissions generated during cultivation, particularly ammonia and nitrogen oxides associated with fertiliser application and fuel combustion. However, the LCA methodology does not capture direct occupational exposure to agrochemicals. Evidence from stakeholder consultations indicates that the use of personal protective equipment (PPE) when handling pesticides and herbicides remains limited, suggesting a need for improved awareness and enforcement of safety practices among agricultural workers.

In terms of climate change, greenhouse gas emissions are largely generated during the cultivation phase, mainly through nitrous oxide emissions from nitrogen fertiliser application and fuel use during field operations. Emissions from maize grain production range between 0.34 and 0.44 kg CO_2eq per kg of grain, placing Georgia at the lower end of the range reported in international studies. This reflects the relatively moderate use of inputs in many Georgian maize production systems. Improving nitrogen use efficiency remains one of the most effective strategies for further reducing emissions while maintaining productivity.

Water consumption represents an additional environmental dimension of relevance in the Georgian maize VC. In rainfed systems, water consumption is negligible and limited mainly to indirect water use associated with input production. In irrigated systems, primarily located in the drier eastern regions of the country, water use increases significantly. Irrigation practices such as furrow irrigation may lead to relatively high water consumption and may also contribute to soil erosion. Recent policy reforms introducing volumetric pricing for irrigation water are expected to encourage more efficient water use and improve irrigation management.

The biodiversity assessment shows limited overlap between maize cropland and protected areas. A GIS-based spatial analysis using Corine Land Cover 2023 data and the Emerald Network of protected areas (although limited to the regions of Kvemo Kartli and Kakheti due to data availability) indicates that cropland rarely overlaps with protected habitats. Only small localized intersections were observed in the Gardabani district, suggesting a generally low direct biodiversity pressure from maize cultivation on protected areas within the analysed regions.

Overall, the maize VC in Georgia exhibits relatively low to moderate environmental impacts per unit of output, particularly when compared with more intensive maize production systems internationally. Nevertheless, targeted improvements in agricultural practices could significantly enhance the environmental sustainability of the sector. Priority areas include improving fertiliser management and nitrogen use efficiency, strengthening soil and water management practices and improving awareness and enforcement of safety standards in agrochemical handling.

Beyond production practices, maintaining and enhancing landscape elements such as hedgerows, riparian vegetation, field margins and tree belts, together with the development of agroforestry practices, could further strengthen biodiversity and ecological resilience in agricultural landscapes.

Conclusion and recommendations

The maize VC is strategically important for Georgia, even with its limited global presence. It plays a key role in sustaining rural livelihoods, supporting livestock, and preserving food traditions. With stronger coordination, targeted investment, and supportive policies, the sector has the potential to deliver broader economic, social, and environmental gains in the coming years.

However, there are several pressures affecting the maize VC. Droughts are becoming more common due to climate change, placing irrigated farming systems at risk. In parallel, the sector is facing demographic and economic challenges, including an ageing rural population and limited financial incentives, which are leading to a decline in small-scale maize production. This combination of factors undermines the country's ability to meet demand and raises the likelihood of continued reliance on imports.

Our results show clear imbalances in profit distribution: small farms depend on it for subsistence, while larger operations and market actors benefit commercially. Regional differences are also pronounced, with subsistence-based white maize in the west and more commercial yellow maize production in the east. Increasing productivity offers opportunities, but sustainable approaches are essential to avoid degrading soil and water resources.

Maize production can play a key role in responding to these pressures, in particular within integrated farming systems. These systems help improve soil health, support better nutrition, and lower risks for farmers compared to monocropping. In Georgia, the strong tradition of maize cultivation creates a solid foundation for expanding such approaches. Strengthening the links between maize and livestock production can further boost farm resilience by improving cost efficiency, product quality, and overall profitability.

The following recommendations draw on an interdisciplinary approach that integrates economic, social, and environmental findings. Their applicability and constraints may be further assessed with stakeholders through a multi-stakeholder workshop upon completion of the study.

From a general perspective, strengthening domestic productivity and competitiveness is a key priority for the maize VC in Georgia, particularly to reduce structural dependence on feed maize imports. Achieving this will require targeted investments in irrigation systems in eastern regions, rehabilitation of drainage infrastructure in the west, expanded use of certified seeds, improved access to mechanization services, and enhanced advisory support on modern agronomic practices. Productivity gains on existing land would support both self-sufficiency and farm profitability. Additional specific recommendations are outlined below (see section 6.5 for a comprehensive list):

- **Developing a national strategy for the maize value chain**

A comprehensive approach is needed for the development of the maize VC, taking into account the distinct features of the food and feed sub-chains while preserving their complementarity in integrated farming systems. As both sub-chains are affected by structural and market challenges, these should be addressed at the national level through a dedicated strategy that defines an enabling business environment and appropriate fiscal framework specific to maize.

- **Adopting differentiated strategies for white and yellow maize**

Public support should reflect the fact that maize in Georgia operates through two partly distinct sub-chains with different roles. White maize is mainly associated with household consumption, traditional foods, and smallholder farming, especially in Western Georgia. In contrast, yellow maize is more market-oriented and closely linked to livestock feed demand in Eastern Georgia. As a result, policies should be tailored: white maize should be supported through cultural promotion and quality branding, while yellow maize should focus on improving competitiveness, scaling production, and strengthening market integration.

- **Supporting smallholders**

Given the dominant role of micro and small farms in maize production, inclusive support measures remain essential. Improved access to finance, machinery-sharing schemes, crop insurance, and farmer training would help smaller producers raise yields and participate more effectively in markets.

- **Enhancing linkages with the feed industry**

Closer integration between maize producers and the livestock feed industry would further strengthen the sector. Long-term contract farming arrangements may place farmers in a disadvantaged position when bargaining power is uneven and quality standards are strict, creating the risk of product rejection. Therefore, improved coordination mechanisms between producers and buyers remain important. From this perspective, organized marketplaces with structured sorting and quality standards could facilitate transactions and trade, while increasing domestic sourcing of yellow maize by feed mills, poultry farms, and livestock enterprises. Such linkages would reduce transaction costs, improve market certainty for farmers, and partially substitute imports.

- **Improving post-harvest handling, storage and processing**

Investments in post-harvest infrastructure should constitute another strategic priority. Drying facilities, moisture testing systems, storage capacity, and local collection centres would reduce quantitative and qualitative losses while improving market timing for farmers. At the processing level, modernization of small and medium milling enterprises could improve flour quality, packaging standards, food safety compliance, and value addition for domestic white maize products.

- **Improving farm working conditions and supporting women and young farmers**

Improving basic working conditions is essential to making maize farming safer and more attractive as a livelihood. Raising farmers' awareness of the importance of adequate working conditions is key to improving worker safety and overall farm performance. Medium- and small-scale young farmers have strong potential to enhance productivity if adequately supported. In addition, many women are actively managing farms, and targeted support measures for both women and young farmers can increase the inclusiveness of the VC while also strengthening the efficiency and productivity of these farms.

- **Mitigating social risks**

Social analysis identified risks that can be mitigated through a set of complementary measures. Priority actions include improving working conditions by promoting formal employment arrangements, enhancing farm infrastructure and occupational health and safety practices, and reinforcing labour inspection. Investments in modern irrigation and drainage systems, together with support for medium-sized farmers, are recommended to address land degradation and improve water management. Modernising the maize VC to increase the availability of locally produced maize will also contribute to strengthening food and nutrition security. Finally, improvements in value chain governance and institutional arrangements, together with investments in rural infrastructure—including farm facilities, access roads and electricity—will strengthen social capital, enhance living conditions, and support the long-term social sustainability of the VC.

- **Promoting efficient use of resources at farm level**

Key areas for intervention should include:
• Improving fertiliser management and nitrogen use efficiency, through soil testing, better timing of applications, and improved advisory services, in order to reduce emissions, improve input efficiency, and enhance soil fertility.
• Enhancing irrigation efficiency and water management, particularly in eastern Georgia, through improved irrigation technologies, better infrastructure maintenance, and policies encouraging efficient water use.
• Strengthening soil conservation practices, including crop rotation, cover cropping, residue retention, contour planting, and reduced tillage, in order to reduce erosion risks and improve soil health.
• Improving drainage management in waterlogged areas, particularly in western Georgia, where poor drainage infrastructure limits agricultural productivity and land use efficiency.

- **Enhancing biodiversity in agricultural landscapes**

At the landscape level, maintaining and restoring hedgerows, riparian buffers, and tree belts, together with the promotion of agroforestry practices, would further strengthen biodiversity, reduce erosion, and improve the resilience of agricultural ecosystems.

- **Strengthening value chain data and information**

Although some information is available, the VC more broadly, suffers from a lack of up-to-date data and statistical coverage. It seems crucial to produce more recent data and to focus on specific segments or population groups in order to analyze their evolution over time (e.g. micro and small-scale farmers, artisanal village millers, imported maize traders, etc.). The VC is complex in the sense that it involves a large number of small and geographically dispersed actors. To address this complexity, it is also important to make use of territorial data in order to better capture regional specificities of the maize VC, from production to trade. This would improve understanding of the flows and price dynamics that shape VC performance.

In summary, stronger sector governance and data systems are needed to guide evidence-based policy making. Updating agricultural census information, improving statistical distinction between white and yellow maize systems (grain and silage), and strengthening dialogue between MEPA, Rural Development Agency, private agribusiness actors, and producer organizations would significantly improve strategic planning. With coherent and differentiated support measures, the maize VC could substantially increase its contribution to rural incomes, food security, and sustainable agricultural development in Georgia.

INTRODUCTION

This maize value chain (VC) analysis is being undertaken in Georgia as part of a number of studies commissioned under the Value Chain Analysis for Development (VCA4D) Project funded by the European Union DG-INTPA and implemented by Agrinatura[4]. The principal aim of the VCA4D is to produce evidence-based quantitative data and analytical information, to underpin policy actions and interventions in the selected VCs.

Analysing VCs provides a comprehensive framework for understanding how value is created, distributed, and captured among different actors, while identifying opportunities to improve efficiency, inclusiveness, and sustainability. It helps to highlight key impacts, understand the main transmission pathways, and determine at which stages of the chain and for which actors investments and targeted support would be most effective.

Background of the study

The choice of the maize VC in Georgia was made by the European Union Delegation (EUD) in Georgia in the aim of reflecting on the bottlenecks that hinder its sustainable development. The findings will help the EUD to support Georgia's irrigated crop management system, particularly under the "Sustainable and Inclusive Irrigated Agriculture Development in Georgia" project. The study will also align with ENPARD evaluation recommendations, focusing on VC and regional development approaches to unlock the agricultural sector's full potential. The findings of the VCA4D study will also support the EU in potentially structuring new action on Sustainable Food Systems and Rural Development. The study also includes capacity strengthening activities. Although the maize VC shows limited impact on sectoral associations, maize producers of all sizes, small, medium, and large, are represented by the Georgian Farmers Association (GFA). The GFA plays a crucial role as a strategic implementing partner in the ongoing programme ENPARD funded by the EU in Georgia. For this reason, the GFA is the key actor in the capacity strengthening component of the study. The maize VC study also aims to build knowledge and promote the use of the study's methodology within the GFA's research department.

Methodological framework

The VCA4D methodology aims to generate evidence-based insights supported by indicators measured either quantitatively or through expert assessments, which can be updated and monitored over time. A multidisciplinary perspective lies at the core of the methodology, enabling VCA4D to assess the inclusiveness and sustainability of agri-based value chains (VCs) across the three dimensions of sustainable development: economic, social, and environmental.

The information produced through VCA4D helps identify constraints, weaknesses, and bottlenecks within VCs, thereby informing policymakers and stakeholders about priority areas for intervention to strengthen sustainability and inclusiveness. The expert assessment of quantitative indicators

[4] Agrinatura is an association of European universities and research centres working on the objective of agricultural development in a sustainable manner.

also makes it possible to establish baseline conditions and provide an accurate description of the circumstances and roles of the different actors involved in the VC.

Through repeated assessments and updates, VCA4D further enables the monitoring of how development initiatives contribute to the achievement of the United Nations Sustainable Development Goals (SDGs) and the strategic objectives of the European Commission, particularly those related to the Directorate-Generate International Partnership (INTPA).

The VCA4D methodology is structured around four Framing Questions:

i) What is the contribution of the value chain to economic growth?

ii) Is this economic growth inclusive?

iii) Is the value chain socially sustainable?

iv) Is the value chain environmentally sustainable?

The analytical process is three-fold:

1. Implementing a functional analysis by setting out the overall VC operating features and inquiring about its general organisation and the main trends and market perspectives. Functional analysis is both a starting point by which the team of experts arranges its work plan, and a continuous work of refinement throughout the study. It benefits to and from the other forms of analysis, allowing to build a common understanding. It includes the definition of a typology of actors and the identification of sub-chains. Both are used by the whole team and must be relevant to outline the benefits and drawbacks for the various stakeholders at the various stages of the VC.

2. Performing economic, social and environmental analyses in order to respond to the four Framing Questions. These investigations are guided by a set of sub-questions, called Core Questions, which:

- point to required significant indicators;
- guide the assembly and processing of data (quantitative and qualitative);
- give directions for interpreting the results, highlighting specific aspects of impact.

The work process encompasses determining data needs and availability, carrying out collection of field information, processing and computing data, and direct interpretation of results.

The economic, social and environmental analyses are led in parallel by the relevant experts and share important elements, such as; the same typology of actors and sub-chains; parts of the data base, e.g. production levels, volume of flows, and technical coefficients (mainly economic and environmental experts). They also interact for specific investigations and analysis, e.g. on the VC governance, on marginalised groups, and on income and job distribution (mainly economic and social experts).

3. Making a Synthesis of the information produced which gives meaning to the many results, individual and combined. Evidence-based indicators and qualitative assessments are reviewed and discussed among the team of experts. The way they relate to each other is examined, analysing interactions and trade-offs. To appraise their significance, they may be compared to other available information (order of magnitude of other activities, benchmarking with other sectors or countries…). They are analysed in relation to the economic, societal and natural endowment context of the country, determining as much as possible how this context affects the VC results and how the VC operations impact on it.

Eventually, the synthesis combines:

- answering the four Framing Questions;
- taking an integrated perspective on growth, inclusiveness and sustainability;
- shedding light on risks, strengths and overall benefits;
- recommendations.

Field missions and stakeholder workshop

The VCA4D team has carried out two field missions for the collection of data. The first mission took place from 14 to 25 July 2025. It began with an official briefing session on the morning of 14 July at EUD in Tbilisi. During this field mission, a wide range of stakeholders (including farmers, NGOs, research centres, international and financial institutions, private companies, etc.) has been interviewed and consulted (See section 8.1). The mission covered Tbilisi, East Georgia (Kakheti, Shida Kartli and Kvemo Kartli) and West Georgia (Samegrelo, Guria, Imereti) which are major producer and consumer regions of maize (**Error! Reference source not found.**).

The first mission also included capacity strengthening activities. A presentation on the VCA4D multidisciplinary methodology was delivered at GFA in Tbilisi. The session proved to be highly productive, generating interesting methodological discussions and valuable insights into the maize VC.

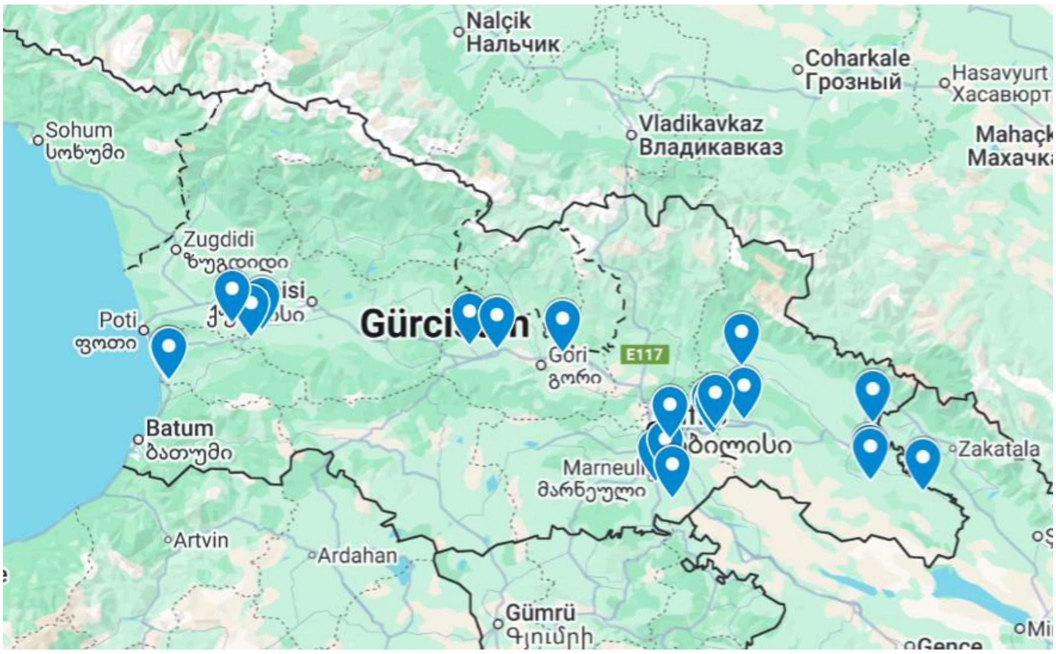

FIGURE I. 1: REGIONS IN GEORGIA COVERED DURING THE FIRST MISSION (14-25 JULY 2025)

The second mission took place from 20 October 2025 to 7 November 2025 and combined institutional consultations, field visits, and follow-up interviews across multiple regions of Georgia. The mission began with coordination meetings in Tbilisi, including internal alignment sessions at the Georgian Farmers' Association (GFA) and consultations with key public stakeholders such as the Rural Development Agency (RDA) and the Ministry of Environmental Protection and Agriculture (MEPA). These meetings provided an overview of the policy environment, institutional support mechanisms, and current priorities in the maize sector, while also supporting the refinement of data collection approaches.

The core phase of the mission focused on extensive fieldwork carried out between 27 and 31 October across key maize-producing regions, including Kakheti, Kvemo Kartli, Imereti, Samegrelo, and Guria. During this period, the team conducted in-depth interviews with a wide range of value chain actors, including smallholder and commercial farmers, small and industrial millers, mechanization service providers, and other local stakeholders. The agenda was designed to capture the diversity of maize production systems, covering both white and yellow maize, as well as variations in scale, technology use, and market integration. Field observations and discussions highlighted the importance of mechanization services, the prevalence of small-scale and semi-formal milling operations, and significant regional differences in production practices and value chain organization.

The final phase of the mission, conducted between 3 and 7 November, focused on follow-up consultations, validation of findings, and filling remaining data gaps. Additional stakeholder meetings were held in Tbilisi, including discussions with the Elkana Biological Farming Association and representatives of maize producers and input suppliers, providing further insights into organic production and input market dynamics. Field visits were also carried out in regions such as Samtskhe-Javakheti, Shida Kartli, and Kakheti, where the team engaged with farmers, small-scale millers, and research institutions, including the Scientific Research Centre working on genetic resources and storage. Particular attention was given to innovative practices, such as minimum tillage systems, as well as to cross-checking previously collected data through additional interviews and phone consultations. The mission concluded with a meeting with MEPA to ensure consistency of findings with national-level perspectives.

Overall, the mission followed a structured and iterative approach, combining stakeholder consultations, field observations, and technical discussions across different regions and levels of the value chain. This approach ensured comprehensive coverage of key actors and enabled the collection of detailed, context-specific information necessary for the analysis of maize production, processing, and market dynamics in Georgia.

This mission also included a workshop which took place on 24 October 2025. The objective of the workshop was to present the preliminary findings of the first mission and discuss them with the maize VC stakeholders.

The workshop brought together representatives from public institutions, private sector actors, farmers, development organizations, and researchers, creating a platform for participatory validation and discussion. The event was opened by representatives of the European Union and the VCA4D team, who highlighted the importance of maize within the broader context of sustainable and inclusive agricultural development in Georgia, as well as the need for improved data and farmer-centered analysis to inform policy and investment decisions.

During the workshop, the research team presented initial findings of the maize value chain analysis, including key statistics on production, consumption, and trade, as well as a preliminary typology of farms and mapping of value chain actors. The presentation emphasized that maize remains the most widely cultivated crop in Georgia, with significant importance for both food and feed systems, while also highlighting structural challenges such as low productivity, limited commercialization, and dependence on imports for feed maize. Participants were introduced to key analytical dimensions of the study, including regional differences (East–West divide), production systems (white vs yellow maize), and the role of indirect actors such as input suppliers, financial institutions, and service providers.

The workshop included an interactive group discussion session, where participants were divided into working groups to reflect on key challenges and opportunities within the maize value chain. Discussions were structured around core questions related to competitiveness, production efficiency, market requirements, and governance. Participants identified several major constraints, including limited access to irrigation and drainage systems, high costs and limited availability of machinery, insufficient storage and drying infrastructure, price volatility influenced by international markets, and limited access to finance. In addition, challenges related to knowledge gaps, weak extension services, and difficulties in accessing government support programs were highlighted.

From the demand side, feed producers emphasized the importance of consistent quality (particularly moisture control), stable supply, and reliable contractual arrangements. At the same time, stakeholders noted that domestic production could increase and better substitute imports if competitiveness in terms of price and quality were improved. The discussions also highlighted the need to differentiate support approaches for white maize (primarily small-scale and food-oriented) and yellow maize (feed-oriented and more commercial).

The workshop further provided insights into potential solutions and policy directions. Participants emphasized the importance of investing in modern irrigation systems, improving access to agricultural machinery, strengthening farmer knowledge and extension services, and developing storage and processing infrastructure. The role of the private sector in providing technical support, facilitating contracts, and investing in value chain services was also highlighted, alongside the need for more accessible financial instruments and better-designed government support programs. Overall, the validation workshop played a critical role in refining the study's analytical framework, validating preliminary findings, and identifying priority areas for further investigation during subsequent field missions.

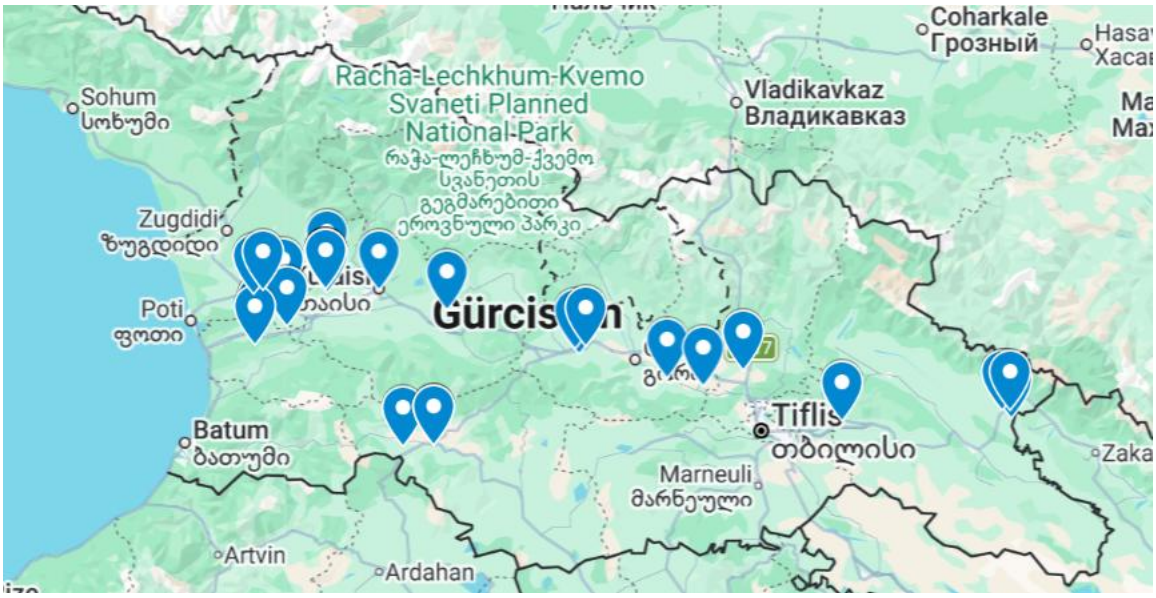

Figure I. 2: Regions in Georgia covered during the second mission (20 October-7 November 2025)

1. FUNCTIONAL ANALYSIS

The functional analysis seeks to develop a comprehensive overview of the VC system. It identifies and characterizes the principal actors and stakeholders involved, while also outlining the key strategic development challenges affecting the chain. This analysis enables the multidisciplinary team to establish a shared understanding of how the VC operates and to define the scope of the assessment. Key components include the identification of a typology of actors, the identification of different sub-chains, and the specification of the relevant geographical and temporal boundaries. These elements constitute the analytical foundation required to address the main framing questions guiding the study.

1.1 Overview of the global maize production

Global maize production in 2024 reached approximately 1.2 billion tonnes, cultivated over an estimated 200 million hectares (Table 1-1). Production is highly concentrated, with a small number of countries accounting for the majority of global output. The top ten producers collectively represent more than 80% of world production, underscoring the strategic importance of these countries in global food and feed markets. Despite having a smaller harvested area than China, the United States achieves significantly higher output, reflecting exceptionally high yields, advanced technologies, and highly mechanized production systems. Its production alone accounts for roughly 31% of global maize output.

China's harvested area is the largest in the world, yet its production remains below that of the United States, indicating lower average yields. Unlike Brazil and Argentina which benefit from large-scale commercial farming, favorable agro-climatic conditions, and strong export orientation, India has moderate production with large land use, indicating relatively low yields compared to major exporters. Maize in India is often grown under rainfed conditions and by smallholders, which contributes to yield variability.

Overall, global maize production system is characterized by: i) high concentration among a few major producers; ii) significant yield differentials, with the U.S., Ukraine, Canada, and France achieving the highest productivity, iii) large harvested areas in China and India, where structural and agro-ecological factors limit yield potential, iv) strong export competitiveness in South America and Eastern Europe due to high yields and large-scale production systems.

TABLE 1-1: MAIN MAIZE PRODUCER COUNTRIES (2024)

Country	Production (t)	Harvested area (ha)
United States	377,632,690	33,547,180
China	294,920,000	44,777,349
Brazil	114,953,303	21,186,816
Argentina	57,494,500	8,736,712
India	40,230,573	11,349,065
Ukraine	26,863,740	4,070,500,
Mexico	24,326,508	6,568,036
Canada	15,344,938	1,449,300
Indonesia	15,138,912	2,548,654
France	14,670,620	1,593,920
World Total	~ 1,217,000,000	~ 200,000,000

Source: FAOSTAT

1.1.1 Maize export in global market

Table 1-2 presents the leading maize-exporting countries in 2024, highlighting both export volumes (in tons) and export values (in thousand USD). The global maize export market is highly concentrated. The top four exporters—United States, Brazil, Argentina, and Ukraine—collectively account for the overwhelming majority of world maize exports. Together, they represent: ~164 million tons, or roughly 81% of global maize exports, ~34 billion USD, or about 75% of global export value. This concentration indicates a market dominated by a few large producers with strong agro-industrial capacity and well-developed export logistics.

The U.S. alone accounts for nearly 31% of global export volume and its leadership reflects large-scale production, high yields, and strong integration into global feed and biofuel markets. The combined share of Brazil and Argentina is approximately 36% of global exports and underscores South America's strategic role in global grain markets. Both countries have expanded maize production significantly over the past decade, driven by export-oriented agribusiness models and competitive production costs. Ukraine, despite geopolitical challenges, exported 29.6 million tons, maintaining its position as a major global supplier. It remains essential to European, Middle Eastern, and North African feed markets. Finally, France, Poland and Romania contribute modestly compared to global leaders but play important roles in intra-EU trade and regional supply stability.

TABLE 1-2: MAIN EXPORTER COUNTRIES IN GLOBAL MAIZE MARKET (2024)

Country	Quantity (t)	Value (thousand USD)
United States	62,589,862	14,341,944
Brazil	39,783,166	8,179,619
Argentina	32,057,356	6,550,709
Ukraine	29,623,666	5,072,452
France	4,064,104	1,855,459
South Africa	3,464,302	862,963
Poland	3,341,622	771,430
Romania	2,885,754	891,688
Russian Federation	2,313,114	457,500
Serbia	2,148,249	483,181
World Total	202,668,628	45,519,596

Source: FAOSTAT

1.1.2 Maize import in global market

Table 1-3 presents the largest importing countries of maize in the global market in 2024, measured in terms of import quantity (tonnes) and import value (thousand USD) using data from FAOSTAT.

The data indicate that Mexico is the world's largest importer of maize, reflecting the country's strong domestic demand for maize, particularly for livestock feed and food processing, which exceeds its domestic production capacity. Similarly, China's significant imports are largely driven by the rapid expansion of its livestock and feed industries, especially in the pork and poultry sectors. Japan ranks as the third largest importer. Having limited arable land, this country relies heavily on imported maize for animal feed, making it one of the most consistent importers in global agricultural trade.

Other major importers include the Republic of Korea, Spain, and Vietnam, with import volumes exceeding 8 million tonnes each. These countries also depend heavily on maize imports to supply their livestock feed industries and food-processing sectors. European countries such as Spain, Italy, and the Netherlands appear among the leading importers due to strong demand from the European livestock sector and feed manufacturing industries.

Additionally, Egypt and Colombia are notable importers, reflecting increasing demand for maize in developing economies, where the growth of poultry and livestock production has led to rising feed grain requirements.

Overall, the world total maize imports in 2024 amounted to approximately 200.28 million tonnes, with a total value of about 52.89 billion USD. The distribution of imports also shows that demand is concentrated in countries with large livestock industries, limited domestic production, or structural dependence on imported feed grains.

TABLE 1-3: MAIN IMPORTER COUNTRIES IN GLOBAL MAIZE MARKET (2024)

Country	Quantity (t)	Value (thousand USD)
Mexico	23,853,749	5,392,120
China	18,595,372	4,856,965
Japan	15,276,693	3,938,886
Republic of Korea	11,341,682	2,898,259
Spain	9,382,677	2,221,252
Vietnam	8,813,381	3,039,583
Egypt	7,890,034	2,271,954
Italy	7,389,690	1,795,173
Colombia	6,850,855	1,579,077
Netherlands	5,348,686	1,343,262
World Total	200,276,450	52,891,659

Source: FAOSTAT

1.1.3 Global maize prices

Concerning wholesale price (Table 1-4), the global market exhibited fluctuations over the period 2022-2024. The lowest wholesale price remained relatively stable, ranging from 0.24 USD/kg in 2022 to 0.25 USD/kg in 2024. However, the highest price decreased significantly, from 1.06 USD/kg in 2022 and peaking at 1.37 USD/kg in 2023, before falling to 0.89 USD/kg.

TABLE 1-4: GLOBAL WHOLESALE PRICES (2022-2024)

Wholesale	2022	2023	2024
Low	$0.24/kg	$0.24/kg	$0.25/kg
High	$1.06/kg	$1.37/kg	$0.89/kg

Source: Tridge (n.d). Global maize prices[5].

Global farmgate prices also fluctuated over the same period (Table 1-5). In 2024, farmgate prices ranged from 0.21 USD/kg and 1.32 USD/kg. Overall, these trends indicate increased price volatility, as the range of prices widened between 2022 and 2024. While producers may benefit from higher prices in 2024, they are simultaneously exposed to lower minimum prices, increasing their vulnerability to market risks.

[5] Retrieved from https://dir.tridge.com/prices/maize

TABLE 1-5: GLOBAL FARMGATE PRICES (2022-2024)

Farmgate	2022	2023	2024
Low	$0.30/kg	$0.27/kg	$0.21/kg
High	$1.05/kg	$1.13/kg	$1.32/kg

Source: Tridge (n.d). Global maize prices[6].

1.2 Overview of the maize value chain in Georgia

Georgia's maize production over the period 2020–2024 is characterized by low output levels and marked interannual variability (Table 1-6). Production fluctuated between approximately 153 and 255 thousand tonnes, with a notable decline in 2022 followed by partial recovery in 2023–2024. From a global perspective, Georgia's contribution to maize production is negligible. With global output averaging around 1.2 billion tonnes annually, Georgia's production accounts for less than 0.02% of the total. In contrast to major producers such as the United States, China, and Brazil, whose outputs reach hundreds of millions of tonnes, Georgia does not exert measurable influence on international maize markets. Its production is therefore best understood as domestically and to a lesser extent regionally oriented, serving primarily subsistence needs and local livestock feed demand rather than export markets, despite recent trade activities with neighbouring countries in small quantities.

In the European context, Georgia also ranks as a minor producer compared to France, Romania, and Poland which produce between 6 and 15 million tonnes annually. This disparity is largely attributable to differences in farm size, mechanization, input intensity, and integration into commercial supply chains. Consequently, Georgia's maize sector aligns more closely with peripheral or semi-subsistence agricultural systems than with the highly commercialized grain economies of the European Union. The country also occupies a marginal position within the group of post-Soviet (former USSR) countries. Ukraine and the Russian Federation, as major producers, generate tens of millions of tonnes annually and play significant roles in global export markets. Smaller countries such as the Republic of Moldova generally produce substantially higher volumes, although with considerable variability due to climatic conditions. However, Georgia assumes greater relative importance at the subregional level of the South Caucasus. Its maize production is broadly comparable to that of Azerbaijan and exceeds that of Armenia, making it a regionally relevant producer despite its small absolute scale. In this context, maize plays a significant role in rural livelihoods, particularly in mixed farming systems where crop production is closely linked to livestock rearing. The high consumption of white maize in Georgian cuisine highlights its significant role across households, as well as in the restaurant and hospitality sectors. Yet, within this subregion, production remains constrained by small landholdings and limited economies of scale.

TABLE 1-6: MAIZE PRODUCTION (THOUSAND TONNES) FOR 2020-2024

Year	2020	2021	2022	2023	2024
Azerbaijan	315	279	270	287	303
France	13,726	15,358	10,877	12,835	14,671
Georgia	255	233	153	191	212
Moldova	1.323	2,787	752	1,420	1,630
Poland	6,694	7,322	8,345	8,982	9,223
Romania	10,097	14,821	8,037	8,744	5,972
Russia	13,879	15,238	15,862	15,000	13,954
Türkiye	6,500	6,750	8,500	9,000	8,100
Ukraine	30,290	42,110	26,187	31,030	26,864

[6] Retrieved from https://dir.tridge.com/prices/maize

United States	358,447	381,469	346,739	389,694	377,633
World	1,155,800	1,207,996	1,163,497	1,241,558	1,217,000

Source: FAOSTAT

1.2.1 Production and land area evolution

Maize area in Georgia shows a clear declining trend over the period 2021-2024 (Table 1-7). Sown area decreased from 79.4 thousand hectares in 2021 to 70.0 thousand hectares in 2024, while harvested area declined from 76.4 to 68.9 thousand hectares over the same period. This represents a contraction of approximately 12–13%, indicating a gradual reduction in the land allocated to maize cultivation. The relatively small gap between sown and harvested areas suggests limited crop loss overall, although the divergence becomes slightly more pronounced in some years (notably 2022), possibly reflecting adverse weather conditions or localized production shocks.

From a regional perspective, maize production is highly concentrated in a few key regions. Imereti and Samegrelo-Zemo Svaneti consistently account for the largest shares of both sown and harvested areas, each contributing around 18–22 thousand hectares annually. Favourable agroecological conditions, including climate and soil suitability, together with the role of white maize in culinary culture as a staple crop, make these regions the core maize-producing zones. Kakheti is also a significant and growing contributor, with sown area increasing from 12.8 thousand hectares in 2021 to a peak of 16.8 thousand hectares in 2023, before stabilizing slightly in 2024. This suggests a partial geographical shift or diversification of maize cultivation toward eastern Georgia where access to larger land plots and irrigation are the key factors. In Kakheti, except for Lagodekhi[7] municipality, the farmers are producing mostly yellow maize.

Several regions exhibit consistently low levels of maize cultivation, mainly due to geographical constraints. Mountainous areas such as Racha-Lechkhumi and Kvemo Svaneti, Mtskheta-Mtianeti, and Samtskhe-Javakheti maintain minimal and in some cases declining maize areas, generally below 1–2 thousand hectares. This reflects natural constraints, including altitude, terrain, and climatic limitations, which restrict large-scale production, which also result in high level of outward migration.

A notable pattern is the general decline across most regions, including major producers. For example, Samegrelo-Zemo Svaneti shows a steady decrease from 21.4 to 17.8 thousand hectares, and Imereti declines slightly from 22.2 to 20.6 thousand hectares. Western regions such as Guria and Adjara also display reductions after minor fluctuations. This widespread contraction suggests systemic factors affecting maize cultivation nationally, such as changes in crop profitability, labour availability, shifts toward alternative crops or leaving land uncultivated, all together leading to high migration from the rural areas.

In consistence with the sown area, maize production in Georgia also shows a declining trend for 2021-2024 (Table 1-8). Production decreased from 233 thousand tonnes in 2021 to 211.5 thousand tonnes in 2024, while average yield remains relatively constant with small fluctuations. This decreasing trend in production can be attributed to the abandonment of land as well as to the relatively lower yields in small farms that constitute the dominant agricultural form in the country.

[7] The municipality is partly populated by people who migrated from western Georgia to Kakheti about a century ago. They brought the tradition of white maize production with them and have maintained it to this day.

TABLE 1-7: SOWN AND HARVESTED MAIZE AREA (THOUSAND HECTARES)

	Sown of maize area				Harvested area of maize			
	2021	**2022**	**2023**	**2024**	**2021**	**2022**	**2023**	**2024**
Adjara AR	2.3	2.3	2.1	1.4	2.2	2.3	2.1	1.4
Guria	3.7	4	2.5	2.3	3.7	3.9	2.4	2.3
Imereti	22.2	22	21.5	20.6	21.2	20.1	21	20.1
Kakheti	12.8	16.5	16.8	16	12.4	16.3	16.7	15.9
Mtskheta-Mtianeti	1.5	1.2	0.6	0.6	1.3	1.1	0.6	0.6
Racha-Lechkhumi and Kvemo Svaneti	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Samegrelo-Zemo Svaneti	21.4	21.2	19.5	17.8	21.1	17.4	18.8	17.7
Samtskhe-Javakheti	1.1	0.9	0.7	0.9	0.9	0.9	0.6	0.9
Kvemo Kartli	7.7	5.9	4.7	4.9	7.6	5.8	4.7	4.9
Shida Kartli	6	5.9	5.1	4.7	5.3	5.6	4.7	4.5
Georgia	79.4	80.5	74.4	70	76.4	73.9	72.4	68.9

Source: National Statistics of Georgia (2024)

From a regional perspective, production is highly concentrated, with eastern region Kakheti and western regions Imereti and Samegrelo-Zemo Svaneti, each representing around 45-62 thousand tonnes of production in 2024. Not surprisingly, some remote regions such as Racha-Lechkhumi and Kvemo Svaneti and Mtskheta-Mtianeti are small contributors, accounting for around 1% of the national production of maize.

It is worth noting that some regions show significant declining trend of production over the period 2021-2024. This is the case of Samegrelo-Zemo Svaneti and Imereti where production decreased from around 55 thousand tonnes in 2021 to around 45 thousand tonnes in 2024. This decline in production appears to be compensated by the increase in East Georgia, especially through Kakheti, Kvemo Kartli and Shida Kartli which showed consistently significant contribution to maize production. Thus, abandonment of maize land in these two western regions is offset by economies of scale and productivity in Kakheti.

TABLE 1-8: PRODUCTION AND AVERAGE YIELD OF MAIZE

	Production (thousand t)				Average yield (t/ha)			
	2021	**2022**	**2023**	**2024**	**2021**	**2022**	**2023**	**2024**
Tbilisi	0.1	0	0	0	2.1	3.8	-	0.8
Adjara AR	4.6	4	3.7	3.1	1.9	1.6	1.6	2
Guria	14.9	8.3	8.6	9.3	3.9	2.1	3.5	3.9
Imereti	57.2	26.2	43.1	48.6	2.6	1.3	2	2.4
Kakheti	48.1	51.7	54.7	61.9	3.9	3.2	3.2	3.9
Mtskheta-Mtianeti	3.1	2.7	2.0	2.3	2.3	2.3	3.5	3.9
Racha-Lechkhumi and Kvemo Svaneti	1.5	0.7	1.4	1.7	2.5	0.1	2.1	2.8
Samegrelo-Zemo Svaneti	54.2	16.4	40.3	43.3	2.6	0.9	2.1	2.4
Samtskhe-Javakheti	1.8	2.3	1.8	2.7	2	2.6	2.9	2.9
Kvemo Kartli	31.6	24.1	18.9	19.4	4.2	4.2	4	3.9
Shida Kartli	15.8	16.5	16.2	19.2	2.9	2.9	3.4	4.2
Georgia	233	152.9	190.9	211.5	3	2	2.6	3

Source: National Statistics of Georgia (2024)

1.2.2 Yields

Average yield in Georgia has increased over the years (3t/ha) but there exist regional variations. From a general perspective, yields in western regions are stated lower. Western Georgia features distinct ecological characteristics with high rainfall and humidity and offers suitable conditions for agricultural production. Farming in this region typically involves smaller land plots, generally without irrigation (though drainage systems are sometimes used), and often focuses on white maize production, which is part of the local culinary tradition and serves as a staple food.

In contrast, Eastern Georgia has a drier climate, but irrigation infrastructure has been expanding, contributing to increasing yields. The region also benefits from economies of scale, as farms tend to operate on larger land plots compared to those in Western Georgia.

These variations across regions are also linked to farm practices and maize variety. Yellow maize variety is attributed to input-intensive, fully mechanized system and gives higher levels of yield while white maize variety, which is traditionally produced, often recurring to manual harvest of cobs and destined to food, gives relatively lower yield but is mostly preferred by consumers. Thus, the distinction between these varieties matters mostly for the market destination and use as final product.

1.2.3 Prices

Maize prices in Georgia exhibit interseasonal variation, largely driven by fluctuations in local maize availability. Prices usually peak between December and March, reflecting limited local supply, following the harvest season, which occurs from August to October. During harvest period, prices tend to decline as newly produced maize enters the market. However, domestic prices are also influenced by global food prices (especially Russian maize prices and its export regulations) and associated costs, which affect both retail and import prices. As a maize-importing country, Georgia is particularly vulnerable to international price fluctuations. Finally, price dynamics are further shaped by demand from the livestock and poultry sectors.

1.2.4 Export

The maize grain exported by Georgia originates both from domestically produced maize and imported supplies. This trade is mainly conducted by large and medium-scale traders who benefit from take the advantages of fiscal exemption.

Georgian maize is primarily exported to regional markets, with Iran being the main destination (receiving almost all of the 10,563 tonnes exported in 2024), followed by Armenia and Azerbaijan.

Export prices for maize grain rose from 0.71 GEL/kg in 2020 to 0.93 GEL/kg in 2021, before gradually declining to 0.64 GEL/kg in 2023 and recovering slightly to 0.70 GEL/kg in 2024 (Figure 1-1).

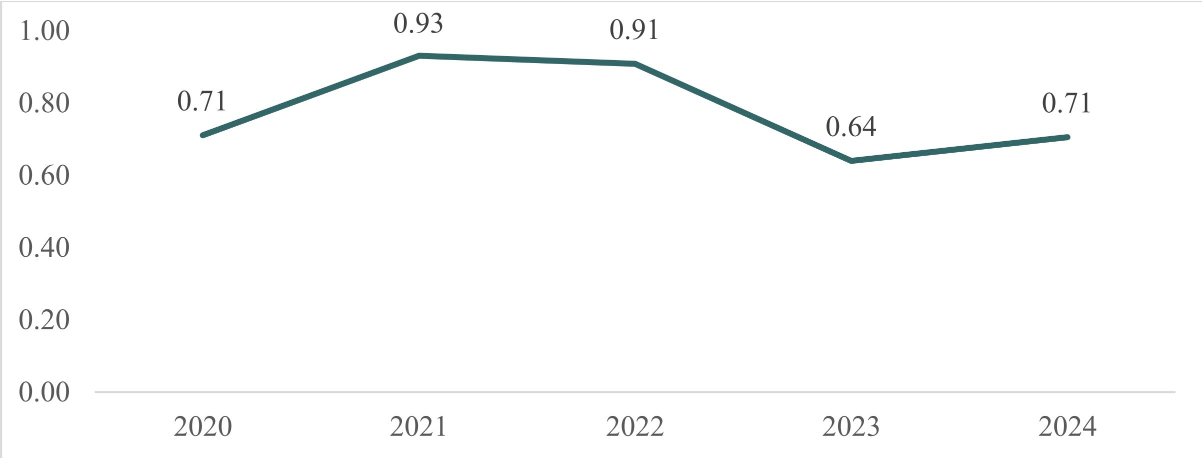

FIGURE 1-1: EXPORT PRICE (FOB) IN GEL FOR MAIZE GRAIN (2020 – 2024)

Export prices for maize seed increased steadily from 8.2 GEL/kg in 2020 to around 9.4–9.6 GEL/kg in 2022–2023, reflecting gradual value addition or niche export opportunities (Figure 1-2).

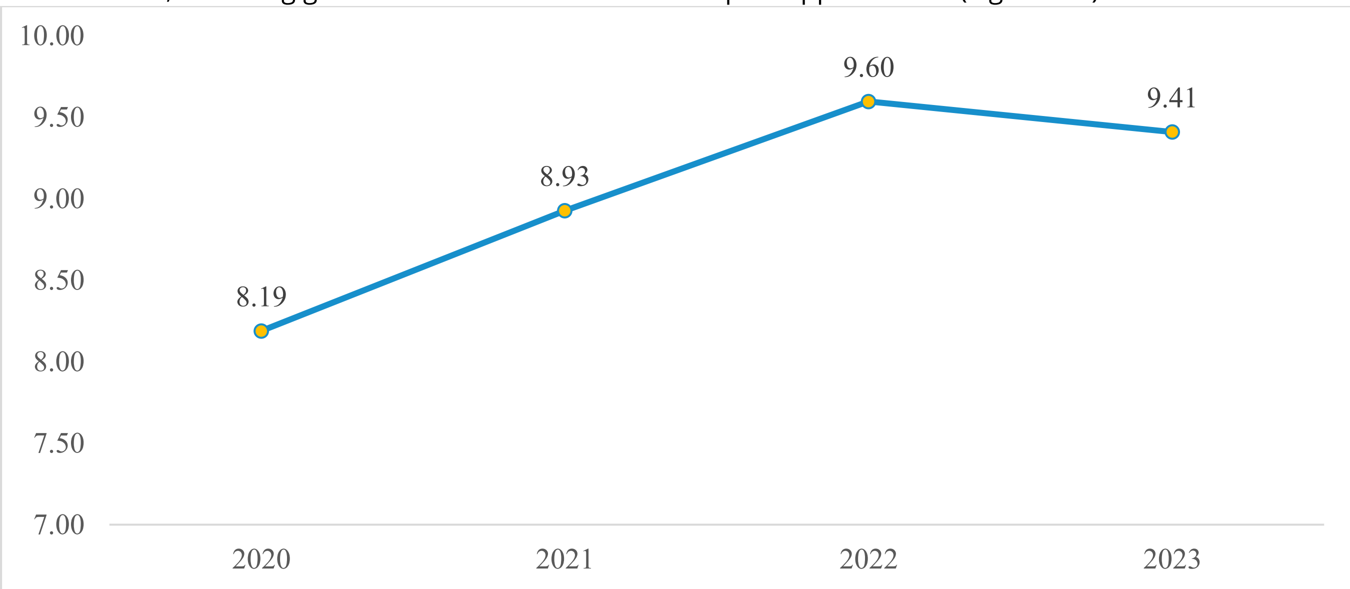

Figure 1-2: Export price (FOB) in GEL for maize seed (2020 – 2023)

1.2.5 Import

Import prices for maize grain in Georgia show a clear upward trend between 2020 and 2022, increasing from approximately 0.57 GEL/kg in 2020 to 0.76 GEL/kg in 2022, reflecting global commodity price increases and supply chain disruptions (Figure 1-3). However, prices declined in 2023 and further stabilized in 2024 at around 0.57 GEL/kg, returning close to pre-crisis levels. This pattern suggests that while international shocks (mostly due to war in Ukraine) significantly affected import costs, the market has partially corrected, easing pressure on domestic buyers.

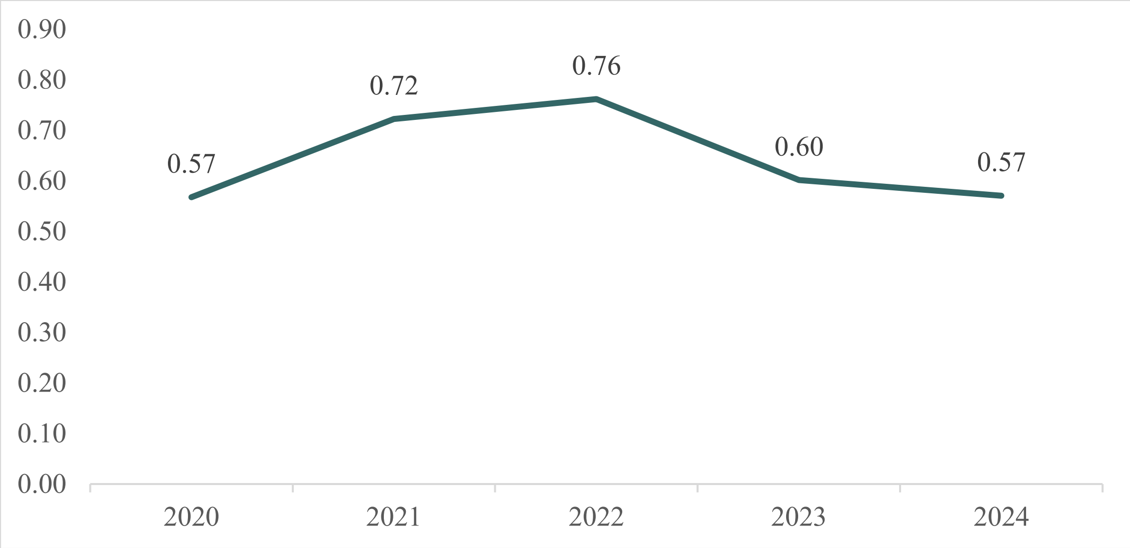

FIGURE 1-3: IMPORT PRICE (CIF) IN GEL FOR MAIZE GRAIN (2020 – 2024)

In contrast to grain, maize seed import prices demonstrate a strong and consistent upward trend over the period (Figure 1-4). Prices increased from 7.7 GEL/kg in 2020 to over 13 GEL/kg in 2024, indicating rising costs for improved or hybrid seeds. The sustained increase suggests growing dependence on imported high-quality planting materials and potentially increasing input costs for farmers, which may affect profitability, especially for medium-scale farmers.

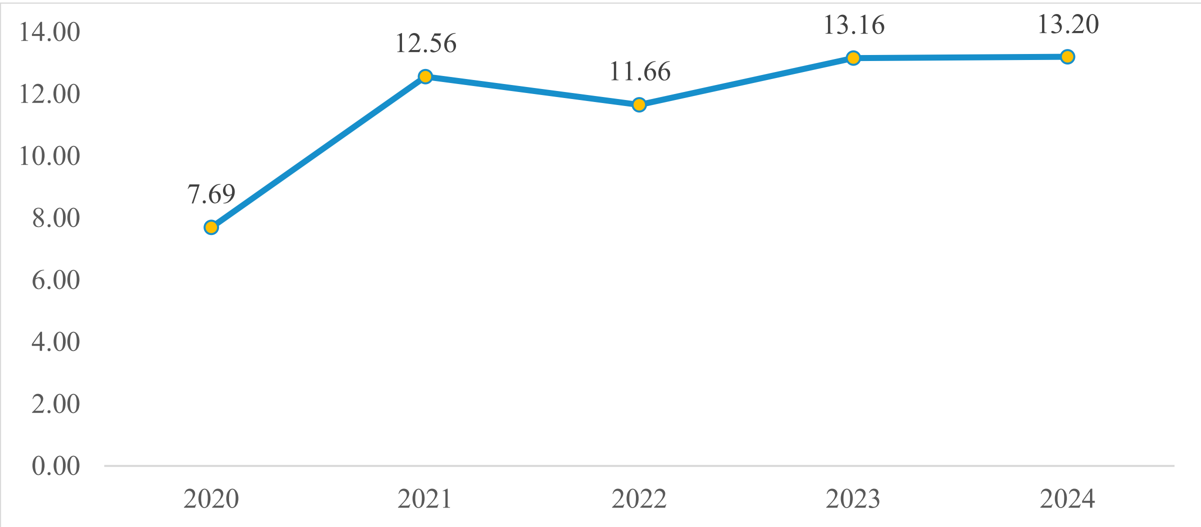

FIGURE 1-4: IMPORT PRICE (CIF) IN GEL FOR MAIZE SEED (2020 – 2024)

The convergence of export and import prices in recent years suggests a relatively integrated market, where domestic prices are closely linked to international trends. However, the limited margin between import and export prices indicates low competitiveness and narrow profitability in export markets.

Overall, the data highlights strong exposure of Georgia's maize sector to international price dynamics, particularly for imports. The relatively close alignment between import and export prices for maize grain suggests limited value addition within the domestic VC. Meanwhile, the rising cost of imported seeds signals increasing production costs, which may not be fully offset by export revenues. These dynamics point to structural challenges in competitiveness and underline the importance of improving productivity, input efficiency, and domestic seed systems. During the fieldwork, one domestic seed producer was identified, however farmers commonly indicated that yields from domestic seeds are much lower compared to international seeds.

1.2.6 Supply and utilization of maize

Despite a smaller harvested area compared to 2022 and 2023, a significant increase in maize yield per hectare led to a sharp rise in total maize grain production in Georgia, by approximately **39%**, from **153 thousand tonnes in 2022** to around **212 thousand tonnes in 2024** (Table 1-9). It should be noted, however, that when compared to **2021**, total maize production in 2024 represents a **9% decrease**, which can be attributed to a reduction in the cultivated area (from 76.4 thousand ha in 2021 to 68.9 thousand ha in 2024) while productivity per ha remained unchanged at 3 t/ha. Yet, those production levels are well far from replying to the country's demand. Georgia's self-sufficiency ratio for maize stands at around 71% (Koghuashvili and Chechelashvili, 2024)[8], varying from 62% (2022) to 79% (2024), meaning that the country produces roughly three-quarters of its maize needs domestically and relies on imports for the remainder.

TABLE 1-9: SUPPLY AND UTILIZATION OF MAIZE IN GEORGIA (2020-2024) (THOUSAND TONNES)

	2020	2021	2022	2023	2024
Domestic production	255	233	153	191	212
Import	121	83	97	81	71
Seed	3	3	3	3	3
Feed	169	141	112	122	120
Food	138	152	151	140	144
Waste	11	9	7	8	8
Export	1	2	2	1	15
Stock variation	54	8	-24	-2	-8

Source: Geostat Food Balance Sheets

Over the period 2020-2024, maize imports declined markedly from 121 thousand tonnes to 71 thousand tonnes, reflecting a reduced quantitative reliance on external supply. However, stock variation for maize has remained negative over the past 3 years, meaning an absence of stock accumulation, and instead, a systematic release of maize store to meet domestic demand. In terms of utilization, maize consumption in 2024 was predominantly allocated to food and feed purposes, accounting for 50% and 42% of total consumption, respectively. Exports constituted a relatively minor share, representing approximately 5% of total maize consumption.

1.2.6.1 Use of maize in food systems

Georgian maize consumption is predominantly based on milled flour which is used for the preparation of several traditional meal and pastries/bakeries, such as *mchadi* (maize bread made from maize, water, salt), *elarji* (made by mixing maize meal with cheese), *ghomi* (porridge made from coarse maize), and some other meals based on maize flour. Western regions are the leader of this traditional maize related cuisine. It is worth noting that, in comparison to yellow maize, white maize is strongly preferred within Georgian gastronomy.

[8] The level of self-sufficiency for other products: wheat 22%, potatoes 115%, vegetables 61%, meat 51%, milk and dairy products 81%, eggs 98%, oil 4%, sugar 0% (Koghuashvili and Chechelashvili, 2024).

Milling activities for white maize flour are predominantly carried out by local small-scale millers, although recent investments have also been made in industrial-scale milling facilities[9]. Most small-scale millers operate on a service basis, processing maize grain supplied directly by households or farmers. In recent years, there has been a tendency for medium-scale farmers to start producing white maize flour, packaging it and selling it through supermarkets chains. Traditionally, white maize flour has been sold in small shops and agricultural markets.

Figure 1-5: Georgian porridge (elarji)

Another form of maize consumption is fresh corn on the cob. This is primarily consumed as a snack during summer months and is commonly sold through roadside vendors or at the Black Sea beaches.

Figure 1-6: A corn on the cob seller in Western Georgia

[9] The VCA4D team visited three medium-scale milling facilities. One of them started operating in 2025, while another is planned to start operations in 2026.

1.2.6.2 Use of maize in feed industries

In Georgia, while white maize has strong cultural significance in human consumption, yellow maize is increasingly critical for the livestock and poultry industries, where it serves as a foundation of feed ration. As domestic demand for animal protein rises, the role of maize in sustaining efficient and competitive feed systems has become more significant than ever.

Globally, around two-thirds of total maize production is used as animal feed, particularly in intensive poultry, dairy, pig, and beef production systems. Maize is highly valued because of its high energy content, digestibility, palatability, and compatibility with compound feed manufacturing. Compared with many alternative cereals, maize provides a dense source of carbohydrates, making it especially suitable for fast-growing poultry and productive livestock systems. For this reason, international maize markets are strongly linked to trends in meat, egg, and dairy sectors.

In Georgia, the feed function of maize is particularly important because the poultry sector is among the most commercialized and rapidly developing segments of agriculture. Poultry farms require consistent supplies of energy-rich feed to maintain productivity, feed conversion efficiency, and competitive production costs. Maize commonly represents the largest cereal component in poultry rations, often combined with soybean meals, vitamins, minerals, and other additives. Broiler chickens and laying hens both depend heavily on maize-based feed, meaning that any disruption in maize availability or price directly affects domestic meat and egg production.

The livestock sector also depends substantially on maize. Dairy and beef farms utilize maize in both grain and silage forms. Grain maize is used in concentrations to improve energy intake and support milk yield, growth performance, and reproductive efficiency. Maize silage, produced from the whole green plant, is one of the most valuable sources for medium and large dairy farms because it provides stable, nutritious, and cost-effective feed throughout the year. In Georgia, maize silage is particularly important in more commercialized dairy systems in eastern regions where larger landholdings and mechanization enable silage production at scale.

According to national food balance data, feed accounts for a substantial share of total maize utilization in Georgia, representing approximately 120 thousand tonnes in 2024, or around 42% of total maize use. This demonstrates that maize is not only a crop for direct human consumption, but also an essential input into higher-value livestock supply chains such as poultry meat, eggs, and milk production. Through this indirect pathway, maize contributes significantly to national food security, rural incomes, employment, and value addition across the broader agri-food economy.

However, Georgia remains structurally dependent on maize imports, especially for feed-grade yellow maize. Domestic production often cannot fully satisfy the quantity, quality, and consistency requirements of large feed mills and commercial farms. Imported maize, particularly from regional suppliers, is frequently more competitive in price and available in bulk volumes. This creates vulnerability to international market volatility, exchange rate fluctuations, logistics disruptions, and geopolitical shocks. As a result, the competitiveness of Georgia’s poultry and livestock sectors is closely tied to maize market dynamics.

Strengthening domestic maize production therefore has strategic importance beyond the crop itself. Higher yields, improved irrigation, better seed systems, post-harvest drying and storage infrastructure, and stronger farmer-market linkages could reduce import dependency while supporting livestock sector growth. Increased local maize supply would enhance feed security, stabilize production costs, and create stronger integration between crop and livestock farming systems.

In conclusion, maize occupies a central position in Georgia's feed economy. It highlights the productivity and competitiveness of poultry, dairy, beef, and pig sectors while contributing indirectly to food security and rural development. Any long-term strategy for strengthening Georgia's livestock industries must therefore recognize maize as a strategic feed crop and prioritize investments that improve its domestic production, quality, and value chain efficiency.

1.2.7 Silage production

Silage production represents an increasingly important component of the maize value chain in Georgia, particularly in relation to the livestock and especially dairy sector. Unlike grain maize, which serves both food and feed markets across a wide range of farm types, silage maize is a more specialized sub-chain primarily linked to medium and large-scale commercial farms with stable demand for cow feed. It plays a strategic role in improving food security, increasing livestock productivity, and reducing seasonal fluctuations in fodder availability, especially during winter months.

At present, official agricultural statistics in Georgia do not separately record silage maize production. Therefore, the analysis relies on field interviews, stakeholder consultations, and producer survey data collected during the VCA4D missions. Based on these findings, total land allocated to silage maize is estimated at approximately 2,800 hectares, generating around 90,000 tonnes of silage annually. Surveyed farms alone accounted for approximately 86,144 tonnes produced on 2,587 hectares, suggesting that the national estimate is robust and conservative.

Regional concentration of silage production

Silage production in Georgia is highly concentrated in Eastern Georgia. This reflects the presence of larger farm structures, irrigated land, greater mechanization, and stronger integration with commercial dairy and livestock enterprises.

Among regions:

- Kakheti dominates national silage production, accounting for approximately 1,766 ha (63%)
- Kvemo Kartli follows with 640 ha (23%)
- Shida Kartli contributes 304 ha (11%)
- Other regions remain marginal producers (3%)

Together, these three eastern regions account for more than 95% of total silage land area.

This regional pattern differs significantly from grain maize production, where western Georgia remains highly important due to white maize cultivation for food consumption. In contrast, silage production is strongly linked to livestock intensity, land consolidation, access to irrigation infrastructure and machinery, all of which are more prevalent in eastern regions.

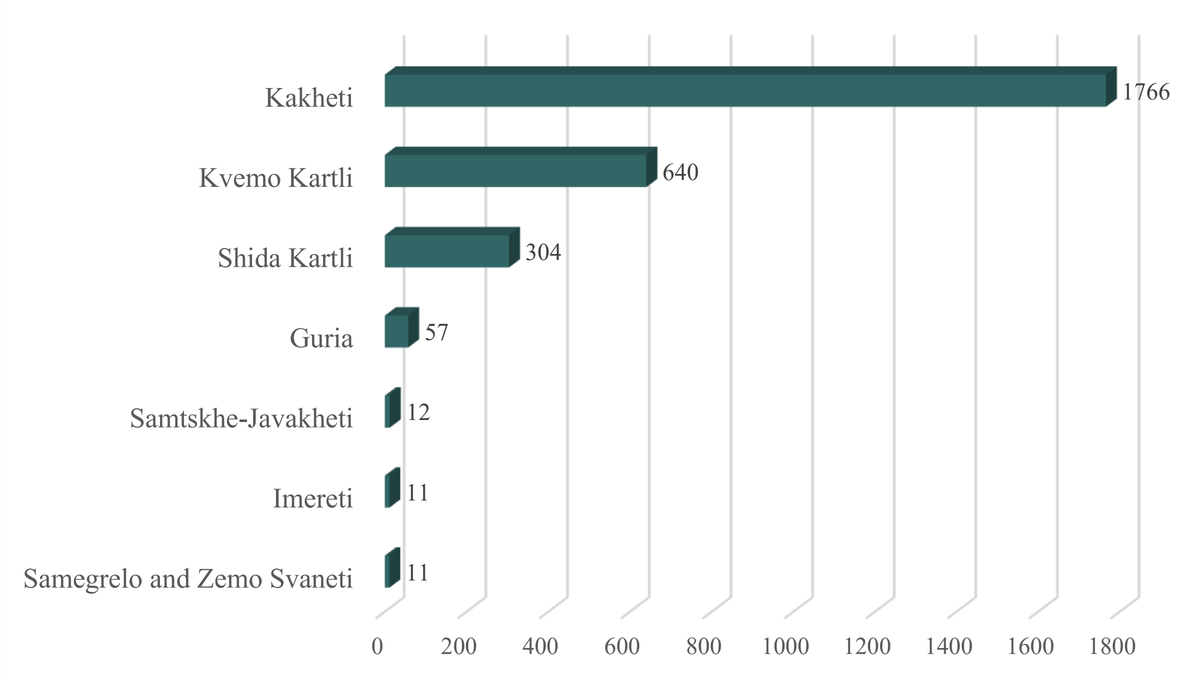

FIGURE 1-7: ESTIMATED LAND UNDER SILAGE BY REGION (HA)

Farm typology and structural characteristics

Silage production is overwhelmingly dominated by medium and large farms, while participation of micro and smallholders remains minimal. This contrasts with grain maize production, where small and subsistence farms remain dominant.

Large farms are particularly important because silage production requires:

- sufficient land area
- stable livestock demand
- access to specialized machinery
- storage infrastructure
- working capital
- Adequate fertilization
- Mechanized chopping and compaction
- Better moisture management
- Compared with grain maize, silage productivity per hectare is substantially higher in physical tonnage terms because the whole green biomass is harvested rather than only grain.

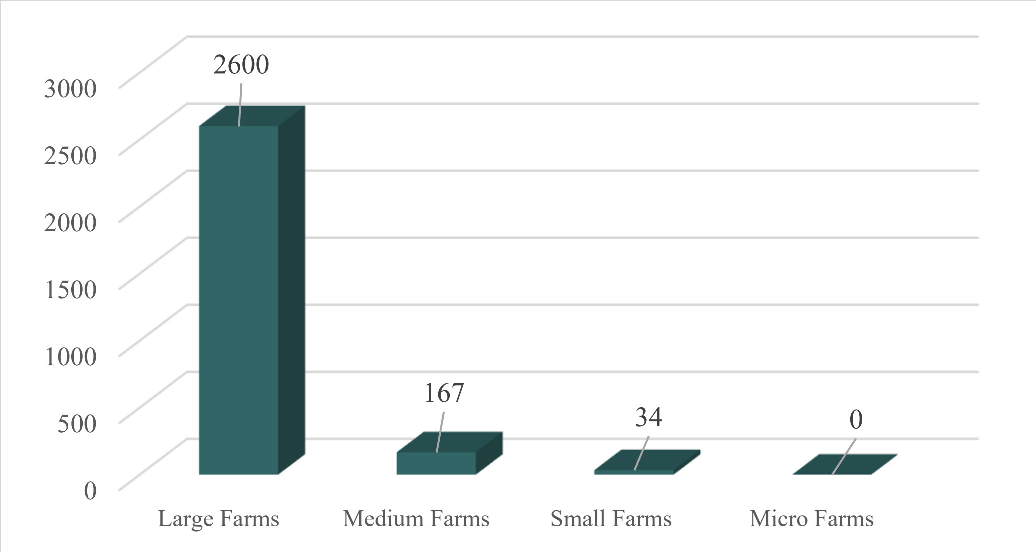

FIGURE 1-8: ESTIMATED SILAGE AREA BY FARM TYPE (HA)[10]

Economic role and market dynamics
Silage provides an important opportunity to substitute imported feed ingredients and reduce livestock production costs. Georgia remains dependent on imported maize grain and protein feed components, particularly for poultry and intensive livestock sectors.
The silage market in Georgia remains relatively informal. Much production is either:

1. consumed on-farm
2. produced under bilateral agreements
3. sold through local networks to nearby livestock farms

Long-distance trade is limited due to the bulky nature of silage and transport costs. Therefore, silage markets tend to be more regional rather than national (but there is trade between Eastern and Western regions of Georgia).
Constraints and bottlenecks
Despite clear potential, several constraints limit silage expansion:

- machinery access
- irrigation limitations
- limited technical knowledge
- finance constraints
- weak contract systems
- lack of statistics

- [10] Large Farms >50 ha, Medium Farms 10 – 50 ha, Small Farms 0.5 – 10ha, Micro Farms <0.5 ha

MAIZE FARMERS
(silage maize grown)

▼

HARVEST / CHOPPING
Contractors / Machinery

▼

SILAGE STORAGE SYSTEMS
• Bunker Silos
• Wrapped Bales / Bags

▼

DAIRY FARMS
Feed ration use

▼

FINAL OUTPUTS
• Milk
• Meat
• Higher Productivity

Figure 1-9 : SIMPLIFIED SILAGE VALUE CHAIN

Development opportunities

Silage production offers significant potential for Georgia’s agricultural modernization. Priority interventions could include:

- support for contractor mechanization services
- irrigation investments
- demonstration farms
- credit products linked to fodder production
- farmer-livestock contract models
- inclusion of silage in official statistics

To summarize, silage production in Georgia is a relatively small but strategically important sub-sector of the maize VC. It is commercially oriented, geographically concentrated, and strongly linked to medium and large livestock farms. Current production is estimated at approximately 90,000 tonnes annually, but there is clear scope for expansion through improved irrigation, mechanization, and stronger crop-livestock integration.

Given rising demand for efficient domestic feed sources, silage may become one of the most dynamic segments of Georgia's maize economy in the coming years, particularly in eastern regions where economies of scale and demand from intensive dairy farms are strongest.

1.3 Value chain actors

Maize production and distribution in Georgia involve several actors, both directly and indirectly linked to the VC. Input suppliers provide agricultural inputs to maize farmers, who then produce maize using both domestic resources (land, water, etc.) and these inputs. Part of the maize is sold to millers for processing into flour and bran, while another portion is self-consumed, directed to feed industries or exported. At every stage of the VC additional value is created, contributing to income generation for the national economy. This section details the main VC actors and their activities.

1.3.1 Farmers

For maize farmers, the latest census dates to 2014. While it does not allow for precise insights into current farmer types and numbers, it still helps us identify some general patterns. The common view is that there is a dominance of very small farms (micro-farms), especially in the Western lowlands and middle lands, in particular in Imereti, Samegrelo–Zemo Svaneti, and Guria as well as in southwest Georgia. These areas are characterized by high fragmentation of land into very small family-owned parcels (typically up to 0.5 ha), which are commonly used for subsistence or small-scale production. Besides, the presence of few large-scale farms that are mainly concentrated in the Kakheti region (which accounts for around 57.8% of all farm holdings exceeding 100 ha (Kaczmarek-Khubnaia, 2020)) is also obvious. Given this structure, it has been decided to categorize maize farmers mainly on the basis of the average size of their farm, by relying on the 2014 Agricultural Census insight (Table 1-10). They are grouped in 4 categories: micro farmers, small farmers, medium-scale farmers and large-scale farmers.

TABLE 1-10: DISTRIBUTION OF AGRICULTURAL HOLDINGS OF MAIZE FOR GRAIN SOWN AREA (2014)

			MICRO		SMALL			MEDIUM		LARGE	
			ha		ha			ha		ha	
		Holdings with maize for grain sown area	<0.1	0.1-0.49	0.5-0.99	1-2.99	3-4.99	5-9.99	10-49.99	50-99.99	≥100
	Georgia	284,085	47,368	155,508	61,898	17,866	701	413	288	29	14
West	Adjara AR	16,553	5,620	10,282	568	79	3	1	0	0	0
West	Guria	22,774	1,041	15,734	5,349	621	10	16	3	0	0
West	Imereti	90,314	8,639	54,300	23,720	3,521	71	42	19	2	0
West	Racha-Lechkhumi&Kvemo Svaneti	7,884	4,120	3,502	237	25	0	0	0	0	0
West	Samegrelo-Zemo Svaneti	52,405	4,031	24,933	17,490	5,723	132	51	41	2	2
East	Tbilisi City	564	414	138	9	3	0	0	0	0	0
East	Mtskheta-Mtianeti	9,095	3,238	4,278	1,285	267	7	14	5	0	1
East	Kakheti	35,632	5,807	15,034	8,398	5,696	336	196	138	19	8
East	Samtskhe-Javakheti	8,786	3,020	5,380	326	54	5	1	0	0	0
East	Kvemo Kartli	20,412	7,066	10,471	1,727	961	84	59	40	2	2
East	Shida Kartli	19,666	4,372	11,456	2,789	916	53	33	42	4	1

Source: Geostat

1.3.1.1 Micro farmers

A micro farm refers to a very small agricultural holding, typically less than < 0.5 ha, particularly in the western part of the country. These are mostly subsistence farms, where households cultivate a mix of products (grains, vegetables) on small plots of land and keep small livestock. According to 2014 Agricultural Census, micro-scale agricultural holdings represented the largest share, accounting for 71% of total maize holdings (Table 1 10).

They are characterized by low input-use and limited mechanization, relying mainly on family labour. Micro farms are generally not integrated into structured VCs or formal supply arrangements. When production is marketed, it is usually in small volumes through local markets (e.g., village, municipal or large city markets) or informal roadside stands (corn on the cob), and depends highly on seasonal surplus. These farms often face constraints in accessing credit, technology, or reliable input supply, storage facilities and transportation.

These farmers cultivate mostly local white and, to a lesser extent also yellow hybrid maize. While a small portion of the white maize grain is stored as seed, the rest is sent for milling so that households can consume it in the form flour or bran. Yellow maize, on the other hand, is typically used by micro farmers to feed their small livestock such as poultry.

Field observations confirmed that maize production in micro farms is rarely a specialized activity. Most households combine maize cultivation with vegetable production, fruit trees, small vineyards, poultry, pigs and one or two cattle. In many cases, household members also engage in seasonal agricultural labour, construction work, local trade, public sector employment or receive remittances from relatives working in urban areas or abroad. Consequently, maize contributes simultaneously to household food security, livestock feeding and supplementary income generation, while the overall livelihood system remains highly diversified and risk-oriented.

1.3.1.2 Small farmers

Small farms are larger than micro farms, typically ranging from 0.5 to 4.99 ha. They often sell part of their output, especially grains such as maize and vegetables. They dominate much of the western lowlands, as well as parts of central and eastern regions. According to the 2014 Agricultural Census, small-scale agricultural holdings accounted for 28% of total maize holdings, reflecting their importance alongside micro farms.

These farms participate in informal or semi-formal markets, selling part of their output, especially grains such as maize and vegetables. The diversity of production systems among small farms varies according to regional conditions. In Western Georgia, many households combine maize with dairy production, fruit orchards, vegetables and vineyards, while in Eastern Georgia farms may integrate maize with wheat, barley or livestock activities. Revenues are typically generated from multiple agricultural products rather than a single commodity, allowing households to distribute risks and maintain cash flow throughout the year. The balance between subsistence consumption and market sales differs significantly across households, reflecting variations in resource availability, market access and production objectives. However, like micro farms, they face difficulties accessing finance and mechanization. Alongside micro farms, they play a vital role in food security and rural employment. However, limited registration and organization make them vulnerable to external shocks, compounded by productivity challenges related to poor infrastructure and outdated equipment. Although yields may vary from farm to farm depending on farming practices, they are commonly observed at around 3 t/ha on micro and small farms, which corresponds to the national average.

Like micro farmers, small farmers also cultivate both white local and yellow hybrid maize. A small portion of the white maize grain is stored as seed, while the remainder is sent for milling. As for yellow maize, farmers use nearly 75% of the production on-farm for self-consumption, while the rest is marketed to other farms, mainly through Facebook groups, an emerging practice that could facilitate inter-farm trade and coordination between VC actors reducing transaction costs.

1.3.1.3 Medium-scale farmers

Medium-scale farms range between 5 and 49.99 ha and are mostly located in Eastern Georgia. According to the Agricultural Census (2014), there were 701 medium-scale farms in the country. These farms, concentrated in Eastern Georgia, are characterized by conditions that allow for monocropping on larger plots. Based on VCA4D field missions, maize cultivation accounts for at least 60% of the total land area in these farms. Both white and yellow maize are cultivated, with yellow hybrid maize being dominant. Yields are higher than on micro and small farms, averaging around 5 t/ha.

These farms rely on external services providers for certain farming activities (e.g. ploughing, sowing, cultivation, harvesting, etc.). Production is relatively diversified, including both grain and silage maize, with a significant share of grain intended for market sales. Silage is mainly used for livestock in integrated farming systems. These semi-commercial operations are often managed by family members.

Although irrigation practices vary within this category, furrow irrigation appears to be the most dominant (VCA4D field missions). Compared to micro and small farms, these farms are better positioned and have easier access to credit, including through the Preferential Agrocredit Project[11], although they still face challenges.

Field observations indicate that medium-scale farms often represent a transition between traditional family farming and fully commercial operations. In addition to maize production, many cultivate wheat, barley, sunflower or vegetables and combine crop production with dairy or beef cattle enterprises. Revenue streams are therefore diversified through grain sales, livestock products and, in some cases, agricultural services. This enables a more efficient use of machinery, labour and land resources while reducing dependence on a single source of income.

1.3.1.4 Large-scale farmers

This category of farmers cultivates in land ≥ 50 ha and like medium-scale farms, is mostly located in Eastern Georgia. Similar to medium-scale farms, maize cultivation represents a significant share of the total cultivated land area. While white maize may also be grown, yellow hybrid maize is the predominant crop. According to the Agricultural Census (2014), the number of large-scale farms was 43 in the country.

Capitalization levels and access to equipment are the highest among large-scale farms. Some farming activities (ploughing, cultivation, harvesting, sowing, herbicide, drying, etc.) are carried out with the support of external service providers. This enables higher yields, averaging around 7.5 t/ha, with some farmers reporting yields of 12-14 t/ha under pivot irrigation. VCA4D field missions have also highlighted the significant presence of pivot irrigation systems on a few large farms in Eastern Georgia.

A substantial portion of the grain production is marketed through traders while silage is mainly used on-farm for livestock consumption.

Large-scale farms are generally characterized by stronger market orientation and greater integration into agricultural VCs. While maize often remains the dominant activity, some farms also integrate other field crops, livestock operations, grain storage facilities or trading activities. These diversified business models allow producers to benefit from economies of scale, capture value across multiple stages of the VC and reduce exposure to fluctuations in individual commodity markets.

1.3.2 Millers

Millers are the main recipients of white maize grain, which they process into flour. Their exact number is unknown but is estimated to be up to 1,000 across the country. These actors are typically small-scale artisanal and carry out milling activities using basic equipment, generally powered with electricity, although also some water mills exist, especially in the west. They mainly rely on family labour and their operating costs are lower compared to larger industrial milling companies. These larger mills also use quite basic equipment, similar to those of the artisanal type except for the size of engines and stones, which are larger.

Most small-scale millers process maize supplied directly by households or farmers. White maize is processed into flour for human consumption (valued at approximately 2.5 GEL/kg) while yellow maize is primarily used for animal feed. Maize bran is also valued by farmers as feed (around 0.30

[11] It has been initiated by the Ministry of Environmental Protection and Agriculture of Georgia and implemented by the Rural Development Agency since March 27, 2013.

GEL/kg). It is worth noting that although in-kind payments are common, some millers no longer accept them and instead operate on a standard fee-for-service basis.

The moisture content of maize grain is higher in Western Georgia due to rainy climatic conditions. After harvesting, farmers store maize grain in plastic or glass containers and typically transport it to millers in cloth bags. Some millers, particularly those attentive to flour quality, prefer to dry the grain on tables outside the mill for about 2 days before processing.

Although some millers also cultivate some plots for subsistence purposes, milling remains their main income generating activity. The peak season for maize milling typically runs from November to March.

For Western Georgia, our field observations confirmed the existence of local agricultural markets where white maize grain is traded, particularly during the post-harvest period and throughout the milling season. These markets are generally small-scale physical marketplaces operating on a weekly or semi-weekly basis and serving surrounding villages and municipalities. They are primarily accessible to micro and small-scale farmers, who can sell relatively small quantities of maize (maximum 300-400 kg annually) directly to consumers, local traders, livestock keepers, and small millers without complex formal requirements.

The volume of maize traded through these markets remains limited compared with total production and therefore they cannot be considered the dominant marketing channel. Nevertheless, they play an important role in facilitating local exchange and providing farmers with direct access to buyers. Market participation is generally localized, with most transactions occurring within short geographical distances.

Price formation in these markets is influenced by several factors, including local supply and demand conditions, grain quality (particularly moisture content and variety), competition among buyers, and reference prices offered by millers and traders. While these markets provide transparency on prevailing local prices and may strengthen farmers' bargaining position, their fragmented and relatively small-scale nature limits their influence on broader maize price formation. Producer prices are ultimately shaped by a combination of local market conditions, trader purchasing practices, and competition from imported maize, particularly in the yellow maize feed segment.

To summarize, our observations confirm that maize grain is mostly supplied directly to millers by farmers, although some micro farmers sell maize grain (white mostly) or maize flour in agricultural markets with small amounts. White maize grain is sold in agricultural markets in Western and Eastern Georgia, including big cities, which are primarily local physical markets. This suggests that some traders purchase maize grain at the farm gate and resell it in these markets, while some farmers (mostly micro and small-scale farmers) sell directly to consumers with minimal formal procedures.

During the VCA4D field missions, no industrial millers were identified. It should be noted that one of the country's major industrial milling companies (Geomill) primarily focuses on wheat rather than maize. Another industrial milling company, processing white maize, recently began operations in 2025 and is therefore not included in this VCA4D study, as its commercial activities and market integration were at an early stage.

1.3.3 Traders

The number of traders involved in maize VC is not precisely known exactly but is estimated to include 5 large, 20 medium and nearly 200 small-scale traders in the country. These traders play an important role in the marketing of both domestically produced and imported maize grain.

Agricultural markets play an important role in connecting producers with consumers and traders and operate in most municipal centres across Georgia. Smaller agricultural markets also exist in larger villages, such as Iormughanlo and Partskhisi. In larger municipalities, agricultural markets typically operate on a daily basis, whereas in smaller municipalities they may function only once or twice per week, depending on local demand and seasonal production patterns.

Access to agricultural markets is generally open to farmers, traders, wholesalers and final consumers. However, the role of farmers varies throughout the week. In many markets, specific market days are designated for direct sales by producers, while on other days agricultural products are mainly sold by traders and intermediaries. For example, in Khashuri municipality the agricultural market operates every day, but farmers primarily sell directly to consumers on Fridays and Sundays, while merchants dominate trade during the remaining days.

The size of agricultural markets varies considerably, ranging from small village markets serving local communities to larger municipal markets attracting buyers and sellers from neighbouring districts. These markets are particularly important for micro and small-scale farmers, who often lack alternative marketing channels and rely on local markets to sell maize grain, maize flour and other agricultural products.

Agricultural markets also influence producer-level price formation, particularly in the white maize VC. According to interviews with traders and maize flour sellers, annual harvest volumes are the main determinant of price fluctuations. Prices tend to increase during the summer months when stocks of white maize become scarce and market supply declines.

Compared to yellow maize, white maize flows less between farmers and traders, as it is, in most cases, sent directly by farmers to millers. In the case of yellow maize, small-scale farmers usually sell their produce independently, often using social media groups. As a result, traders are more likely to purchase yellow maize grain from medium and large-scale farmers, who are estimated to supply around one-third of the national output.

It should be noted that economies of scale exist in the marketing maize grain from medium and large-scale farmers as they supply larger quantities. In contrast, small-scale farmers sell yellow maize in smaller volumes and therefore incur higher transport costs per tonne. Consequently, the farmgate price of yellow maize grain tends to be slightly lower for medium and large-scale farms. For the reference year 2024, the farmgate price for yellow maize grain ranged from 650 GEL/t to 750GL/t.

Georgia imported 71,000 tonnes of maize in 2024, mainly from Russia. The preference of importing Russian maize grain is driven by its significantly lower farmgate price in Russia, even after accounting for transport costs. As a result, many traders import Russian maize into the country, earning profit margins of approximately 20-30 GEL/t. Small-scale traders are also involved in this trade and are reported to have maize trading capacities comparable to those of medium-scale traders.

Both domestically produced and imported maize are primarily sold to domestic actors in Georgia. In 2024, only 10,563 tonnes of grain were exported (to Iran), while the remainder was marketed by traders to livestock, poultry and pig farms, as well as to feed millers. It should be noted that, feed millers and large poultry farms benefit from the price advantage of imported maize, as they purchase large quantities from traders at prices lower than Georgian farmgate levels.

1.3.4 Indirect actors

Indirect actors are those who do not produce, process, or trade maize directly but provide goods or services that enable these activities. These include input suppliers, mechanization and equipment service providers, transport and logistics providers, storage operators, financial services providers, extension and advisory services (Table 1-11).

TABLE 1-11: INDIRECT ACTORS IN MAIZE VC IN GEORGIA

Actor Type	Role in VC	Main actors	Primary Users	Challenges
Seed Suppliers	Provide certified or uncertified maize seeds	Agrosphero, Lomtagora, other seed companies	All farm types, although micro farms procure seeds in rare cases	Availability, cost, use of non-recommended seed
Fertilizer / Agrochemicals	Provide inputs for soil fertility, pest/weed control	Agro-stores and international companies with local distributors	All farm types	Cost, inappropriate use, limited training
Irrigation Providers	Provide irrigation equipment and services	Government company LTD Melioration, private companies (e.g.ProAgro) or state-run programs funded by local budget or international organizations (WB, ADB, etc.)	Mostly large and medium farms	Poor infrastructure
Mechanization Services	Provide farm machinery and repair	Private service providers, mechanization LTDs, Government support programs (e.g. through Agricultural and Rural Development Agency)	Medium and large, some small	High costs, limited access for micro and small-scale farmers, limited machinery (e.g. harvesters and silage related machinery)
Transport Providers	Transport maize to downstream actors, markets and end users	Private operators, local aggregators	All farm types	Poor infrastructure, high transport cost for small volumes
Storage Operators	Store maize for sale and/or processing	Private storage facilities operators, some wholesalers, farmers	Medium and large farms	Lack of quality storage for small and medium-scale farmers
Financial Institutions	Provide credit, leasing, insurance to VC actors	Commercial banks (TBC, Bank of Georgia), microfinance institutions, donor programs (ENPARD, FAO, etc.)	Medium and large farms	Limited access to financial assets for micro and small-scale actors
Extension Services	Provide technical advice and training to VC actors	State extension services under MEPA, NGOs and donor-funded programs (EU, FAO, UNDP, IFAD, Word Bank), input suppliers (private agronomists)	All farm types	Limited inclusivity, difficulties to reach actors in remote areas

1.4 Value chain mapping and flows

The mapping of the maize VC in Georgia was conducted using data collected during field missions, complemented by national statistics from Geostat. While the mapping drew extensively on the most recent Agricultural Census (2014), several assumptions were required to account for evolutions up to the study's reference year, 2024. In particular, estimates of the shares of white and yellow maize were necessary, as this distinction is not captured in national statistics. These assumptions are based on expert observations and consultations with public institutions, which informed estimates of potential changes across different farm typologies. Table 1-12 presents the assumptions underpinning the VC mapping.

TABLE 1-12: ESTIMATED MAIZE FARM TYPES AND THEIR CHARACTERISTICS (2024)

	Micro farms	Small-scale farms	Medium-scale farms	Large-scale farms	Georgia
Estimated number of maize farms	172,155	44,877	839	75	217,947
Total agricultural land holding (ha)	17,216	40,389	7,552	3,743	68,900
Production of grain (t)	41,432	108,555	34,387	27,127	211,500
Yield (t/ha)	2.4	2.7	4.5	7.2	3
Average area per farm (ha)	0.1	1	10	50	
Production share (%)	19.6	51.3	16.3	12.8	100

Table 1-12 estimates that there were approximately 218,000 maize farmers in the reference year 2024. This represents a decrease of around 66,000 farmers compared to the 2014 Agricultural Census, a trend widely reported and confirmed by VC stakeholders during field missions. This decline reflects the abandonment of micro and small-scale farms, partially offset by an increase in the number of medium and large-scale farms. This structural shift affects the distribution of production, with micro and small-scale farmers still estimated to contribute around 71% of national output, consistent with the typology described by Ducourtieux (2022), while total national production reached 211,500 tonnes in 2024.

Micro farms typically operate for subsistence purposes on small plots associating different crops, accordingly the average area per micro farm is estimated at 0.1-0.2 ha for the model computations. The average farm size for small, medium and large-scale farms is assumed to be 1, 10 and 50 ha, respectively. Average yield levels of maize are estimated to be lower for micro and small-scale farms due to relatively limited input use and mechanization. In contrast, medium and large-scale farms exhibit higher yields, however, for the sake of model consistency, these are set at 4.5 t/ha and 7.2t/ha, respectively, although some farmers report achieving higher yields. It should be noted that for the purposes of the VC model and computation of indicators, average values for farm area and yield were assumed, notwithstanding the presence of exceptions within each farm category.

For silage, production modelling is based on the information provided in section 1.2.7. Production is assumed to take place primarily on medium and large-scale farms in Eastern Georgia. Output is highly concentrated in Kakheti, which alone accounts for approximately 63% of total silage production. Yield levels exhibit regional variation; however, an average national yield of 30t/ha is used for the analyses.

Figure 1-10 is the flow chart of the maize VC in Georgia showing the main VC actors and flows. While white maize production is concentrated in Western Georgia and involves predominantly micro and small-scale farmers, yellow maize and silage production dominate Eastern Georgia, in particular in Kakheti, where large-scale farms correspond to 57.8% of all farm holdings exceeding 100 ha (Kaczmarek-Khubnaia, 2020).

The feed milling industry uses a variety of inputs to produce animal feed, with maize being one of the key cereals in compound feed. However, this industry has not been considered a direct actor within the VC scope due to the methodological complexity involved in analyzing it. Given its importance for the development of the maize VC and the national economy, the VCA4D team decided to examine the industry more closely and conduct a supplementary economic analysis—beyond the scope defined by the Functional Analysis—to estimate its value added prior to the workshop.

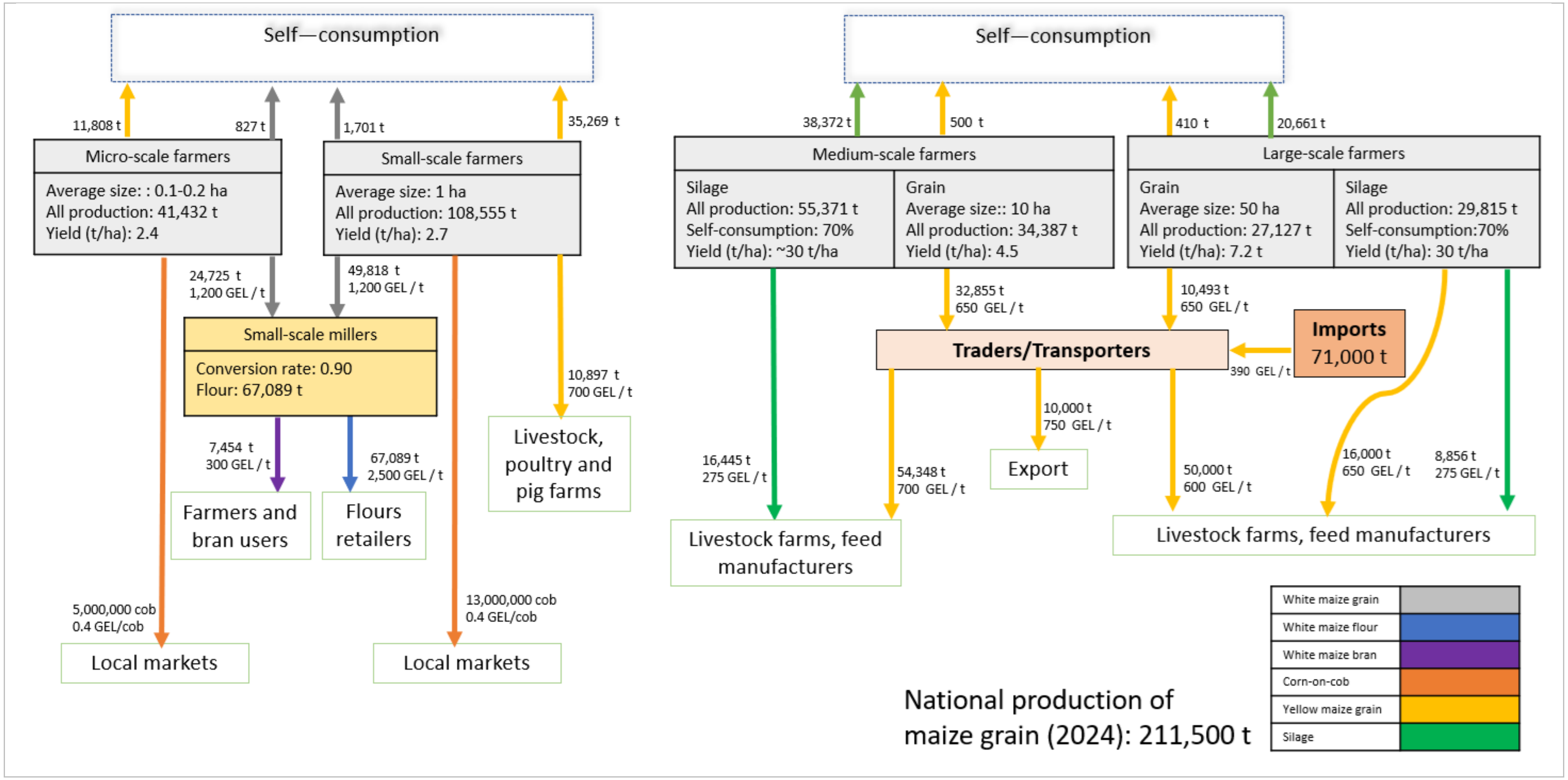

FIGURE 1-10: FLOW CHART OF THE MAIZE VALUE CHAIN IN GEORGIA (2024)

1.5 Sub-chains

A sub-chain forms a part of the overall VC but is distinguished by its own specific characteristics. Although the actors do not operate in isolation, two main sub-chains can be identified based on regional characteristics and the maize varieties used for consumption purposes (Figure 1-10). The first is food-maize sub-chain, characterized by the widespread cultivation of white maize in Western Georgia, primarily by micro and small-scale farmers. As this sub-chain is oriented toward human consumption, it is more closely linked to Georgian gastronomy and holds greater socio-cultural significance within overall maize production.

The second sub-chain is characterized by the production of yellow maize and silage for animal feed. It involves primarily medium and large-scale farms concentrated in the eastern regions. Traders play a significant role in this sub-chain, particularly in the import and distribution of relatively cheaper maize.

These two sub-chains also differ in their farming practices, with lower input level and less intensive mechanization in the first sub-chain, and due to regional climatic and environmental conditions in the western and eastern regions. The western region is more humid, often requiring drainage of agricultural plots, and is characterized by smaller farm sizes, whereas the eastern region is drier, and therefore relies more heavily on irrigation.

1.6 Governance of the value chain

1.6.1 Marketing networks and distribution channels

The VC is primarily characterized by short, private marketing circuits, structured around semi-commercial relationships among farmers and other private actors. At the distribution level, a diverse range of small, medium and large-scale traders are involved in the marketing of flour and yellow maize grain.

For imported maize, the marketing circuit is longer, as traders transport maize grain over long distances from farms in Russia to the domestic market.

Intra-farm trade, referring to the exchange of maize products between farmers, and trade with wholesalers, are common and is often conducted through social media networks. For farmers, information on maize prices and available volume of maize products is generally accessible via public websites, social media platforms, and informal communication with wholesalers and other farmers. This access is even more readily available for downstream actors such as traders and processors.

1.6.2 Stakeholders' strategies

Farmers' strategies are driven by the pursuit of high yields, both to ensure household consumption and to generate cash income, whenever climatic and soil conditions allow. For micro farmers (who represent the most vulnerable segment of subsistence agriculture, often consisting of an older couple as a household) and most small-scale farmers, access to inputs, agricultural machinery and extension services is essential to achieve yields sufficient to sustain both their ruminants and their families. Land fragmentation also remains an issue in these structures.

For medium and large-scale farmers, there is significant potential to adopt improved cultivation techniques, including the acquisition of mechanized equipment and the installation of irrigation systems. Most maintain stable relationships with their suppliers. There is also a strong emphasis on on-farm-storage and drying facility, to a lesser extent, on improving access to inputs and credits.

1.6.3 Horizontal coordination

Horizontal coordination within the maize VC in Georgia is mostly informal. Cooperation between micro and small farmers is extremely limited. We have not identified any cooperation between micro or small-scale farms including formal cooperation. Micro and small-scale farmers tend to operate individually and rely mainly on household labour and local networks. In west Georgia, we have identified some traditional forms of cooperation among small-scale farmers, such as mutual labour exchange practices (e.g. nadi), but their importance is gradually declining due to rural outmigration and structural changes in agriculture.

Among medium and large-scale farmers, some forms of informal cooperation are observed, particularly in joint procurement of inputs, shared use of machinery and coordinated access to service providers (e.g. irrigation or agricultural drones). These arrangements help reduce costs and improve efficiency; however, they remain ad hoc and are not institutionalized. In some cases, mostly in east Georgia, large-scale farmers procure inputs abroad and resell to medium farmers.

Formal farmer organizations and cooperatives are largely underdeveloped within the maize VC. Although associations such as the Georgian Farmers' Association (GFA) and Elkana provide support in terms of training and capacity building, their direct role in fostering horizontal coordination among maize producers remains limited. The Georgian Maize Association exists but has relatively low institutional capacity and limited influence. Overall, the lack of strong and inclusive producer organizations constrains collective action, bargaining power and knowledge sharing across the VC.

1.6.4 Vertical coordination

Vertical coordination in the maize VC is characterized by relatively loose linkages between actors and a predominance of market-based, transactional relationships. Most exchanges between farmers, traders, processors and input suppliers are conducted through informal arrangements, often without written contracts. However, in recent years, an increasing number of farms selling packaged white maize and white bran have established formal contracts within the supply chains.

Small-scale farmers typically sell white maize through local markets or to intermediaries, with limited integration into structured VCs. In some cases micro farmers sell white maize grain to millers or grain and flour to the wholesalers who afterwards sell products in big cities and agricultural markets. Price formation is largely determined by market conditions, and farmers have limited bargaining power, particularly in remote areas. In contrast, medium and large-scale farmers demonstrate stronger vertical linkages, including more stable relationships with input suppliers, service providers and buyers. These farmers mainly supply maize to retail chains, processors or feed producers, indicating higher levels of market integration in domestic economy.

Input suppliers (agro-shops) play an important role in the VC by providing both inputs and advisory services, partially compensating for the limited reach of public extension services. However, the absence of formal contractual arrangements and structured supply chains reduces predictability and limits incentives for investment and upgrading.

Overall, vertical coordination remains moderate and uneven, with stronger integration observed among larger, more commercially oriented farms, while smallholders remain weakly connected to downstream actors.

1.6.5 Policy framework

The policy framework governing the maize VC in Georgia is shaped by a combination of national agricultural strategies, sectoral programmes and broader rural and agricultural development policies implemented by MEPA and its affiliated agencies. The following table presents the functions of governmental institutions involved in overall agricultural policy, including those related to the maize VC.

TABLE 1-13: POLICY INSTITUTIONS WITHIN THE MAIZE VC FRAMEWORK

	MEPA	Rural Development Agency (RDA)	National Food Agency (NFA)	Scientific-Research Center of Agriculture (SRCA)
1.	Implementation of state policy for the sustainable development of maize	Implementation of agricultural development programmes such as Preferential Agrocredit Project, co-financing programme for harvesting agricultural machinery, agro-insurance, programme for promoting agricultural production on irrigated land plots and others	Animal health management and certification of livestock farms	Explore-study, rehabilitate and develop local gene pool of the annual and perennial crops; Set up the genetic bank; Observe, evaluate and adapt the introduced species and varieties of crops in Georgia;
2.	Development of legal acts, including strategies, action plans, laws and other normative acts; development of projects and their presentation to the Government of Georgia for approval, the issuance of administrative acts within its competence, and the state control of the execution of corresponding normative acts	Coordinates agricultural extension services. The agency has 9 regional offices and 45 information service centers providing extension services to farmers.	Monitoring feed quality, for example silage quality	Arrange the standardization and certification systems for planting and seedling materials; Study the land pool and restore the soil fertility of Georgia; Endorse the bio-agro (organic) production, promote the ecologically safe food and harmonize it with international standards;
3.	Promotion of scientific research and the implementation of relevant technologies to support maize sector management and its sustainable development			Measure the pests and diseases of plants and elaborate the integrated control systems;
4.	Definition of policies related to land management, irrigation and drainage			Scientifically evaluate the risk probability, revealed in food and forage and work out the recommendations for the risk management bodies; Communicate with the public, international, donor and non-governmental organizations; Develop and promote the extension programs, spread the regional knowledge.

The government has introduced a range of support mechanisms aimed at improving agricultural productivity and rural livelihoods. These include co-financing programmes for agricultural machinery, irrigation infrastructure development, improved access to finance and targeted support for smallholder farmers. Institutions such as RDA play a key role in implementing these programmes. In addition, state-owned enterprises such as “Georgian Amelioration” are responsible for irrigation and drainage infrastructure, which is critical for maize production.

However, during field missions, farmers commonly noted that programmes require some modifications and improved accessibility. For instance, despite the existence of a programme to procure new harvesters, prices remain too high for farmers to afford them, even with government support. Agro-insurance and Preferential Agro-credit programmes also face several bottlenecks, highlighting the need for closer cooperation with farmers to improve and adapt these initiatives. Thus, despite these efforts, several policy challenges remain. Access to support programmes is often uneven, with medium and large-scale farmers better positioned to benefit due to their higher capacity to co-finance investments. Public extension services remain relatively weak, limiting the dissemination of knowledge and innovation, particularly among smallholders. Furthermore, limited coordination between policy instruments and VC actors reduces the overall effectiveness of interventions.

International organizations, the EU, AFD, EIB, EBRD, the World Bank, Asian Development Bank, FAO and other development partners, complement national policies by supporting sectoral development, capacity building and infrastructure investments, including rehabilitation and development of irrigation system that is crucial for maize production development in eastern Georgia. To this regard, the national irrigation strategy will be updated to improve water efficiency in the framework of the implementation of the sustainable and inclusive irrigated agriculture development programme co-funded by the EU, AFD, ADB and EIB. However, stronger alignment between policy measures, VC needs and social inclusion objectives would be required to enhance the overall governance and performance of the maize VC.

1.7 SWOT Analysis

Strengths	Weaknesses
• Significant contribution of maize production to food security • Availability of local varieties • Suitable climatic and environmental conditions for maize cultivation (limited to some regions) • Significant role of white maize production in country's tradition/culture and its importance in the country's gastronomy	• Fragmented land plots (micro and small farms) limiting mechanization and modernization, with labour shortages due to labour-intensive activities, contrasted with relatively highly mechanized medium and large farms • Limited access of VC actors to machinery and equipment (in particular small farmers but in some cases even medium and large farms affected) • Poor infrastructure for effective irrigation systems • Weak soil fertility management practices and a lack of high-quality organic compost and fertilizers • Limited capacity for storage, particularly in small-scale farms • Farmers' limited connection with downstream actors • Dependency on imported agricultural inputs and exposure of farmers to price volatility • Absence of effective organizations for maize VC
Opportunities	**Threats**
• Increased demand of livestock industries for maize • Presence of feed miller companies, that are also oriented to export • High demand for maize flour by the HoReCa sector	• Price and quality competition with the imported maize • Non-diversified import market (solely dependent on Russia's risky market) • Climate change impacts • Soil degradation due to continuous maize cropping • Lack of effective water and wetland management • Abandonment of farming activities by young generation

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

2.1 Profitability & Sustainability of actors

2.1.1 Background and hypotheses

This "financial analysis" focuses on individual actors within the VC (maize farmers, millers, traders, etc.). It is based on the construction of operating accounts for each representative type of actor, as defined in the common typology. As outlined in the Functional Analysis chapter, diversity of actors, in terms of size, practices, technologies, strategies and operating conditions, have been simplified for analytical purposes, while acknowledging the existence of exceptions and outliers within each category.

Some actors may also be involved in activities beyond production, and some farmers may cultivate multiple maize varieties. Consistent with the VC approach, the analysis focuses exclusively on maize-related activities, while incorporating other relevant elements into the operating accounts where possible. In other words, each actor's operating account reflects only activities related to the VC, and the calculated operating profit corresponds solely to their involvement in the maize VC. Consequently, these operating profits do not represent the actor's total income and may be supplemented by revenues from other activities. This is particularly important at the household level, where additional income may be generated from non-maize activities undertaken by the actor or other household members.

To carry out the financial analysis, we relied as much as possible on existing data as well as information collected during field missions, while remaining mindful of potential representativeness issues. Where data were unavailable at the time of the study, realistic assumptions were made regarding the necessary parameters to fill these gaps.

We used the most recent statistical data produced by GEOSTAT for the following variables: volume of national output in 2024, supply and utilization of maize, selling price of maize products. Production costs rely mostly on data from our own surveys as well as data confirmed by GFA's surveys and national statistics.

For carrying out the economic analysis, AgriFood Chain Analysis (AFA[12]) software has been used.

[12] AFA software (developed by Cirad) helps facilitate the systematic organisation of physical and economic data. It ensures coherence, e.g. to ascertain that physical supplies and utilisations are balanced or that prices used are consistent. It automatically calculates indicators (financial profitability for the actors, direct value added at sub-chains and whole chain levels, total effects, sustainability within the international economy).

TABLE 2-1: HYPOTHESES FOR FINANCIAL ANALYSIS

Actors	Actor characteristics for financial analysis
Micro-scale farmers	On average 0.1-0.2 ha, with a yield of 2.4 tonne/ha. Production includes white and yellow maize, as well as corn on the cob. Low mechanization and limited access to financial assets. No labour costs. Main production costs include inputs (seed, diesel, fertilizer, herbicide). Milling service of yellow maize (feed) is also considered.
Small-scale farmers	On average 1 ha, with a yield of 2.7 tonne/ha. Production includes white and yellow maize, as well as corn on the cob. Limited mechanization and access to financial assets at higher interest rate (23%). Labour costs mainly associated with harvesting. Main production costs include inputs (seed, diesel, fertilizer, herbicide) and external cultivation services. Yellow maize for self-consumption (feed) also has milling service cost. Depreciation cost is practically absent as farmers rely primarily on outsourced equipment.
Medium-scale farmers	On average 10 ha, with a yield of 4.5 tonne/ha. Production includes yellow maize and silage. Mechanization and access to financial assets are higher compared to smaller farms. External labour is also employed. Main production costs include agricultural inputs (seed, diesel, fertilizer, herbicide, etc.), transport, and external cultivation services. Yellow maize grain is milled for use as livestock feed (self-consumption), which involves additional milling service costs. Depreciation costs are mainly related to farm buildings. Land rent (around 600 GEL/ha[13]) is also significant and around 20% of land is rented. These farmers also pay land and property taxes. They have access to lower-interest loans through the Preferential Agro-Credit Programme, offering approximately 10,000 GEL at 3–4% interest.
Large-scale farmers	On average 50 ha, with a yield of 7.2 tonne/ha. Production includes yellow maize and silage. Mechanization levels and access to financial resources are higher. External labour is employed. In addition to agricultural inputs (seed, diesel, fertilizer, herbicide, etc.), production costs include water, electricity, transport, external cultivation services. Yellow maize grain undergoes milling for livestock feed, adding a service cost. Depreciation costs are associated with farm equipment (buildings, tractors, combines) as well as modern irrigation systems, where applicable (pivot, linear, guns, drip, sprinkler). Like medium-scale farms, large-scale farms also have access to lower-interest loans, typically offering around 100,000 GEL at 3–4% interest. They also pay land and property taxes, and rent 20% of the land at around 650 GEL/ha.
Silage farmers	On average 50 ha, with a yield of 30 tonnes/ha. Production costs include agricultural inputs (seeds, fertilizers, herbicides) as well as external services (cultivation, ploughing, etc.). Manure is also used, which incurs additional spreading costs. Their cost structure is similar to that of large-scale farms, including hired labor, rented land, and taxes (land and property), along with access to lower-interest financing. Depreciation costs cover buildings, tractors, combines, and irrigation systems.
Millers	A small-scale village miller with a capacity of 10–15 tonnes per year. The main cost items are electricity and equipment maintenance, with occasional use of hired labour. Depreciation costs relate to the mill building. The miller charges a service fee of around €300 per tonne.
Small and medium-scale traders	4 tonne/day over 200-220 effective working days. Yearly volume per trader is 800-900 tonnes. It is estimated up to 200 small-scale and 20 medium-scale traders. Maize grain and transport are the main cost items. Other costs include electricity, wages, financial credit payments and depreciation of equipment (trailers and loaders).
Large-scale traders	25 tonne/day over 200-220 effective working days. Yearly volume per trader is around 5,000 tonnes. There are 5 large-scale traders in total. Maize grain procurement and transport are the main cost components. Additional costs involve electricity, wages, loan repayments and depreciation of equipment (trailers, loaders and spreaders).

[13] Land rent is about 800 GEL for irrigated land and 300 for non-irrigated land.

2.1.2 Financial analysis of individual accounts

Table *2-2* illustrates key components of the operating accounts of maize VC actors as well as Net operating profits (NOPs). Operating accounts reflect yearly expenses and production of maize activity. NOP is the remaining profit after paying all costs (also excluding depreciation costs which mean capital investment to maintain and renew equipment).

It is seen that maize VC activities allow for receiving positive net profits for all VC actors. Among farmers, NOP is lower for micro and small-scale farmers, which is around 235 GEL and 1,200 GEL, respectively. However, for these farms, maize production represents only a share of total income, as farmers are also engaged in activities outside the maize VC. Moreover, maize plays an important role in their food security, given the significant level of self-consumption for both food and feed purposes.

Medium- and large-scale farms, together with silage farms, achieve higher NOPs. Compared to micro and small farms, they are better positioned to benefit from mechanization and a combination of family and hired labour. However, large-scale farms record the lowest return on turnover (ROT), as their production costs are higher due to scale and mechanization. These farms rely more heavily on hired labor, whereas micro and small farms, and, to a lesser extent medium-scale farms, depend largely on family labour. In addition, the greater use of machinery increases depreciation costs, further reducing profit margins. Nevertheless, higher yields generally offset these cost pressures. In our model, we assumed relatively lower yield levels for large farms, although in practice they often achieve yields exceeding 7.5–8 tonnes/ha.

TABLE 2-2: INDIVIDUAL ACCOUNTS OF MAIZE VALUE CHAIN ACTORS (IN GEL)

Actors	Production	IGS	Wages	Taxes	Interest on loan	Land fee	Depreciation	Net Operating Profit (NOP)	Return on turnover (ROT)
Micro Farmer	362	127	0	0	0	0	0	235	64%
Small Farmer	2,776	990	162	0	406	0	0	1,218	43%
Medium-scale farmer	37,700	19,886	422	1,392	1,582	1,160	844	12,415	33%
Large-scale farmer	266,500	124,486	22,038	6,089	15,375	6,663	10,421	81,429	31%
Silage farm	412,500	130,500	68,750	6,600	12,900	0	13,848	179,902	44%
Miller	16,960	13,867	32	0	0	0	42	3,020	18%
Small/medium-scale trader	450,225	407,950	12,408	0	4,593	0	1,837	23,436	5%
Large-scale trader	4,537,441	4,119,090	125,232	4,239	111,271	0	47,151	130,458	3%

For a small-scale village miller of 10 tonnes annual capacity, the net profit from maize is estimated at around 3.020 GEL. Intermediate goods and services (IGS) constitute the main cost component, particularly electricity costs. It should be noted that the miller also processes other cereals and therefore supplements maize-related profits with additional sources of income.

Traders operate with high levels of profits, but their margin is thin (0.02-0.03 GEL/kg). Their main activity consists of purchasing, transporting and reselling maize grain, generating relatively low added value. In contrast to upstream activities, trade requires both skilled and unskilled labour, which is relatively better remunerated. Capital investment is also significant, particularly among large-scale traders, due to the use of machinery and equipment, resulting in higher depreciation costs.

2.2 Total effects within the national economy

2.2.1 Consolidated account of the value chain

The operating accounts of all maize VC actors have been consolidated into a single account encompassing all flows generated by the VC, in order to assess its impact on both the actors and the national economy. The consolidation was based on the VC flow chart (Figure 1-10).

Table 2-3 illustrates the consolidated account of the maize VC. The total value of production amount to 273 million GEL for the reference year 2024. Direct VC actors (maize farmers, millers, traders) generate a direct value added (VA) of 155 million GEL. Net operating profits of the actors (76%) and wages (10%) are among the main components of this direct VA. It should also be noted that interest on loans represents a significant share of direct VA which can be explained by the large number of small farmers who hold smaller loans at higher interest rates compared to medium- and large-scale farmers.

2.2.2 Distribution of direct value added

Maize farmers and millers are the main contributors to the generation of the direct VA (80% and 15%, respectively) (Figure 2-1). Micro and small-scale farmers, together, account for 57% of the VA generation which shows that the maize VC is highly smallholder driven. Therefore, a large share of income generation remains at the production level, particularly among small actors. It should be noted that these farms constitute the majority and the fact that they transform inputs into products using fewer intermediate goods and services lead higher VA share.

Maize millers' contribution to VA is also remarkable (15%). This highlights the importance of processing activities in value creation, confirming that transforming maize into flour is one of the main drivers of VA generation. Although comparisons between different VCA4D studies are not fully appropriate due to differences in VC scope and context, this contribution of the processing stage falls within the range observed in previous VCA4D[14] studies in the African context (from 15% to 43%). However, it remains significantly high when compared with a similar context (wheat VCA4D study in Moldova[15] (3%)). This can be partly explained by the fact that Moldova largely imports wheat flour while exporting unprocessed wheat, whereas white maize grain milling in Georgia transforms locally produced maize into flour, thereby generating higher value addition.

The feed milling industry is excluded as a direct actor from the VC scope, and its VA is therefore not captured in the economic analysis.

Traders' contribution is lower as they mainly operate by buying and reselling maize in large volumes on small margins.

[14] Ghana groundnut (23%) (Kleih et.al, 2017), Ghana sorghum (43%) (Onumah et al., 2018), Nigeria maize (19%) (Onumah et al., 2021), Zambia maize (15%) (Fusillier et al., 2021), Niger groundnut (19%) (Andres et al., 2023).
[15] Kotyza et al. (2025)

CALLOUT BOX 1: Methodological considerations for the feed milling industry

One of the feed milling companies visited by the VCA4D team accounts for approximately 50-55% of the Georgia's feed market share. The company manufactures feed for multiple livestock species, including cattle, pigs, poultry, fish, sheep, and rabbits, plus pet food, using a range of raw materials. While maize is the main cereal used in broiler feed, wheat is the dominant cereal in pig and beef feed, meaning that maize represents only one of several production inputs across the company's operations. The company's maize sourcing highly relies on imported yellow maize.

Integrating this company into a VC analysis would have required access to its operating accounts in order to estimate its operating profit and VA. However, the resulting VA would reflect the company's overall feed manufacturing activities rather than the maize component specifically. Isolating the VA attributable to maize would therefore require different methodological approach using a two-actor model within the economic software AFA (feed manufacturing company and a buyer), focusing exclusively on feed products in which maize constitutes the dominant share of the consumable inputs, such as broiler feed. Due to data and time limitations, this analysis could not be undertaken within the scope of the present study and is therefore not planned for subsequent phases.

TABLE 2-3: CONSOLIDATED ACCOUNT OF THE MAIZE VALUE CHAIN IN 2024 (IN THOUSAND GEL)

Actors	Production	IGS	Wages	Taxes	Interest on loan	Land Fee	Depreciation	NOP	VA
Micro farmers	43,538	14,153	0	0	0	0	0	29,385	29,385
Small farmers	93,225	33,244	5,456	0	13,641	0	0	40,883	59,981
Medium-scale farmers	21,680	11,436	242	800	909	667	485	7,139	10,244
Large-scale farmers	17,753	8 ,292	2,268	405	1,024	443	694	5,424	9,460
Silage farms	23,100	7,308	3,050	369	722	0	775	10,876	15,792
Millers	126,034	103,046	237	0	0	0	308	22,441	22,987
Small/medium traders	67,480	61,144	1,859	0	688	0	275	3,512	6,336
Large traders	17,696	16,064	488	16	433	0	183	508	1,631
VALUE CHAIN	**273,771**	**117,952**	**13,603**	**1,592**	**17,419**	**1,110**	**2,722**	**119,370**	**155,819**

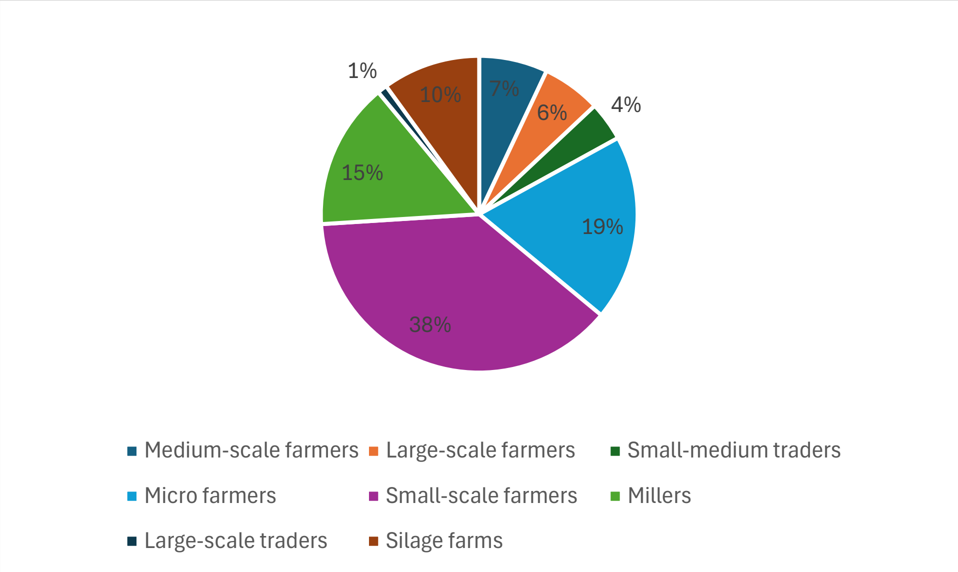

FIGURE 2-1: VA GENERATION BY VC ACTORS

Figure 2-2 illustrates the distribution of direct VA in its components. It is seen that a large share of the VA remains as profit for the VC actors. This distribution also reflects the labour structure, indicating limited reliance on hired workers, particularly among micro and small-scale farms. While interest on loans represents a notable share of VA (pointing to a certain degree of financial dependence of a large number of small farmers at higher interest rate and the importance of borrowing costs), the very low level of taxation is also noteworthy. This can be partly explained by a large number of micro and small-scale farms which are exempted from fiscal obligations. In such farms, self-consumption is a considerable part of farm production whereas sales are intra-farm or with wholesalers in short marketing circuits. In-kind payment also happens in most villages. Taxes are more significant in medium and large-scale farms and large traders whose number is relatively small among the VC actors.

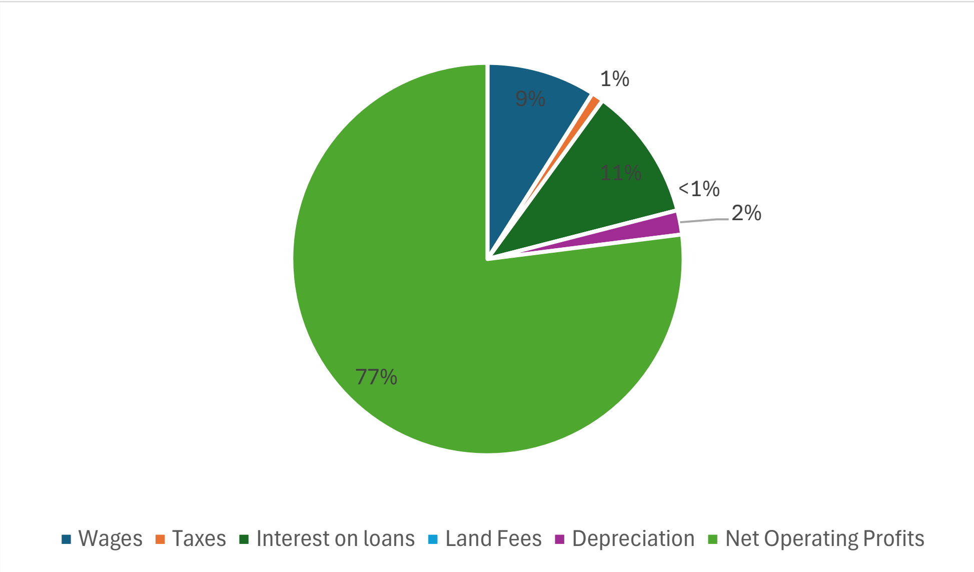

FIGURE 2-2: DIRECT VA COMPONENTS

2.2.3 Computation of total effects

After consolidating operating accounts, we calculated the total VA of the VC, defined as the sum of direct VA (created by direct actors within the VC boundaries, e.g. maize farmers, millers, traders) and indirect VA, generated by upstream providers of intermediate goods and services outside the VC boundaries (e.g. yellow maize grain village millers, agricultural input suppliers, service providers, transporters, etc.).

The analysis of total effects (total VA and total imports) consists of adding indirect effects (indirect VA and indirect imports) to direct VC effects (direct VA and imports), by tracing back through the production chains that supply IGS to VC actors via external agents. The data used are drawn from national accounts (input-output tables), which allow for disaggregation of IGS values across the relevant sectors.

Table 2-4 shows direct, indirect and total effects generated by the maize VC activities in 2024.

TABLE 2-4: DIRECT, INDIRECT AND TOTAL EFFECTS OF THE MAIZE VALUE CHAIN IN 2024 (IN THOUSAND GEL)

	Direct effects	Indirect effects	Total effects	% of total VA
Imports	27,690	20,330	48,020	
IGS not dissagregated		25,380	25,380	
Value added				
Wages	13,603	12,234	25,837	13%
Taxes	1,592	650	2,242	1%
Financial charges	17,419	0	17,419	9%
Land fee	1,110	0	1,110	<1%
Depreciation	2,722	4,274	6,996	3%
Net Operating Profit (NOP)	119,370	27,483	146,853	73%
Total VA	155,819	44,642	200,461	

Total VA created by the maize VC in Georgia was estimated at 200 million GEL for the reference year 2024. This total VA is composed mainly of NOPs generated by direct and indirect actors, followed by wages paid to workers. Farmers are the main contributors to total VA generation (Figure 2-3). This distribution also highlights the significant role of IGS suppliers, indicating strong backward linkages. This suggests that VC activities rely heavily on inputs and services, and that these supporting sectors generate a substantial share of total VA.

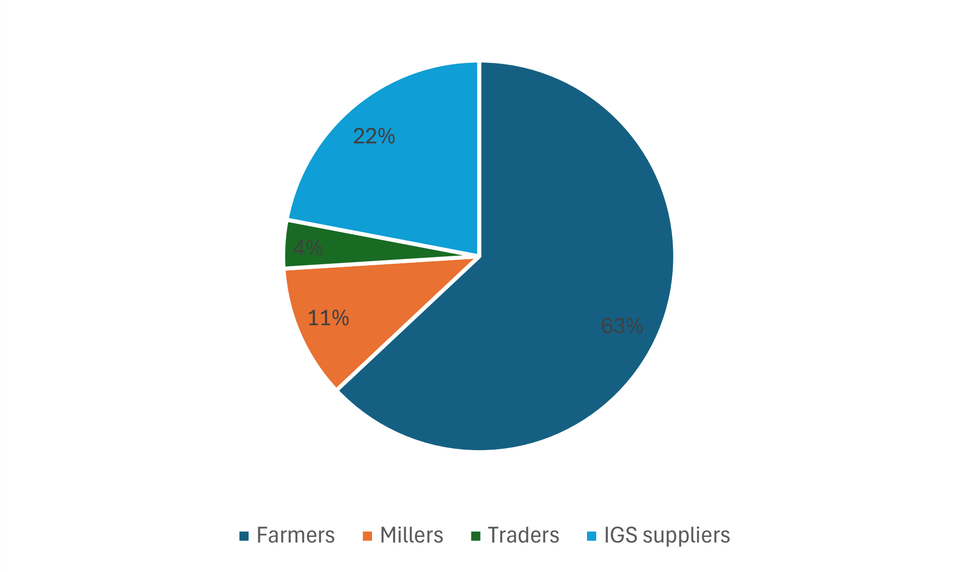

FIGURE 2-3: SHARE OF TOTAL VA BY VC STAGE (2024)

2.2.4 Contribution to economic growth

Growth is usually estimated by Gross Domestic Product (GDP), which is the sum of the VA created by all the domestic agents. The Direct VA measures the contribution of VC actors to growth and the Indirect VA the contribution of the domestic IGS suppliers to growth. Total VA measures the overall contribution to national growth entailed by the VC operations.

While the total VA generated by the maize VC represents only 0.2% of national GDP, it accounts for 4% of agricultural GDP[16]. The contribution of farmers alone (i.e., excluding the VA of millers and traders) represents 2.7% of primary sector GDP. These results highlight the importance of maize VC within the country's agricultural sector.

2.2.5 Driving effects within the domestic economy

Total VA also provides information on the level of integration of activities created and induced by the VC within the domestic economy. The integration rate indicates the share of the value of VC production that remains within the domestic economy. In other words, by showing the extent to which VC actors rely on domestic production capacities for IGS, this indicator measures the VC's capacity to drive development by stimulating domestic activities and economic growth.

The maize VC in the Georgia has an integration rate of 73% within the national economy. This means that for each maize product valued at 100 GEL, the value of import (embodied in imported maize, agricultural inputs, equipment, vehicles, etc.) is 27 GEL, while the remaining part (73 GEL) is the gain for the domestic economy. In other words, for each maize valued at 100 GEL, the domestic economy loses 27 GEL through imports of the IGS whereas 73 GEL is shared as income among the stakeholders in the maize sector.

Another indicator, called Driving effect ratio, informs on the involvement of domestic business in supporting the activities of the VC (Indirect VA / Direct VA). For the maize VC in Georgia, it has been

[16] The GDP of Georgia was 33.78 billion US dollars in 2024 (≈ 91.2 billion GEL) and with the contribution of agricultural sector to it by 5%.

computed as 0.28 meaning that for every 1 GEL of value created by the maize VC, 0.28 GEL of value is generated indirectly by suppliers through linkages. However, this value can be improved with policies targeting reduced dependency on imported IGS developing domestic industries.

2.2.6 Impact on public finances

The State levies few direct taxes related to the activities of the maize VC. Indirect taxes are also low. Taxes concern land and property tax and are included in the computation. Total taxes (direct and indirect) amounts to 2,242 thousand GEL constituting 1% of the total VA created by direct and indirect actors.

From a general perspective, Georgia applies very low tariffs (import duties) to imported products. Rates fall into three bands: 0%, 5% and 12% depending on the nature of the product. Nearly 90% of goods benefit from a zero rate of duty[17]. For agricultural inputs (seeds, fertilizers, agrochemicals, etc.), the tariff is often 0% if they are not produced locally and or imported under trade agreements. However, an 18% of VAT is applied to most imported goods, again with the exception for many agricultural inputs which are VAT-exempt[18] (seeds, fertilizers, agrochemicals).

There are no direct subsidies or expenses on VC's activities by the State. The government has introduced a range of mechanisms (see section 1.6.5) to support agricultural actors and improve productivity and rural livelihoods. For instance, the Preferential Agro-Credit program co-finances loan interest rates provided by private institutions to farmers. Farmers borrow from these private institutions, repay the principal and pay a reduced interest rate as government covers part of it. However, this support mechanism cannot be considered as direct subsidy program as it does not provide cash payments to VC actors nor guarantee any price support. On the other hand, the import duty policy that mentioned above reduces production costs (by enabling VC actors to import inputs cheaply) and creates an implicit subsidy effect as an indirect support measure.

Our calculations show a positive balance for public finances, despite limited tax revenues and indirect state support to the VC through the preferential agro-credit programme. The amount the state co-finances annually for part of medium- and large-scale farms remains lower than the taxes collected. As a result, the balance reflects a surplus of approximately 1,765 thousand GEL.

2.2.7 Impact on balance of trade

Importing IGS denotes losing foreign currency for the national economy while VC exports (if any) bring foreign currency gains. The VC balance of trade is the difference between its exports and imports.

The value of export of Georgia was 6.56 billion US dollars (≈17.7 billion GEL) in 2024. Georgia exported 10,000 tonnes of maize in 2024. With an export value of 16.3 million GEL, the maize export accounts for 0.1% of total exports of Georgia.

The value of total imports of the VC is 48 million GEL for the reference year 2024 (Table *2-4*). Thus, the trade balance (16.3 million GEL- 48 million GEL) is negative. The VC total imports accounts for

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[17] "Import of agricultural goods, food products, clothes, construction materials, wood and wood products, plastics, wire and cable, iron, steel, soap, organic surface-active agents, and washing preparations which are produced in Georgia in whole or in part, are major areas of goods taxed at higher rates". (Source: https://www.trade.gov/country-commercial-guides/georgia-import-tariffs)

[18] See here the source for detailed HS codes, indicating specific agri inputs that are VAT exempted: https://matsne.gov.ge/ka/document/view/1297485?publication=0

0.1% of the imports of the country. The negative balance of trade of the VC (-31.6 million GEL) remains tiny compared to Georgia's trade deficit[19], representing only 0.09%.

2.3 Competitiveness and viability within the international economy

As Georgia is part of the global economy, we assess the viability of the VC within the global economy using two indicators: the Nominal Protection Coefficient (NPC) and the Domestic Resource Cost Ratio (DRC), both commonly used to analyze the competitiveness of a VC.

Domestic products somehow compete with those available in the international market. International competitiveness is assessed with the NPC which compares the national and international prices of every VC product.

An indication of the overall economic gain or loss for the national economy is given by the DRC. The DRC compares: i) the actual internal cost for the economy given by the actual remuneration of the domestic non-tradeable factors (labour, capital, land, environmental goods) mobilised in the VC, and ii) the net value created within the economy: estimated using international parity prices (of IGS and production), i.e. from the opportunity standpoint of international markets.

For white maize, the Georgian variety has specific characteristics for which there is no standardized international price, making direct comparison difficult. For silage, the price also depends heavily on local production conditions as well as transport costs, since it is a bulky product that requires costly handling and logistics. Therefore, there is no single global price, as silage is not standardized traded commodity like maize grain. Prices are highly country-dependent and are shaped by dry matter content and local feed market conditions. For 2025, the price of silage at 13 tonnes of dry matter was estimated to be equivalent to a standing maize price of €980/ha, based on a grain maize price delivered to port at €190/t[20].

For yellow maize, domestic maize is more expensive than imported maize, which gives an NPC higher than 1 (1.21). This indicates an inefficiency in the domestic production.

DRC is less than 1 (0.18) meaning that the maize VC is viable in the global economy because the value of domestic factors which are consumed (land, labour, water, etc.) is lower than the value they produce (from the standpoint of the international markets and considering the present level of remuneration of domestic factors).

2.4 Sub-chain economic profiles

The economic analysis gathers evidence on how sub-chains perform. In this section, we present economic indicators for two sub-chains identified in the Functional Analysis (section 1.5). The first, the food sub-chain, primarily consists of micro and small-scale farmers and millers who produce and transform white maize for human consumption. This sub-chain mainly includes actors located in western regions of Georgia. The second, the feed sub-chain, involves medium and large-scale farmers and traders who are concentrated in eastern regions. Maize in this sub-chain is mainly used by livestock farms and the feed industry.

The economic indicators for these two sub-chains are presented in Table 2-5. The results should not be interpreted in a comparative manner, as the sub-chains differ in scope and relate to

[19] In 2024, the value of national export was around 17.7 billion GEL against value of national import of 50.2 billion GEL.
[20] Source: https://conseilenagriculture.fr/calculer-le-prix-du-mais-ensilage-2024/?utm_source=chatgpt.com

different maize varieties. In particular, the food sub-chain includes VA from processing maize into flour, whereas the feed sub-chain does not include transformation activities, as the VA of feed millers are not integrated in the current analysis, estimation requiring supplementary analysis beyond the scope of the VCA4D methodology (See Callout Box 1).

The value created per tonne of maize is significant in the food sub-chain (1200 GEL/t). This is largely due to processing activities, as maize is transformed into flour, thereby adding value per tonne of product. This highlights the potential benefits of directing development investments toward strengthening the domestic processing sector.

The resulting VA in the food sub-chain is primarily composed of profits, followed by interest on loans. It should be noted that, micro and small farmers face constraints in accessing financial services: even small loans are typically associated with high interest rates (23%), as reported during the field missions[21]. A relatively small share of VA is distributed across other components such as wages, taxes and depreciation. This reflects the structure of the food sub-chain, which is largely driven by smallholders relying on unpaid labour and often operating outside formal fiscal obligations.

In the feed sub-chain, the value created per tonne of maize is 202 GEL. It should be noted that this sub-chain also relies on imported maize. The relatively higher shares of wages and taxes in VA reflect a greater potential for generating income through employment and fiscal contributions within the domestic economy. This contrasts with the food sub-chain, where such effects are limited due to its more informal structure.

Processing plays a role in the feed sub-chain, as maize is further transformed through its use in animal feed. This indirect processing adds value supporting livestock production and the broader agri-food system. However, this VA is not included in the current results, the reported VA for the feed sub-chain would likely be higher if the feed milling industry were included in the analysis (see Callout Box 2).

These results indicate that processing in both sub-chain represents significant potential for the domestic economy. However, actors in the food sub-chain face structural challenges related to low productivity (due to fragmentation and limited economies of scale), as well as constrained access to credit and equipment. For the feed sub-chain, although not quantified in the current analysis, the feed milling industry and its linkages to the domestic economy and export markets are likely to offer substantial potential for future development of the maize VC.

Overall, the maize VC has significant potential in both food and feed sub-chains, and development policies should consider their complementarity in order to promote synergies and mutual gains.

[21] "While total loans to micro and small farmers are relatively small, they face higher interest rates (23-25%). In contrast, medium- and large-scale farmers borrow larger amounts at lower interest rates (3-4%) through Preferential agro-credit programme" (Source: field data collected from financial institutions).

TABLE 2-5: MAIZE SUB-CHAIN ECONOMIC INDICATORS (2024)

	Unit	Food sub-chain	Feed sub-chain
Maize input (grain)	tonne	84,272	131,668 (incl. imports), total 215,668 t
Maize input (silage)	tonne		84,000
Production	thousand GEL	134,799	109,065
Production to input	GEL/tonne	1,599	491
IGS	thousand GEL	33.110	65,600
Wages	thousand GEL	3,931	9,458
- wages on production	%	2.9%	8.6%
Taxes	thousand GEL	0	1,592
- taxes on production	%	0%	1.4%
Interest on loan	thousand GEL	9,234	3,778
- Interest to production	%	6.8%	3.4%
Depreciation	thousand GEL	308	2,414
- Depreciation to production	%	<1%	2%
Net Operating Profit	thousand GEL	88,215	25,110
- NOP to production	%	65%	23%
Direct VA	thousand GEL	101,689	43,616
- VA on production	GEL/tonne	**1200**	**202**
Return on turnover (ROT)	%	65	23
VA / Value of VC production	%	75	40

CALLOUT BOX 2: Importance of the feed milling industry

The feed milling industry in Georgia is a key downstream component of Georgia's livestock value chains, supplying compound feed for poultry, cattle, pigs, fish, sheep, and rabbits. It is a rapidly modernizing sector, with some largest companies exporting produce and some medium-size companies having vertically integrated complexes. These companies own grain fields (wheat and corn), grain storage silos, and feed mills directly connected to their own hatcheries and livestock farms. This is expressed by "Chicken raised on Georgian soil with Georgian maize". However, despite the importance of maize in feed manufacturing, the industry's linkage with domestic maize production remains limited. The limited production of yellow maize, combined with inadequate drying, storage, and quality control infrastructure, constrains the ability of local producers to meet the volume and quality requirements of commercial feed manufacturers. Consequently, the poultry industry, which represents the largest consumer of compound feed, remains highly dependent on imported maize as a key feed ingredient. Large feed manufacturers rely heavily on imported yellow maize due to the insufficient quantity and inconsistent quality of domestically produced maize. As a result, imports constitute the primary source of maize for commercial feed production, particularly for the poultry sector, where maize is the dominant cereal ingredient.

Nevertheless, the feed milling industry represents a significant potential market for domestic maize producers. Strengthening linkages between maize producers and feed manufacturers could create substantial opportunities for import substitution and domestic value addition. Investments in improved seed, mechanization, post-harvest handling, drying and storage facilities, as well as contractual arrangements between producers and feed mills, could facilitate a more reliable supply of quality maize to the feed industry and improve the competitiveness of the Georgian maize value chain. Improvements in maize productivity, quality, drying, storage, and marketing could strengthen linkages between local maize production and the feed industry, reducing dependence on imports and increasing opportunities for domestic value addition along the maize VC.

2.5 Answer to the Framing Question 1

Maize VC in Georgia, including both traditional and mechanized production systems, has a significant economic impact on a country of almost 4 million inhabitants. The results of our analysis show that the maize VC provides income for all the actors involved directly in production, processing and marketing activities. These positive financial returns enable around 217,000 micro and small-scale farmers to consume and market maize products. From this point of view, maize is not only a financial instrument for these farmers, but also a means to ensure food security. For larger scale farms, maize is profitable as it provides income and allows them to continue livestock activities. These farms, taking advantage of economies of scale, benefit from lower costs of bulk production despite more diverse production costs they face.

On the macroeconomic scale, although maize VC's contribution to national GDP is quite small, its impact on the agricultural sector is significant. The contribution of maize farmers to agricultural GDP is 2.7%. Overall, the maize VC is relatively highly integrated in domestic economy (rate of integration 73%) providing income for many direct and indirect actors through backward linkages. However, the VC follows the national trade deficit pattern, with a negative balance of 31.6 million GEL. Although this value represents a very small share of national imports (0.09%), it indicates a degree of dependence on imported goods. While relying on cheaper imported goods can boost economic activity in the short-term, il also contributes to currency loss. Over time, this could increase the vulnerability of the maize VC -and to a lesser extent, the overall economy- to external supply shocks.

Our results also highlight the potential that the processing industry can create for the maize VC. Transformation creates added value at each stage, which leads to higher VA per tonne for the national economy. From this perspective, both sub-chains can provide a basis for the development of the processing sector. However, any development strategy of the maize VC should avoid treating the sub-chains in isolation, as both are highly integrated with the livestock sector and play an important role in food security.

These positive results shouldn't mask the difficulties faced by VC actors, and more generally by the agricultural sector in Georgia. The abandonment of farming activities and youth migration from rural areas call for policies that adopt a broader perspective beyond the limits of the maize VC.

TABLE 2-6: SUMMARY TABLE OF INDICATORS FOR FRAMING QUESTION 1 (DEFINITIONS OF ECONOMIC TERMS ARE PRESENTED BEFORE THE EXECUTIVE SUMMARY)

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 Table *2-2*
		Net operating profit by type of actor	Micro farmer: 235 GEL Small farmer: 1,218 GEL Medium-scale farmer: 12,415 GEL Large-scale farmer: 81,429 GEL Silage farm: 179,902 Miller: 3.020 GEL Small/medium trader: 23,436 GEL Large-scale trader: 129,350 GEL
		Return on turnover (operating profit/production)	Micro farmer: 64% Small farmer: 43% Medium-scale farmer: 33% Large-scale farmer: 31% Silage farmer: 44% Miller: 18% Small/medium trader: 5% Large-scale trader: 3%
		Benchmarks for farmers' net income (minimum wage, livelihood needs, job opportunities...)	The average nominal monthly earnings for all employees was 1970.8 GEL in 2024[22]. For micro, small farmers and to a less extent for some medium-scale farmers, the income is below this average.

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**	273,771 thousand GEL
		Direct VA	155,819 thousand GEL
		Total VA	200,461 thousand GEL
		Total VA creation per stage	Farmers: 63% Processors: 11% Traders:4% Suppliers: 22%
		Total VA and components:	Wages/salaries:13% Interest on loan:9% Taxes: 1% Land fee:<1% Depreciation: 3% NOP farmers: 46% NOP processors: 11% NOP traders:2% NOP IGS suppliers:14%
		Total VA in percentage of the GDP	0.2% of national GDP, 4% of agricultural GDP
		Rate of integration into the Economy (total VA/VC production)	73%

[22] Source: https://www.geostat.ge/en/modules/categories/39/wages

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**	2.7% of primary sector GDP
CQ1.4	What is the contribution of the VC to the public finances?	**Receipts of the government (taxes, etc.)**	2,242 thousand GEL
		Outlays of the government (subsidies, etc.)	477 thousand GEL
		Public Funds Balance	Positive (1,765 thousand GEL)
CQ1.5	What is the contribution of the VC to the balance of trade?	**VC exports**	16.3 million GEL
		VC total imports (goods and services)	48 million GEL
		Balance of trade of the VC	Negative (31.6 million GEL)

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)**	**1.21 for yellow maize**
		Domestic Resource Cost Ratio (DRC)	**0.18**

3. IS THIS ECONOMIC GROWTH INCLUSIVE?

This section aims at building an image of the inclusiveness of the VC, by highlighting how the VC organisation and governance involve the various stakeholders and how the incomes and employment generated are distributed among social groups. The VC specific impact on vulnerable groups such as subsistence-oriented micro farmers, smallholders, women, youth, and marginalised people (rural workers, minority communities…) will be documented.

3.1 Participation in the value chain governance

Maize producers' participation in the VC governance is limited due to the limited coverage of formal farmer organizations and cooperatives. This constrains farmers' access to relevant market and price information and reduces their bargaining power with downstream actors. While medium and large-scale farms benefit from stronger integration due to scale and geographical advantages (larger land areas in more accessible zones), micro and small-scale farmers are particularly vulnerable to power asymmetries (for details see Section 1.6).

3.2 Income distribution

Economic analysis showed that the VC distributes 119.3 million GEL as net profits to VC direct actors and 13.6 million GEL in wages, out of a direct VA of 155 million GEL. The income distributed to farmers in the food sub-chain accounts for 60% of total profits, highlighting the VC's significant importance, for a large number of micro and small-scale farmers who are involved in this sub-chain's activities.

Based on our assumptions regarding average trader profit margins (20-30 GEL/t), maize farmers do not appear to be disadvantaged in the distribution of income. When the marketing channel is direct (from farmer to end-user), farmers capture the entire margin on their sales. In other cases, they capture between 48% and 90%, depending on the marketing channel and the flow of maize to downstream actors (millers, traders).

VA generation in the maize VC is production driven, with micro and small-scale farmers as the main contributors to direct VA creation (see Figure 2-1). Traders play relatively a minor role in value creation, although to certain extent they also procure the grain or maize flour from the micro and small-scale farmers. Therefore, vulnerable groups such as micro and small-scale farmers are key actors in the VC. The high share of micro and small-scale farmers in value creation can be partly explained by their aggregate contribution, reflecting their numerical dominance despite lower productivity.

To assess if these vulnerable actors are disadvantaged in terms of income distribution, we analyze the distribution of total profits within the VC. Figure 3-1 illustrates the distribution of NOP among VC actors. Vulnerable actors, such as micro and small-scale farmers, together receive nearly 60% of total VC profits. This confirms that the VC is inclusive of smallholders, as they capture a large share of income. However, the VC structure remains fragmented in the sense that production is spread across a large number of micro and small farms that are dispersed and lack collective organization. Besides, income gained from maize is relatively low for micro and small-scale farmers.

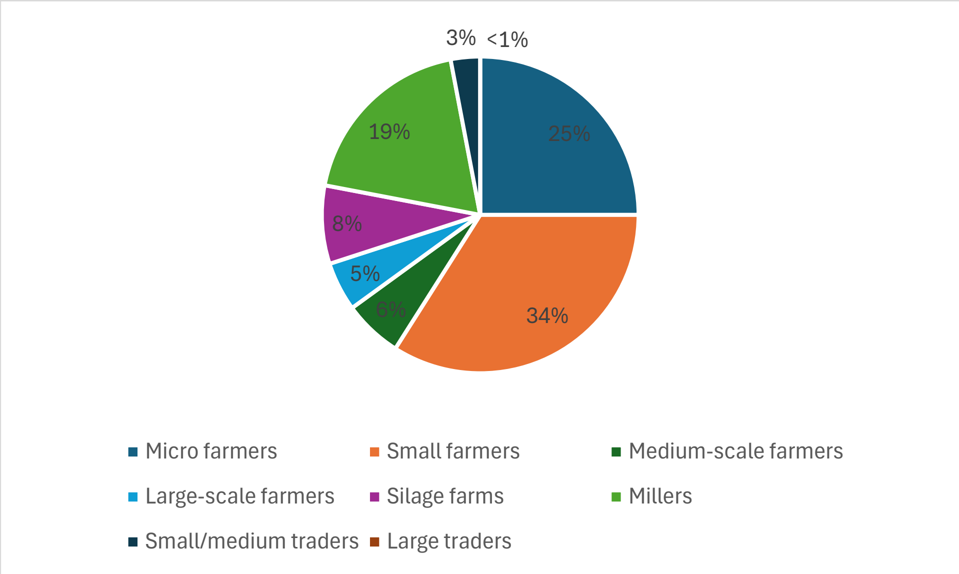

FIGURE 3-1: DISTRIBUTION OF NET OPERATING PROFITS AMONG VC ACTORS

Although smallholders capture a large share of total profits, the Gini coefficient[23] of the maize VC (0.69) indicates a remarkable level of inequality in income distribution (Figure 3-2). This suggests that while a large number of small actors earn relatively low profits, a limited number of large actors capture substantially higher returns from VC activities. Thus, the Gini coefficient reveals underlying inequalities that are masked by the aggregation of numerous small and vulnerable actors. While many micro and small-scale maize farmers dominate total share of profits, per capita income remains higher among larger-scale actors.

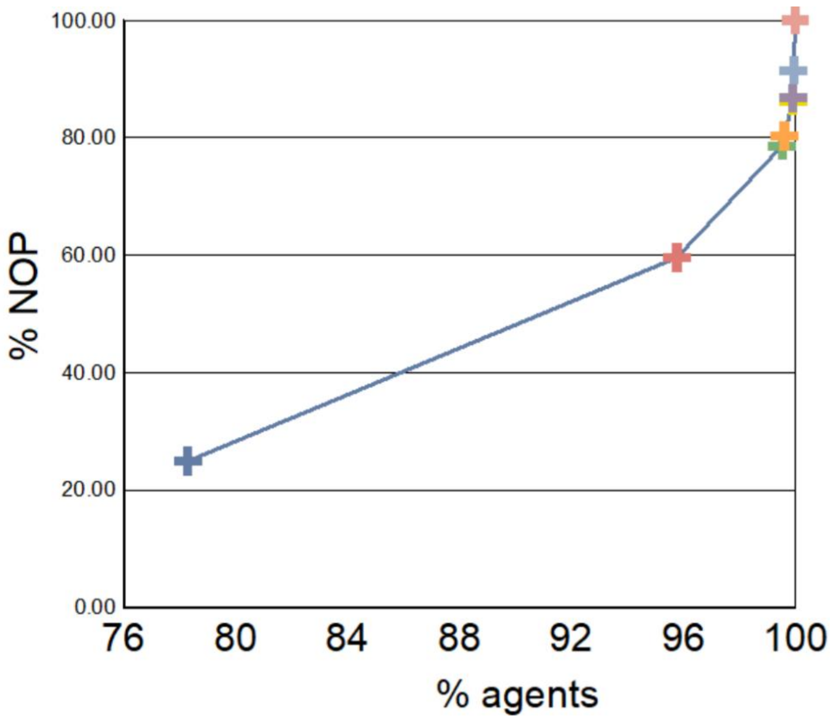

FIGURE 3-2: GINI COEFFICIENT OF THE MAIZE VC IN GEORGIA (2024)

[23] The Gini coefficient of zero means fair distribution of income while 1 refers to total inequality.

3.3 Employment

Employment in the maize VC is highly driven by the production stage, particularly by the dominant share of small-scale farms, although mechanization is also present. Micro farms primarily rely on family labour and therefore generate limited employment, however in most of the cases they also outsource mechanization services. The outsourced mechanization system is particularly important for micro and small and medium-scale farmers, as they may face greater difficulties in purchasing their own tractors, combines and other machineries.

Outsourced mechanization services can take several forms, but informal farmer-to-farmer arrangements appear to be common, especially in Western Georgia. In other cases, farmers may rely on private providers or hire specialized service operators. Government-supported mechanization services are comparatively less developed.

Medium and large-scale grain and silage farms, provide both skilled and unskilled jobs. Temporary employment at the farm level consists of agricultural work during cultivation, irrigation and harvest periods, yet some permanent positions for skilled workers also exist. Overall, farm-level activities represent an additional, and some cases, the primary source of income for micro and small-scale farmers, whereas large farms primarily rely on employees and outsourced mechanization service providers.

White maize millers are mostly located in rural villages and typically operate with family labour, only in exceptional cases do they rely on hired workers. As a result, field missions report that small-scale, artisanal village milling generates limited employment. However, when strategically developed, processing can offer significant potential for value addition, and consequently, job creation.

The trade stage accounts for 17% of total wages, largely driven by small and medium actors mostly individual entrepreneurs. This reflects the importance of aggregation, transport and market intermediation.

At the national scale, total wages generated by the maize VC account for 0.1% of the total wages[24] in the country.

Women, as part of vulnerable groups, are actively involved in farming activities, particularly in micro farms. As farm scale and mechanization increase, women's participation in agricultural work tends to decline. Women are also engaged in livestock activities integrated into maize farming, especially in western parts of Georgia. While their involvement is most prominent in micro and small-scale farms, women also occupy skilled positions in medium and large-scale farms, although their representation remains lower than that of men. A notable wage gap exists between women and men, with average monthly earnings of approximately 1,770-1,780 GEL for women compared to about 2,650 GEL for men. Overall, these patterns reflect structural inequalities in women's employment, despite their essential role in domestic economy.

Maize VC employs ethnic Azerbaijani workers who perform unskilled labour on maize farms and in milling facilities, particularly in eastern Georgia (Kvemo Kartli and Kakheti). In rare cases, they

[24] Total wages in Georgia are estimated by Geostat at 28,739,570,000 GEL for the reference year 2024, with 1,215,000 employees and an average nominal monthly salary of 1,970 GEL.

hold supervisory positions (e.g. head of milling facilities). Field visits indicate that wage practices are reported to be not discriminatory.

The total number of jobs created by the maize VC has been computed by using the AFA software. To do this, we have estimated daily wage for 6 categories of labour which are shown by Table 3-1.

TABLE 3-1: ESTIMATED DAILY WAGE APPLIED IN THE JOB ANALYSIS

Labour category on AFA	Daily wage (GEL / day)	Monthly wage (20 days)
Male temporary	61.90	1,238
Female temporary	43.20	864
Male unskilled	72.82	1,456
Female unskilled	50.82	1,016
Male skilled	91.03	1,820
Female skilled	63.53	1,310

Table 3-2 shows the distribution of wages across the VC actors and the number of jobs created in FTE. Employment is primarily driven by the unskilled activities carried out by small-scale farmers, and small and medium-sized traders. Skilled jobs are limited and mainly concentrated among large-scale actors. Overall, the maize VC generates **912 FTE jobs** in the reference year. Male employment accounts for nearly 80% of total FTE jobs. Although women are present in smaller-scale and less mechanized activities, they remain underpresented overall, especially in skilled roles.

TABLE 3-2: WAGE DISTRIBUTION AND FTE JOBS IN THE MAIZE VC IN GEORGIA (2024)

Value of wages (thousand GEL)	Temporary labour	Permanent unskilled	Permanent skilled	Total male	Total female	Total
Micro farmers	0	0	0	0	0	0
Small farmers	1,636	3,819	0	4,910	545	5,456
Medium-scale farmers	109	97	36	121	121	242
Large-scale farmers	913	293	1060	954	513	2,268
Silage farms	1,525	0	1,525	3,050	0	3,050
Miller	0	225	11	130	107	237
Small/medium traders	0	1,859	0	1,115	743	1,859
Large-scale traders	0	97	390	341	146	488
VC	4,184	6,393	3,024	11,424	2,178	13,603
Number of FTE jobs	**308**	**442**	**162**	**728**	**184**	**912**

3.4 Answer to the Framing Question 2

The economic growth generated by the maize VC involves actors of varying sizes with widely differing operating incomes. Vulnerable actors, such as micro and small-scale farmers, collectively receive nearly 60% of total VC profits. However, although these actors dominate total profits, they face significant income inequality, as their per capita earnings remain lower than those of larger-scale actors. A large number of micro and small farms operate in a dispersed manner and face limited bargaining power and restricted access to resources, partly due to the limited power of farmer organizations and collective action.

Despite increasing mechanization, labour remains an important component of the VC. Although the VC accounts for only 0.1% of total national wages, indicating a limited contribution at the macroeconomic level, it remains important in terms of agricultural production and inclusion of vulnerable groups.

The maize VC is estimated to generate 912 FTE jobs in 2024. Employment is highly informal, low-skill and gender-imbalanced. The wage gap is persistent and structural. Consequently, women are mainly concentrated in lower-paid and unskilled jobs, which do not allow them to secure stable employment.

FIGURE 3-3: SUMMARY TABLE OF INDICATORS FOR FRAMING QUESTION 2 (DEFINITIONS OF ECONOMIC TERMS PRESENTED BEFORE THE EXECUTIVE SUMMARY)

Framing Question 2: Is this economic growth inclusive? *(To be completed with Social Analysis results)*		**INDICATORS**	**RESULTS**
CQ2.1	How is income distributed across actors of the VC?	**Disaggregated Value Added**	Direct VA distribution: Wages: 9% Taxes: 1% Depreciation: 2% Land fee: <1% Interest on loan:11% NOP: 77%
		Total farm income	93,707 thousand GEL
		Wages and salaries (at every stage, all activities)	13,603 thousand GEL Production: 80% Processing:2% Trade: 18%
		Total income accruing to marginalized and vulnerable groups	70,268 thousand GEL
CQ2.2	What is the impact of the governance systems on income distribution?	**Income distribution among actors**	NOP distribution Micro farmer:25% Small-scale farmer:34% Medium-scale farmer:6% Large-scale farmer:5% Silage farms:8% Miller:19% Small/medium trader:3% Large-scale trader:<1%
		Share of farm gate price in the final price (%)	48%
CQ2.3	How is employment distributed across the VC?	**Number of jobs (family, self- and formal employment) at different VC stages (permanent/ temporary, skilled/unskilled...)**	Number of actors: 217,947 farmers with smallholders representing 99% of it. FTE jobs: 912
		Employment of women	20% of total FTE jobs

4. IS THE VALUE CHAIN SOCIALLY SUSTAINABLE?

4.1 Working conditions

Research Question: Are working conditions throughout the maize value chain socially acceptable and sustainable?

Georgia has ratified all eight fundamental conventions of the International Labour 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, fieldwork conducted with actors involved in the maize VC indicates that awareness of labour rights and international labour standards remains low among workers.

A defining characteristic of employment in the maize VC is its high level of informality. Most workers do not have formal employment contracts, and working arrangements are typically based on verbal agreements. In most cases, farmers recruit workers through informal local networks. When labor is needed, they inform existing employees, relatives, friends or residents of neighboring villages about available job opportunities. The employment conditions, including wages and working arrangements, are negotiated directly between the farmer and the prospective worker. If both parties reach an agreement, the worker starts employment, usually without a formal written contract. In some regions where it is difficult to find workers, there are cases when farmers invite workers from other regions, providing food and shelter at the same time. For instance, one farmer from Samtskhe-Javakheti region hired employee from Adjara (another region of Georgia). This finding aligns with recent evidence suggesting that approximately four out of ten workers in Georgia are informally employed (Pignatti, 2026). According to Geostat (2024), in 2024, 34.4% of rural employment was informal, compared to 26.0% in urban areas, highlighting a pronounced rural–urban disparity.

Working conditions in agriculture are further characterized by relatively low wages. In 2024, the average monthly earnings in agriculture amounted to 1,282 GEL, making it the lowest-paid sector in the Georgian economy and approximately 35% lower than the national average wage of 1,970 GEL (Geostat, 2024). Despite low remuneration, agriculture remains one of the key sources of employment, accounting for approximately 16% of total employment in 2024.

At the same time, employment intensity in the maize VC is relatively low compared to other agricultural sectors such as horticulture and viticulture. This reflects the structural characteristics of cereal production, which is less labour-intensive and more seasonal.

Farm Typologies and Labour Organization

Micro farms (<0.5 ha)

Micro farms represent the largest category of agricultural holdings in Georgia, with approximately 172,155 farms. These farms are predominantly located in western Georgia and are largely semi-subsistence in nature. Many have historical roots in the Soviet period, when households maintained small private plots alongside collective farming systems. Following land privatization, maize remained a central crop in these systems.

Maize plays an important cultural, social and economic role. It is a staple food (e.g. mchadi, ghomi), supports social ties through food sharing with urban relatives, and serves as an important source of animal feed.

From an economic perspective, maize provides limited but important supplementary income, with households typically selling 100–300 kg annually.

Labour organization is predominantly family-based. External workers are rarely employed. Traditional mutual aid practices such as nadi are still observed, while mechanized services are usually outsourced.

Small farms (0.5–5 ha)

Small farms share many characteristics with micro farms but are more market-oriented and often combine crop production with small-scale livestock farming. Farmers frequently attempt to expand landholdings over time.

Family labour remains dominant, with occasional use of seasonal workers (approximately 20 days per year). Employment remains informal and conditions are similar to micro farms.

Medium farms (5–50 ha)
Medium-sized farms are more commercially oriented and often located in eastern Georgia. They typically produce yellow maize and may integrate crop production with livestock farming.

These farms employ both permanent and seasonal workers, although employment remains largely informal (as noted above). Permanent workers are primarily engaged in livestock activities and participate in maize production for approximately 20–25 days per year.

Two main categories of workers are identified:

a)Skilled workers (e.g. machinery and pivot irrigation operators, administration)
b) Unskilled workers (manual labour)
for seasonal workers seasonal wages vary by region:

- Western Georgia: 40–70 GEL/day
- Eastern Georgia: 40–60 GEL/day
- Irrigation work: up to 100 GEL/day

Working hours are long and irregular during peak periods, often starting early in the morning due to climatic conditions.

Large farms (>50 ha)

Large farms are diversified enterprises operating across multiple agricultural VCs. They employ both permanent and seasonal workers, though informal employment arrangements remain common.

In some cases, workers receive formal contracts and monthly salaries. Skilled workers earn approximately 1,500–1,800 GEL per month, while managers earn around 3,000 GEL. Unskilled workers earn approximately 1,000–1,200 GEL/month when formally employed.

Despite relatively better conditions, informal arrangements remain widespread, even in larger and more advanced farms.

Socially Derived Farmer Profiles

Young farmers as drivers of development

Young farmers represent a dynamic and innovative group within the maize VC. They are typically highly motivated, growth-oriented and open to innovation. Many actively expand their land, adopt new technologies and participate in training programmes.

Sub-types include:

a)Educated farmers with formal agricultural training

> "I did my bachelor thesis on modernization of cereal production, and now I apply it in practice. Despite many challenges, my brother and I continue to develop maize production and livestock." (Farmer, Samtskhe-Javakheti)

b)Returnee farmers from non-agricultural careers

> "I worked as head of hotel security in Batumi. Then I decided to return to farming. I am satisfied with this decision, and despite challenges, our farm is developing." (Farmer, Guria)

c) Family-continuity farmers

d) Entrepreneurial entrants from other sectors

> "I was doing business in constructions and continue doing it. My main income come from this activity but maize farm and milling gives me pleasure and happiness" (Farmer/Miller from west Georgia')

These farmers demonstrate strong potential for VC development.

Farmers from the older generation

Older farmers often have experience from Soviet-era agricultural systems and accumulated land during privatization. Their production strategies are typically more traditional, and their engagement with innovation and external support is more limited.

> "When I pass away, I think my children will sell this land and do not continue farming. But I am happy to be here and do maize farming' (men, above 65, Kakheti)

Farms Practicing Sustainable (Conservation) Agriculture

Beyond the farm categories described above, a small number of producers are attempting to adopt conservation and environmentally sustainable agricultural practices within the maize VC. One notable example is a farm cooperating with the association Elkana, which has been promoting organic and sustainable agricultural value chains in Georgia for over 30 years.

This farm produces maize on approximately one hectare and operates as a family business led by internally displaced persons (IDPs). Although it does not hold full organic certification, it has received a quality “marker” from Elkana, indicating that production follows largely environmentally friendly practices. The farm benefits from support provided by various international organizations, including training and technical assistance. In addition to primary production, the family processes maize into flour and sells it through large supermarket chains in Georgia.

The success of this farm is largely attributed to strong family involvement combined with institutional support from Elkana and development partners. However, the farm remains vulnerable to social and environmental shocks, and continued external support is important for its long-term sustainability.

A second example is a nunnery in western Georgia that produces white maize using partially sustainable practices and supplies local markets, including supermarkets. These cases demonstrate emerging but still limited adoption of environmentally friendly production models in the VC.

There have also been attempts particularly by the ongoing FAO no-till practices initiative funded through EU ENPARD IV[25] to introduce conservation agriculture practices possibly applicable for maize production in Georgia. However, these initiatives have not yet been widely successful. According to farmers, soil conditions in many regions may not be suitable for no-till practices, although this perception has not been fully validated by scientific evidence.

Health Insurance and Social Protection

As noted earlier, the majority of workers and farm owners in the maize VC operate within the informal economy. Consequently, employer-provided private health insurance is generally absent. During fieldwork, only one case was identified where private health insurance was provided, and this applied exclusively to administrative staff (e.g. managers and accountants). In that case, insurance costs were shared between the employer and employees.

Most workers rely on the state-funded Universal Healthcare Programme provided by the Government of Georgia. The majority are covered under the standard state healthcare package, which includes full coverage of primary healthcare services (e.g. family doctor and nursing services), as well as partial coverage of specialist consultations, diagnostic tests, emergency care and certain planned surgical procedures.

More vulnerable population groups such as pensioners, socially vulnerable individuals, women and children under five receive broader coverage under enhanced state programmes. While the universal healthcare system provides an essential safety net, the absence of employer-based insurance reflects the broader issue of informality and limited social protection within the maize VC.

Labour Force Characteristics

The agricultural labour force is ageing, particularly among unskilled workers. Many workers are over 50 years old, while younger populations show limited interest in agricultural employment.
Labour shortages are increasingly reported, partly due to rural–urban migration and emigration.
In some regions, ethnic minority groups play an important role in agricultural labour supply.

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[25] Focused on crops including wheat, barley, peas, and sorghum, on more than 800 ha in 2025, primarily in cooperation with five large-scale farmers across seven municipalities: Akhalkalaki, Gori, Bolnisi, Marneuli, Dedoplistskaro, Sighnagi, and Sagarejo.

Occupational Safety and Working Conditions
Occupational safety and health conditions across the maize VC are generally weak. Most farms lack basic infrastructure such as drinking water, sanitation facilities and rest areas. Training on occupational safety is limited, despite legal requirements.

The use of personal protective equipment (PPE) is rare across all farm types. While some workers use gloves or masks, comprehensive protection is largely absent. Limited availability of PPE in local markets further constrains its use.

In one case, a reported fatal accident linked to fertilizer exposure led to increased awareness and partial adoption of protective measures among local farmers.

Working hours are highly seasonal and depend on climatic conditions. During peak periods, workers may exceed standard working hours, while during off-peak periods activity is reduced.

Working Time and Leave

Leave arrangements are informal and based on mutual agreement. Sundays are generally rest days, except during peak seasons. Workers are granted leave for social and cultural events and religious holidays. Some farms provide limited annual leave.

Investment Sources and Sector Attractiveness

Investment in the maize VC comes from reinvestment by farmers, diversification from other sectors and, to a lesser extent, external funding. Government programmes and international organizations provide some support.

Despite the presence of motivated young farmers, the sector faces challenges in attracting labour. Many young people prefer non-agricultural employment, contributing to labour shortages.

Conclusion

Overall, working conditions in the maize VC are characterized by high levels of informality, low wages, limited social protection and weak occupational safety standards. While larger farms offer relatively better conditions, informal employment remains dominant across all farm types.
These findings suggest that working conditions in the maize VC are only partially socially acceptable and raise concerns regarding long-term sustainability, particularly due to weak labour protection and increasing labour shortages. Improving working conditions may also contribute to higher productivity and reduce rural outmigration.

TABLE 4-1: WORKING CONDITIONS

1. WORKING CONDITIONS	
1.1 RESPECT OF LABOUR RIGHTS	*MODERATE/LOW*
1.2 CHILD LABOUR	*HIGH*
1.3 JOB SAFETY	*MODERATE/LOW*
1.4 ATTRACTIVENESS	*SUBSTANTIAL*
AVERAGE	*SUBSTANTIAL*

4.2 Land and water rights

Research Question: Are land and water rights socially acceptable and sustainable?

Land fragmentation and small landholdings represent one of the key structural challenges for agricultural development in Georgia (FAO, 2023/2024; World Bank, 2024). This issue was consistently highlighted by farmers across all categories during fieldwork. Fragmentation reduces efficiency, increases labour requirements and raises the costs associated with agricultural machinery and production.

The impact of land fragmentation varies across farm types. Micro and small farmers generally continue to cultivate the land allocated during the post-Soviet privatization process and rarely expand their holdings. In contrast, medium and large farmers actively seek to increase their land area, often acquiring additional plots on a regular basis. This trend is particularly evident among younger farmers, who tend to adopt more strategic approaches to farm expansion, including medium-term planning (e.g. three- to five-year land acquisition strategies). These patterns suggest that larger and more commercially oriented farmers are more likely to remain engaged in and contribute to the development of the maize VC.

Farmers identified several key challenges related to land fragmentation. First, machinery-related costs are significantly higher on fragmented land. When services are outsourced, mechanization providers often charge higher fees per hectare due to inefficiencies. When machinery is owned by farmers, fragmentation increases fuel consumption and time requirements.

Second, fragmentation creates logistical challenges. When plots are located in different regions, additional transport and coordination are required in all steps of agricultural activities. For example, moving harvesting equipment between distant plots increases both costs and the risk of delays, which can negatively affect yields.

Third, irrigation investments particularly for systems such as pivot, sprinkler or drip irrigation are less economically viable on fragmented land, limiting adoption of more efficient technologies.

Land Rights

Private property rights, including ownership of agricultural land, are guaranteed under the Constitution of Georgia. In general, farmers do not report significant issues related to land ownership or land use rights. However, incomplete land registration remains an important constraint.

To address this issue, the Government of Georgia implemented the *Systematic Land Registration Reform (2022–2024)* through the National Agency of Public Registry. This reform enabled many citizens to formally register their land, improving legal clarity and security. Despite this progress, a portion of agricultural land remains unregistered, although precise figures are not readily available.

In 2019, the Georgian Parliament adopted a new Organic Law on Agricultural Land Ownership, which defines key principles governing land ownership and use. Land transactions (buying and selling) can be conducted relatively easily through public service agencies, with minimal administrative burden. Fieldwork findings indicate that farmers generally do not face significant bureaucratic barriers in land transactions.

Land Ownership and Management Practices

Different forms of land ownership and management were identified across farm types.

Micro farms typically cultivate land obtained through privatization. In some cases, farmers also cultivate land belonging to relatives or neighbours who have emigrated or are no longer farming. These arrangements are informal, and in some cases the cultivator shares a portion of the harvest with the landowner.

Small farms follow similar patterns but more frequently cultivate additional land, including plots under state ownership.

Medium and large farms use mixed land arrangements, combining owned land with leased and rented plots. Government-owned land may be leased for long periods (up to 50 years), while privately owned land is often rented.

Land Rental Practices

Land rental is common across both eastern and western Georgia, particularly among medium and large farms. However, two key features characterize rental arrangements:

- Agreements are typically informal and based on verbal contracts
- Rental periods are usually short-term (often one year)

These practices create several challenges. First, farmers tend to invest less in rented land compared to owned land. For example, they may avoid applying manure or making long-term soil improvements, as the benefits may not be realized if the lease is not renewed.

Second, short-term agreements limit long-term planning and investment, reducing incentives for sustainable land management. Improving land rental arrangements by promoting longer-term, contract-based rental agreements would contribute to more sustainable land management. Such agreements would encourage farmers to make long-term investments in soil fertility, irrigation infrastructure and other land improvements, thereby enhancing both productivity and environmental sustainability.

Rental costs vary by region:

- Eastern Georgia: 500–800 GEL per hectare per year
- Western Georgia: 300–500 GEL per hectare per year

In rare cases, rent may be paid in kind (e.g. maize grain), though monetary payments are the dominant form.

Land Management and Environmental Practices

Farmers’ approaches to land management vary significantly by farm size. Micro and small farmers generally do not conduct soil analysis and rely on traditional knowledge or advice from agro-input suppliers. The use of fertilizers and pesticides is often not based on scientific assessment. Furthermore, despite a progressive alignment with EU standard of Georgia’s regulations on pesticides, active substances that the EU no longer authorizes are still in use in the country. Also, organic inputs such as manure are applied only when readily available.

In contrast, medium and large farms are more likely to conduct soil analysis and apply inputs based on technical recommendations. However, differences persist between owned and rented land, with better management practices typically applied to owned plots.

The handling of hazardous agricultural waste represents significant environmental concern. Fieldwork revealed that disposal practices are often unsafe. Common practices include leaving empty pesticide containers in the field, burning them or disposing of them in general waste systems. Only one large farm was observed to follow proper storage and disposal procedures for hazardous waste.

Water Resources and Irrigation

Georgia is relatively rich in water resources and ranks 42nd globally according to the Environmental Performance Index (EPI). However, access to irrigation water is uneven across regions.

In eastern Georgia, limited access to irrigation water constrains agricultural production. In contrast, western Georgia faces challenges related to excess water and inadequate drainage systems, which hinder maize cultivation.

Irrigation and drainage policies are managed by MEPA, with implementation carried out by the state-owned company “Georgian Amelioration”. This entity is responsible for maintaining main irrigation canals and drainage systems, while farmers are responsible for delivering water to their fields. Irrigation costs are partially subsidized by the government.

Despite ongoing investments supported by international organizations (e.g. World Bank, Asian Development Bank), farmers continue to report challenges related to both irrigation and drainage infrastructure.

Irrigation Practices by Farm Type

Micro and small farms

Most micro farms do not use irrigation systems. In some cases, simple furrow irrigation is applied when water sources are accessible. Small farms also rely primarily on furrow irrigation under similar conditions.

Medium and large farms

Several irrigation systems are used, particularly in eastern Georgia:

Furrow irrigation:
The most common method, but relatively inefficient, requiring large volumes of water and manual labour.

Sprinkler (watergun) irrigation:

Considered efficient and relatively affordable, though still not widely accessible due to cost. It allows for increased production intensity (e.g. multiple harvests per year in far eastern Georgia Akhmeta Municiaplity).

Pivot irrigation:

Used mainly by large farms. While highly efficient, it requires significant investment and is only suitable for large, consolidated land areas. This limits its adoption in fragmented landscapes. The pivot irrigation is the most costly between irrigation types.

Drip irrigation

Large farmers have drip irrigation in relatively small parts of their land plots. Although they are satisfied with the results of drip irrigation, they highlighted that it needs high labour intensity to maintain and also frequent changes of the pipeline therefore they prefer other types of irrigations at current stage.

Drainage Systems

In western Georgia, drainage systems developed during the Soviet period are still in use but are largely outdated. Although "Georgian Amelioration" conducts periodic cleaning of drainage canals, farmers report that these measures are insufficient. Significant structural rehabilitation is required to improve water management and support agricultural productivity.

Conclusion

Land and water rights in Georgia are generally secure from a legal perspective, and farmers do not face major institutional barriers to land ownership or transactions. However, structural challenges for land tenure —particularly land fragmentation, informal rental practices and uneven access to irrigation and drainage infrastructure—limit the efficiency and sustainability of agricultural production.

These findings suggest that while land rights are socially acceptable, their effectiveness is constrained by structural and institutional factors. Similarly, water resource management remains only partially sustainable due to infrastructure limitations and regional disparities. Addressing these challenges will be essential for improving productivity, promoting sustainable land use and strengthening the resilience of the maize VC.

TABLE 4-2: LAND AND WATER RIGHTS

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

4.3 Gender equality

Research Question: Is gender and social inclusion throughout the maize value chain acknowledged, accepted, and enhanced?

Gender disparities in Georgia remain significant, including within the agricultural sector. According to the Women and Men in Georgia 2024 report by the National Statistics Office of Georgia (Geostat,2024), the gender pay gap persists across sectors. The hourly gender pay gap stands at 13.2%, while the monthly gap reaches 20.9%. In absolute terms, women earn approximately 1,770-1,780 GEL per month compared to 2,650 GEL for men.

In agriculture, forestry and fisheries, gender disparities are even more pronounced. Women earn on average 926 GEL per month, compared to 1,321 GEL for men, resulting in a gender pay gap of approximately 29%. Employment patterns also reflect gender imbalance: 14.1% of employed women (84,000) work in agriculture compared to 18.5% of men (136,400). Furthermore, in 2023, approximately 80% of agricultural land (including leased land) was operated by men and only 20% by women. In agricultural enterprises, women accounted for 38.8% of employees compared to 61.2% for men (Geostat, 2024). These data confirm the structural dominance of men within the agricultural sector.

According to FAO (2025), rural women in Georgia play a critical but often under-recognized role in agriculture, including crop production (such as maize and cereals) and livestock systems. Gendered divisions of labour remain pronounced. Women are primarily engaged in labour-intensive activities such as planting, weeding, harvesting and post-harvest operations (e.g. sorting, processing and food preparation), often for household consumption or small-scale sale. In contrast, men tend to dominate mechanized and market-oriented activities, including ploughing, irrigation, pesticide application and transport, marketing is sometimes done by men and sometimes by women.

Despite their substantial contributions, women's roles remain insufficiently documented due to limited availability of sex-disaggregated data, constraining evidence-based policymaking. Women are also more likely to engage in lower-capital agricultural activities due to structural barriers, including limited access to land, irrigation, finance and extension services. These constraints, combined with the burden of unpaid domestic work, reduce women's economic returns and limit their participation in higher-value segments of the VC (FAO, 2025).
Fieldwork findings largely confirm these patterns but also reveal variations across farm types within the maize VC.

Gender Roles by Farm Type

Micro farms

Women play a central role in maize production within micro farms. They are actively involved in planting, manual cultivation, harvesting, post-harvest processing (e.g. cleaning maize grains from cobs) and storage. Many of these activities are performed jointly with men, although women are typically responsible for food preparation and processing maize into flour for household consumption.

Women also play a key role in livestock-related activities, including preparing feed and managing small-scale dairy production. In addition, women are often responsible for selling small quantities of maize or maize flour in local markets, contributing directly to household income.

Small farms

In small farms, women's involvement in maize production is relatively lower compared to micro farms due to increased mechanization. However, women remain highly active in livestock-related activities, particularly in western Georgia, where they produce dairy products such as cheese and cottage cheese and participate in local markets.

Women also continue to perform essential reproductive roles, including food preparation and household management, supporting male family members who are more directly involved in field-based agricultural activities.

Medium and large farms

In medium and large farms, women's roles are more limited and often segmented. Women are employed in both skilled and unskilled positions, although their participation remains lower than that of men.

- Skilled roles: administration, accounting and, in some cases, farm management
- Unskilled roles: seasonal work such as maize harvesting, cleaning and, in rare cases, work in farm kitchens

Women employed in these farms are typically hired on a seasonal basis, and their daily wages (approximately 40–50 GEL) are generally lower than those of men, reflecting persistent gender wage disparities.


FIGURE 4-1: WOMEN SORTING CORN COBS

Women in Other Segments of the Value Chain

Women are also active in other segments of the maize VC beyond primary production. Fieldwork identified women working as traders in agricultural markets, selling maize grain and maize flour, as well as operating small-scale milling businesses, often in cooperation with family members.

Women are also employed in agricultural input supply shops, occupying positions ranging from sales assistants to managers. In processing, women are involved in cleaning, packaging and preparing maize flour for sale in medium-sized milling enterprises. These activities demonstrate women’s important role in downstream segments of the VC.

Women “Champions” in the Maize Value Chain

Although maize production remains male-dominated, several cases of female leadership were identified.

One example is an internally displaced woman from South Ossetia who established an organic white maize farm. With family support and participation in development programmes, she expanded production, accessed funding and became a recognized producer in niche markets.

Another example is a woman in western Georgia who assumed management of her farm following the death of her husband. She successfully continued and developed maize production, managing all aspects of the farm.

A third example is a young nun managing a monastery in western Georgia. Facing financial constraints, she initiated maize production and processing, combined with beekeeping. Within a few years, the monastery developed a sustainable income source and established supply links with supermarkets in urban markets.

These cases illustrate that, despite structural barriers, women can successfully lead and innovate within the maize VC when they have access to adequate resources and support.

Ethnic Minorities and Social Inclusion

Georgia is an ethnically diverse country. According to the 2014 census, ethnic minorities constitute approximately 13% of the population, with Azerbaijanis (around 6%) and Armenians (around 4.5%) representing the largest groups.

Fieldwork identified the presence of ethnic Azerbaijani workers in maize farms and milling facilities, particularly in eastern Georgia (Kvemo Kartli and Kakheti). These workers are predominantly employed in unskilled roles, including manual labour and irrigation activities. In rare cases, they hold supervisory positions (e.g. head of milling facilities).
Although no explicit discrimination in wages or working conditions was observed, ethnic minority workers are concentrated in lower-skilled positions. Workers reported being able to observe cultural and religious practices, including holidays. However, the absence of women from ethnic minority groups in the maize VC suggests additional gendered barriers to participation.

Conclusion

The maize VC in Georgia remains strongly gendered, with men dominating access to land, capital and higher-value activities, while women are concentrated in labour-intensive, lower-paid and often informal roles. Despite their significant contribution, women's participation remains under-recognized and constrained by structural inequalities.

At the same time, examples of female entrepreneurship and leadership demonstrate the potential for greater inclusion when enabling conditions are present. Addressing gender disparities will require targeted interventions to improve women's access to productive resources, enhance their participation in decision-making and strengthen their integration into higher-value segments of the VC.

Social inclusion challenges also persist, particularly for ethnic minorities, who are predominantly engaged in low-skilled labour. Strengthening inclusion will require improved access to education, skills development and opportunities for upward mobility.

Overall, while gender and social inclusion are partially acknowledged within the maize value chain, significant gaps remain in achieving equitable and sustainable outcomes.

TABLE 4-3: GENDER AND SOCIAL INCLUSION

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

4.4 Food and nutrition security

Research Question: Is food and nutrition stability socially acceptable?

Food security in Georgia remains a significant development challenge, shaped by structural constraints in agricultural production, high dependence on food imports and socioeconomic inequalities. Despite some improvements in recent years, approximately 36.5% of the population experienced moderate or severe food insecurity in 2022, one of the highest rates in the Europe and Central Asia region (FAO, 2023).

A key structural vulnerability lies in the country's heavy reliance on imported food, particularly cereals. Georgia imports around 80–85% of its wheat supply, making the national food system highly exposed to global price volatility, supply chain disruptions and geopolitical shocks (World Bank, 2024; FAO, 2023). This dependency became particularly evident during recent global crises, highlighting the fragility of food availability and stability.

Domestic agricultural production is largely dominated by smallholder, semi-subsistence farming systems, which limits productivity, commercialization and market integration. As a result, the availability of locally produced food remains constrained. At the same time, low household incomes and rising food prices reduce economic access to food, particularly among rural populations, exacerbating food insecurity and vulnerability (World Bank, 2023).

From a structural perspective, food security in Georgia is affected by several interconnected factors:

- low self-sufficiency ratios, particularly for cereals
- underdeveloped agricultural value chains
- limited access to modern technologies and inputs
- climate-related risks affecting agricultural productivity

These factors collectively weaken the stability of the food system. Strengthening domestic agricultural production particularly cereals such as maize alongside improving VC integration and rural livelihoods is therefore critical for enhancing national food security and resilience.

Role of Maize in Food and Nutrition Security

Maize production plays a crucial role in food and nutrition security in Georgia, both directly (as a food source) and indirectly (as animal feed).

White maize and food consumption

White maize has historically been a central component of diets in western Georgia and continues to play an important role today. Due to historically limited access to wheat in western regions, maize traditionally served as a substitute for bread and remains embedded in local food culture and dietary practices.

Maize flour is used to prepare staple foods such as Mchadi (traditional maize bread) and Ghomi, which are widely consumed at the household level especially in west Georgia. The products by maize flour is used and Georgian gastronomy, tourism and restaurants. In many rural households, particularly in western Georgia, these products remain part of daily diets. In addition, fresh maize (boiled or roasted) is commonly sold in local markets and coastal areas, contributing to both food availability and small-scale income generation.

Beyond direct consumption, maize also contributes to food security through its multifunctional use. Crop residues and grains are widely used as animal feed, supporting small-scale livestock production and thereby indirectly contributing to household nutrition (e.g. dairy and meat consumption).

<u>Yellow maize and livestock production</u>

Yellow maize plays a critical role in livestock feeding systems across Georgia. It is widely used as feed in both smallholder and commercial farms, either through direct grain use or through silage production.

At the same time, maize provides an important source of income for farmers. Producers may either sell maize grain on the market or use it within integrated farming systems. Farmers report relatively stable demand and satisfactory prices for maize, particularly for feed purposes. Export of yellow Maiz grain is also observed in neighboring countries.

<u>Silage production and consumption</u>

In recent years, the expansion of silage production has been observed, particularly among medium and large farms, supporting more intensive livestock systems. This contributes to improved productivity in the livestock sector and enhances the availability of animal-based food products. Silage production was developed during the Soviet Union but afterwards it was declined. In last decades it is increasing and farmers report that the demand to procure silage is high. It is also observed that the development of silage production needs support to increase silage production skills and practices within the VC.

Conclusion

Food and nutrition security in Georgia remains only partially socially acceptable due to persistent structural vulnerabilities, including high import dependence, low agricultural productivity and unequal economic access to food. While maize plays a vital role in both food consumption and livestock systems, particularly in rural areas alone cannot compensate for broader systemic weaknesses.

Strengthening the maize VC, particularly through increased productivity, improved market integration and support for smallholder farmers, can contribute to enhanced food security. However, broader policy interventions are required to reduce import dependence, improve rural incomes and build a more resilient and sustainable food system.

TABLE 4-4: FOOD AND NUTRITION SECURITY

4. FOOD AND NUTRITION SECURITY	
4.1 Availability of food	Substantial
4.2 Accessibility of food	Substantial
4.3 Utilisation and nutritional adequacy	Substantial
4.4 Stability	Substantial
Average	Substantial

4.5 Social capital

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

Social capital within the maize VC in Georgia manifests in multiple forms, including horizontal (peer-to-peer) and vertical (institutional and market-based) relationships. These networks vary significantly across farm types in terms of strength, inclusiveness and influence. Overall, social capital plays a critical role in shaping access to resources, knowledge, services and market opportunities, thereby directly influencing farm performance and value chain development.

Social Capital Forms within the Maize Value Chain

Fieldwork identified both bonding social capital (within communities and families) and bridging/linking social capital (connections with markets, institutions and external actors). However, the distribution of these forms is uneven, with stronger and more influential networks concentrated among medium and large farmers.

Micro Farms: Strong Bonding Social Capital

Within micro farms, social capital is primarily localized at the village level and embedded in traditional community structures. Strong interpersonal trust and reciprocity characterize these networks.

A key example is the traditional practice of “Nadi”, whereby neighbours and relatives collectively assist each other during labour-intensive agricultural activities such as harvesting, seeding or cultivation. This informal labour-sharing mechanism reduces labour costs while strengthening social cohesion and mutual support within communities. In ethnological research different songs were identified that are used during the working hours by the members of “Nadi”, special dinner is dedicated after the work that also plays significant role on social cohesion. Neverthless, the respondents highlighted that the tradition is declining due to high outward migration from villages and decreasing interest to do small semi-substantial agricultural practices for the new generation.

In addition, micro-level social capital extends to connections with relatives and family members who emigrated in the cities. For instance, cases were observed where emigrants invested in restoring traditional assets (e.g. water mills) and entrusted their management to respected community members. Such practices reinforce trust-based relationships and create additional livelihood opportunities at the local level.

However, while bonding social capital is strong, micro farmers have limited access to bridging social capital, such as links to markets, institutions or development programmes, which constrain their ability to scale production or innovate. Most households sell maize grain and flour either at the nearest agro-market or to twholesalers.

Small Farms: Emerging Market-Oriented Networks

Small farms demonstrate a transition from purely local networks toward broader market integration. These farmers are more actively engaged in:

- livestock-related value chains
- relationships with input suppliers
- interactions with traders, including cross-border actors

For example, livestock trade connections with buyers from neighbouring countries (e.g. Azerbaijan and Middle Eastern markets) create transnational linkages that extend beyond local networks.

Small farmers also rely on informal networks for accessing inputs, sometimes sourcing seeds and agricultural inputs through larger farmers who import them at lower cost from abroad. This reflects emerging horizontal cooperation, although it remains informal and uneven.

Interactions with local government are also present but vary depending on farmers' social influence. Farmers with stronger local connections are more likely to receive support (e.g. infrastructure improvements such as access roads), highlighting inequalities in access to institutional support.

Medium and Large Farms: Strong Linking Social Capital

Medium and large farmers possess the most developed and influential social capital within the VC. Their networks extend vertically to:

- local and central government institutions (MEPA and different relevant entities under the ministry)
- development programmes funded by international organizations
- agricultural associations and service providers

These farmers often have greater bargaining power and are better positioned to access subsidies, co-financing schemes and technical support. Their participation in donor-funded programmes further strengthens their capacity for innovation and expansion.

Horizontal cooperation is also observed among larger farmers. For example, farmers may coordinate jointly to procure services (e.g. agricultural drones for pesticide application, agricultural machinery etc.) or negotiate better terms with service providers. Such cooperation enhances efficiency and reduces costs.

However, this concentration of social capital also creates power asymmetries. For instance, access to irrigation water may be prioritized for larger farms, potentially disadvantaging smaller producers. This indicates that while social capital is strong, it is not equitably distributed.

Social Networks within Farms

At the farm level, particularly in medium and large enterprises, strong informal relationships exist between employers and workers. These relationships often extend beyond formal labour arrangements and include elements of social protection.

Workers reported receiving support from farm owners during times of personal hardship, including financial assistance for medical expenses or other emergencies. In rare cases, farmers have provided substantial support, such as housing assistance. These practices reflect paternalistic but trust-based relationships that partially compensate for the absence of formal social protection mechanisms.

However, such support is discretionary and dependent on personal relationships, which raises concerns about consistency and equity.

Associations and Collective Action

Agricultural associations in Georgia are relatively recent following the collapse of the Soviet Union. Their influence is gradually increasing but remains limited.

The Georgian Maize Association, despite having approximately 200 members, has limited institutional capacity and advocacy power. Its ability to influence policy or effectively represent farmers' interests is constrained.

In contrast, stronger organizations such as the Georgian Farmers' Association and Elkana play a more significant role. These organizations provide:

- training and capacity building
- access to funding and programmes
- support for innovation and sustainable practices

Despite these efforts, overall representation of maize producers remains fragmented and relatively weak. As the maize production increases and more medium and large farmers emerge in the coming years, there will be opportunities to enhance cooperation and establish stronger associations.

Cooperation and Cooperatives

Formal agricultural cooperatives are largely absent in the maize VC. Only isolated examples were identified, and these were not primarily focused on maize production.

Instead, informal cooperation mechanisms are more common, particularly among medium and large farmers. These include:

- joint input procurement

- shared use of machinery
- coordinated sales to meet buyer demand

While these informal arrangements provide some benefits, they lack institutional stability and scale of formal cooperatives. Farmers themselves recognize the potential benefits of stronger cooperation, particularly for improving bargaining power, reducing costs and addressing logistical challenges. Yet, they also highlight that, overall, there is a low cooperation culture in Georgia.

Knowledge Sharing and Innovation

Knowledge transfer within the maize VC occurs primarily through informal channels, including:

- peer-to-peer learning among farmers
- internet-based information sources
- input suppliers (agro-markets) providing technical advice

The role of formal extension services provided by the government remains limited. None of farmers reported receiving technical support from public extension systems, although some acknowledged receiving information about government programmes.

Development projects implemented by organizations such as the Georgian Farmers' Association (e.g. USDA-funded programme) play an important role in disseminating knowledge, particularly among medium and large farms.

A clear distinction exists between:

- White maize systems, which rely more on traditional practices with some exceptions
- Yellow maize systems, which are more technologically advanced and based on hybrid varieties

This distinction also reflects differences in access to knowledge, resources and innovation.

Conclusion

Social capital within the maize VC in Georgia is significant but unevenly distributed. While strong bonding social capital exists at the community level particularly among micro and small farmers access to bridging and linking social capital is concentrated among medium and large farms.

This unequal distribution affects access to resources, services and opportunities, reinforcing structural inequalities within the VC. Although informal networks provide important support mechanisms, particularly in the absence of formal institutions, they cannot fully substitute for inclusive and institutionalized forms of cooperation.

Strengthening farmer organizations, improving access to extension services and promoting more inclusive forms of cooperation will be critical for enhancing social capital in a more equitable and sustainable manner.

TABLE 4-5: SOCIAL CAPITAL

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

4.6 Living conditions

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

According to the National Statistics Office of Georgia (2025), there is a significant disparity in average monthly income between rural and urban households. In 2024, average monthly income in urban areas was 1,436 GEL, compared to 746 GEL in rural areas, indicating a gap of approximately 48%. This substantial income difference contributes to disparities in living standards and food security outcomes.

Poverty indicators further highlight this inequality. The share of the population living below the absolute poverty line is higher in rural areas (11.9%) compared to urban areas (7.8%). Similarly, relative poverty, defined as income below 60% of the median, is significantly higher in rural areas (25%) compared to urban areas (15%) (Geostat, 2025)

The universal healthcare programme provided by the Government of Georgia (most of the workers and micro and small farmers are beneficiaries of this programme) covers most of the rural population, including workers in the maize VC. Primary healthcare services are generally accessible in municipal centres. However, in cases of more serious health conditions, rural populations must travel to larger cities, often to Tbilisi. While public healthcare covers a range of services, access may still be constrained by distance and associated costs.

Regarding infrastructure in rural areas, improvements have been observed in recent years. Main roads in villages are often asphalted or rehabilitated. However, roads leading to agricultural land plots remain in relatively poor condition, creating challenges for agricultural machinery and logistics within the maize VC.

Rural infrastructure and housing conditions remain a critical dimension of socioeconomic development in Georgia, with direct implications for agricultural productivity, livelihoods and food security. Despite recent progress, substantial disparities persist between urban and rural areas in access to basic services and infrastructure. These inequalities reflect broader structural challenges in rural development.

Housing conditions in rural areas are generally characterized by lower-quality dwellings and more limited access to essential infrastructure. Rural households are less likely to be connected to centralized water supply, sewerage systems networks, often relying on alternative or less reliable sources (FAO, 2025). Access to safe drinking water and sanitation remains uneven, and in many cases households depend on wells or stored water, which may pose health risks and increase the time burden associated with water collection.

Energy use patterns further illustrate rural–urban disparities. Rural households rely more heavily on traditional energy sources, particularly firewood, for heating and cooking, while urban households have greater access to natural gas and modern energy systems (FAO, 2025). This reliance reflects both infrastructure limitations and lower income levels and has environmental and social implications, including increased labour burden and pressure on natural resources.

Transport and connectivity remain key constraints. Rural areas often have limited access to transport services, which restricts mobility and access to markets, healthcare and some education centers facilities. Poor infrastructure increases transaction costs for farmers and limits their participation in agricultural value chains, including maize production. It also affects access to inputs and extension services.

Access to information and communication technologies (ICT) has improved, but disparities remain. Limited internet connectivity in rural areas reduces access to market information, financial services and knowledge, constraining innovation and competitiveness, particularly for smallholder farmers.

From a socioeconomic perspective, infrastructure inequalities are closely linked to income disparities. Lower rural incomes limit households' ability to invest in housing, services and productive assets, reinforcing cycles of poverty and limiting development opportunities.

Rural infrastructure also has important gender dimensions. Women are disproportionately affected by inadequate infrastructure due to their greater involvement in unpaid domestic work. Limited access to water, energy and transport increases their time burden and reduces their participation in income-generating activities and agricultural markets. Restricted mobility and access to information further limit women's engagement in training and decision-making processes.

The infrastructure in the farms in most cases is very low developed. Most of the farms have issues related to drinking water, sanitation, resting rooms and other basic infrastructure for operation. Only a few large farms have more acceptable infrastructure. Raising awareness about the importance of the development of farm infrastructure requires further support and structural developments.

Overall, addressing rural infrastructure gaps requires integrated and gender-sensitive policy approaches focused on improving access to basic services, enhancing connectivity and supporting agricultural development. Investments in water, sanitation, energy, transport and digital infrastructure are essential for reducing rural–urban disparities and strengthening food security.

Access to education in rural areas of Georgia remains constrained by structural and socioeconomic barriers, despite improvements in overall educational attainment. Rural populations face reduced access to quality educational infrastructure, including fewer schools, and lower availability of specialized programmes, particularly in vocational and agricultural education (FAO, 2025). Geographic isolation and infrastructure limitations further affect school attendance, especially in remote areas.

In addition, economic disparities contribute to higher rates of youth not in education, employment or training (NEET), particularly among rural populations and young women. Limited digital connectivity further restricts access to modern learning opportunities. As a result, inequalities in education access continue to reinforce broader rural–urban disparities and constrain human capital development in rural Georgia.

Conclusion

Living conditions in rural Georgia remain significantly below those in urban areas, driven by disparities in income, infrastructure and access to services. Despite improvements in recent years, rural households continue to face higher poverty rates, weaker housing conditions and limited access to reliable water, sanitation, energy and transport infrastructure. These constraints reduce quality of life and limit economic opportunities, particularly for smallholder farmers involved in the maize VC.

Overall, while basic services such as universal healthcare are available, living conditions can be considered only partially acceptable. Infrastructure gaps, limited access to education and persistent gender inequalities continue to constrain development outcomes and reinforce rural–urban disparities. The basic infrastructure on the farm level remains very low. Addressing these challenges requires targeted and integrated policies to improve infrastructure, enhance service access and strengthen rural livelihoods, thereby supporting more inclusive and sustainable development.

TABLE 4-6: LIVING CONDITIONS

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

4.7 Answer to the Framing Question 3

The maize VC is structured, providing relatively low and seasonal employment opportunities for rural population with the salaries similar to the other agricultural VCs in Georgia. Employees within VCs are mostly employed seasonally, although in large and some medium farmers certain numbers of skilled and unskilled permanent workers are presented.

Work safety, especially when applying fertilizers and pesticides, requires significant improvement. The working environment, buildings, sanitation facilities and access to safe drinking water is limited and require significant improvement.

The high informal working arrangements are observed within most of the farms that limits the power of bargaining of the employees and limits accessibility to private insurance, formal paid holidays and other social security dimensions.

Women farmers are rare in the VC, however, there are couple of farms successfully leaded by the women. Mostly, men are employed into the VC. However, some skilled women like managers, accountants and unskilled workers cleaning ladies, kitchen workers and others are present.

White maize plays a direct role, and yellow maize an indirect role, in Georgian cuisine, including its cultural and traditional value in Georgian kitchen.

Medium and large farmers are characterized with high level of social capital, whereas micro and small farmers lack it. Farmers and agricultural enterprises possess high levels of horizontal and vertical social capital.

While basic living conditions in rural areas, including access to healthcare and educational services, are reasonable, roads reaching the agricultural lands and relevant infrastructure still require significant improvement.

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

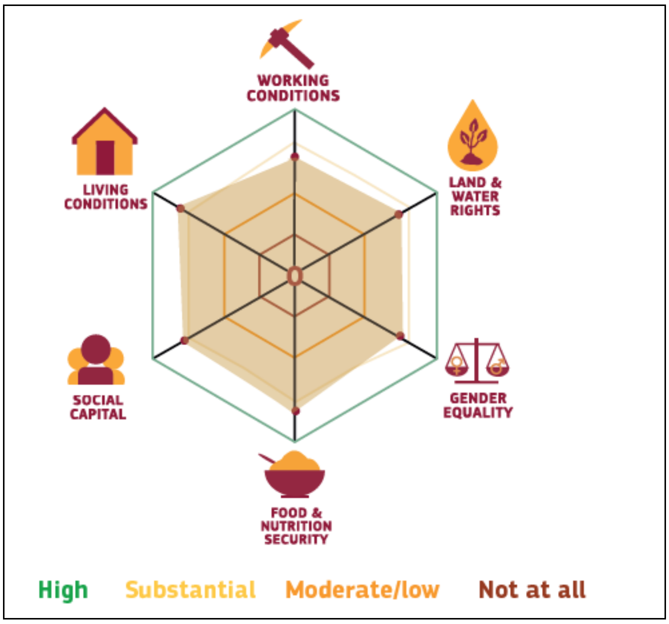


FIGURE 4-2: SOCIAL PROFILE OF THE MAIZE VALUE CHAIN IN GEORGIA

In summary, social analysis recommendations would concentrate on the following measures to ensure social sustainability and inclusiveness:

- Working conditions: formal contracts, improved farm infrastructure, occupational health and safety training, stronger labour inspection.
- Land and water rights: irrigation and drainage modernization, support for medium-sized farmers.
- Gender equality: women's empowerment and support programmes for young farmers.
- Food and nutrition security: modernization of the maize value chain to improve productivity.
- Social capital: farmer capacity building and stronger producer associations.
- Living conditions: improvements to farm infrastructure, roads, and electricity access.

	Key issues identified in the VC	Mitigation measures
Working conditions	Absence of formal contracts between farmers and employers in most of the farms. Relatively low infrastructure -hygienic and sanitary standards on the farms. Relatively low working safety skills end knowledge. Especially while using fertilizers and pesticides.	Enhancement of formal contract in VC. Awareness rising on the importance of the working infrastructure within the farms. Trainings on the importance of safety standards during working. Enhancements of the role of labor inspection.
Land and Water Rights	Land fragmentation and land degradation. Lack irrigation infrastructure in east Georgia Outdated drainage system in west Georgia.	Supporting strengthening of young medium farmers. Modernization of the key irrigation channels. Supporting farmers to install modern pivot and gun sprinkling irrigation systems. Full reconstruction of drainage systems in west Georgia.
Gender Equality	Gender pay gap. Relatively low position of women in VC. Lack of attractiveness of VC for youth.	Women strengthening in VC. Elaboration special support programmes for young medium and small-scale farmers.
Food and Nutrition Security	Very important role of white maize in Georgian cousin and cultural traditions. Indirect role of the yellow maize.	Modernization of the VC to enhance yields and contribution of local production in food and nutrition security.
Social Capital	Relatively low social capital of the micro and small-scale farmers. The role of white maize as a “gift exchange” between close social security. Lack of strong association within the VC.	Capacity building of the small-scale and medium farmers to enhance their involvements in VC.
Living Conditions	Low infrastructure in the farms. Low infrastructure to reach the farms in most of the places.	Improving infrastructure within the farms (buildings, hygienic and sanitary services) and local roads, electricity until the farms.

5. IS THE VALUE CHAIN ENVIRONMENTALLY SUSTAINABLE?

5.1 Introduction

The objective of the environmental analysis of this VCA4D study is to identify the main environmental issues affecting the maize VC in Georgia and to assess its environmental sustainability. The analysis aims to support policy dialogue by providing evidence-based information on the environmental performance of the VC and on potential areas for improvement.

The environmental assessment addresses the core VCA4D environmental framing question: **is the maize VC in Georgia environmentally sustainable?** To answer this question, the analysis evaluates the VC's impacts on three areas of protection (resource depletion, ecosystem quality and human health) while also examining its contribution to climate change and water consumption.

A **Life Cycle Assessment (LCA)** was carried out to quantify environmental impacts associated with maize production and processing. This quantitative analysis is complemented by qualitative information collected through stakeholder interviews and field observations, conducted during field missions in Georgia, and through literature review.

During the initial stage of the study, interviews with farmers, service providers and other VC actors helped identify the main environmental challenges affecting maize production. A number of issues emerged consistently across regions.

First, **low crop yields** are widespread in much of the country. In western Georgia, maize production is dominated by small family farms operating on fragmented plots, often with limited access to equipment. In eastern regions such as Kakheti, agricultural infrastructure and support services are more developed and plots are larger, but yields often remain relatively low despite more favourable production conditions.

Several factors contribute to this productivity gap. These include limited availability of high-quality seeds, sub-optimal input management, limited availability of farming equipment, and constraints related to irrigation and drainage infrastructure. The continued use of rather **obsolete agricultural machinery** is a particularly important issue, often leading to inefficient fuel use, higher operational costs and reduced agronomic efficiency.

The shortage of key machinery also affects harvesting operations. Interviews with mechanization service providers indicated that harvesting equipment such as combine harvesters and silage harvesters is extremely scarce in some regions, leading to delays in harvest operations and increased post-harvest losses.

Soil management challenges also emerged as a significant environmental concern. In most cases maize is cultivated under continuous monoculture. This is particularly the case where irrigation infrastructure has been installed. Farmers often maintain maize monocropping to justify irrigation investments, but this practice may contribute to soil degradation, declining fertility and increasing dependence on chemical inputs over time.

In addition, maize cultivation on sloping land without appropriate soil conservation practices can lead to erosion. Measures such as contour planting, terracing, cover crops or intercropping are rarely implemented, increasing the risk of soil degradation in vulnerable areas.

Water management issues differ across regions. In western Georgia, poor drainage infrastructure often leads to waterlogging, reducing effective land use and constraining mechanization. In eastern regions, irrigation is more common but sometimes relies on inefficient systems such as furrow irrigation or high-flow sprinklers, which may increase both water consumption and soil erosion risks.

Despite these challenges, the field mission also identified **positive practices** that could support more sustainable production systems. In some areas, where maize production is integrated with livestock farming, **manure is applied to soil** as organic fertiliser, **increasing circularity within the VC** by closing nutrient loops. Post-harvest grazing is also practiced in some regions, where livestock feed on crop residues while contributing to soil fertility through natural manure deposition. Also, the practice of retention of crop residues on fields after harvest is a common virtuous strategy for improving soil organic matter and, therefore, soil health, enhancing resilience of crops to climate variability.

In addition to the LCA analysis, the environmental assessment also considers **potential risks to biodiversity** through a GIS-based spatial analysis conducted by overlaying **Corine Land Cover 2023 data** with the **Emerald Network of protected areas**. Due to the partial availability of the CLC dataset in Georgia, the analysis was limited to the regions of **Kvemo Kartli and Kakheti**, where maize production is significant. The results show **very limited overlap between cropland and Emerald sites**, with only small localized intersections observed in the Gardabani district, **suggesting a generally low direct biodiversity risk** from maize cultivation within the areas assessed.

Life Cycle Assessment (LCA)

A Life Cycle Assessment of the maize VC in Georgia was conducted to quantify the environmental impacts associated with maize processing into flour for human consumption and maize grain and silage production for feed.
LCA is a methodological approach that **quantifies environmental impacts throughout the VC**. The impact assessment method adopted is ReCiPe[26], which covers all core questions of the VCA4D methodology. Indeed, 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 and water consumption associated with maize production systems and downstream activities along the VC.
Environmental impacts are expressed per **unit of product**, allowing comparison across production systems and facilitating the identification of environmental hotspots.
The methodological framework of the LCA consists of four main phases:

1. **Definition of objectives and functional units**
2. **Life Cycle Inventory (LCI)**: compilation of data describing inputs and outputs of the system
3. **Impact assessment**: calculation of environmental impacts
4. **Interpretation and discussion of the results**

The present assessment relies primarily on information collected through stakeholder interviews, field observations and literature sources, complemented by available statistical data. As a result, the analysis focuses on representative, most widespread, production systems.

Functional unit

Environmental impacts are expressed relative to a **functional unit**, which represents the reference quantity to which environmental impacts are attributed.
In this study, impacts are calculated per:

- **1 kg of maize grain at farm gate**, for the assessment of cultivation impacts
- **1 kg of maize grain at the end user gate**, for the assessment of the feed grain sub-chain (with additional irrigation scenario).
- **1 kg of maize silage at farm**, for the assessment of silage production impacts (with additional irrigation scenario).
- **1 kg of maize flour**, for the assessment of maize processed for human consumption.

[26] Huijbregts et al., 2017.

Life Cycle Inventory (LCI)

The Life Cycle Inventory compiles the data describing all relevant inputs and outputs associated with maize production and processing.

Information for the cultivation stage was derived from:

- stakeholder interviews conducted during the field mission
- direct field observations
- national statistics and official reports
- technical literature

These sources were used to characterize representative maize production systems in Georgia, including rainfed and irrigated production systems, as well as systems oriented toward different outputs such as grain for food, grain for feed and silage production.

The following cultivation systems were considered in the LCA:

• **MIC – Micro-scale rainfed maize farms**

Very small family farms producing maize mainly for self-consumption. Low input use and limited mechanization. Average grain yield about **2.4 t/ha**.

• **S – Small rainfed maize farms**

Small farms cultivating maize under rainfed conditions with slightly higher input use than micro farms. Average grain yield about **2.7 t/ha**.

• **M - Medium-sized (M) maize farms**, use a moderate level of mechanization and fertiliser. Average grain yield about **4.5 t/ha**. These farms may be rainfed or irrigated. In the **M-irrigated scenario** 1,750 m^3/ha of irrigation water was assumed.

• **L – Large (L) maize farms**, grain-oriented farms with higher mechanization and fertiliser use. Average grain yield about **7.2 t/ha**. These farms may be rainfed or irrigated. In the L-irrigated scenario 3,500 m^3/ha of irrigation water was assumed.

• **Silage**, maize cultivated for livestock feeding where the entire above-ground biomass is harvested. Typical silage yield about **35 t/ha**. Farms producing silage are mostly irrigated. In the irrigation scenario 4,500 m^3/ha of water was assumed.

For each system, the Life Cycle Inventory includes the main inputs used for cultivation (seeds, mineral fertilisers, manure, where applicable, diesel for field operations, plant protection products and irrigation water where relevant).

Information on downstream stages of the VC, particularly milling operations, was obtained through visits to milling facilities and interviews with mill operators. Therefore, the LCI is based on representative technical coefficients derived from the above sources to represent the main production systems currently operating within the maize VC.

5.1.1 Impact Assessment: Results of the Calculations of the Life Cycle Impacts

5.1.2 Selection of Relevant Impact Categories and Life Cycle Phases

The Life Cycle Impact Assessment was conducted using the ReCiPe method, which evaluates environmental impacts across multiple midpoint categories and aggregates them into endpoint indicators corresponding to the three areas of protection of the VCA4D framework: **resource depletion, ecosystem quality and human health**. The detailed information about the ReCiPe method is explained in the Appendix 9.1.

Figure *5-1* presents the relative contribution of each phase of the maize VC to the total environmental impact for the food sub-chain (maize flour for human consumption, which, by including a processing stage, is the most complex within the VC). The results are expressed as percentages of the total environmental impact across all life cycle stages. These values represent a weighted average, based on the relative contribution of micro and small-scale farmer typologies to the national output of grain for flour production (28% and 72% respectively).

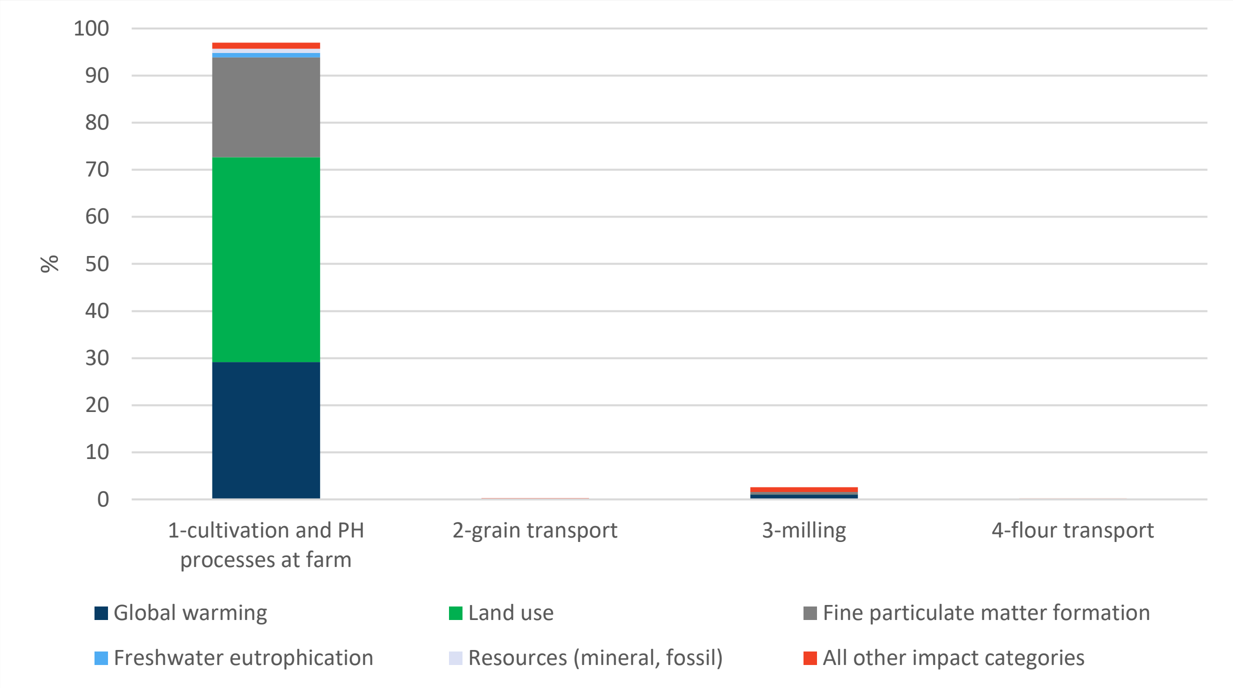


FIGURE 5-1: RELATIVE CONTRIBUTION OF THE MAIN IMPACT CATEGORIES ALONG THE VC STAGES

Values are shown as percentage of the total environmental impacts and contribution of the stages of the VC to the total impacts (cultivation + grain transport + milling + flour transport = 100%). Listed Midpoint impact categories add to 97% of the total environmental impacts (remaining 3% merged together as "All other impact categories").

From a VC phase perspective, the analysis shows that the **cultivation stage dominates the environmental profile of the maize VC**, accounting for approximately 97% of total impacts[27]. Transport phases contribute only marginally, accounting for approximately 0.5%, while milling operations contribute approximately 2.5%.

From an impact category perspective, the largest contributions arise from land use and climate change, which represent approximately 43% and 30% of the total impacts, respectively, both largely attributed to the cultivation phase. **These are followed by fine particulate matter formation** (22%, 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 3%.

Given the relatively small contribution of transport stages, **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 97% 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 99.5% of the overall environmental burden** across the food maize sub-chain. Therefore, processes involved in the phases of transport, which

[27] The cultivation stage includes the shelling process in the case of small-scale farmers, using an electric sheller, while for micro-scale farmers, the process is excluded since shellers used by this typology are often manual.

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).
Regarding the feed sub-chains, all downstream processes except grain transport (which has negligible impacts) are beyond the scope of the analysis (see Appendix 9.1). Therefore, virtually all impacts derive exclusively from the cultivation phase, which will be discussed in the following section.
Also, for the sake of simplicity, the impact of transport to export hubs at any given border depot were excluded from the assessment, given the relatively small impact of grain transport. Therefore a sub-chain representing grain export was considered to be superfluous.

5.1.3 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 productivity, as this indicator reflects the amount of land required to produce one unit of output.
2) **Global warming potential** is mainly 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, maize **grain production** in Georgia **has environmental impacts within the expected range**. For example, GHG emissions expressed as kg CO_2 eq per kg of maize grain at farm gate ranged from 0.34 (large-scale) to 0.44 (micro-scale) (Appendix 0 - Midpoint Life Cycle Impact Assessment). These results are around the lower end of the range of LCA result on maize production in other contexts (0.25 to 1.76 kg CO_2eq per kg of maize grain, Table 5-1). Silage production, due to the use of the whole above-ground biomass has much lower GHG emissions per unit of product (0.06 kg CO_2eq/kg silage).

TABLE 5-1 : COMPARISON OF THE MAIZE GLOBAL WARMING POTENTIAL RESULTS OF MAIZE CULTIVATION IN GEORGIA WITH VALUES FROM LITERATURE. SOURCE: AUTHORS, BASED ON LITERATURE REVIEW.

Source	Country	GWP - kg CO2 eq / kg grain
Zhang et al., 2017	China	1.76
Wang et al., 2015	China	1.01
Kim et al., 2009	USA	0.25 - 0.82*
Farag et al., 2018	Egypt	0.31
Supasri et al., 2020	Thailand	0.25 - 0.52
Ma et al., 2012	Canada	0.44 - 0.76
Wettsein, 2017	South Africa	0.50 - 0.80
Wettsein, 2017	Argentina	1.24
This study (2024)	**Georgia**	**0.34 - 0.44****

*in eight major producing counties in the US Corn Belt.
**minimum and maximum values, according to the cropping system.

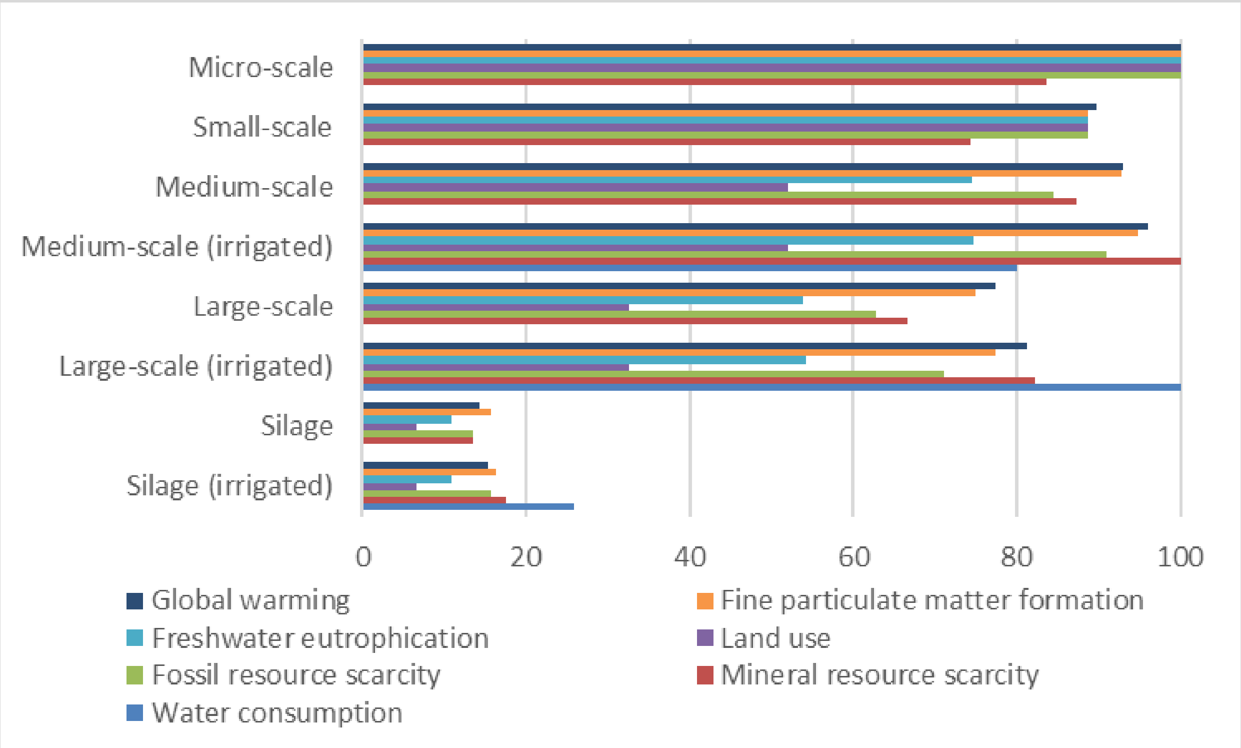


FIGURE 5-2: SELECTED ENVIRONMENTAL IMPACTS OF MAIZE PRODUCTION ACCORDING TO THE TYPOLOGIES OF FARMERS (PER KG OF GRAIN AT FARM GATE)

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, Water consumption: m^3. The highest score in the comparison is shown as 100%.

The comparison of the individual farmers typologies reveals higher environmental impacts in the micro-scale typology, followed by the small-scale and medium-scale farmers. Global warming, particulate matter formation and resources depletion are highest in these typologies due to the combined effects of lower crop yield, relatively high fuel consumption for field operations and fertiliser use, which are sources of GHGs, especially nitrogen-based fertilisers (largely used for maize cultivation). In addition, low yields per hectare, as in the case of micro and small-scale farms (Figure 5-2), lead to larger land use.

5.1.3.1 Water consumption and irrigation scenarios

Irrigated production systems were addressed by constructing two scenarios of irrigated production, namely grain in medium scale and large scale farms and silage in large-scale farms (assuming water consumption of 175, 350 and 450 mm respectively). The aim was to represent typical irrigation volumes applied in the drier eastern regions of Georgia, where maize cultivation may depend on supplemental irrigation during the growing season.

Water consumption in irrigated systems is therefore significantly higher than in rainfed systems, where water use is limited to indirect water consumption associated with input production and water used for the dilution and application of agrochemicals.

It is worth mentioning that under the tariff model for irrigation water in place during the reference year of the present study (75 GEL/ha/year), a rational allocation of irrigation water has proved difficult to implement. The fixed tariff structure provided limited incentives for farmers to optimize water use or adopt more efficient irrigation practices. For this reason, a new tariff model is expected to come into effect from April 1, 2026, under which the fixed fee will be replaced by a volumetric pricing system based on actual water consumption. This policy change is expected to encourage more efficient water use and improve irrigation management practices.

This issue is particularly relevant considering that, in the relatively few cases where maize is irrigated, the dominant irrigation method observed during field missions was furrow irrigation, typically associated with high flow rates and relatively low application efficiency. Such irrigation practices can lead not only to high levels of water consumption, but also to soil degradation risks, particularly through surface runoff and erosion in sloped or poorly structured soils.

Access to irrigation water is also constrained by physical and institutional limitations of the irrigation infrastructure. Irrigation canals managed by Georgian Amelioration cover only certain areas of the country (Figure 5-3), which significantly restricts the spatial extent of irrigated agriculture. As a result, many maize plots are located outside the service areas of the irrigation network and therefore rely entirely on rainfall.

In addition to these structural limitations, stakeholder consultations and field observations revealed several operational constraints affecting the effective use of irrigation infrastructure. Farmers and local stakeholders reported that plots must generally be located in close proximity to the canals of the Georgian Amelioration network in order to be irrigated, as the available infrastructure does not always allow water to be transported over longer distances to fields. Moreover, several irrigation canals have not yet undergone rehabilitation and remain partially or completely non-operational, further limiting the effective availability of irrigation water in some areas.

Another frequently mentioned issue concerns the distribution of water along canal systems. According to anecdotal information collected during field missions, plots located towards the end of canal networks often receive little or no water, as the available water volumes may not be sufficient to reach the downstream sections of the canals, particularly during peak irrigation periods. This uneven water distribution generates additional constraints for farmers located at the end of irrigation systems and reduces the overall effectiveness of the irrigation infrastructure. Overall, the current irrigation system provides limited and uneven access to irrigation water, even within areas technically served by the canal network.

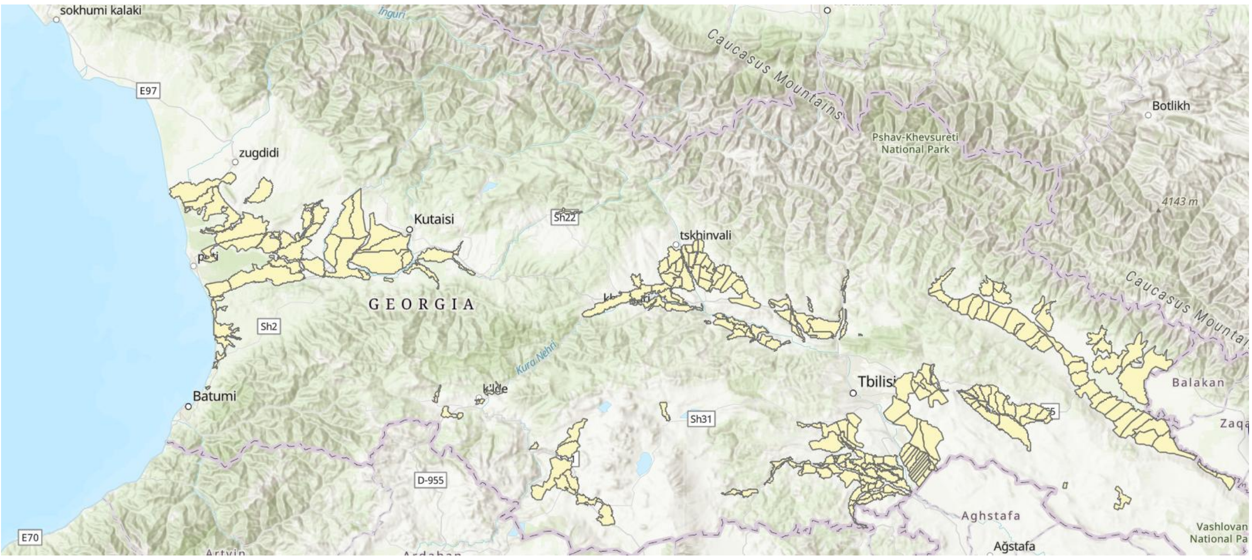


FIGURE 5-3: MAP OF AREAS WHERE IRRIGATION (EAST AND WEST) AND DRAINAGE (WEST) INFRASTRUCTURES ARE MANAGED BY GEORGIAN AMELIORATION. SOURCE: HTTPS://AG.GE/GIS-MAP

Appendix 0 shows the results per kg of grain at farm gate, of all farmers typologies, for the 18 Midpoint categories (Table Appendix 9-5) and for the selected Midpoint impact categories (Figures Appendix 9-6 to Appendix 9-116).

5.1.4 Environmental Impacts of the Milling Stage

The production of maize flour involves traditional processes, mainly carried out in small-scale village mills, characterized by productivities that can vary, from a few kg/hour to over 100 kg/hour depending on the equipment used. In some isolated cases, flour is packaged in kraft paper bags for retailing. Nevertheless, most mills sell bulk flour or provide milling service to customers at a stipulated toll. Figure *5-4* shows a small-scale service mill.

FIGURE 5-4: A SMALL-SCALE MILL
SOURCE: AUTHORS.

As previously discussed, milling activities account for approximately 2.5% of the total environmental impacts across the VC.
The primary single impact categories at this stage are **global warming potential** and **fine particulate matter formation** from indirect emissions derived from electricity production. Technical parameters of the milling process are shown in Table Appendix 9.

5.2 Discussion of the LCA results

The overall impacts of the VC (as weighted average of the two contributors to the national maize flour output), are calculated as proportions per each area of protection and of the climate change impact category. These calculations highlight where to focus attention for each environmental goal and are shown in
Figure *5-5*. The impacts of feed grain and silage production were not elaborated as above, since they concentrate almost exclusively at the cultivation stage, being the downstream phase represented by a relatively short road transport (Appendix 9.2).

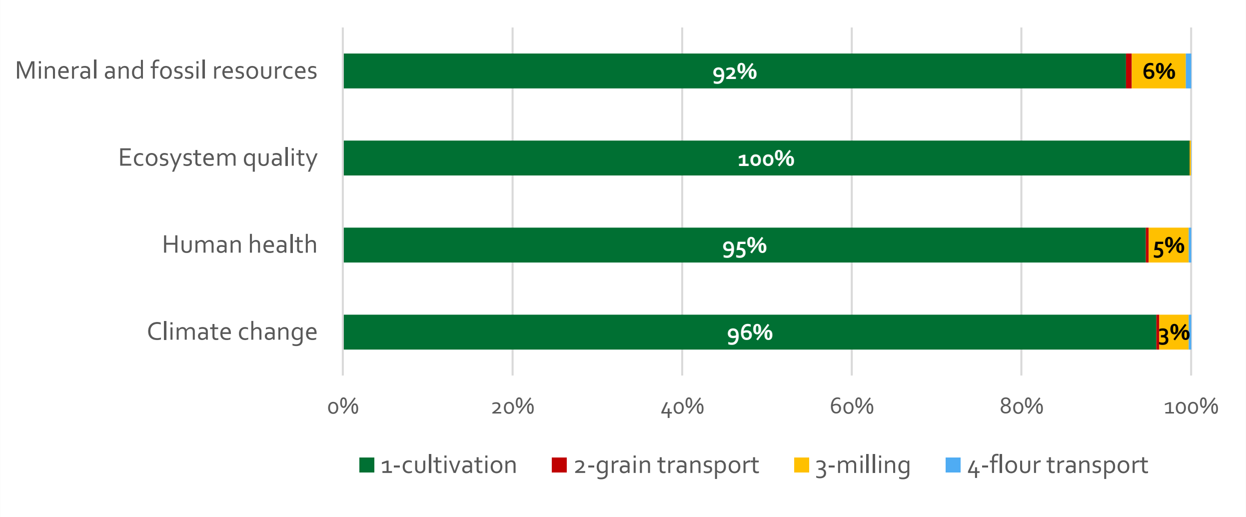


FIGURE 5-5 MAIZE FLOUR FOR HUMAN CONSUMPTION - RELATIVE CONTRIBUTION (%) OF CULTIVATION, GRAIN TRANSPORT, MILLING AND FLOUR TRANSPORT TO EACH SELECTED ENVIRONMENTAL AREA OF PROTECTION AND THE CLIMATE CHANGE IMPACT CATEGORY

Values represent the weighted average of micro and small-scale farms, contributing to the total output of domestic maize flour in Georgia. Functional unit: 1 kg of maize flour at retailer or consumer's household (for both cases the same transport distance was assumed).

As previously discussed, the cultivation stage emerges as the main contributor to the three areas of protection, and to climate change, with variations depending on the environmental indicator. Transport to and from mills contribute is negligible, while milling impacts vary more depending on the indicator but generally remain secondary, contributing between 3% (Climate change) and 6% (Resources depletion). Ecosystem quality is solely affected by the cultivation stage, therefore none of the downstream phases have impact on this area of protection.
When analysing other outputs of the VC (grain for feed, silage) the dominance of the cultivation stage emerges even more strongly, considering that those outputs have just one downstream phase (transport alone). Therefore, virtually all impacts are associated with the cultivation stage (Appendix 9.2) and, in the case of silage, post-harvest operations at the farm (silage transport to bunkers and mechanical compaction).

Impacts on resources, ecosystems, human health, climate change and water consumption are presented for maize flour, grain and silage production. In addition, scenarios irrigation (grain and silage maize) in large farms are presented in order to highlight the impact of pivot irrigation.

5.2.1.1 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. Except for silage production, across all typologies, values are relatively similar but **slightly higher depletion is observed in maize flour production** (Figure 5-6). The reason is twofold, on the one hand, at the cultivation stage resource depletion is higher compared to that of the other typologies due to lower grain yields and in the other hand, the milling process also contributes to resource depletion due to electricity consumption.
In all cases **cultivation stage is the largest contributor to resource depletion**. The level of inputs (mainly fertilisers and fuel) in relation to crop yield explains the greatest part of this indicator.

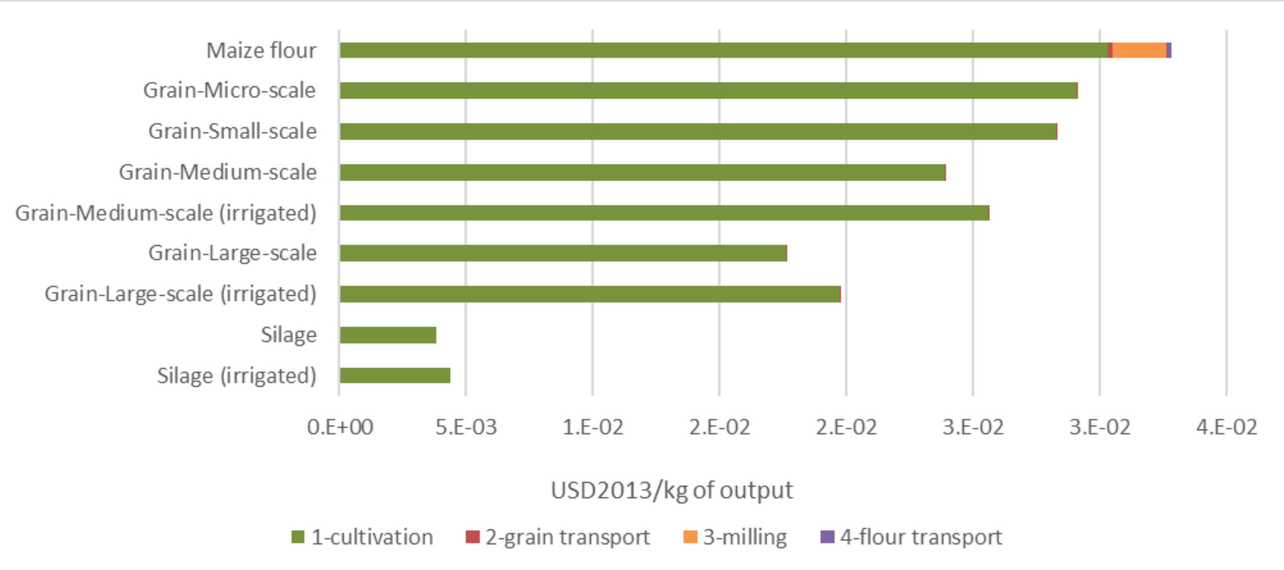


FIGURE 5-6: RESOURCE DEPLETION PER KG OF OUTPUT (FLOUR FOR FOOD, GRAIN AND SILAGE FOR FEED)

5.2.1.2 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, herbicide. These plant-protection products are generally used at low levels (especially by micro and small-scale farmers) and do not indicate a substantial pressure. Nevertheless, minimizing chemical inputs remains important to prevent cumulative effects on biodiversity and freshwater quality. This area of protection is dominated by farming activities, with transport and milling impacts being completely negligible (Figure 5-7).

Among typologies, micro and small-scale farms have the highest ecosystem impacts, linked to low yields that increase land use, in this case, per kg flour. This indicator is closely related to crop yield, therefore **cultivation efficiency** (**higher yields with low levels of input use**, including fertilisers and pesticides) is key to reducing ecosystem impacts. Also, the irrigated scenarios show slightly higher impacts compared to the corresponding rainfed typologies, due to the impact of water scarcity on ecosystems.

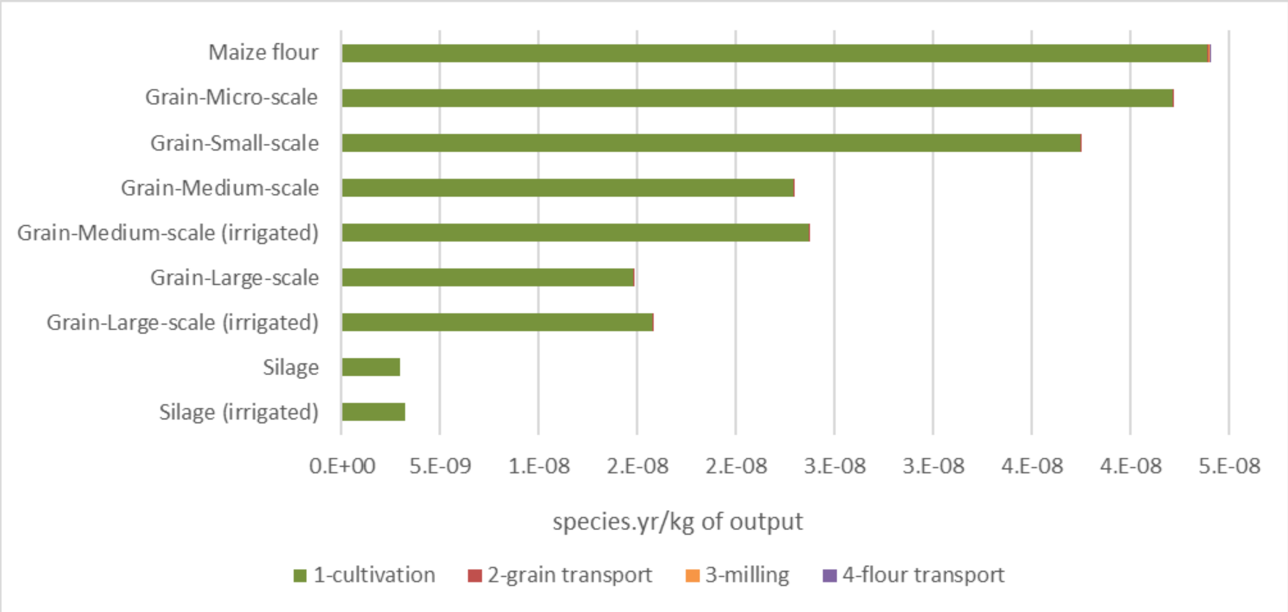


FIGURE 5-7: DAMAGE TO ECOSYSTEMS PER KG OF OUTPUT (FLOUR FOR FOOD, GRAIN AND SILAGE FOR FEED)

5.2.1.3 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[28]). Fuel combustion for transport and energy use for milling also contribute but to a lesser extent.
Highest DALY values were registered for maize flour production (at the cultivation stage the impact is higher compared to that of the other typologies due to lower grain yields and, also, the milling process contributes to human health impacts due to electricity consumption). (Figure *5-8*).

The pattern observed in the other damage categories is repeated also for this area of protection: **cultivation efficiency** (**higher yields with low levels of input use**) translates into less emissions affecting human health per output unit.

[28]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).

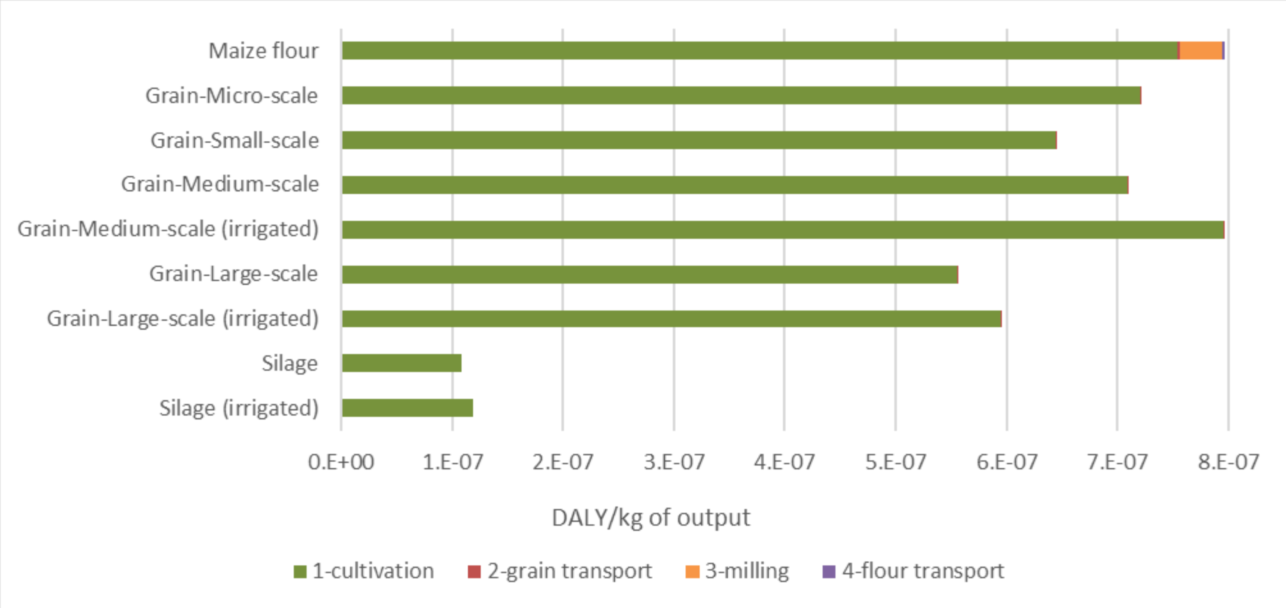


FIGURE 5-8: IMPACT ON HUMAN HEALTH PER KG OF OUTPUT (FLOUR FOR FOOD, GRAIN AND SILAGE FOR FEED). NOTE: TRANSPORT OF GRAIN FOR FEED HAVE NEGLIGIBLE IMPACTS.

5.2.1.4 Climate Change

The climate change impact category is measured in terms of global warming potential (GWP), expressed as kg CO_2eq emissions. Figure *5-9* 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, herbicides, seeds).

As for other indicators, 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 micro and small-scale farms (contributors of grain for flour production), which are characterized by low crop yield. Transport contribution is negligible.

Although the milling process also consume energy, its climate impact is overshadowed by cultivation emissions.

Across all environmental domains studied, **cultivation is the critical stage where intervention will yield the greatest sustainability gains** in the maize VC, while transport and milling contribution is completely negligible.

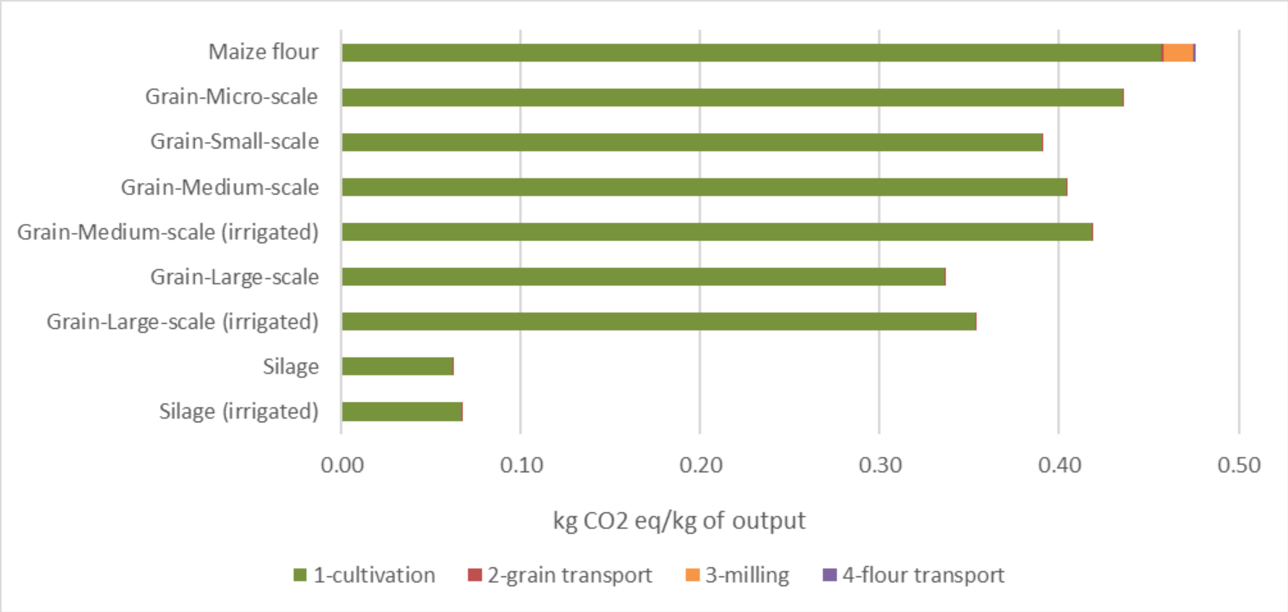


FIGURE 5-9: IMPACT ON CLIMATE CHANGE PER KG OF OUTPUT (FLOUR FOR FOOD, GRAIN AND SILAGE FOR FEED). NOTE: TRANSPORT OF GRAIN FOR FEED HAVE NEGLIGIBLE IMPACTS)

5.2.1.5 Water consumption

Water consumption is negligible in all rainfed systems. Indeed, in these systems, water consumption derives only from dilution of agrochemicals and from its indirect use (in the processes of fertiliser and electricity production). Figure 5-10 shows the water consumption by rainfed systems, while Figure *5-11* shows that of irrigated systems.

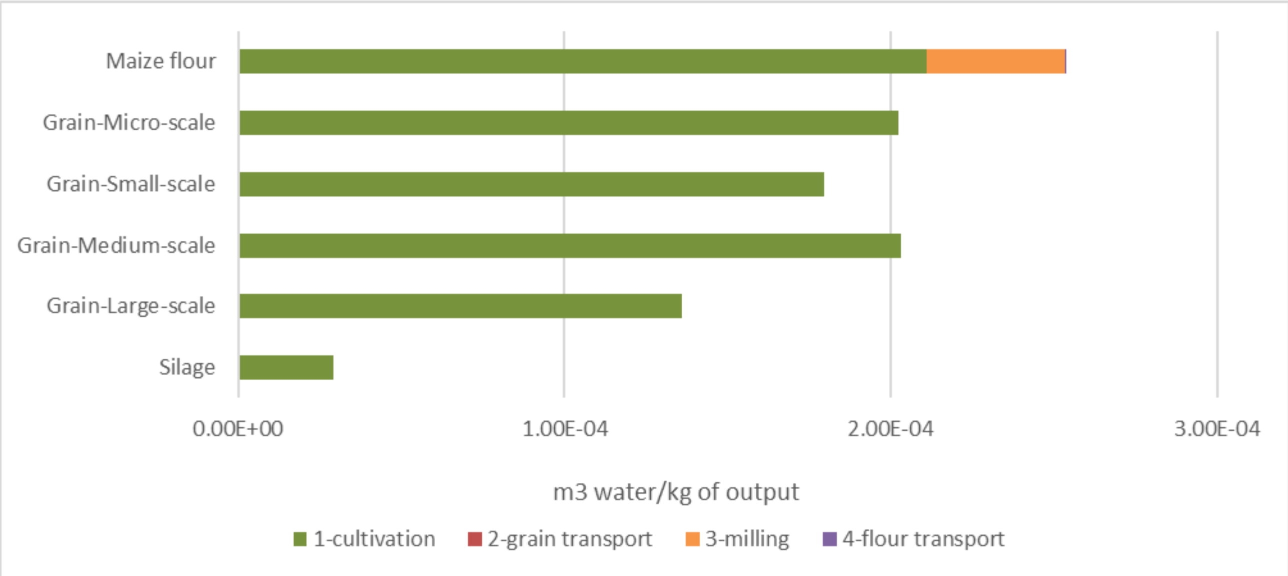


Figure 5-10: IMPACT ON WATER CONSUMPTION PER KG OF OUTPUT IN RAINFED SYSTEMS (FLOUR FOR FOOD, GRAIN AND SILAGE FOR FEED)

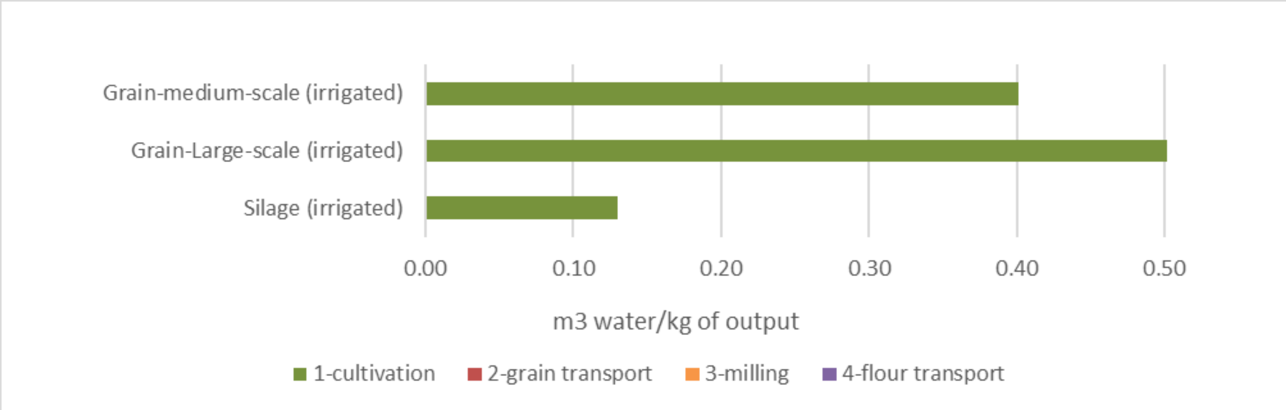


FIGURE 5-11: IMPACT ON WATER CONSUMPTION PER KG OF OUTPUT IN IRRIGATED SYSTEMS (GRAIN AND SILAGE FOR FEED)

The above phase-based breakdown confirms that **any sustainability improvements must primarily target agricultural practices**.

Answering the four core questions: Contextualizing impacts

5.2.1.6 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.

The impact per unit of production is relatively low, 0.004 USD2013 per kg silage, 0.023 USD2013 per kg of maize grain, and 0.033 USD2013 per kg of flour. The main drivers of resource use in the VC are diesel consumption (mainly for field operations) 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.

5.2.1.7 Ecosystem quality

Ecosystem impacts are expressed as the fraction of species that may disappear due to land use, emissions, pesticide use and other pressures.
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 herbicides through improved crop management, better targeting of applications, and strengthened advisory services. While current use levels of herbicides in maize production are not high, progressive reductions can further limit ecosystem pressures.

5.2.1.8 Human Health

LCA captures impacts on human health **derived mainly from air emissions, which are linked with the cultivation phase.** This includes particulate matter, ammonia, nitrous oxides (the latter

also driving global warming, which affects human health[29]). Energy use for milling also contribute, but to a much lesser extent.
There are further risks to human health that arise from direct exposure to hazardous chemical substances (such as pesticides and herbicides), which are not addressed by the LCA approach. Evidence from farmer interviews indicates that pesticide handling is often conducted with **limited or no personal protective equipment** (PPE, which includes respiratory and eye protection, gloves, and protective clothing). In several cases, PPE use is restricted to wearing a mask during pesticide mixing, while **spraying operations frequently occur without adequate protection**. Although a few farmers reported the use of gloves, masks, or basic body protection, these practices appear to be the exception rather than the norm, and overall awareness and adoption of safety measures remain low. In some instances, respondents reported **serious health consequences linked to pesticide exposure**, highlighting the potential risks associated with inadequate safety standards and insufficient protective practices among agricultural workers.

5.2.1.9 Climate Change

Climate change impacts are measured in terms of global warming potential (GWP), expressed as kilograms of CO_2 equivalent (CO_2eq) emissions, mainly due to soil emissions of nitrous oxide (N_2O) resulting from nitrogen fertilization.
At the product level:

- Emissions ranged from 0.34 to 0.44 kg CO_2eq/kg maize grain, depending on production practices (lowest large-scale farms, highest in micro-scale farms with lower input efficiency).

- Emissions for flour production was 0.48 kg CO_2eq/kg flour.

For comparison:

- Maize production in other contexts ranges between 0.31 and 1.76 kg CO_2eq/kg grain.

- Maize flour production in international studies report higher values (i.e. 0.91 kg CO_2eq/kg *CarbonCloud product LCA for corn flour/cornmeal*; maize flour, at processing, 0.48 and 0.53 kg CO_2eq/kg, Italy and Poland, respectively; maize flour-dry milling 0.92 and 1.25 kg CO_2eq/kg, Italy and Poland, respectively)

These **comparisons place Georgian maize VC at the lower end of the emissions range**, reflecting relatively low environmental impacts, particularly by certain typologies.

When considering the overall environmental footprint of the VC, it is worth mentioning that maize cropping involves several virtuous practices. In particular, the widespread practice of retention of crop residues on the fields after harvest is an outstanding example. This practice enhances soil organic matter and provides a mulching effect, benefiting soil health. Also, the spreading of manure, where available, increases circularity within the VC, by closing nutrient loops. Nevertheless, the latter practice is limited mostly to vertically integrated livestock farms and to owned plots, while on rented plots manure is rarely applied.
Targeted policy measures, particularly around soil fertility management, water management and improvement of conservation agriculture practices such as cover cropping, can further enhance sustainability and strengthen resilience, especially under increasing climate pressures.

[29]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).

5.3 Biodiversity risks evaluation

A GIS-based analysis was carried out using the Corine Land Cover (CLC) [30] 2023 dataset together with the spatial layer of protected areas belonging to the Emerald Network of Areas of Special Conservation Interest[31]. These two geographically explicit datasets were overlaid in order to identify potential overlaps between cropland areas and protected natural reserves that could indicate biodiversity risks associated with agricultural production.

In Georgia, the Emerald Network represents the country's main framework for the conservation of habitats and species. The network currently includes 66 designated Emerald sites, covering approximately 18.5% of the national terrestrial territory. Management plans are progressively being developed and implemented to ensure the conservation of important habitats and species and to support sustainable use of natural resources[32].

In the case of Georgia, however, the CLC 2023 land use and land cover map is currently available only for partial territorial coverage, specifically for the regions of Kvemo Kartli and Kakheti. As a consequence, the spatial analysis does not represent a full national assessment but rather a sample-based evaluation limited to these two regions, which together account for a significant share of the country's maize production areas.

Figure *5-12*-A presents the resulting elaboration. In this map, land use and land cover categories from the Corine dataset are displayed only within the boundaries of Emerald Network sites located in Kvemo Kartli and Kakheti. The dominant land cover types within these conservation areas correspond primarily to **natural and semi-natural vegetation**, including forests, shrublands, and other non-agricultural land uses. These categories occupy the vast majority of the Emerald sites in the two regions considered.

The spatial overlay shows that **agricultural land within the protected areas is very limited**. In particular, cropland categories are largely absent within the Emerald sites of Kakheti and most of Kvemo Kartli. The only notable intersection between cropland and protected areas occurs in small localized areas within the Gardabani district, located in the southern part of Kvemo Kartli. Even in this case, the extent of overlap remains limited.

Figure *5-12*-B highlights specifically the areas classified as Arable land that intersect with Emerald sites within the study regions. As shown in the figure, these overlaps are minimal and spatially concentrated, confirming that agricultural encroachment into protected habitats appears to be limited in the available sample of territories analysed.

Georgia is committed to strengthen its biodiversity conservation framework through the development and implementation of management plans for Emerald Network sites, aligned with

[30] Corine Land-Cover in Eastern Partnership Countries.
[31] Emerald Network data (vector) - the Pan-European network of protected sites version 2024.
[32] EU4Environment, World Bank (2024)

broader European conservation standards. Recent initiatives supported under the EU4Environment programme include the development of **guidelines for managing forest habitats within Emerald sites**, aimed at improving conservation practices and strengthening site-level management.

Despite the minimal interaction between cropped areas and the areas of conservation interest, conservation practices should be further promoted, including reduced or no-till cultivation, crop rotation with leguminous crops (to enhance soil nitrogen available to crops) cover crops, crop residue retention on soil and use of manure and other organic fertilisers. In this regard, the intervention of extension services is key. Such practices should be tailored according to specific cases, considering the variety of soil types and micro-climatic zones in the country.

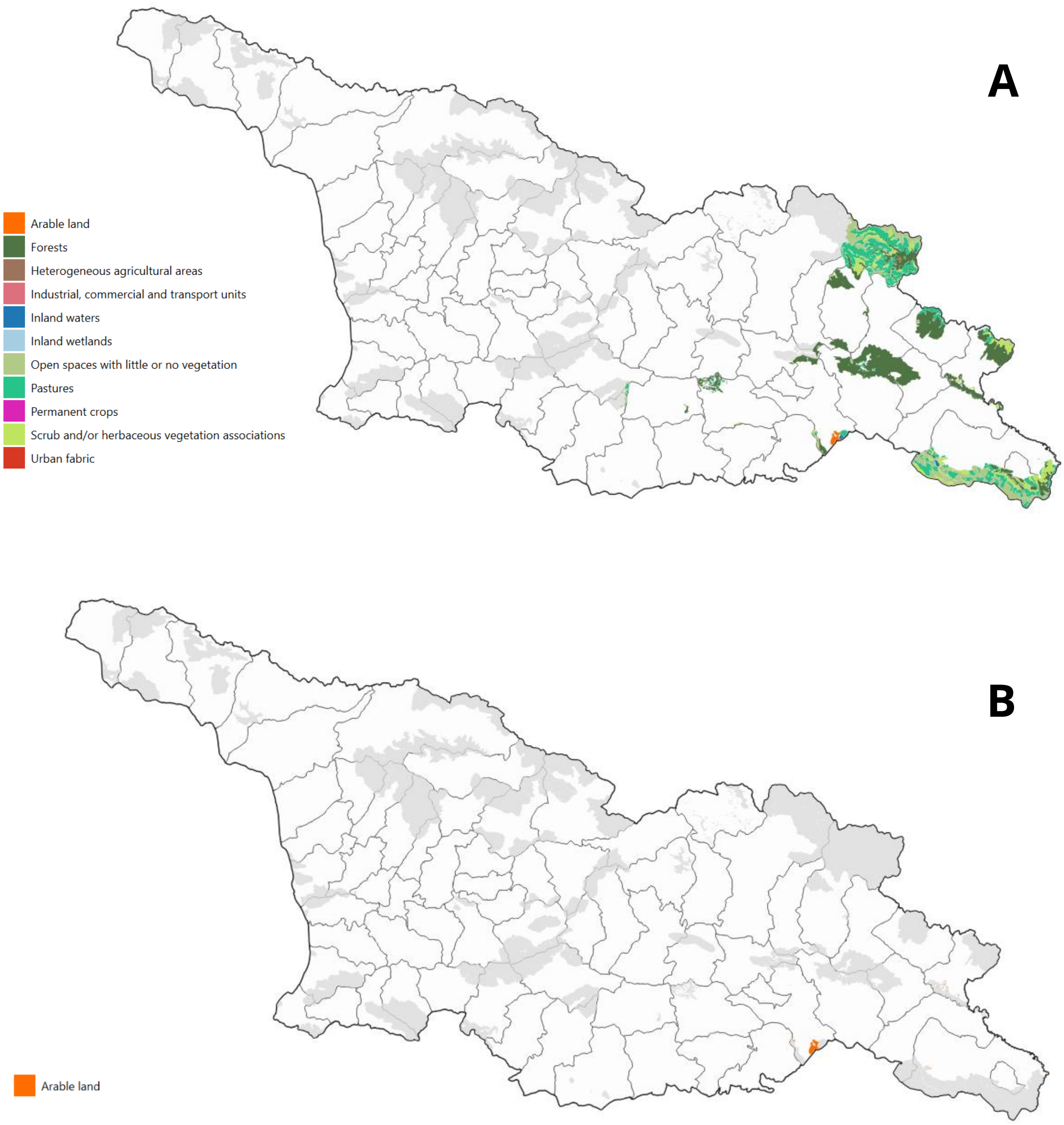


FIGURE 5-12 GEOGRAPHICALLY-EXPLICIT BIODIVERSITY RISK ASSESSMENT.

SOURCE: AUTHORS (BASED ON CORINE LAND COVER MAP AND EMERALD NETWORK MAP OF GEORGIA). A-LAND COVER CATEGORIES DISPLAYED ONLY WITHIN EMERALD SITES OF KVEMO-KARTLI AND KAKHETI. B-ARABLE LAND OF KVEMO-KARTLI AND KAKHETI OVERLAPPING THE MAP OF EMERALD SITES.

5.4 Synthesis of the environmental aspects

The LCA conducted on the maize VC in Georgia for the reference year 2024 indicates a relatively low environmental impact per unit of output, from cultivation to processing. As observed in many agricultural VCs, the cultivation stage represents the main environmental hotspot, accounting for the majority of impacts across the environmental areas assessed. Downstream stages, including processing and distribution, contribute only marginally to the overall environmental performance of the VC.

Overall, the environmental performance of the maize VC in Georgia is characterized by moderate use of external inputs, relatively low mechanization levels in smallholder systems, and limited processing intensity. These characteristics contribute to relatively modest environmental impacts compared with more intensive maize production systems observed in other regions.

In terms of resource depletion, impacts are mainly associated with the use of mineral fertilisers and diesel fuel during cultivation. As fertiliser production and field operations account for most of the resource use in the VC, improving the efficiency of input use represents the main opportunity for reducing resource-related environmental pressures.

Regarding ecosystem quality, the main drivers of impact are land use and nutrient-related emissions from fertilisation, particularly those associated with nitrogen application. As in many crop systems, improving cultivation efficiency (higher yields with moderate input use) is key to reducing environmental impacts per unit of production. Maintaining soil fertility and improving agronomic practices are therefore central to the long-term environmental sustainability of maize production in Georgia.

The life-cycle impact of the maize VC on human health, as captured through the LCA indicators, is relatively low compared with other major environmental health risks. This refers, in particular to occupational direct exposure to hazardous substances, such as pesticides and herbicides, which the LCA methodology does not account for. Qualitative information collected during stakeholder consultations suggests that the use of personal protective equipment (PPE) when handling agrochemicals is limited, reflecting both low awareness and limited enforcement of safety practices. Strengthening awareness and training on safe handling of agricultural inputs would therefore represent an important complementary measure to improve environmental and occupational safety in the sector.

In terms of climate change, greenhouse gas (GHG) emissions associated with maize production are mainly generated during the cultivation phase, particularly through nitrogen fertiliser use and fuel consumption in field operations. The relatively moderate input intensity observed in many Georgian maize systems contributes to comparatively limited emissions per unit of output. However, improving nitrogen use efficiency (NUE) remains one of the most effective strategies to further reduce GHG emissions while maintaining or improving productivity.

Water use represents an additional environmental dimension of relevance in the Georgian maize VC. Water management also emerged as a significant issue, although the nature of the challenge differs across regions of the country.
In western Georgia, where rainfall is generally sufficient for maize production, the main problem relates to insufficient drainage infrastructure. In several areas the drainage ditches are shallow or poorly maintained, resulting in waterlogging of agricultural land. This limits mechanization and reduces the effective area available for cultivation, as farmers often leave wide buffer strips along the drainage channels that cannot be easily farmed (Figure *5-13*).

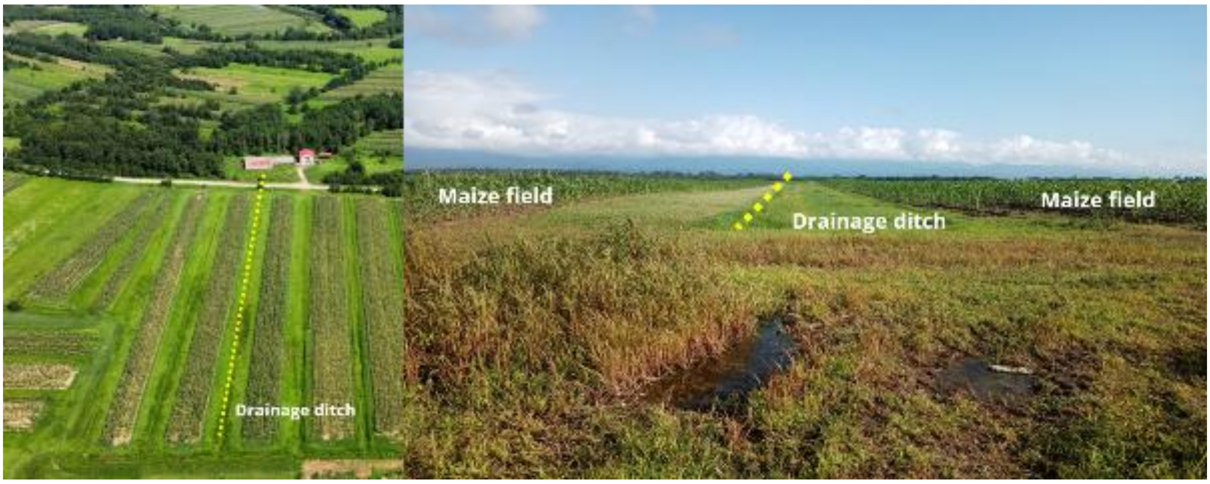


FIGURE 5-13 : SHALLOW DRAINAGE DITCHES AND UNUSED BUFFER AREAS IN MAIZE FIELDS (WESTERN GEORGIA). SOURCE: AUTHORS.

These drainage constraints not only reduce the productive potential of farmland but also contribute to inefficient land use, as significant portions of agricultural plots remain underutilized.

In eastern Georgia, where climatic conditions are drier, irrigation plays a more important role in maize production. While some farms use relatively efficient irrigation systems such as drip or pivot irrigation, other systems remain less efficient. In particular, furrow irrigation is still practiced in some areas.
When applied on soils with limited structure or on sloping land, furrow irrigation can largely contribute to soil erosion, as water flowing along the furrows can progressively remove fine soil particles and leave behind coarser fragments (Figure 5-14).

Figure 5-14: Soil erosion caused by furrow irrigation in maize field (rock fragments prevail inside the furrows where soil was eroded).

Soil erosion risks are further amplified in areas where maize is cultivated on slopes without the adoption of soil conservation measures such as contour planting, terracing or cover crops.

Also the disposal of waste pesticides and their packaging is largely inadequate, since most respondents indicated that the disposal are carried out either by burning or by burying waste materials. As long as formal procedures for conferring these and other wastes to recycling plants are not in place, the use of polyethylene materials such as stretch film (for silage wrap) and dripping lines, will continue posing environmental problems.

The analysis clearly indicates that improving the environmental performance of the maize VC in Georgia requires interventions primarily at the cultivation stage, particularly in the following areas:

• Improving fertiliser management and nitrogen use efficiency (NUE)
Optimizing fertiliser application through soil testing, improved timing of fertilisation and better matching of nutrient supply to crop requirements would reduce nitrogen losses to the environment. This would contribute simultaneously to reducing greenhouse gas emissions, limiting nutrient-related ecosystem impacts and improving input efficiency.

• Exploring policies for promotion of manure use in crop production systems, which can contribute to more circular and resilient farming. Indeed, manure is a valuable source of organic nutrients which can help reduce dependence on synthetic fertilisers, improve soil fertility, and enhance long-term soil health through increased organic matter and biological activity.

• Improving irrigation efficiency and water management
Given these structural and operational limitations for irrigated maize production in the areas of the country characterized by higher levels of water stress, parallel long-term strategies should be considered. These may include water harvesting systems, the development of reservoirs, and the adoption of water-stress-resistant maize varieties. Such measures, combined with the introduction of a volumetric water pricing system, could contribute to a more rational and efficient use of irrigation water.
Integrating these measures into a comprehensive water management approach, including infrastructure rehabilitation, improved irrigation practices, and incentives for water-saving practices, could significantly improve both the environmental sustainability and climate resilience of irrigated maize production systems in Georgia.

• Improving soil and water management in poorly drained areas
In western Georgia, improving drainage conditions and soil management practices would help increase yields and reduce environmental pressures per unit of output (i.e. underutilized portions of agricultural plots leading to inefficient land use due to waterlogging). Better water management would also contribute to improved soil structure and nutrient efficiency.

• Strengthening safe handling practices for agrochemicals
Although pesticide use in maize production is generally moderate, the limited use of personal protective equipment observed during stakeholder consultations highlights the need for improved awareness, training and enforcement of safety standards in the handling of hazardous substances.

• Establish procedures for conferring to recycling plants waste materials used for cultivation and post-harvest operations.

As the environmental impacts of the VC are largely determined at the cultivation stage, improvements in agricultural practices are likely to generate significantly greater environmental benefits than interventions at downstream stages such as processing or distribution.

Downstream stages, including maize milling and local processing activities, contribute relatively little to the overall environmental footprint of the VC. Therefore, efforts to improve environmental sustainability should focus primarily on supporting sustainable agricultural practices while maintaining the viability of small-scale processing operations that play an important role in rural livelihoods and food security.

The GIS-based biodiversity risk screening indicates limited interaction between maize cultivation areas and protected habitats in Georgia. A sample spatial analysis (based on the available Corine Land Cover 2023 data for Kvemo Kartli and Kakheti) shows that cropland rarely overlaps with sites of the Emerald Network, which currently includes 66 protected areas covering about 18.5% of the national territory. Only small, localized overlaps were identified in the Gardabani district, while no cropland encroachment was observed in other Emerald sites within the analysed regions. Although the analysis is not national due to partial land-cover coverage, the results suggest generally low direct biodiversity pressure from maize cultivation on protected areas in the sampled regions.

Beyond protected areas, biodiversity in agricultural landscapes is also influenced by the presence of natural vegetation patches and ecological landscape elements within farming areas. Features such as hedgerows, riparian vegetation, field margins, and tree belts can support pollinators, natural pest predators, and farmland bird species. Maintaining and enhancing these elements in maize-producing regions, alongside the implementation of agroforestry practices, could further strengthen ecological connectivity and biodiversity conservation within Georgia’s agricultural landscapes.

6. SYNTHESIS & RECOMMENDATIONS

This chapter will deliver a clear picture of the operation of the VC, highlighting the main results and critical points. It encompasses answering the four Framing Questions, pointing at the risks, to inform on growth, inclusiveness and sustainability of the VC, summing up the main benefits and strengths, and identifying the main leverage points for possible action.

6.1 Answering the framing questions

6.1.1 From the perspective of economic growth

The various activities of the maize VC are viable. All actors earn positive income, but volatility of maize prices currently impacted by imports trend, may make the situation of some actors problematic.

The NOP of micro-scale maize producers is very low, but maize is not the sole crop in such subsistence production systems, and farmers also rely on other agricultural income, also sometimes from sources outside the VC. These farmers mainly use income from maize grain or flour when they lack cash or need additional funds for children's schooling or other expenses.

The VC generates a total VA of 200 million GEL which is not negligible, with small-scale and micro farmers being the main contributors. Operating income from the VC activities and wages are the main components of this total VA. The maize VC contributes 4% to the country's agricultural GDP. However, the trade balance is negative (31.6 million GEL) as the value of exports of the VC is lower than the value of imported goods that are used in production. The contribution of maize farmers to agricultural GDP is 2.7%. The integration rate within the national economy is relatively high (73%), meaning that it generates indirect revenue for the national economy and offers potential to offset foreign exchange losses related to consumable imports.

Our results also highlight the potential of the processing industry in both sub-chains. Processing maize into flour and animal feed may generate higher VA per tonne for the national economy. From this perspective, both sub-chains can provide a basis for the development of the processing sector. These sub-chains operate in a complementary manner rather than in isolation, supplying white maize flour and animal feed, which are crucial for the country's food security. Therefore, the development policies for the maize VC should consider complementarities between the two sub-chains, as this enables more efficient resource use and more resilient and integrated market systems.

Overall, the maize VC shows sign of competitiveness in terms of the efficient use of domestic resources to create economic value. However, the competitiveness of yellow maize relative to imported maize is lower as Nominal Coefficient Protection (NPC) indicates that domestic yellow maize is more expensive than imported maize.

6.1.2 From the perspective of inclusiveness

The growth generated by the VC involves actors of varying sizes with widely differing operating incomes. Vulnerable actors, such as micro and small-scale farmers, collectively receive nearly 60%

of total VC profits. However, despite this seemingly positive distribution, the Gini coefficient indicates a considerable level of income inequality, as per capita earnings among micro and small-scale farmers remain significantly lower than those of larger-scale actors. This disparity points to governance challenges within the VC. A large number of smallholders lack collective organizations, accessibility to modern agricultural machinery, proper irrigation and other means of efficient operating, which limits their bargaining power and reduces their participation in VC governance.

In terms of employment, temporary jobs are present but do not constitute the dominant form of employment. Large-scale actors tend to offer more skilled positions. Women actively participate in VC activities at the micro farm level, however their involvement across other actor types tends to decline with increasing scale and mechanization, although some skilled and unskilled women are employed in large scale farms. In the eastern part of the country, ethnic minorities are also involved in the VC, mostly as unskilled labor. Overall, the maize VC is estimated to generate 912 Full time equivalent (FTE) jobs in the reference year 2024.

6.1.3 From the perspective of social sustainability

Working conditions across all types of farms remain relatively weak. Exceptions are observed in some large farms, where workers have access to better infrastructure, including improved hygienic and sanitary conditions, rest areas and basic facilities. However, overall working conditions particularly related to infrastructure require further improvement.

Most employment relationships are based on verbal agreements, meaning that a large share of labour remains informal. This negatively affects access to paid leave, private health insurance and workers' bargaining power. As a result, labour conditions across the VC raise concerns in terms of social sustainability.

There is also a need for modernization of both irrigation and drainage systems. Medium and large farms generally have better access to irrigation water and more modern facilities, while smaller farms face more constraints, creating inequalities within the VC.

Men are predominantly involved in the VC, while women are underrepresented and a significant gender pay gap persists. At the same time, there are notable exceptions where women successfully manage maize farms. In addition, the presence of young farmers operating small and medium-sized farms represents a positive development, and further support to these groups has strong potential for VC development.

White maize plays a significant role in Georgian food security due to its traditional importance in national cuisine, while yellow maize is a key component in animal feed production and contributes to nutritional security. However, cooperation and farmer organizations within the VC remain relatively weak and require further strengthening to improve coordination and inclusiveness.

6.1.4 From the perspective of environmental sustainability

The environmental assessment of the maize VC in Georgia indicates relatively low to moderate impacts, although the cultivation stage clearly dominates the environmental footprint. Life Cycle Assessment (LCA) results show that farming activities account for the vast majority of environmental pressures across impact categories, including resource depletion, ecosystem

quality, human health, climate change, and water consumption, while downstream activities such as transport and milling contribute only marginally.
The main drivers of environmental impacts are the use of diesel fuel and mineral fertilisers, particularly nitrogen fertilisers. Greenhouse gas emissions are primarily associated with nitrous oxide emissions from fertiliser application and fuel use during field operations. Although emission levels per kilogram of maize grain remain relatively moderate by international standards, improving nitrogen use efficiency (NUE) through better fertiliser management and advisory services would reduce emissions, improve input efficiency, and strengthen farm productivity.

Impacts on ecosystem quality are largely linked to land occupation and nutrient-related emissions, which are amplified by relatively low crop yields observed in some production systems. Increasing productivity through improved seed quality and agronomic practices, alongside enhanced soil fertility management would reduce land pressure per unit of output and improve overall environmental performance.

Water consumption represents an additional environmental dimension of relevance in the Georgian maize VC. While rainfed production systems show negligible direct water use, irrigated systems, mainly in the eastern regions, can involve significant water consumption. Improving irrigation efficiency, alongside ongoing reforms introducing volumetric water pricing, could support a more sustainable use of water resources.

The biodiversity screening suggests limited interaction between maize cropland and protected areas. A GIS-based analysis conducted for the regions of Kvemo Kartli and Kakheti shows very limited overlap between cropland and sites of the Emerald Network, with only small localized intersections observed in the Gardabani district. Despite this limited overlap, promotion of conservation practices should be sought, including reduced tillage, crop rotation including leguminous crops and cover crops. Such practices need to be supported by extension services and tailored considering the large variety of soil type and micro-climatic zones in the country.

6.2 Synthesis

Maize VC in Georgia faces challenges common to the country's broader agricultural sector, including a reliance on imported agricultural inputs as well as on maize grain. In 2024, according to Geostat data, the country's domestic maize production was 211,500 tonnes, while imports amounted to 71,000 tonnes. On the one hand, our indicators illustrate that the sector has the potential to develop its processing industry of white maize and ensure a stable supply of grain for food consumption. However, this raises several additional challenges, such as the lack of storage and processing facilities, accessibility of modern agricultural machineries particularly if the country targets to meet quality standards.

On the other hand, the importation of cheaper maize is often explained by stakeholders as a consequence of insufficient domestic production of high-quality grain. Thus, the quality issue matters in both food and feed sub-chains. This leads to a critical question: to what extent does maize importation compensate for the domestic sector's inability to supply grain of adequate quality? More broadly, why is the VC struggling to develop and experiencing a decline in production, despite involving a significant number of actors? Several factors may explain this situation, including price distortions caused by imported maize from Russia, as well as deeper structural and geographical constraints that limit productivity and contribute to rural outmigration.

While there are strong interactions between the food and feed sub-chains, there are no inherent incompatibilities in terms of volume. These sub-chains should therefore not be viewed as competing forces. On the contrary, both generate income and employment, support national economic growth, foster economic activity in remote areas, and show potential for social and environmental sustainability.

If key constraints (such as limited access to inputs, machinery, land and financial resources, as well as lower yield and weak governance) are addressed, Georgia is likely to develop both sub-chains, particularly given the potential for increased demand for food and feed maize. However, any development policy concerning the Georgian maize VC must begin with the consideration of agricultural practices' diversity at the farm level, as impacts on the three pillars of sustainability (economic, social and environmental) are primarily rooted at this stage. Therefore, the maize VC requires a comprehensive and collectively developed national strategy that addresses pressing issues in the current context, including dependence on imports, competition from cheaper maize, limited access to resources and services, lack of cooperation action, and weak linkages between upstream production planning and downstream marketing and processing actors. Its implementation should also be carried out in an inclusive manner.

In what follows, we revisit key concerns and discussion points raised by stakeholders and policy makers during the October 2025 workshop and interpret them in light of our findings.

Production efficiency constraints

At farm level, producers face several challenges that affect productivity, particularly among micro and small-scale farms. Limited access to agricultural inputs, machinery and appropriate information remains a major constraint. It should be noted that the VC is structurally based on both labour and a certain level of mechanization. However, access to such equipment is often beyond the reach of smallholders operating in remote areas with limited financial resources. As a result, investment in productivity-improving technologies is largely confined to larger-scale actors.

One of the most significant productivity constraints specific to maize VC in Georgia is land fragmentation. The VC involves a large number of micro and small-scale farmers cultivating plots allocated during the post-Soviet privatization process. These farmers tend not to expand their holdings. In contrast, land expansion has been observed among medium and large-scale farms, whose operators are more likely to have stable, long-term plans in agriculture.

Key obstacles to yellow maize competitiveness in meeting local demand

Field missions indicate that price and quality of the imported maize are the main factors for the consumers (feed milling industry) to use it. This maize is available at cheaper and more stable prices due to economies of scale and more productive agricultural systems in which farmers in exporting country (Russia) operate. Thus, Georgian maize farmers face a strong competitive pressure on price.

One of the reasons why domestic maize does not meet the quality standards required by the feed industry lies in post-harvest challenges and limited infrastructure. Poor storage and handling practices at the farm level lead to losses, as well as high moisture content and contamination, which reduce the quality competitiveness of Georgian maize vis-à-vis imported maize. Another constraint relates to transport and supply chains, which lack effective collection and aggregation of domestic maize from farmers.

Finally, weak coordination between farmers and downstream actors results in underdeveloped supply chains that deliver lower-quality maize to end users, in particular feed industry. This is closely linked to broader governance challenges, as discussed below.

Key issues affecting integrated farms and maize specialization

Integrated systems can generate multiple benefits by creating synergies between different components of farm systems and supporting the sustainable valuation of natural capital through the provision of ecosystem services (Sekaran et al., 2021). Such systems represent an important lever for agricultural development, particularly in contexts of high food security risks.

In Georgian context, land fragmentation is one of the factors limiting economies of scale and constraining the effective functioning of integrated farming systems, particularly in ensuring a consistent supply of maize for feed. Today, most farms combine maize production with livestock activities, but many still rely on external feed suppliers rather than using farm-produced maize. This is partly due to the availability of cheaper imported maize, which reduces incentives to invest in maize specialization.

It is also worth noting that climate change and environmental stress are becoming increasingly significant constraints for large-scale maize production that is concentrated in Eastern Georgia. Water resources are especially vulnerable, posing risks to future VC activities, as large farms in these drier areas depend heavily on irrigation.

Role of private sector in addressing farmers' constraints

VCA4D field missions allowed us to identify a large share of private sector actors involved in maize VC activities. These private enterprises highlighted key challenges faced by the maize VC and were open and responsive during the interviews. While processors are considered key private actors in the maize VC, traders also play an important role, particularly in importing maize grain from Russia.

However, the role of private sector should be carefully considered and not equated with a dominant position in VC governance. While these actors can drive positive developments (e.g. particularly in areas such as collection and aggregation, storage, logistics and quality standards), the overall governance of the VC should remain balanced and inclusive, ensuring that the interests of farmers are adequately presented.

In addition, private sector can play a valuable complementary role, especially where public extension services are not accessible to all producers. At the same time, it is important to ensure that this engagement supports, rather than substitutes for, public extension systems in the long term.

Governance constraints and coordination

Governance of the maize VC remains weak, as linkages between VC actors and related institutions are limited. In particular, insufficient coordination among farmers, processors and traders represents a key bottleneck to the development of stable supply chains. Farmers also have low bargaining power, partly due to the absence of effective producer organizations.

This lack of coordination, combined with limited support measures, constrains the effective functioning of the maize VC and undermines its competitiveness in terms of both quality and price relative to imports. Strengthening competitiveness will therefore depend, in part, on the ability of both public and private actors, across the food and feed these sub-chains, to address these governance and coordination challenges. Maize is an important commodity for national food security, not only through its direct consumption by humans and livestock, but also through income generation that enables households to access other food products. Therefore, improving the functioning of the VC, including better coordination and targeted initiatives, could enhance the valorization of maize and its co-products and contribute to greater food system resilience.

6.3 The risk analysis

The risk analysis explores how future unfavourable events could negatively affect the situation as observed by the team, looking particularly at their consequences on growth, inclusiveness and sustainability. The risk analysis matrix is presented by Table 6-1.

TABLE 6-1: RISK ANALYSIS MATRIX OF THE MAIZE VC IN GEORGIA (2024)

Risk description	Risk level = probability * intensity of damages				Capacity of actors to manage risks
	Growth	**Inclusiveness**	**Social sustainability**	**Environmental sustainability**	
Erosion of economic viability of small-scale actors and progressive disengagement of maize production: Micro and small-scale farmers have limited capacity to control external shocks. Their disappearance due to lower financial returns may create serious issues. Their decreasing share in total volume of production can be compensated by medium and larger farms; however the role of micro and small-scale farms goes beyond supply, they are also component of territorial resilience and employment. The exposure to risk would make the maize VC more fragile if the production was concentrated on fewer larger-scale farms.					High capacity if policies are shaped around territorial resilience and rural exodus.
Reduced incentives for investment in the maize VC: The risk of relying on continued external supply chains of maize may make the VC more vulnerable to price shocks and crises. Also, depending on imported yellow maize may hinder connections between maize farmers and domestic feed processors. Overall, this situation may be demotivating for investors in the maize VC.					High capacity in case national sectoral strategy focuses on the improving linkages between domestic production and feed processing.
Rising income inequalities within the VC: If the income gap between small-scale and larger-scale farmers widen over time (as indicated by Gini coefficient in our results), the benefits will likely be concentrated among larger-scale actors, marginalising further micro and small-scale farmers.					Weak capacity of actors due to absence of producer organization and lack of collective action to target inclusiveness-based policies.
Lack of strong VC governance: The maize VC is highly dominated by micro and small-scale farmers that are not presented in the VC governance due to absence of producer organization and cooperatives. This situation also hampers the overall functioning of the VC, isolating upstream actors (farmers) from downstream actors (processors and traders) and prevent them from improving marketing and aggregation conditions which affect product quality.					Strong capacity because it may be easily addressed by policy-makers to foster the ability of VC actors to cooperate around the common interests.
Irrigation and Water Constraints: Limited access to irrigation infrastructure: A significant share of maize production depends on rainfed agriculture. Degraded or insufficient irrigation systems constrain productivity and increase vulnerability to climate variability.					Moderate capacity, but highly dependent on public investment in irrigation rehabilitation and water governance reforms.
Climate change impact: Increasing frequency of droughts, irregular rainfall patterns, and extreme weather events (hail, floods) negatively affect maize					Low to moderate capacity, due to limited access to irrigation systems,

yields, particularly in rainfed systems. Eastern Georgia is especially vulnerable due to water scarcity and limited irrigation infrastructure.					climate-resilient seeds, and agricultural insurance mechanisms. Requires strong public investment and climate adaptation strategies.
Low Productivity and Technology Gap: Maize yields in Georgia remain below potential due to limited use of improved seeds, fertilizers, mechanization, and extension services.					Moderate capacity, constrained by limited access to finance, weak extension systems, and fragmented land holdings.
Informality and Weak Market Integration: High level of informality and weak market integration: Many small-scale farmers operate outside formal markets, limiting access to stable buyers, contracts, and price information.					Low capacity without institutional support; requires development of aggregation systems, cooperatives, and market infrastructure.
Land Fragmentation: Small and scattered land plots reduce economies of scale, limit mechanization, and increase production costs.					Low capacity in the short term; requires long-term land consolidation policies and incentives for cooperative farming.
Dependence on Imported Inputs: Dependence on imported agricultural inputs (seeds, fertilizers, fuel): This increases production costs and exposes farmers to exchange rate volatility.					Low to moderate capacity; mitigation depends on input market development and possible local production.

Low	Moderate	High	Extreme

6.4 Summing up benefits and negative impacts

Maize production in Georgia plays an important role in livelihoods of rural populations as well as in culinary traditions. While the humid climatic conditions in Western Georgia enable maize to be produced under rainfed systems, production in Eastern Georgia is characterized by larger-scale, irrigated systems. In terms of agricultural expertise, the country has a strong background in small-scale, traditional maize production.

However, the maize VC currently faces several challenges. Climate change is increasing the frequency of droughts, threatening irrigated systems, while demographic trends -such as an ageing rural population, and relatively low financial returns, high outward migration from rural areas, contribute to the decline of micro and small-scale maize farming. These factors not only weaken the country's capacity to meet food and feed demand, but also increase the risk of continued dependence on external maize supplies.

Maize production also offers opportunities to mitigate some of these challenges, particularly within integrated farming systems. Such systems can enhance soil health, improve nutritional outcomes and reduce risks for farmers compared to monoculture cropping. Georgia's strong background in maize farming provides a basis for developing these systems. By strengthening maize-livestock linkages, maize can contribute to greater farm resilience through improved cost management, better quality production, and enhanced financial returns.

One of the obstacles to expanding maize cultivation in the country is land fragmentation and tenure, which generally slows the pace of investment in the sector, despite the potential of both food and feed sub-chains to generate value for the domestic economy and strengthen food security.

The benefits generated along the maize VC are not distributed equally among actors. Micro and small farms benefit mainly through self-consumption, household food security, and supplementary income, while medium and large-scale farms capture stronger commercial gains through higher productivity and larger marketed volumes. Traders, input suppliers, and mechanization service providers also benefit from economies of scale and stronger market integration.

The sector also demonstrates a clear regional differentiation. Western Georgia remains more associated with white maize, traditional food uses, fragmented landholdings, and subsistence-oriented production systems. Eastern regions increasingly specialize in yellow maize production with larger farm sizes, irrigation potential, and stronger links to feed markets.

Although the maize VC shows resilience through continued domestic production and adaptive informal market channels, it remains vulnerable to weather shocks, rising input costs, international price volatility, exchange-rate movements, and import competition.

Future productivity growth may improve self-sufficiency and farm incomes; however, intensification without safeguards could increase pressure on soils, water resources, and input use. Sustainable growth therefore requires climate-smart production systems, efficient irrigation, crop rotation, and balanced nutrient management.

Many of the negative impacts -such as quality issues, lower yields, price competition with imported maize, limited access to resources, services and information- are closely linked to the absence of effective farmer organizations. Such organizations are important for representing farmers interests and strengthening their capacity to cooperate with both private and public actors in order to reach consensus and improve coordination.

Overall, the maize VC has strategic relevance for Georgia beyond its modest global market position. It contributes to rural livelihoods, livestock development, food traditions. With differentiated policy support, targeted investment, and stronger coordination between public and private actors, the sector could substantially increase its economic, social, and environmental performance over the medium term.

6.5 Recommendations

The VCA4D team worked on a series of recommendations which are derived from the analyses as well as the synthesis (see 7.2). In this section, some of these recommendations that the VCA4D team think more important for policy actions will be presented. Their limits and relevance may be discussed with stakeholders through a multi-stakeholder workshop following the completion of the study.

Before outlining the specific recommendations, it is important to note that, improving domestic productivity and competitiveness remains a central issue for the maize VC in Georgia, in order to reduce structural dependence on imports, particularly for feed maize. This requires targeted investments in irrigation systems in Eastern Georgia, rehabilitation of drainage systems in humid western regions, wider use of certified seed, improved access to mechanization services, and stronger advisory support on modern agronomic practices. Increasing productivity on existing land would help strengthen self-sufficiency while improving farm profitability.

Developing a national strategy for the maize value chain

In the current context, the role of maize and its expected development trajectory within the country's agricultural sector are not explicitly defined in any sectoral policy or strategy. Maize is only implicitly included in Agriculture and Rural Development Strategy (ARDS) 2021–2027 and indirectly addressed through broader support programs or policies. The absence of a maize specific strategy makes it difficult to obtain a clear and updated picture of the sector and to anticipate its future evolution.

However, the development of the maize VC requires a comprehensive approach that accounts for the specificities of both the food and feed sub-chains, while preserving their complementarity within integrated farming systems. Both sub-chains face structural and market challenges that should be addressed at the national level through a dedicated strategy that defines an enabling business environment and fiscal conditions within a maize-specific framework.

Adopting differentiated strategies for white and yellow maize

Public support should recognize that maize in Georgia consists of two partially distinct sub-chains with different economic functions. White maize is strongly linked to household food systems, traditional cuisine, and smallholder livelihoods, particularly in Western Georgia, while yellow maize is more commercially oriented and linked to livestock feed markets, especially in Eastern Georgia. Policy measures should therefore be differentiated, combining cultural-product promotion and quality branding for white maize with competitiveness, scale, and market integration and fair and competitive market access measures, including yellow maize. Improved locally selected seeds may play a crucial role in increasing crop productivity while limiting environmental impacts due to better adaptation. In this regard, MEPA's Scientific-Research Center of Agriculture (SRCA) has developed maize varieties focusing on traits such as nutritional enhancement, climate resilience and resistance to diseases and pests. Nevertheless, due to budget issues, the SRCA has reduced its activities over time. Given the current challenges, such as those posed by climate variability, SRCA activity should be prioritized and further supported. Furthermore, seed produced by SRCA is sold via electronic auctions – carried out by the Ministry of Economy – which regards large quantities excluding small or medium-size farmers from the possibility of buying and testing the seed by themselves.

Undertaking a detailed analysis of imports in the maize value chain

The dependence on imports of intermediate goods and services (IGS) represents a net outflow of foreign exchange for the national economy, while exports generate foreign exchange earnings. The maize VC has a negative impact on the trade balance, as it requires approximately 48 million GEL in imported goods and services annually, while exporting only limited maize products.

This situation has two sides. On the one hand, although imports required for maize-related activities are significant, these VC activities contribute to food security by supporting domestic production, thereby reducing the need for additional food imports. On the other hand, imports of yellow maize are mainly linked to the feed sub-chain, meaning that the food sub-chain is less affected and continues to support white maize as a staple for human consumption.

While a certain level of imports is necessary to sustain VC activities, continued reliance on imports may pose long-term risks. Sourcing imported IGS from diversified markets can help reduce dependency on a single supplier. At the same time, reliance on imported inputs should not discourage investment in domestic industries. The overarching objective should therefore be to reduce unnecessary imports while promoting investment in related sectors (seed, fertilizer, packaging, etc.), thereby increasing VA within the national economy. Achieving this would require a coherent national strategy, in conjunction with the maize-specific strategy outlined above.

Supporting smallholders

Given the dominant role of micro and small farms in maize production, inclusive support measures remain essential. Improved access to finance, machinery-sharing schemes, crop insurance, and farmer training would help smaller producers raise yields and participate more effectively in markets.

Strengthening the value chain institutional framework

Our findings confirm that the VC institutional and organizational structure is fragmented, with weak and largely informal linkages between actors, which also reflects the fragmented structure of farms. The VC is monitored and regulated through the involvement of several institutions (see Section 1.6), however, the absence of maize-specific strategies provides limited incentives for VC actors to strengthen coordination.

Micro and small-scale farmers are dispersed and face structural constraints that affect their productivity. While such issues should ideally be represented through producer groups or cooperatives, these institutions are currently either inactive or lack sufficient resources.

Strengthening these organizations would not only enhance smallholder inclusion in VC governance, but also give voice to medium and large-scale farmers' concerns, thereby helping to build new linkages (vertical integration) or reinforce existing ones between actors across different stages of the VC. For this reason, it is important that, on policy side, a national maize-specific strategy VC be developed to encourage coordination and cooperation among actors and institutions.

Improving post-harvest handling, storage and processing

Investments in post-harvest infrastructure should constitute another strategic priority. Drying facilities, moisture testing systems, storage capacity, and local collection centres would reduce quantitative and qualitative losses while improving market timing for farmers. At the processing level, modernization of small and medium milling enterprises could improve flour quality, packaging standards, food safety compliance, and value addition for domestic white maize products.

Enhancing linkages with the feed industry

Closer integration between maize producers and the livestock feed industry would further strengthen the sector. Long-term contract farming arrangements, may place farmers in a disadvantaged position when bargaining power is uneven and quality standards are strict, creating the risk of product rejection. Therefore, improved coordination mechanisms between producers and buyers remain important. From this perspective, organized marketplaces with structured sorting and quality standards could facilitate transactions and trade, while increasing domestic sourcing of yellow maize by feed mills, poultry farms, and livestock enterprises. Such linkages would reduce transaction costs, improve market certainty for farmers, and partially substitute imports.

Promoting efficient use of resources at farm level

Interventions targeting improved farm-level practices offer the greatest potential for reducing environmental impacts and strengthening the long-term sustainability and resilience of maize production systems, in particular, key areas for intervention should include:

• **Improving fertiliser management and nitrogen use efficiency**, through soil testing, better timing of applications, and improved advisory services, in order to reduce emissions, improve input efficiency, and enhance soil fertility.

• **Enhancing irrigation efficiency and water management**, particularly in eastern Georgia, through improved irrigation technologies, better infrastructure maintenance, and policies encouraging efficient water use.

• **Strengthening soil conservation practices**, including crop rotation, cover cropping, residue retention, contour planting, and reduced tillage, in order to reduce erosion risks and improve soil health.

• **Improving drainage management in waterlogged areas**, particularly in western Georgia, where poor drainage infrastructure limits agricultural productivity and land use efficiency.

Promoting safe handling of agrochemicals

Stronger enforcement of safety standards is needed to increase the use of personal protective equipment when handling agrochemicals. Strengthening awareness and training on safe handling of such materials would represent an important measure to improve environmental and occupational safety in the sector.

Enhancing biodiversity in agricultural landscapes

At the landscape level, maintaining and restoring hedgerows, riparian buffers, and tree belts, together with the promotion of agroforestry practices, would further strengthen biodiversity, reduce erosion, and improve the resilience of agricultural ecosystems.

Improving farm working conditions and supporting women and young farmers

Improving basic working conditions is essential to making maize farming safer and more attractive as a livelihood. Raising farmers' awareness of the importance of adequate working conditions is key to improving worker safety and overall farm performance. Medium- and small-scale young farmers have strong potential to enhance productivity if adequately supported. In addition, many women are actively managing farms, and targeted support measures for both women and young farmers can increase the inclusiveness of the VC while also strengthening the efficiency and productivity of these farms.

Mitigating social risks

Social analysis identified risks that can be mitigated through a set of complementary measures. Priority actions include improving working conditions by promoting formal employment arrangements, enhancing farm infrastructure and occupational health and safety practices, and reinforcing labour inspection. Investments in modern irrigation and drainage systems, together with support for medium-sized farmers, are recommended to address land degradation and improve water management. Modernising the maize VC to increase the availability of locally produced maize will also contribute to strengthening food and nutrition security. Finally, improvements in value chain governance and institutional arrangements, together with investments in rural infrastructure—including farm facilities, access roads and electricity—will strengthen social capital, enhance living conditions, and support the long-term social sustainability of the VC.

Strengthening value chain data and information

Although some information is available, the VC more broadly, suffers from a lack of up-to-date data and statistical coverage. In this VCA4D study, we had to model VC mapping using 2014 Agricultural Census data, based on a set of assumptions. It is therefore essential to produce more recent data and to focus on specific segments or population groups in order to analyze their evolution over time (e.g. micro and small-scale farmers, artisanal village millers, imported maize traders, etc.). The VC is complex in the sense that it involves a large number of small and geographically dispersed actors. To address this complexity, it is also important to make use of territorial data in order to better capture regional specificities of the maize VC, from production to trade. This would improve understanding of the flows and price dynamics that shape VC performance.

In summary, stronger sector governance and data systems are needed to guide evidence-based policy making. Updating agricultural census information, improving statistical distinction between white and yellow maize systems (grain and silage), and strengthening dialogue between MEPA, Rural Development Agency, private agribusiness actors, and producer organizations would significantly improve strategic planning. With coherent and differentiated support measures, the maize VC could substantially increase its contribution to rural incomes, food security, and sustainable agricultural development in Georgia.

6.6 Conclusion and scenarios

This VCA4D study shows that the maize VC is an important component of Georgia's agriculture and national economy and plays a key role in national food security. It has significant macroeconomic implications, yet it can't escape the negative trade balance faced by the country. This raises the issue of import dependency, alongside productivity challenges that are partly linked to structural factors.

In the current context, the VC provides income-generating activities for many actors, in particular smallholders. Farmers are the main contributors to value added generation. However, there is a room to improve this situation by making the VC more inclusive and narrowing the gap in per capita earnings between different farm scales.

The analysis also underlines the dual structure of the maize VC. White maize remains strongly linked to household consumption, traditional cuisine, and smallholder livelihoods, particularly in Western Georgia, while yellow maize is increasingly associated with commercial production systems and livestock feed markets in Eastern regions. Future policy measures should therefore differentiate between these two sub-chains rather than treating maize as a homogeneous commodity.

Environmental sustainability will also be decisive for the future of the VC. Climate variability, water management constraints, soil degradation risks, and inefficient input use may limit future growth if not adequately addressed. Productivity improvements should therefore be aligned with climate-smart farming practices, efficient irrigation, crop rotation, and balanced nutrient management.

Therefore, the VC should be considered at the national level through a comprehensive strategy that enables further analyses under alternative scenarios. To help policymakers more concretely visualise study findings under possible development pathways, we propose two scenarios illustrated in Table 6-2. In both cases, efforts are required from all VC actors and public institutions to reach a consensus on priorities according to territorial and national interests. This again highlights governance as a fundamental component regardless of the scenario chosen.

Finally, the VCA4D team recommends further investigations on: maize VC export and import operations and flows, competitiveness of domestic maize relative to imports, income diversification strategies among micro and small-scale farms, regional productivity gaps, post-harvest losses and storage systems, contractual arrangements with feed industries and linkages with livestock VCs, and environmental performance of alternative production systems, in order to gain a better understanding of its functioning and potential evolution.

TABLE 6-2: DEVELOPMENT SCENARIOS

	Scenario 1	Scenario 2
Development focus	Productivity and competitiveness	Inclusiveness and resilience
Target sub-chains	Feed sub-chain	All VC (both the food and feed sub-chains)
Target actors	Medium and large-scale farmers	All farmers, with a specific attention to smallholders
Main maize orientation	Primarily yellow maize production linked to feed markets	White and yellow maize production across both food and feed sub-chains
Objective	To support productivity among medium and large-scale farmers through land expansion, enabling Georgian maize to compete with imports and ensuring a more stable supply of maize for the feed industry	To encourage integration of maize and livestock production at all scales, ensuring the full valorisation of maize products and co-products
Necessary conditions	Existence of strong linkages between farmers and feed companies and processors	Existence of strong producer organization and cooperatives alongside accessible extension services
Target market	Domestic market + export market	Domestic market
Areas requiring domestic investment	Mechanization, improved seed, irrigation, large-scale storage, logistics	Machinery services, storage, drying and processing facilities
VA and employment	Medium and large-scale farms and feed processing industries	Processing industries in both sub-chains
Balance of trade	Improvement due to increased exports and domestically supplied IGS	Improvement due to gradual reduction of imported IGS
Food security	Improvement due to domestic livestock industries supported by maize production	Improvement due to consumption of better quality of maize products through better storage and processing
Other expected outcomes	Increase in national production through improved yield levels Strengthened competitiveness with imported maize Stronger linkages between farmers and feed industries through consistent supply	Productivity and quality gain in medium and small-scale farms Stability of rural income Resilience of maize VC through diversified production systems
Implementation timeframe	Medium-term gains (3–5 years)	Gradual but longer-term gains (5+ years)
Public policy requirement	Large-scale infrastructure investment, irrigation expansion, mechanization support, and stronger market linkages	Strong extension systems, cooperative development, local processing support, and coordinated policies
Risks	Exclusion of micro and small-scale farmers Deepened territorial inequalities Concentration of production on only large-scale actors	Slower pace of yield improvement
Main governance challenge	Ensuring fair participation of smallholders and avoiding excessive concentration of benefits	Coordinating multiple actors and institutions across regions and VC segments

7. References

Buono da Silva Baptista, V., Córcoles, J. I., Colombo, A., & Moreno, M. Á. (2019). Feasibility of the use of variable speed drives in center pivot systems installed in plots with variable topography. *Water*, *11*(10), 2192. https://www.mdpi.com/2073-4441/11/10/2192

Ducourtieux O. Dynamiques agraires et développement de l'agriculture irriguée en Géorgie. Note de synthese provisoire pour AFD et AgroParis Tech, 2022.

European Environment Agency (2017). Emission Factor Database (EMEP/EEA), available at http://efdb.apps.eea.europa.eu/

ISO 14040:2006, Environmental management – Life cycle assessment – Principles and framework. https://www.iso.org/standard/37456.html

ISO 14044:2006, Environmental management – Life cycle assessment – Requirements and guideline. https://www.iso.org/standard/38498.html

IPCC (2006). IPCC Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds). Published: IGES, Japan. https://www.ipcc-nggip.iges.or.jp/support/Primer_2006GLs.pdf

Kaczmarek-Khubnaia J. Agriculture in Georgia − the condition of the sector and its importance in the process of socio-economic development of the country and its regions. Journal of Geography, Politics and Society. 10(2), 35–44. 2020
https://doi.org/10.26881/jpgs.2020.2.05

Kim, S., Dale, B. E., & Jenkins, R. (2009). Life cycle assessment of corn grain and corn stover in the United States. *The International Journal of Life Cycle Assessment*, *14*(2), 160-174. https://link.springer.com/article/10.1007/s11367-008-0054-4

Koghuashvili P., Chechelashvili M. Georgia's food security: reality and challenges. Norwegian Journal of development of the International Science No 125. 2024

Ma, B.L., Liang, B.C., Biswas, D.K. *et al.* The carbon footprint of maize production as affected by nitrogen fertilizer and maize-legume rotations. Nutr Cycl Agroecosyst 94, 15–31 (2012). https://doi.org/10.1007/s10705-012-9522-0

Nemecek, T., Kägi, T., & Blaser, S. (2007). Life cycle inventories of agricultural production systems. *Final report ecoinvent v2. 0 No*, *15*. https://www.researchgate.net/profile/Thomas_Nemecek2/publication/284329314_Life_cycle_inventories_of_agricultural_production_systems/links/5d95c28c458515c1d38f3551/Life-cycle-inventories-of-agricultural-production-systems.pdf

Supasri, T., Itsubo, N., Gheewala, S.H. et al (2020). Life cycle assessment of maize cultivation and biomass utilization in northern Thailand. Sci Rep 10, 3516 . https://doi.org/10.1038/s41598-020-60532-2

Wang, Z. B., Wen, X. Y., Zhang, H. L., Lu, X. H., & Chen, F. (2015). Net energy yield and carbon footprint of summer corn under different N fertilizer rates in the North China Plain. *Journal of Integrative Agriculture*, *14*(8), 1534-1541. https://www.sciencedirect.com/science/article/pii/S2095311915610425

Wettstein, S., Muir, K., Scharfy, D., & Stucki, M. (2017). The environmental mitigation potential of photovoltaic-powered irrigation in the production of South African maize. *Sustainability*, *9*(10), 1772. https://www.mdpi.com/2071-1050/9/10/1772

Zhang D., Shen J., Zhang F. et al. (2017). Carbon footprint of grain production in China. *Scientific Reports* 7, 4126.
https://doi.org/10.1038/s41598-017-04182-x

Zhang, G., Wang, X., Zhang, L., Xiong, K., Zheng, C., Lu, F., ... & Ouyang, Z. (2018). Carbon and water footprints of major cereal crops production in China. *Journal of Cleaner Production*, *194*, 613-623. https://www.sciencedirect.com/science/article/abs/pii/S0959652618313519

Food and Agriculture Organization of the United Nations (FAO). (2023). The state of food security and nutrition in the world 2023. Rome: FAO.

Food and Agriculture Organization of the United Nations (FAO). (2025). National gender profile of agriculture and rural livelihoods: Georgia. Budapest: FAO.

Food and Agriculture Organization of the United Nations (FAO). (2023/2024). Georgia: Land consolidation and country resources. Rome: FAO.

National Statistics Office of Georgia (GEOSTAT). (2024). Women and men in Georgia 2024. Tbilisi: GEOSTAT.

National Statistics Office of Georgia (GEOSTAT). (2024). Labour force statistics 2024. Tbilisi: GEOSTAT.

National Statistics Office of Georgia (GEOSTAT). (2025). Income, poverty and living conditions indicators. Tbilisi: GEOSTAT.

World Bank. (2023). Georgia poverty and equity assessment. Washington, DC: World Bank.

World Bank. (2024). Georgia country economic memorandum. Washington, DC: World Bank.

Pignatti, N. (2026). Informality and labour market dynamics in Georgia.

8. Appendix

8.1 First mission agenda (14th – 25th July 2025)

Tbilisi

15.07.2025

Time	Description	Location
10:00 – 12:00	Finexcoop	Online
15:00 – 17:00	Meeting with ProAgro - irrigation company	Online
17:00 – 19:00	Meeting with Gastronomy association	Online

16.07.2025

Time	Description	Location	Activity
10:00 – 12:00	Capacity strengthening activities	GFA's Office	Training on methodology
12:00 – 14:00	Meeting with TBC Bank	GFA's Office	
15:00 – 17:00	UNDP/GECSA	GFA's Office	
17:00 – 19:00	Meeting with SRCA (Scientific-research center)	Online	

East Georgia (Kakheti)
17.07.2025

Time	Description	Location	Activity
09:00 – 11:00	Visit at farm	Sartichala	Large beef farmer, largest maize producer in Georgia
11:00 – 13:00	Visit at farm	Sartichala	Large maize producer with sub - surface irrigation system
15:30 – 17:30	Visit at farm	Sagarejo	Poultry farm and maize producer

18.07.2025

Time	Description	Location	Activity
09:00 – 11:00	Visit at farm	Dedoplistskaro	Medium Dairy and Beef Farmer, maize producer
11:00 – 13:00	Visit at farm	Dedoplistskaro	Large Dairy Farmer, Maize producer Farmer
13:00 – 14:00	Visit at farm	Dedoplistskaro	Combined feed producer company
16:00 – 18:00	Visit at farm	Lagodekhi	Large Maize producer, dairy farmer

19.07.2025

Time	Description	Location	Activity
11:00 – 13:00	Visit at farm	Akhmeta	Medium Dairy Farmer, Silage producer
17:00 – 19:00	Visit at farm	Ujarma	Small maize producer farmer

East Georgia (Kvemo Kartli)
21.07.2025

Time	Description	Location	Activity
10:00 – 12:00	Visit to the company, input supplier (seed, machinery, chemicals)	Marneuli	Agrosphero
12:00 – 14:00	Visit at company producing maize seed	Marneuli	Lomtagora
15:00 – 16:30	Visit at farm	Marneuli	Maize producer
17:00– 19:00	Visit at company	Ponichala	Nutrimax, feed producer company

West Georgia (22 – 24 July)
22.07.2025

Time	**Description**	**Location**	**Activity**
14:30 – 16:30	Visit at farm	Natanebi, Ozurgeti	Large dairy farmer, maize producer
16:30 – 18:30	Visit at farm	Natanebi, Ozurgeti	Large dairy farmer, maize producer

23.07.2025

Time	**Description**	**Location**	**Activity**
10:00 – 12:00	Visit	Samtredia	Maize Farmer, Equipment provider
14:00 – 16:00	Visit at mill	Samtredia	Miller
16:30 – 18:00	Visit	Abasha	Maize Farmer, Equipment provider

24.07.2025

Time	**Description**	**Location**	**Activity**
11:00 – 12:00		Nabakhtevi, Khashuri	Bio Farmer -seeds producer
12:00 – 14:00	Visit at farm	Kareli	Dairy farmer, maize producer as silage
15:00 – 17:00		Gori	Storage Facilities

25.07.2025

Time	Description	Location
14:00 – 15:00	Meeting with representative of FAO - Climate Change and Environment Protection Programme	FAO

8.2 Second mission agenda (20 October – 7 November 2025)

Tbilisi
20.10.2025

Time	Description	Location	Name, Surname
10:30 – 17:00	Team Meeting at GFA Office	(64 Egnate Ninoshvili street) - https://maps.app.goo.gl/Mu9UoDJG1h69sK5f8	Rati Kochlamazashvili Natia Gelashvili Frédéric LANCON

21.10.2025

Time	Description	Location
10:30- 13:00	Meeting at GFA	
14:00 – 16:00	Meeting with RDA	RDA Office

22.10.2025

Time	Description	Location
11:00 – 13:00	Meeting with Maize producer Farmer	Kareli
14:00 – 15:00	Meeting with Maize producer and livestock Farmer	Kareli
16:00 – 17:00	Meeting with Miller	

23.10.2025
11:00 – 12:00 - Meeting with MEPA - Department of Agriculture and Rural Development Policy at GFA
Workshop Preparation – Full-Day Team Meeting.

27.10.2025

Time	Description	Location
09:00 – 10:00	Meeting with Miller	Patardzeuli
12:00 – 14:00	Meeting with white maize Miller Hereti	Lagodekhi - Vardisubani
15:00 – 17:00	Meeting with Small Scale Miller	Vardisubani

28.10.2025

Time	Description	Location
10:00 – 12:00	Meeting with miller and farmer	Koda, Tetritskaro
16:00 – 18:00	Meeting with small scale farmers	GFA's office in Kutaisi

29.10.2025

Time	Description	Location
11:00 – 13:00	Meeting with small scale miller and small-scale farmers	Patara Jikhaishi
15:00 – 18:00	Meeting with industrial Miller Odoia	Abasha

30.10.2025

Time	Description	Location
11:00 – 12:00	Meeting with mechanization service provider and farmer	Lanchkhuti
12:00 – 13:00	Meeting with small scale maize farmer	Lanchkhuti
13:00 – 14:00	Meeting with small scale maize farmer	Lanchkhuti
15:30 – 16:00	Meeting with representative of Monastery	Village Juanve
16:30 – 18:00	Meeting with medium scale farmer and mechanization service provider	Village Gulieikari, Abasha

31.10.2025

Time	Description	Location
11:00 – 12:00	Meeting with medium size farmer	Senaki, village Teklati
12:30 – 13:30	Meeting with small scale Euro Miller	Senaki

03.11.2025

Time	Description		Location
12:00 – 13:00	Meeting with Biological Farming Association Elkana		GFA's Office
14:00 – 16:20	Meeting with Maize Producers Association and Agro Inputs Provider		GFA's Office

04.11.2025

Time	Description	Location
12:30 – 15:00	Meeting with Two Farmers	GFA's Regional Office in Akhaltsikhe
16:00 – 18:00	Meeting with Farmer	

05.11.2025

Time	Description	Location
11:00 – 12:00	Meeting with small scale miller and small-scale farmer	Agara
14:30 – 17:00	Meeting with Scientific Research Centre (Genetic Bank, Storage and field)	Tsilkani

06.11.2025

Time	Description	Location
10:30 – 11:30	Phone Call with Maize Farmer	GFA's Office
11:30 – 12:30	Phone Call with Maize Farmer and Mechanization Provider	GFA's Office
12:30 – 13:15	Phone Call with Monastery	GFA's Office
14:00 – 15:00	Meeting with MEPA	GFA's Office

07.11.2025

Time	Description	Location
11:00 – 12:00	Meeting with Farmer used minimal tillage for maize	Tamariani, Lagodekhi
12:00 – 13:00	Meeting with maize farmer	Bolokiani, Lagodekhi
13:00 – 14:00	Meeting with maize Farmer	Chaduniani, Lagodekhi

9. Appendix

9.1 Appendix to Environmental analyses (LCA)

Appendix 9.1 - 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. 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 9.2: Midpoint impact categories for production and transport of feed grain (weighted average)

Impact category	Unit	Total	1-cultivation	2-transport of grain
Global warming	kg CO2 eq	0.3793	0.3771	0.0021
Stratospheric ozone depletion	kg CFC11 eq	8.56E-06	8.56E-06	5.98E-10
Ionizing radiation	kBq Co-60 eq	1.91E-03	1.91E-03	2.59E-06
Ozone formation, Human health	kg NOx eq	7.01E-04	6.75E-04	2.62E-05
Fine particulate matter formation	kg PM2.5 eq	4.23E-04	4.20E-04	3.18E-06
Ozone formation, Terrestrial ecosystems	kg NOx eq	7.10E-04	6.83E-04	2.63E-05
Terrestrial acidification	kg SO2 eq	2.64E-03	2.63E-03	1.04E-05
Freshwater eutrophication	kg P eq	9.35E-04	9.35E-04	1.47E-09
Marine eutrophication	kg N eq	8.36E-06	8.36E-06	6.29E-09
Terrestrial ecotoxicity	kg 1,4-DCB	4.65E-02	4.17E-02	4.86E-03
Freshwater ecotoxicity	kg 1,4-DCB	6.48E-04	6.46E-04	2.29E-06
Marine ecotoxicity	kg 1,4-DCB	2.67E-04	2.60E-04	6.79E-06
Human carcinogenic toxicity	kg 1,4-DCB	4.03E-04	3.98E-04	4.79E-06
Human non-carcinogenic toxicity	kg 1,4-DCB	4.78E-03	4.61E-03	1.69E-04
Land use	m2a crop eq	2.3426	2.3426	0
Mineral resource scarcity	kg Cu eq	5.27E-04	5.27E-04	6.88E-08
Fossil resource scarcity	kg oil eq	5.63E-02	5.56E-02	6.92E-04
Water consumption	m3	2.39E-03	2.39E-03	1.91E-07

9.1.1 Life cycle Inventory

APPENDIX 9-3 LIFE CYCLE INVENTORY (CULTIVATION)

		MIC	S	M	L	L-irrigated	Silage	Silage-irrigated
Inputs/ha	Unit							
Land occupation	m2	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Seed	kg	9	9	25	25	25	35	35
Grain used as seed (white maize)	kg	11	11					
AN (ammonium nitrate)	kg	100	100	200	300	300	250	250
UREA	kg	0	50	0	0	0	0	0
NPK (8-24-24)	kg	100	100	200	250	250	100	100
Manure	t	0	0	0	5	5	25	25
Diesel, mechanical operations	L	80	80	100	100	100	120	120
Herbicide	L	1	1	1	2	2	2	2
Water (well or surface water), dilution	L	200	200	200	400	400	400	400
Water (well or surface water), irrigation	m3					3,500		4,500
Outpus/ha	Unit							
Grain	t	2.4	2.7	4.5	7.2	7.2		
Silage	t						35	35

9.1.1.1 *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[33]. 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 reaches the river, according to the equation by Nemecek and Kagi (2007). The quantity of soil eroded was assumed to be 10 t/ha/year. 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 9-1 Life Cycle Inventory (transport to mill). Unit: 1 kg of transported grain

input/output	material	unit	amount	description
INPUT	transport of grains to local mill	kg.km	10	assuming 10 km from farm to mill

Appendix 9-2 Life Cycle Inventory (TRANSPORT), Transport of feed grain to End user. Unit: 1 kg of transported grain

[33] 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 $N\text{-}N_2O$ to kg of N_2O.

input/output	material	unit	amount	description
INPUT	transport of feed grains to end user	kg.km	10	assuming 10 km from farm to end user

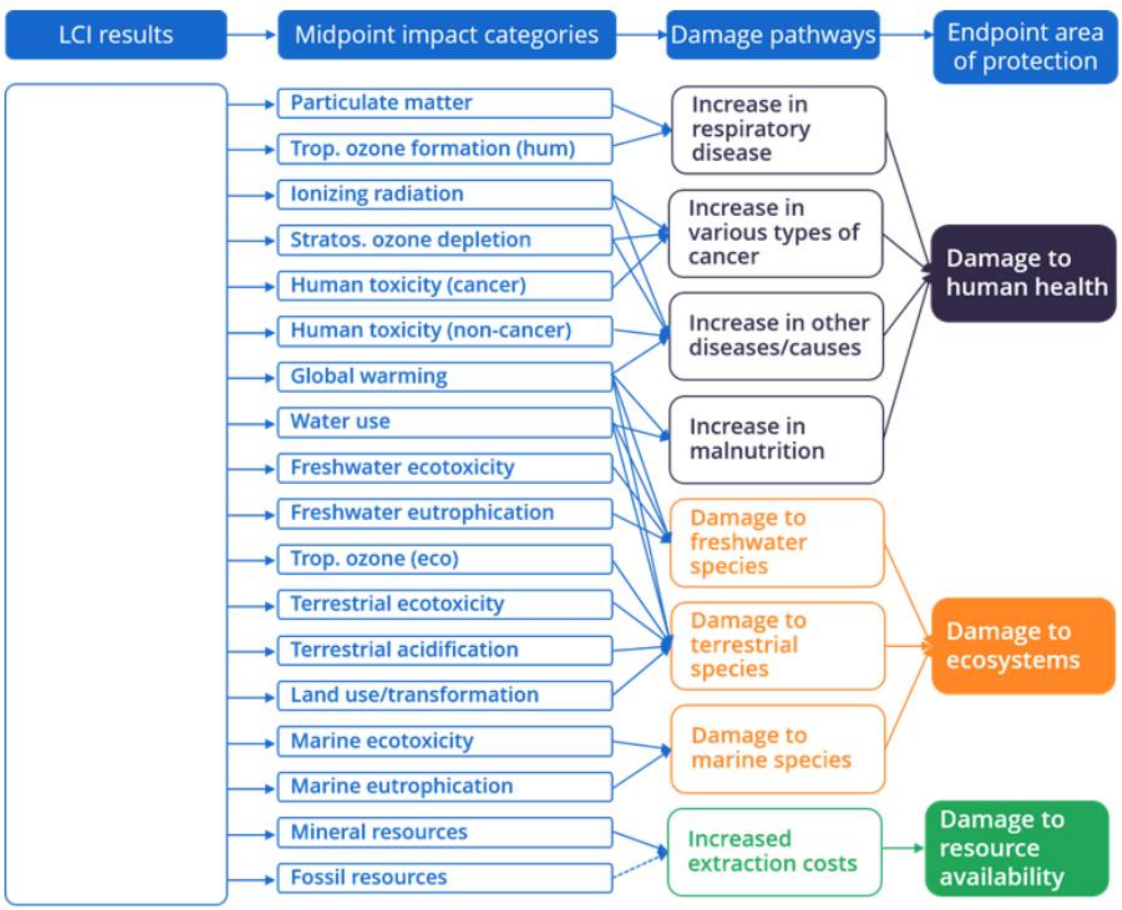
Appendix 9-6 Life Cycle Inventory (TRANSPORT), Transport of Flour to Market. Unit: 1 kg of transported grain

input/output	material	unit	amount	description
INPUT	transport of flour to market	kg.km	10	assuming 10 km mill to market

Appendix 9-3 Life Cycle Inventory (MILLING), Functional Unit: 1 kg of maize flour at mill gate

inputs	**value**	**unit**	**comment**
maize grain, uncleaned	1.13	t	2% screenings, spills, milling losses
Electricity from national grid, low voltage	100	kWh	kWh/t flour
outputs	**value**	**unit**	**comment**
maize flour	1.00	t	90% flour, human consumption
maize bran	0.11	t	10% bran, given to livestock
screenings, spills, milling losses	0.02	t	given to livestock

Source: field surveys

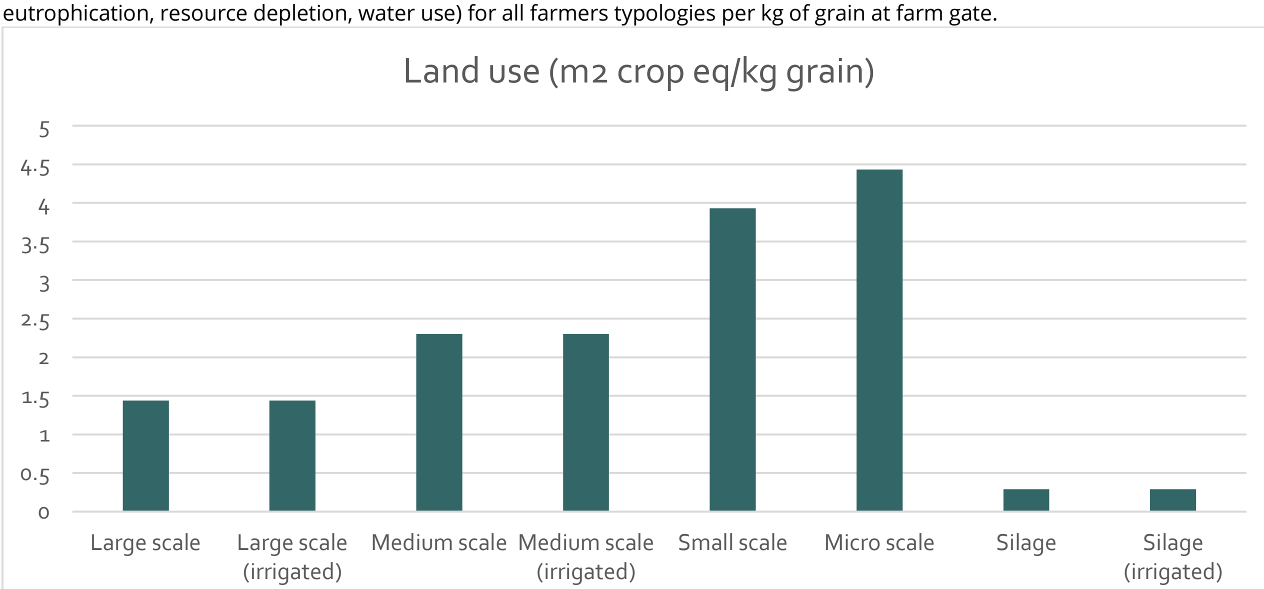


Appendix 9-4 Relationship between Life Cycle Inventory-LCI parameters (left), midpoint indicator (middle) and endpoint indicator (right) in the ReCiPe 2016 method of life cycle impact assessment.

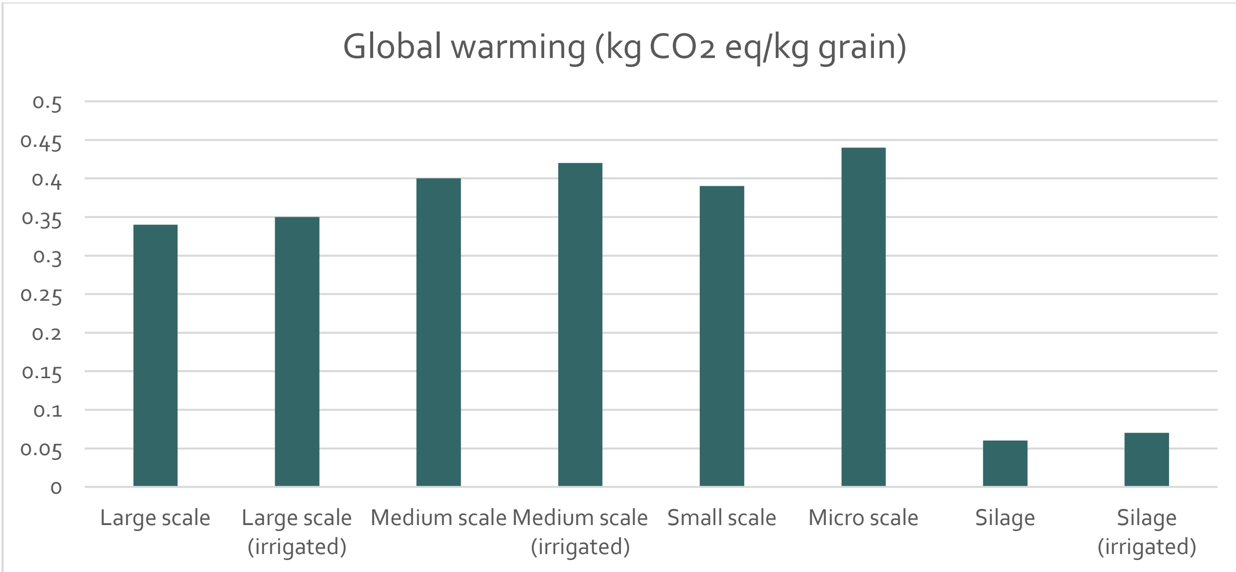
APPENDIX 9-5 MIDPOINT IMPACT RESULTS PER KG OF OUTPUT AT FARM GATE

Impact category	Unit	Large scale	Large scale (irrigated)	Medium scale	Medium scale (irrigated)	Small scale	Micro scale	Silage	Silage (irrigated)
Global warming	kg CO2 eq	0.34	0.35	0.40	0.42	0.39	0.44	0.06	0.07
Stratospheric ozone depletion	kg CFC11 eq	8.16E-06	8.17E-06	9.03E-06	9.03E-06	8.05E-06	8.89E-06	1.36E-06	1.37E-06
Ionizing radiation	kBq Co-60 eq	1.53E-03	1.60E-03	2.24E-03	2.40E-03	2.08E-03	2.34E-03	3.22E-04	3.40E-04
Ozone formation, Human health	kg NOx eq	4.72E-04	4.97E-04	7.33E-04	7.53E-04	9.24E-04	1.04E-03	1.11E-04	1.17E-04
Fine particulate matter formation	kg PM2.5 eq	3.69E-04	3.81E-04	4.57E-04	4.67E-04	4.37E-04	4.92E-04	7.72E-05	8.03E-05
Ozone formation,Terrestrial ecosys.	kg NOx eq	4.78E-04	5.06E-04	7.42E-04	7.64E-04	9.35E-04	1.05E-03	1.12E-04	1.19E-04
Terrestrial acidification	kg SO2 eq	2.42E-03	2.46E-03	2.82E-03	2.85E-03	2.53E-03	2.85E-03	4.95E-04	5.04E-04
Freshwater eutrophication	kg P eq	7.09E-04	7.12E-04	9.80E-04	9.82E-04	1.17E-03	1.32E-03	1.43E-04	1.44E-04
Marine eutrophication	kg N eq	2.13E-05	2.14E-05	3.40E-05	3.41E-05	1.05E-06	1.18E-06	4.29E-06	4.33E-06
Terrestrial ecotoxicity	kg 1,4-DCB	3.39E-02	8.46E-02	5.24E-02	9.29E-02	5.56E-02	6.26E-02	7.10E-03	2.02E-02
Freshwater ecotoxicity	kg 1,4-DCB	3.95E-04	3.92E-03	6.31E-04	3.45E-03	4.67E-04	5.26E-04	7.97E-05	9.94E-04
Marine ecotoxicity	kg 1,4-DCB	3.32E-04	4.68E-03	5.25E-04	4.00E-03	1.25E-04	1.41E-04	6.85E-05	1.19E-03
Human carcinogenic toxicity	kg 1,4-DCB	9.26E-04	3.27E-03	1.47E-03	3.35E-03	8.18E-05	9.21E-05	1.88E-04	7.95E-04
Human non-carcinogenic toxicity	kg 1,4-DCB	8.60E-03	4.16E-02	1.36E-02	4.00E-02	2.16E-03	2.43E-03	1.75E-03	1.03E-02
Land use	m2a crop eq	1.44	1.44	2.3	2.30	3.93	4.43	0.29	0.29
Mineral resource scarcity	kg Cu eq	4.60E-04	5.69E-04	6.03E-04	6.91E-04	5.13E-04	5.78E-04	9.38E-05	1.22E-04
Fossil resource scarcity	kg oil eq	4.50E-02	5.10E-02	6.05E-02	6.53E-02	6.37E-02	7.17E-02	9.72E-03	1.13E-02
Water consumption	m3	1.36E-04	0.50	2.03E-04	0.40	1.80E-04	2.02E-04	2.93E-05	0.13

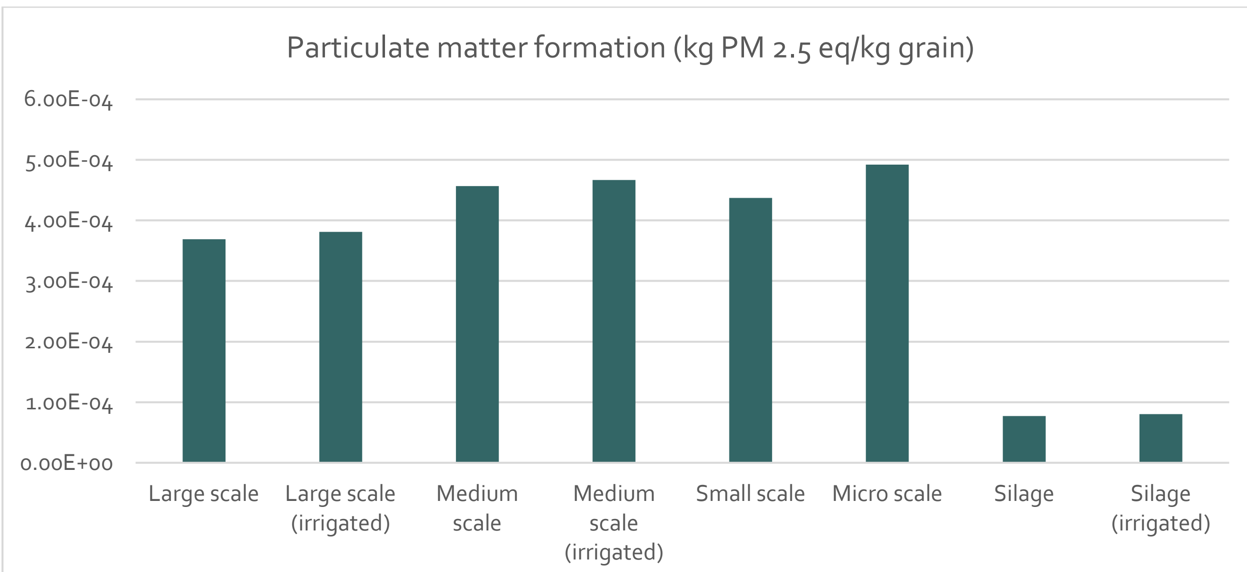
Selected Midpoint results per kg of grain at farm gate (Land use, Global warming, Fine particulate matter, Freshwater eutrophication, resource depletion, water use) for all farmers typologies per kg of grain at farm gate.



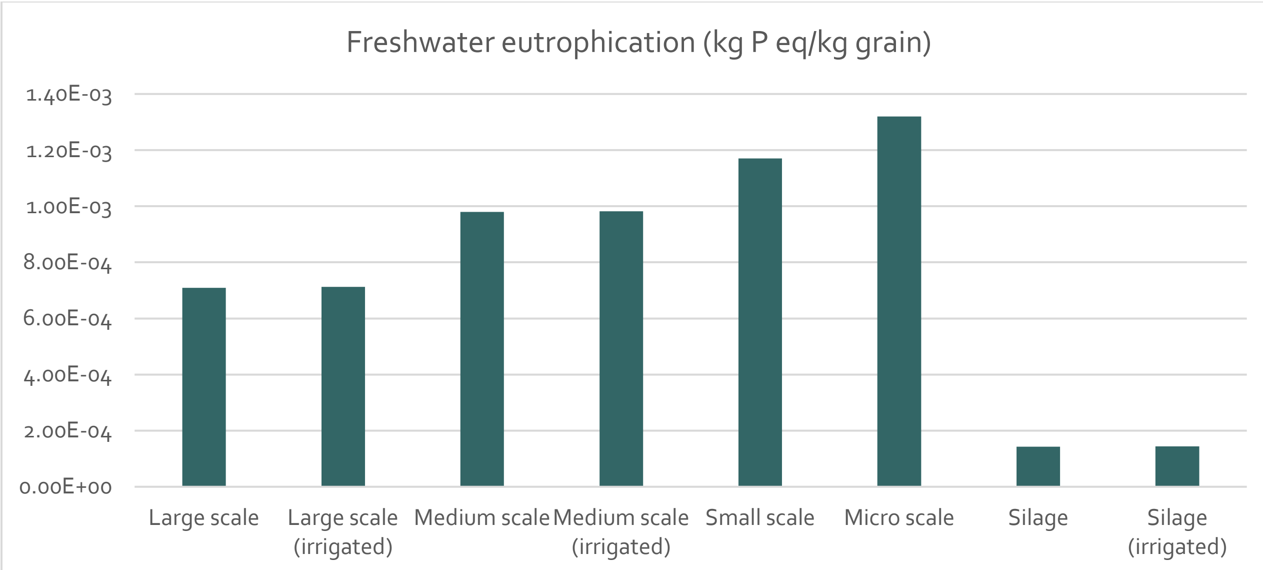
APPENDIX 9-6 LAND USE (M2 CROP/KG GRAIN AT FARM GATE)



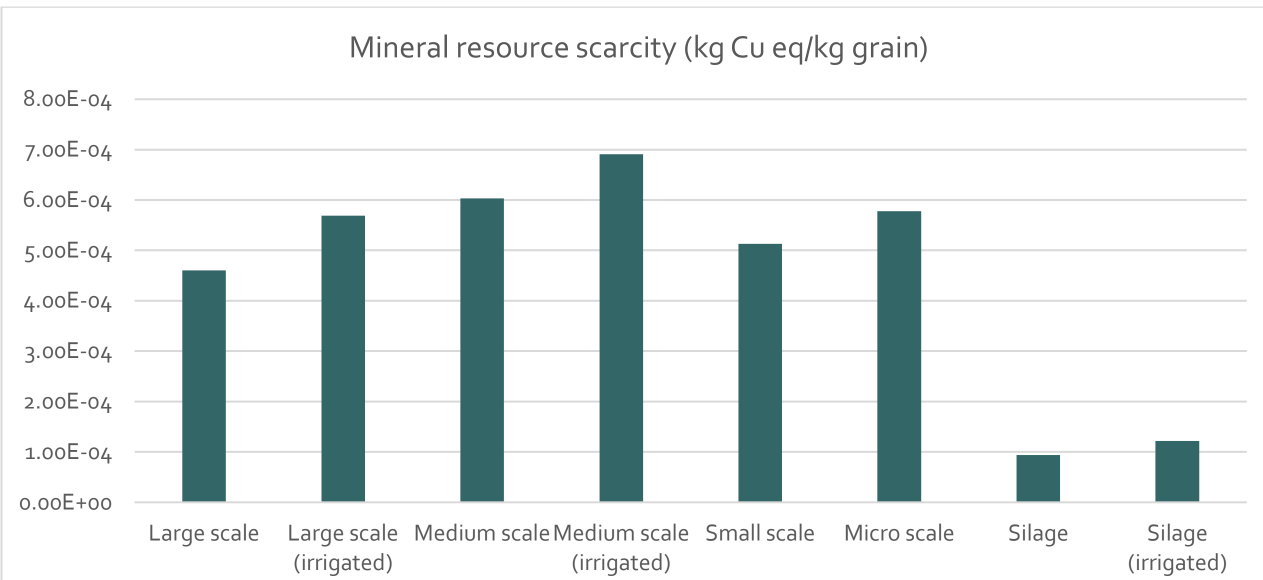
Appendix 9-7 Global warming (kg CO_2eq/kg grain at farm gate)



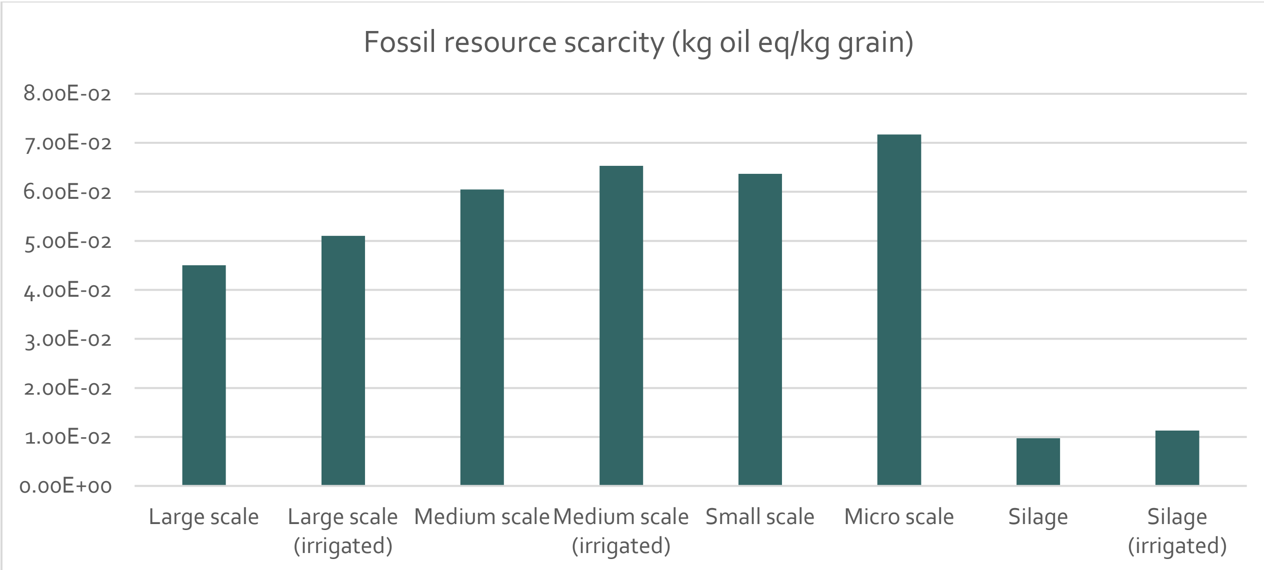
Appendix 9-8 Fine particulate matter formation (kg PM2.5eq/kg grain at farm gate)



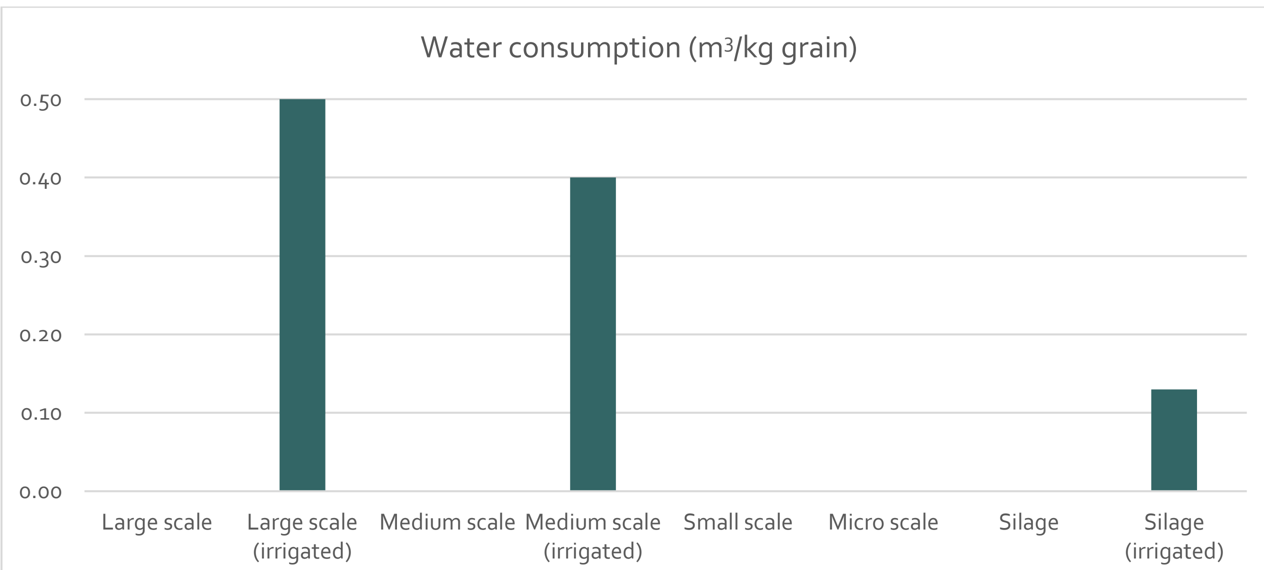
APPENDIX 9-9 FRESHWATER EUTROPHICATION (KG PEQ/KG GRAIN AT FARM GATE)



APPENDIX 9-10 MINERAL RESOURCES SCARCITY (KG CU EQ/KG GRAIN AT FARM GATE)



APPENDIX 9-11 FOSSIL RESOURCES SCARCITY (KG OIL EQ/KG GRAIN AT FARM GATE)



APPENDIX 9-16 WATER CONSUMPTION (M^3/KG GRAIN AT FARM GATE)