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[VCA4D]
VALUE CHAIN ANALYSIS FOR DEVELOPMENT

Freshwater aquaculture value chain analysis in Georgia

Value chain analyses assist in informing policy dialogue and investment operations. They help the understanding of how agricultural development fits within market dynamics. They permit an assessment of the value chains' impact on smallholders, businesses, society and environment.

The European Commission has developed a standardised methodological framework for analysis (https://europa.eu/capacity4dev/value-chain-analysis-for-development-vca4d-/wiki/1-vca4d-methodology). It aims to understand to what extent the value chain allows for inclusive growth and whether it is both socially and environmentally sustainable.

The value chain context

The development of freshwater aquaculture in Georgia dates to the beginning of the 20th century under the Soviet Union. Inland fisheries and aquaculture (mainly Cyprinidae) were well developed and benefited from the state support, which was interrupted with the collapse of the Soviet Union. The subsequent economic instability, negatively affected fish production, but in recent years the production is revamping.

Being very rich in water resources and fish species, aquaculture represents an opportunity for the Georgian economy, as only 30-40% of the potential of existing ponds and basins is utilised. Georgian aquaculture is mainly composed of carp, catfish, rainbow trout and sturgeon farming and the production was estimated at 5,000 tons in 2019. The country relies on fish imports to meet its domestic demand (with aquaculture still representing a small portion of annual catches), although the consumption level is quite low.

The European Union intervention

Through the European Neighbourhood Programme for Agriculture and Rural Development (ENPARD), the European Union (EU) has supported the implementation of the agricultural and rural strategy of Georgia since 2012. Phase 4 of ENPARD provides €55 million for the implementation of the new Agriculture and Rural Development Strategy (2021-2027), focusing on food safety and rural development.

The EU is also supporting Georgia's rural reforms and development strategy via the 2014 EU/Georgia Association Agreement, which includes a Deep and Comprehensive Free Trade Area (DCFTA). In force since 2016, this agreement focuses on quality production, EU food safety standards and promotion of export of Georgian products to the EU.

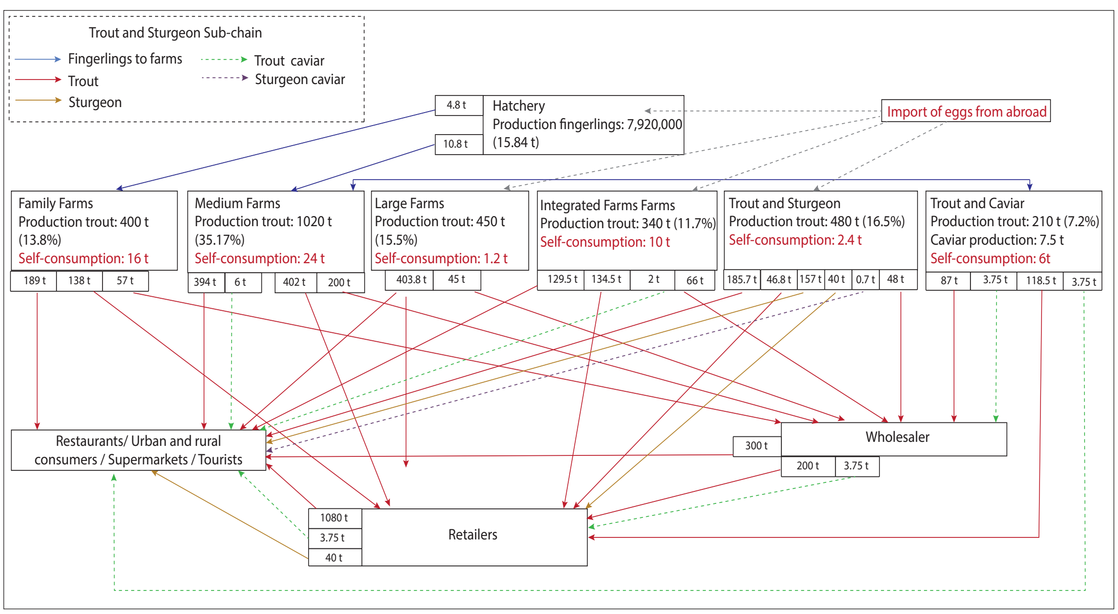

Figure 1: Flowchart of the trout sub-chain in Georgia, one type of farm also producing sturgeon

Functional analysis

Sub-chains and typology of fish farms

The production of 5,000 tons of fish from aquaculture in 2019 is composed by **trout (55%)**, **carp** and **catfish (41%)** and **sturgeon (4%)**. The freshwater aquaculture value chain (VC) in Georgia consists of two main sub-chains based on different production systems: i) the **trout and sturgeon sub-chain**, in recently established **basin/pool systems which use imported feed**, (Figure 1), ii) the **carp and catfish sub-chain (hereafter called trout sub-chain)** in historically old **pond systems with the use of local grains as feed** (Figure 2).

For the **trout sub-chain**, 6 types of farms are identified based on size, level of integration and product (Figure 3). The majority of the farms produce trout. Sturgeon is produced in some large trout farms, in specific separate pools. These farms also produce sturgeon caviar, marketed mainly in luxury hotels. Some trout farms also make trout caviar. The trout sub-chain is highly dependent on **imported compound feed**. The access to imported feed is an issue due to an unfavourable exchange rate since 2018. Moreover, most of the farmers do not have storage facilities and must buy feed every month. Inadequate storage conditions also affect the feed quality, and therefore the feed conversion rates.

For the **carp sub-chain**, 4 types of farms are identified (Figure 3). Family farms (using family labour) and extensive farms (hiring permanent and seasonal workers) do not integrate the fingerling production unlike the medium and large integrated farms. Medium integrated farms use fingerlings for their needs only, while the large integrated ones sell part of the fingerlings to the family and extensive farms. The carp sub-chain uses locally cultivated grains as feed.

Fish marketing and export

Freshwater aquaculture products are mainly absorbed by local markets. Trout and sturgeon are either sold as live fish directly to consumers or marketed through wholesalers and retailers. Some farms also provide restaurant services and sell trout per unit. The caviar is sold to luxury hotels and casinos or to tourists.

For the carp sub-chain, a small part of the production is self-consumed by the farmers (2%) and another part is sold directly at the farm (2%). The majority of fish is sold through wholesalers and retailers.

Fresh, chilled and frozen trout are the main export products (mainly to Azerbaijan and Armenia). Export of carp and caviar represents less than 1% of the total fishery export. The VC does not enable regular export due to the low production capacity, and the country is a net importer of fish.

Governance

Up until recently, aquaculture has not been the main subject of policies. The aquaculture law has been newly established but is still to be implemented and made known to farmers. Inside the Ministry of Environmental Protection and Agriculture (MEPA) agencies there is a need to increase capacities to provide advice and information to farms. Fish farm associations also require financial and human resources support to strengthen their role in the VC.

Sub-chain	Types of farms	Estimated number of farms	Production/ year (ton)	Number of Basins for trout/ Ponds for carp	Caviar (kg/ year)
Trout and Sturgeon	Family	80	4.8	4	-
	Medium	60	16.6	8	100
	Large	2	224.4	80	-
	Integrated	20	16.5	10	100
	Trout and Sturgeon	6	80	35	115
	Trout and Caviar	15	13.6	7	500
Carp and Catfish	Family	100	1.41	1-3	
	Extensive	75	14.16	3-7	
	Medium integrated	10	18.9	7-15	
	Large integrated	15	47.2	10-25	

Figure 3: Typology of farms in the Georgian aquaculture sub-chains

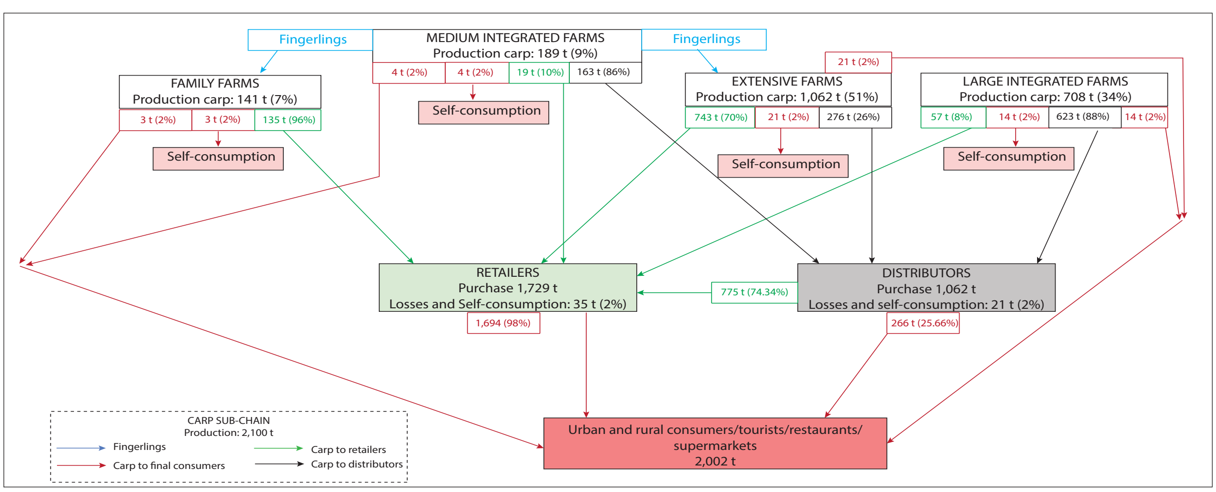

Figure 2: Flowchart of the carp and catfish sub-chain in Georgia

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

Financial viability for the actors

The operations in the aquaculture VC are profitable for all actors (Figure 4). For the trout sub-chain, the farms producing both trout and sturgeon are the most profitable. Despite the income from fish being low, it represents an important additional income for family farms. Large and sturgeon farms benefit from economies of scale and from a higher price on the caviar market. For the trout farms, the most important cost is represented by the imported feed, followed by eggs and fingerlings. Small and medium farms purchase feed in importers' warehouses, while larger producers negotiate their supply directly with the feed company.

For the carp sub-chain, the return on turnover is around 40% due to the low cost of feed and labour. Family farms earn less than in the trout sub-chain because of the lower volumes of production.

Sub-chain	Actor	Annual Net Operating Profit (NOP)	Return on turnover (%)
Trout and Sturgeon	Hatchery	29,000 GEL (€9,200)	30
	Family farm	14,400 GEL (€4,560)	29
	Medium farm	35,000 GEL (€11,100)	19
	Large farm	613,000 GEL (€194,300)	27
	Integrated farm	36,000 GEL (€11,400)	20
	Trout and sturgeon farm	810,000 GEL (€257,000)	47
	Trout and caviar farm	33,700 GEL (€10,700)	18
	Retailer	20,900 GEL (€6,600)	6
	Wholesaler	24,200 GEL (€7,700)	8
Carp and Catfish	Family farm	4,500 GEL (€1,400)	37
	Extensive farm	56,800 GEL (€18,000)	48
	Medium integrated farm	79,100 GEL (€25,000)	46
	Large integrated farm	156,600 GEL (€50,200)	40
	Retailer	26,200 GEL (€8,300)	6.5
	Wholesaler	308,000 GEL (€97,600)	19

Figure 4: Profitability for the individual actors

Net Operating Profit (NOP): Net income of the actor (excluding depreciation)

Return on turnover: Operating profit/production

Effects within the national economy

The **total value added (VA)** generated by the aquaculture VC in 2019 is estimated at **42.6 million GEL (€13.5 million)**. The direct VA by the farmers and the traders accounts for 72% of the total VA, whilst the remaining 28% represents the contribution from suppliers of goods and services (feed, eggs, fingerlings, transport).

The trout and carp sub-chains contribute respectively by 52% and 48% to the total VA. The contribution of the VC to the GDP is 0.09%. The **contribution of the VC agricultural actors to the agricultural GDP is still limited to 0.72%.**

The total VA is composed by net operating profits (61%) followed by wages (18%) and depreciation (10%) (Figure 5). Family farms obtain 3% of the total VA, compared to the 23% received by medium and large farms.

The **contribution of the VC to public finances** records a positive impact of **1 million GEL (€317,000)** as there are some taxes and no subsidies to the VC. The **contribution to the trade balance is negative** (by €5.8 million) due to the trout sub-chain's large imports of feed. **With a rate of integration at 70%**, the VC is well-integrated into the local economy as 70% of the value of production is value added and 30% imports.

Viability in the international economy

The **Nominal Protection Coefficient (NPC) is estimated at 1** for the trout and carp sub-chains, meaning that the remuneration would be the same if international prices were applied. The Domestic Resource Cost (DRC) is below 1 for both sub-chains denoting a **comparative advantage** and **viability in the international economy**.

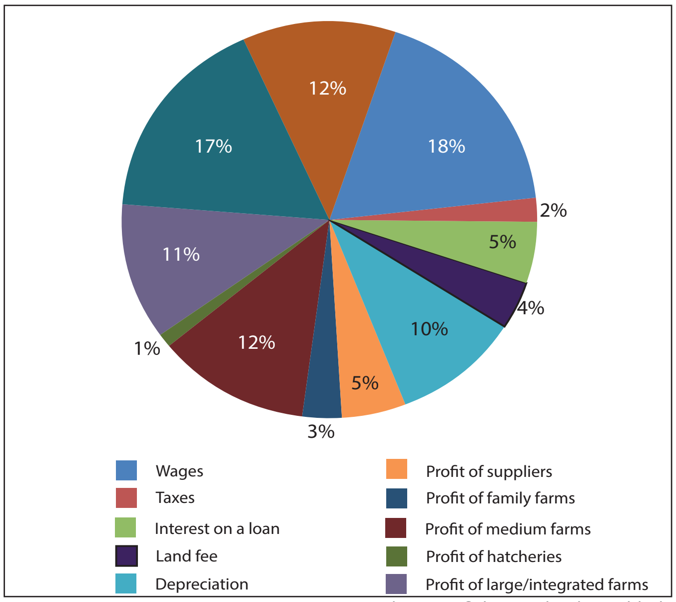

Figure 5: Distribution of the total value added

The aquaculture value chain is profitable for all actors, helping small farmers to diversify income and contributing to their food security. For the trout sub-chain, the lack of domestic supply of fishmeal and egg limits the performance. Due to the higher price of the imported fishmeal, family farmers cannot purchase enough fishmeal which in turn influences the amount of the production. The carp sub-chain shows better performance because of its integrated cereal production (feed) within the farm. The contribution of the value chain to the national GDP is still low.

Is the economic growth inclusive?

Distribution of income among the actors

For **the trout sub-chain**, the net operating profit (NOP) of **10.5 million GEL (€3.3 million)** is shared mainly between the trout and sturgeon farms (44%), medium farms (16%), family and large farms (both 9%).

In the **carp sub-chain**, the NOP is **12.6 million GEL (€4 million)** and distributed between the extensive (27%) and large integrated farms (15%). Carp family farms only receive 3.6% of the NOP despite their high number.

Job creation and employment

The aquaculture VC creates **636 jobs in Full Time Equivalent (FTE)** of which 51% are offered by the trout sub-chain and 49% by the carp sub-chain. Permanent unskilled workers are the most frequent job category in both sub-chains. Around 400 farms and 100 traders are involved in the VC activities. The wages in the whole aquaculture VC are of **3.9 million GEL (€1.2 million)** and women get only 1.2% of them.

Small family farms receive only 3% of the income generated by the value chain (total value added). Family farmers, especially those in the trout sub-chain, lack access to locally produced feed and to information on international prices and the capacity to negotiate equally with the suppliers and the wholesalers. The value chain creates jobs for men workforce who receive almost the total of the wages generated.

Is the value chain socially sustainable?

The following graph and table provide an image of the main social consequences of the VC activities in six strategic domains.

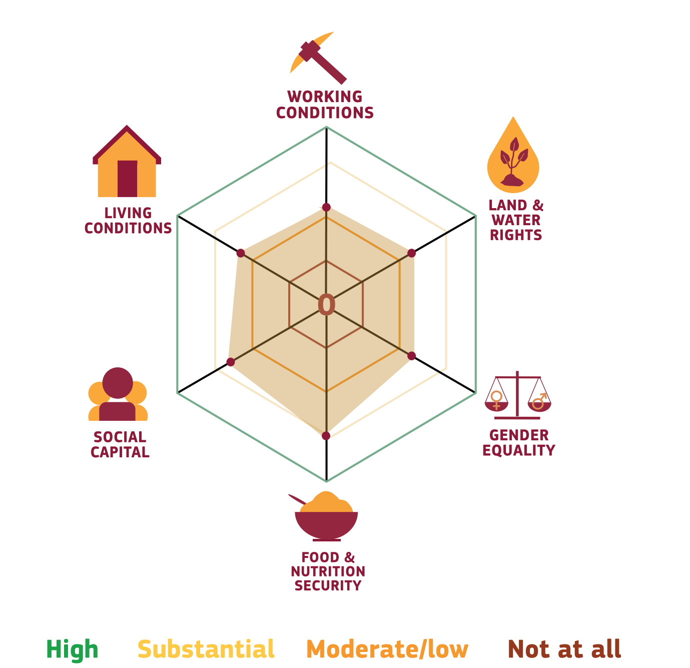

Figure 5: Social profile

The value chain enables the actors to secure their livelihoods and contributes to food security. However, improvements are needed, especially on working conditions and gender equality. The relatively low salaries and lack of formal contracts hinder the quality of life for the employees making them vulnerable. The value chain activities at farms are not attractive for the youth due to low salaries and hardship of work. Family farms lack social networks and face difficulties in accessing to finances. The value chain is gendered, and men are the main actors.

Working conditions	• Informal agreements in place between employers and employees • Old working equipment in family farms burdening the workload • Fish farming less attractive for youth due to heavy workload and low salaries
Land and water rights	• No cases of large-scale investment in aquaculture • Water scarcity in the carp farms during summer • Low water quality in some trout farms because of the flow of the same water among close farm
Gender equality	• Weak involvement of women in fish production except in the hatcheries and restaurant services of large integrated farms • Presence of women in trade activities • Significant gender gap in the ownership of agricultural land and equipment • Limited access to extension services for both women and men
Food and nutrition security	• Important role of fish as a source of protein in family farms • Increasing production of local fish reducing reliance on imports • Contribution of the VC income to the purchase of food for the VC actors
Social capital	• In the carp sub-chain, close relationship between actors and strong information flow among the farmers; no effective cooperatives • In the trout sub-chain, weaker social networks and cooperation among farms; existence of few cooperatives in the mountainous area, created with the support of international donors • Low influence of the few fish farming associations on the aquaculture policy development
Living conditions	• Access of the VC actors to public health services • Dwellings not well-equipped for workers in the carp farms • Few trainings on aquaculture in rural areas, very limited extension services

Is the value chain environmentally sustainable?

The environmental impacts of the aquaculture VC are measured through the Life Cycle Assessment (LCA) method, considering three areas of protection: **resource depletion**, **ecosystem quality** and **human health**. LCA results also show the VC's impact on **climate change**.

The aquaculture VC in Georgia creates very limited environmental impacts at the scale of the entire country. The damage on **resource depletion** due to fossil resource used by the VC activities refers to 0.001% of the damage on resource depletion generated by the whole Georgian population. This is caused mainly by the mechanical process used for feed production in the trout sub-chain. For the **ecosystem quality**, the carp sub-chain's contribution to the loss of species is relatively higher due to need for more land area to produce grain and fish. Concerning **human health**, the aquaculture VC emissions represent a very small contribution (0.04%) to the overall health impact per year of the total population of Georgia, while the contribution to **climate change impact** corresponds to only 0.1%. The small contribution to the environmental impact, however, is mainly due to the small size of the VC in Georgia.

Impact per value chain stages and sub-chains

When analysing the contribution of the different stages to the most relevant impact categories per kg of fish, for **the trout sub-chain, feed production** has the highest contribution to most categories (Figure 7), followed by transport of live fish and feed. For the **carp sub-chain**, cereal production (feed), farm emissions caused by fish production and pond excavation (capital goods) are the main contributors to impact (Figure 8).

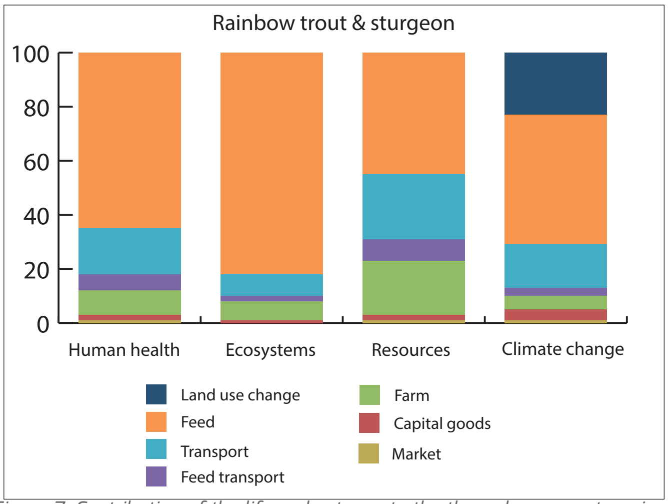

Figure 7: Contribution of the life cycle stages to the three damage categories and climate change in the trout sub-chain (per kg of fish)

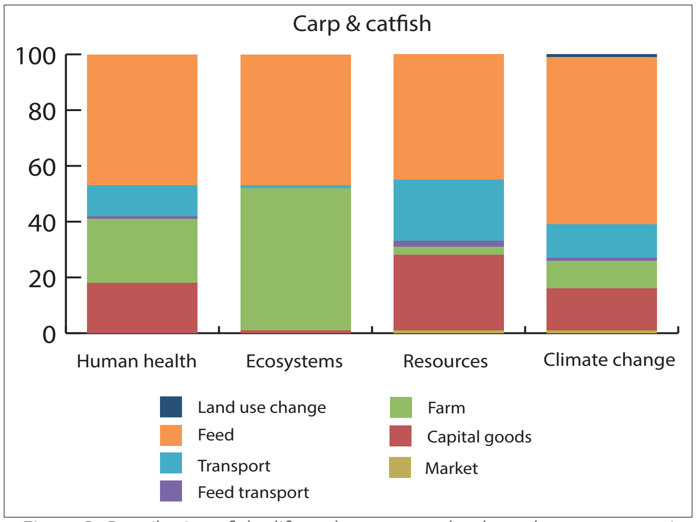

Figure 8: Contribution of the life cycle stages to the three damage categories and climate change in the carp sub-chain (per kg of fish)

Biodiversity

The **impact** of the Georgian freshwater aquaculture VC **on biodiversity is low** because the feed for trout sub-chain is imported and the grains for the carp sub-chain are not grown in protected areas or national hotspots for biodiversity. Moreover, the extensive carp sub-chain ponds in Georgia even appear to allow a fair degree of biodiversity providing habitat for wild flora and fauna and maintaining ecosystem services (landscape and local climate regulation, water retention, regulation and purification, antiflood role, etc) compared to the surrounding arable land. However, there are some risks on biodiversity linked to i) fish escape from the basins and ponds generating a negative impact on the natural freshwater ecosystems in Georgia, ii) diseases passing from farmed fish to wild fish species, iii) use of large amounts of wild fish in Georgian waters for feeding trout and sturgeon.

The environmental impact of aquaculture fish is in general significantly lower compared to several other animal meat products. The feed supply and fish transport generate impacts on climate change and human health through the release of particulate matters. Lower fish yields in small family farms can generate higher environmental impacts per kg of fish produced. However, these higher impacts are compensated by the lower impact on energy use and transport as family farmers sell their products mainly to the local markets. For the carp sub-chain, the emissions of amonia and nitrate from the stagnant water ponds are higher compared to the continuously flowing water in the trout basins.

Main findings

Today, only around 20% of the water resources available in Georgia are used for fish farming. This means that the freshwater aquaculture VC has the potential to increase production, ensure incomes for the VC actors and contribute to the country food security and protein intake. Effective decentralised water management is needed to preserve the quality and the proper use of the water resources. Being a historically old establishment, the carp sub-chain shows signs of resilience thanks to the fact that feed production has been integrated in the cropping systems. The trout sub-chain has been relatively recently set up. Using higher imported feed, this sub-chain represents more challenges as it is impacted by exchange rates. Overall, the lack of effective producers' cooperatives and specific supports to both sub-chains represent an issue.

Strengths, weakness, opportunities, threats

STRENGTHS	WEAKNESS
• Positive impact of the VC on food and nutrition security • Use of local feed for the carp • Lower environmental impact of fish production compared to most other animal meat products • Local and touristic demand for trout and carp • Availability of land and water resources to develop aquaculture • Trade of caviar at higher price • High consumption of trout by restaurants	• Dependency on imported feed for trout and sturgeon causing high cost and environmental impact • Lack of training for aquaculture especially for feeding, processing, water quality and fish disease • Lack of decentralisation in water resources management and VC governance • Lack of cooperatives and interprofessional agreement • Emissions caused by the transport of live fish in small vans with water containers
OPPORTUNITIES	**THREATS**
• Government support to the diversification of agricultural production to the farmers' competitiveness • Collaboration with the EU for the entrance in the EU market • Suitable geographic position to export, especially for the sturgeon and trout caviar	• Lack of work force and low attractiveness for youth in the agricultural sector • Unfavourable exchange rate (for feed import) • Lack of knowledge about the aquaculture production techniques • Risks on biodiversity (escape of fish from the basins and ponds influencing natural freshwater ecosystems, dissemination of diseases)

Recommendations

Participation of the actors in the VC governance and cooperation among them should be promoted to increase economic resilience. Associations and professional organisations should be strengthened to foster decentralised governance. Women's involvement in the VC should also be promoted.

Extension services and trainings should be enhanced to provide farmers with appropriate recommendations especially for fish diseases and quality. Strengthening local capacity building and setting up a knowledge sharing mechanism between actors could facilitate the dissemination of techniques regarding major innovations and sustainable practices. The access of family farms to input and microcredit should be enhanced considering the seasonality of their needs in feed and fingerling (especially for the trout sub-chain).

The transport of live fish in small vans with water containers is polluting and stressful for the fish. **Cooled transport of chilled fish could reduce environmental impacts.**

The country is rich in water resources usable for aquaculture: lakes, rivers, reservoirs, geothermal waters and also the Black Sea. Nevertheless, **good water management** is to be implemented to reduce risks of water scarcity linked to the development of irrigated agriculture and urbanization.

Thus, water and ponds management should be part of a decentralised governance allowing family farms to be represented in the process. Finally, an ecosystem approach shall be adopted when setting up the strategy on aquaculture development, considering different ecological interactions and the sustainable management of all resources.

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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-

This document is based on the report "Freshwater Aquaculture Value Chain Analysis in Georgia" 2022, by Ludovic Andres (ISTOM), Thomas Ponsioen, Giorgi Shubitidze, Nino Chobaniani, Pavel Kotyza (CZU) and Luboš Smutka (CZU). Only the original report binds the authors.