CIRCULARITY MAPPING FOR GEORGIA 2022

Circularity Mapping for Georgia has been prepared by
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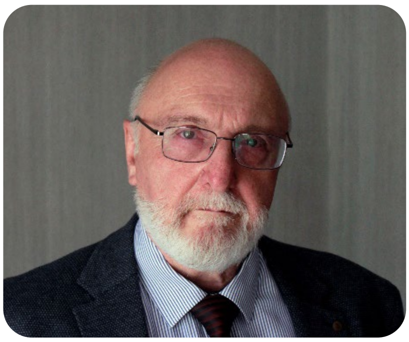

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ABBREVIATIONS

AA	EU-Georgia Association Agreement
AR	Autonomous Republic
BTC	The Baku-Tbilisi-Ceyhan Pipeline
CE	Circular economy
CO_2e	Carbon dioxide equivalents
CSO	Civil society organization
DE	Domestic extraction
DMC	Domestic material consumption
EPR	Extended Producers Responsibility
EU	European Union
FAO	United Nations Food and Agriculture Organization
FLW	Food loss and waste
GDP	Gross domestic product
GEL	Georgian Lari
Geostat	The National Statistics Office of Georgia
GFCM	General Commission for Mediterranean Fisheries
GGTC	Georgian Gas Transportation Company LLC
GHG	Greenhouse gases
GNTA	Georgian National Tourism Administration
GoG	Government of Georgia
GOGC	Georgian Oil and Gas Corporation JSC
GSE	Georgian State Electrosystem
GSNE “Orchis”	Georgian Society of Nature Explorers “Orchis”
GWA	Georgian Wine Association
HPP	Hydro power plant

HZW	Hazardous waste
IFC	International Financial Corporation
IFIs	International Financial Institutions
JSC	Joint stock company
LEPL	Legal entity of public law
MoEPA	Ministry of Environmental Protection and Agriculture of Georgia
MVP	Minimal viable products
NACE	Nomenclature of Economic Activities, Statistical Classification of Economic Activities in the European Community
NEAP	National Environmental Action Programme
NECP	Georgian National Integrated Energy and Climate Plan
NFA	National Forestry Agency of Georgia
NSMP	The North-South Main Gas Pipeline
NWMAP	National Waste Management Action Plan
NWMS	National Waste Management Strategy
PET	Polyethylene terephthalate
RME	Raw material equivalent
ROA	Return on assets
ROE	Return on equity
SCP	The South Caucasus Pipeline
SIDA	Swedish International Development Cooperation Agency
SMEs	Small and medium size enterprises
SWMC	Solid Waste Management Company of Georgia Ltd
TPP	Thermal power plant
UNEP	United Nations Environment Programme
WREP	the Western Route Export Pipeline
WPP	Wind power plant

EXECUTIVE SUMMARY

Georgia has recently embarked on an accelerated path to transition to the Circular Economy and is seeking partnerships to benefit from the experiences of more advanced countries and become the leader of circularity in the Region. The Government of Georgia (GoG) strongly believes that Circular Economy strategies benefit from inclusive partnerships. Different players capable of providing the knowledge, funding or improving the regulation need to work together to bring about a paradigm shift with the general objective of replacing the 'end-of-life' concept with an economic system that closes material loops. The key support for the programme has been provided to date by the Government of Sweden through the Swedish International Development Cooperation Agency (SIDA).

The first element of the programme encompasses an awareness programme aiming at promoting the Circular Economy. The programme is being implemented by CSO Georgian Society of Nature Explorers "Orchis". The programme provides recommendations to various groups of stakeholders, including policy makers, financial institutions and project promoters how to accelerate the implementation of circular economy principles at various levels of economic activity.

As the programme on raising awareness on the Circular Economy in Georgia has been received very positively by a number of stakeholders, the GoG has approached SIDA to support them in mapping the circularity of the Georgian economy with a view to provide recommendations to develop a Roadmap to Circularity and adopt a Circular Economy Strategy. The request has been approved by the Government of Sweden and the programme is currently at the final stages of implementation. This research summarizes the work of a group of international and national experts with a sound knowledge of the Georgian economy and environmental, social and governance issues which has been working together with an inter-ministerial working group (coordination board) formed by the GoG, which includes members from different government departments (including business/industry and environment), The group has been working on mapping the circularity of Georgia between November 2020 and October 2022.

The results of the work show that Georgia is 1.3% circular — leaving a significant circularity gap of more than – 98.7%. This means that the vast majority of resources Georgia uses to satisfy its needs come from virgin sources. The country's economy is largely linear. More than 315 million tonnes of resources are entering Georgian economy each year, amounting to nearly 78 tonnes per person — a figure that has continued to grow over recent years.

This research analyses how resources — metal ores, non-metallic minerals, biomass and fossil fuels—are used to meet the country's needs, from housing and mobility to food and consumer goods. A significant portion of its demand is met through products imported from outside of Georgia's borders: around 217 million tonnes of resources are extracted abroad to satisfy the country's needs, making up just under 69% of its consumption footprint. Georgia's high material consumption is still deeply interlinked with emissions-intensive processes.

Georgia's Circularity Metric of 1.3% doesn't mean that 98.7% of the materials flowing through its economy go to waste. The circularity gap is composed of a range of elements: many materials (40,056,014 tons) are added to stock in the form of buildings and infrastructure, while around 1,355,355 tons of materials are represented by biomass with the potential for cycling, such as wood products and food crops. While materials in both these categories can be cycled, quite some time will pass before this is possible. It is important to stress that while developing a Roadmap to circularity, it is crucial to focus on design of new materials and products to ensure that end-of-life cycling will be feasible and of high value. Non-circular flows, such as fossil fuels, and non-renewable inputs together represent significant part of the gap. Georgia's most critical goal will be cutting this while boosting its circularity metric—especially as stock build-up will continue to grow due to population growth, the country's geography and an appetite for bigger houses, among other factors. The target for coming 5/10 years will be to increase the level of circularity from current 1.3% up to 6.6%.

During the initial screening of sectors of Georgian economy, the team of experts selected 14 sectors, which seemed to have the highest potential for developing circular models of economy. Overview of these sectors has demonstrated that their level of circularity is low for each separate sector. The losses and waste generation are significant in each selected sector, while the reuse of materials, recycling of wastes or recovery of materials, as well as efficient use of resources is poor. At the same time, most of the selected sectors have significant potential for improving performance and circularity indicators. The experts have also identified priorities within each of the selected sectors. The analysis confirmed the preliminary assumption that one of the key sectors with the highest circularity potential is agribusiness.

For further preparation of the Circularity Roadmap and the National Strategy for Circular Economy, the group of experts analysed key gaps and provided a number of financial and non-financial policy recommendations. In addition, based on the work recently carried out by other group of experts in the preparation of the Circularity Gap for Sweden, our experts recommended to further explore during the preparation of the Circularity Roadmap, various scenarios to shift the Georgian economy towards circularity. These scenarios could include the following: 1) Construct a circular built environment, 2) Cultivate a thriving food system, 3) Make manufacturing circular, 4) Reshape extractive industries, 5) Drive clean mobility forward and 6) Design conscious consumables. While individual scenarios may have limited impact, all together, they can significantly increase Georgia's circularity.

GLOSSARY

Consumption refers to the usage or consumption of products and services meeting (domestic) demand. *Absolute consumption* refers to the total volume of either physical or monetary consumption of the Georgian economy as a whole. In this research, when we talk about consumption we are referring to absolute consumption.

Domestic Extraction (DE) is an environmental indicator that measures, in physical weight, the amount of raw materials extracted from the natural environment for use in the economy. It excludes water and air.

Domestic Material Consumption (DMC) is an environmental indicator that covers the flows of both products and raw materials by accounting for their mass. It can take an 'apparent consumption' perspective — the mathematical sum of domestic production and imports, minus exports — without considering changes in stocks. It can also take a 'direct consumption' perspective, in that products for import and export do not account for the inputs — be they raw materials or other products — used in their production.

Greenhouse gases (GHG) refers to a group of gases contributing to global warming and climate breakdown. The term covers seven greenhouse gases divided into two categories. Converting them to **carbon dioxide equivalents** (CO_2e) through the application of characterisation factors makes it possible to compare them and to determine their individual and total contributions to Global Warming Potential.

High-value recycling refers to the extent to which, through the recycling chain, the distinct characteristics of a material (the polymer, the glass or the paper fibre, for example) are preserved or recovered so as to maximise their potential to be re-used in a circular economy.

Materials, substances or compounds are used as inputs to production or manufacturing because of their properties. A material can be defined at different stages of its life cycle: unprocessed (or raw) materials, intermediate materials and finished materials. For example, iron ore is mined and processed into crude iron, which in turn is refined and processed into steel. Each of these can be referred to as materials.

Material footprint, also referred to as Raw Material Consumption (RMC), is the attribution of global material extraction to the domestic final demand of a country. In this sense, the material footprint represents the total volume of materials (in Raw Material Equivalents) embodied within the whole supply chain to meet final demand. The total material footprint, as referred to in this research, is the sum of the material footprints for biomass, fossil fuels, metal ores and non-metallic minerals.

Material flows represent the amounts of materials in physical weight that are available to an economy. These material flows comprise the extraction of materials within the economy as well as the physical imports and exports (for instance, the mass of goods imported or exported). Air and water are generally excluded.

Raw Material Equivalent (RME) is a virtual unit that measures how much of a material was extracted from the environment, domestically or abroad, to produce the product for final use. Imports and exports in RME are usually much higher than their corresponding physical weight, especially for finished and semi-finished products. For example, traded goods are converted into their RME to obtain a more comprehensive picture of the 'material footprints'; the amounts of raw materials required to provide the respective traded goods.

Resources include, for example, land, water, air and materials. They are seen as parts of the natural world that can be used for economic activities that produce goods and services. Material resources are biomass (like crops for food, energy and bio-based materials, as well as wood for energy and industrial uses), fossil fuels (in particular coal, gas and oil for energy), metals (such as iron, aluminium and copper used in construction and electronics manufacturing) and non-metallic minerals (used for construction, notably sand, gravel and limestone).

Secondary materials are materials that have already been used and recycled. This refers to the amount of the outflow which can be recovered to be reused or refined to re-enter the production stream. One aim of dematerialisation is to increase the amount of secondary materials used in production and consumption to create a more circular economy.

Sector describes any collective of economic actors involved in creating, delivering and capturing value for consumers, tied to their respective economic activity. We apply different levels of aggregation here—aligned with classifications as used in GEOSTAT. These relate closely to the European sector classification framework NACE.

Socioeconomic metabolism describes how societies metabolise energy and materials to remain operational. Just as our bodies undergo complex chemical reactions to keep our cells healthy and functioning, a nation (or the globe) undergoes a similar process—energy and material flows are metabolised to express functions that serve humans and the reproduction of structures. Socioeconomic metabolism focuses on the biophysical processes that allow for the production and consumption of goods and services that serve humanity: namely, what and how goods are produced (and for which reason), and by whom they are consumed.

Total material consumption is calculated by adding Raw Material Consumption (material footprint) and secondary material consumption (cycled materials).

1 INTRODUCTION

We are living in the Anthropocene: a geological epoch where our human imprint on the planet has caused increasing devastation to the natural world. According to our *Circularity Gap Report 2022* our planet is only 8.6% circular: much of what we consume is wasted. Our linear 'take-make-waste' economy has made throw-away culture the norm, putting increasing pressure on natural resources and our climate. Much of the globe functions within the linear economy: our dominant economic model characterised by 'take-make-waste' processes powered by fossil fuels. The global economy consumes over 100 billion tonnes of materials a year. It relies on heavy extraction and emissions-intensive processes to fulfil societal needs — be they Housing, Nutrition or Mobility.

The transition to a circular economy requires a radical change in the way we produce and consume. Products are designed for durability, upgradeability, reparability and reusability. Companies develop new business models generating revenue streams from services rather than products, while making more efficient use of resources and materials, and consumers use products efficiently and discard them in such a way that they can be turned into secondary materials that can enter a new production-consumption cycle. The circular economy concept is gaining attention in light of increasing consumption and resource use by a fast-growing population with rising standards of living. This is a new economic model that represents sustainable progress towards efficient green growth. Due to its expected environmental, climate, social and economic benefits, the circular economy is not only being strongly promoted by the EU institutions, as well as a growing number of national and local governments but it is also attracting increasing attention from the business community and from public and private financiers.

Like with any systemic change, the transition to the circular economy requires several elements of the system to change simultaneously. The inertia and resistance of the current linear economic systems prevent the transition from occurring. Concerted actions by a host of stakeholders are needed for change. Governments at all levels, businesses, innovators, academia, investors and consumers all have to play their distinct roles and contribute to the process. The recent years have seen a rapid development of the circular economy business models such as resource recovery, remanufacturing and product life extension, sharing and product service. However, the market penetration of circular business models remains limited and there is a considerable scope for their future growth. Such growth should be supported by a well-functioning, non-distortive policy and regulatory framework, which ensures a level playing field for circular economy business models by eliminating legacy subsidies that reward linear behaviours and by fully pricing in risks and externalities associated with the linear production and use of materials. Such a framework facilitates and accelerates the allocation of capital to circular investments and activities. It stimulates private sector finance and allows optimal leverage of public funding.

There is a general consensus among many experts that in spite of the fact that there are several examples of effective EU, national such as the Netherlands, Sweden, Denmark and Finland and regional policies which support the increasing 'circularity' of economic systems, the existing policy frameworks and skills of the policy makers are insufficient to achieve a meaningful acceleration for the transition to the circular economy. Various expert groups have identified several key recommendations for financial and non-financial policy makers, project promoters and public authorities to achieve concerted actions in the acceleration of the circularity measures.

One of the common themes in these recommendations is the need to develop taxonomy, standards and metrics for circular economy to enable better assessment of circular risks versus linear risks. Also, social and environmental benefits of the circular economy should become explicit, quantifiable and disclosed, and should be taken into account in financing decisions. The experts also stress the role of public authorities and the need to increase their capacities. Public authorities, on all levels, can provide incentives to promote circular economy models via, for example, public procurement, subsidies, taxation and funding. They have the legitimacy and means to reward positive externalities. Work also has to be undertaken to set circular economy performance requirements for products and services.

Public authorities and project promoters play an important role in creating circular businesses. The principal objective should be to succeed in correctly identifying, conceptualising and developing circular business models and projects that are both sound and bankable, and congruent with a long-term development vision and strategy for the transition to the circular economy. Awareness-raising both at the level of internal organisations and external stakeholders (including the value chain network) is crucial in this context. They can advise and improve the economic viability and bankability of projects; and visualise collaborative arrangements within the supply chain.

There is also a need for partnership, cooperation and coordination between various stakeholders. Weak policy coordination remains a common feature across countries. At governmental level, responsibility for the areas of policy relevant to circular economy tends to be distributed across more than one ministry. Often, existing decision-making structures and processes do not deal effectively with cross-ministerial topics. Better coordination and cooperation between governing bodies would result in addressing the above issues. Policy coordination requires involvement of stakeholders outside government. The importance of involving private-sector stakeholders, both employers and workers, in policy decisions and in the design of skills development measures is essential.

It is important to strengthen national and local governmental policies to support the widespread implementation of circular business models through, among other things, setting quality standards for recycled and reused materials, or by pushing for innovative initiatives. Further work is required to ensure circular business models become the best option for companies willing to gain competitive advantage and maintain their market share while aligning their goals with society's goals. Barriers both at the company level and along the value chain, as well as from a policy perspective still persist. Overcoming these obstacles and seizing opportunities is key for the transition towards a more sustainable and competitive economic model.

The first step to introduce policies and strategies conducive to the accelerated transition to circularity is to set the baseline conditions through mapping of the circularity and assessing sectoral potential for further policy actions. This report documents the work of international and local experts who worked closely with the representatives of the Government of Georgia (GoG) over a period of two years to accomplish this task.

The research provides recommendations to policy makers and project promoters at various national levels to provide initial analysis of various policy considerations and the level of awareness and skills required by public bodies to accelerate the transition to the circular economy. It provides recommendations for the key actions to be included in the development of the Circular Economy Roadmap encompassing various groups of stakeholders, including financial and non-financial policy makers and project promoters regarding measures which need to be adopted to achieve accelerated transition to circularity.

Circularity Mapping for Georgia has been prepared in response to the request from GoG as part of the ongoing circular economy program being implemented by the Georgian Society of Nature Explorers “Orchis” and supported by the Government of Sweden. This program is the basis for the Georgia’s accelerated shift to circularity. It is also a vital contribution to fulfil Georgian commitments under the Association Agreement with the European Union.

2 KEY STEPS OF THE CIRCULARITY MAPPING IN GEORGIA

The key objectives of the circularity mapping for Georgia:

1. Provide a snapshot of how circular Georgia is by applying an internationally recognized circularity metric methodology.
2. Identify how materials flow throughout the economy and how they may limit or boost the current circularity metric.
3. Spotlight possible interventions within significant industries that can aid Georgia's transition to circularity and reduce its material footprint.
4. Spotlight avenues for businesses and governments to change their behaviour to encourage circular consumption.
5. Provide recommendations for the development of the Road Map to Circular Economy in Georgia.

2.1 Align on starting point, ambition and focus

In this first step, the core team has benchmarked circularity metrics in Georgia, facilitated first discussions with project stakeholders, and made an assessment of their role in the national economy and circularity potential in the sector selection. The core project team included 10 experts from different sectors such as business/industry and environment, to ensure broad expertise. Specifically, it comprised the International Expert in Circular Economy, Sustainable Finance, Environmental, Social and Governance Areas and 9 national experts in ESG, agriculture, construction, energy, tourism, macro-economics, regional development, resource management and waste management having sound knowledge and experience in the relevant areas of concern.

In order to promote the transition of Georgia to the circular economy and to co-ordinate with the core team during the CE mapping, the GoG has also created a co-ordinating panel with the meaningful representation of all essential GoG ministries and cross-ministerial bodies to ensure broad expertise and early by-in from key departments. This co-ordinating panel, comprising 36 members, had an advisory and supervising roles as well as ensured access to relevant data for the core team. The composition of the panel is given in Annex 1.

Businesses. Significant effort was made to involve businesses throughout the project in order to: (i) get insights and knowledge to identify the most relevant circular economy opportunities and barriers in each focus sector; (ii) create early alignment on common direction for Georgia as a whole country and for the focus sectors; (iii) further demonstrate circular economy benefits to businesses and build capabilities.

Policymakers. Aside from a core group of policymakers leading the project, a significant effort was made to engage a wider group of policymakers, including representatives from different government departments (for example Finance, Business/Industry, Environment, Food/Agriculture, Energy). They will remain to be involved intensively till the final stages of the mapping and should also play a key role in the development of the roadmap to circularity as well as the country strategy for the circular economy.

Other society stakeholders. Citizens and consumers, labour and environmental organisations, researchers and academic have also been involved throughout the project to ensure a rounded picture of national circumstances and ambitions.

2.2 Assessing the current level of Georgia's circularity

The assessment of the current level of circularity is a key step to provide useful guidance to set an appropriate national ambition level. The assessment of the circularity baseline has provided indication of the areas in which a country is more or less advanced compared to its peers, which is the next step for setting the ambition level. It has also provided initial high-level direction on the potential solutions. The baseline assessment has focused on four key areas and corresponding metrics:

- **Resource productivity.** The resource productivity metric is the lead indicator of the European Commission's Resource Efficiency scoreboard, and consequently has high-quality data availability and transparency.
- **Circular activities.** A complete set of indicators including the adoption of remanufacturing and sharing has been measured. As this data was not readily available, recycling rate and eco-innovation indexes have been used as proxy indicators.
- **Waste generation** by industries and consumers.
- **Energy and greenhouse gas emissions.** Two straightforward metrics of renewable energy use and greenhouse gas emissions per GDP output have been used.

2.3 Setting a national ambition level

Setting national target (ambition) level has been based on the following key areas:

- **Quantitative circularity targets.** The targets have been proposed using existing Indicators as used in the majority of EU Member States.
- **Quantitative 'common' national policy targets.** Circular economy can contribute to many 'common' policy objectives, such as, for example, the targets related to the UN SDG or climate related commitments.
- **Qualitative circular ambitions.** This entailed setting a qualitative goal of being the 'best in the Caucasus Region' in waste prevention or recycling, or becoming a 'the regional leader' in remanufacturing.

2.4 The sector selection

The sector selection is a key tool in the mapping methodology, as it determines the focus for the rest of the project, not only in terms of analysis but also in terms of stakeholder engagement. A large part of the analysis has been sector-specific, as opportunities, barriers and policy options typically differ significantly from sector to sector. Stakeholders from the selected sectors (and their broader value chains) have been engaged extensively in the sector specific analysis.

The two natural dimensions to prioritise sectors in a circular economy included the sectors' role in the national economy and their resource profile.

- **Role in the national economy**: size (and growth) measured by share of GVA (gross value added), contribution to employment (and growth), international competitiveness.
- **Circularity potential**: material and energy intensity, volume of waste generated, share of waste landfilled/incinerated, high-level estimate of scope for improved circularity.

This list has been extensively consulted and agreed with the key stakeholders of the Circular Economy project, in particular with the Inter-ministerial panel. It has been modified and adapted based on, among others, data availability and national priorities. Other sub-dimensions, such as the environmental impact of resource extraction and use, or the scarcity of required resources, have also been taken into account.

2.4.1 Screening of economic sectors and methodology for Mapping

2.4.1.1 Circularity mapping tasks and the country's circular profile

Mapping the circularity of the economy is a preparatory work for the development of a strategy and roadmap for the country, necessary for the gradual transition of the country's economy from linear models to a circular model. In a broader context, circularity mapping refers to the creation of a "circularity profile": a short description of the economy as a whole and its individual sectors in terms and indicators that allow us to assess the current degree of circularity, the existing potential, factors contributing to or hindering the transition to the rails of circularity. The "circularity profile" - this kind of "snapshot" reflecting the current state of the country's economy, should become the basis for subsequent reflections and decisions. Given the experience of Swedish and Danish models[1],[2] we expected two possible types of outcomes from the mapping process:

1. **Prioritization of industries:** Identification of a small group of clearly priority industries from the entire set of economic sectors represented in the country, which have the most favourable prospects for a significant increase in the degree of circularity. Obviously, this would allow, with subsequent planning, to avoid the dispersion of resources and focus on the most promising areas. With this approach, you can achieve maximum results with the same effort. Achieving a tangible and obvious result within the scheduled time frame, in addition to the direct effect, has an important additional value, namely, the value of a demonstration example that contributes to changing the mentality of the economic community and the rooting of the principles of the circular economy. Prioritization of industries is exactly the task that the developers of the Swedish and Danish circularity models have set themselves and successfully solved. Initially, we set a goal, if possible, to follow the methodology of the above studies and try to isolate clearly priority areas of the economy.

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[1] Delivering the Circular Economy; A Toolkit for Policy Makers; 2015; The report has been produced by a team from the Ellen MacArthur Foundation. This report describes a methodology for circular economy policymaking. It also explores a range of policy options that Denmark – the country of the report's pilot study – could choose to pursue.

[2] Measuring and Mapping Circularity; Technical Methodology Document; *Circularity Gap Reporting Initiative*

2. **Clustering of industries:** splitting the entire set of economic industries represented in the country into groups of the same type according to the criteria of circularity. The description of the "circularity profile" is multiparametric and includes not only economic and environmental indicators (share in GDP, resource consumption, material and waste flows), but also indicators characterizing key players and the process of sector administration. There is reason to expect that the entire group under consideration will break up into several similar subgroups, for which well-defined circularity and administration factors will be important: for some industries, saving resources or reducing losses may be a priority, and waste management may be less important, for others, on the contrary, waste recycling may be a key circularity factor. For some industries, the key players responsible for administration may be governmental organizations and agencies, for others – a small number of large companies, and for others – a large number of small and medium-sized businesses. It is obvious that for an industry that has a significant contribution to GDP and is also significant in other economic indicators, but is represented by many small and medium-sized enterprises, it is more difficult to achieve tangible results in a short time. For a tangible shift towards circularity, it may take more time and more sophisticated mechanisms of administration, investment and creation of incentives. Other industries represented by only a few major players (private companies or government organizations) may have a smaller contribution to GDP, but can make a significant contribution to increasing circularity, due to the fact that one or two leading circularity factors for this industry have been identified and the administration process has been simplified, due to the limited number of key players. Clustering of industries can be useful even if at the previous stage it was possible to identify clearly priority sectors of the economy: in principle, the priority sectors consisting of different subsectors, themselves can be clustered and this will help in the subsequent planning of investments and their administration. However, clustering becomes especially important if it is not possible to clearly identify several priority industries and the overall picture appears to be structured in a more complex way: many different industries and subsectors have generally comparable circularity potential with a different set of favourable factors and hindrances. Clustering may help subdivision of the economy sectors is few groups and apply similar strategies for transition within the group, while these strategies will differ by groups.

Isolating a small group of clearly priority industries from the entire set of economic sectors is a very tempting task, but not always feasible. The group started the mapping task with an understanding of this complexity: the primary task of the ball was an attempt at prioritization and an alternative and/or addition to this priority task – clustering.

2.4.1.2 Primary screening as preparatory work for mapping circularity

Prioritization of industries and/or their clustering is the final, summarizing part of the mapping process: first, the main profile of the circularity of the Georgian economy is developed – a uniform, multiparametric description of each sector with the identification of material flows – resource consumption, energy, volume of products and waste streams (recyclable and not). Then, there is an understanding of this basic material, prioritization and clustering. But the initial process preceding the compilation of the profile is the primary screening. Primary screening implies a superficial but quick analysis of the entire set of industries recorded in the register of the National Agency for Statistics, based on only two or three key criteria. The register of the National Statistics Office of Georgia contains 99 items in the list of various types of economic activity. Obviously, this is too long a list to compile a profile. The list also includes such types of economic activity that are insignificant in their contribution to GDP, are not associated with significant consumption of energy resources and raw materials or waste generation. To carry out a description of all these activities would be unproductive and unjustified. Preliminary screening allows us to weed out unpromising types of activity at an early stage in order to narrow the range of activities to a reasonable minimum. Further mapping work is carried out on this shortened list of sectors.

The set of screening criteria should reflect, on the one hand, the importance and contribution of the industry to the overall structure of the country's economy, and on the other hand, the most important aspect of circularity.

► Economic Indicators Selected for Mapping Circularity

During the consultation with the Governmental CB and analysis of the available statistical data, we came to conclusion that for estimation of the role of different economic sectors and sub-sectors following indicators could be used available in data bases of the National Statistics Office:

- Input of the sector in GDP (main criteria)
- Number of employees engaged in sector (additional criteria)

Combination of these two indicators gives an overall picture about the significance of the sector in the economic structure and the trend during the recent 10 years enables to make conclusions regarding the potential for further development. Actually, share in GDP is considered by us as the main economic criteria for estimation of the sector importance and number of employees is taken as additional criteria.

► Circularity Indicators Selected for Mapping Circularity of Georgia

- At the screening stage of the project development, we have focused at the waste generation and recyclability indicators to estimate the circularity potential of the sectors.
- Resource management, product durability or and energy saving indicators could be applied later, at the next stage of the assessment

For screening needs we used qualitative estimation of waste volumes generated by the sector and subsectors and three grades:

- High level of waste generation per unit of product or activity
- Medium level of waste generation
- Low level of waste generation

2.4.1.3 Primary screening of economic sectors in Georgia: selection of industries that should be reflected in the circularity profile of Georgia

As we indicated earlier, the register of the National Statistics Office of Georgia contains 99 items in the list of various types of economic activity. We conducted a preliminary assessment of each industry according to screening criteria. As a result of such an assessment, as expected, it was not possible to isolate only a few priority groups in order to complete prioritization already at this stage. But it was possible to cut off a lot of unpromising areas and narrow the range of economic activities under consideration to 16. Below we present a screening evaluation table for the types of economic activities that have been screened and are of interest for subsequent mapping.

Table 2.4-1 General Macro-economic Metrics and Circularity Qualitative Indicators

Nace Rev.2	Economic Activities	GDP Mln GEL 2019	GDP %	Employment Thousand Persons	Annual Turnover Mln GEL	Annual Production Value Mln GEL	Qualitative Indicators of Circularity (High/ medium/low)			Circularity Potential
							Waste Generation	Resource saving potential	Energy Saving Potential	
1-3	**Agriculture, forestry and fishing**			**250**		**726**				
1	Crop and animal production, hunting and related service activities	3050.6	7.1				High			Extremely High
2	Forestry and logging	117.6	0.3				Medium			Medium
3	Fishing and aquaculture	35.6	0.1				Medium			Medium
5-9	**Mining and quarrying**	596.3	1.4		1,000.00	1,000				
	Mining of coal and lignite	5.3			13.90	16	High			Medium
	Extraction of crude petroleum and natural gas	8.7			20.00	26	High			Medium
	Mining of metal ores	477.0			993.00	991	High			Extremely High
	Other mining and quarrying and Mining support service activities	104.0			199.00	201	High			Medium
10-12	Manufacture of food products, beverages and tobacco products	2271.7	5.3		4,680.00	4,800	High			Extremely High
13-15	Manufacture of textiles, wearing apparel, leather and related products	116.3	0.3		360	360	Medium			Medium

Nace Rev.2	Economic Activities	GDP Mln GEL 2019	GDP %	Employment Thousand Persons	Annual Turnover Mln GEL	Annual Production Value Mln GEL	Qualitative Indicators of Circularity (High/ medium/low)			Circularity Potential
							Waste Generation	Resource saving potential	Energy Saving Potential	
16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	49.2	0.1		120	110	Medium			Medium
22	Manufacture of rubber and plastic products	99.3	0.2		430	423	Medium			Medium
23	Manufacture of other non-metallic mineral products	423.7	1.0		1,400.00	1,424	Medium			High
24	Manufacture of basic metals	651.2	1.5		1,450.00	1,440	High			Extremely High
25	Manufacture of fabricated metal products, except machinery and equipment	139.2	0.3		400	378	Medium			Medium
31-32	Manufacture of furniture	72.6	0.2		220	222	Medium			Medium
33	Repair and installation of machinery and equipment	70.6	0.2		150	140	Medium			Medium
35	Electricity, gas, steam and air conditioning supply	1009.1	2.3		3,500	1,650				
	Electric power generation, transmission and distribution				3,100	1,525	Medium			Medium
	Manufacture of gas; distribution of gaseous fuels through mains				430	138	Medium			Medium
	Water supply; sewerage, waste management and remediation activities			350		2500 340				
36	Water collection, treatment and supply	243.5	0.6		260		Low			Medium

Nace Rev.2	Economic Activities	GDP Mln GEL 2019	GDP %	Employment Thousand Persons	Annual Turnover Mln GEL	Annual Production Value Mln GEL	Qualitative Indicators of Circularity (High/ medium/low)			Circularity Potential
							Waste Generation	Resource saving potential	Energy Saving Potential	
37-39	Sewerage; Waste collection, treatment and disposal activities; Waste utilization, remediation activities and other waste management services	107.0	0.2				Medium			Medium
41-43	Construction	3680.8	8.5	95	8,200.00	9,074	High			Extremely High
	Wholesale and retail trade; repair of motor vehicles and motorcycles			190						
45	Wholesale and retail trade and repair of motor vehicles and motorcycles	838.4	1.9				High			Extremely High
46	Wholesale trade, except of motor vehicles and motorcycles	2795.2	6.5				High			Extremely High
47	Retail trade, except of motor vehicles and motorcycles	2527.4	5.9				High			Extremely High
	Transportation and storage									
49	Onshore transport and transport via pipelines	1065.9	2.5				High			Extremely High
50	Water transport						Medium			Medium
51	Air transport						Low			Low
52	Warehousing and support activities for transportation						Medium			Medium
55-56	Accommodation and food service activities	2223.0	5.2	40		1,200	High			Extremely High

Sectors and subsectors selected as a result of the screening exercise are as follows:

1. Annual crop production (agriculture)
2. Permanent crop production and manufacture of food products (agriculture)
3. Grape cultivation and wine making
4. Animal husbandry and manufacture of food products
5. Logging and wood products
6. Fishery and fish processing
7. Mining and quarrying (except oil and gas extraction)
8. Construction
9. Manufacture

   9.1 Manufacture of Food, beverages and tobacco

   9.2 Manufacture of other non-metallic mineral products

   9.3 Manufacture of basic metals
10. Electricity, gas, steam and air conditioning supply (Electric power generation, transmission and distribution/ Manufacture of gas; distribution of gaseous fuels through mains
11. Sewerage; Waste collection, treatment and disposal activities; Waste utilization, remediation activities and other waste management services
12. Wholesale and retail trade
13. Oil and Gas Production, Onshore Transport and Transport via Pipelines
14. Accommodation and food service activities

Based on these sectors will be prepared the profile of circularity and conducted prioritization and clustering of sectors.

2.4.1.4 Criteria and circularity indicators selected for the compilation of the "circularity profile"

To compile a circularity profile, a brief description of each of the types of economic activity selected at the screening stage is being prepared. The description includes as the main set of parameters: macroeconomic indicators already used at the screening stage, indicators of consumption of raw materials and electricity, the volume of production, the amount of waste generated. The main information is also the share of energy consumed based on renewable resources, the share of recycled waste. Other indicators that complement the main picture can also be given as non-binding.

The main source of information for us was the databases of the National Statistics Office of Georgia, Customs Department of Georgia, ministries and subordinate organizations. Not all the information necessary to compile a circularity profile is available in databases in a ready-made form. Many of the indicators are calculated using appropriate approximations and logical generalization of the particular cases.

2.5 Assess sector circular economy opportunities

The sector selection has considered the producing sectors such as agriculture, forestry and fishing; mining and quarrying; construction; electricity and gas; manufacturing, as they typically have the largest direct material footprint. The experts have also looked at non-producing sectors such as health care and transport that are large consumers of resources.

In addition, based on the experience of other countries, the following factors have been taken in the selection of sectors:

- In addition to the economic size of a sector, its growth potential has been included as a factor for the 'score' on the 'role in national economy' dimension.
- The 'circularity potential' dimension takes into account not only total resource consumption and waste generation, but also the potential to avoid and/or valorise that waste. For example, mining and quarrying has the lowest score since initial analysis indicated that there is little dependence on other raw materials, little intrinsic value of the materials handled (since mining is generally the first stage in a value chain), limited avoidable waste generated, and a small potential value to valorise the waste. In contrast, the construction sector has a high raw material dependence and handles materials with high intrinsic value, while generating significant volumes of waste that are deemed feasible to further valorise through circular activities.
- The resulting matrix has been treated only as a guide to the sector prioritisation – and a judgement from the expert opinion supported by the stakeholder consultation has been significantly taken into consideration in the final selection.
- In addition to sectors, the experts have also considered other important contributors to resource consumption and waste in the economy such as packaging, especially from a consumer point of view.

While most data needed to assess the role in the national economy was obtained from national statistical databases (Geostat), assessing the 'circularity potential' have relied more heavily on expert opinion and judgement. Assessing the 'circularity potential' have involved a round of interviews with sector experts and consultation of previous reports prepared for various reasons and diverse audiences.

Once the focus sectors have been selected, the sector-specific assessment has been carried out. This step has been conducted in parallel sector working groups, and heavily relied on the involvement of businesses representatives. The most relevant circular economy opportunities have been mapped and prioritised. For the prioritised opportunities, sector-specific economic impact has been also assessed, barriers limiting their realisation identified and policy options to overcome these barriers mapped and recommended.

For some sectors deep dives have been conducted in parallel by the relevant key sectoral experts. In this stage an analysis of the value chains has been carried out. This task will need further work in the subsequent staged during the development of the circularity roadmap in order to create early alignment on a common direction for the country and the focus sectors and further demonstrate circular economy benefits to businesses and build capabilities.

2.6 Mapping circular economy opportunities in each focus sector

For mapping circular economy opportunities, **the ReSOLVE framework** has been used as it offered a structure for a systematic screening of opportunities to identify and map opportunities. It has been an iterative exercise that began with a high-level mapping for each focus sector derived from existing circular economy literature. Thereafter, it has been verified and fine-tuned with sector stakeholders and experts to ensure that the mapping covered all relevant opportunities. The key focus of the mapping exercise has been to create an overview of opportunities by sector.

2.7 Prioritise and detail circular economy opportunities

The systematic screening of opportunities described above have resulted in a large number of possible opportunities for each focus sector. To guide further analysis, these opportunities have been prioritised. The prioritised opportunities then have been detailed and assessed in terms of sector-specific impact, barriers and policy options. This part of the project required most involvement of businesses as only businesses could provide input grounded in local business reality on what the opportunities could exactly look like.

A simple, qualitative scoring mechanism to rank the circular economy opportunities have been used. An indicative prioritisation based on economic and resource impact of the different action areas have been based on the ReSOLVE framework for 20 major sectors in Europe.

Prioritising and detailing the opportunities has taken into account the following:

- **Circular design**, i.e. improvements in materials selection and product design (standardisation/ modularisation of components, purer materials flows, and design for easier disassembly).
- **Innovative business models**, especially changing from ownership to performance-based payment models, which are instrumental in translating products designed for reuse into attractive value propositions.
- **Core competencies along reverse cycles and cascades**, which involve establishing cost-effective, better-quality collection and treatment systems (either by producers themselves or by third parties).
- **Enablers for improving cross-cycle and cross-sector performance** which are factors that support the required changes at a systems level and include higher transparency for materials flows, alignment of incentives, and the establishment of industry standards for better cross-chain and cross-sector collaboration. Other aspects are access to financing and risk management tools and infrastructure development.

To ensure a consistent ambition (target) level when detailing the opportunities, the discussion with the GoG has been conducted to define the time horizon and the overall scenarios in which these opportunities could be assessed. A short-term and long-term time horizon has been defined to identify tangible near-term opportunities as well as more ambitious, longer-term potential. An attempt was made but will need to be further analysed on how the selected time horizons would align with other strategic national or international targets and initiatives.

RESOLVE FRAMEWORK

The three principles of the circular economy can translate into six business actions: **Regenerate, Share, Optimise, Loop, Virtualise, and Exchange – together, the ReSOLVE framework.**

REgenerate. Shift to renewable energy and materials; reclaim, retain, and regenerate health of ecosystems; and return recovered biological resources to the biosphere.

Share. Keep product loop speed low and maximise utilisation of products by sharing them among users (peer-to-peer sharing of privately owned products or public sharing of a pool of products), reusing them throughout their technical lifetime (second-hand), and prolonging their life through maintenance, repair, and design for durability.

Optimise. Increase performance/efficiency of a product; remove waste in production and the supply chain (from sourcing and logistics to production, use, and end-of-use collection); leverage big data, automation, remote sensing, and steering. None of these actions requires changing the product or technology, as exemplified by the lean philosophy made famous by Toyota.

Loop. Keep components and materials in closed loops and prioritise inner loops. For finite materials, this means remanufacturing products or components and as a last resort recycling materials, as Caterpillar, Michelin, Rolls Royce, and Renault are doing.

Virtualise. Deliver utility virtually – books or music, online shopping, fleets of autonomous vehicles, and virtual offices. Google, Apple,38and most OEMs plan to release driverless cars in the next decade.

Exchange. Replace old materials with advanced non-renewable materials; apply new technologies (e.g. 3D printing and electric engines); choose new products and services (e.g. multi-modal transport).

In different ways, these actions all increase the utilisation of physical assets, prolong their life, and shift resource use from finite to renewable sources. Each action reinforces and accelerates the performance of the other actions, creating a strong compounding effect.

2.8 Identification of barriers

Upon the identification and prioritisation of the circular economy opportunities, the project team has reviewed the barriers that stand in their way and analysed their severity. Careful analysis of barriers has formed the basis for the next step of arriving at targeted policy options. The analysis of the barriers has been based on the methodology described in the Circular Economy Toolkit for Policy Makers by Ellen MacArthur Foundation[3] and include the following:

- ► Economic
  - Not profitable for businesses even if other barriers are overcome.
  - Capital intensive and/or uncertain payback times.
  - Technology not yet available at scale.
- ► Market failures
  - Externalities (full costs to society) not fully reflected in market prices.
  - Insufficient public goods/infrastructure provided by the market or the state.
  - Insufficient competition/markets leading to lower quantity and higher prices than is socially desirable.
  - Imperfect information that negatively affects quality of market decisions, such as asymmetric information.
  - Split incentives (agency problem) when two parties to a transaction have different goals.
  - Transaction costs such as the costs of finding and bargaining with customers or suppliers.
- ► Regulatory failures
  - Inadequately defined legal frameworks that govern areas such as the use of new technologies.
  - Poorly defined targets and objectives which provide either insufficient or skewed direction to industry.
  - Implementation and enforcement failures leading to the effects of regulations being diluted or altered.
  - Unintended consequences of existing regulations that hamper circular practices. Social factors.
  - Capabilities and skills lacking either in-house or in the market at reasonable cost.
  - Custom and habit: ingrained patterns of behaviour displayed by consumers and businesses.

2.9 Mapping sector-specific policy options

Upon the identification of the barriers for each circular economy opportunity, the project team has mapped policy options to overcome them. The following policy options have been considered: (i) Information and awareness; (ii) collaboration platforms; (iii) Business support schemes; (iv) Public procurement and infrastructure; (v) Regulatory frameworks; and (vi) Fiscal frameworks.

[3] https://www.ellenmacarthurfoundation.org/resources/apply/toolkit-for-policymakers

3 KEY PROJECT FINDINGS

3.1 General Assumptions

In assessing Georgia's circularity, the project team first needed to decide to either take a production or consumption perspective. In a production perspective, we consider all the materials involved in any sort of processing of production activity, regardless of whether they are exported or consumed domestically. In a consumption perspective, we consider only the materials that are consumed domestically. Whether we apply the metric from a consumption or production perspective will yield different results. Our Mapping Report takes a consumption perspective in a bid to generate actionable insights for the economy and consumption on the ground, and to enable comparison between countries. However, there are some limitations to our approach: Georgia's significant level of imports and exports—means it is more susceptible to the limitations of both the material flow analysis and input-output analysis, the latter in particular. Some of these limitations include difficulties in calculating the import content of exports.

Secondly, most production is ultimately driven by the demand of consumers for a certain product or service. In an increasingly globalised world, the chain that connects production to consumption becomes more entangled across regions. Demand-based indicators—applied in this analysis—allow for a re-allocation of environmental stressors from producers to final consumers. This ensures transparency for countries with high import levels and also supports policies aimed at reducing or shifting consumer demand, at helping consumers understand the material implications of their choices, or at ensuring that costs of, and responsibilities for, resource depletion and material scarcity are allocated to entities and regions based on their roles in driving production processes through consumption.

Impact prevention through reduction in demand is an important first step before exploring other mitigation options. This is reflected also by environmental management hierarchies (for example, the circular economy waste management hierarchy) wherein reduction of production and consumption is always the preferred and most effective strategy.

Thirdly, when considering what Georgian citizens consume to satisfy their needs, we must apply a nuanced lens to the direct imports; meaning we work out the full material footprints of the products. To account for the material footprint of raw materials is straightforward, but this is not the case with semi-finished and finished goods. A motor vehicle, for example, may weigh 1 tonne when imported, but all the materials used to produce and transport it across global value chains can be as much as 3.4 tonnes. To represent actual material foot- prints in imports and exports, we apply so-called raw material equivalents (RMEs) coefficients in this study.

Finally, the circularity metric considers all secondary materials as adding to a country's level of circularity. These secondary materials can be part of those cycled within the country, as well those that are imported or exported, either as waste destined for recycling or as secondary materials embedded in traded products.

However, estimating the shares of traded secondary materials is a difficult undertaking, so we introduce an important assumption: in order to estimate the volume of secondary materials imported, we apply the average Global Circularity Index (GCI)—calculated per resource group—to the net direct imports of the country (aggregated by resource group). Because the GCI includes waste for recycling and partially also secondary materials, we assume that this is a good proxy for the estimation of the total amount of secondary materials in the system. The underlying assumption is that—although varying in terms of volume—imports of every country have the same average share of secondary materials per resource group. To determine which share of secondary materials are consumed domestically, rather than exported, we make a second assumption. This is that the share of secondary materials in the total consumption of raw materials is equal to the share of imported and domestically cycled secondary materials in the total input of raw materials.

Providing a year-zero baseline measurement of the circularity of Georgian economy based on resource flows offers many advantages, not least that it can be used as a call to action. But the circular economy is full of intricacies, and therefore, simplifications are necessary, which result in limitations that must be considered. Some detail needs to be shed for the benefit of having an updated and relevant figure of circularity to guide future legislative action.

There is more to circularity than cycling. A circular economy strives to keep materials in use and retain value at the highest level possible, while decreasing material consumption. The cycling of materials measured in the circularity metric is only one component of circularity.

The metric doesn't capture all aspects of sustainability. The circularity metric in this report focuses only on material use: the share of cycled materials in the total material input. It does not account for other crucial aspects of sustainability, such as impacts on biodiversity, pollution, toxicity, and so on.

Lack of consistency in data quality. Whilst data on material extraction and use are relatively robust, data on the end-of-use stage are weak, presenting challenges in quantifying global material flows and stocks.

Quality loss and material degradation. The metric focuses on the end-of-use cycling of materials that re-enter the economic system but does not consider in what composition, or to what level of quality. As such, any quality loss and degradation in processing goes unconsidered.

Relative compared to absolute numbers. The circularity metric considers the relative proportion of cycled materials as a share of the total material input: as long as the amount of cycled materials increases relative to the extraction of new materials, we see the statistic improving, despite the fact that more virgin materials are being extracted— which goes against the primary objective of a circular economy.

3.2 Key Findings based on Sectoral Analysis

3.2.1 Annual Crop Production

Agriculture, Forestry and Fishing

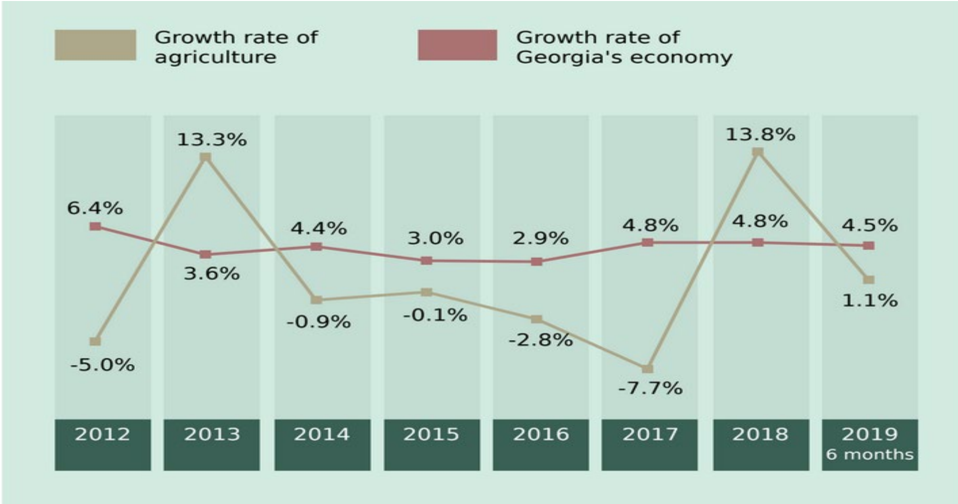
Sector nomination and NACE Index (NI): Crop and animal production, hunting and related service activities (NI/ 1)
Input in GDP of the entire sector (Mln GEL): 3,050.6 (7.1%)

Subsector: Annual Crop Production

3.2.1.1 Overview of Agriculture Sector

Agriculture is the one of the significant sectors of the Georgian economy. It follows behind the trade, industry, construction, and real estate activities. In 2018, more than GEL 3 billion of agricultural output was produced in Georgia, and this rate is maintained. Current input in GDP of the entire sector (year 2019 data) equals GEL 3.050 billion in current fixed prices, which is 7.8% of the total economy. The real economic grow of agriculture (not masked by inflation) in 2012-2018 equalled GEL 220 million. In real terms, the growth of the agricultural sector from 2013 to 2018 was only GEL 29 million. From 2012 to the first half of 2019, the Georgian economy grew by an average of 4.3% annually. In the same period, the average real growth rate of agriculture was 1.5%, which is 3 times less than the average growth rate of the economy. During the 2012 - 2020, agricultural output grew only in 2013, 2018 and the first half of 2019, compared to the previous years. High growth rates were recorded in 2013 and 2018 (Figure 3.2-1)[4].

[4] Georgia's Agriculture Sector Key Trends for 2012-2019; Transparency International; 2020



Source: Georgia's Agriculture Sector Key Trends for 2012-2019; Transparency International; 2020

Figure 3.2-1 Growth rate of the agriculture sector vs the national economy

The high growth rate in 2013 was caused by the free ploughing and planting state program that had a one-time effect. In addition, since 2013 the Russian market has been opened for Georgian agricultur al products and in 2013 exports to Russia increased by 300%. The export growth was also the main reason for the 13.8% growth in 2018. In 2014-2017, agricultural production was declining each year. This was due to the reduced funding of the free ploughing and planting program and its consequent cancelation as well as to the worsened economic situation in the region, especially in Russia. As the growth of the agriculture sector is significantly below the average growth rate of the economy, the share of agriculture in Georgian economy decreases every year. In 2018, this figure dropped to 7.8% from 9.6% of 2013.

It is noteworthy that since November 2019, the National Statistics Office of Georgia has moved to a new methodology for the National Accounts System, which has had an impact on the growth rate in the agricultural sector. According to the methodology in place until November, there was 0.7% growth in agriculture in 2018. The new methodology has improved data sources and increased the share of non-observable economies in agriculture, which had not previously belonged to the sector[5].

3.2.1.2 Annual Crop Production

3.2.1.2.1 Resources

Land: In 2018, compared to 2012, the total crop area decreased by 20%. According to the Geostat, due to the methodological changes, it is more reasonable to compare this data from 2014. In 2018, compared to 2014, the crop area still was contracted by 25% (68 thousand hectares). The largest reduction - 44% (65 thousand hectares) was in corn areas. The harvested area of vegetables also decreased by 17%. Since 2013, the crop areas have been declining annually. Free ploughing and planting vouchers caused a one-time rapid growth of harvested areas in 2013. As mentioned above, this program has contracted during the following years and was fully cancelled in 2017.

[5] Georgia's Agriculture Sector Key Trends for 2012-2019; Transparency International; 2020

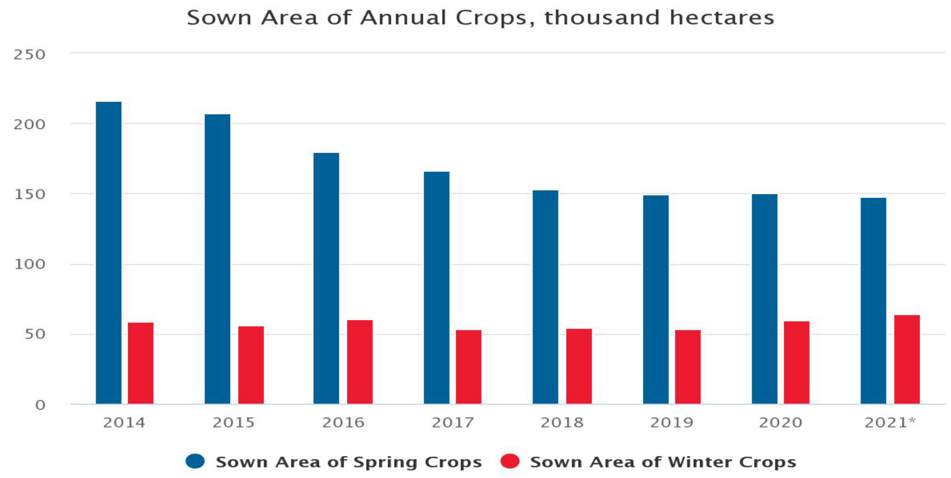


Figure 3.2-2 Sown area of annual crops during 2014-2021

Water: In Soviet times the area of irrigated land constituted 400,000 ha, while for year 2015 has been reduced to 40,000ha. Current water consumption is reported to be about 150 million cubic meters. The new Irrigation Strategy envisages to invest in rehabilitation of the irrigation system and to achieve the level of irrigated are of 200,000ha for the year 2025. Under this scenario the water consumption will reach 900 million cubic meters[6].

3.2.1.2.2 Crop Production

Crops can be divided into two main parts: a) annual crops, and b) perennial crops. Annual crops include the production of grains and vegetables (including watermelon, melon, and pumpkin). In 2012, Georgia's grain harvest was 370 thousand tonnes, which is 6 thousand tonnes more than in 2018. The harvest reached a maximum of 483,000 tonnes in 2013, with the lowest yield being at 288,000 tonnes in 2017. Corn and wheat are the main grains in Georgia. Compared to 2012, in 2018, the wheat harvest increased by 33%, but it still was lagging behind the 2015-2016 figures. As for the corn yield, it decreased by 27% in 2018, compared to 2012. In 2018, compared to 2017, wheat and corn crops increased (Figure 3.2-3). Kakheti region produces 80% of Georgia's wheat and 33% of its corn. The share of Samegrelo (25%) and Imereti (17%) is also high in the production of corn.

Potato and tomato are the most consumed vegetables in Georgia. By weight, more than half of all vegetables grown in Georgia come from potatoes. In 2018, Georgia harvested 238,000 tonnes of potatoes, which is 5% less than in 2012. Compared to 2017, in 2018 and 2019 the potato yield has increased by 32%, but it is still lagging behind the 2013 and 2016 figures. 62% of potato crops come from Samtskhe-Javakheti and 20% - from Kvemo Kartli. Harvest of tomatoes, cabbage, onions and other vegetables (beans, garlic, carrots, peppers, etc.) is declining. Only cucumber yield has a growth trend (see Annex 2).[7]

Despite the decline in total crop yields, there is a positive trend of productivity growth in almost every annual crop. There was an average of 9.9 tonnes of potatoes per hectare in 2012, while this

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[6] Irrigation Strategy for Georgia:2016 – 2025; Ministry of Agriculture of Georgia/Georgian Amelioration; 2017/WB financed study

[7] Georgia's Agriculture Sector Key Trends for 2012-2019; Transparency International; 2020

number reached 12.5 tonnes in 2018, which is a 26% increase. The highest increase was in the wheat crop yield. Compared to 2012, wheat yields per hectare increased by 47% in 2018. Corn (maize) had the slowest productivity growth (Figure 3.2-3)[8]. Georgian wheat production in 2021 increased by 32.9 percent to 136,100 tonnes, while the production of vegetables decreased by 15.4 percent to 149,000 tonnes year-on-year. Barley production went up to 58,300 tonnes (a 28.4 percent increase), while maize amounted to 233,000 tonnes (a 8.6 percent decrease).

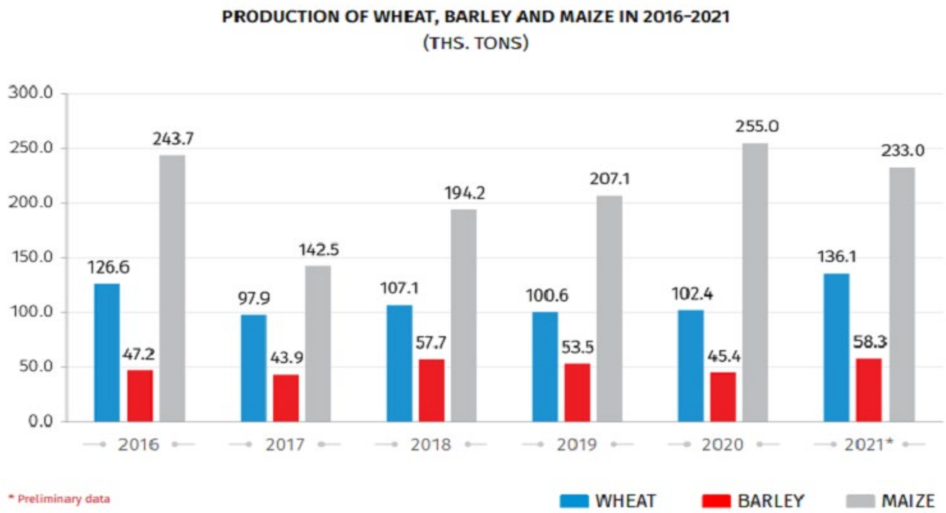


Figure 3.2-3 Production of wheat, barley and maize in 2016-2021

The production of potatoes in the country increased from year 2020 to 2021 year by 12.7 percent and reached 235,100 tonnes, as the data of the Geostat revealed. The average yield of maize and vegetables in the country reduced in 2021 compared to the previous year, while the figure grew for wheat, barley and potato.

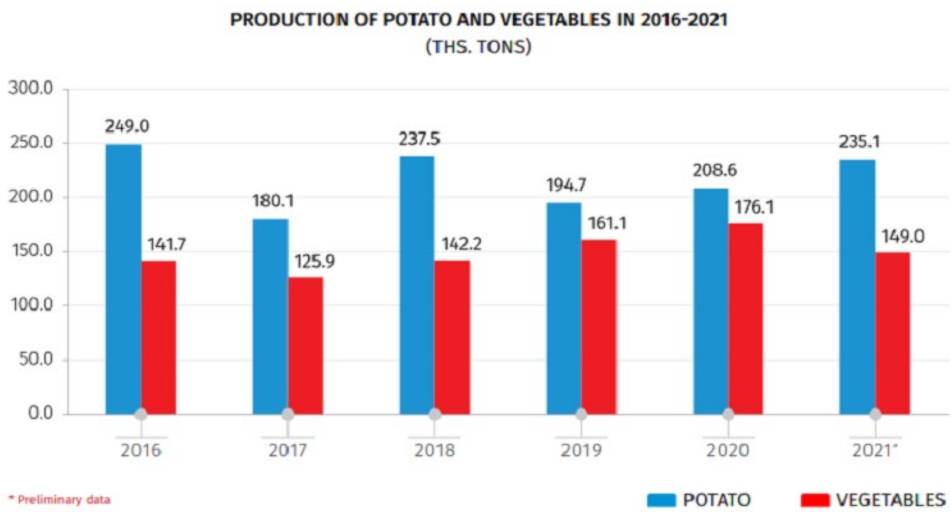


Figure 3.2-4 Production of potato and vegetables in 2016-2021

[8] National Statistics Office of Georgia (Geostat)/Geostat provides information related to maize along with statistics on other cereal grains produced last year.

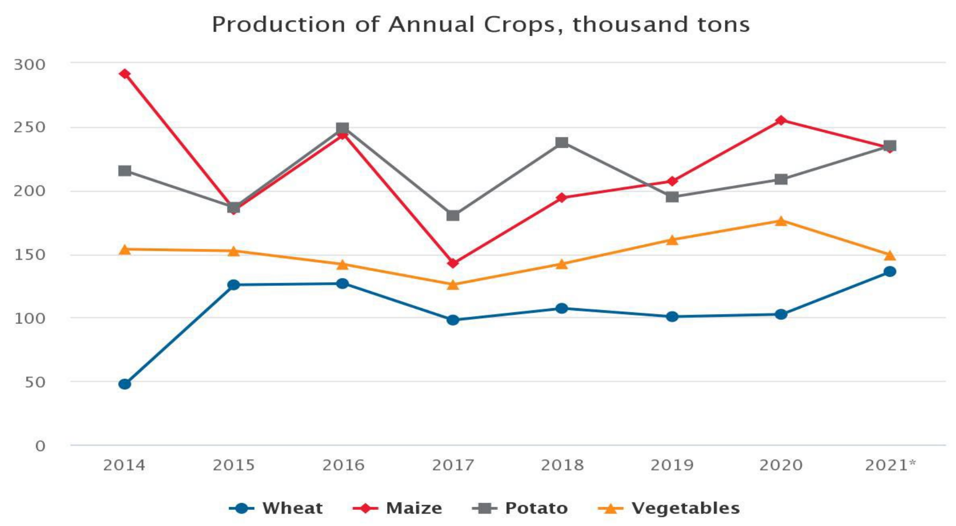


Figure 3.2-5 Production of annual crops in 2014-2021

3.2.1.2.3 Annual Crop Production, Export, Import and Internal Demand Balance for 2020

The export of annual crops is not high (around 15,000 tons per year), and is mostly related to the export of high quality products (vegetables and potato), while cheaper vegetables and potatoes are imported in much high amounts (137,000 tons). The most important item for import is wheat: the total import in 2020 was equal 561,000 tons.

Table 3.2-1 Average annual production, import and export of annual crops in 2020[9]

Annual Crop	Average Annual Production (ths. tons)	Average Annual Import (ths. tons)	Average Annual Export (ths. tons)
Wheat, total	102.4	561.0	0
Barley, total	45.4		
Oats	2.3		
Maize	255.0	121.0	1.0
Haricot beans	5.2		
Sunflower	1.9		
Potato	208.6	24.0	4.0
Vegetables, total	176.1	113.0	10.0
Melons total	83.6		
Hay	51.4		
TOTAL	**932**		

3.2.1.3 Food Loss and Waste in Annual Crop Value Chain

The most part of losses and produced wastes are related to the losses during harvest period and storage. The data on wastes is provided by Agriculture Scientific-Research Centre, which is the agency operating under the Ministry of Environmental Protection and Agriculture of Georgia

[9] Agriculture of Georgia 2020/Geostat/ Statistics Publication 2021

(MoEPA). In total about 47,700 tons of wastes is generated associated with the annual crop production. Used waste (mostly as additional animal fodder) is about 10% (4,770 tons).

Table 3.2-2 Average annual wastes/ losses of annual crop production sector

Annual Crop	Average Annual Wastes/losses (ths. tons)
Wheat, total	13.0
Barley, total	approximately 4.0
Oats	approximately 0.2
Maize	11.0
Haricot beans	approximately 0.1
Sunflower*	0.4
Potato	3.0
Vegetables, total	8.0
Melons total	approximately 8.0
Hay	
TOTAL	**47.7**

The waste minimization is strongly dependent on the availability of refrigerators and storage facilities. Data on currently available facilities is given Annex 2.

3.2.1.4 *Circularity Profile: Annual Crop Production*

<table>
<tr><th colspan="2">Agriculture, Forestry and Fishing
————————————————————
Sector nomination and NACE Index (NI): Crop and animal production, hunting and related service activities (NI/ 1)
Input in GDP of the entire sector (Mln GEL): 3,050.6
————————————————————
Subsector: Annual Crop Production</th></tr>
<tr><th>Material Resources Used:</th><th>Energy Consumption and GHG Emissions:</th></tr>
<tr><td>Agricultural land (arable land, haylands)
Area of Spring Crops (average 2018 – 2021) - 150,000ha
Area of winter crops (average 2018 – 2021) - 60,000ha
Current water consumption in irrigation systems:
- 150 million cubic meters for 2015 - 2017
- 900 million cubic meters for 2025
Irrigated land area:
- 40,000ha for 2015
- 200,000 ha planned for 2025
Total water consumption in agricultural sector (2020): 1430.42 million m^3</td><td>Mostly fossil fuel (diesel for tractors; natural gas for greenhouses)
Annual indicators for the entire agriculture sector;
- Electric power consumption: 83.8 GWh annually
- Natural Gas consumption: 10.3 mill. m^3 annually
GHG Emissions (for 2017) - 3,488 Gg CO_2(eq.)</td></tr>
</table>

Mass Flow Indicators:

Production Rate, import-export balance

Annual Crop	Average Annual Production (ths. tons)	Average Annual Import (ths. tons)	Average Annual Export (ths. tons)
Wheat, total	102.4	561.0	0
Barley, total	45.4		
Oats	2.3		
Maize	255.0	121.0	1.0
Haricot beans	5.2		
Sunflower	1.9		
Potato	208.6	24.0	4.0
Vegetables, total	176.1	113.0	10.0
Melons total	83.6		
Hay	51.4		
TOTAL	932	819	15

Annual wastes and losses:

Annual Crop	Average Annual Wastes/Losses (ths. tons)
Wheat, total	13.0
Barley, total	approximately 4.0
Oats	approximately 0.2
Maize	11.0
Haricot beans	approximately 0.1
Sunflower*	0.4
Potato	3.0
Vegetables, total	8.0
Melons total	approximately 8.0
Hay	
TOTAL	47.7
Used waste (mostly as animal fodder)	4,770 tons/ 10%
Not recycled waste	42,930 tons / 90%

Summary on circularity:

a) Current level of circularity is extremely low

b) Recycling of wastes is minimal and spontaneous (part of organic waste is used as animal food)

c) The land resources are not optimally used due to poor irrigation

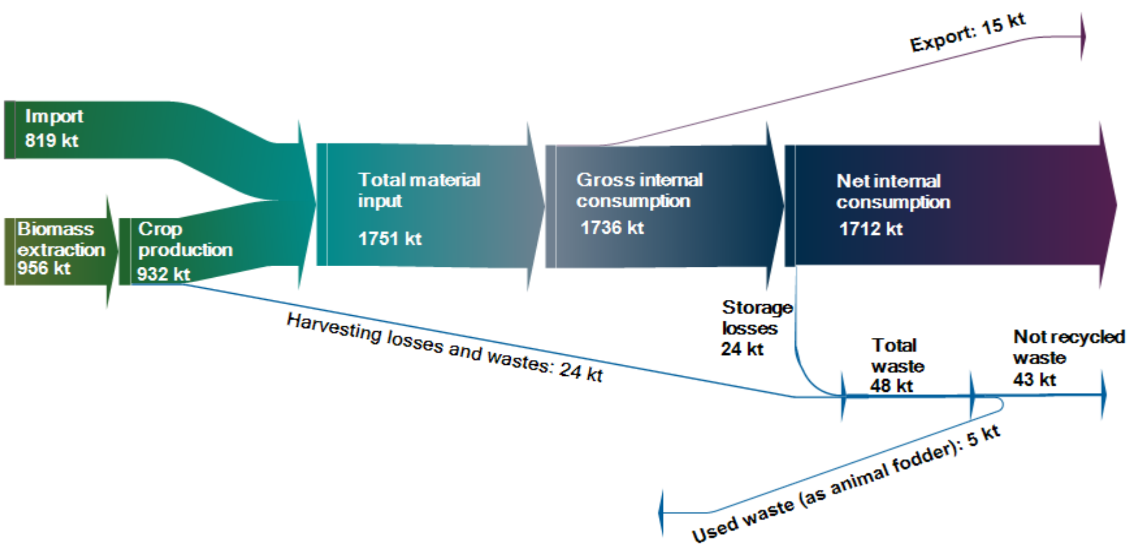


Figure 3.2-6 Mass flow diagram for annual crop production

Potential for improving circularity:

1. Collection and recycling of annual crop wastes
2. Rehabilitation of the irrigation systems at the entire country level, according to Irrigation Strategy
2. Modern crop storage facilities to minimize losses
3. Modern technologies optimizing production rate and resource restoration:

a) Modern agricultural technologies of plant production to improve productivity per ha
b) Modern, economically viable and resource saving schemes of irrigation and watering at the level of individual farms;
c) Enhancing land resources through modern agricultural technologies
d) Increase hay production through simple and non-costly interventions: seeding productive species of grass-plants on pastures

4. Implementation of energy supply schemes based on local renewable power (solar; wind; thermal) and energy efficient technologies in greenhouses, agribusiness farms and food processing plants

ReSOLVE FRAMEWORK

Regenerate	– Regenerate and enhance land resources using relevant agricultural techniques – Shift to renewable energy resources – Increase collection and use of annual crop waste
Share	– Rehabilitate irrigation systems according to the Irrigation Strategy, and ensure equitable access to water for all users
Optimise	– Increase energy efficiency of the sector – Optimize irrigation techniques to minimize losses – Optimise productivity of annual crops and arable lands – Optimize harvesting and storage techniques to minimize losses
Loop	
Virtualise	
Exchange	– Shift to higher productivity and/or higher value varieties of annual crops and eco-friendly agrochemicals

Key actors in implementing CE and direct beneficiaries:

► **Private sector:**
– Private elevators
– Private agricultural and food processing businesses
– Individual farmers

► **Local government:**
– Participation in Implementation of the irrigation programs

► **Central government:**
– Development and implementation of irrigation programs
– Support through developing the policy and creating incentives for CE activities

3.2.2 Permanent Crop Production

Agriculture, Forestry and Fishing

Sector nomination and NACE Index (NI): Crop and animal production, hunting and related service activities (NI/ 1)
Input in GDP of the entire agriculture sector (Mln GEL): 3,050.6 (7.1%)

Subsector: Permanent Crop Production Crop Production*

** This sector is accounted with the exception of grapes and winery products.*

3.2.2.1 Permanent Crop Production Sector

3.2.2.1.1 Resources

Land: The data on the land areas covered by perennial crops is available only for 2017 and 2020. According to the latest data, vineyards, orchards, citrus plantations and berries occupy a total of 127,900 hectares. Out of this area, orchards occupy 75,000 hectares, and vineyards - 41,200 hectares.

Table 3.2-3 Land Area Under Permanent Crops

Land Area (ths. hectares)	2017	2020
Land under orchards	74.8	75.9
Land under berries	1.0	1.7
Land under citrus plantations	8.9	9.1

Water: In Soviet times the area of irrigated land constituted 400,000 ha, while for year 2015 has been reduced to 40,000ha. Current water consumption is reported to be about 150 million cubic meters. The new Irrigation Strategy envisages to invest in rehabilitation of the irrigation system and to achieve the level of irrigated are of 200,000ha for the year 2025. Under this scenario the water consumption will reach 900 million cubic meters.[10]

3.2.2.1.2 Production (Biomass Extraction)

Perennial crops include fruits. In 2018, 513 thousand tonnes of fruits were harvested in Georgia. By weight, 88% of Georgia's fruit crops come from five sorts: grapes, apples, tangerines, peaches and nuts. Grapes are 51% of the total fruit crops. In 2012, this figure stood at 38%. Compared to 2012, in 2018, the tangerine and hazelnut crop declined, while the yield of grapes, apples and peaches increased. Since 2014, only grape and peach crops have increased. Grapes, which increased for 2019 by 116 thousand tonnes (80%), compared to 2012, and by 87 thousand tonnes (50%), compared to 2014, caused the total growth of fruit crop.[11]

Shida Kartli region produces 87% of apples in Georgia. 72% of grapes and 79% of peaches come from Kakheti. Samegrelo has 56% of hazelnut crop, and 73% of citrus is produced in Adjara. The production of pome fruit declined in the country for year 2021, posting a 16.2 percent reduction year-on-year to 85,600 tonnes, while the production of stone fruit also decreased by 5.4 percent, totalling 57,400 tonnes.[12]

Figures for other types of fruit produced in Georgia in 2021 were as follows:

- Nuts - 53,800 tonnes (+31.9%)
- Subtropical fruit - 23,000 tonnes (+3.1%)
- Citruses - 61,500 tonnes (+8.3%)

Table 3.2-4 Production of permanent crops (ths. tons) in 2015 - 2021

	2016	2017	2018	2019	2020	2021*
Pome fruit	77.1	25.8	93.3	52.7	102.1	85.6
Stone fruit	57.2	47.1	54.2	38.5	60.7	57.4
Nuts	33.4	24.9	23.1	30.9	40.8	53.8
Subtropical fruit	15.8	13.0	16.0	20.3	22.3	23.0
Berries	3.0	3.2	1.8	2.0	2.7	2.9
Citruses	65.5	58.2	66.3	64.0	56.8	61.5

Source: Geostat

[10] Irrigation Strategy for Georgia: 2016 – 2025; Ministry of Agriculture of Georgia/Georgian Amelioration; 2017/WB financed study

[11] Georgia's Agriculture Sector Key Trends for 2012-2019; Transparency International; 2020

[12] Geostat 2021/ https://agenda.ge/en/news/2022/1299

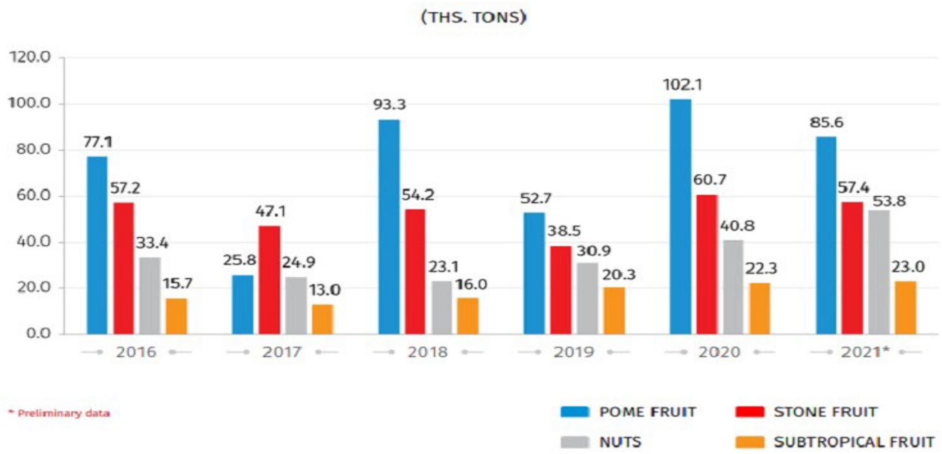
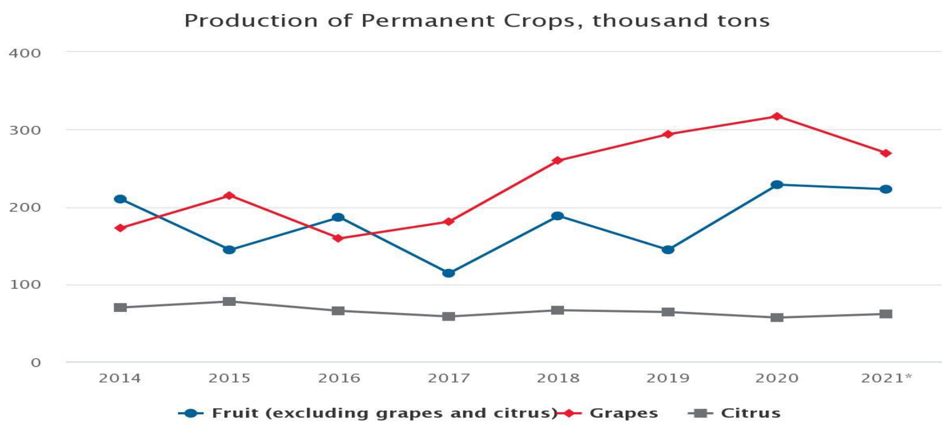


Figure 3.2-7 Production of pome, stone and subtropical fruits and nuts in 2016-2021[13]



Source: Geostat

Figure 3.2-8 Production of permanent crops in 2014-2021

3.2.2.2 *Permanent Crops Production, Export, Import and Internal Demand Balance*

Import of fruits in Georgia comprises seasonal supply of common fruits (apples, stone fruits etc.) and whole season supply of tropical fruits, like bananas. The main product for export from permanent crops is grape. Actually the entire share of exported grape is first processed into wine and wine is subject for export. Other fruits and berries are exported fresh or dried, and only 10% is processed fruits (juices, jams, etc.).

In 2020, Georgia exported $27M in Citrus, making it the 35th largest exporter of Citrus in the world. In 2020, Georgia imported $13.9M in Citrus, becoming the 76th largest importer of Citrus in the world. At the same year, Citrus was the 143rd most imported product in Georgia.[14]

The export rates data is available for 2007 – 2013 and shows quite low figures (see Figure 3.2-9).

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13 Geostat 2021/ https://agenda.ge/en/news/2022/1299

14 Citrus in Georgia/ https://oec.world/en/profile/bilateral-product/citrus/reporter/geo

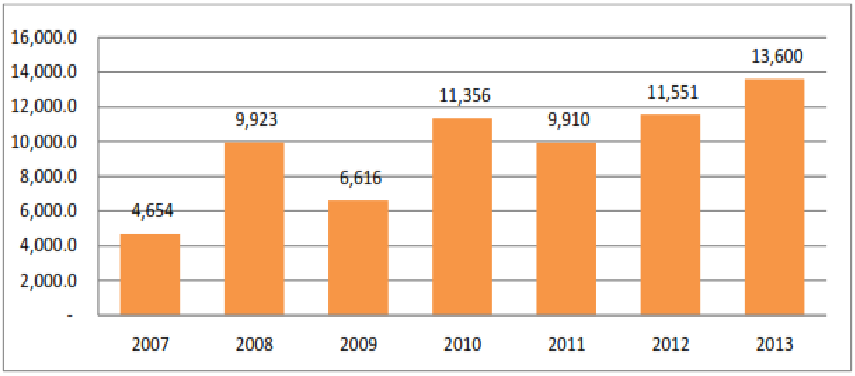


Figure 3.2-9 Total fruit export for 2007–2013 (thousand tons)[15]

The trend is positive after 2014 and shows permanent grow of fruit and nut export (fresh fruits, dried fruits and processed products).

Table 3.2-5 Summary Table: Permanent Crop Value Chain for 2018 - 2020

Permanent Crops	Average Production (ths. t/y)	Average Import (ths. t/y)	Processed Fruits (ths. t/y)	Internal consumption (ths. t/y)	Average Export (ths. t/y)
Nuts (walnut and hazelnut)	24.5	3.0		10.2	17.3
Citruses (orange, tangerine, lemon, kiwi, feijoa)	62.3	10.0	15.0	22.5	49.8 Total 15.0 processed 34.8 Fresh
All other fruit	163.5	97.8	50.0	178.8 (of this 5.0 processed)	81.6 (of this 45.0 processed)
TOTAL Fruits	**252.5**	**110.8**	**65.0**	**201.5**	**148.7**

3.2.2.3 *Food Loss and Waste in Permanent Crop Value Chain*

The losses and wastes are generated at the harvesting stage (10 – 12%) and during the processing of the product (about 7%). At present some part of the fruit waste is used as an additional fodder to feed the livestock.

Losses and waste generated during harvesting products and processing harvested and imported fruits are given in Table 3.2-6 below:

Table 3.2-6 Losses and wastes generated during fruit harvesting and processing in 2018-2020

Permanent Crops	Total waste (harvesting + storage and processing) (ths. tons/year)
Teal Leave	
Nuts (walnut and hazelnut)	3.15
Citruses (orange, tangerine, lemon, kiwi, feijoa)	12.0 -17.0
All other fruits	21.0
TOTAL	**41.15**

[15] Association of Young Economists of Georgia/Agricultural products value chain for Imereti and Racha regions of Georgia; 2015

3.2.2.4 *Circularity Profile: Permanent Crop Production*

Agriculture, Forestry and Fishing

Sector nomination and NACE Index (NI): Crop and animal production, hunting and related service activities (NI/ 1)
Input in GDP of the entire sector (Mln GEL): 3,050.6

Subsector: **Permanent Crop Production**

Material Resources Used:	Energy Consumption and GHG Emissions:
Land: 86,700 ha Current water consumption in irrigation systems: - 150 million cubic meters for 2015 - 2017 - 900 million cubic meters for 2025 Irrigated land area: - 40,000ha for 2015 200,000 ha planned for 2025 Total water consumption in agricultural sector (2020): 1430.42 million m³	Mostly fossil fuel (diesel for tractors; natural gas for greenhouses) Annual indicators for the entire agriculture sector: - Electric power consumption: 83.8 GWh annually - Natural Gas consumption: 10.3 mill. m³ annually GHG Emissions (for 2017) - 3,488 Gg CO_2(eq.)

Mass Flow Indicators:

Products:

Permanent Crops	Average Production (ths. t/y)	Average Import (ths. t/y)	Processed Fruits (ths. t/y)	Internal consumption (ths. t/y)	Average Export (ths. t/y)
Tea Leave	2.2				
Nuts	24.5	3.0		10.2	17.3
Citruses	62.3	10.0	15.0	22.5	49.8 Total 15.0 processed 34.8 Fresh
All Other Fruits	163.5	97.8	50.0	178.8 (5.0 processed)	81.6 (45.0 processed)
TOTAL	**252.5**	**110.8**	**65.0**	**201.5**	**148.7**

Annual Wastes and losses:

Permanent Crops	Total waste (harvesting + storage and processing), ths. t/y
Tea Leave	
Nuts (walnut and hazelnut)	3.15
Citruses	12.0 -17.0
All other fruits	21.0
TOTAL	**41.15**
Used waste	**0%**

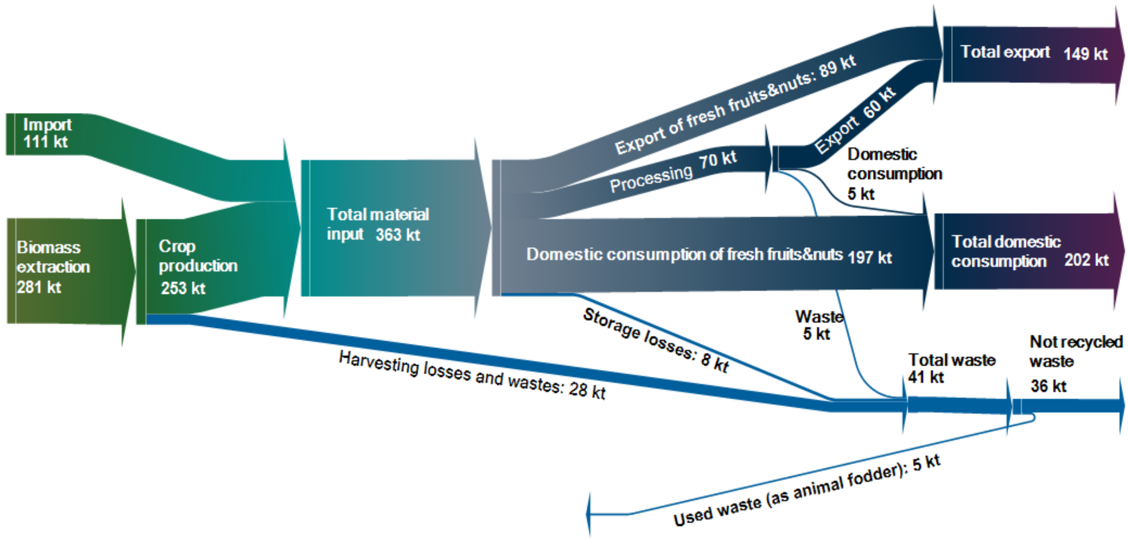


Figure 3.2-10 Mass flow diagram for permanent crop production

Potential for improving circularity:

1. Collection and recycling of permanent plant wastes;
2. Modern fruit storage facilities and refrigerators; minimization of losses;
3. Arrangement of fruit processing plants (minimization of losses)
4. Introduction of modern technologies optimizing production rate and resource restoration:
   a) Modern agricultural technologies of plant production and harvesting;
   b) Modern, economically viable and resource saving schemes of irrigation and watering;
5. Resource management: Irrigation of land; increasing productivity of used land; Increasing area of viable land for agriculture;
6. Implementation of energy supply schemes based on local renewable power (solar; wind; thermal) and energy efficient technologies in greenhouses, agribusiness farms and food processing plants.

ReSOLVE FRAMEWORK

Regenerate	– Regenerate and enhance land resources using relevant agricultural techniques – Shift to renewable energy resources – Increase collection and use of permanent crop waste – Increase processing to minimise losses
Share	– Rehabilitate irrigation systems according to the Irrigation Strategy, and ensure equitable access to water for all users
Optimise	– Increase energy efficiency of the sector – Optimize irrigation techniques to minimize losses – Optimise productivity of permanent crops and lands – Optimize harvesting and storage techniques to minimize losses
Loop	
Virtualise	
Exchange	– Shift to higher productivity and/or higher value varieties of permanent crops and eco-friendly agrochemicals

Key actors in implementing CE and direct beneficiaries:
► **Private companies:** – improving the efficiency of harvesting process and minimization of losses – Arrangement of storage facilities (minimization of losses) – Arrangement of fruit processing plants (minimization of losses) – Implementation of the CE technologies: recycling of wastes ► **Central Government:** – Improving Policy and creation of incentives for the private sector introduce CE elements in their businesses

3.2.3 Grape Production and Winemaking

Sector: Agriculture, Forestry and Fishing

Sector nomination and NACE Index (NI): Crop and animal production, hunting and related service activities (NI/ 1)
Input in GDP of the entire sector (Mln GEL): 3,050.6 (7.1%)

Subsector: Grape Production and Winemaking

3.2.3.1 Grape Production and Winemaking Sector

3.2.3.1.1 Regional Profile

Kakheti, Kartli, Imereti, Racha – Lechkhumi, Meskheti regions and the Black Sea coastal area (Guria, Samegrelo, Abkhazeti and Adjara) are the most developed areas for grape production and winemaking in Georgia. 72% of grapes come from Kakheti region.

► **Kakheti**

Kakheti is the most important winemaking region in Georgia. The vineyards giving the best quality wines are located in the Alazani and Iori basins, at 400-700 m asl, on humus-carbonate, black and alluvial soils. Of 20 aboriginal wines registered in Georgia 15 belong to Kakheti, such as Tsinandali, Gurjaani, Vazisubani, Manavi, Kardanakhi, Tibaani, Kakheti, Kotekhi, Napareuli, Mukuzani, Teliani, Kindzmarauli, Akhasheni, Kvareli and Khashmi. Among grape varieties there should be noted:

Rkatsiteli, Kakhuri Mtsvane (Kakhetian Green), Qisi, Khikhvi, Budeshuri, Mtsvivana, Sapena, Kunsi, Saperavi, Cabernet-Sauvignon, Tavkveri, Ikalto Red, etc. High quality wines are made Kakhetian grape varieties using both European and traditional wine making technology.

► Kartli

Kartli is one more notable wine making region in Georgia. It is known for its classic European style and high-quality sparkling wines. The vineyards are cultivated in extensive basins of the rivers - Mtkvari and its tributaries, Liakhvi and Ksani, at 450-700 meters above sea level. The indigenous sorts add a special character to Kartli as well as other regions. Notable white varieties are Chinuri, Gori Mtsvane, Budeshuri. The red varieties are Tavkveri, Shavkapito and Saperavi. Also we can meet rare varieties: Jvari, Andreuli, Aragvispiruli, Grdzelmtevana, Melikuda, Chrogha, Kharistvala, Rko, Dzelshavi. Besides local varieties foreign varieties are also common in Kartli: Aligote, Pino Nuari, Chardonnay, Sauvignon White, Merlot, Cyrano, Risling, Green Muscat and others. Like in Kakheti both traditional and European wine-making techniques are common in Kartli. Of the place of origin-named wines - Atenuri is produce just in Kartli.

► Imereti

Imereti is one of the most diverse regions of Georgian wine making, climatic conditions and soil composition are very different, and so the wines are also different every. The varieties spread in Imereti are: Tsolikauri, Thiska, Krakhuna, Kvishkhuri, Dondghlabi, Bazaleturi, Kundza, Tklapa, Otskhanuri Sapere, Argvetuli Sapere, Rko, Adanasuri, Bzvanura, Black Dondghlabi, Dzelshavi, Aladasturi, Vani Chkhaveri, etc. Traditional winemaking here as well as in other regions is linked with qvevri, which is called Churi in Imereti. The wine of Imeretian type has beautiful yellow colour, full, quite harmonious and cheerful. Imereti is famous for Sviri Krakhuna, Obchuri Tsolikouri and Kvalituri Tsitska. The place of origin wines – Sviri should be noted among them, in which three sorts of grapes - Tsitska, Tsolikouri and Krakhuna are used.

► Racha - Lechkhumi

Racha - Lechkhumi is distinguished other regions by scarcity of vineyards and rare grape varieties. The most widespread varieties are Tsulukidze Tetra and Tsolikouri, Aleksandrouli, Mudjuretuli, Rachuli Dzelshavi, Usakhelauri and Orbeluri. Racha encompasses the bigger section of Ambrolauri district. The vineyards here are grown mostly on the slopes of River Rioni gorge. The lower Racha is renowned for Khvanchkara micro-zone. Main micro-zones of Lechkhumi district are: Tsageri, Orbeli, Alpana-Tvishi, Zubi-Okureshi. Among the most notable wines in this region are Usakhelouri and the place of origin-named wines are Khvanchkara and Tvishi. Tvishi micro-zone climate provides high sugar content and acidity in Imeretian grape variety Tsolikouri, and exactly this micro-zone Tsolikouri is made naturally semi-sweet white wine Tvishi. It should be also noted Orbeli Ojaleshi which by its nature differs Mingrelian Ojaleshi.

► The Black Sea coastal area (Guria, Samegrelo, Abkhazeti and Adjara)

Viticulture and wine making of these regions is situated along the Black Sea coastal area, the vineyards are at 2-4 m above sea level and extend up to 500 meters. The climate is subtropical, humid, in some areas even wetland and therefore, the vine has a long vegetation period. Guria – Samegrelo region is probably one of the oldest centres of winemaking in Georgia. First of all, this region is distinguished by vine planting culture which had been almost entirely cultivated in high vineyards until the 19th century. Out of the local historical varieties the most known are Guruli:

Chkhaveri, Jani, Mtevandidi, Skhilatubani, Sakmiela; Mengrelian: Ojaleshi, Godaaturi, Chvitiluri, Chechipeshi. Vintage in these regions started very late, November and sometimes lasted even until the end of January.

Abkhazia and Adjara. Abkhazia is considered the historical region of winemaking. Vine here grows best of all up to the height of 400 to 800 meters. Earlier the winemaking here was developed quite at a high level, but powdery mildew and gray mold damaged this region very much. The local sorts are: Amlakhu, Avasikhva, Kaghighi, Agshibi, Akabuli, Absuaj, Lakoaj, Khapshira, Khunaliji and others. Besides the local varieties Tsolikouri, Ojaleshi, Chkhaveri, Krakhuna give good results in Abkhazia. As for Adjara, in recent years there has started the restoration of the old grape varieties and efforts are made to follow actively the winemaking. historical varieties in Adjara the best known are: Brola, Khopaturi, Klarjuli, Mekrenchkhi, Burdzghala, Kviristava, Shvashura, Jineshi, Satsuri, Batomura.

► Meskheti

Meskheti is probably the highest mountain viticulture region not only in Georgia, but throughout the world. The vine is found here at 900-1700 meters above the sea level. The Meskhetian Viticulture primarily means gardens and vineyards on terraces, which have several names: Oroko, Dariji, Bakani, Saqve. In Meskheti there was a lowland and a highland vineyard, although the main species was high, and it was of course different from the Guria-Samegrelo highlands, mainly because it was mostly on the apricot tree. Meskheti is one of the most ancient sites of viticulture in Georgia, some scientists believe that ancient Georgian varieties Saperavi, Dzvelshavi, Khikhvi and others could have origins in Meskheti.

3.2.3.1.2 Land Resources

The data on the land areas covered by perennial crops, including vineyards, is available only for 2017 and 2020. According to the latest data, vineyards occupy a total of 41,200 hectares.

Table 3.2-7 Land Area Under Permanent Crops (Dynamics)

Area (ths. hectares)	2017	2020
Land under vineyards	36.1	41.2

Table 3.2-8 Land Area under vineyards by Regions in 2021

	Entire Georgia	Distribution by Regions		
		Kakheti	Racha-Lechkhumi	Other regions
Land under vineyards ths. hectares	42.0	38.6	0.9	2.5

Source: LEPL National Wine Agency - Legal Entity of Public Law under the Ministry of Agriculture of Georgia

3.2.3.1.3 Production (Biomass Extraction)

Grapes are 51% of the total fruit crops produced in Georgia. In 2012, this figure stood at 38%. Since 2014, grape production has increased. Grapes, which increased by 116 thousand tonnes (80%) compared to 2012 and by 87 thousand tonnes (50%) compared to 2014, caused the total growth of fruit crop. 72% of grapes come from Kakheti region.

For year 2021 Geostat revealed the production of grapes in Georgia had decreased by 15.1 percent compared to the previous year, equalling 269,200 tonnes. Average production for 2009-2021 is estimated as 280,000 tons/year, while average for 2019–2021 is close to 300,000 tons/year.

Table 3.2-9 data on grape production in 2014-2021, ths. tons

	2014	2015	2016	2017	2018	2019	2020	2021*
Grapes	**172.6**	**214.5**	**159.2**	**180.8**	**259.9**	**293.8**	**316.9**	**269.2**
Of which:								
White grapes	-	-	111.8	121.6	179.3	203.1	224.1	184.8
Red grapes	-	-	47.4	59.2	80.6	90.7	92.8	84.4

* Preliminary data. The final data of 2021 will be available on June 15, 2022.
Source: Geostat

3.2.3.2 Grape Production, Winemaking, Export, Import and Internal Demand Balance

The main product from permanent crops is grape (see Figure 3.2-8). Its share is about 50% of all fruits. Grape is main fruit item for export. Actually the entire share of exported grape is first processed into wine and wine is subject for export. About 87% of harvested grapes (253,300 tons) are used for wine production. The wine export recalculated by grape mass equals 98,000 tons per year. Imported grapes are not used for wine production. Imported grapes are of table grape varieties.

Table 3.2-10 Summary Table: Grape and Wine Making Value Chain for 2018-2020

	Average Production (ths. t/y)	Average Import (ths. t/y)	Wine production (ths. t grape/y)	Internal consumption (ths. t/y)	Average Export (ths. t/y)
Harvested Grapes	290.2	1.0	87% Wine 253.3 ths.tons of grapes into Wine 212.8 wine 40.5 waste	37.9 (13%) grape as fruit 155.3 for wine 130.5 wine	98.0 grape as wine 82.3 wine

Table 3.2-11 Grape and Wine Making Value Chain statistics for 2020

	Total Georgia	By Regions		
		Kakheti	Racha-Lechkhumi	Other Regions
Turnover (Mll. GEL)	321,7	287,5	18,5	15,7
Land area occupied (ths. ha)	42,0	38,6	0,9	2,5
Annual Production (Thousand tons)	283,1	271,3	2,9	8,9
Annual production for selling (Thousand tons)	271,1	262,0	2,7	6,4
Annual production for self-consumption (Thousand tons)	12,0	9,3	0,2	2,5
Number of large enterprises processing grapes and average annual production	30 companies; 38,300 tons	25 companies 35,7 tons		5 companies; 2,600 tons

	Total Georgia	By Regions		
		Kakheti	Racha-Lechkhumi	Other Regions
Number of small and medium enterprises processing grapes and average annual production	6 companies; 300 tons		6 companies; 300 tons	
Number of individual households processing grapes and average annual production	25500 households, 244,200 tons	22000 households, 235,600 tons	1300 households, 2,600 tons	2200 households, 6,300 tons

3.2.3.3 Food Loss and Waste in Grape and Wine Value Chain

The losses and wastes are generated at the harvesting stage and during the processing of the product. The total amount of wastes as estimated by the National Wine Agency equals 50,500 tons. The waste consists of losses during harvesting (10,000 tons) and wastes produced during wine making (40,500 tons). The balance is as follows: total grape yield - 300,200 tons, 10,000 tons lost and 290,200tons harvested. 253,000 tons of grape are used for wine production: 212,800 tons of wine produced and 40,500 tons of organic waste generated.

3.2.3.4 Circularity Profile: Grape Production and Winemaking

Sector: Agriculture, Forestry and Fishing -- **Sector nomination and NACE Index (NI):** Crop and animal production, hunting and related service activities (NI/ 1) Input in GDP of the entire sector (Mln GEL): 3,050.6 (7.1%) -- Subsector: **Grape Production and Winemaking**	
Material Resources Used:	**Energy Consumption and GHG Emissions:**
Land: 41,200 ha Current water consumption in irrigation systems: - 150 million cubic meters for 2015 - 2017 - 900 million cubic meters for 2025 Irrigated land area: - 40,000ha for 2015 - 200,000 ha planned for 2025 Total water consumption in agricultural sector (2020): 1430.42 million m^3	Mostly fossil fuel (diesel for tractors; natural gas for greenhouses) Annual indicators for the entire agriculture sector: – Electric power consumption: 83.8 GWh annually – Natural Gas consumption: 10.3 mill. m^3 annually – GHG Emissions (for 2017) - 3,488 Gg CO_2(eq.)

Mass Flow Indicators:				
Products:				
Average Yield (ths.t/y)	Average Import (ths.t/y)	Wine production (ths. t/y)	Internal consumption (ths.t/y)	Average Export (ths.t/y)
300.2	1.0	Grapes processed - 253,300 Wine produced - 212.8	37.9 (13%) grape as fruit 130.5 wine	82.3 wine

Annual Wastes and losses:

Permanent Crops	Total waste (ths. t/y)
Organic wastes from wine production (Skin, seeds, etc.)	40.5
Wastes produced during harvesting	10.0
TOTAL	**50.5**
Share of recycled waste:	**0%**

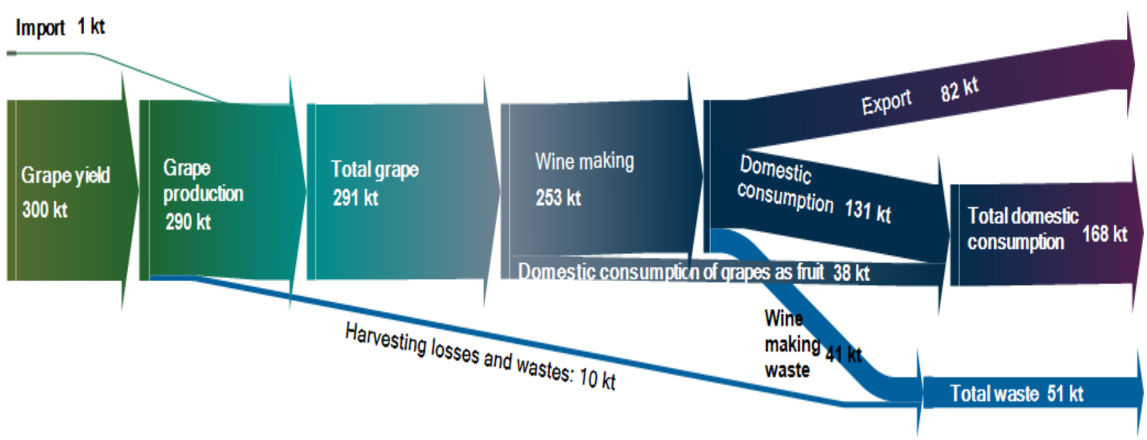


Figure 3.2-11 Mass flow diagram for grape and wine production

Potential for improving circularity:

1. Collection and recycling of grape production and winery wastes;
2. Optimization of grape collection from households with minimal losses; At present part of grapes harvested by individual farmers is lost or quality is lowered due to difficulties of purchase process organized by wineries.
3. Arrangement of fruit processing plants and additional wineries (minimization of losses);
4. Introduction of modern technologies optimizing production rate and resource restoration:
   a. Modern agricultural technologies of plant production and harvesting;
   b. Modern, economically viable and resource saving schemes of irrigation and watering;
5. Resource management: Irrigation of land; increasing productivity of used land; Increasing area of viable land for agriculture.

ReSOLVE FRAMEWORK	
Regenerate	– Collect and use of grape production and winery wastes – Increase processing to minimise losses – Regenerate and enhance land resources using relevant agricultural techniques – Shift to renewable energy resources
Share	– Rehabilitate irrigation systems according to the Irrigation Strategy, and ensure equitable access to water for all users
Optimise	– Increase energy efficiency of the sector – Optimize irrigation techniques to minimize losses – Optimise productivity of vineyards and lands – Optimize harvesting and storage techniques to minimize losses – Find new markets for grapes and wine to enhance the sector and minimize losses
Loop	
Virtualise	
Exchange	– Shift to higher productivity and/or higher value varieties of permanent crops and eco-friendly agrochemicals

Key actors in implementing CE and direct beneficiaries:

► **Private companies:**
– Improving the efficiency of harvesting process and minimization of losses
– Optimization of grape collection from households with minimal losses
– Implementation of the CE technologies: recycling of wastes

► **Central Government:**
– Improving Policy and creation of incentives for the private sector introduce CE elements in their businesses
– Support in optimization of grape collection from households with minimal losses
– Centralized programs for rehabilitation of Irrigation systems for vineyards.

3.2.4 Livestock Production

Sector: Agriculture, Forestry and Fishing

Sector nomination and NACE Index (NI): Crop and animal production, hunting and related service activities (NI/ 1)
Input in GDP (Mln GEL): 3,050.6 (7.1%)

Subsector: Animal Production

3.2.4.1 Resources and Production

3.2.4.1.1 Resources

The Soviet-period economic policy and the shift towards industrial agriculture caused a serious degradation of agricultural ecosystems. Natural meadows, which have been used as pastures and hay meadows for centuries, were especially affected. Unfortunately, the pace of degradation of pasture vegetation significantly exceeds that of restoration that in most cases excludes the possibility of natural self-regeneration of vegetation. An extremely dire situation can be observed on winter pastures, where together with overgrazing a process of desertification has started. Today, significant parts of both winter and summer pastures are covered by modified meadows thereof a considerable area can be characterized as disrupted natural ecosystems. Due to the large volume of livestock grazing, intensive processes of desertification and soil erosion have started in pastures, which are especially vivid in east Georgia. The semi-arid zone of Georgia (Kakheti) has been historically used as a winter pasture (from September to April) for livestock (mainly sheep). Livestock herded here, grazes on summer pastures in the northeast and central parts of Georgia. However, the existing area of winter- pastures is not sufficient for the livestock, which has increased in number for the past years Considering the semi-arid features of the zone/area the seasonally high number of sheep and uncontrollable grazing causes overstocking and signs of disturbance. For example, the Shiraki pastures, whose total area amounts to 57 000 ha, endure more than 400 000 sheep (more than half of sheep of the country) for more than seven months.

Such a high concentration of the sheep and an intensive utilization of pastures cause overgrazing, which becomes a reason of territory degradation.

Significant erosive processes on winter pastures in Kakheti have been observed. High and low parts of the pastures, except for modern terraces of Iori and Alazani, are composed of deposit rocks with the content of sea salt, which are easily subjected to weathering, collapsing and washing processes. The rocks having collapsed from the slopes gather on relatively plain pastures and cause an increase in salt content of the soil. Sheep farming is a traditional sector in the Mtskheta-Mtianeti region. During the Soviet Union, there were approximately 120 000 heads of sheep in Kazbegi Municipality, while their number exceeded 200 000 in Tianeti and Dusheti Municipalities. A drastic reduce in sheep is preconditioned by a shortage of winter pastures. The degradation of pastures is an important problem for Samtskhe-Javakheti region as well. Their productivity has perceptibly decreased. An additional problem is brought about by inadequate veterinary services. Irregular herding routes and disordered summer camps lead to risks of spreading such diseases as foot-and-mouth disease and anthrax. Due to sheep overgrazing, pastures on both slopes of Kvernati Ridge in Shida Kartli are moderately eroded; at some places, soil erosion is being observed. However, there are miscellaneous opinions about the condition of pastures. These opinions are held due to the fact that it has been long times since in-depth investigations of pastures have taken place. Since the collapse of the Soviet Union, the pastures assessment and monitoring system has been dysfunctional in Georgia. The methodologies that have been used in Soviet times are either outdated or require an engagement of huge amount of material and high-qualified human resources. Unfortunately, together with the collapse of uniform state financing system, the relevant research institutes have become unable to pursue their researches which resulted in cessation of pastures assessment and monitoring. Hence, Georgia today is lacking both an up-to-date assessment of pastures and a monitoring.[16]

For year 2018 Georgia has 788,000 hectares of agricultural land, out of which 488,000 hectares were arable or for greenhouse and perennial plants. Pasture and hayland is 300,000 hectares.[17]

3.2.4.1.2 Livestock and livestock products

At the end of 2018, farmers and households in Georgia had a total of 1,912 thousand livestock (cattle, pigs, sheep and goats). This figure is 8% lower than in 2012 and 7% lower than in 2014. Compared to 2012, the number of cattle and pigs decreased, while the number of sheep and goats increased. Compared to 2014, the quantities of livestock are reduced by a total of 148,000. Compared to 2017, in 2018, only the number of pigs has increased by 13 thousand, while the rest has decreased by 141 thousand.

Compared to 2012, in 2018, the number of poultry increased by 32%. However, since 2015 there has been a declining trend of poultry production. For example, in 2018, compared to 2017, poultry production decreased by 198 thousand and amounted to 8,111 thousand. The decline in poultry production continued in 2019. In the first half of the year, compared to the same period of 2018, the number of poultry decreased by 5% - 497 thousand.

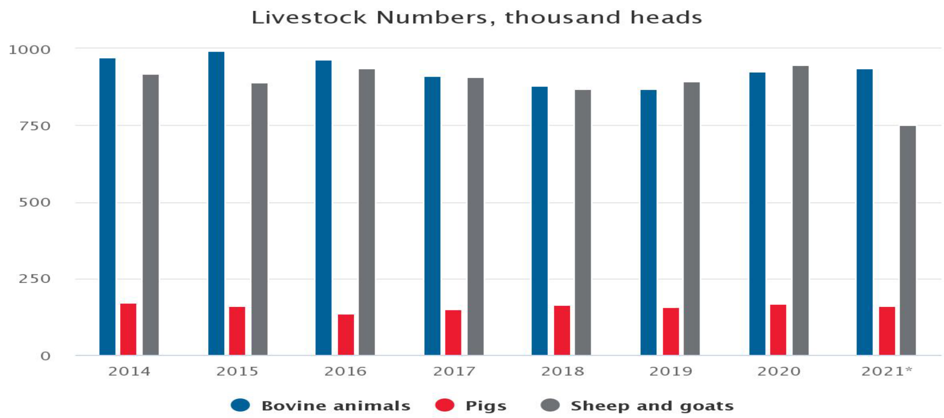
[16] Pasture Management in Georgia Report of 2019; REC Caucasus and GIZ.

[17] Transparency International Report: of 12 March, 2020 “Trends in Georgia's Agriculture Sector in 2012-2019”

Table 3.2-12 Number of livestock in 2014-2021, ths. heads

	2014	2015	2016	2017	2018	2019	2020	2021*
Bovine animals	970.0	992.1	962.7	909.7	878.9	869.5	925.8	935.2
Pigs	169.7	161.5	136.2	150.7	163.2	155.5	165.7	161.0
Sheep and goats	919.6	891.4	936.5	907.0	869.5	891.5	946.5	750.0
Poultry, ths. heads	6 657.8	8 308.6	8 237.8	8 386.0	8 110.9	9 466.4	10 146.5	9 039.8
Beehives, ths. hives	190.7	197.1	205.3	240.6	257.8	257.3	228.5	...

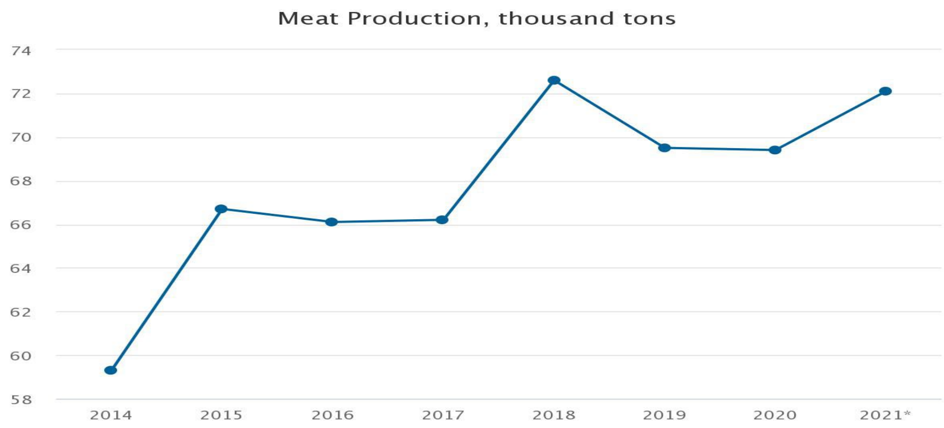
Source: Geostat



Source: Geostat

Figure 3.2-12 Livestock numbers in 2014-2021

The decline in the quantities of livestock in 2012-2018 did not have a clear impact on livestock production. Meat production had an upward trend. In 2018, 73,000 tons of meat was produced in the country, which is 70% more than in 2012 and 22% more than in 2014. Growth rates were observed in beef, as well as pork, lamb and poultry production.



Source: Geostat

Figure 3.2-13 Meat Production in 2014-2021

Unlike meat, milk production has decreased. In 2018, compared to 2014, only 555 million liters of milk were produced, which is a 6% decrease. In 2018, 635 million eggs were produced, which is 34% more than in 2012 and 15% more than in 2014 (Figure 18). In the first half of 2019, compared to the same period of 2018, meat production decreased by 6.7%, and egg production - by 4.8%, while milk production increased by 0.8%.

Table 3.2-13 Production of livestock products in 2014-2021, ths. tons

	2014	2015	2016	2017	2018	2019	2020	2021*
Meat, total	**59.3**	**66.7**	**66.1**	**66.2**	**72.6**	**69.5**	**69.4**	**72.1**
Of which:								
Beef	22.8	24.4	21.5	21.4	22.9	22.1	20.1	...
Pork	17.3	18.7	16.1	15.5	17.6	18.3	19.8	...
Sheep and goat	4.1	4.8	4.6	6.7	9.1	5.9	4.9	...
Poultry	14.6	18.4	23.5	22.3	22.6	22.8	24.2	...
Other meet	0.4	0.4	0.4	0.4	0.4	0.4	0.4	...
Milk (mill. litres)	**588.8**	**566.3**	**540.1**	**528.4**	**555.3**	**561.8**	**569.0**	**577.5**
Egg (mill. pieces)	**551.9**	**602.5**	**590.4**	**600.1**	**634.8**	**661.2**	**674.5**	**637.7**
Wool	**2.1**	**2.3**	**2.0**	**2.0**	**1.9**	**1.8**	**1.9**	**...**
Honey	**1.9**	**2.0**	**2.1**	**2.5**	**2.5**	**2.5**	**2.4**	**...**

Source: Geostat

3.2.4.2 Livestock Production, Export, Import and Internal Demand Balance

Table 3.2-14 Livestock Production, Export, Import and Internal Demand in 2017-2020

Livestock products	Average Annual Production (ths. tons)	Average Annual Import (ths. tons)	Average Annual Export (ths. tons)	Average Annual Consumption (ths. tons)
Beef	21.0	8.0	2.0	27.0
Pork	18.0	22.0	1.3	38.7
Sheep and goat	6.5	0.5	4.0	3.0
Poultry	23.0	53.0	7.0	69.0
Milk and milk products	550.0	140.0	11.0	679.0
TOTAL	618.5	223.5	25.3	816.7
Eggs[18]	650 Mill eggs	25 Mill. eggs	5.8 Mill. eggs	669.2 Mill eggs
	32,500 tons	1,250 tons	290 tons	33,460 tons

Source: Geostat

3.2.4.3 Food Loss and Waste in Livestock Value Chain

Table 3.2-15 Average annual waste disposed (not used) during 2017-2020

Livestock products	Average Annual Waste Disposed (not used) (ths. tons)
Beef	9.3
Pork	9.4
Sheep and goat	1.3
Poultry	5.5
Milk and milk products	6.5
TOTAL	32.0

[18] 50 gr is taken for the egg weight to estimate tonnage of eggs

3.2.4.4 *Circularity Profile Livestock Production Subsector*

Sector: Agriculture, Forestry and Fishing

Sector nomination and NACE Index (NI): Crop and animal production, hunting and related service activities (NI/ 1)
Input in GDP (Mln GEL): 3,050.6

Subsector: **Animal Production**

Material Resources Used:	Energy Consumption and GHG Emissions:
Land: Pasture and hayland is 300,000 hectares. Total water consumption in agricultural sector (2020): 1430.42 million m^3	Mostly fossil fuel (diesel for tractors; natural gas for greenhouses) **Annual indicators for the entire agriculture sector:** Electric power consumption: 83.8 GWh annually Natural Gas consumption: 10.3 mill. m^3 annually GHG Emissions (for 2017) - 3,488 Gg CO2(eq.)

Mass Flow Indicators:

Products:

Livestock products	Average Annual Production (ths. tons)	Average Annual Import (ths. tons)	Average Annual Export (ths. tons)	Average Annual Consumption (ths. tons)
Beef	21.0	8.0	2.0	27.0
Pork	18.0	22.0	1.3	38.7
Sheep and goat	6.5	0.5	4.0	3.0
Poultry	23.0	53.0	7.0	69.0
Milk and Milk Products	550.0	140.0	11.0	679.0
TOTAL	**618**	**223.5**	**25.3**	**816.7**
Eggs	650 Mill eggs	25 Mill. eggs	5.8 Mill. Eggs	669.2 Mill eggs
	32,500 tons	1,250 tons	290 tons	33,460 tons
GRAND TOTAL	**650.5**	**224.75**	**25.59**	**850.16**

Annual Wastes and losses:

Livestock products	Average Annual Wastes (ths. tons)
Beef	9.3
Pork	9.4
Sheep and Goat	1.3
Poultry	5.5
Milk and Milk Products	6.5
TOTAL	**32.0**
Share of recycled waste	**0%**

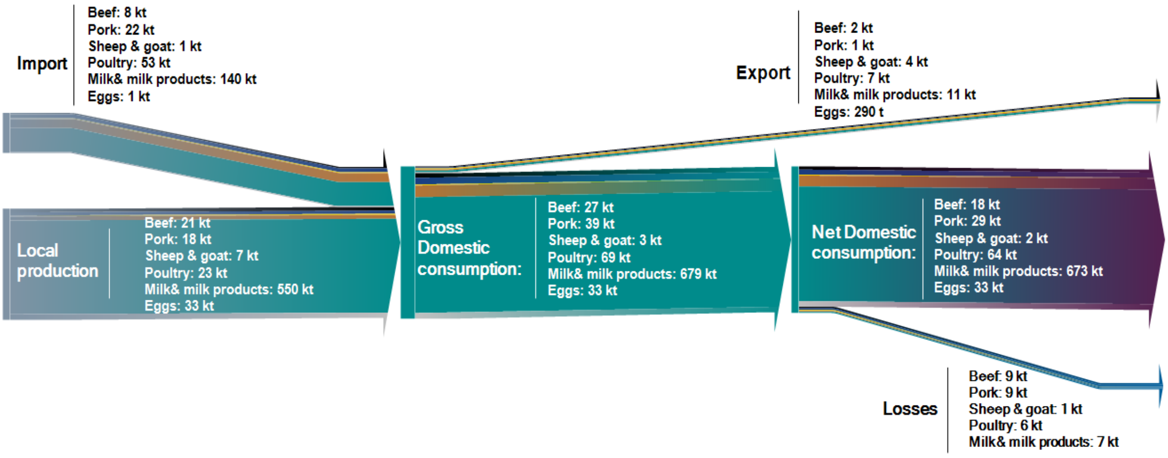


Figure 3.2-14 Mass flow diagram for livestock production sector

Potential for improving circularity:

Potential for increasing level of circularity:

1. Collection and recycling of animal production and diary wastes;
2. Rehabilitation and improvement of pastures replacing the native, low-productive grass by high productive grass species
3. Improvement of veterinary services
4. Introduction of modern technologies optimizing production rate and resource restoration:
    a. Modern agricultural technologies of cattle breeding, husbandry and dairy production
    b. Artificial breeding

Implementation of energy supply schemes based on local renewable power (solar; wind; thermal) and energy efficient technologies in greenhouses, agribusiness farms and food processing plants

RESOLVE FRAMEWORK

Regenerate	– Collect and use of animal production and diary wastes – Regenerate and enhance pastures using modern land reclamation and cattle grazing techniques – Shift to renewable energy resources in cattle farms and processing plants
Share	– Rehabilitate irrigation systems according to the Irrigation Strategy, and ensure equitable access to water for all users – Promote shared use of storage and processing facilities
Optimise	– Optimize the use of haylands – Increase energy efficiency of the sector – Optimise productivity of animal husbandry – Optimise diary production to minimize losses – Optimize water use to minimize losses and increase availability of this resource
Loop	
Virtualise	
Exchange	– Shift to higher productivity varieties of animals

Key actors in implementing CE and direct beneficiaries:
▶ **Private companies:**
– Collection and recycling of the animal production and dairy products (production of animal fodder etc.)
– improving the efficiency of cattle breeding and poultry practices minimization of losses
– Improvement of veterinary services
▶ **Individual farmers/ households:**
– Collection and recycling of the animal production and dairy products (production of animal fodder etc.)
– improving the efficiency of cattle breeding and poultry practices minimization of losses
▶ **Central Government:**
– Improving Policy and creation of incentives for the private sector introduce CE elements in their businesses
▶ **Municipal Authorities:**
– Rehabilitation and improvement of pastures
– Improvement of veterinary services

3.2.5 Forestry and Manufacture of wood and of products of wood

Sector nomination and NACE Index (NI): Forestry (NI 2) and Manufacture of wood and of products of wood (NI/ 16)

Input in GDP (Mln GEL): Forestry 117.6 Mln.GEL (0.3%) / Manufacture of wood and of products of wood 49.2 Mln.GEL (0.1%)

3.2.5.1 The forest sector in Georgia's economy

The forestry sector forms only a small part of Georgia's economy. The total share of the forestry in GDP is 0.3%, or GEL 117.6 Mln in monetary values in 2019. This figure includes both timber and non-timber forest products, however accounts only for legal sector only. Separate estimates for timber and non-timber forest products are not readily available; however, the share of non-timber products should be negligible if consider logging volumes (see below). Wood processing has even smaller contribution in the national economy comprising only 0.1% of GDP, i.e. GEL 49.2 Mln in 2019. That is, these two economic activities comprise 0.4% of GDP, or GEL 166.8 Mln (Geostat). Legal logging, transport and wood processing contributed about GEL 75 Mln to Georgia's GDP in 2014 that was the same 0.3% of the total GDP[19].

[19] Wood market study / Authors: Michael Garforth, Sten Nilsson, Paata Torchinava / Integrated Biodiversity Management/ December 2016

3.2.5.2 Forest Resources

According to 2020 data, the forest area of Georgia is around 3.1 Mln. ha, that is around 43% of the country's territory respectively. Of the total forest area, ca. 1.9 Mln ha are under the National Forestry Agency (NFA), 500 ths. ha under the Agency for Protected Areas, 150 ths. ha under the Forestry Department of the Autonomous Republic of Adjara, and remaining 423 ha under the Autonomous Republic of Abkhazia and out of the control of the Government of Georgia. It should be noted that only 2.8 Mln. ha land area, i.e. 40.3% of the country territory is factually covered by forest (Table 3.2-16) [20]. Georgia is a highland country, thus almost all forest (97.7%) are located on the mountain slopes.

The distribution of the forest area by regions of Georgia is shown in Table . According to this data, Imereti region has the largest share in the forest area among the regions controlled by the GoG.

Regarding species composition of forests in Georgia, according to 2002 data (Metreveli, 2002), *Fagus* spp. is the most widespread occupying 48.5% of the forest area, *Quercus* spp. - 10.2%, *Abies* spp. - 8.4%, *Carpinus* spp. - 6.6%, *Picea* spp. - 5.8%, *Pinus* spp. 4.7%, *Alnus* spp. - 3,2%, *Castanea sativa* - 2.5%, other species - 10.1%.[21]

Table 3.2-16 Forest area in 2020 (Geostat)

	Forest area	
	ths. ha	%
Forest area of Georgia	**3 063.6**	**100**
Forest area under the Abkhazia AR*	423.4	13.8
Forest area under the Forestry Agency of Adjara	149.6	4.9
Forest area under the Agency of Protected Areas**	500.1	16.3
Forest area under the National Forestry Agency***	1 990.5	65.0

*The data were evaluated by satellite observation as a result of spectral analysis.

** Including Autonomous Republic of Abkhazia and Tskhinvali region. In 2019, the forest areas under the Agency of Protected Areas was specified.

*** Including Tskhinvali region.

Source: MoEPA. LEPL Agency of Protected Areas. LEPL Forestry Agency of Adjara. LEPL National Forestry Agency.

The volume of wood standing in the forest was reported to be about 454 Mm^3 in 2015, and the annual increment around 4 Mm^3. These data are not precise: 85% of Georgia's forests have not been inventoried for more than 15 years and 60% for more than 20 years.[22]

Wood Market Study (2016)[23] reports that high proportion of logging during the last 25 years has been carried out without proper authorization or without any authorization at all and has not been officially recorded. According to this study estimations, 2.7–3.0 Mm^3 of roundwood were removed from Georgia's forests in 2014 what is five times more than the sustainable volume estimated by

[20] Natural Resources of Georgia and Environmental Protection 2020 / Statistical Publication National Statistics Office of Georgia; Tbilisi

[21] Wood market study / Authors: Michael Garforth, Sten Nilsson, Paata Torchinava / Integrated Biodiversity Management/ December 2016

[22] ibid

[23] ibid

this study at 600,000 m^3. Out of that amount 0.7 Mm^3 were harvested legally and 2.0-2.3 Mm^3 illegally; thus 75% of the removals were illegal. It should be noted that illegal logging rate reported by Geostat much lower comprising 45,915 m3 in 2014[24], and ca. 34,590 m3 in average during 2015-2020 (see Table 3.2-19).

In 2013 the NFA estimated sustainable wood removals to be 1.09 Mln. m^3 annually for Georgia excluding Abkhazia AR, and in the NFA reported to Forest Europe in 2015 that the gross annual increment in the exploitable forests is 0.94 Mm^3/year (Wood Market Study, 2016).

Forest restoration measures, including seedling and planting of forest forming species as well as facilitating natural regeneration process are carried out each year in the country. On average around 180 ha are reforested each year since 2010, mainly through facilitation of natural recovery (Table 3.2-17).[25] Thanks to this, the net gain of forest areas comprised 100 ths. ha from 2010 to 2020; however, this is not a significant growth (see dashed trendline in Figure 3.2-15).

Table 3.2-17 Forest restoration measures since 2010

Year	Forest restoration, ha	Forest seeding and planting, ha	Facilitating natural recovery of forest, ha	Area covered by forest, Mln. Ha
2010	165	111	54	2.77
2015	142	21	121	2.70
2016	178	50	128	2.69
2017	156	44	112	2.69
2018	265	152	113	2.68
2019	201	15	186	2.66
2020	166	8	158	2.80

Source: MoEPA. LEPL Agency of Protected Areas. LEPL Forestry Agency of Adjara. LEPL National Forestry Agency.

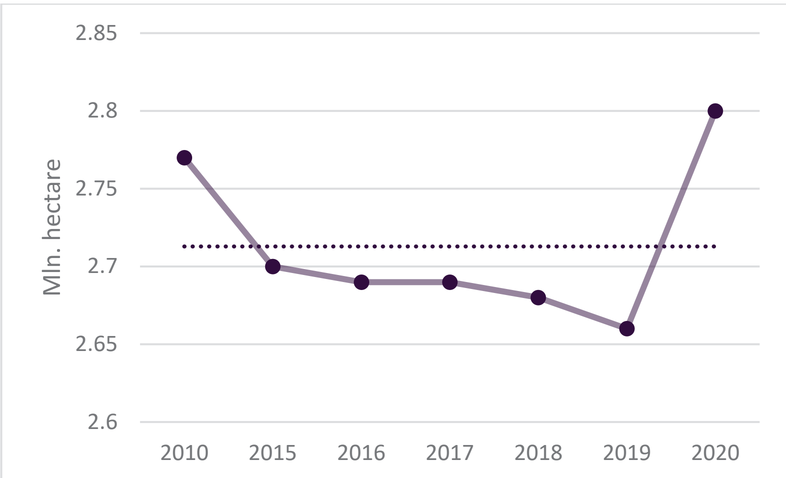


Figure 3.2-15 Forested area dynamics from 2010 to 2020

[24] Natural Resources of Georgia and Environmental Protection 2020 / Statistical Publication National Statistics Office of Georgia; Tbilisi

[25] ibid

3.2.5.3 Timber Production

Below provided Table 3.2-18 shows legal timber harvesting volumes for 2015-2020 period. As it shows, timber production has gradually reduced during given period. The average annual harvesting of timber comprised 605,145 cubic metre, which is rather close to the sustainable logging rate defined by the Wood Market Study (2016). In regional context, Samtskhe-Javakheti is on leading position in timber production though this region is on the second lowest position after Guria by forested areas (see Annex 6).

Table 3.2-18 Volume of felled timber in cubic metre in 2015-2020 according to Geostat

	2015	2016	2017	2018	2019	2020	Average Annual
Georgia	712 336	628 035	630 462	578 031	593 235	488 773	605 145

Source: MoEPA. LEPL Agency of Protected Areas. LEPL Forestry Agency of Adjara. LEPL National Forestry Agency.

Table 3.2-19 gives illegal logging volumes for 2015-2020 period. According to this data, average annual illegal logging comprised ca. 32,700 m³ for this period, i.e. around 5% of the total wood harvesting. However, as mentioned above, Wood Market Study (2016) gives different estimate of illegal logging concluding that it comprised 2.0-2.3 Mln. m³ or 75% of the total logging in 2014.

Table 3.2-19 Illegal logging data for 2015-2020 (cubic metre)

	2015	2016	2017	2018	2019	2020	Average Annual
Georgia	44 612	28 586	35 022	32 494	38 507	16 998	32 703

Source: MoEPA. LEPL Agency of Protected Areas. LEPL Forestry Agency of Adjara. Department of Environmental Supervision.

According to Wood Market Survey (2016), 2.7–3.0 Mm³ were cut in 2014, and 2.2-2.3 Mm³ (i.e. 77-81%) of the wood removed were used as fuel. This is not consistent with Table 3.2-18; however, Energy Balance of Georgia (Geostat, 2015) informs that ca. 2.475 Mm³ firewood was harvested and used in Georgia in 2014 – this is much higher than the total (legal and illegal) logging values reported by Geostat (2020) (Table 3.2-18 and Table 3.2-19), and comparable to the findings of Wood Market Study (2016). Considering this, for the purpose of this report it is assumed that 80% of harvested timber represents firewood reported in the Energy Balance of Georgia, and wood cutting volumes for respective years are estimated based on this. These estimates are given in Table 3.2-20, and used for mass flow balance.

Table 3.2-20 Volumes of fuel wood and estimated wood harvesting in 2015-2020

	2015	2016	2017	2018	2019	2020	Average Annual
Fuel wood production (ths. m³)[26]	2,124.6	2,052.2	1,937.8	1,440.1	1,295.0	1,212.0	**1,677**
Total wood production (ths. m³)	2,656	2,565	2,422	1,800	1,619	1,515	**2,096**
Total wood production (ths. ton)	***2,045***	***1,975***	***1,865***	***1,386***	***1,247***	***1,167***	***1,614***
Of them illegal logging (ths. m³)*	1,944	1,937	1,792	1,222	1,026	1,026	**1,491**

** The volume of Illegal logging is estimated based on officially reported data on legal logging*

[26] Energy Balance of Georgia for 2016, 2017, 2018, 2019, 2020, and 2021. Geostat.

In order to comprise the mass flow balance, relevant volumetric data has been converted into mass equivalent. Species distribution of collected timber material is not known. Therefore, we used the averaged density of green tree of the main forest forming species (see Section 3.2.5.1). This accuracy is sufficient for the purpose of this report. The density of the main forest forming species are provided in Table 3.2-21.

Table 3.2-21 Volumes of fuel wood and estimated wood harvesting in 2015-2020[27]

Tree species	Density, kg/m^3
Beech	865
Oak	977
Alder	721
Chestnut	881
Hornbeam (dry)	762
Fir	737
Pine	673
Spruce	545
Average	770

3.2.5.4 Import, Export and Internal Consumption of Non-Processed Timber

Table 3.2-22 and Table 3.2-23 below, which are taken from Geostat data[28], provide import and export rates of non-processed timber for 2015-2020 period.

As Table 3.2-22 shows, non-processed timber is regularly imported in Georgia. The average annual import comprises 28,440 cubic metres. According to Geostat, the main importer is Turkey with average 44% for the period.

Import of non-processed timber is around 1.4% of the local logging as estimated in Table 3.2-20. However, the import demonstrates notable growing trend (see trendline in Figure 3.2-16).

Georgia's export of non-processed timber is very low and irregular, with 91.64 m^3 annual average for the discussed 2015-2020 period. As Table 3.2-23 below shows, the export was zero or negligible in some years. The average annual import of non-processed timber comprised 0.02% of the total timber production.

Table 3.2-22 Import of non-processed timber in 2015-2020

		2015	2016	2017	2018	2019	2020	Average Annual
Total import	ths. USD	4,058.4	3,043.7	4,019.4	5,448.1	5,015.9	3,091.7	**4,112.9**
	m3	27,052	23,114	25,377	30,901	37,495	26,706	**28,440**
	tons	20,830	17,798	19,540	23,794	28,871	20,564	**21,899**

Source: National Statistics Office of Georgia.

[27] https://www.engineeringtoolbox.com/weigt-wood-d_821.html

[28] Natural Resources of Georgia and Environmental Protection 2020 / Statistical Publication National Statistics Office of Georgia; Tbilisi

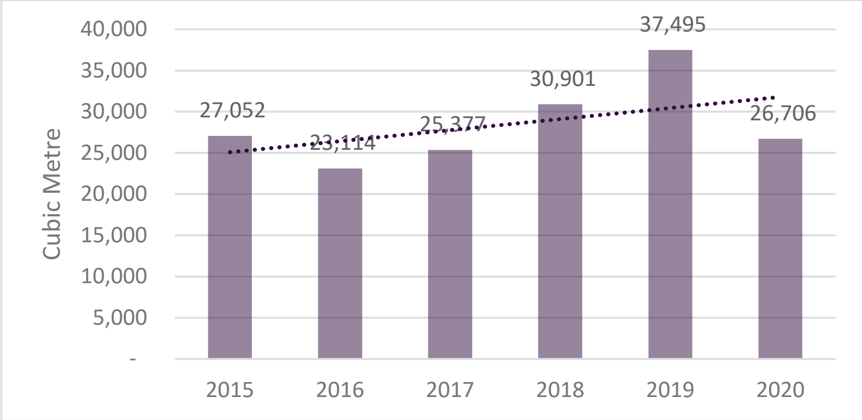


Figure 3.2-16 Import of non-processed timber in 2015-2020

Table 3.2-23 Export of non-processed timber in 2015-2020

		2015	2016	2017	2018	2019	2020	Annual Average
Total export	ths. USD	15.1	11.9	15.9	0.5	-	22.2	**13.12**
	m^3	126	15	200	1	-	116.2	**92**
	tons	97	12	154	1	0	89	**71**

Source: National Statistics Office of Georgia.

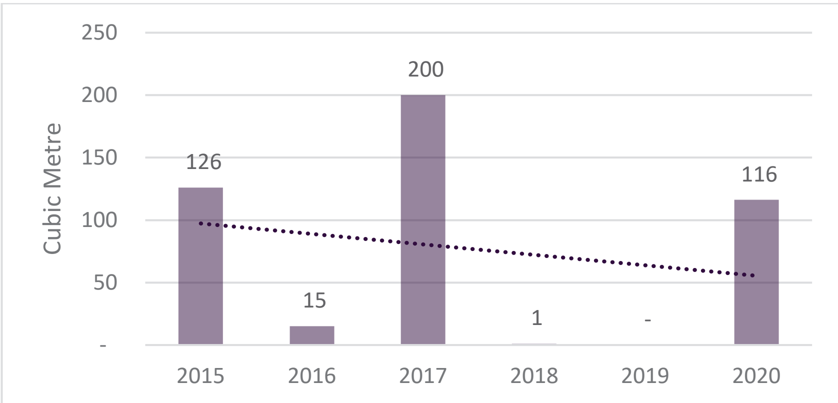


Figure 3.2-17 Export of non-processed timber in 2015-2020

The Wood Market Survey (2016) found that the major portion of harvested wood is used for fuel by population. As mentioned above, this is assumed to be roughly 80% of the total logging. Fire wood production volumes as of the annual reports on Energy Balance of Georgia (Geostat) are given in Table 3.2-20 above. According to this reports, virtually all fuel wood harvested is consumed locally.

3.2.5.5 Processed Wood Production, Import and Export Balance

As mentioned, the annual turnover of forestry sector comprised 117.6 Mln.GEL in 2019, and the annual turnover of the manufacture of wood and of products of wood is 49.2 Mln.GEL that is around 42% of the official forestry sector. However, this does not mean that nearly 42% of timber is processed and converted into wood products – processing notably increases market value and respectively turnover of this sector. As assumed above, 80% of harvested timber is firewood. Respectively, 20% of collected timber should be converted to different wooden products (the export of non-processed timber is negligible). Considering the import-export of non-processed timber, the total volume of processed timber material to manufacture wood products is estimated at 447,350m^3 (i.e. 344,460 tons) that will be used in material flow balance. This is quite close to that estimated by the Wood Market Survey (2016) – according to this report, 480-660 ths. m^3 went for processing (mostly to sawmills but some to veneer) in 2014.

Wood harvesting and processing volumes suggest that most of Georgia's wood harvest goes into lower value application (e.g. fuel). As reported by Wood Market Study (2016), Georgia's primary processing industry is geared-up to supply low price, low quality markets and adds relatively little value. The report recommends to move towards production of higher value added production in order to improve the economy of the sector, as even simplest processing, e.g. sawmilling adds substantial value. According to K. Metreveli (2002)[29], wood-drying facilities and modern processing technologies are required to in order to produce high quality wooden products and receive high prices.

Detailed information about wood processing industry is not available. However, the export data on secondary wood products (see Annex 6) suggest that timber material is converted in Georgia into at least 20 groups of wooden commodities that have different added value. Production proportion by commodity groups is not known. Mass volumes of exported and imported wooden products is not known either. Therefore, for the mass flow balance, we assume that half of the timber converted into various products is exported – considering processing losses (see Section 3.2.5.6), this is 134,205 m^3 (i.e. ca. 103,338 tons). This assumption does not have any sound basis; however, it is acceptable for the purpose of this report to map circularity level because it does not affect waste streams significantly.

Monetary volumes of the export and import of processed wood products for 2015-2021 years (see Annex 6) show that the average annual import of wood products is 3.6 times higher than the export. This proportion is used to assess the timber equivalent of wood commodity imports that, according to our assumption, roughly comprises ca. 483,140 m^3 (i.e. 372,020 tons). However, the import of processed wood products does not influence neither forestry and wood processing nor waste streams, and therefore is not included in the mass flow balance.

3.2.5.6 Loss and Waste in Timber and Wooden Product Value Chain

The timber and wooden products value chain is characterized by different waste streams that generate from harvesting to the final consumer. According to FAO (1990), after processing, only 28% of the original tree becomes lumber, the remainder being different residues.

Extracting logs from the forest results in residues such are branches, leaves, stumps, roots, low grade and decayed wood, etc. that are generally considered of no economic use for further processing. Wood processing industries that includes sawmilling, plywood and particleboard production, furniture production, etc. produce sawdust, trimmings, split wood, planer shavings, etc.

According to the National Forestry Agency estimates, the residues of forest logging comprises 10% of logged volumes. They have planned to harvest 150ths.m^3 timber in 2021, and 180ths.m^3 timber in 2022. The volume of timber harvesting waste comprises 15 ths.m^3 and 18 ths. m^3 in 2021 and 2022 respectively. However, according to our assessment (see Section 3.2.5.3), the average

[29] Forest and Forest Products Country Profile, Georgia. Author Kate Metreveli. Forest Development Project. UNECE/FAO Timber and Forest Discussion Papers. 2002

annual production is at 2,096 ths.m^3, and harvesting losses of 10% (as estimated by the NFA) total 233 ths. m^3 (corresponding total volume of the logged trees is 2,329 ths. m^3, out of which 2,096 ths.m^3 is product and 233 ths. m^3 waste).

It should be mentioned that valuating harvesting losses at 10% may be a significant underestimate. According to FAO (1990), of a typical tree, less than two-thirds is taken from the forest for further processing, the remainder being either left, burnt or collected as fuelwood by the local inhabitants. The residues left in the forests include top, branches and foliage 23%, stump (excluding roots) – 10%, and sawdust – 5%, totalling up 38%. Applying this wastage rate to the average harvesting value (Table 3.2-20) suggests that around 1,285 ths.m^3 of logging residues may be left annually in the forests in Georgia.

For the purpose of this report, we take an averaged value of ca. 760 ths. m^3 (i.e. 585.2 ths. tons) for the tree logging waste volume to for the material flow.

The information on wooden waste streams from wood processing industry could not be found for Georgia. The amount of waste generated from wood processing industries varies from one type industry to another depending on the form of raw material and finished product. Therefore, it is difficult to estimate.

According to BioEnergy Consult[30], in general, processing of 1,000 kilos of wood in the furniture industries will lead to wood waste generation of almost half (45 %), i.e. 450 kilos of wood. Similarly, when processing 1,000 kilos of wood in sawmill, the waste will amount to more than half (52 %), i.e. 520 kilo of wood.

According to FAO (1990)[31], the integrated average residues and losses of different wood processing industries (sawmilling, plywood manufacturing and particleboard manufacturing) comprises 32%; specifically for sawmilling, which is likely to have a lion share in the wood processing industry (Wood Market Survey, 2016), this index is estimated at 43%. Based on this discussion, we will be using the integrated average value of 40% as a waste generation index for wood processing industry (comprising lumber production and production of final wooden products, lie furniture etc.). According to this assumption, ca. out of 447,350 m^3 (344,460 tons) material processed for lumber and wood product production, 178,940 m^3 (i.e. 137,780 tons) is converted into waste, while the integrated volume of all wooden products is 268,410 m^3 (206,680 tons).

Thus, according to our estimates, total 938,940 m^3 (i.e. 722,980 tons) of wood waste and residues are generated in Georgia each year.

Information on timber and wood waste recycling is not available. Most probably certain portion of wood waste is used as fuel. Certain portion of sawdust could be used in agriculture, e.g. in cattle growing sector. Some small scale initiatives for producing sawdust pellets could be also present. For the purpose of this report we assume that 5% of tree logging residues and 5% of wood processing waste are used for different purposes – this comprises 38 ths. m^3 (29.3 ths. tons) for the logging waste and 8.95 ths. m^3 (6.9 ths. tons) for wood processing waste, i.e. ca. 46.95 ths.m^3 (i.e. 36.2 ths. tons) wood waste is recycled. However, major portion of the waste recycling potential is likely to be untapped.

30 https://www.bioenergyconsult.com/biomass-from-wood-processing-industries

31 Energy conservation in the mechanical forest industries, FAO Forestry Paper 9, FAO, 1990

3.2.5.7 Circularity Profile: Forestry and Manufacture of wood and of products of wood

Sector nomination and NACE Index (NI): Forestry (NI 2) and Manufacture of wood and of products of wood (NI/ 16)

Input in GDP (Mln GEL): Forestry 117.6 Mln.GEL (0.3%) / Manufacture of wood and of products of wood 49.2 Mln.GEL (0.1%)

Material Resources Used:	Energy Consumption and GHG Emissions:
Land: Forest - 3.1 Mln. ha Total water consumption for Logging and wood products, construction and mining: 5.42 mln.m3/year	Mostly fossil fuel (diesel for tractors; natural gas for greenhouses) **Annual consumption for the wood and wood products;** – Electric power: 5.5 GWh annually – Natural Gas: 0.3 mill. m³ annually **Total GHG emissions for Logging and wood products, construction, manufacture and mining: 1,190 Gg CO² eq.)**

Mass Flow Indicators:

Products:

Products	Average Annual Production	Average Annual Import	Average Annual Export	Average Annual Domestic Consumption
Timber production	2,096ths.m3 = 1,614 ths.t	28,440m3 = 21,899 t	92m3 = 71t	1,677 ths.m3 = 1,291 ths. t
Timber processing and export/ import of manufactured wood products	447,350m3 = 344,460 t	805,230m3 = 620,000 t	134,205m3 = 103,338 t	134,205m3 = 103,338 t

Annual Wastes and losses:

► **Timber extraction wastes & losses:**
- Total wastes 760 ths. m³ = 585.2 ths. tons
- Recycled portion (5%): 38 ths.m³ = 29.3ths. tons
- Not recycled portion (95%): 722ths.m³ = 555.9 ths. tons

► **Timber processing wastes & losses:**
- Total waste: 178,940 m³ = 137,780 tons
- Recycled portion (5%): 8,950 m³ = 6,900 ths. tons
- Not recycled portion (95%): 169,990m³ = 130,880 tons

► **Total wastes & losses:**
- Total waste: 938,940 m³ = 722,980 tons
- Recycled portion (5%): 46,950 m³ = 36,200 tons
- Not recycled portion (95%): 891,990 m³ = 686,780

Summary on circularity:

- Current material efficiency of timber harvesting and wood processing industries is very low
- Residuals and wastes of roundwood production and manufacture of wood products are used minimally (if any) and in a non-systemic manner
- The sustainability of forest harvesting is under the question due to illegal logging
- Lion's portion of harvested timber resources is used as fuel (firewood) that is a low value application

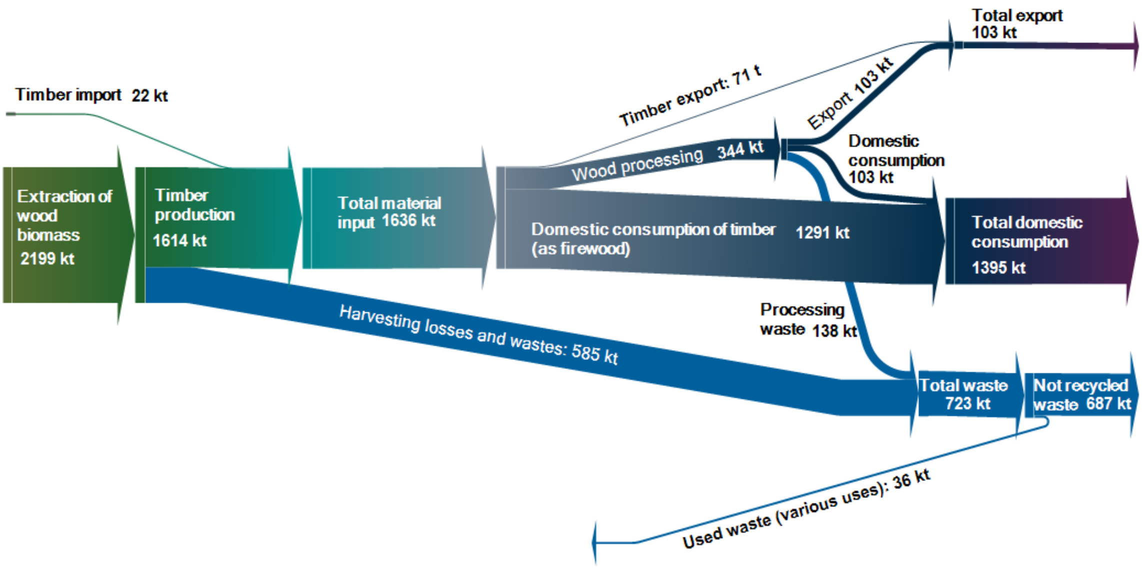


Figure 3.2-18 Mass flow diagram for forestry and manufacture of wood and of wood products

Potential for improving circularity:

1. Collection and recycling of forest harvesting and wood processing remains and wastes to reduce the need for resource extraction
2. Upcycling of wood wastes (i.e. recycle not for fuel) at the maximum economically viable level to ensure higher value and longer use of wood resources
3. Introduction / scale-up of modern wood processing technologies to increase the resource efficiency of the industry, as well as the quality and value added of wood manufacture products to improve the economy of the sector and gain access to better markets.
4. Improving of energy supply (preferably from renewable and affordable sources) of the population that depend on firewood to reduce low value use of timber resources and illegal logging, and increase sustainability of forest use.
5. Growing of plantation forests for timber harvesting to ensure sustainable use of native forests.

ReSOLVE FRAMEWORK

Regenerate	– Increase collection and use of forest harvesting and wood processing wastes – Promote forest plantation for economic purposes to preserve natural forests
Share	
Optimise	– Improve energy supply of local population to minimize their dependence on firewood as energy to increase sustainability of forest use – Promote wood processing industry to ensure that higher value added is generated by the sector – Implement modern wood processing technologies to improve product quality and increase efficiency – Promote upcycling of wood waste
Loop	

Virtualise	
Exchange	

Key actors in implementing CE and direct beneficiaries:

- **Central Government:**
  - Improve forestry and energy policies and creating incentives for the private sector to collect and recycle forestry/ wood waste and introduce CE elements in their businesses
  - Promote forest plantation for economic use
- **Municipal Authorities:**
  - Support forestry/ wood waste collection and recycling schemes
- **Private companies:**
  - Implement modern timber harvesting/processing technologies and methods to increase their value added and improve product quality
  - Increase the resource efficiency of forest harvesting and wood processing operations
  - Collect and recycle forestry and wood processing remains and wastes
  - Investigate opportunities for upcycling forestry and wood processing wastes
- **Individual farmers/ households:**
  - Collect and use tree remains generated during logging for own needs

3.2.6 Fishing and Aquaculture, Processing of Fish

Sector: Agriculture, Forestry and Fishing

Subsector: Fishing and Aquaculture

Subsector nomination and NACE Index: Fishing and Aquaculture (NI/3)
Input in GDP (Mln GEL): 35.6

3.2.6.1 General Characteristics of the sector

3.2.6.1.1 Aquaculture

Resources

According to the survey results, at the end of 2019 the total area of waterbodies of Georgia amounted to 4 503.1 hectares, of which, pond area equalled 2 424.8 hectares. In the reference year (2019), the area of pools reached 27.9 hectares. The total area of reservoir and natural waterbodies (including lake or part of lake, river and sea) in the country amounted to 2 050.3 hectares. By the end of 2019, the largest portion of ponds was located in Kakheti occupying 1 603.6 hectares; the pond area in Samegrelo-Zemo Svaneti equalled 475.5 hectares, in Imereti – 163.0 hectares, while in remaining regions in total - 182.8 hectares. By December 31th of 2019, the largest part of the pools was located in Shida Kartli within 18.6 hectares. The pools area in Samtskhe-Javakheti equalled 3.1 hectares, in Adjara - 2.0 hectares, in Guria - 1.4 hectares, while in remaining regions - 2.7 hectares. The diagram below (see Figure 3.2-19) presents the structure of the used area of waterbodies used for aquaculture by the end of 2019.

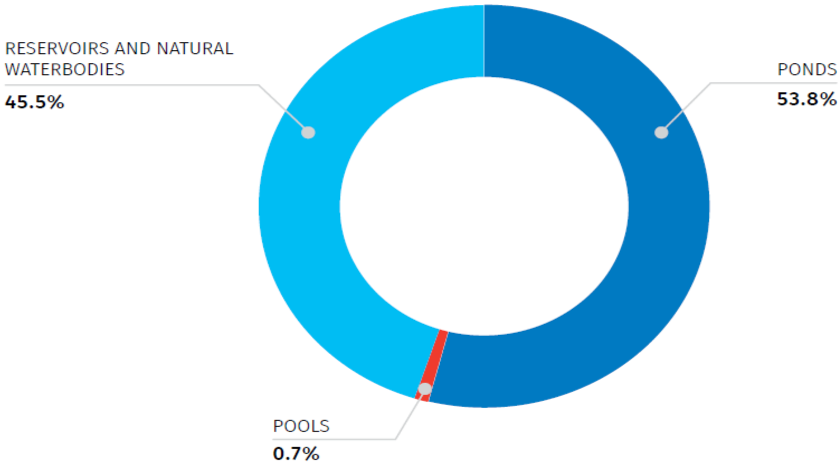


Figure 3.2-19 The structure of area of waterbodies used for aquaculture in Georgia by the end of 2019

Aquaculture Production

In 2019, fish production by aquaculture holdings equalled 2 464.7 tons which is 3.5 percent higher compared to the previous year. Of this, the production of *Salmonidae* consisted 1 339.8 tons (9.2 percent less compared to the previous year), the production of *Cyprinidae* equalled 1 012.7 tons (23.9 percent more compared to the previous year), the production of Sturgeons equalled 97.3 tons (29.7 percent more compared to the previous year), and the production of *Siluridae* equalled 14.3 tons (13.5 percent more compared to the previous year).

Rainbow trout has the highest share (98.7 percent) in *Salmonidae* production. In *Cyprinidae* production, 47.4 percent are Common carp and Mirror carp production, 39.1 percent are Silver carp and Bighead carp production, and 13.3 percent are Grass carp production.

According to the fish production in 2019, Kakheti was the leading region with 35.1 percent, followed by Shida Kartli with 30.3 percent and Guria with 10.1 percent, while in fish production in the country 24.4 percent comes from the remaining regions.

The diagrams (Figure 3.2-20, Figure 3.2-21) below present the structure of the fish production by regions and by fish families.

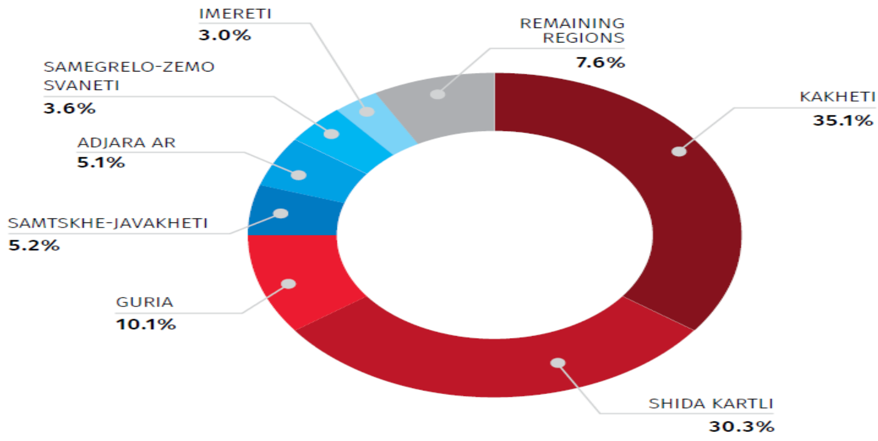


Figure 3.2-20 Fish production by regions in Georgia in 2019

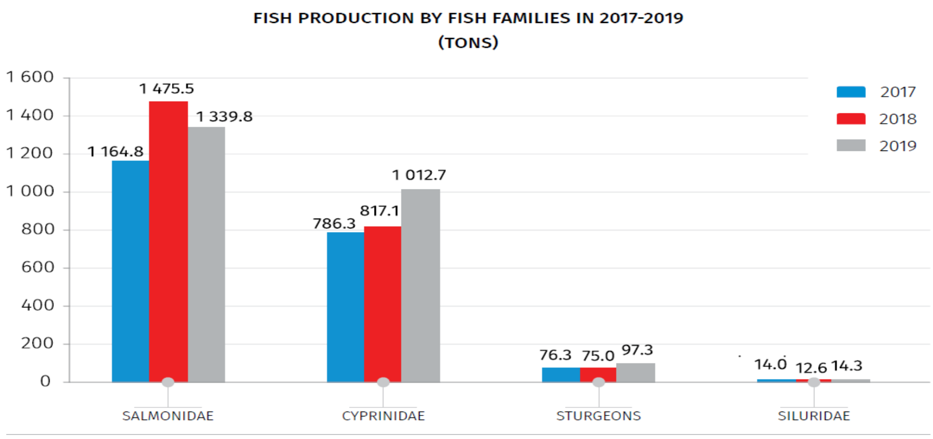


Figure 3.2-21 Fish production by fish families in Georgia in 2017-2019[32]

3.2.6.1.2 Marine fishery

Unlike farm-based fish, the amount of fish (anchovy) caught on the local shores of the Black Sea is limited by the preliminary defined quotas. These quotas, which ranged between 60-90 thousand tons per year till 2019, are established by the government based on scientific research of fisheries. For the recent years, with the support of the European Union and the United Nations Food and Agriculture Organization's (FAO) General Commission for Mediterranean Fisheries (GFCM), it has set quotas for fish stocks in the Black Sea for 2020-2021, including caps, amounting to 109,000 tonnes.

3.2.6.1.3 Fish Export and Import and Internal Demand

Fish caught in the shores of the Black Sea is accepted by the European market, which gives opportunities for local producers to export raw and processed fish products (fish flour and fish oil) to the European market. Despite this, only a small amount raw and processed anchovy is exported

[32] The National Statistics Office of Georgia: Survey of Aquaculture Holdings of 2019

to the European market and producers mostly are oriented on Turkish market; in fact, the entire quota of harvested anchovy is processed into fish flour and oil and exported to Turkey.

Apart from the production, it is important to assess a demand side as well. Fish consumption in Georgia is quite low. According to the FAO, the average fish consumption per year per capita was about 7.83 Kg in 2017 in this country, while it is significantly higher in the world and equals to 20.5 Kg. The average fish consumption in Europe is 21.3 Kg, and more than 30-40 kg in Asian countries. For example, the average fish consumption per year is about 42 Kg in China, which is number one producer of fish and aquaculture (according to the World Bank, the total production of this country was 69 mln tones in 2019, which is about 62% of the total aggregated production). Low consumption level in Georgia can be explained by low fish culture and existing social-economic situation. It should be noted that the demand on fish increases with the increase of number of tourists in Georgia.[33]

The largest portion of the local consumption is addressed by imported fish. According to the National Statistics office of Georgia, the local production satisfies only 10-15% of the domestic consumption. The total amount of the imported fish for 2014-2020 period was 113 thousand tons. 90% of them comes as frozen fish, and the remaining 10% as live fish, fresh or chilled fish, fish fillet and other fish meat. During this period, 58% of live fish imports came from Armenia, 27% from Turkey, and the remaining 15% from 16 different countries around the world. In the case of frozen fish, the importing countries are more diversified - Norway and Iceland lead with 18-18% of imported fish, Spain with 16%, while the remaining 48% were imported from 51 different countries around the world. Fresh or chilled fish is mainly imported from 2 countries - Norway and Turkey. During this period, 51% of imports came from Norway and 43% from Turkey. Fresh or chilled fish were regularly imported from these two countries, while the remaining 6% were imported from different countries inconsistently, and it had one-time nature. It should be noted that fresh or chilled fish imported from Turkey has an increasing dynamic, while fresh or chilled fish imported from Norway is declining every year. This may be explained by the fact that the average price of fish imported from Norway is much higher than the price of fish imported from Turkey. In the first case, this figure was equal to an average of 10 USD by 2019, and in the second case - 4 USD.

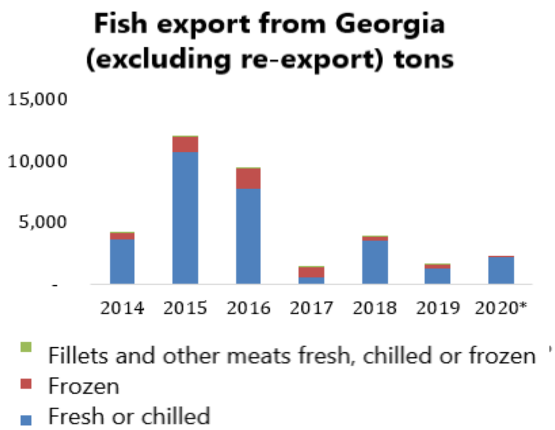


Figure 3.2-22 Fish import and export by Georgia during 2014-2020

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33 Aquaculture survey in Georgia for 2019; Geostat; Fisheries and Aquaculture In Georgia 2006 – Current Status and Planning FAO Fisheries Circular No. 1007

Import quantities are more or less homogeneous by months, with little decrease during the summer, which can be explained by the fact that the supply of locally produced fish increases during that period.

3.2.6.1.4 Fish Processing

The major share (more than 99%) of processed fish in Georgia is falling on production of anchovy fish flour and oil for export. Amount of fish processed for internal consumption as a food (e.g. smoked fish) is negligible. Average quota for Georgia during the recent years is about 100,000 tons og anchovy annually. Licensees are selling a very small portion of total caught fish from Georgian shores of the Black Sea as a fresh. They mostly produce processed fish products such as fish flour and oil. The main market for both, fresh and processed fish products, is Turkey. In case of fresh fish, the best option it exporting to Turkey due to the geographical proximity. Export of fresh fish to the Turkish market is more secured, as the risk of fish damage is low. When transportation time increases, the probability of fish damage also increases. Freezing of fish would solve this problem, however, this method is not attractive alternative for the farmers. They claim that Georgian anchovies are too small and less attractive for European partners. Therefore, considering the increased cost of freezing on the one hand, and low demand on the other hand, the trade with frozen fish is not an attractive decision for the licensees. Instead, they process most part of natural recourses by themselves and export mostly to Turkish market.

3.2.6.2 Food Loss and Waste in Fish Value Chain[34]

Capture Fisheries

Harvesting is the process of gathering and removing fish from the place in which it has grown, and refers therefore to fishing and catching wild fish and shellfish. The harvesting of aquatic resources uses a large variety of technologies - from artisanal to highly-industrial - encompassing vessels and equipment as well as fishing gears and methods.

The key causes of **food loss and waste (FLW)** during harvesting are:

- Fisheries management measures that encourage discarding of fish at sea (resource losses)
- Less selective fishing gear that results in capture, retention, and subsequent discarding of immature fish and unwanted species (resource losses)
- Abandoned, lost, or otherwise discarded fishing gear (ALDFG) which continues to catch fish (causing unintentional mortality), resulting in “ghost fishing” (resource losses)
- Delays in removing fish from the fishing gear leading to quality deterioration of catch due to spoilage and physical damage (resource losses and potential wastes)
- Consumption and damage of fish by predators prior to hauling (resource losses)

In case of marine fishes, the average post-harvest loss for per metric ton of marine fish was found 11.67% which is higher than the loss of culture fish (4.47%). Therefore, the referred study suggests

[34] This section is mainly based on FAO materials/ Food Loss and Waste in Fish Value Chains https://www.fao.org/flw-in-fish-value-chains/overview/food-loss-and-waste-in-fish-value-chains/en/

to government and fisheries related agencies to focus on promoting initiatives, practices and policies to minimize the post-harvest loss and maximize the contribution of fisheries sector[35].

10% losses are assumed for Georgia as a rate of losses during fishing the anchovy, and 5% of losses for aquaculture.

Aquaculture

The key causes of **food loss and waste (FLW)** for aquaculture are:

- Poor harvesting practice
- Mortality of fish during live fish marketing, as well as fish sold at a lower price point due to, for example, the presence of some damage
- Poor handling leading to contamination and physical damage
- Lack of cold chain
- Rejection of product due to food safety risks or inappropriate documentation

Key causes of **the FLW** associated with the mortality during grow out include:

- temperature change
- extreme weather events
- fish escapes
- diseases and parasites
- misuse of chemicals or treatments for disease and parasites
- poor handling
- algal blooms
- predators (birds, seals, lizards, jellyfish)
- poor water quality
- oxygen shortages

The study shows that culture fisheries accounted 3.14-6.36% post-harvest loss[36].

Processing and Storage

Processing refers to mechanical or chemical operations performed on fish in order to transform or preserve them. Fish are processed in a variety of ways and in different working environments. Removing the entrails from fish (e.g. gutting or cleaning) is a simple processing technique designed to extend shelf life. Smoking, sun drying, and salting are common traditional processing methods associated with small-scale fisheries value chains and are often practiced using low cost technology and with minimal services and facilities. More sophisticated processing takes place in factory environments, which meet high international standards of hygiene and food safety. Fresh chilled, frozen and canned products are all associated with high investment factory processing and international trade.

[35] Post-Harvest Losses of Culture, Capture and Marine Fisheries of Bangladesh/ Md. Mamun or Rashid Patuakhali Science and Technology University, Patuakhali, BANGLADESH and Md. Sujahangir Kabir Sarkar United Nations University, Tokyo, Japan.

[36] ibid

Both low value and high value fish are processed. Low value fish are processed for both human consumption and for animal feed production. High value species from both capture fisheries and aquaculture are typically processed into fresh chilled or frozen products. By-products from processing such as frames, viscera, and skins are also processed into nutrient supplements, pharmaceutical products and fertilizer.

Artisanally processed products are important for food security and nutrition, as they provide animal protein and nutrients to low income populations. Some traditionally processed products can also be of high value and desired by wealthy consumers.

Artisanally processed dried, salted or smoked products are sold in domestic urban and rural markets, as well as sub-regional and international markets. These products are often transported long distances and marketed in areas far from where capture and processing take place. **Food loss and waste (FLW)** can occur if the product is damaged or stored for long periods under inadequate conditions, resulting in microbial contamination and insect infestation.

Processing Plants

Fish processing plants convert fresh or frozen fish into various types of product. Typical operations inside a factory include stunning, grading, slime removal, de-heading, washing, scaling, gutting, cutting of fins, filleting, de-boning, meat bone separation, packaging and labelling. Waste is often generated during some of these operations. This waste is sometimes classed as by-products or co-products. In the UK alone over 133,000 tonnes of fish waste, including by-products, is generated by the processing sector in total per year. This amounts to 12.7% of total inputs by weight (FAO Report).

The discards from the processing plants can be used to produce fish protein concentrate, fish oils and enzymes (such as pepsin and chymotrypsin), and other value-added products. The fish oil is used for products such as margarine, omega-3 fatty acids and biodiesel. The fish protein concentrate is used as human food and animal feed. Fish protein is also rich in amino acids which are highly suitable for human consumption.

As it has been mentioned above, the vast majority of the fish businesses in Georgia prefer to process most part of natural recourses by themselves and export processed materials (Fish concentrate and fish oil) mostly to Turkish market and partly, to Europe. Production rate is given in the table below:

Table 3.2-24 Production rates for fish processing industry

Products of Fish Processing Industry	Production Rate
Fish (Anchovy)	1000 tones
Fish Concentrate	10.5 tons
Fish Oil	4.2 tons
Waste	0
Energy consumed	20,000 kw/hour

Source: Paliastomi 2004 Ltd

3.2.6.3 *Circularity Profile: Fishing and Aquaculture, Processing of Fish*

Sector: Agriculture, Forestry and Fishing

Subsector: Fishing and Aquaculture

Subsector nomination and NACE Index: Fishing and Aquaculture (NI/3)
Input in GDP (Mln GEL): 35.6

Material Resources Used:	Energy Consumption and GHG Emissions:
Marine Fish: total quota for Georgia 109,000 tons of European anchovy to be extracted **Aquaculture:** – Total Land and surface water resources for Aquaculture 4,503.1 hectares – The area of natural reservoir and waterbodies (including lake or part of lake, river and sea) in the country amounted to 2,050.3 hectares. – Water Consumption (2020) - mln.m³/year: 11.62	**Processing:** 20,000 kw/hour per 1000 tons raw material **Annual indicators for the entire agriculture sector:** – Electric power consumption: 83.8 GWh annually – Natural Gas consumption: 10.3 mill.m³ annually GHG Emissions (for 2017) - 3,488 Gg CO2(eq.)

Mass Flow Indicators:

Products:

Fishing and Aquaculture	Average Production for 2018 – 2020 (ths.t/y)	Average Import for 2018 – 2020 (ths.t/y)	Average Export for 2018 – 2020 (ths.t/y)
Fishing	109.0	10.0	5.0
Aquaculture	2.5		
Total	111.5	10.0	5.0

Annual Wastes and losses:

– Marine fish: 10%/ 10,900 tons
– Aquaculture: 5%/ 125 tons
– Total waste and losses: 11,025 tons

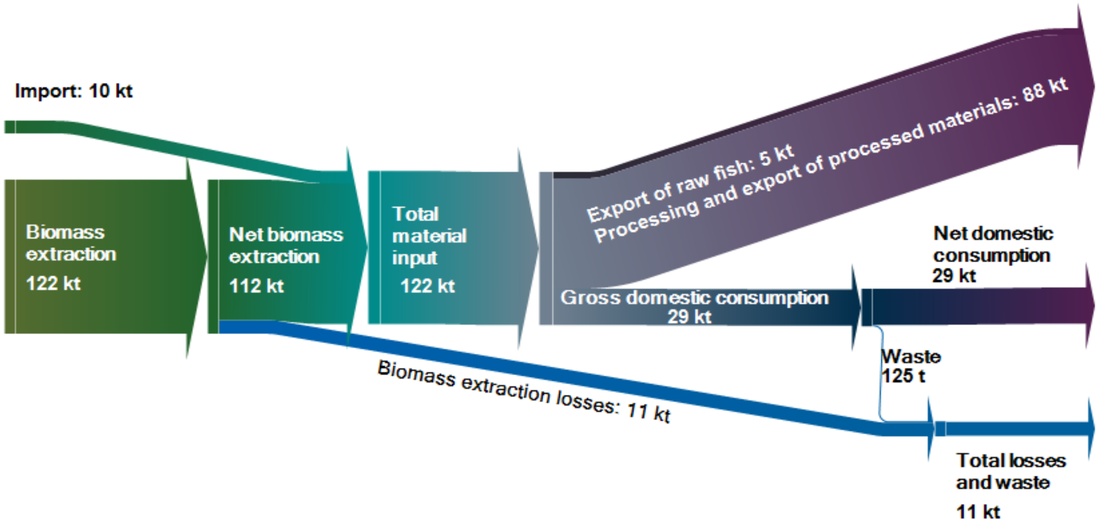

Figure 3.2-23 Mass flow diagram for fishing, aquaculture and fish processing

Potential for improving circularity:

1. Current practices allow minimization of losses and waste by about 30% as compared with the schemes based on trading with the frozen fish.
2. Further improvement is possible through implementing modern technologies of concentrate and oil production. The modern technologies can minimize emissions and other environmental impacts, and improve quality of the product. However, the impact on further waste minimization will be negligible as waste rough grease is the only type of waste that could be further reduced, but its amounts are negligible.
3. Resource management: Improving Policy, supervision and enforcement mechanisms is required from the Government to ensure sustainable practices of marine fishing and conservation of aquatic habitats.
4. Support for more intensive development of the aquaculture and implementation of technologies for minimization of aquaculture losses and wastes could be considered as CE activity. However, at present the share of the aquaculture in fish production is very low.

ReSOLVE FRAMEWORK

Regenerate	– Minimize emissions and losses during fish processing and storage to reduce environmental impacts, increase efficiency and sustainability of the sector – Ensure sustainable marine fishing through improving policy and enforcement mechanisms as well as promoting aquaculture development
Share	
Optimise	– Reduce biomass loss during harvesting – Increase share of renewable energy sources in fish farming, fish processing and storage
Loop	
Virtualise	
Exchange	

Key actors in implementing CE and direct beneficiaries:

- Private companies:
  - Improving the efficiency of production (concentrates and oil)
- Central Government:
  - Improving Policy and monitoring to ensure sustainable practices of marine fishing and conservation of habitats

3.2.7 Mining (except oil and gas extraction)

Sector nomination and NACE Index (NI): Mining (NI/ 5 - 9)

Input in GDP (Mln GEL): 586.3 Mln GEL / 1.4%
Annual Production value: 974 Mln GEL

Includes: Mining of coal and lignite, Mining of metal ores, Other mining and quarrying

3.2.7.1 *Mining Industry and Production*

3.2.7.1.1 Overview of the Mining Industry in Georgia[37]

Geological features of Georgia are connected to the active geodynamic processes (tectonics, magmatism, earthquakes, etc.) leading to the emergence of diverse minerals. Despite the small size of the territory, Georgia is host to an array of minerals that include metallic and non-metallic minerals: aluminium, antimonite, arsenic, barite, bentonite, clay, coal, copper, diatomite, lead, manganese, marble, precious gems/stones, zeolites, and zinc. Construction materials are also indicated. Historically, certain minerals were developed that continue to be explored today, e.g., gold, copper, ferroalloys (metallic minerals used in steel production), manganese, and construction

[37] The overview is based on Georgia Mining Sector Development Programme, Phase I / Policy and Strategy /EBRD Status Report, November 2018

materials as well as coal. A country-wide geological map has not been prepared to reflect the current state of the country's reserves.

Quarries

In Georgia, quarries are treated as part of the minerals sector and in Georgia, specifically indicate the mining of "construction materials" (e.g., brick clay, building stone, clay, chalk, dolomite, gravel, gypsum, limestone, sand and slate).[38] Quarrying for construction materials occurs throughout Georgia. These materials are naturally occurring substances that include stone, rock, clay, sand, and are used typically in the construction of buildings, roads and various structures as well as the production of clinker and cement. In Georgia, municipalities play a significant role as a primary customer of quarries; in this instance pricing is negotiated often to the benefit of the host municipality.[39]

Mines[40]

At present the most important mining sites in Georgia include: the Madneuli gold-polymetal, Chiatura manganese, Tkibuli coal and Chordi barite deposits. Georgia is presently host to several large- and medium-scale mining investments; however, two of them are presently challenged with (1) special management requirements – Chiatura manganese, and (2) temporarily suspended due to safety – Tkibuli coal.

Chiatura manganese mine located in Western Georgia is a world class deposit that has been mined for most of the 20th century, produced manganese and was a major generator of budget revenues, stemming from the export of copper concentrate (ore removed from the copper). Today, "Georgian Manganese" is licenced to operate this mine. The operation employs approximately 6,000 local citizens, and includes value-addition processing such smelting at Zestafoni. The "Chiatura 14 mine complex" includes four underground mines and three quarries, and has an annual production capacity of 1.18 million tons of manganese ore and 400,000 tons of manganese concentrate. The mine complex transports its manganese ore by rail to the ferroalloy plant located in Zestafoni.

Tkibuli coal located in Tkibuli is licenced to the Georgia Industry Group (GIG) and produces thermal (lignite) coal, primarily for domestic power generation (13 megawatts). The under licence reserves are of more than 330 million tons. According to the National Agency of Mineral Resources, total annual coal production is equal in average to 174,000 tons. [Source; written communication with National Agency of Mineral Resources specially for this Report].

JSC RMG Copper and LTD RMG Gold (known as Rich Metals Group-RMG) have operated in partnership with the Georgian Mining Company and other companies in east Georgia, specifically in Bolnisi and Dmanisi to produce gold (Dore alloys (half fabricates) by mining and processing copper and gold containing ores. RMG was listed in the top companies with foreign direct investment in Georgia for 2017.

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[38] Note: other minerals that are not categorized as "construction materials" may also be "quarried". In general understanding of the term, quarries are referred to as "open mines".

[39] Note: Where construction materials are found on a landowner's private property, a licence is not required for use by the owner for private purposes, but a licence is required where those quarried materials are sold.

[40] Georgia Mining Sector Development Programme, Phase I; Policy and Strategy; EBRD, 2018

Heidelberg Caucuses Cement has two operations in eastern Georgia that include mining of raw materials for clinker and cement production and factories. In 2011, Heidelberg Cement commissioned a port terminal with the capacity to transport 1,200 metric tons per day of cement at Supsa, a port on the Black Sea; today the company reports the need to reduce production due to increased competition and falling market prices.

Geostone marble. The licence is for marble in the amount of 532,000 cubic meters. In 2017 no marble was produced; reports indicate that most was extracted in 2016 following issuance of the licence.

Other mineral deposits of note are:

- Kakheti marble. A licence is issued for approximately 50,000 cubic meters. Cutting is conducted at this site for marble product export.
- Tkvarcheli coal in Abkhazia, occupied territory by Russia for the past 25 years. Value coal is host to “black” coal (anthracite, bituminous) not presently under development.
- Chordi barite deposit (included arsenic at the Zopkhito Deposit) formerly exported to Ukraine for use in electrical parts manufacturing, is licenced and in operation, but not a large mine.[41]

3.2.7.1.2 Annual Production of the Mining Industry

The annual rates of production of the mines and quarries and volumes of explored minerals and construction materials are presented in Table 3.2-25 and Table 3.2-26. The data are provided by the LEPL National Agency of Mineral Resources. Please note that raw data provided by this Agency is given in Annex 7, while Table 3.2-26 gives summarized data converted into mass equivalent, because for the purpose of this report to describe total material flows, we need all input data in tons. As the density of the stone materials varies from 1,4 ton/m^3 to 3 ton/m^3, the average density of 2.0 ton/ m^3 has been used for the conversion.

The data in Table 3.2-25 and Table 3.2-26 refer to volumes of extracted ore but not the product (concentrate). Only I case of coal the data corresponds to the hard coal (product) to be used in energy sector. After preliminary processing within the mines, the enriched by the valuable material concentrate is exported or used domestically, while the wastes are disposed as tailings. Tailings still contain lower concentrations of the valuable material. In fact, the tailings are technogenic deposits of material, which are supposed to be used in future, when the modern technologies will make it possible and economically viable to extract the low concentrations of substances from stored mass. Thus the recycling of tailings is one of the aspects of circularity in case of mining industry.

[41] Georgia Mining Sector Development Programme, Phase I; Policy and Strategy; EBRD, 2018 and written communication with National Agency of Mineral Resources specially for this Report

Table 3.2-25 Annual production rates of the mines and quarries

	Average Production, ton	Number of Licensees	Wastes (tailings etc.) Quantity
Coal (coal and lignite)	174,000	1	
Production of Ores:			
Manganese ore	1,749,000	1	1
Precious metals (gold and silver) ores	4,376,000	1	1
Copper ores	4,271,000	1	1
Total	**10,570,000**		

Table 3.2-26 Annual production rates of construction materials

	Average Production Volume, tons	Number of Licensees
Dimension Stones	1,003,434	264
Construction Materials (volcanic rocks)	9,212,996	442
Construction Materials (sedimentary rocks)	28,979,644	1029

Source: LEPL National Agency of Mineral Resources/ data for 2021

3.2.7.2 Export and Import of the mining products

To get an idea about mass flow, it is useful to compare data of the total export with Domestic export and import. This data is available in Geostat. Data is provided in monetary expression, but it gives an idea about mass flow, which could be further specified using data-bases of the customs department.

Table 3.2-27 Export and Import of the mining products in 2015-2021

	Name of position	2015	2016	2017	2018	2019	2020	2021*
Export Thous. USD	Copper ores and concentrates	270,601.0	312,349.0	422,488.9	504,352.3	656,808.4	778,994.6	815,437.8
	Refined copper and copper alloys, unwrought	0.4	1.6	0.2	959.6	463.4	315.5	390.0
	Manganese ores and concentrates	3,162.9	18,441.2	3,219.2	9,826.9	6,562.4	3,125.6	1,706.9
	Manganese oxides	5,581.3	5,797.6	5,572.4	8,280.0	10,208.5	12,090.0	13,248.8
	Precious metal ores and concentrates	-	4,765.6	1,234.2	-	3,208.2	41,763.1	44,066.8
	Gold unwrought or in semi-manufactured forms, or in powder form	62,102.1	81,082.8	70,771.2	69,809.6	72,832.0	97,571.5	64,220.3
	Coal; briquettes and similar solid fuels manufactured from coal	130.0	127.3	159.3	184.7	70.2	45.4	426.9
	Coke and semi-coke of coal, of lignite or of peat, retort carbon	-	-	949.1	305.4	231.2	37.2	-
Domestic Export Thous. USD	Copper ores and concentrates	193,570.4	312,349.0	422,488.9	504,352.3	656,808.4	778,994.6	815,437.8
	Refined copper and copper alloys, unwrought	0	0	0	0	0	0	0
	Manganese ores and concentrates	3,162.9	18,441.2	3,219.2	9,826.9	6,196.7	3,125.6	1,706.9
	Manganese oxides	5,581.3	5,797.6	5,539.7	8,280.0	10,208.5	12,090.0	13,248.8
	Precious metal ores and concentrates	-	4,765.6	1,234.2	-	3,208.2	41,763.1	44,066.8
	Gold unwrought or in semi-manufactured forms, or in powder form	62,102.1	81,082.8	70,771.2	69,809.6	72,832.0	97,571.5	64,220.3
	Coal; briquettes and similar solid fuels manufactured from coal	0	0	0	0	0	0	0
	Coke and semi-coke of coal, of lignite or of peat, retort carbon	0	0	0	0	0	0	0
Import Thous. USD	Copper ores and concentrates	207,870.7	248,535.3	338,880.0	396,699.9	603,692.5	582,382.1	736,080.5
	Refined copper and copper alloys, unwrought	148.8	78.2	41.0	965.8	501.7	452.2	321.0
	Manganese ores and concentrates	24,188.6	11,845.5	18,024.4	31,197.1	17,587.6	6,541.1	17,355.8
	Manganese Oxides	0	0	0	0	0	0	0
	Precious metal ores and concentrates	2,294.7	1,860.5	3,193.4	6,203.1	6,392.5	28,257.5	2,422.6
	Gold unwrought or in semi-manufactured forms, or in powder form	25.4	19.6	24.1	4.0	0.6	0.6	-
	Coal; briquettes and similar solid fuels manufactured from coal	10,746.9	8,599.4	17,823.5	26,512.6	25,072.5	15,113.7	9,000.7
	Coke and semi-coke of coal, of lignite or of peat, retort carbon	26,127.1	24,743.4	34,469.7	43,799.6	39,147.8	18,870.4	56,998.9

Comparison of the Export figures with the values of Domestic Export (see Table 3.2-27) both provided by Geostat), although the figures are given in monetary expression, makes possible to make certain judgement about the mass flow. In particular, it becomes clear that:

- Georgia is not exporting coal and coal products (like coke and semi-coke) produced from the raw materials explored in Georgia (Tkibuli mine). Domestic export of the products is zero. All exported coal and coal materials (the value significantly varies by years and in average export price is approximately 162,000 USD for coal and 217,000 USD for coke and semi-coke of coal or lignite) represents re-export. Import of coal and coal products exceeds export 20 times and more. We exclude the coal export and import from mass flow charts, as these flows do not represent mining sector but use of mining products for different other sectors.

- Georgia is not re-exporting copper ores and concentrates: domestic export is equal to the total export. All exported copper ore is explored in Georgia. Export of the refined copper and copper alloys, unwrought is entirely based on re-export. Domestic export of these products is zero. Import of copper ores and concentrates is comparable with the export figures, while import of copper alloys exceeds export values significantly. We exclude the export and import of refined copper and copper alloys from mass flow charts, as well as import of copper ores and concentrates. These flows do not represent mining sector but use of mining products for different other sectors. Export of copper concentrates will be included in the mass flow chart.

- Georgia is not re-exporting Manganese ores and concentrates and Manganese oxides: domestic export is equal to the total export. All exported Manganese (concentrates and oxides) is explored in Georgia. Import of manganese ores and concentrates is about 60 times less that export, and no manganese oxides are imported at all. We exclude the import of manganese products from mass flow charts, as these flows do not represent mining sector but use of mining products for different other sectors. Export of Manganese (ores and concentrates, as well as oxides) will be included in the mass flow chart.

- Georgia is not re-exporting Precious metal ores and concentrates, as well as Gold unwrought or in semi-manufactured forms: domestic export is equal to the total export. All exported precious metal ore and gold products are explored and produced in Georgia. Import of precious metal ores and concentrates is in average 20 times lower that the export figures, while import of gold unwrought or in semi-manufactured forms is only 1% of the export values. We exclude import of the gold concentrates and semi-manufactured forms from mass flow charts, as these flows do not represent mining sector but use of mining products for different other sectors. Export of gold concentrates and semi-manufactured products will be included in the mass flow chart.

Table 3.2-28 Domestic export of copper, manganese and precious metal ores and concentrates for 2021

	Copper ores and concentrates, tonnes	Manganese ores and concentrates, tonnes	Precious metal ores and concentrates (Gold and silver), tonnes
Annual Export	452,399.2	2,707.5	13,429.7

Source: Customs department of revenue service of Georgia

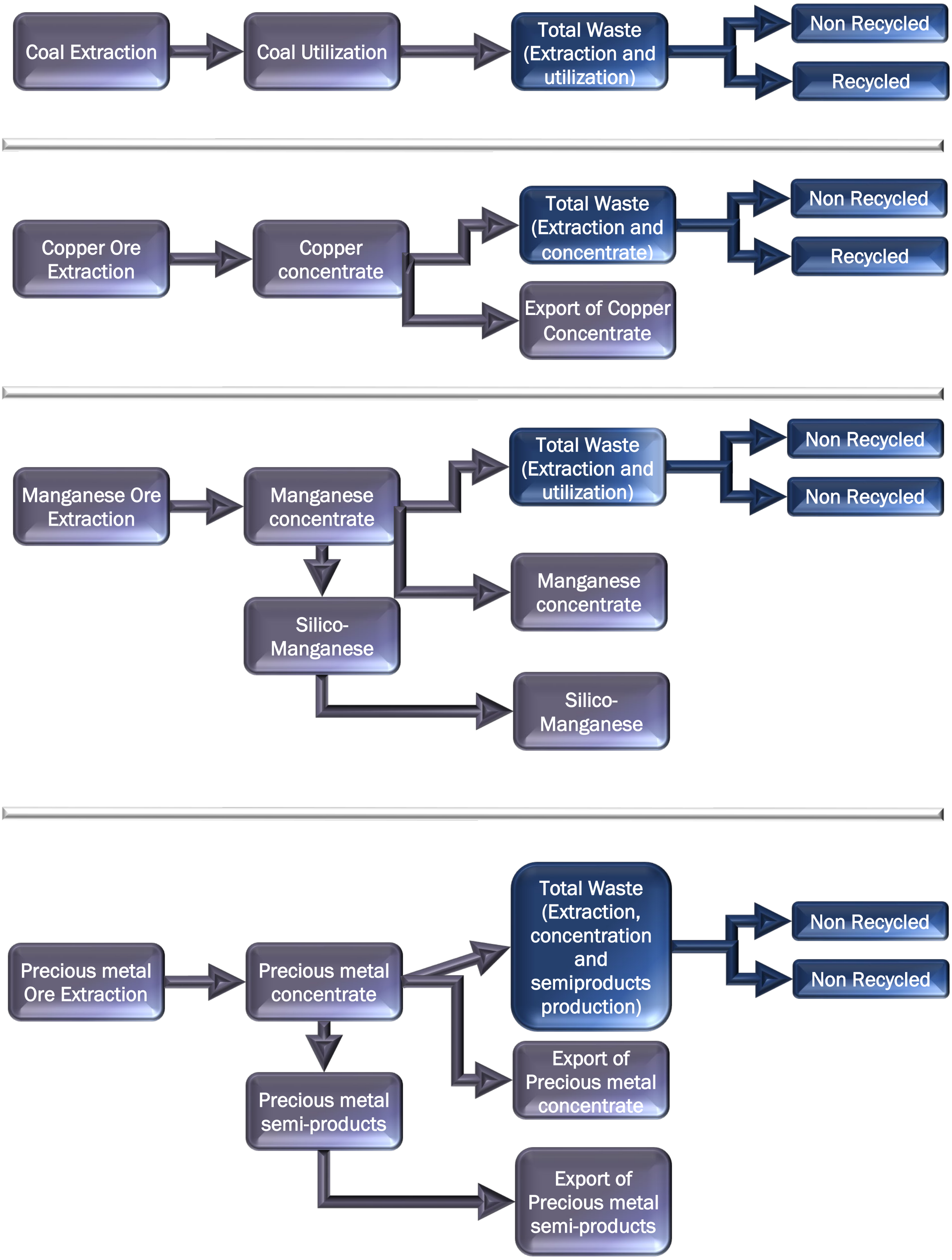


Figure 3.2-24 Material flow scheme for the mining industry

Table 3.2-29 Coal, manganese, precious metals and copper ores production and export data

Explored Ore	Explored ore, tons	Average Annual volume of product (concentrate), tons	Tailings (Waste)	% of tailing waste recycled	Refined products	Export	Domestic Use	Waste generated during production of refined products	Recycled part of waste	Not recycled part of waste
Coal	223,076	174,000	49,076 22% of product	0 Recycled Recyclable 60%	power generation (13 megawatts)	0	power generation (13 megawatts)	0	0	0
Manganese ore	1,749,000	400,000 In 2017, the Chiatura Mine produced an estimated 460,000 t of manganese concentrate	1,349,000	0	260,000 (65%) In 2017, the plant produced about 289,800 t of silicomanganese	2,707.5		140,000	10% 14,000	90% 126,000
Precious Metals (Gold and Silver)	4,376,000	13,423	4,362,570	0	0	13,430	0	0	0	0
Copper ores	4,271,000	452,399	3,818,601	0	0	452,399	0	0	0	0

3.2.7.3 Mining Waste in Value Chain

3.2.7.3.1 General Overview of Mining Waste matters[42]

Each of the ore-mining and-processing steps can generate mining waste. This waste generally has different physical and chemical properties, resulting in different potential environmental impacts. The respective volumes of waste produced essentially depend on the type of deposit and the technological alternatives used for mining and for ore processing; stripping of the deposits in strip-mined quarries is often one of the steps producing the most waste during ore extraction operations. The chemical composition of the waste varies considerably according to the substance mined and the nature of the geological formation containing the deposit.

The main types of mining waste in addition to topsoil and subsoil spoil can be classed into two categories:

- waste rock (mine rock piles);
- tailings (processing waste);

It is interesting to note that for some EU Member States, the term "waste" is not applied to residues (coarse or fine) resulting from the quarrying and processing of crushed-rock aggregates. In the most part, these are saleable products, which will be sold if local market conditions are favourable. In addition, both coarse and fine residues are routinely required for road construction, site reinstatement and landscaping.

Waste rock

Waste rock is hence durably unused extraction products that is generally stored indefinitely in a landfill site which, for economic reasons associated with transport costs, is located in the immediate vicinity of the main mining centre. The quantity of mining waste that can be stored at a mining centre varies considerably and mainly depends on the selectivity of the mining method. As a rule, opencast pits and quarries generate much more mining waste than an underground mine. The main type of waste rock is generated by surface (or barren rock) stripping to expose the shallow ore. This is rock that is weathered to varying degrees, although increasingly fresh with depth and showing the geological characteristics of the local surrounding material. Its composition is similar to the rocks of the sector. The largest (in tonnage) quantity of barren rock comes from stripping for opencast mines. In underground mines, these barren rocks are generated by the passages (shafts, crosscuts).

Tailings (processing waste)

At a mine, an ore mill normally abuts on the extraction centre to produce the first marketable products (metallic concentrates, sorted ore, and ingots). The technological processes are very different according to the type of substance mined, and the modernity of the technologies employed (flotation, leaching, and biotechnology). These units produce various types of waste, which can include:

[42] This section is largely based on: Management of Mining, Quarrying and Ore-Processing Waste in the EU/ Study made for the DG Environment, EU Commission; December 2001.

- aqueous solutions from cyaniding,
- slurries of finely ground particles that have undergone one or more types of physical or chemical treatment, and which frequently contain one or more industrial additives that have participated in the conversion process (xanthates, miscellaneous salts, starch, etc.). These tailings are normally dumped in a sort of lagoon or settling basin within an embankment at the exit of the mill;
- in some case, atmospheric releases from sulphide roasting.

Mill waste is generally referred to as tailings, or releases or effluents. It is generated by the various mineral-upgrading processes employed to meet demand. For a given mineral, it will have different physicochemical properties according to the conditions in which it has been generated. Its volume and variety have increased to match raw material demand, combined with the proliferation of upgrading methods and their degrees of sophistication. It is found in solid, liquid and gaseous form. Waste is generated at all levels of the recovery process to upgrade the minerals, within the same process chain, and is considered as ultimate or stripped of useful elements. Its content depends on the time that it was generated.

Through the years, solid waste has evolved in line with technological progress, from multi-centimetre grain size with a still high content of the desired element (i.e. low tonnage and hence low exchange surface areas [culling or manual sorting waste]) to micron grain size with very low chemical contents (i.e. high tonnage implying commensurate exchange surface areas [flotation waste, colloids, fines]). The release mesh varies from one ore deposit to another, depending not only on the level of technology but also on the geological and mineralogical characteristics.

3.2.7.3.2 Mining Waste Generation in Georgia

The above described methodology has been used for the estimations of wastes of the mining industry.

Production of coal and metal ores and waste generation

Data on production from the National Agency for Mineral Resources and Customs department of revenue service of Georgia have been used as an input data, as well as average figures provided by mining industry in relation with tailings and other wastes. The figures are provided in Table 3.2-30.

Table 3.2-30 Production of Coal and Ores and waste generation

Explored Ore	Explored ore, tons	Average volume of product (concentrate), tons	Tailings (Waste)	% of tailing waste recycled	Refined products	Waste generated during production of refined products	Recycled part of waste	Not recycled part of waste
Coal	223,076	174,000	49,076 22% of product	0 Recycled Recyclable 60%	power generation (13 megawatts)	0	0	0
Manganese ore	1,749,000	400,000 In 2017, the Chiatura Mine produced an estimated 460,000 t of manganese concentrate	1,349,000	0	260,000 (65%) In 2017, the plant produced about 289,800 t of silicomanganese	140,000	10% 14,000	90% 126,000
Precious Metals (Gold and Silver)	4,376,000	13,4230	4,362,570	0	0	0	0	0
Copper ores	4,271,000	452,399	3,818,601	0	0	0	0	0

Production of Construction Materials

The EU Commission Study (2001) suggests that processing of construction materials is not connected to waste generation as all remains of the production could be used. We apply this approach in case of Construction Materials, and particularly for sandstone, sand and gravel production. For the Dimension Stones (like basalt, marble, etc.), the problem is that the remains generated during processing the stone slabs are not often used for production of composite materials and other products. Thus here is a space for improving circularity and zero waste could be seen as a target but not the current situation.

For production of the dimension stones, we can assume that only 70% of explored raw material corresponds to the final product, while 30% is waste. Out of this 30% only 5% is at present recycled (used for production of composite materials) and 25% is not recycled. Waste estimates has been made based on these assumptions. In order to use waste estimates for preparing the mass flow balance, we have converted volumetric data into mass equivalent. The density of the stone materials varies from 1,4 ton/m^3 to 3 ton/m^3. The average density of 2.0 ton/ m^3 has been used here.

Table 3.2-31 Assessment of construction materials quarrying waste streams

	Average Production Volume		Waste Generation	
	m3	Ton	m3	Ton
Dimension Stones (Construction Stones), Total	501,717	1,003,434	Total waste: 215,021 Recycled waste: 35,836 Not recycled: 179,184	Total waste: 430,042 Recycled waste: 71,672 Not recycled: 358,368
Construction Materials (volcanic), Total	4,424,298 m3 + 364,400 t	9,212,996	0	0
Construction Materials (sedimentary) Sandstone, Sand and gravel, Total	14,489,822	28,979,644	0	0

3.2.7.4 Circularity Profile: Mining

Sector nomination and NACE Index (NI): Mining (NI/ 5 - 9) Input in GDP (Mln GEL): 586.3 Mln GEL / 1.4% Annual Production value: 974 Mln GEL Includes: Mining of coal and lignite, Mining of metal ores, Other mining and quarrying	
Material Resources Used:	**Energy Consumption and GHG Emissions:**
Entrails Water consumption is less than 5.42 million m^3 Total water consumption in mining, construction and logging/wood and wood products sector (2020): 5.42 million m^3	Electric power: 126.6 GWh annually Natural Gas: 1.8 mill. m^3 annually Total GHG emissions for Logging and wood products, construction, manufacture and mining: 1,190 Gg CO_2 eq.)

Mass Flow Indicators:

Products:

Extraction of Materials (Products)	Average Production Volume, tons	Domestic Export, tons
Coal (coal and lignite)	174,000	0
Production of Ores		
Manganese	1,749,000	2,707.5
Precious Metals (Gold and Silver)	4,376,000	13,430
Copper	4,271,000	452,399
Dimension Stones (Construction Stones	1,003,434	0
Construction Materials (Volcanic)	9,212,996	0
Construction Materials (sedimentary) Sandstone, Sand and gravel	28,979,644	0
Total Mass	**50,179,550**	**468,536.5**

Annual Wastes and losses:

Waste description	Total Wastes, Tones
Coal ore tailings	49,076
Manganese	1,349,000
Precious Metals (Gold and Silver) ore tailings	4,362,570
Copper ore tailings	3,818,601
Dimension Stones (Construction Stones)	Total waste: 430,042 Recycled waste: 71,672 Not recycled: 358,368

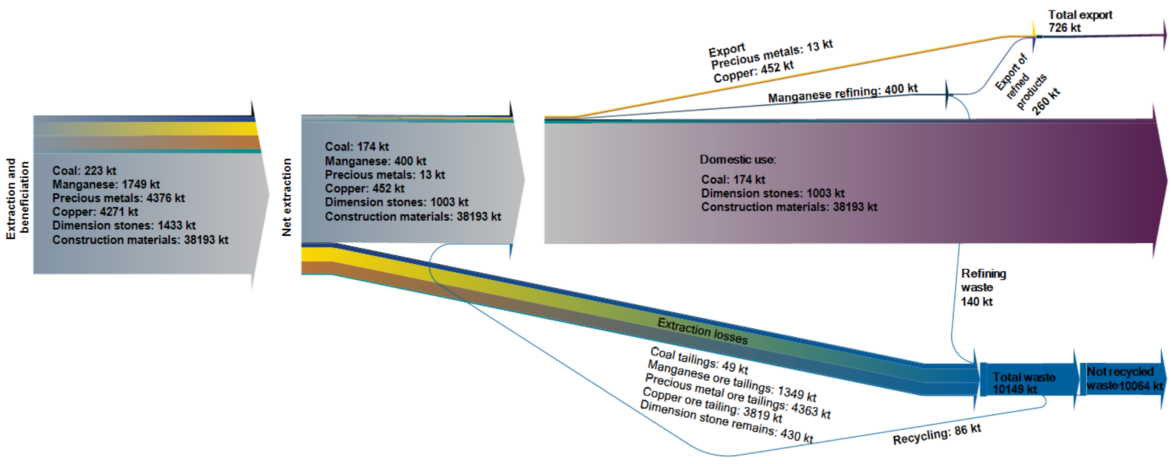


Figure 3.2-25 Mass flow diagram for mining sector (except oil and gas extraction)

Potential for improving circularity:

1. Implement modern technologies for mining to reduce pollution and emissions, and increase recovery of materials.
2. Implement modern technologies to recover the materials from tailings.
3. Recycle remains of the construction stone production
4. Implementation of energy supply schemes based on local renewable power (solar; wind; thermal) and energy efficient technologies

ReSOLVE FRAMEWORK

Regenerate	– Modern technologies enable recovery of materials from tailings so that losses and wastes are minimized – Remains of construction stone production can be recycled for various uses in the construction industry – Increase the share of renewable energy sources in the mining industry
Share	
Optimise	– Optimize mining technologies to increase recovery of extracted materials and efficiency of the industry – Increase energy efficiency of the industry through implementation of modern technologies and improved management
Loop	
Virtualise	
Exchange	

Key actors in implementing CE and direct beneficiaries:

► **Private companies:**

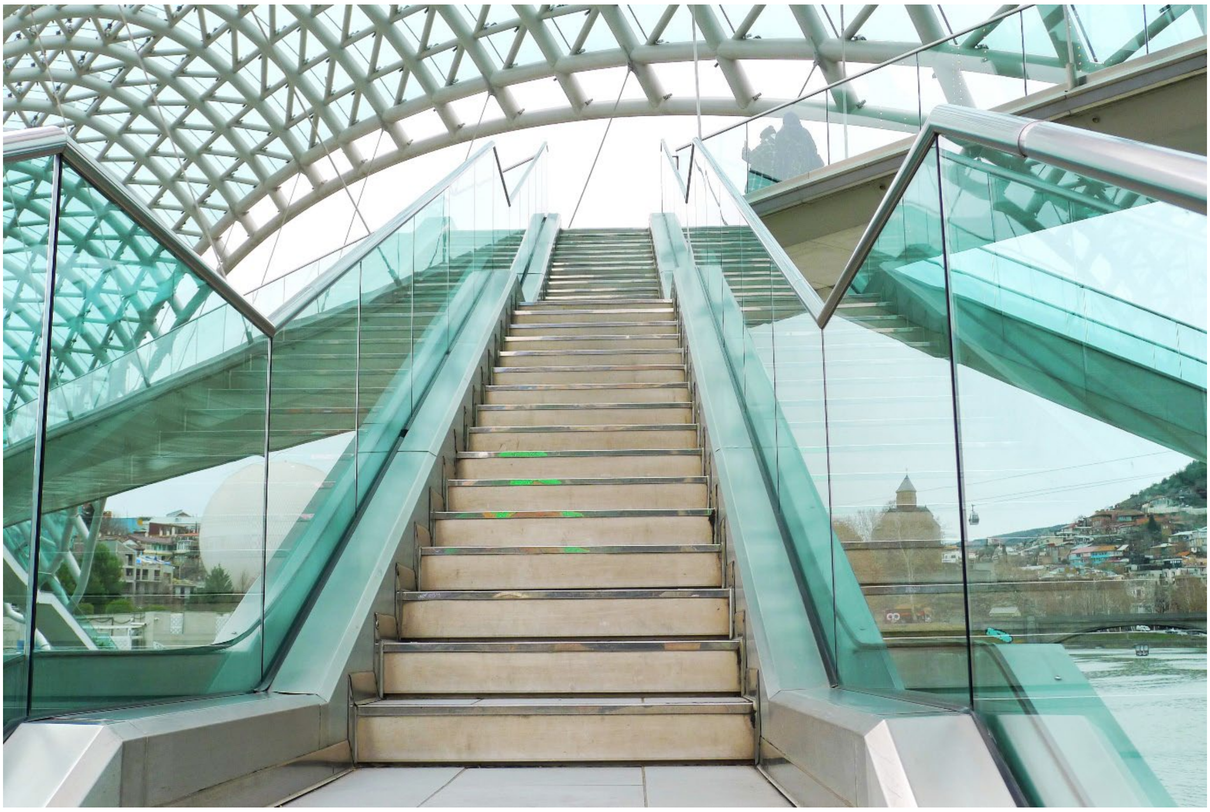
– Large companies dealing with mining of ores may introduce modern technologies to recover materials from tailings

– Small, Medium and large companies producing construction stones have space to recycle remains into composite materials.

► **Central Government:**

– Improving Policy and creation of incentives for the private sector introduce CE elements in their businesses

3.2.8 Construction



Sector nomination and NACE Index (NI): Construction (NI/ 41 - 43)

Input in GDP (Mln GEL): 3,680.8 Mln GEL / 8.5%

Annual Production value: 9,074.00 Mln GEL

3.2.8.1 Overview of the Construction Industry in Georgia

3.2.8.1.1 Basic Financial and Economic Indicators for Construction Sector

Based on information published by Geostat, construction sector is one of the largest and intensively growing sector of Georgia's economy. During last three years (2019 – 2021), added value in construction sector exceeded GEL 3,400 Mln GEL, thus, being 8.5% of Georgia's Gross Domestic Product – (GDP). Growing trend is clearly expressed. Below we provide different financial/economic indicators (source: Geostat 2022), better describing the role of construction for Georgia's economy.

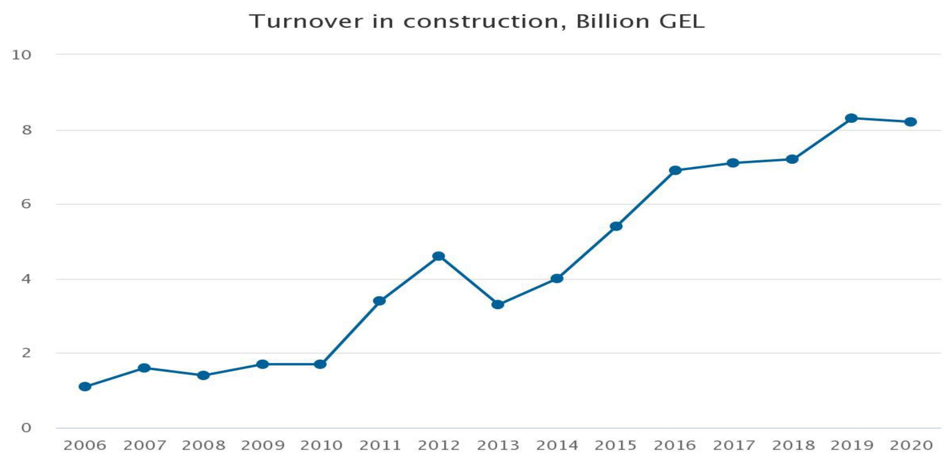


Figure 3.2-26 Turnover in construction in 2006-2020

Table 3.2-32 Turnover in construction by size of enterprises in 2006-2020

Year	Total	Large-Size Enterprise	Medium-Size Enterprise	Small-Size Enterprise
	Mln. GEL			
2008	1,412.0	466.6	726.0	219.4
2009	1,740.2	528.0	824.5	387.7
2010	1,721.7	648.0	634.5	439.2
2011	3,367.9	1,438.8	1,101.7	827.4
2012	4,581.1	1,828.0	1,744.7	1,008.4
2013	3,327.6	787.7	1,319.7	1,220.2
2014	4,027.6	1,131.7	1,391.4	1,504.5
2015	5,447.1	1,899.4	1,685.2	1,862.5
2016	6,863.2	2,742.5	1,949.3	2,171.4
2017	7,051.2	2,109.8	2,353.7	2,587.7
2018	7,171.3	1,640.3	2,855.0	2,676.0
2019	8,263.2	2,132.4	3,084.0	3,046.8
2020	8,157.7	1,875.2	3,064.1	3,218.4
2021	8,360.1	1,974.8	2,988.7	3,396.6

Source: Geostat

The size of enterprises is determined by the following methodology:

- **Large size enterprise** is an enterprise, where average annual number of employed exceeds 249 persons and/or volume of average annual turnover - 60 million GEL.
- **Medium size enterprises** are all enterprises of organizational-legal form, where average annual number of employed ranges from 50 to 250 persons and average annual turnover – from 12 million to 60 million GEL.
- **Small size enterprises** are all enterprises of organizational-legal form, where average annual number of employed does not exceed 50 persons and average annual turnover - 12 million GEL

Figure 3.2-27 Number of persons employed in construction in 2006-2021

3.2.8.1.2 Indicators of Construction Activities

From 2018 to 2021, 12,054 constructions have been completed. On average 3,013.5 constructions have been completed annually.

During the last 4 years (2018 to 2021), in total 40,612 construction permits have been issued, therefore, on average 10,153 permits have been issued annually. This figure shows certain plateau after significant growth trend as compared with the previous years: for instance, 2 725 construction permits were issued in 2006, as for 2017, this number quadrupled and reached 10 495. During the last four years, on average 10,153 construction permits have been issued annually. Number of issued permits exceeds the number of completed constructions almost 3 times and this ratio is maintained during almost 8 years.

Fir circularity needs, considering estimation of material flow assessment, it is interesting to know total area of completed constructions and issued permits.

During 2018 - 2021, permits have been issued for construction of about 26,385,133 m2 buildings (in average 6,596,283 m2 annually). In reality, during these four years constructions have been completed for 8,093,865 m2 of buildings (three times less than planned). Annually this resulted in average in 2,023,466 m2 of constructed buildings.

If we look at Completed objects by type for 2021, we will find out that constructions for living purpose have the lion's share. In 2021, construction of residential buildings takes share of s 80% of total construction area. This data base does not include infrastructure projects, but covers only construction of buildings: Administrative, residential, hotels, restaurants etc.

In more details the construction indicators could be seen in tables below, summarizing Geostat data for 2022.

Table 3.2 33 Construction permissions granted and completed construction objects in Georgia in 2018 2020 (declared data)

Region	2018		2019		2020		2021	
	number	space, m²	number	space, m²	number	space, m²	number	space, m²
Construction permissions granted	10,204	6,206,009	10,749	7,538,398	9,564	5,206,256	10,095	7,434,470
completed construction objects	2,518	2,091,861	2,508	2,547,924	2,134	1,694,301	2,347	1,759,779

3.2.8.2 Material flow in Construction Sector

3.2.8.2.1 Construction Materials: Annual production, import, export, internal consumption

Quarries

In Georgia, quarries are treated as part of the minerals sector and in Georgia, specifically indicate the mining of “construction materials” (e.g., brick clay, building stone, clay, chalk, dolomite, gravel, gypsum, limestone, sand and slate).[43] Quarrying for construction materials occurs throughout Georgia; these materials are naturally occurring substances that include stone, rock, clay, sand and are used typically in the construction of buildings, roads and various structures as well as the production of clinker and cement. Improved quarry governance and oversight is recommended. In Georgia, Municipalities play a significant role as a primary customer of quarries; in this instance pricing is negotiated often to the benefit of the host Municipality.[44]

The annual production of the quarries and volumes of explored construction materials are described in Section 3.2.7 Mining. For completeness of the picture for the construction section, the production rates are repeated here, in Table 3.2-34.

Table 3.2-34 Annual production rates of construction materials for 2021

	Average Production Volume, tons	Number of Licensees
Dimension Stones	1,003,434	264
Construction Materials (volcanic rocks)	9,212,996	442
Construction Materials (sedimentary rocks)	28,979,644	1029

Source: LEPL National Agency of Mineral Resources

3.2.8.2.2 Annual Export and import of construction materials[45]

Focus is made on sand, gravel, pebbles, bricks, blocks, cement and cement clinker, considering that this creates the basic mass flow and besides, wooden materials are accounted in other chapters of this report (forestry and wood production; metal production etc.). From circularity standpoint, the wooden wastes and especially metal scarp is more or less collected, separated

[43] Note: other minerals that are not categorized as “construction materials” may also be “quarried”. In general understanding of the term, quarries are referred to as “open mines”.

[44] Note: Where construction materials are found on a landowner’s private property, a licence is not required for use by the owner for private purposes, but a licence is required where those quarried materials are sold.

[45] All data in this section are provided by the Customs Department

and recycled. Problematic is the inert material waste, as waste of materials used for construction, as well as demolition of the building.

Table 3.2-35 Export and import of construction materials in 2021

Construction Materials	Export, ton	Import, ton
Bricks, blocks, ceramic tiles	0	5,760
Sand, gravel, pebbles etc.	8,889.8	4,074.6
Cement, cement clinkers etc	0	850,106.3
Total	**8,889.8**	**9,834.6**

3.2.8.2.3 Annual inert waste generation rates

At present, management of the construction waste is a problem for country. A lot of construction wastes are irregularly disposed on municipal landfills, on surrounding territories and in a thousand of illegal dumpsites (mostly in gorges and wastelands near the settlements). In 2022 a thematic study on Sustainable Management of the Inert Wastes has been conducted by the Georgian Parliament and firs concept notes have been produced. However, this is only beginning of the long process. The inventory of the inert construction waste is not available and data on construction waste amounts and typology is not provided in any statistic databases. Only fragmentary data related to particular landfills or particular waste operators could be found. In a thematic study on Sustainable Management of the Inert Wastes, the in 2018 – 2021 years about 780 000 tons of construction waste entered the inert waste landfill of “Tbilservice Group”. We tried to make some assumptions on approximate annual generation of construction wastes, based on this data and Batumi data provided by the Adjara WM Company.

Table 3.2-36 Annual production rates of construction materials for 2021

	Approximate Annual Production of Construction Wastes	Average Annual Construction Activity (area/m^2)
Tbilisi	195,000 tons	1,089,434
Adjara	25,000 tons	327,507
Average Ratio waste tones /area m^2	0.075 - 0.178 t/m^2	assumption: 0.15 ton/m^2
Approximation for Georgia **TOTAL Construction Wastes**	**Approximately 303,520 tons annually**	**2,023,466**

Annual inert waste generation volumes for Georgia is roughly estimated as 303,520 tons. Mostly the construction waste consists of remains of concrete, blocks and bricks, cement/clinker products (78%), some part of wooden materials (10%), packaging (8%) and much less metal scarp (4%), as the latest usually is separated and removed at earlier stages.

3.2.8.2.4 Annual balance of materials

Import – Export shows figures about 851,051 tons of construction materials. This material is used for construction in Georgia.

Internal production of raw construction materials (sand, gravel, pebbles, stone, tuff etc.) is equal to 39,196,074

Approximate volumes of construction wastes constitute 303,520 tons annually. This covers wastes produced during construction and during processing of raw materials and production of construction semi-products, like bricks, slabs, clinker etc.

3.2.8.3 Circularity Profile: Construction

<table>
<tr><th colspan="2">Sector nomination and NACE Index (NI): Construction (NI/ 41 - 43)
Input in GDP (Mln GEL): 3,680.8 Mln GEL / 8.5%
Annual Production value: 9,074.00 Mln GEL</th></tr>
<tr><td>Material Resources Used:</td><td>Energy Consumption and GHG Emissions:</td></tr>
<tr><td>Internal production of raw construction materials (sand, gravel, pebbles, stone, tuff etc.) is equal to 39,196,074 tons

Water consumption is less than 5.42 million m^3
Total water consumption in mining, construction and logging/wood and wood products sector (2020): 5.42 million m^3</td><td>Electric power: 117.8 GWh annually
Natural Gas: 28.6 mill. m3 annually

Total GHG emissions for Logging and wood products, construction, manufacture and mining: 1,190 Gg CO_2 eq.)</td></tr>
<tr><td colspan="2">Mass Flow Indicators:</td></tr>
<tr><td colspan="2">Import – Export = 851,051 tons of construction materials. This material is used for construction in Georgia.

– Import - 859,940.9 tons
– Export - 8889.8 tones

Internal production of raw construction materials (sand, gravel, pebbles, stone, tuff etc.): 39,196,074 tons

Approximate volume of construction wastes constitutes 303,520 tons annually. This covers wastes produced during construction and during processing of raw materials and production of construction semi-products, like bricks, slabs, clinker etc.

Net consumption of building materials - 38,893,499 tons</td></tr>
</table>

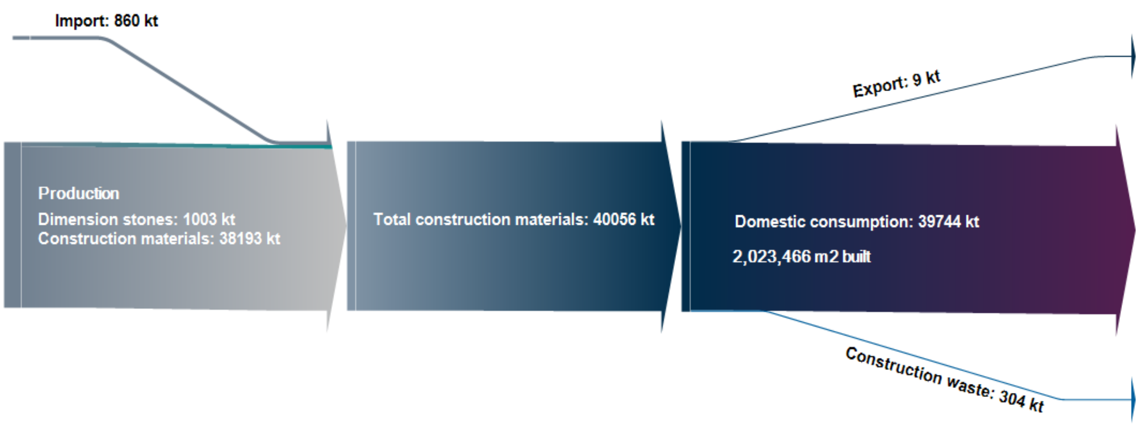


Figure 3.2-28 Mass flow diagram for construction sector

Potential for improving circularity:

1. Implement modern technologies for production of new construction materials and other goods out of construction waste. Crushing stones and concrete remains and production of artificial gravel could be one example. Production of composite materials could be also thought as a version.
2. Where possible, reuse the spoil and other fine materials for slope stabilization and erosion control measures in the villages, or stones for river bank protection. This will minimize need of quarrying and will minimize resource waste.
3. Implement energy-efficiency principles during design and construction of buildings

ReSOLVE FRAMEWORK

Regenerate	– Reuse and recycle construction and demolition wastes to minimize the need for extraction of virgin resources and waste disposal
Share	– Promote sharing of building machinery, as well as sharing of premises and commodities built
Optimise	– Promote energy efficient and green buildings, as well as energy efficiency during construction works
Loop	
Virtualise	
Exchange	– Replace building materials with more energy efficient and/or safe materials

Key actors in implementing CE and direct beneficiaries:

- **Private companies:**
  - Large companies dealing with construction or production of construction materials could be interested in recycling production of new construction materials and other goods out of construction waste.
- **Municipal Waste Operating Companies (like landfills or waste collecting companies):**
  - could be interested in recycling production of new construction materials and other goods out of construction waste.
- **Central Government:**
  - Improving Policy and creation of incentives for the private sector introduce CE elements in their businesses

3.2.9 Energy Generation and Transport

Sector nomination and NACE Index (NI): Electric power generation, transmission and distribution (NI/ 35.1);

Input in GDP (Mln GEL): 1009.1 Mln GEL* / 2.3%
Annual Production value: 1,650 Mln GEL*

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* Data for GDP and Annual Production value is given for the entire NI/ 35, which includes also gas, steam and air conditioning supply. However, the Lion's share in this figure should be attributed to (NI/ 35.1).

3.2.9.1 Electric power generation

3.2.9.1.1 Electric power generation in Georgia

The power system in Georgia is characterized by relatively stable seasonal supply and consumption patterns. Due to abundant hydro resources, hydropower dominates the electricity generation in Georgia Currently, 87 small, medium and large scale hydro power plants are operating with total of 3260.07 MW installed capacity and 9949,3 mln. kWh annual generation (2018).

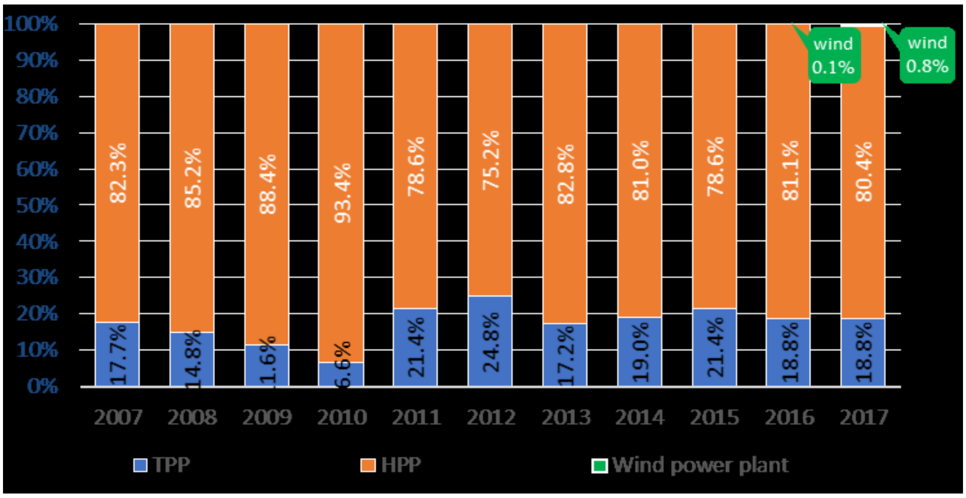
However, in spring-summer period electricity production peaks, though consumption decreases, creating imbalance between supply and demand. The electricity shortages in winter is compensated by thermal power plants and electricity imports. To meet increasing energy demand, overcome the winter deficit and to decease the dependence on imported energy resources additional generation units are being developed. In total, 139 renewable energy projects are under development. The total installed capacity of these projects is 3218 MW and approximate electricity generation is around 13891 mln. kWh. Out of which, 24 Projects are on Construction and Licensing stage, with installed capacity of 235 MW, annual generation of 1,065 mln. kWh. 24 Projects are on Construction stage, installed capacity equals 376 MW, annual generation of 1700 mln. kWh.

91 Projects on the Feasibility Study Stage with 2607 MW installed capacity and annual generation of 11 126 mln. kWh.

The first wind power plant “Kartli” was taken into operation in 2016. Total installed capacity is 20,7 MW and total annual generation equals 84,3 mln kW/h (2018). In 2017, share of the electricity generated by HPPs in the total generation was 80,4%. The share of the electricity generated by wind power plant being put in operation at the end of 2016 amounted to 0,8%, though not yet enough to cover the country’s consumption-generation gap.

As for thermal power, there are four gas-fired thermal power plants and one coal-fired thermal power plant with total installed capacity of 924,4 MW. Additionally, Ministry of Economy and Sustainable Development has planned to construct another 230 MW thermal power, equipped with combined cycle gas turbine, and decommission Mtkvari Unit 9 by 2025.

In the electricity generation structure, increase of the electricity shares generated (delivered on a bus bar) by thermal and hydro power plants is more or less stable. Electricity generated by the thermal power plants in 2016-2017 has constituted 18.8% of the total generated electricity. The share of the electricity generated by HPPs in the total generation has been 80.4%. The share of the electricity generated by the wind power plant being put into the operation by the end of 2016 has been 0.8%.



Source: Draft National Sustainable Energy Action Plan of Georgia

Figure 3.2-29 Electricity generation structure in 2007-2017

Electricity demand is highly seasonal in Georgia, with peak demand in winter and lower demand in summer. This is the inverse of the seasonal hydropower generation pattern: hydropower generators tend to produce at their peak in summer months and at their lowest levels in winter. This enables Georgia to export energy during the summer, but also requires hydropower generators to spill large amounts of water. Due to low hydropower output in winter, Georgia relies on thermal generation, which makes up 24-28% of total electricity generation annually, though this rate increases in winter, and decreases to less than 1% in summer.

Georgia has an installed generating capacity of around 4246.7 MW comprising a mix of hydro and thermal power plants (HPPs and TPPs). The dominant generator is the Enguri HPP with an installed capacity of 1300 MW and an operational capacity of 1250 MW, and which is responsible around one-third of total electricity generation in Georgia. The other large HPP is Vardnili. Together, the

Enguri HPP and Vardnili cascade with other middle-size and smaller HPPs provide around 3301 MW of regulating HPP capacity (with 1992 MW from reservoir HPP, and 389 MW from daily regulatory HPP). The total existing operational capacity makes up 4100 MW, including 3167 MW of HPPs, 20 MW of wind power plant and 913 MW of operation capacity of TPPs. It is estimated that an additional capacity of new HPPs and TPP will be added by 2020-2030 that will increase the installed generation capacity to 4639 MW by 2020. From 2021, wind and solar installed capacities will be added to existing hydro and thermal capacities and the total installed capacity will increase to 7658 MW (including 5357MW of HPPs, 1355 MW of thermal and 686 MW of wind and 260 MW of solar power plants capacities) by 2025, and to 9741 MW (including 4097 MW of regulatory HPPs, 2438 MW of run-of-the-river HPPs, 1330 MW of wind power plants, 520 MW of solar power plants, 110 MW of gas turbines, and 1245 MW of high efficiency combined thermal power plants replacing outdated Gardabani units No 3, 4 and 9) by 2030. Proportion of HPPs in total installed capacity will be up to 67% by 2030, with 42% of regulatory power plants in total installed capacity of the country. This will ensure utilization of water collected during high water season in low water periods, and decrease of reliance on importing fuel for electric power and thermal plants. It should be noted that the proportion of wind and solar power plants will be approximately 18% by 2030.[46]

3.2.9.1.2 Electric power balance: generation, import, export, consumption

Electricity demand is highly seasonal in Georgia, with peak demand in winter and lower demand in summer. While Georgia has interconnections with Russia, Turkey, Azerbaijan and Armenia, the vast majority of its trade is with the first two countries. Trade with these countries comprises imports in winter months to meet Georgian demand, with exports in summer months when Georgia has excess hydro output. Trade with Azerbaijan follows a similar pattern although volumes are much smaller. There are very small quantities of exports to Armenia. In 2006 -2010 exports increased every year. Due to the increase in consumption, a subsequent decrease in exports was seen in 2011-2018. In 2019 Georgia exported 0.243 billion kWh in total, representing a 0.346 billion kWh decrease over the equivalent period in 2018. It should be noted that Georgia imported 1.626 billion kWh in 2019, representing a 0.116 billion kWh increase over the import amount for 2018. In accordance with the forecasts of Ten Year Network Development Plan of Georgia 2020-2030 the rough estimates show that annual domestic consumption of electricity will increase by about 5% each year (up to about 17.8 billion kWh by 2025, 22.7 billion kWh by 2030), annual generation will rise on average 10-12% per year (up to about 25.2 billion kWh by 2025 and 32.62 billion kWh by 2030). Accordingly, up to about 7.4 billion kWh per annum will be subject to export by 2025, and 9.9 billion kWh by 2030.

In 2017 the electricity imports exceeded exports by 2.2 times (see Figure 3.2-31) and reached 1,497.2 Mln kWh that exceeds the same indicators of the previous year by three times and indicators of 2015 by two times.

With regards to exports, 685.7 Mln kWh electricity has been exported from Georgia that exceeds indicators of the previous year by 22.7%. The dramatic increase of imports has been caused by the decreased water inflow and stopping of Enguri HPP for two weeks. Besides, for the purpose of meeting internal consumption and filling the deficit that has resulted from decreased hydro generation, thermal generation was substituted by import based on its competitive price.

[46] Georgian States Electrosystem (GSE), Annual Report 2019/2020

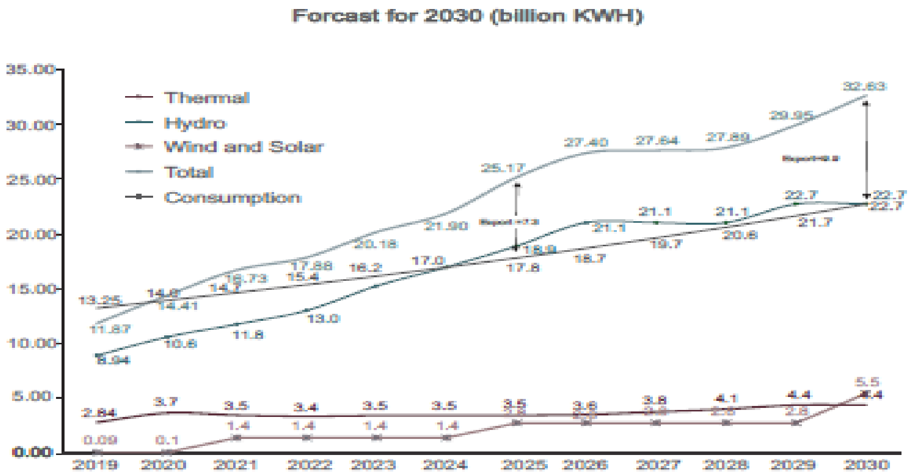


Figure 3.2-30 Electricity sector forecast for 2030

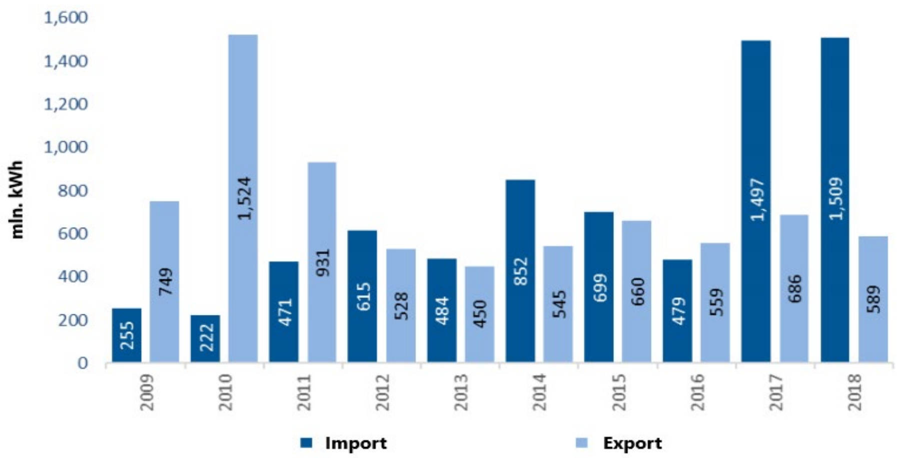


Figure 3.2-31 Electricity import and export in 2009-2018

Table 3.2-37 Supply and consumption of electricity and heat, 2020 (thousand tonnes of oil equivalent)

	Hydro	Wind	Geothermal	Solar	Electricity	Total
Production	709.2	7.8	15.6	3.1	-	735.8
Imports	-	-	-	-	147.2	147.2
Exports	-	-	-	-	22.0	22.0
Stock Changes	-	-	-	-	-	-
DOMESTIC SUPPLY	709.2	7.8	15.6	3.1	125.2	861.0
Available	709.2	7.8	15.6	3.1	1 084.8	-
Transfers	-	-	-	-	-	-
Statistical Differences	0.0	0.0	0.0	0.0	0.0	0.0
Transformation Sector - Input	709.2	7.8	-	-	-	717.0
MA Hydro Electricity Plants	709.2	-	-	-	-	709.2
Wind Plants	-	7.8	-	-	-	7.8
Transformation Sector - Production	-	-	-	-	959.6	959.6
MA Thermal Electricity Plants	-	-	-	-	242.5	242.5

	Hydro	Wind	Geothermal	Solar	Electricity	Total
MA Hydro Electricity Plants	-	-	-	-	709.2	709.2
Wind Plants	-	-	-	-	7.8	7.8
Energy Sector	**-**	**-**	**-**	**-**	**21.4**	**21.4**
Coal Mines	-	-	-	-	1.1	1.1
Own Use in Thermal Electricity Plants	-	-	-	-	9.5	9.5
Own Use in Hydro Electricity Plants	-	-	-	-	10.9	10.9
Other	-	-	-	-	0.0	0.0
Losses	-	-	**1.5**	-	**76.3**	**77.8** (7.7% of total consumption)
FINAL CONSUMPTION	**-**	**-**	**14.1**	**3.1**	**987.0**	**1 004.3**

Table 3.2-38 Supply and consumption of electricity and heat, 2020

	Hydro (GWh)	Wind	Geothermal (TJ)	Solar (TJ)	Electricity (GWh)
Production	8 248.2	90.8	653.8	130.8	11 159.8
Imports	-	-	-	-	1 711.9
Exports	-	-	-	-	255.6
Stock Changes	-	-	-	-	-
DOMESTIC SUPPLY	**8 248.2**	**90.8**	**653.8**	**130.8**	**12 616.1**
Transfers	-	-	-	-	-
Statistical Differences	0.0	0.0	0.0	0.0	0.0
Transformation Sector - Input	**8 248.2**	**90.8**	**-**	**-**	**-**
MA Hydro Electricity Plants	8 248.2	-	-	-	-
Wind Plants	-	90.8	-	-	-
Transformation Sector - Production	**-**	**-**	**-**	**-**	**11 159.8**
MA Thermal Electricity Plants	-	-	-	-	2 820.8
MA Hydro Electricity Plants	-	-	-	-	8 248.2
Wind Plants	-	-	-	-	90.8
Energy Sector	**-**	**-**	**-**	**-**	**249.1**
Coal Mines	-	-	-	-	12.4
Own Use in Thermal Electricity Plants	-	-	-	-	109.9
Own Use in Hydro Electricity Plants	-	-	-	-	126.7
Other	-	-	-	-	0.1
Losses	-	-	**63.2**	-	**887.7** (7.7% of total consumption)
FINAL CONSUMPTION	**-**	**-**	**590.6**	**130.8**	**11 479.3**

Source: Geostat; Energy Balance for 2020, Georgia

3.2.9.2 Electric Power Transmission

Transmission assets of GSE and its subsidiary Energotrans include 500/400/220/110/35kV overhead lines with the total length of 3 434 km and 93 substations with the total installed capacity of 11 938MVA, including six (6) strategically important 500kV substations and eighteen (18) 220kV substations throughout the territory of Georgia. Georgia's transmission network operates at 500kV, 400kV, 330kV, 220kV, 110kV and 35kV voltages. A backbone 500kV transmission line (Kavkasioni – Imereti – Kartli-2 – Kartli-1) connects Russia and the large generators (notably Enguri hydro power plant (HPP)) in the north-west to Tbilisi. There is a reasonably extensive 220kV grid connecting other demand centres and generators.

The Georgian grid is interconnected with Russia at 500kV and 220kV (through Abkhazian AR), with Azerbaijan at 500/330kV, with Armenia at 220kV, and with Turkey at 220/400kV. There are also isolated 110kV connections with Armenia and Russia. The 500kV line, 330kV interconnection with Azerbaijan and 220kV interconnection lines with Turkey are owned by JSC Sakrusenergo, 50%-owned by the State and 50%-owned by a Russia's Federal Grid Company, while the majority of the 220kV and part of 110kV lines and 35kV network which is used for transmission services is owned by GSE.

GSE's subsidiary, Energotrans, owns and operates 500kV transmission lines Vardzia, Gachiani and Zekari and 400kV Meskheti interconnection with Turkey constructed as part of the Black Sea Transmission Network Project. The new lines provide additional security to Georgia's transmission network, by adding a second West-East 500kV link, and create up to 1,050MW export capacity to Turkey.

During the past few years GSE has invested vast funds for improving the reliability of the transmission grid and diminishing the risks of outages or incidents. Replacement of primary or secondary hardware, installation of remote control systems, intelligent electronic devices, and state-of-the- art equipment across the transmission lines and substations has helped to minimize the number of total blackouts and provide quality services to customers.

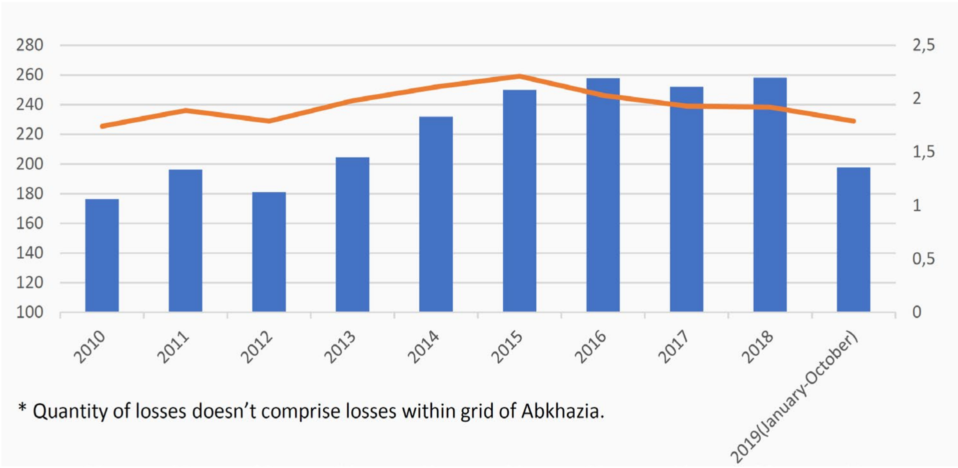
In terms of maintaining the operational reliability GSE implements initiatives or projects aimed at further improving and expanding its transmission infrastructure and dispatch capabilities to better meet the new requirements imposed by the intensification of cross border trading of electricity.

3.2.9.3 Losses for the Transmissions and Distribution Networks

Part of the transmission mainlines owned and operated by the State company GSE and distribution networks operated by the companies JSC Telasi and JSC Energo-Pro Georgia, needs rehabilitation so far as unacceptable losses are observed in the network. Dynamics of the total losses for the transmission and distribution network for the recent years is shown below[47]:

- 2001 – 18.53%
- 2006 – 13.20%
- 2016 – 7.21%
- 2018 – 6.48 %

[47] Report/presentation "Georgia: Security of Supply", December 2019; Ministry of Economy and Sustainable Development of Georgia



Source: Report/presentation "Georgia: Security of Supply", December 2019; Ministry of Economy and Sustainable Development of Georgia

Figure 3.2-32 Dynamics of the total losses for the transmission and distribution network in 2010-2018

More recent data on losses is given in Georgia's Energy Balance for the recent years published by National Statistics Office of Georgia. According to Georgia's energy balance for 2019 and 2020, electricity losses account for 7.6% - 7.7% of final energy consumption. According to the Georgian National Integrated Energy and Climate Plan (NECP), it is planned to reduce losses by 5% by 2030.

According to the ten-year development plan of the Georgian transmission network, the implementation of the following projects is defined:

- Cross-Khorga (2021), reduction of 2 MW loss; 17.52 GWh / year;
- Batumi-Akhaltsikhe (2021-2023), reduction of 10 MW loss; 87.6 GWh / year;
- Ksani-Stepantsminda-Mozdok (2025), 37 MW loss reduction; 324.12 GWh / year;
- Marneuli-Ayrum (2023). Loss reduction <1 MW; 4.3 GWh / year
- Jvari-Tskaltubo-Akhaltsikhe (2022), 28 MW loss reduction 245.3 GWh / year;
- North Ring - Tskaltubo (2022-2029), 13.5 MW loss reduction; 117.45 GWh / year;
- Guria (2021), reduction of 1.6 MW loss; 14.01 GWh / year;
- Akhaltsikhe-Tortum (2022-2025), reduction of 25 MW loss; 219 GWh / year;
- Batumi-Muratli (2025), reduction of 2 MW loss; 17.52 GWh / year;
- Namakhvani - Tskaltubo (2023), reduction of 1.27 MW loss; 11.13 GWh / year;

The following investments are planned for the implementation of the above-mentioned projects by years:

- 420 million euros / 1.636 million GEL in 2019-2021;
- 185 million Euros / 721 million GEL in 2022 - 2030.

3.2.9.4 Losses Associated with the HPP Subsector

Rehabilitation of the existing old HPPs is considered as one of the efficient ways for increasing Georgia's generation capacity with minimal expenses and in shortest time. Under this context it is worthy to mention a problem, which is very common for most of large HPPs in Georgia, like the main Enguri HPP, or Gumati, Lajanuri and Vartsikhe HPPs. The problem is related to sedimentation of the HPP reservoirs, filling significant part of the reservoirs by debris and sediments and reduction of the production capacity and life-time of the HPP. The reason is that regular flushing and cleaning of the reservoirs have not been conducted according to standard requirements. As a result, Gumati and Vartsikhe reservoirs are almost full of sediments, while Lajanuri's one has been regularly flushed since more than 30 years partially maintaining its life capacity. There is no available data on all large HPPs in Georgia, but below we will bring data on three large HPPs and further make certain approximations for the entire sector.

The cascade is located on the river. On the Rioni from the village of Zhoneti to the Rioni HPP. The hydropower plants are served by a concrete dam located 7 km away from Kutaisi, which creates a reservoir with a capacity of 39 million m3 (with a useful capacity of 13 million m3). Both HPP Gumati HPP 1 and Gumati HPP 2 have been operating since 1958.

Gumati HPP: 39 Mm3 reservoir with Installed Capacity of 69.5 MW. Total useful storage is 13 Mm^3. Gumati hydroelectric project, operating since the 1959. The Gumati reservoir filled up about 95% during the first 9 years.

- The Gumati reservoir filled up about 95%
- Reduction of the sediment fill by 80% the useful capacity will be increased by 8.5 Mln. m^3 equivalent to 0.8Mln. kW/h;
- Filling reservoir 10 times allows to increase annual generation by 8 Mln. kW/h

Table 3.2-39 Main characteristics of Gumati reservoir

Gumati							
Total capcacity	source	Mm^3	24.6				
year		y	1958	1962	1964	1967	1969
Reservoir Filling		n^0 y	0	4	6	9	11
	Stucky feas 2012	%	0	50		85	
	Matcharadze 2014		0			96	
	Kereselidze 1985			51			
	ECH 2007		0	52	74	84	90
	MEAN			51	74	88	90
Sediment trapped in reservoir	Stucky feas 2012	Mm^3/y	0	19.5		33.2	
	Matcharadze 2014		0			37.4	
	Kereselidze 1985		0	20			
	ECH 2007		0	20.2	28.8	32.7	35
	MEAN			20	29	34	35
Average sediment trapped		Mm^3/y		5.0	4.8	3.8	3.2

Gumati reservoir - sediment samples, summary results

	Particle diameter mm	Mass % S1 GU	S2 GU	S3 GU	S4 GU	S5 GU	S6 GU	S7 GU
Boulder	300 - 75	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gravel	75 - 4.75	70.8	72.2	72.9	55.5	53.8	77.1	0.0
Sand	4.74 - 0.075	26.7	25.6	25.5	43.3	33.1	19.7	83.8

Vartsikhe HPP cascade: Vartsikhe HPP cascade (IP = 184 MW) is the most modern of the existing plants (1972-1987) and it is composed by four plants in cascade (Vartsikhe I…IV) with a single reservoir part of the Vartsikhe I HPP. This reservoir (total storage 14.6 Mm3) has been filled about 90% during the first 5 years of operation.

- 24Mln. m^3 reservoir with total useful storage 14.6 Mln. m^3
- Vartsikhe HPP reservoir is filled up about 95%
- Reduction of the sediment fill by 80% the useful capacity will be increased by 9 Mln. m^3 equivalent to 1.5 Mln. kW/h;
- Filling reservoir 10 times allows to increase annual generation by 15 Mln. kW/h

Table 3.2-40 Main technical characteristics of Vartsikhe reservoir

Vartsikhe					
Total capcacity		Mm^3	24.6		
year	source	y	1978	1982	1983
Reservoir Filling		n^0 y	0	4	5
	Stucky feas 2012	%			
	Matcharadze 2014		0		93
	Kereselidze 1985		0	92	
	ECH 2007				93
	MEAN			92	93
Sediment trapped in reservoir	Stucky feas 2012	Mm^3/y			
	Matcharadze 2014		0		14.0
	Kereselidze 1985		0	13.75	
	ECH 2007				
	MEAN			13.8	14.0
Average sediment trapped		Mm^3/y		3.4	2.8

Lajanuri HPP: Lajanuri HPP (total storage 24.6 Mln. m^3) operates from 1960. The plant uses the water of Lajanuri (an affluent of Roni) together with some of the waters of the Tskhenistskali river.

- 25Mln. m^3 reservoir with total useful storage by 18 Mln.m^3
- Lajanuri HPP reservoir is filled up about 60%
- Reduction of the sediment fill by 80% the useful capacity will be equivalent to 2-2.5 Mln. kW/h;
- Filling reservoir 10 times allows to increase annual generation by 20-25 Mln. kW/h

Table 3.2-41 Main technical characteristics of Lajanuri reservoir

Ladjanuri								
Total capcacity		Mm^3	24.6					
year	source	y	1960	1965	1970	1974	1975	1980
Reservoir Filling		n^0 y	0	5	10	14	15	20
	Stucky feas 2012	%	0	26	43	55	56	68
	Matcharadze 2014		0	26	43	55	56	68
	Kereselidze 1985					47		
	ECH 2007							
	MEAN			26	43	52	56	68
Sediment trapped	Stucky feas 2012	Mm^3/y	0	6.4	10.6	13.5	13.8	16.7
in reservoir								
	Matcharadze 2014		0	6.4	10.6	13.5	13.8	16.7
	Kereselidze 1985		0			11.6		16.1
	ECH 2007							
	MEAN			6	11	13	14	17
Average sediment trapped		Mm^3/y		1.3	1.1	0.9	0.9	1.0

The values, by which the annual generation would be increased in case of debris removal from the reservoirs could be considered as losses for present time. However, in reality the picture is much more complex and the increase of the reservoir's capacity may not result directly in growth of generation. Increase of the reservoir's capacity definitely will increase stability of generation and minimize dependence on seasonal fluctuations of water income. Having this in mind, we will still try to present the potential impact of sedimentation of the HPP reservoirs in terms of potential losses, and estimate this impact very roughly as loss of 0,1-0,2% of the annual generation.

3.2.9.5 *Circularity Profile: Electric Power Generation, Transmission and Distribution*

Sector nomination and NACE Index (NI): Electric power generation, transmission and distribution (NI/ 35.1); **Input in GDP (Mln GEL):** 1009.1 Mln GEL* / 2.3% **Annual Production value:** 1,650 Mln GEL* * Data for GDP and Annual Production value is given for the entire NI/ 35, which includes also gas, steam and air conditioning supply. However, the Lion's share in this figure should be attributed to (NI/ 35.1).	
Material Resources Used:	**Energy Consumption and GHG Emissions:**
Water Consumption: 26300.78 million m3	**Annual use of electric energy for internal use of TPPs and HPPs:** 21.4 Thousand tonnes of oil equivalent or 236,6 GWh **Natural gas consumption:** 603.8 mil. m3 **Annual Emissions of GHG –** 10,726* Gg. CO^2 eq. *Data is for entire Energy Industry, but the lion's share here is connected to the emissions due to thermal plant generations
Mass Flow Indicators:	
Products:	
– Import of electric power: 1 711.9 GWh annually – Thermal power generation: 2,820.8 GWh annually (18.8%) – HPP generation: 8 248.2 GWh annually (80,4%) – Other renewable sources: Wind power plant "Kartli" (0.8%) – Annual generation equals 90.8 GWh – Total generation 11 159.8 GWh annually – Export of electric energy: 255.6 2 GWh annually – Domestic consumption of electric power: 11 479.3 GWh annually	
Annual Wastes and losses:	
– Losses in transmission lines and distribution networks (significant effect): 76.3 Thousand tonnes of oil equivalent or 887.7 GWh (7.7% of annual consumption) – Loses of water spilled without generation, i.e. losses due to absence of energy storages: Due to this, energy sector has seasonal limitations and necessity to import the electricity. The wastage of the resource could be estimated as minimum as import - 1 711.9 GWh/y. – Losses due to filing the reservoirs of HPP (insignificant direct effect; affects stability rather than generation): Roughly, about 0,1- 0,2% – Wastes: The exact figures are not available for all large HPPs and their reservoirs, but far more than 100Mm3 of sediments is accumulated in the reservoirs as ballast.	

Gaps in Circularity:

1. **Losses:** 7.7% of annual consumption is lost in networks;
2. The energy system is dependent on imports (1 711.9 GWh annually) and thermal generation (18.8% of generation/ 2 820.8 GWh annually). Due to absence of storage facilities, energy sector has seasonal limitations and necessity to import the electric energy (1 711.9 GWh annually). Part of water is spilled without using it for generation. This is in fact a waste of water. The waste of water could be expressed in units of energy production. At present is equal as minimum to 1 711.9 GWh).
3. **Wastes:** The exact figures are not available for all large HPPs and their reservoirs, but far more than 100Mm^3 of sediments is accumulated in the reservoirs as ballast.

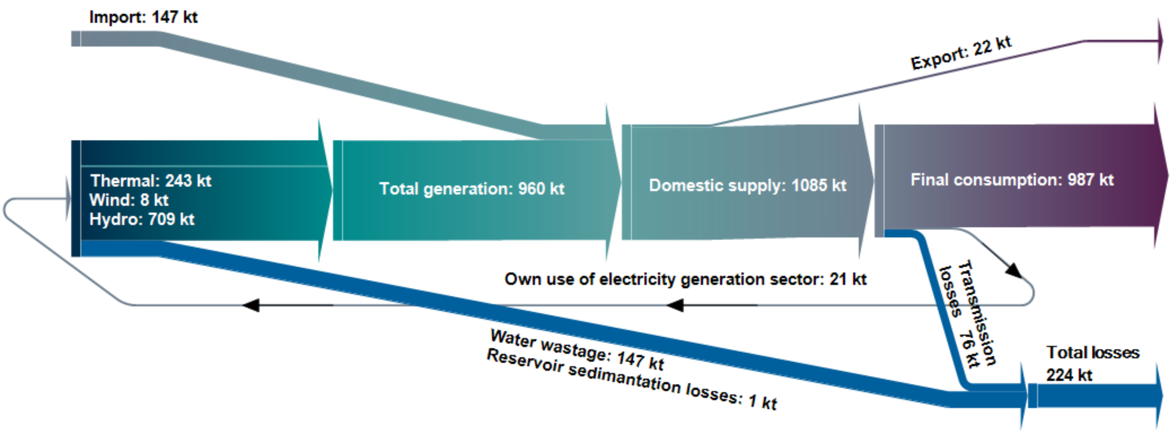


Figure 3.2-33 Mass flow diagram for electricity generation and transmission sector

Potential for improving circularity:

1. Implementation of projects aimed on minimization of losses: the target for 10 years (till 2030) is to reduce the losses from 7.7% to 5.0% as minimum[48].
2. Installation of energy storage facilities (Hydropumped reservoirs near Enguri HPP; Electric storage batteries; etc.) is a strategy of the government aimed on no-import regime and fixed, constant consumption of the gas imported from Azerbaijan. Energy generated by hydropower or other renewables will be used to cover the demands without import (currently import covers 1 711.9 GWh
3. Removal of sediments from HPP reservoirs and recycling of this waste as a construction materials and fertilizers. Removal of sediments from reservoirs may slightly increase production, but the main effect is increase of stability of the system. Huge amounts of the removed wastes (with different granulometric features) could be used for production of sand, gravel and boulders needed as construction materials, while fine-clay sludge could be used as fertilizers.

[48] Georgian National Integrated Energy and Climate Plan (NECP)

ReSOLVE FRAMEWORK	
Regenerate	– Removal of sediments from HPP reservoirs would increase power generation, lifetime and efficiency of HPPs. Removed material could be used in the construction industry and/or agriculture. – The planned minimization of transmission and distribution losses of electricity would have notable effect for the sector.
Share	
Optimise	– Pumped hydro and battery storage schemes would enable to optimise the use of renewable energy sources and reduce the dependence of the country on imported energy (electricity and gas)
Loop	
Virtualise	
Exchange	

Key actors in implementing CE and direct beneficiaries:

► **Private companies:**

– Large companies involved in energy generation: HPPs, TPPs, WPPs (Installation of energy storage facilities; removal of sediments from HPP reservoirs and recycling it as a construction materials and fertilizers)

► **Governmental Organisations or companies (e.g. JSC GSE):**

– Implementation of projects aimed on minimization of losses in transmission and supply networks.

► **Central Government:**

– Improving Policy and creation of incentives for the private sector introduce CE elements in their businesses

3.2.10 Oil and Gas Production, Onshore Transport and Transport via Pipelines

Sector nomination and NACE Index (NI):

Extraction of crude petroleum and natural gas (NI/ 6);
Input in GDP (Mln GEL): 8.7 / 0.2%

Onshore transport and transport via pipelines (NI/ 49);
Input in GDP (Mln GEL): 1065.9 Mln GEL* / 2.5%

3.2.10.1 *Gas Supply, Consumption and Transit*

3.2.10.1.1 Natural Gas Supply and Consumption

Share of natural gas in total supply of energy resources in Georgia is about 40%. Gas is the most widely consumable primary energy resource in Georgia. Natural gas sector is one of the most dynamically developing segments of the country.

Local gas production is rather low (less than 0.5% of total annual consumption), therefore, demand of Georgia on natural gas is mainly balanced by import. Today, gas import is provided from two foreign sources on the basis of several independent contracts.

Georgian Oil and Gas Corporation (GOGC) carries out natural gas import on the basis of agreements made between the parties followed by wholesale supply of natural gas to distribution companies.

The distribution companies, from their part, supply natural gas to the so-called social sector and commercial consumers.

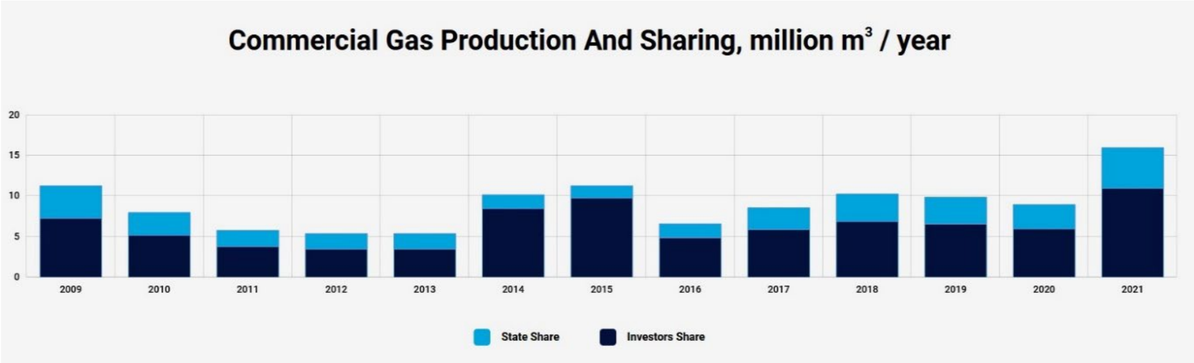


Figure 3.2-34 Commercial gas production and sharing in 2009-2021

Table 3.2-42 Supply and consumption of natural gas in 2018-2020

	mil. m³		
	2018	2019	2020
Production	10.0	9.6	8.9
Imports	2,357.1	2,685.8	2,690.8
Exports	-	-	-
Stock Changes	-	-	-
DOMESTIC SUPPLY	**2,367.1**	**2,695.4**	**2,699.7**
Transfers	-	-	-
Statistical Differences	0.0	0.0	0.0
Transformation Sector - Input	**480.2**	**666.4**	**603.8**
MA Thermal Electricity Plants	480.2	666.4	603.8
MA Hydro Electricity Plants	-	-	-
MA Heat Plants	-	-	-
Petroleum Refineries	-	-	-
Losses	108.6	87.0	**89.5**
FINAL CONSUMPTION[49]	**1,778.3**	**1,942.0**	**2,006.5**

Source: Geostat; Energy Balances for Georgia (2018 – 2020)

3.2.10.1.2 Natural Gas Transit

Transit of gas in Georgia is provided by two gas pipelines - the South Caucasus Pipeline (SCP) and the North-South Main Gas Pipeline (NSMP).

The South Caucasus Pipeline also known as Baku-Tbilisi-Erzerum Gas Pipeline transits gas produced from Shah Deniz field from Azerbaijan to Turkey. The pipeline length is 692 km, the

[49] Final consumption comprises all items of internal consumption except the gas used in Thermal Power Plant. This is gas delivered to the consumers (private persons and private companies, as well as governmental organisations) through the gas distribution network

length of the Georgian section is 249 km. The design throughput of the pipeline is 20 billion cubic meters per year. SCP mainly lies parallel to BTC pipeline.

The NSMP transits Russian gas to Armenia. The length of the Georgian section of NSMP is 234 km, and its design throughput is 12 billion cubic meters per year.

The natural gas transportation system in Georgia is operated by Georgian Gas Transportation Company LLC (GGTC), which is the state-owned enterprise and the natural gas transportation licensee. GGTC obtained the respective license in 2009 and has been transporting gas through the territory of Georgia from the above period.

The natural gas transport infrastructure registered on the balance of GOGC is transferred to GGTC within the Lease Agreement signed between them.

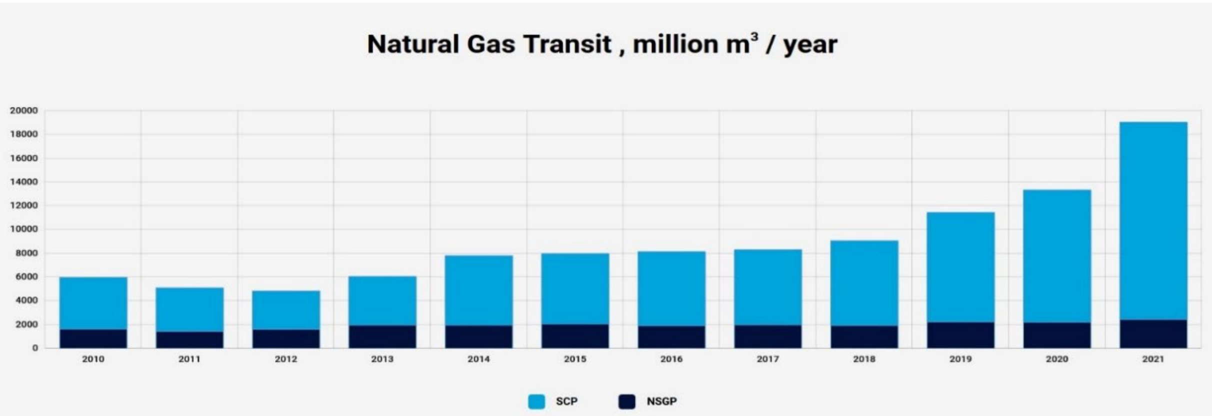


Figure 3.2-35 Natural gas transit in 2010-2021

3.2.10.2 Crude Oil Supply, Consumption and Transit

3.2.10.2.1 Crude Oil Supply and Consumption

The current, scientific methods and technologies of exploration and production of oil and gas fields were introduced in Georgia and all over the world in the second half of the 19th century. Development of this sector in Georgia is associated with the National Oil Company "Georgian Oil", which started to operate in 1929 and currently, JSC GOGC is its successor.

Annual production of oil was sharply increased in the highly productive fields discovered in the suburbs of Tbilisi in 1970s and 1980s (Samgori-Patardzeuli-Ninotsminda, Teleti, Samgori South Dome) and exceeded 3 million tons per year in 1980-1983.

Presently, 15 oil fields and 1 gas condensate field are discovered and being processed on the aboveground territory of Georgia. In total, more than 28 million tons of oil and 3 billion cubic meters of gas have been produced from these fields.

The average stock tank production of oil during 2019 – 2021 equals to 33,000 tons/year (average State share is 40% and the investor's share – 60%). For year 2020, oil production equalled to 31,300 tons.

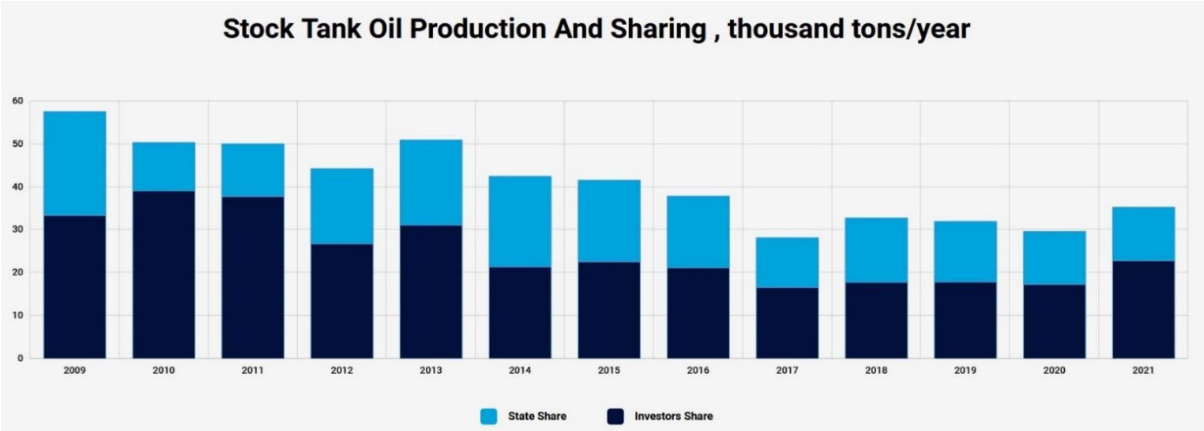


Figure 3.2-36 Stock tank oil production and sharing in 2009-2021

The shelf and aboveground territory of Georgia is divided into License Areas (so-called Blocks).

Exploration and production works are carried out by investor companies selected through international tenders, on the basis of Production Sharing Contracts signed with the State. The works are performed by operating companies established in Georgia.

As of today, 24 Production Sharing Contracts are concluded between the Georgian State and investor companies and apart from GOGC, 7 oil companies are operating under these Contracts: "Norio Operating Company", "Block Operating Company", "Kura Basin Operating Company", "NVP Georgia", "West Gulf Petroleum Engineering", "Georgia Coalition Energy Limited", "OMV Petrom". Also, GOGC holds the license for oil production and produces oil on the license area.

Transformation Sector - Input: Refining of crude oil and processing oil products[50, 51]

Globusi Ltd and ZD Oil Company Ltd are two oil refineries licensed in Georgia. Licenses for both enterprises were issued in 2015 and are valid for a period of 25 years. It should be noted that the Georgian oil products market is 98% dependent on fuel imported from abroad. The refinery of Globusi Ltd is located in the vicinity of the railway station "Veli" in Tbilisi and its capacity, according to the technological project, is 80,000 tons per year. ZD Oil Company Ltd is located in the village of Martkopi, Gardabani Municipality, on the territory of Vaziani and its production is 130,000 tons per year. According to the State Agency of Oil and Gas, Globe Ltd does not process crude oil at this stage for various reasons.

The total amount of the refined oil in 2019 equalled to 37 thousand tons of crude. 23,425.53 tons of oil was processed in Georgia in 2017. According to the State Oil and Gas Agency, the outcome was:

- Oil - 3424.9 tons (14%);
- Gasoline - 2197.7 tons (9%);
- Diesel - 9986.9 tons (41%);
- Fuel oil - 8751.9 tons (36%);

[50] Energy Balance of Georgia 2020, Geostat

[51] Business Media; 18 Dec. 2020 15:00; /Forbs. February 14, 2018

Table 3.2-43 Supply and consumption of oil and oil products, 2020

	Crude Oil (1000 tonnes)	Liquefied Petroleum Gases (1000 tonnes)	Motor Gasoline (1000 tonnes)	Kerosene type Jet Fuel (1000 tonnes)	Kerosene (1000 tonnes)	Road diesel (1000 tonnes)	Heating and other gas oil (1000 tonnes)	Fuel oil-low sulphur (<1%) (1000 tonnes)	Fuel oil-high sulphur (>=1%) (1000 tonnes)	Lubricants (1000 tonnes)	Bitumen (1000 tonnes)	Paraffin Waxes (1000 tonnes)	Non-specified Petroleum Prods. (1000 tonnes)
Production	31.3	-	-	-	-	-	-	-	-	-	-	-	-
Imports	4.2	29.2	541.8	56.6	-	557.7	9.8	0.3	-	24.9	129.5	-	0.6
Exports	-	0.0	1.3	0.0	-	4.2	-	9.1	-	2.1	0.0	-	0.0
International marine bunkers	-	-	-	-	-	3.8	-	-	-	-	-	-	-
International aviation bunkers	-	-	-	55.3	-	-	-	-	-	-	-	-	-
Stock changes	1.9	-0.1	-6.0	-1.2	-	-17.6	-	-2.0	-	-0.2	-0.2	-	3.1
DOMESTIC SUPPLY	**37.3**	**29.1**	**534.4**	**0.1**	-	**532.2**	**9.8**	**-10.8**	-	**22.6**	**129.3**	-	**3.8**
Transfers	-	-	-	-	-	-	-	-	-	-	-	-	-
Statistical differences	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	-	0.0	0.0	-	0.0
Transformation Sector - Input	**37.3**	-	-	-	-	-	-	-	-	-	-	-	-
Petroleum refineries	37.3	-	-	-	-	-	-	-	-	-	-	-	-
Transformation Sector - Production	-	-	**9.6**	-	-	**11.6**	-	**11.8**	-	-	**1.5**	-	**2.7**
Petroleum refineries	-	-	9.6	-	-	11.6	-	11.8	-	-	1.5	-	2.7
FINAL CONSUMPTION	-	**29.1**	**544.1**	**0.1**	-	**543.8**	**9.8**	**1.1**	-	**22.6**	**130.8**	-	**6.5**

3.2.10.2.2 Crude oil transit via pipelines

The Baku-Tbilisi-Ceyhan (BTC) and the Western Route Export Pipeline (WREP) transport oil through the territory of Georgia.

The total length of Baku-Tbilisi-Ceyhan (BTC) oil pipeline is 1798 kilometres, 248 km, DN 1167 (46 inch) section with 12,7-23,88 wall thickness is located on the territory of Georgia. The pipeline starts at Sangachal terminal and ends at Ceyhan deep water terminal on the Mediterranean coast via the territories of Georgian, Azerbaijan and Turkey. BTC pipeline exports oil extracted from the Azeri-Chirag-Gunshli field to the Ceyhan port in Turkey. BTC is the second longest pipeline in the world. The total length of the pipeline is 1.768 km with 229 km in Georgia. The pipeline has eight pumping stations, two of which are located in Georgia.

Oil transportation through the BTC pipeline started in 2005. WREP also known as the Baku-Supsa Pipeline is the first investment of International Oil Consortium in Georgia, which has been in operation since 1999. The length of the WREP is 830 km. Its diameter is 530 mm. The pipeline transports crude oil from Azeri-Chiragi-Guneshli oil field to the Supsa terminal in West Georgia. The Supsa terminal with the capacity of 120 000 tons was constructed as part of the (WREP) pipeline construction project. Oil was first pumped into the WREP from the terminal at Sangachal in December, 1998 and the first tanker was loaded at Supsa in the summer of 1999.

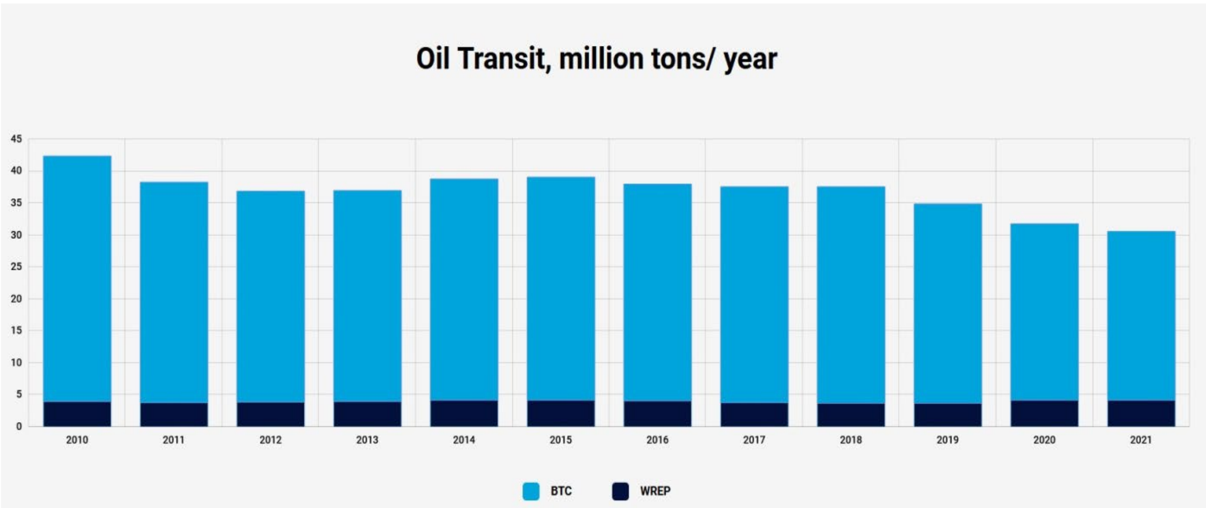


Figure 3.2-37 Oil transit through Georgia in 2010-2021

The average oil transit by pipelines during 2019 – 2021 equals to 32,400,000 tons/year (average share of WREP is 12.5% and the BTC's share – 87.5%).

BTC pipeline mainly transports Azeri Light blend oil extracted from Azerbaijani offshore Azeri-Chirag-Giunshli field, as well as oil supplied from neighbouring countries. In 2018 the pipeline transported 33,83 million tons of Azeri oil (81,5 % of total export).

3.2.10.2.3 Crude Oil Transit via Georgian Railways

Table 3.2-44 Freight transportation volume in 2016-2020

	For the year ended 31 December Million tons				
	2020	2019	2018	2017	2016
Liquid cargoes	**3,046**	**3,077**	**3,140**	**4,347**	**5,494**
Oil products	3,040	3,063	2,972	3,946	3,686
Crude oil	6	14	168	401	1,808

Source: Georgian Railway; Annual Report 2020

3.2.10.3 Losses and Wastes in Oil and Gas Sector

3.2.10.3.1 Oil and gas transit

Transit of the natural gas and oil is not associated with losses. Transit of oil and gas by means of pipelines is not connected to generation of oil wastes like sludge, wax, etc. Sludge and wax is exported mixed with aggregated crude oil fractions. The other waste streams of the sector are negligible.

Transportation of oil and oil products by railway is associated with potential production of oil contaminated wastewater. However, according to the GR contracts with the oil transporter companies, the companies do not wash their railway tanks in Georgia, thus avoiding local waste generation.

Certain amount of oil sludge is accumulating in oil terminals, which receive the crude oil by means of railway (as reported in the Batumi Oil Terminal's Waste Management Plan of 2019). Batumi Oil Terminal has stored about 5,000 m^3 oil sludge during the recent 20 years. Composition of the sludge: 5-20% oil products; 45-50% mechanical contamination; 30-35% water. We can assume that annually the sludge production does not exceed 250 m^3. Very rough estimation is that for Batumi and Poti oil terminals the annual sludge generation does not exceed 500m^3, which is negligible amount and may be not accounted in the mass flow charts.

3.2.10.3.2 Natural gas distribution networks

Natural gas is supplied to the natural gas market by 34 suppliers, including the three largest companies in the sector distribution network - JSC Sakorggaz, SOCAR Georgia Gas Ltd. and Tbilisi Energy Ltd. The natural gas distribution network is significantly expanding, which allows for an increase in the number of private companies and customers. In 2015, the total losses in the distribution network amounted to 103.8 million m^3, 64% of which came from KazTransGas-Tbilisi.

It is planned that gas networks / systems will be rehabilitated - including pipelines, valves, pressure reducing units, etc. Under license agreements, it is recommended to reduce losses. Specific interventions include the following:

- Replacement of old, worn out gas pipelines;
- Improved maintenance and leak control;
- Control of meters and change them if necessary;
- Additional measures, including reduction of non-technical losses

Georgia's energy balance (Geostat) shows that average losses of natural gas during 2018 - 2020 accounted for 96,967,000m3 (3.7% of inflow and 5.1% of Final Consumption). According to the Georgian National Integrated Energy and Climate Plan (NECP), it is planned to reduce losses by 4% by 2030. To achieve this figure, it is planned to invest 144,140,000 GEL by 2030.

3.2.10.3.3 Refineries

Wastes generated in refineries (mostly, oil sludge), is of negligible amounts and is not accounted in the mass flow charts.

3.2.10.4 Circularity Profile: Oil and Gas Production, Onshore Transport and Transport via Pipelines

Sector nomination and NACE Index (NI):
Extraction of crude petroleum and natural gas (NI/ 6); Input in GDP (Mln GEL): 8.7 / 0.2%
Onshore transport and transport via pipelines (NI/ 49); Input in GDP (Mln GEL): 1065.9 Mln GEL* / 2.5%

Material Resources Used:	Annual Energy Consumption and GHG Emissions Indicators:
Water consumption: 0.16 mil. m^3	(see table below)

	Electric Energy Consumption	GHG Emissions* Gg. CO2eq.
Natural Gas and Crude Oil production	0.1 GWh	-
Crude oil and Natural Gas transit and in country distribution by pipelines	22.3 GWh	190
Crude oil and refined oil transportation and distribution by railway	105.7 GWh (27% of railway transport)	1.1 (27% of railway transport)
Oil Refining	About 81.9[52] GWh	-
TOTAL	**210 GWh**	**191.1**

****Figures are based on the data of the National Greenhouse Gas Inventory Report of GEORGIA 1990-2017***

Natural gas consumption: 169.0 mil. m3

Mass Flow Indicators:

Production, Import and Export:

Natural Gas Production (average annual for 2018 – 2020)

Inflow	**Internal Consumption**	**Outflow**
Production: 9,500,000 m^3	For Electric Energy Production (TPPs): 583,500,000 m^3	Export: 0
Imports: 2,579,900,000 m^3	Social and Commercial Consumption: 1,908,933,000 m^3	Waste and Losses: 96,967,000m^3 (3.7% of inflow and 5.1% of social and commercial consumption)

52 Approximated based on data of Energy Balance of Georgia for 2020 and assumption that oil refining consumption is Total Chemical Industry consumption – consumption of Rustavi Azot.

Natural Gas Transit (average annual for 2018 – 2020)

Inflow	Internal Consumption	Outflow
12,327,000,000 m^3	0	12,327,000,000 m^3
		Waste and Losses: 0 (negligible)

Crude Oil Production (for year 2020)

Inflow	Internal Consumption	Outflow
Production + Stock Changes: 33,100 tons	Petroleum Refineries: 37,300 tons	Refined Products:37,200 tons
Imports: 4,200 tons	Other Consumption: 0	Export: 0
		Waste and Losses: 100 tons

Refined Oil Production (for year 2020)

Inflow	Internal Consumption	Outflow
Production: 37,200 tons	1,375,100 tons	
Imports: 1,354,600 tons		Export: 16,700 tons
		Waste and Losses: tons

Crude Oil and Refined Oil Product Transit (For year 2020)

Inflow	Internal Consumption	Outflow
Crude oil Pipeline Transit: 32,400,000 tons	0	Crude Oil: 38,395,800
Crude oil Railway Transit: = 5,995,800 tons	0	Refined product transit 1,691,400 ton
Refined product transit 1,691,400 tones	0	Waste and Losses: 0

Wastes and losses:

Losses in internal gas distribution networks (significant effect):

Average losses of natural gas during 2018 - 2020 accounted for 96,967,000m^3 (5.1% of commercial and social consumption).

Circularity Gaps:

- Losses: 96,967,000m^3 (5.1% of commercial and social consumption) is lost in gas distribution networks.
- During the recent years not more than 70% of the full capacity of oil pipelines is used for transit and about 83% of gas pipeline capacity. Increasing efficient use of the existing facilities should be seen as optimization and sharing actions according to RESOLVE framework.
- Absence of gas Storage facilities affects not only sustainability of supply, but also cost of consumed energy. Reduction of costs of valuable energy resource should be seen as optimization procedure according to RESOLVE framework.

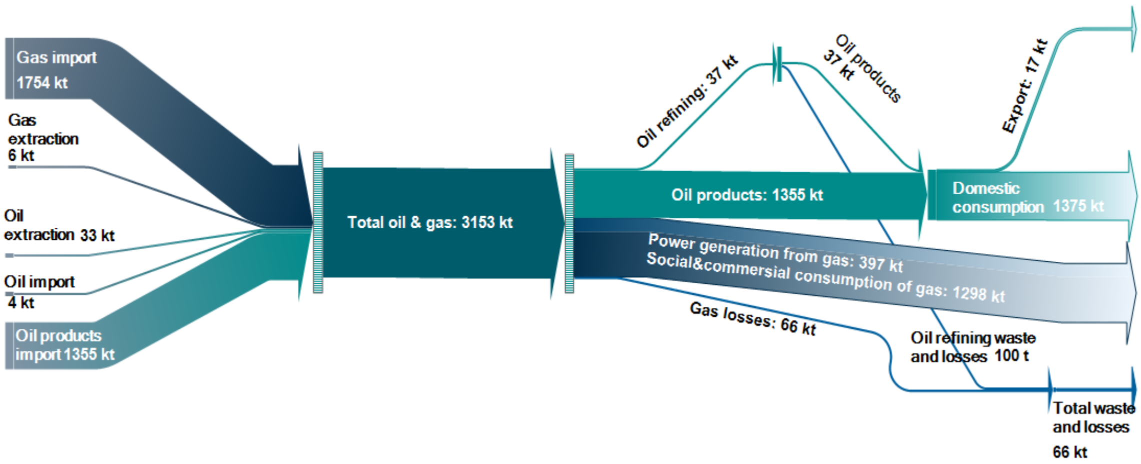


Figure 3.2-38 Mass flow diagram for oil and gas production and transport sector

Potential for improving circularity:

Potential for increasing level of circularity:

1. According to the Georgian National Integrated Energy and Climate Plan (NECP), it is planned to reduce gas losses in network by 4% by 2030. To achieve this figure, it is planned to invest 144,140,000 GEL by 2030 in rehabilitation of gas networks.
2. Construction of the gas storage will be carried out on the processed oil field of Samgori South Dome near Tbilisi and it will be possible to store up to 300 million cubic meters of gas in it. JSC "Georgian Oil and Gas Corporation" successfully continues negotiations with the European Investment Bank to raise additional USD 100 million for construction of the underground gas storage which will be enough for implementation of the project together with the funds received from KfW. Absence of gas Storage facilities affects not only sustainability of supply, but also cost of consumed energy. Reduction of costs of valuable energy resource should be seen as optimization procedure according to RESOLVE framework.
3. During the recent years not more than 70% of the full capacity of oil pipelines is used for transit and about 83% of gas pipeline capacity. Optimal planning may help to increase these indicators up to 90% of existing capacity. Increasing efficient use of the existing facilities should be seen as optimization and sharing actions according to RESOLVE framework.

ReSOLVE FRAMEWORK

Regenerate	– Shift to renewable energy resources: use fixed current values of natural gas supply and related energy production and base further increase of energy generation on HPPs and other renewables.
Share	– Optimal use of gas and oil pipelines to use up to 90% of existing capacity.
Optimise	– Reduce losses in gas transport distribution by 4% by 2030. – Construction of the gas storage with the capacity up to 300 million cubic meters of gas.
Loop	
Virtualise	
Exchange	

Key actors in implementing CE and direct beneficiaries:
► **Private companies:**
– Large companies involved in oil and gas production, refining, transit and in-country transport and distribution: Implementation of projects aimed on minimization of losses in gas transportation and distribution networks.
► **Governmental Organisations or companies (e.g. JSC GOGC):**
– Implementation of projects aimed on minimization of losses in gas transportation and distribution networks.
► **Central Government:**
– Improving Policy and creation of incentives for the private sector introduce CE elements in their businesses

3.2.11 Tourism, Accommodation and Food Service Activities

Sector nomination and NACE Index (NI):

Accommodation and Food Service Activities (NI/ 55-56);
Input in GDP (Mln GEL): 2223 Mln. GEL / 8.4%/
Annual production value 2,100,000,000GEL (2019 year)

Travel agencies, tour-operators and associated activities (NI/ 79);
Input in GDP (Mln GEL): 154.4 Mln GEL / 0.36% (2019 year)

3.2.11.1 Accommodation, food services and Tourism[53]

The tourism industry is deeply integrated with other sectors of economy, like agriculture and food processing, construction, transport, and different services. Tourism is interlinked with and dependent on multiple key resource flows, asset and commodity value chains in society.

In a list of economic activities (NACE rev.2), which is used by National Statistics Office of Georgia (Geostat) as an official reference register, there is no mention of Tourism as a separate sector of economy. Only activities of the tourist operators are referred, as a subsector of minor significance by its input in GDP etc. The other activities, which usually is tightly associated with the Tourism, are

[53] "Circular Economy in Travel and Tourism. A conceptual Framework for Sustainable, Resilient and Future Proof Industry Transition"; 2020

united in a group entitled as Accommodation and Food Services. So far as the statistic information and data bases are matched to the Geostat list (NACE rev.2), we will also make focus on these type of activities, having in mind that Accommodation and Food Service activities are to great part associated with the internal and international tourism.

For developing and introducing principles of circular economy in tourism sector, it will be required to integrate concepts such as ‘deep cooperation’, ‘value co-creation’, ‘destination carrying capacity’, ‘system optimisation (instead of commercial silos maximisation)’, ‘purpose driven operations’. The framing of destinations needs to evolve from a ‘commodity’ that can be consumed, exploited to that of an ‘asset’ made of natural and social stocks that should be protected and optimised for the long term benefit of all actors.

3.2.11.2 Overview of the Tourism Sector in Georgia

Tourism is perceived as one of the most prospective sector of economy in Georgia. Georgia has substantial potential for tourism development due to its natural beauty, varied landscapes, a pleasant climate, and rich culture and history. However, paradoxically, there is no nomination of Tourism as a sector in the Geostat registry and no NACE Index is given under this title. Separately are nominated the subsectors of economy, which in fact are very closely associated with the tourisms. These are activities nominated as: a) Travel agencies, tour-operators and associated activities, (NI/ 79); and b) Accommodation and Food Service Activities (NI/ 55-56); We have united these two subsectors in one group and stressed their interrelation with the tourism sector.

Overview of the tourism activities and growth trends are mostly described based on data available till 2019, as the years of 2020 and 2021 were strongly affected by COVID-19 pandemic and do not show the trend. As an entire sector, tourism accounted for 7.5 percent of GDP growth from 2018-2019. Georgia received a record number of 9.3 million international visitors (tourists, transit, other) in 2019, a 7 percent increase over 2018. This figure included 4.8 million tourists, which was 16 percent higher than the previous year. To facilitate tourism, the Government of Georgia elaborated and implemented Regional Tourism Development Strategies and launched a program for infrastructure rehabilitation: construction and rehabilitation of roads, arrangement of tourism infrastructure near the site-seeings (information centres; parking; toilets and waste management facilities; etc.). This was also done to encourage the private sector to develop tourism oriented accommodation and food services. New development has taken place in Batumi; at ski resorts in Mestia, Bakuriani, Gudauri, and Goderdzi.

Citizens from Georgia’s neighbouring countries made up the largest share of international visitors in 2019. The top five source countries were Azerbaijan, Russia, Armenia, Turkey, and Iran. The number of visitors from Europe increased by 12 percent and from the United States by 25 percent from 2017 to 2018. The government has made it a priority to turn Georgia into a four-season tourist destination, and is supporting and promoting medical, entertainment, sports, wine, and other kinds of tourism. ‘Check In Georgia’ is an example of a government project that supports turning Georgia into a regional, cultural and entertainment centre.

However, the COVID-19 pandemic and regulations to curb the spread of the virus caused a reduction in tourism revenue and overall economic growth in 2020.[54],[55]

Between 2018 and 2019, the total value added in the tourism sector increased by 20.4% and reached 3.63 billion GEL due to increased demand. As a result, tourism's gross value added, as a proportion of GDP, increased from 7.8% to 8.4%. The additional value added in the tour- ism industry in 2019 was mainly driven by accommodation (+31.6%), transport (air transport increased 40.3% and other transport increased 11.4%), food objects (an increase of 8%), and travel companies (an increase of 28.7%).[56]

Below we provide tables with the indicators, which characterize those aspects of tourism that have direct regard to the circularity: number of foreign and local visitors, need for accommodation and food services. Accommodation and food service patterns determine the type and amounts of waste generated and waste-generation sites. Possibilities for sharing accommodation and food service facilities are also dependent on these basic indicators.

International traveller trips to Georgia have been growing rapidly in recent years. In 2019, they reached a record number of 9,357,964, which represents an annual growth rate of 7.8%. International traveller trips include trips made by international visitors (83%) and other (non-tourist) trips (17%). Out of the total number of international visitor trips, 66% were tourist trips, and 34% were same-day trips.

Table 3.2-45 Statistics of foreign visitors and local tourists for 2014-2020

Years	No of Foreign Visitors	Average Nights / Foreign visitor	Local Tourists Annual	Average Nights / Local visitor
2020	1,513,421		12,473,517	2.2
2019	7,725,774	4.1	14,251,973	2.0
2018	7,203,350	4.2	13,137,724	1.9
2017	6,482,830	4.3	12,637,215	1.9
2016	5,392,816	3.9	12,960,138	2.2
2015	5,255,999	3.4	12,360,678	2.2
2014	5,004,331			

Source: *Geostat / Georgian Tourism in Figures/ Georgian National Tourism Administration/ Annual Report for 2019 and 2020*

Out of the total number of trips, 73.8% were repeat trips and 26.2% of trips were for the first time. Most of the residents of neighbouring countries have travelled to Georgia before. The largest share of repeat trips was conducted by Azerbaijani visitors (28.9%), followed by Armenian (22.2%),

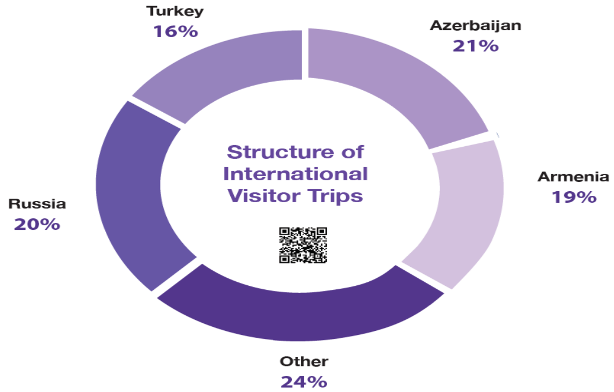
54 Georgian Tourism in Figures. Georgian National Tourism Administration. Annual Report for 2019 and 2020

55 Georgia - Country Commercial Guide. The International Trade Administration: https://www.trade.gov/country-commercial-guides/georgia-tourism

56 Georgian Tourism in Figures. Georgian National Tourism Administration. Annual Report for 2019 and 2020

Russian (20.8%), and Turkish (15.5%). The leaders among first-time trips were Russia and Turkey, with 23% and 16.8% shares respectively.

In 2019 the number of international trips to Georgia amounted to 7,725,774. A total of 66% (5,080,478) of trips included at least one overnight stay, which is by definition a tourist trip. 34% were day trips (2,645,296).



Source: Geostat / Georgian Tourism in Figures/ Georgian National Tourism Administration/ Annual Report for 2019 and 2020

Figure 3.2-39 Structure of international visitor trips

In 2019, the number of domestic trips within Georgia amounted to 14.3 million. The majority of trips were from Tbilisi (29.9%). Most visits were to large cities. Visitors' average trip length was 2 nights and varied by place of residence. Visitors from Tbilisi tended to stay for longer periods (3.4 nights, on average), while on average, other visitors spent one or two nights away from their usual environment. The majority of domestic trips (51%) were carried out by domestic residents to visit friends or relatives. Shopping was the main reason for 12.3% of visitors, and leisure and recreation for 9.7% of visitors. Other frequently-observed purposes were: health and medical care (8.8%) and business and professional purposes (4.7%).

During this period, the total number of overnight stays was 28.1 million, including 58.3% of domestic travellers who stayed in the private homes of friends and relatives. This is partially a consequence of the dominant influence of the "visiting friends and relatives" segment. A considerable number of domestic visitors, 28.8%, stayed in their own homes, while 4.2% stayed in a family hotel.

Table 3.2-46 Average annual stays of international and local visitors

	Average Annual Number	Average Nights	Annual nights	Hotels %	Hotels Annual	Boutique Hotels and Guesthouses %	Small Hotels and Guesthouses Annual
International Visitors	7,500,000	4	30,000,000	35%	10,500,000	13%	3,900,000
Local Visitors	12,000,000	2	24,000,000	3%	720,000	4%	960,000
TOTAL					**11,220,000**		**4,860,000**

Source: Geostat

3.2.11.3 Accommodation and Food Service Activities

The number of accommodation units registered in the database of the Georgian National Tourism Administration (GNTA) is 2,575, with a total of 94,438 beds. Adjara region has the largest number of beds (26,519 = 28.1%), followed by Tbilisi with 23,596 beds (25%).

Tbilisi boasts several international hotel brands: Radisson Blu Iveria Hotel, Tbilisi Marriott, Courtyard Marriott, Sheraton, Holiday Inn, Citadines Apart'Hotel, Best Western Tbilisi, Mercure, Hotels and Preference, The Biltmore Hotel, Ibis Styles Tbilisi Center, Best Western Tbilisi City Centre, Ramada Encore, and Moxy by Marriott. In 2019, Wyndham Grand and Ibis Tbilisi Stadium were added to this list.

Several brand hotels have also started operating in the regions of Georgia. In Kakheti, Radisson Blu Tsinandali, Park Hotel Tsinandali, and Holiday Inn Telavi joined the list of hotel brands. Furthermore, Best Western Gudauri started to operate.

The majority of hotels being constructed in Georgia are located in Tbilisi and Adjara, Imereti, Samtskhe-Javakheti, and Kakheti regions.

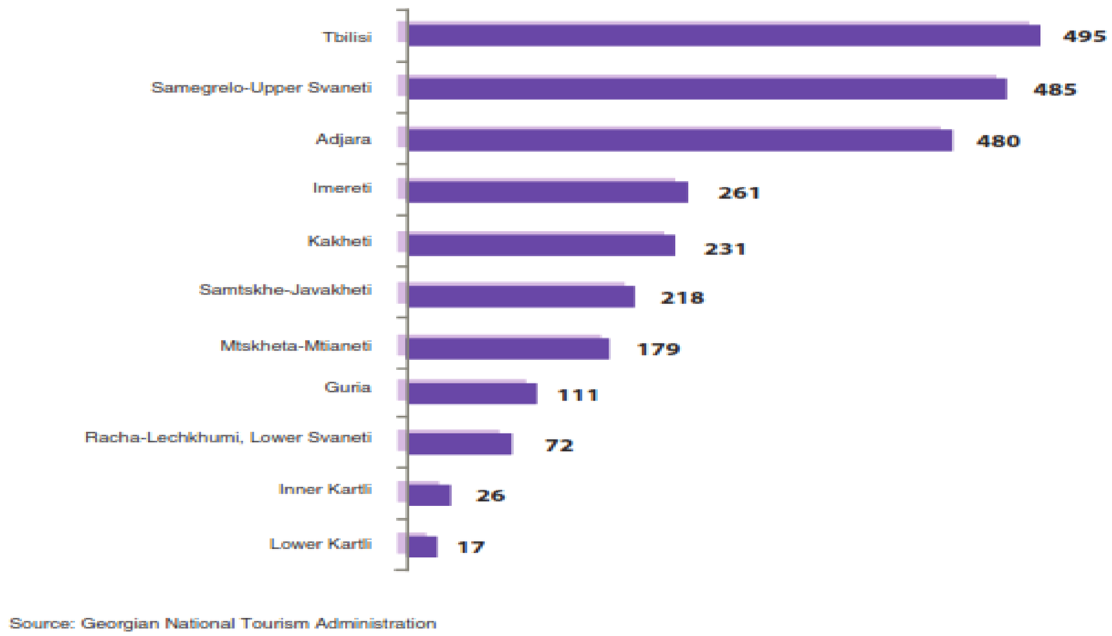


Figure 3.2-40 Number of accommodation units in Georgia by regions

According to STR Global data[57], the occupancy rate of hotels in Georgia equalled 56.7%; a decrease compared to the previous year of 6.3%. The highest occupancy rates were registered in August (77.1%), September (74.5%), and July and October (66.8%), while the lowest were in January (34.6%), February (36.4%), and December (38.5%). The highest occupancy rate among cities was recorded in Tbilisi (59.7%), followed by Batumi (58.9%) and in the category "other Georgia" (46.7%).

[57] Georgian Tourism in Figures' 2019; prepared by STR Global for GNTA

Table 3.2-47 Economic indexes of tourism, accommodation and food service activities in 2014-2020

	2014	2015	2016	2017	2018	2019	2020
Turnover, Million Gel	843.6	1069.8	1307.0	1562.3	1811.7	2089.1	1232.4
Production Value, Million Gel	832.8	1057.1	1325.3	1564.5	1816.1	2101.1	1197.6
Value Added, Million Gel	327.3	416.7	608.0	700.1	788.8	1074.6	468.3.
Intermediate Consumption, Million Gel	505.5	640.4	717.3	864.3	1027.4	1026.5	729.3
Fixed Assets, Million Gel	730.8	1017.1	1838.9	1846.5	2810.3	3058.8	1983.2
Number of Employed, Thousand Person	31.3	33.9	37.4	42.2	45.7	48.6	31.8
Average Monthly Remuneration of Employees, Gel	477.8	563.9	626.6	673.3	826.9	853.6	822.1

Source: Geostat

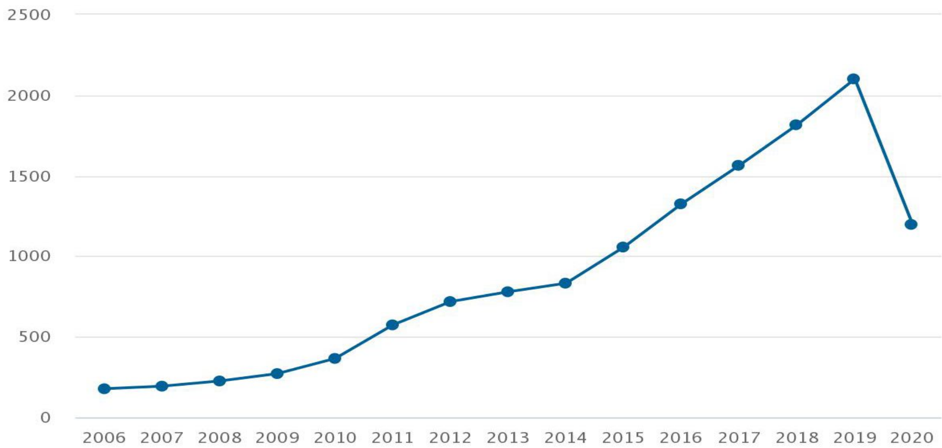


Figure 3.2-41 Production value (Mln. GEL) in accommodation and food service activities in 2006-2020

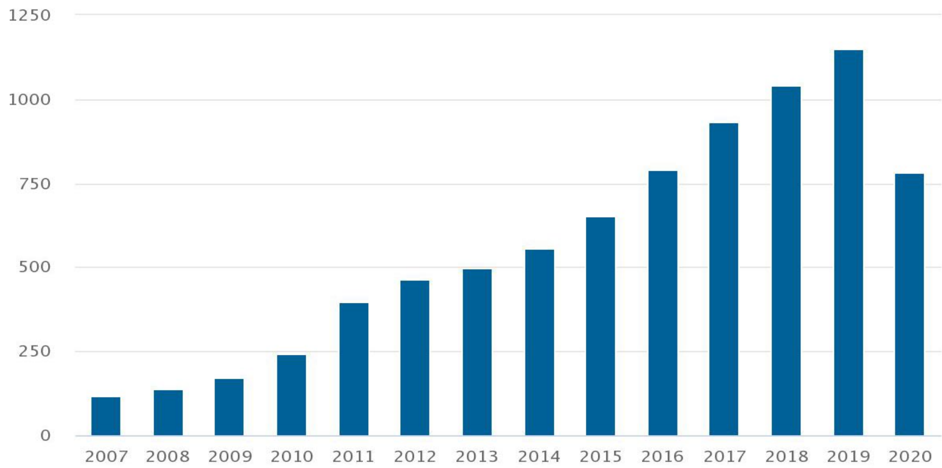


Figure 3.2-42 Purchases of goods and services (Mln. GEL) in accommodation and food service activities in 2007-2020

Table 3.2-48 Production value in accommodation and food service activities by kind of economic activity

Year	Accommodation and food service activities – total, Million GEL	of which:	
		Accommodation	Food and beverage service activities
2007	193.5	93.8	99.7
2008	225.7	104.8	120.9
2009	271.5	104.5	167.0
2010	365.6	137.1	228.5
2011	574.0	202.1	371.9
2012	718.7	244.9	473.8
2013	779.6	281.3	498.3
2014	832.8	303.2	529.6
2015	1,057.1	459.8	597.3
2016	1,325.3	591.9	733.4
2017	1,564.5	727.5	836.9
2018	1,816.1	921.8	894.3
2019	2,101.1	1,145.2	955.9
2020	1,197.6	430.9	766.7

Table 3.2-49 General Information about Hotels and Hotel-type Enterprises* (declared data)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Number of hotels*	353	386	462	616	777	836	986	1,225	1,496	1,595	1,639	1,682	1,054
Total number of rooms	8,582	9,393	10,564	12,901	14,463	15,351	18,248	23,097	28,437	30,657	33,186	35,101	26,897
Suite	720	746	947	1,168	1,578	1,661	2,152	2,457	2,850	3,029	3,491	3,339	2,407
Single room	1,299	1,813	2,032	2,420	2,375	2,456	2,701	3,163	3,665	4,007	4,021	4,362	3,530
Double room	5,120	5,479	5,873	7,382	7,983	8,367	10,126	13,477	16,434	17,543	18,795	20,273	16,066
Three and more places	1,443	1,355	1,712	1,931	2,527	2,867	3,269	4,000	5,488	6,078	6,879	7,127	4,894
Total floorage, thousand sq. m.	485.3	536.9	611.0	747.7	875.5	889.6	1,032.4	1,293.1	1,675.1	1,790.3	1,927.9	2,272.3	1,826.5
Number of visitors, total (thsd. persons)	266.3	350.0	596.9	853.0	1,185.1	1,255.5	1,391.4	1,854.5	2,539.8	3,381.5	3,666.1	4,014.0	1,344.7
of which foreigners	103.7	150.9	306.5	438.5	625.5	773.6	866.2	1,170.0	1,670.2	2,355.3	2,615.2	2,868.4	411.1
Number of employed persons in hotels	4,237	4,824	6,161	7,416	8,561	8,735	10,211	13,236	15,628	17,591	19,261	20,575	13,615
of which women	2,366	2,834	3,508	4,375	5,079	5,189	6,074	7,865	9,336	10,009	11,098	11,789	7,463

3.2.11.4 Wastes in Tourism, Accommodation and Food Service Sector

Georgia does not have a nationally approved methodology for estimating waste amounts by waste types for various sectors, among them tourism sector. Therefore, indicators of other counties should be used to determine waste volume for tourism sector to roughly draw the amount of waste generated per tourist in Georgia.

In EU, the tourism sector is responsible for 6,7% of the total waste - expressed in percentage, this share is low, however it is impressive in absolute values comprising 35 Mln. tonnes/ year.[58]

In some cases, tourist can produce twice as much solid waste per capita as local population (IFC, 2007).[59]

Different studies give different values of waste produced per tourist per day:

- For European countries, the averaged amount of waste totals 1.67 kg/day per tourist.[60]
- For middle class hotels of Europe this indicator comprises 0.46 kg/day. Around 84% of these wastes (by mass) is recyclable.[61]
- According to the data of 36 Austrian and German hotels that hold 2-4 stars, one tourist produces 1.98 kg/day waste. This index totals 0.4 kg/ day for Tenerife island.[62]

The composition of waste from hospitality facilities (hotels, hostels, etc.) is similar to household waste, however organic content is higher for hotels that have restaurants. Organic waste, paper, cardboard, plastic and glass are the main fractions of the waste generated in such facilities.[63]

The amount and composition of waste produced by tourists in hotels depends on the environmental policy and waste management practice of the hotel. Below is provided information on wastes generated by a small British hotel having 14-rooms.[64]

Table 3.2-50 Waste generated by a small 14-rooms British hotel

Waste Category	%
Paper and cardboard	28.6 %
Glass	30.3

[58] EEA, European Environment, State and Outlook 2010, EEA, 2010, Copenhagen. ISBN 978-92-9213-155-5.

[59] IFC, Environmental, Health, and Safety Guidelines for Tourism and Hospitality Development, 2007, Washington D.C.

[60] Ramusch, R., Obersteiner, G., Gruber, I., 2016. Urban Strategies for Waste Management in Tourist Cities. D2.1-Literature Review on Urban Metabolism Studies and Projects. http://www.urban-waste.eu/wp-content/uploads/2017/08/D2.1-Literature-Review-on-Urban-Metabolism-Studies-and-Projects.pdf

[61] European Commission. Joint Research Centre (JRC) Scientific and Policy Report on Best Environmental Management Practice in the Tourism Sector Authors: D. Styles, H. Schönberger, J.L. Galvez Martos. p 721. September 2013.

[62] The contribution of tourism to municipal solid waste generation: A mixed demand-supply approach on the island of Tenerife. Eugenio Diaz-Farinaa, Juan J.Díaz-Hernández. Noemi Padrón-Fumero. Waste Management. Volume 102, 1 February 2020, Pages 587-597

[63] European Commission. Joint Research Centre (JRC) Scientific and Policy Report on Best Environmental Management Practice in the Tourism Sector Authors: D. Styles, H. Schönberger, J.L. Galvez Martos. p 721. September 2013

[64] ibid

Waste Category	%
Metals	1 %
Polyethylene/ plastic	0.7
Organic materials	37.6
Litter	1.8 %

Different from the above mentioned, plastic content of municipal waste is much higher in Georgian reality.

Below is provided the findings of the waste composition study carried out in one of the touristic regions of Georgia.[65]

Table 3.2-51 Waste composition for one of the touristic regions of Georgia

Waste Category	%
Paper and cardboard	14.7%
Glass	5.02%
Metals	1.73 %
Polyethylene/ plastic	16.68%
Sanitary pads	5.89 %
Fabrics	6.81 %
Organic materials	36.6%
Construction waste	6.0%

The average daily amount of waste generated by Tbilisi population is around 0.9 - 1.1 kg/day per capita. (According to two-year data, this index is in the range of 0.9 - 0.95 kg/day (2016 – 370 000 tonnes/ 1 132 000 * 1 000 / 365 = 0.89 kg/day; 2017 – 397 505 /1 145 500 * 1 000/ 365 = 0.95 kg/day).

Based on the above mentioned, we assume that one household produces 1.1 kg/day waste and almost the same amount is generated by tourists (with the exception of construction waste). This assumption gives us a total 0.907 kg of waste per tourist per day.

Table 3.2-52 Total Wastes Generated by Tourists Annually

Waste Type	%	Average Daily Waste per Household	Average Daily Waste per tourist (kg)	30,000,000 Annual International Visitors x nights (tons)	24,000,000 Annual Local Visitors x nights (tons)
Paper	14.7%	0.162	0.162	4,860	3,888
Glass	5.02%	0.055	0.055	1,650	1,320
Metals	1.73 %	0.019	0.019	570	456
Plastic	16.68%	0.183	0.183	5,490	4,392

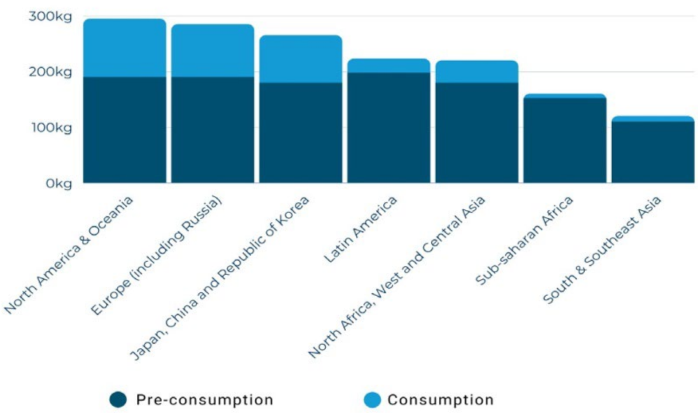
65 Report on Seasonal Survey of Morphological Composition of Solid Household Waste in Adjara AR, the programme Waste Management Technologies in Regions. CENN, 2016.

Waste Type	%	Average Daily Waste per Household	Average Daily Waste per tourist (kg)	30,000,000 Annual International Visitors x nights (tons)	24,000,000 Annual Local Visitors x nights (tons)
Organic waste	36.6%	0.403	0.403	12,090	9,672
Trash	1.8 %	0.019	0.019	570	456
Sanitary pads	5.89%	0.065	0.065	1,950	1,560
Construction waste	17.58%	0.193			
Total	100%	1.1	0.906	27,180	21,744

3.2.11.5 Data accounted for tracking mass flow

In order to provide some input data for mass flow charts, we have made several assumptions:

1. We have focused on food waste generated at the consumption stage. In general, food waste is defined as food and associated inedible parts removed from the human food supply chain in the following sectors: manufacturing of food products (under certain circumstances); food/grocery retail; food service; and households. Two reasons were for such choice: a) food wastes represent the major share in the total waste streams produced by tourists; b) It is possible to make some approximations regarding the ratio of food consumption and food waste generation, which is necessary for making mass flow charts.
2. In addition to food waste we have tried to provide approximations for glass and plastic wastes associated with the food (e.g. plastic and glass bottles for beverages).
3. According to UNEP Food Waste Index Report of 2021, the food waste and glass/plastic bottle waste associated with the consumption stage, is generated in the retail trade sector, accommodation and food service sector and at the household level. We have assumed that while retail trade sector is used both by households and tourists, the accommodation and food services are used only by local and foreign tourists.



Source: IDB Invest, Report: Fighting Food Waste in the Tourism Sector, 2020

Figure 3.2-43 Annual per capita food waste by regions

Taking into account data given in Table 3.2-52, the volumes of organic waste annually generated by households (3.7 Mln persons by 360 days) could be estimated as 536,796 tons and 21,762 tons produced by local and foreign tourists (total 54 Mln man/days). In total this equals 558,558 tons.

The other way to estimate the volumes of food waste is the extrapolation of the earlier studied data. UNEP Food Waste Report of 2021 provides estimations for Georgia. These estimations are based on study of 2014 conducted in Kutaisi (Denafas et al., 2014; Kutaisi). The estimations of UNEP for the food waste, are given in Table 3.2-53 below.

Table 3.2-53 Household food waste estimate for Georgia

Household food waste estimate (kg/capita/year)	Household food waste estimate (kg/capita/day)	Household food waste estimate (ton/year)	Reference estimate
101	0.280	403,573	Denafas et al., 2014; Kutaisi

Source: UNEP Food Waste Index Report 2021

Taking into account current demographic indicators (which are lower than for 2014), we think it is acceptable to take as a reference value an average of two presented estimations: 450,000 tons.

Below is given the average food waste (kg/capita/year) distribution of food waste. The figures are given for countries of high-income group (by World Bank income classification) and present food waste generation figures related to consumption. Pre-consumption wastes (harvest, storage, production) are not reflected in these tables.

Table 3.2-54 Average annual food waste per capita

Average Food Waste (kg/capita/year)		
Retail	Food Service	Households
13	26	79
11%	22%	67%

Source: UNEP Food Waste Index Report 2021

In 2020, in total 1,100,000 tons of solid municipal waste has been generated, out of which plastic was 168,000 tons[66]:

- 40,000 PET bottles
- 80,000 plastic bags
- 48,000 other plastic wastes

40,000 tons of PET bottles is taken as a reference value. The weight of 355ml volume PET bottle is 13.11 grams. 40,000 tons of PET bottles correspond to 40,000x355/13.11+40,000 = 1,123,143 tons of product (weight of bottles included; assumption: 1 litre of the product weights 1 kg).

[66] The draft National Plastic Waste Prevention Programme of Georgia, 2021

Out of 1,100,000 tons of solid waste that was disposed at the municipal landfills in 2020, about 25,298 tons (2.3%) is glass and about 22,770 tons constitute glass bottles. Weight of glass bottles is estimated as 520 grams per 1 litre. In average, 1 ton of glass bottles corresponds to 1,9 tons of liquid. Thus the estimation is that 22,770 tons of glass bottles corresponds to 66,033 tons of product (including the bottle weight).

Total volume of sanitary pads is 5.89% of waste mass disposed on landfills (64,790 tons in 2020). 4% out of this volume is generated by tourists (about 2,592 tons.)

Table 3.2-55 Food consumption and food waste in Georgia

Food	Food except beverages (Annual and permanent crops, meat, milk and milk products, and eggs)	Beverages in Plastic Bottles	Beverages in glass Bottles	TOTAL
Consumption, tons	2,854,437	1,123,143 (including bottles)	66,033 (including bottles)	4,042,813
Total Food Waste, tons	450,000	plastic bottles 40,000	glass bottles 22,770	512,770
Retail trade Food Waste (11%), tons	Tourists 0.44% / 1,980	Tourists 0.44% / 176	Tourists 0.44% / 100.2	Tourists 2,256
	Households 10.56% / 47,520	Households 10.56% / 4,224	Households 10.56% / 2,404	Households 54,148
Food service Food Waste (22%), tons	Tourists 99,000	Tourists 8,800	Tourists 5,009	Tourists 112,809
	Households 0	Households 0	Households 0	Households 0
Households Food Waste (67%), tons	Tourists 0	Tourists 0	Tourists 0	Tourists 0
	Households 301,500	Households 26,800	Households 15,256	Households 343,556
Tourism related food waste	100,980 22.44%	8,976 22.44%	5,109 22.44%	115,065
Household related Food Waste	349,020 77.56%	31,024 77.56%	17,660 77.56%	397,704

Note: Food consumption values are calculated based on consumption data provided in chapters 2.5.1 – 2.5.6. Consumption of beverages is calculated based on data on disposed bottles, with the assumption that all bottles were disposed and accounted.

Table 3.2-56 Summary data on food consumption and food waste in Georgia

FOOD	Consumption			Waste		
	Total	Tourism related, 22.44%	Household 77.56%	Total	Tourism related 22.44%	Household 77.56%
Food except beverages (Annual and permanent crops, meat, milk and milk products, eggs)	2,854,437	640,536	2,213,901	450,000	100,980	349,020

FOOD	Consumption			Waste		
	Total	Tourism related, 22.44%	Household 77.56%	Total	Tourism related 22.44%	Household 77.56%
Beverages in plastic bottles	1,123,143	252,033	871,110	plastic bottles 40,000	8,976	31,024
Beverages in glass bottles	66,033	14,818	51,215	glass bottles 22,770	5,094	17,606
TOTAL	4,043,613	907,387	3,136,226	512,770	115,050	397,650

3.2.11.6 *Other indicators of CE in Georgia's Tourism Sector*

Georgia is currently at the early stage of establishing integrated management systems to plan and manage the multiple sector dependent tourism activities. From 2011 to 2015, the country developed several Regional Tourism Development Plans, comprising Kakheti, Imereti, Samtskhe-Javakheti and Mtianeti regions of Georgia. The mentioned plans already imply to use during the planning such concepts as "destination carrying capacity", "sustainable tourism". Agri-Tourism Strategy has been developed for Samtskhe-Javakheti and Kvemo-Kartli regions of Georgia. Agri-tourism can be defined as visiting a working farm or any agricultural, horticultural, or agribusiness operation for the purpose of enjoyment, education, or participation in the activities of the farm or operation.

In 2020, the Ecotourism Strategy of Georgia for 2020–2030 was elaborated by Georgian National Tourism Administration (GNTA). The strategy gives the following definition of ecotourism for Georgia: "*Ecotourism is travelling and touristic activities and services with a focus on preservation and experience of nature and living culture in and outside of Protected Areas for the benefit of the local people and the country*." The principles adopted by the strategy are illustrated in a scheme given below:

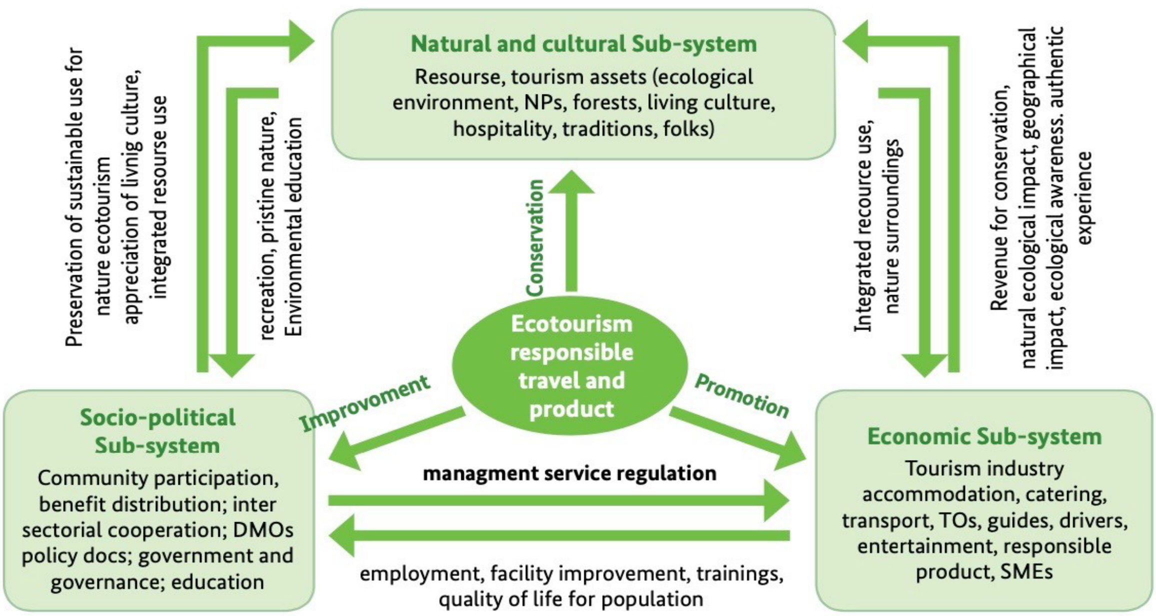


Figure 3.2-44 The principles defined by the Ecotourism Strategy of Georgia 2020–2030

Implementation of the Ecotourism and Agri-Tourism Strategies will improve at least several aspects of circularity:

- sharing of facilities for accommodation
- sharing human resources
- regenerative approach to ecosystems

Current tourism related activities demonstrate that to some extent principles of circular economy are shared by construction and transport sectors connected to the tourism industry:

- Developer groups and construction companies are constructing not only large hotels managed by owner/operator company, but also apartment complexes owned by many independent private owners, but shared as accommodation facilities with the travellers. Apartment complexes are intensively developed in major tourist destinations, like Tbilisi, Batumi and Adjara coastal zone, Gudauri and Bakuriani ski resorts, Borjomi.
- Tour-agencies and digital platforms (like Airbnb) enable the local owners of accommodation facilities to lease them and thus share their facilities with the tourists.
- Transport agencies provide services for leasing cars and different type vehicles (offroaders, minibuses, etc.)
- Almost all of the large and medium sized hotels provide services sharing their facilities for organizing special events, like conferences, business meetings, celebrations.

The examples given above demonstrate that not only waste recycling activities, but also other aspects of circularity are already to certain extent regarded in Georgia and have prospect for further development and improvement.

3.2.11.7 Tourism Agencies and Tour-Operators

The number of travel agencies in Georgia by 2022 is 1196 units. The main part of them is concentrated in Tbilisi. From 2020, the development pace and annual turnover in the sector of travel agencies has significantly decreased due to the current pandemic situation conditioned. According to the National Statistics Office of Georgia, the distribution of tourism agencies by regions for 2022 looks like this:

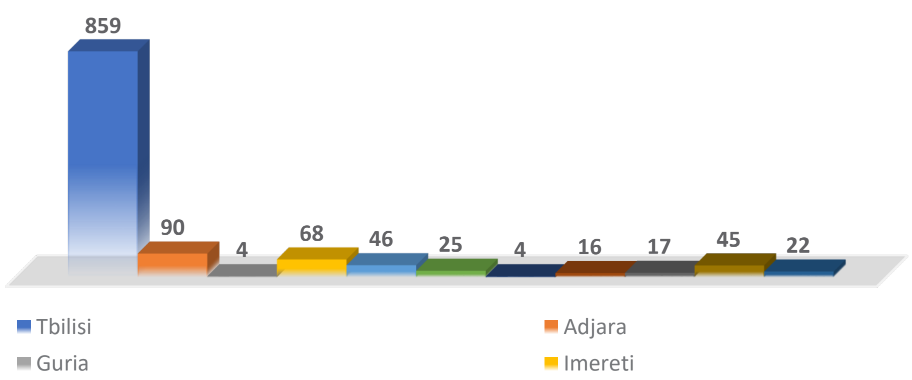
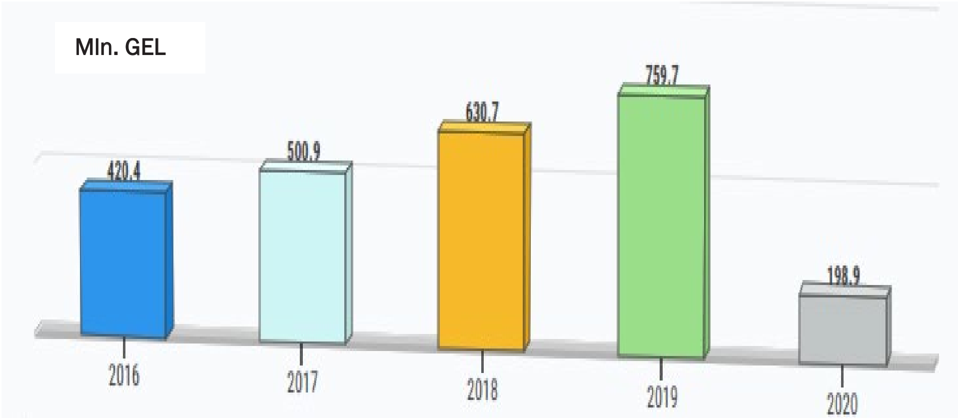


Figure 3.2-45 Distribution of travel agencies by regions in 2022

As the diagram shows, the main part of travel agencies in 2022 is represented in Tbilisi - 859 units, then comes Adjara - 90 units, and Imereti is on the third place - 68 units.

For the last five years, the turnover of travel agencies, tour operators and other enterprises engaged in booking service activities in Georgia is shown on Figure 3.2-46 (declared data).



Source: Geostat

Figure 3.2-46 Turnover of travel agencies, tour operators and other enterprises engaged in booking service activities in Georgia in 2016-2020

As can be seen from the diagram, the turnover volume of travel agencies was steadily increasing from 2016 up to 2019, while the benchmark reduced by 74% by 2020. Return on assets (ROA) is 37% and return on equity (ROE) is 40%.

As for the average number of employees in travel agencies in the last five years, the course is as follows:

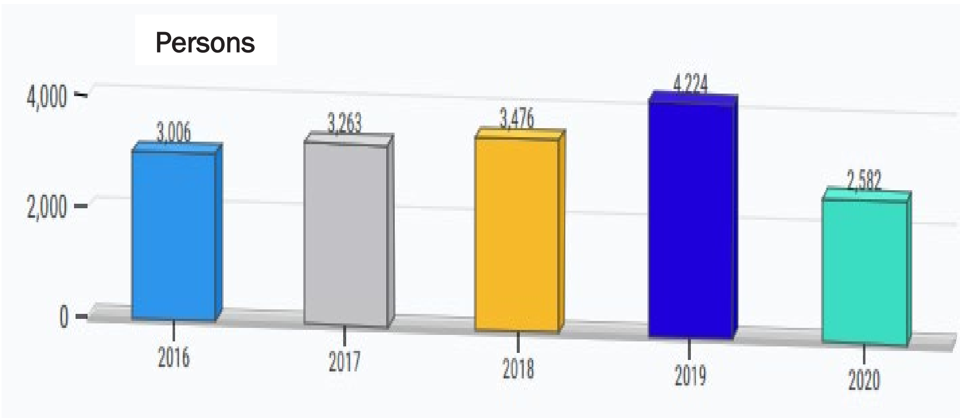


Figure 3.2-47 Average number of employees in travel agencies, tour operators and other enterprises engaged in booking service activities in Georgia in 2016-2020

As can be seen from the diagram, in the last five years in travel agencies the maximum number of employees was recorded in 2019, and the minimum in 2020.[67]

[67] AGIC / Survey of Travel Agencies Industry in Georgia (2019-2020 data)

3.2.11.8 Circularity Profile: Tourism, Accommodation and Food Service Activities

Sector nomination and NACE Index (NI):

Accommodation and Food Service Activities (NI/ 55-56);
Input in GDP (Mln GEL): 2223 Mln. GEL / 8.4%/
Annual production value 2,100,000,000GEL (2019 year)

Travel agencies, tour-operators and associated activities (NI/ 79);
Input in GDP (Mln GEL): 154.4 Mln GEL / 0.36% (2019 year)

Material Resources Used:	Annual Energy Consumption and GHG Emissions Indicators for the Sector:
Water	Annual Use of Electric Energy for entire Commercial and public services - 2,915.0 GWh Natural gas consumption - 176.8 mil. m3

Mass Flow Indicators:

Mass flow:

FOOD	Consumption (tons)			Waste (tons)		
	Total	Tourism related 22.44%	Household 77.56%	Total	Tourism related 22.44%	Household 77.56%
Food except beverages (Annual and permanent crops, meat, milk and milk products, and eggs)	2,854,437	640,536	2,213,901	450,000	100,980	349,020
Beverages in Plastic Bottles	1,123,143	252,033	871,110	plastic bottles 40,000	8,976	31,024
Beverages in glass Bottles	66,033	14,818	51,215	glass bottles 22,770	5,094	17,606
TOTAL	4,043,613	907,387	3,136,226	512,770	115,050	397,650

Wastes and losses (significant effect):

The enormous amount of food/products, which is still edible, as well as non-edible products end up in the Landfills. Level of recycling is very low and in fact is limited to the use of non-edible food wastes for feeding animals. Composting is practiced in very rare cases.

Total food waste estimations: 450,000 tons annually

- Tourist's share in food wastes: 100,980 tons
- Total PET bottles - 40,000 tons annually
- Tourist's share in PET bottles - 8,976 tons
- Total Glass bottles – 22,700 tons annually
- Tourist's share in glass bottles - 5,094 tons annually
- Total Sanitary pads - 64,790 tons annually
- Share of tourists in sanitary pads - 2,592 tons

Gaps in Circularity:

1. The enormous amount of food/products, which is still edible, ends up in the Landfill on a daily basis. Three main factors impede the development of the food/product donation practice in Georgia, in particular:
   - The strict financial regulations,
   - The low awareness of the business entities on their rights towards the food/product donation opportunity,
   - Additional transportation costs of the food/products to the beneficiary.
2. Non-edible food waste, as well as PET and glass bottles are the major component of waste flows generated by tourists. The food waste is not recycled. The level of recycling PET bottles and glass is very low.
3. Digital platforms, green-procurement, facility and resource sharing principles are not widely used in Tourism and associated sectors.

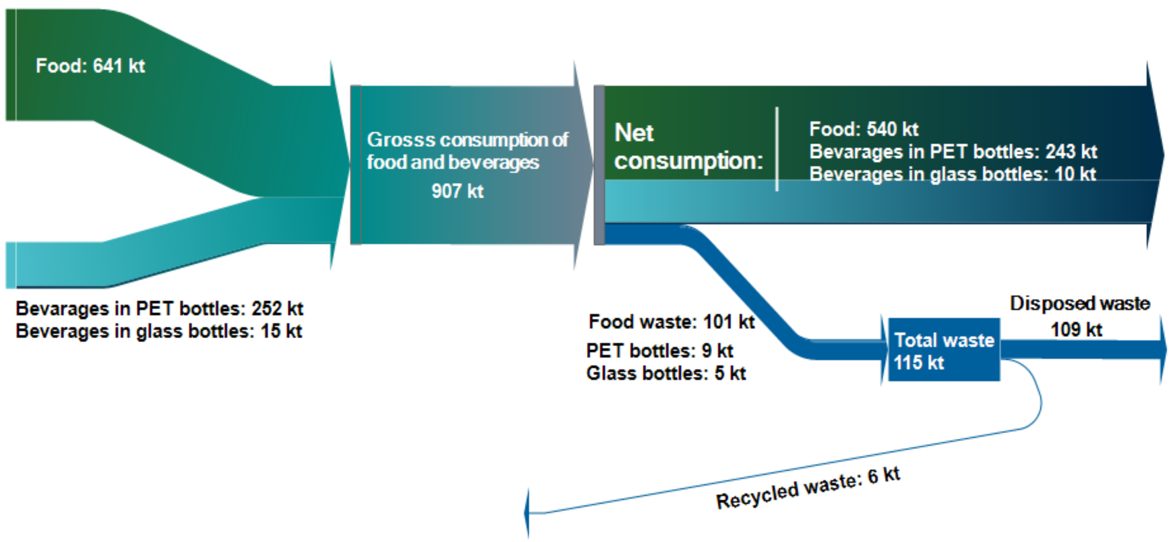


Figure 3.2-48 Mass flow diagram for tourism, accommodation and food services activities sectors

Potential for increasing level of circularity:

1. Collect and use the edible food wastes:

   It is easier to organize separation of the edible food wastes in accommodation and food service facilities, rather than at the municipal level. In case of adjusted legal regulations, food/product waste can be significantly reduced by donating it for example to the Catharsis, Caritas Georgia and Social Canteens.

2. Collect and recycling of the non-edible food wastes:

   It is much easier to organize separation of the non-edible food wastes in accommodation and food service facilities, rather than at the municipal level. Separated food waste, glass, plastics could be collected and recycled by different waste operators. Demanded organic compounds, animal fodder, fertilizers or other products could be produced from the food waste.

3. Implement appropriate digital platforms, green-procurement procedures, facility and resource sharing principles in Tourism sector and associated sectors.

ReSOLVE FRAMEWORK	
Regenerate	- Reuse and recycle the edible and non-edible food waste. - Promote ecotourism and agri-tourism, as well as other forms of tourism activates regenerating and preserving ecosystems.
Share	- Promote transport leasing companies and activities; - Support facility sharing models for tourist facility construction sector (apartment buildings. Digital platforms for leasing private facilities) - Share hotel premises for different events (conferences; business meetings etc.)
Optimise	- Optimise urban planning and construction of tourist facilities: ○ Take into account carrying capacity of destination ○ Facility sharing models for tourist facility construction sector ○ ensure energy efficient buildings for tourism and food service sectors
Loop	
Virtualise	
Exchange	For food services: optimise packaging, replace disposable items with reusable alternatives where practicable; use recyclable disposable items, etc.

Key actors in implementing CE and direct beneficiaries:

► **Private companies:**

– **Large companies involved in hotel business and food services, transport services, construction companies and developers; waste operators.** The companies may have their input in food waste minimization and recycling, sharing facilities and transport means; introducing regenerative and ecologically friendly models of tourism.

– **Small and medium size companies** running small hotel business, food services and/or transport services;

► **Central Government:**

– Improving Policy and creation of incentives for the private sector introduce CE elements in their businesses

– optimization of urban planning, integration of CE in sectoral development strategies

3.2.12 Manufacture (Manufacture of food products, beverages and tobacco products; Manufacture of basic Metals; Manufacture of Non-metallic mineral products)

Sector nomination and NACE Index (NI)

Manufacture of food products, beverages and tobacco products (NI/ 10-12);
Input in GDP (Mln GEL): 2271.7 Mln GEL / 5.3%
Annual Production value: 4,800.00 Mln GEL

Manufacture of the Non-metal Mineral Products (NI 23)
Input in GDP (Mln GEL): 423.7 Mln GEL / 1.0%
Annual Production value: 1,400.00 Mln GEL

Manufacture of the Basic Metals (NI 24)
Input in GDP (Mln GEL): 651.2 Mln GEL / 1.5%
Annual Production value: 1,450.00 Mln GEL

3.2.12.1 Overview of Manufacture Sector

Within the total structure of entire manufacture sector, there are clear priorities for several subsectors, which have significant economic input in total GDP, annual turnover, annual production value and other economic indicators (see Table 3.2-58). The priority subsectors, which are selected for our further discussions, are:

- Manufacture of food products, beverages and tobacco products
- Manufacture of other non-metallic mineral products
- Manufacture of basic metals

Table 3.2-57 General Macro-economic Metrics and Circularity Qualitative Indicators of manufacturing sector of Georgia

General Macro-economic Metrics and Circularity Qualitative Indicators		GDP, Mln GEL	GDP %	Annual Turnover, Mln GEL	Annual Production Value /Mln GEL
Nace Rev. 2	Economic Activities	2019			
10-12	Manufacture of food products, beverages and tobacco products	2271.7	5.3	4,680.00	4,800.00
13-15	Manufacture of textiles, wearing apparel, leather and related products	116.3	0.3	360	360
16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	49.2	0.1	120	110
22	Manufacture of rubber and plastic products	99.3	0.2	430	423
23	Manufacture of other non-metallic mineral products	423.7	1.0	1,400.00	1,424.00
24	Manufacture of basic metals	651.2	1.5	1,450.00	1,440.00
25	Manufacture of fabricated metal products, except machinery and equipment	139.2	0.3	400	378
31-32	Manufacture of furniture	72.6	0.2	220	222

Table 3.2-58 Statistics of enterprises operating manufacturing sector in Georgia

Registered entities		Active entities									
Number	%	Total		Among them							
				Large		Medium		Small		Size unknown	
		Number	%	Number	%	Number	%	Number	%	Number	%
40388	4.69	17908	8.49	61	10.36	274	9.57	16792	8.95	781	3.91

3.2.12.2 *Manufacture of food products, beverages and tobacco product (NI 10-12)*

3.2.12.2.1 *Manufacture of Annual Crop Products*

Table 3.2-59 Local production, import and export of annual crop products

Annual Crop	Average Annual Production (ths. tons)	Average Annual Import (ths. tons)	Average Annual Export (ths. tons)	Average Annual Processed Crops (ths. tons)
Wheat, total	102.4	561.0	0	663.4
Maize	255.0	121.0	1.0	375
Sunflower	1.9			1.9
TOTAL	**359.3**	**682.0**	**1.0**	**1,040.3**

According to different sources, at the milling stage of the production in average 76% of flour, 4% of solid waste and 20% of bran and other by products are generated. Total solid wastes are produced from raw materials and manufactured products. If we consider bran and other by-products as a solid waste, the amount of solid wastes could be increased to 24%.

Almost 50% of sunflower seed weight is waste[68], meaning that sunflower oil industry in Georgia each year generates approximately between 950 t of the waste sunflower husk. After industrial processing, this type of waste often ends up at landfills, or being used as energy source, or as an animal feed.

Table 3.2-60 Waste and by-products produced during the manufacture of annual crop products in Georgia

Annual Crop	Average Annual Processed Crops (ths. tons)	Average Annual Product (ths. tons)	Bran and other by-products	Average Annual Solid Waste (ths. tons)	Total of waste and by-product
Wheat, total	663.4	504.184	132.68	26.536	158.216
Maize	375	285	75	15	90
Sunflower	1.9	0.95		0.95	0.95
TOTAL	**1,040.3**	**790.134**	207.68	42.486	249.166

3.2.12.2.2 Manufacture of Permanent Crop Products (except grapes)

Table 3.2-61 Manufacture of permanent crop products in Georgia in 2018 – 2020

Permanent Crops	Average Production (ths.tons/year)	Average Import (ths.tons/year)	Processed Fruits (ths.tons/year)	Internal consumption (ths.tons/year)	Average Export (ths. tons/year
Citruses (orange, tangerine, lemon, kiwi, feijoa)	62.3	10.0	15.0	12.5	49.8 Total 15.0 processed 34.8 Fresh
All other fruit	163.5	97.8	50.0	178.8 (out of this 5.0 processed)	81.6 (out of this 45.0 processed)
TOTAL Fruits	225.8	107.8	65	191.3	131.4

The losses and wastes are generated at the processing of the product is about 7%. At present some part of the fruit waste is used as an additional fodder to feed the livestock.

Losses and waste generated during processing harvested and imported fruits are given in a table below:

Table 3.2-62 Losses and waste generated during processing harvested and imported fruits in 2018-2020

Permanent Crops	Processed Fruits (ths. t/y)	Processed Fruit Products (ths. t/y)	Average waste generated for (ths. t/y)
Citruses (orange, tangerine, lemon, kiwi, feijoa)	15.0	13.95	1.05
All other fruit	50.0	46.5	3.5
TOTAL Fruits	**65.0**	**60.45**	**4.55**

[68] Conversion of Sunflower Seed Hulls, waste from edible oil production, into Valuable Products February 2019; Journal of Environmental Chemical Engineering 7(1):102893 DOI:10.1016/j.jece.2019.102893

3.2.12.2.3 Wine production

Table 3.2-63 Grape and Wine Making Value Chain

Input			
Grapes used for Wine Production Average 2018–2020, ths.tons/year	Wine production, ths.tons /year	Glass bottles for internal market, tons/year	Plastic bottles for internal market, tons/year
253.3	212.8	1,800* tons	0.5* tons

Outcome				
Internal consumption of Wine, ths.tons/year	Average Export of Wine for 2018 – 2020, ths.tons/year	Organic Waste production, ths. tons /year	Plastic bottles remaining from internal consumption, ths.tons/year	Glass bottles remaining from internal consumption, ths.tons/year
130.5	82.3	40.5	0.5 tons	1,800 tons

**50,000 plastic bottle of 0.5l/9.9g is accounted and 3 mln glass bottles of 0.75l/600g (only 1.7% of wine consumed internally is bottled). Glass bottles produced and mostly imported for export share of wine is not accounted.*

3.2.12.2.4 Milk and Milk Products

Table 3.2-64 Material flow in milk and milk products manufacturing sector, 2017 - 2020

Average Annual Production, ths. tons	Average Annual Import, ths. tons	Average Annual Export, ths. tons	Average Annual Consumption, ths. tons	Average Annual Products Consumed, ths. tons	Milk whey and other wastes Average Annual, ths. tons
550.0	140.0	11.0	679.0	Total 78.0 7.0 milk 71.0 dairy products	601.0

According to the Geostat, in Georgia total 360 businesses are register as manufactures of milk and dairy products. Of them 82 (23%) are registered as only cheese producers, 75 (21%) – as producers of heat treated milk, and 7 (2%) – as butter producers. On the other hand, majority of the registered businesses (54%) have diversified manufacture of milk and dairy products, and respectively they are registered as manufacturers of milk and dairy products (Geostat, 2019). Great majority of the registered entities are concentrated in Tbilisi (75 businesses, i.e. 21.1%), Kakheti (75 businesses, i.e. 20.8%) and Kvemo Kartli (60 businesses, 16.7%) (Geostat, 2019).

According to the Georgian Dairy (2017), the business entities manufacture milk products that are listed in Table 3.2-65.

Table 3.2-65 Milk products manufactured by Georgian enterprises in 2018

Milk Product	Production Volume, ton/year
Milk	7,039
Butter	8,308
Cheese	15,382
Matsoni	11,576

Milk Product	Production Volume, ton/year
Yoghurt and other fermented products	3,328
Kefir	1,382
Cottage cheese	4,045
Sour cream	11,563
TOTAL	**77,970**

3.2.12.2.5 Beverages (other than wine)

Table 3.2-66 Beer production in Georgia in 2010-2016

	2010	2011	2012	2013	2014	2015	2016*
Ths. decalitre	8279,0	7873,9	9903,4	1009,0	9965,5	8605,8	9772,4
Price (ths. GEL)	106418,1	101372,4	130538,5	128204,3	146228,5	117179,4	115027,2

Source: Nana Kirvalidze, Maia Jegashvili, Beer Production in Georgia, Iv. Javakhishvili Tbilisi State University; and Paata Gugushvili Institute of Economics International Scientific/ "ECONOMY – XXI CENTURY"/2017

Table 3.2-67 Export and import of malt beer in Georgia in 2010-2016

Year	Export		Import	
	Ths. USD	Ths. Litre	Ths. USD	Ths. Litre
2010	495,4	856,7	8686,4	14994,1
2011	1776,9	2972,3	9352,0	13104,9
2012	2804,5	5207,4	7598,5	9046,1
2013	2468,1	4452,8	7416,2	7842,0
2014	1355,4	1911,5	7607,3	7864,3
2015	908,2	1035,6	6699,8	7840,9
2016	1133,2	1143,2	7014,3	8208,7

Source: Nana Kirvalidze, Maia Jegashvili, Beer Production in Georgia, Iv. Javakhishvili Tbilisi State University; and Paata Gugushvili Institute of Economics International Scientific/ "ECONOMY – XXI CENTURY"/2017

In 2016 about 1,143,200 l was exported out of 97,724,000 litre produced (1.1%). It is assumed that this % of export is maintained for 2020 and out of 73,500 t beer produced in Georgia 808.5 t was exported.

Below is presented the dynamics of manufacture of mineral water and soft drinks in Georgia (Table 3.2-68).

Table 3.2-68 Manufacture of mineral water and soft drinks in Georgia in 2013-2017

Product	Unit	2013	2014	2015	2016	2017*
Soft drinks	ths. decalitre	18955,1	22269,8	21872,0	20514,8	16882,3
	ths. GEL	193192,3	227828,3	233789,6	234327,2	210529,2
Mineral water	ths. decalitre	21208,4	24465,0	20301,1	19911,0	17040,2
	ths. GEL	229480,1	288269,5	226018,1	221347,7	198388,8

Source: Nana Kirvalidze, Maia Jegashvili, Beer Production in Georgia, Iv. Javakhishvili Tbilisi State University; and Paata Gugushvili Institute of Economics International Scientific/ "ECONOMY – XXI CENTURY"/2017

Table 3.2-69 Export and import of mineral water and soft drinks in Georgia in 2013-2017

Year	Export		Import	
	Ths. USD	Ths. Litre	Ths. USD	Ths. Litre
2013	124192,3	154374,4	21821,2	19830,8
2014	165502,1	194561,4	24542,4	21347,5
2015	100678,8	131665,3	21247,6	21967,2
2016	91198,8	136532,5	18780,8	21508,4
2017	113135,7	174549,1	18922	22636,7

Source: Nana Kirvalidze, Maia Jegashvili, Beer Production in Georgia, Iv. Javakhishvili Tbilisi State University; and Paata Gugushvili Institute of Economics International Scientific/ "ECONOMY – XXI CENTURY"/2017

In 2017, out of 339,225,000 litres produced mineral water and soft drinks 174,549,100 litres were exported, which is 51.5% of production. In our calculations we will use 50.0% as a reference for export for year 2020.

Table 3.2-70 Material flow data for beverage manufacturing industry

Product	Material inflow			
	Product value, GEL	Production amounts, tonnes	Plastic bottles, tonnes	Glass bottles, tonnes
Soft drinks	210,529,000	168,230	6,124	28,262
Mineral water	198,388,800	170,402	6,203	28,627
Beer	108,142,500	73,500	2,675	12,348
Total Beverages	2,200,000,000 (including wine)			
Product	**Material Outflow**			
	Internal consumption of Georgian product	Export	Waste remaining (plastic bottles), tonnes	Waste remaining (glass bottles), tonnes
Soft drinks	84,115	84,115	3,062	14,131
Mineral water	85,201	85,201	3,101.5	14,313.5
Beer	73,500	0	2,675	12,348

** weight of 0.5l glass bottles is assumed as 280g and 0.5l PET bottle weights 26g: Rough assumption is that 70% of soft drinks and water is bottled in PET and 30% in glass bottles. Export of beer does not exceed 1.1% and is neglected.*

3.2.12.3 *Manufacture of the Non-metal Mineral Products (NI 23)*

Manufacture of other non-metallic mineral products has significant input in GDP 423.7 Mln GEL, which is 1.0% of GDP (as of 2019). The sector is in principle mostly represented by JSC Rustavi Azot, which is the largest chemical company and only producer of industrial chemicals and mineral fertilizers in South Caucasus.

JSC Rustavi Azot produces approximately 450 000 tonnes of nitrogen based fertilisers (ammonium nitrate). Out of this amount 65 000 is sold on internal market, while the remaining portion is exported. The export of fertilisers comprised 120 Mln. GEL in 2021.

► Wastes Generated

Recycled wastes

- **Plastic waste** – nitrogen fertilizers are transported to the port packed in big-bags. In most cases the big-bags are cut in the ports, and the fertilizer is transported as bulk cargo. The packaging material is returned to the Rustavi Azot, where it is recycled.
- **Waste oils** – Rustavi Azot regenerates all used oils produced during its operations
- **Different wastes** – the enterprise has own incinerator, where different hazardous wastes that are produced during operations (wiping materials, own medical waste, etc.) are burned.

Other wastes:

Code	Description	Amount, ton
20 03 01	Mixed municipal solid waste	390,077
17 09 04	Mixed construction and demolition wastes not included in 17 09 01, 17 09 02 and 17 09 03	268.0
13 02 05*	Mineral-based non-chlorinated engine, gear and lubricating oils	22.400
15 02 02*	Wiping cloths contaminated by oil (oil content less than 15%	4.700
06 09 99	Magnesite waste, Mgo, Mg(NO3)	180
15 01 10*	Used polyethylene and polypropylene bags	460.050
19 09 04	Spent activated carbon	0.5
03 01 05	sawdust other than those mentioned in 03 01 04	30.5
12 01 01	Ferrous metal filings and turnings	25.0
19 09 02	Sludges from water clarification, sludges containing coagulant	600.0
16.08.01 / 16.08.03	Various spent catalysts	195.675
15 02 03	Textile filters	2.250
07 02 13	Spent plastic fiber filters	2.790
06 10 02*	Wastes containing dangerous substances (monoethanolamine)	200
06 10 02*	Wastes containing dangerous substances (anisole)	40
10 01 14* /15/16/17	Bottom ash and slag from incineration	4.4

► **Energy consumption** - 304.9 GWh annually (2020)

► GHG emissions

In ammonia production, CO_2 is emitted when hydrocarbon feedstock is broken down for producing H2. Most of the ammonia in Georgia is produced through the Haber-Bosch process called a synthesis of ammonia: nitrogen and hydrogen enter into a reaction. The required hydrogen is a product of natural gas conversion.

Differentiated indicators of GHG emissions for manufacture sector are not reported. The aggregated value of GHG emissions for Logging and wood products, construction, manufacture and mining sectors is equal to 1,190 Gg CO_2 eq.)

3.2.12.4 Manufacture of the Basic Metals (NI 24)

Manufacture of basic metals has significant input in GDP 651.2 Mln GEL, which is 1.5% of GDP (as of 2019).

The ferroalloy plant of Zestaponi produces 220 000 tons of ferroalloys, of which 98% is exported. In 2021, ferroalloys of 477.44 Mln. GEL were exported.

Steel and iron products (mainly reinforcement) are manufactured by 2 companies – Rustavi Steel and GeoSteel – these companies manufactured 363 000 tons of steel and iron products in 2020, their price comprising 405.1 Mln. GEL. 95% of the production is consumed by the local market.

► Wastes Generated

In 2020 Rustavi Steel JSC and GeoSteel LLC together produced 363 000 tons of steel. **Around 40 300 tailings** can be generated during manufacturing **363 000 tons of this product.**

The annual production of Zestaponi Ferroalloy Plant is 220 000 tons of ferroalloys. The manufacturing of this volume of ferroalloys can produce the same amount of tailings – the output depends on the purification degree of the raw materials (concentrate).

► **Energy consumption** - 1 739.5 GWh annually (2020)

► GHG Emissions

Currently, the Steel production is carried out by two major factories - LTD Georgia Rustavi Steel and GeoSteel using Electric Arc Furnace. In the recent past the steel was produced by the only metallurgical factory in Georgia - LTD Georgia Rustavi Steel. In 1990 the several technological lines were operated in the factory, particularly it had a sinter production, pig iron production and steel production via marten kiln lines. In 1993 the pig iron production was terminated. The sinter production was closed in the following year. The use of marten kilns was terminated in 1999. During 2000 - 2010 years period the factory produced steel by melting the cast iron, which is not characterized by the industrial GHG emissions.

Since 2010 the steel production through the EAF was launched by GeoSteel and two years later the Rustavi Steel joined it. During the recent few years, the trend was characterized by the significantly low emissions compared to the emissions related to the years of 1990-1992.

The ferroalloy plants produce the enriched alloys that are transmitted to the steel producing plants for manufacturing steel alloy. Ferroalloys production includes the metallurgical reduction process that causes significant emission of CO_2 and minor emission of CH4. The ferroalloys including Ferro silicomanganese, Ferrosilicon, and Ferromanganese are produced by several plants in Georgia. The dominant product is silicomanganese - with about 82% share, followed by ferrosilicon - with 14% share and ferromanganese - with 4 per cent share.

In 2015 the emissions were about 405 Gg CO_2 eq. - the lowest value for the recent five years. It slightly declined (by 11 per cent) compared to the value of 2014. In 2016 the emissions declined by 14 % followed by 18 % increase in 2017. The emission had a fluctuating trend between 2011 and 2017 period. The highest emissions from the ferroalloys production in Georgia during the whole time series from 1990 to 2017 were estimated in 2012 - 457 Gg of CO_2eq. At the beginning of the period the emission was 74 % lower than in 2017. During the following six years the emissions trend was descending and it reached the level of 25 Gg CO_2eq. in 1996, the minimum level of emissions for the whole estimating period.

3.2.12.5 Circularity Profile: Manufacture (Manufacture of food products, beverages and tobacco products; Manufacture of basic Metals; Manufacture of Non-metallic mineral products)

Sector nomination and NACE Index (NI)

Manufacture of food products, beverages and tobacco products (NI/ 10-12);
Input in GDP (Mln GEL): 2271.7 Mln GEL* / 5.3%

Annual Production value: 4,800.00 Mln GEL*

Material Resources Used:

Water Consumption (mln.m3/year):
Manufacture of Food, beverages and tobacco - 2.56
Manufacture of other non-metallic mineral products - 5.84 (chemical industry)
Manufacture of basic metals - Manufacture of basic metals - 8.59

Energy Resources:

Sectors	Electric Power Consumption, GWh	Natural Gas consumption, (mil. m3)
Manufacture of Food, beverages and tobacco	246.5	47.5
Manufacture of other non-metallic mineral products	304.9	31.9
Manufacture of basic metals	1,739.5	21.3

Total GHG emissions for Logging and wood products, construction, manufacture and mining: 1,190 Gg CO2 eq.)

Mass Flow Indicators:

	Manufacture of food products, beverages and tobacco product (NI 10-12)	Manufacture of the Non-metal Mineral Products (NI 23)	Manufacture of Basic Metals (NI 24)	Total Manufacture
Volume of processed Row Material, ths.tons	2,515.80	842	843.3	**4,201.10**
Average Annual Product, ths.tons	1,617.50	450	583	**2,650.50**
Internal Consumption, ths.tons	1,407.40	65	349.3	**1,472.40**
Export, ths.tons	210.1	385	233.8	**828.9**
Byproducts and Tailings, ths.tons	207.7		260.3	**468. 0**
Waste, ths.tons	690.6	392		**1,082.60**
Total of waste and by-product, ths.tons	898.3	392	260.3	**1,550.60**

Gaps in Circularity:

1. Tailings (about 260,300 t annually) are generated by basic metal manufacture sector and stored. The tailings could be used for recovering additional portions of valuable materials, using modern technologies;
2. By-products generated in food processing industry (207,700 t annually), as well as food waste and other organic wastes are not recycled and reused
3. Recycling and reuse of the packaging waste is poor
4. Energy use structure for manufacture of metals could be optimized through decreasing use of coal and increasing share of renewable energy sources

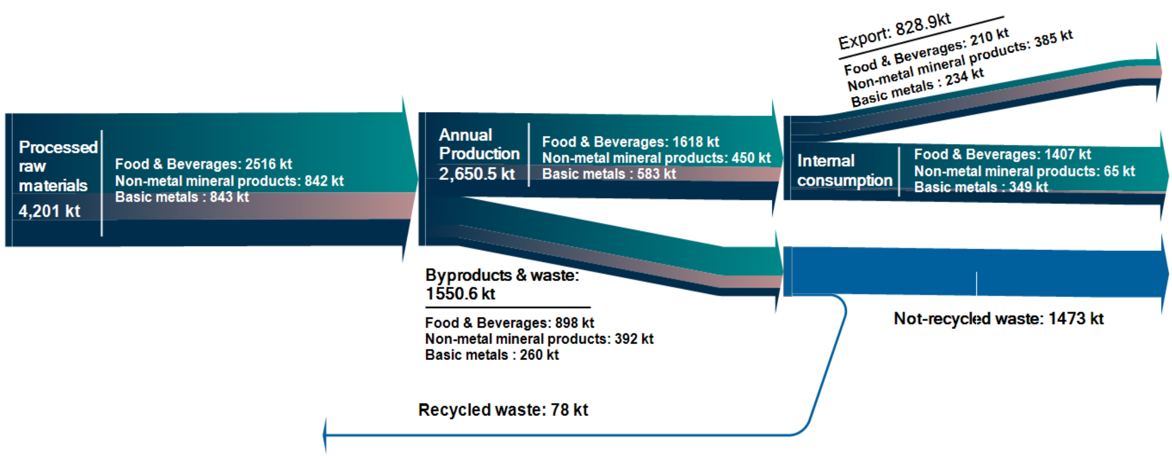


Figure 3.2-49 Mass flow diagram for manufacture sector

Potential for improving circularity:

ReSOLVE FRAMEWORK

Regenerate	– Reuse and recycle the edible and non-edible food waste. – Reuse stored tailings and recover valuable materials through implementation of modern technologies – Reuse plastic and other packaging materials
Share	
Optimise	– Reuse stored tailings and recover valuable materials through implementation of modern technologies – Reuse and recycle the edible and non-edible food waste. – Optimize the energy use structure for manufacture of metals could through decreasing use of coal and increasing share of renewable energy sources
Loop	– Reuse stored tailings and recover valuable materials through implementation of modern technologies
Virtualise	
Exchange	– Optimize the energy use structure for manufacture of metals could through decreasing use of coal and increasing share of renewable energy sources

Key actors in implementing CE and direct beneficiaries:
► Private companies: Large companies involved in the manufacture of basic metals and non-metal mineral products. – The companies may have their significant input in CE by reusing of stored tailings and recovering valuable materials through implementation of modern technologies. Large companies (food production; manufacture of basic metals and non-metal mineral products) – The companies may have their input in CE by reusing plastic and other packaging materials. – Increasing share of renewable energy Small and medium size companies (manufacture of food and beverages) – Collection and recycling of the organic wastes (food waste etc.) – Reusing plastic and other packaging materials ► Central Government: – Improving Policy and creation of incentives for the private sector to introduce CE elements in their businesses – Legal requirements set forth to regulate reuse of tailings and recovery of valuable materials – Legal requirements set forth to regulate collection and recycling of the food waste

3.2.13 Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles

Sector nomination and NACE Index (NI): Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles (NI/ 35-47)

Input in GDP (Mln GEL): 6161 / 14.3%

Input of different subsectors:

Economic Activities	Input in GDP (Mln GEL)	Input in GDP %
Wholesale and retail trade and repair of motor vehicles and motorcycles	838.4	1.9
Wholesale trade, except of motor vehicles and motorcycles	2795.2	6.5
Retail trade, except of motor vehicles and motorcycles	2527.4	5.9
TOTAL: Wholesale and retail trade; repair of motor vehicles and motorcycles	**6161**	**14.3**

3.2.13.1 Statistics for Wholesale and Retail Trade in Georgia

Table 3.2-71 Statistics for wholesale and retail trade in Georgia for 2014-2022Q1

	2014	2015	2016	2017	2018	2019	2020	2021 I	2021 II	2021 III	2021 IV	2022 I
Turnover, Billion Gel	25.2	26.7	29.3	32.8	37.4	43.0	43.4	10.7	12.8	14.8	15.8	14.0
Production Value, Billion Gel	4.4	5.0	5.6	6.3	6.9	7.9	8.2	1.9	2.5	2.9	3.1	2.5
Value Added, Billion Gel	3.0	3.2	3.6	4.2	4.4	5.1	5.4	…	…	…	…	…

	2014	2015	2016	2017	2018	2019	2020	2021 I	2021 II	2021 III	2021 IV	2022 I
Intermediate Consumption, Billion Gel	1.5	1.8	2.1	2.2	2.4	2.8	2.8	...	...	...	...	...
Fixed Assets, Billion Gel	2.4	2.6	2.7	3.1	3.3	3.7	3.9	...	...	...	...	...
Number of Employed, Thousand Person	138.4	156.1	169.7	183.9	196.9	210.0	197.3	169.6	180.6	185.9	187.0	185.6
Average Monthly Remuneration of Employees, Gel	702.6	783.8	790.4	844.3	950.9	970.8	1036.5	1128.2	1210.8	1317.8	1465.0	13

Preliminary data

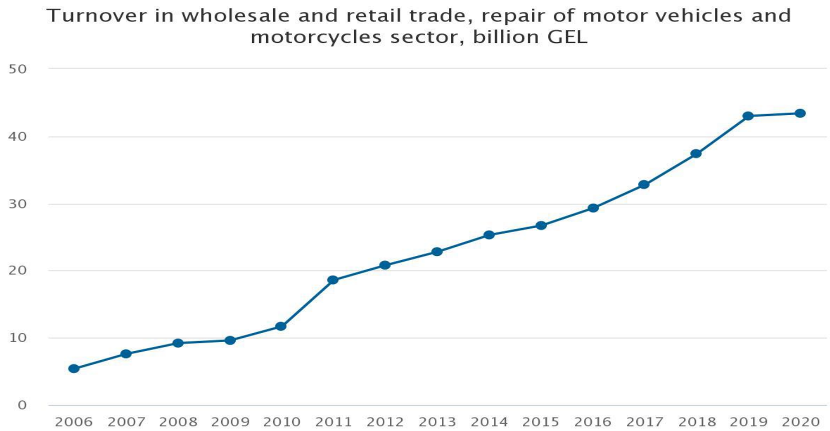


Figure 3.2-50 Turnover in wholesale and retail trade, repair of motor vehicles and motorcycles sector in 2006-2020

Table 3.2-72 Turnover in enterprises of wholesale and retail trade, repair of motor vehicles and motorcycles by kind of economic activity in 2014-2022Q1

Year	Quarter	Total, mln. GEL	of which:			
			Wholesale and retail trade and repair of motor vehicles and motorcycles	Wholesale trade, except of motor vehicles and motorcycles	Retail trade, except of motor vehicles and motorcycles	of which: Retail sale of automotive fuel in specialised stores
2014	...	25 249.5	2 039.5	13 619.0	9 591.0	2 936.3
2015	...	26 690.5	1 689.9	15 138.7	9 861.9	2 718.1
2016	...	29 284.7	1 886.8	16 775.6	10 622.3	2 520.5
2017	...	32 816.3	2 209.9	18 656.5	11 949.9	3 150.4
2018	...	37 409.5	2 692.6	20 576.4	14 140.5	3 506.4
2019	...	42 955.4	3 807.9	23 473.9	15 673.6	3 466.1
2020	...	43 355.6	4 040.4	23 233.1	16 082.1	3 056.5
2021	I	10 746.3	1 086.7	6 021.4	3 638.3	774.4
	II	12 847.0	1 184.5	6 979.9	4 682.6	1 061.9
	III	14 783.1	1 278.1	7 892.1	5 613.0	1 447.1
	IV	15 826.3	1 331.7	8 719.5	5 775.1	1 345.0
2022	I	14 099.2	1 086.8	8 244.7	4 767.6	1 029.7

Table 3.2-73 Turnover in enterprises of wholesale and retail trade, repair of motor vehicles and motorcycles by size of enterprises

Year	Quarter	Total, mln. GEL	of which:		
			Large	Medium	Small
2014	...	25 249.5	9 842.9	5 090.6	10 316.1
2015	...	26 690.5	9 948.8	5 694.1	11 047.6
2016	...	29 284.7	10 813.5	6 047.5	12 423.8
2017	...	32 816.3	12 872.9	7 280.5	12 662.9
2018	...	37 409.5	15 126.5	8 158.7	14 124.3
2019	...	42 955.4	18 379.8	9 501.4	15 074.2
2020	...	43 355.6	18 969.2	9 267.7	15 118.6
2021	I	10 746.3	5 421.5	2 281.6	3 043.2
	II	12 847.0	5 636.6	2 984.0	4 226.4
	III	14 783.1	6 398.4	3 311.6	5 073.1
	IV	15 826.3	7 163.2	3 759.0	4 904.1
2022	I	14 099.2	7 500.3	2 668.8	3 930.1

Size of enterprises determined by the following methodology:
Large size enterprise *is an enterprise, where average annual number of employed exceeds 249 persons and/or volume of average annual turnover - 60 million GEL.*
Medium size enterprises *are all enterprises of organizational-legal form, where average annual number of employed ranges from 50 to 250 persons and/or average annual turnover – from 12 million to 60 million GEL.*
Small size enterprises *are all enterprises of organizational-legal form, where average annual number of employed does not exceed 50 persons and average annual turnover - 12 million GEL.*

Table 3.2-74 Production value in enterprises of wholesale and retail trade, repair of motor vehicles and motorcycles by kind of economic activity

Year	Quarter	Total, mln. GEL	of which:			
			Wholesale and retail trade and repair of motor vehicles and motorcycles	Wholesale trade, except of motor vehicles and motorcycles	Retail trade, except of motor vehicles and motorcycles	of which: Retail sale of automotive fuel in specialised stores
2014	...	4 446.4	357.2	2 319.6	1 769.7	460.6
2015	...	4 981.5	351.8	2 677.4	1 952.4	428.5
2016	...	5 633.2	413.2	3 043.6	2 176.4	457.0
2017	...	6 345.4	513.4	3 405.2	2 426.8	478.0
2018	...	6 884.0	546.6	3 631.8	2 705.6	480.4
2019	...	7 945.3	745.0	4 020.8	3 179.5	516.5
2020	...	8 156.5	714.1	4 248.3	3 194.2	490.8
2021	I	1 886.3	197.5	996.3	692.5	120.3
	II	2 524.9	262.0	1 357.7	905.1	126.4
	III	2 899.5	264.3	1 545.9	1 089.3	174.1
	IV	3 059.2	269.5	1 606.5	1 183.3	159.8
2022	I	2 479.5	204.6	1 334.1	940.8	138.0

Table 3.2-75 Production value in enterprises of wholesale and retail trade, repair of motor vehicles and motorcycles by size of enterprises

Year	Quarter	Total, mln. GEL	of which:		
			Large	Medium	Small
2014	...	4 446.4	1 608.5	977.4	1 860.5
2015	...	4 981.5	1 697.5	1 167.0	2 117.0
2016	...	5 633.2	1 936.0	1 317.4	2 379.7
2017	...	6 345.4	2 274.4	1 519.6	2 551.4
2018	...	6 884.0	2 382.5	1 677.6	2 823.9
2019	...	7 945.3	2 852.2	1 985.2	3 107.9
2020	...	8 156.5	3 063.9	2 052.9	3 039.7
2021	I	1 886.3	757.5	506.5	622.3
	II	2 524.9	1 006.3	671.3	847.3
	III	2 899.5	1 083.7	707.4	1 108.4
	IV	3 059.2	1 135.2	828.3	1 095.8
2022	I	2 479.5	1 056.7	591.5	831.2

Georgia Employment: Business Sector: by Economic Activity: NACE 2: Wholesale & Retail Trade; Repair of Motor Vehicles & Motorcycles data was reported at 185,583.000 Person in Mar 2022. This records a decrease from the previous number of 187,007.000 Person for Dec 2021. Georgia Employment: Business Sector: by Economic Activity: NACE 2: Wholesale & Retail Trade; Repair of Motor Vehicles & Motorcycles data is updated quarterly, averaging 170,388.000 Person from Mar 2016 to Mar 2022, with 25 observations. The data reached an all-time high of 188,566.000 Person in Dec 2019 and a record low of 147,710.000 Person in Mar 2016. Georgia Employment: Business Sector: by Economic Activity: NACE 2: Wholesale & Retail Trade; Repair of Motor Vehicles & Motorcycles data remains active status in CEIC and is reported by National Statistics Office of Georgia.

Figure 3.2-51 Number of persons employed in wholesale and retail trade, repair of motor vehicles and motorcycles sector in 2006-2022Q1

Table 3.2-76 Wholesale and Retail Trade Indicators by Years

Year	Total, mln. GEL	of which:			
		Wholesale and retail trade and repair of motor vehicles and motorcycles	Wholesale trade, except of motor vehicles and motorcycles	Retail trade, except of motor vehicles and motorcycles	of which: Retail sale of automotive fuel in specialised stores
2014	1 470.6	127.8	661.2	681.7	228.0
2015	1 768.7	108.3	847.5	812.9	189.7
2016	2 053.9	145.7	983.1	925.0	251.0
2017	2 159.7	204.5	986.0	969.2	250.8
2018	2 447.6	173.9	1 111.1	1 162.6	273.5
2019	2 827.4	198.1	1 249.5	1 379.9	296.8
2020	2 771.1	190.4	1 315.7	1 264.9	274.7

Table 3.2-77 Total purchases of goods and services in enterprises of wholesale and retail trade, repair of motor vehicles and motorcycles by kind of economic activity

Year	Quarter	Total	of which:			
			Wholesale and retail trade and repair of motor vehicles and motorcycles	Wholesale trade, except of motor vehicles and motorcycles	Retail trade, except of motor vehicles and motorcycles	of which: Retail sale of automotive fuel in specialised stores
2014	...	23 072.9	1 942.0	12 396.0	8 734.9	2 683.2
2015	...	23 908.1	1 352.0	13 604.8	8 951.3	2 465.0
2016	...	26 417.7	1 646.2	15 093.3	9 678.2	2 411.5
2017	...	29 363.2	1 971.3	16 571.2	10 820.8	2 894.3
2018	...	33 871.5	2 437.5	18 513.0	12 921.1	3 310.7
2019	...	38 880.2	3 419.8	21 151.7	14 308.8	3 258.4
2020	...	39 007.1	3 549.6	20 713.1	14 744.4	2 818.0
2021	I	9 885.0	998.9	5 505.3	3 380.8	715.0
	II	11 937.1	999.9	6 646.6	4 290.6	998.0
	III	13 267.3	1 236.8	6 939.6	5 090.9	1 414.2
	IV	15 058.9	1 146.6	8 162.6	5 749.6	1 380.6
2022	I	13 377.7	1 044.4	7 787.5	4 545.8	1 081.8

Table 3.2-78 Total purchases of goods and services in enterprises of wholesale and retail trade, repair of motor vehicles and motorcycles by size of enterprises

Year	Quarter	Total, mln. GEL	of which:		
			Large	Medium	Small
2014	...	23 072.9	9 034.8	4 679.2	9 358.8
2015	...	23 908.1	8 926.4	5 043.3	9 938.4
2016	...	26 417.7	9 841.6	5 346.3	11 229.8
2017	...	29 363.2	11 643.1	6 442.2	11 277.9

Year	Quarter	Total, mln. GEL	of which:		
			Large	Medium	Small
2018	...	33 871.5	13 922.3	7 279.6	12 669.6
2019	...	38 880.2	16 990.8	8 371.8	13 517.6
2020	...	39 007.1	17 324.4	8 068.3	13 614.3
2021	I	9 885.0	5 054.6	2 051.2	2 779.2
	II	11 937.1	5 401.4	2 753.9	3 781.8
	III	13 267.3	5 753.1	2 935.4	4 578.7
	IV	15 058.9	7 075.8	3 477.5	4 505.7
2022	I	13 377.7	7 092.5	2 501.1	3 784.0

- **Import indicators** - 5,963,274.5 thousands USD (2021)
- **Export indicators** - 1,235,147.9 thousands USD (2021)[69]

3.2.13.2 Review of Subsectors

3.2.13.2.1 The retail trade (excluding motor vehicles and motorcycles)

Input in GDP (Mln GEL)	Input in GDP %
2527.4	5.9

Evolution of the Sector

According to Colliers International 2017 Report, the retail trade (excluding motor vehicles and motorcycles) is one of the largest and fastest growing sectors in Georgia. In 2016, retail trade turnover volume amounted to GEL 10.6 billion (at current prices). When compared to the same timeframe in 2015, this reflects an 8% increase. A massive growth was recorded in 2013, when the figure increased by 20%. The number of employed persons also grows steadily in the sector. In 2016, this figure amounted to 95K, which reflected an 8% growth compared to the previous year. With an 81% share, Tbilisi dominates Georgia's trade economy. The average annual growth rate of the trade sector in Tbilisi was 12% during the last three years. Adjara and Imereti are other significant trade regions with 6% and 3% shares, respectively. In Adjara and Imereti regions, the average annual growth during the last three-year period amounted to 18% and 17%, accordingly.

Although some importers still handle their own distribution, several distribution companies have established networks for food, cosmetics, and consumer goods. A significant part of retail stores are sole proprietorships with one outlet, especially in the regions outside Tbilisi, but there are a growing number of market chains such as Foodmart (SPAR's Georgian partner), Goodwill, Ioli, 2Steps, Fresco, Smart, and Nikora. Carrefour, which currently operates 8 stores in the capital, is

69 Import and export indicators are taken from Geostat data

planning to open new stores across the country. Retail chain shops sell Western brands of cosmetics, household goods, clothing, and electronics.

Market share

Georgia with 4,8 million population and 8,4 billion dollars of total retail sales are one of the country in central Asia that had an increment in retail market in these years. Georgia has a solid per capita spending growth over the past five years, and an underpenetrated retail market.

Georgia remains attractive for retailers across all categories. Despite growth and expansion in food retail, modern formats still represent only 30% of the market, with most key players considering traditional market their strongest competitors. Carrefour and local Goodwill remain the only hypermarket players, while the minimarket playing field is a bit more competitive. SPAR (with 42 stores as of today) entered the Georgia market in the summer of 2014 by acquiring Populi, the third-largest retail chain, with plans to rebrand and expand its network from 51 to 80 stores by 2018. Local food retailer Nikora reinforced its leading position by acquiring a small regional chain of 12 supermarkets in December 2014[70].

CE Indicators for the retail trade (excluding motor vehicles and motorcycles)

There is no available data to characterise the entire subsector in terms of mass flows and wastes generated at the different stages of supply chain. However, we can make assumption, that the food product retail is the main contributor in waste production and losses and the most tangible effects of shifting to CE models of economy, should be related to this subsector.

According to the UN's Food and Agriculture Organisation, one-third of the food produced for human consumption does not make it to our plates which equates to 1.3bn tonnes of food per year. Food waste occurs along the entire food supply chain which results in financial losses and waste of natural resources. Approximately two-thirds of all food waste is avoidable and the food we waste consumes an estimated 20% of freshwater, fertiliser, cropland and landfill volume. Food that contributes to food waste include, 45% of all fruits and vegetables, 35% of fish and seafood, 30% of cereals, 20% of dairy products and 20% of meat. According to recent research on the commercial and industrial sectors (EPA NSW 2016) the wholesale and retail trade sectors are two of the principal contributors of food waste to landfill in NSW[71].

The several researches have shown that 10-28% of food produced for human consumption is lost at retail[72]. According to EPA (Ireland), globally, more than 25% of food produced is wasted. Food waste is also a significant contributor to climate change. It is estimated that food waste generates about 8% to 10% of global greenhouse gas emissions. Reducing food waste is therefore an effective climate action. Preventing food waste should be prioritised, and any unavoidable food waste should be treated in the most resource efficient way possible. Diverting food waste from

[70] Colliers/ Retail Market, Georgia 2019; and Lloyds Bank: https://www.lloydsbanktrade.com/en/market-potential/georgia/distribution

[71] Food waste opportunities within the food wholesale and retail sectors /FINAL REPORT 2017/ prepared by the Institute for Sustainable Futures (ISF)

[72] Food Waste at Retail /Erin G. Killeen Davis/ University of Arkansas, Fayetteville : https://scholarworks.uark.edu/etd]

landfill has environmental and financial benefits, and the benefits of preventing food waste are even greater.

According to the Food Waste Index Report 2021 (UNEP), the distribution of food waste among households, food services and retail has following features in case of Georgia:

- Household food waste: 403 573 tonnes/year
- Food Services: 110,504 tonnes/year
- Retail: 62,511 tonnes/year

Based on these figures and an assumption that 25% of the food produced or imported for distribution within the country turns into waste, we can approximate following figures for the mass flow chart: 62,511 tonnes/year is food lost at retail (25%) and the total mass entering retail market is 250,044 tonnes/year.

Below we provide overview of the strategies that are thought to be efficient in minimizing and handling food wastes:

Preventative Measures & Solutions in the Food Supply Chain to Reduce Food Waste[73]

1. Use-by-dates

The UK retailer Co-op is scrapping use-by-dates on own brand yoghurts in a bid to reduce food waste. Approx. 42,000 tonnes ($127.6 million worth) of edible yoghurts are thrown out by UK households each year. By removing the date labels, will help prevent unnecessary as testing has shown that yoghurt is safe to consumer the use-by date. The date range on food products is a significant reason that it is wasted in households.

2. Monitor use-by dates

Chowberry- is focused on ending food waste in Africa by connecting families in need to local supermarkets with nearly expired foods. Stores use the Chowberry app to scan the barcodes of food products. Once uploaded, the app informs retailers when the products have reached the “best before” date and automatically offers those products at a reduced price through the app and the accompanying retail website. The closer the products are to the latest possible selling date, the lower the price is to enable dynamic pricing in food retail. For more economically unstable families, the app helps provide more affordable and consistent food options without causing retailers to lose profit.

3. Data tracking

Escavox innovative start-up that offers sensor for data collection to help growers, retailers and manufacturers to manage their supply chain more efficiently. The sensor increases visibility

[73] Food waste opportunities within the food wholesale and retail sectors /FINAL REPORT 2017/ prepared by the Institute for Sustainable Futures (ISF)

throughout the supply chain as the hardware travels with the food. Also, aids in inventory management to reduce excess inventory and handling, cut down on the amount of perishables

4. Redistribute Surplus Food

Tonnes of food that goes to waste each year is still edible. Companies, charities and individuals can all benefit from the redistribution of surplus food to those who need it.

Food companies can often save money be donating food rather than paying the per tonne landfill tax and disposal cost. For example, a law has been introduced in France which has banned French supermarkets from throwing away or destroying unsold food and must donate it to food banks or for animal feed. Also, social enterprises such as Food Cloud connects food retailers with charities so they can efficiently donate good food that would otherwise be thrown away.

A recent phenomenon, Dumpster Diving, has been taking on the food waste in the retail sector in the US and EU. Rob Greenfield and Caitin Weich are just two dumpster divers, who are foraging through supermarket bins to collect perfectly good food. A whole third of the food that goes into our supermarkets ends up in the bin and will never even make it to consumer's homes. These two dumpster divers are raising awareness of this huge amounts of unnecessary food supermarkets dump.

5. Law

Policy can play a positive role in reducing food waste and Ireland's National Waste Policy 2020-2025, commits to developing a Food Waste Prevention Roadmap that provides the pathway to help achieve Ireland's goal of reducing food waste by 50% by 2030.

Anaerobic Digestion for Food Waste

Anaerobic digestion occurs naturally, in the absence of oxygen, as bacteria break down organic materials and produce biogas. The process reduces the amount of material and produces biogas, which can be used as an energy source. Over 30 million tonnes of food waste is sent to landfills each year.

Reasons to divert food waste from landfills: 1) Food is easily biodegradable and 2) Renewable energy generation.

Food waste is highly biodegradable and has a much higher volatile solids destruction rate (86-90%) than biosolids. Biosolids are solid organic matter recovered from treatment and used as fertiliser. This means that even though additional material is added to the digesters, the end residual will only increase by a small amount.

Food waste can be converted into energy in an anaerobic digester by using naturally occurring bacteria to break down organic waste into biogas and an organic fertiliser by product. It also leads to the creation of what is known as digestate, which is a nutrient-rich organic fertiliser that farmers can use on their land and is better for both the land and the environment than raw slurry. The digestate also helps reduce farmers' dependence on costly fossil fuel-based chemical fertilisers.

Food Waste-Reduction and Prevention is Vital in The Retail Sector

Food wastage is a problem throughout the food chain, and action needs to be taken at all stages to ensure that all stakeholders can benefit. A third of the food we produce never gets into our mouths. Either it is not picked up by farmers during harvesting, is lost when being transported to shops, or simply thrown away due to the use by date or it is considered imperfect produce. Each of us plays our role as supporters and advocates for reducing waste. Prevention should be particularly emphasized, as preventing wastage is more advantageous in all respects than following it up. In fact, the less food wasted, the fewer the related impacts which would lead to an improvement in the sustainability of the entire food service sector.

Strategy to help retailers reduce food waste[74]

#1. Upgrade inventory systems with the latest technology. Advancements in automation and software capabilities have made inventory management scalable across more SKUs and product types. Companies like Whole Foods and Target in the U.S. are now using software to input their store layouts so that deliveries are custom-organized in shelving sequence, making it possible to go directly from distribution warehouse to the retail floor. Before, retailers relied on intermediaries to move goods from the warehouse to the store. Investing in new technology can reduce excess inventory and handling, and cut down on the amount of perishables that ultimately go to waste. Savings promise to be large and lucrative but are still far from scaling. A number of pilots and minimal viable products (MVP) are currently being launched – and if proven right, they'll open the doors to massive investments in the technology surrounding inventory systems.

#2. Partner with farmers in the supply chain. Food waste starts at farms in the value chain. In the U.S., it is estimated that about 7% of produce is left unharvested in fields every year. This is partly due to the tendency to grow more than needed as a hedge against weather and disease and fluctuating wholesale and retail orders. But if more retailers start working directly with farmers or encourage their intermediaries to collaborate more with farmers, agricultural food waste can be significantly reduced.

Food retailers can be more systematic in sharing forecast data for specific food items to help farmers with their production plans and prevent overplanting. Retailers can also share productivity-enhancing knowledge and techniques to help farmers increase their production efficiency and boost farm product quality. For example, by working closely with its 822 sheep farmers during a season of poor Spring weather in 2015 that delayed lamb maturation, Sainsbury's in the UK was able to extend the lamb season by five weeks. By waiting until lamb reached their full weight, Sainsbury's boosted UK-grown lamb availability for customers and prevented potential farm losses. Further, to help British dairy farmers who have been suffering from volatile pricing, Sainsbury's also adopted a "cost-of-production" model that directly reflects the real costs of the farms, builds in a profit, and rewards farmers for following best animal welfare and environmental standards. Choosing this model over the traditional market pricing model, Sainsbury's helped dairy farms to stay in business and ensured continuous supply of milk for future years.

[74] How Large Food Retailers Can Help Solve the Food Waste Crisis/ by Yasemin Y. Kor, Jaideep Prabhu, and Mark Esposito, December 19, 2017/ https://hbr.org/2017/12/how-large-food-retailers-can-help-solve-the-food-waste-crisis

This collaborative approach in working with suppliers means treating farmers as partners rather than contractors and investing in the long-term sustainability of the supply chain instead of maximizing returns from a product in the short term. Similarly, Marks and Spencer (M&S) works closely with its farmers to divert surplus farm produce away from waste streams and into food charities with the help of partner organizations like Company Shop and FareShare.

Big food can also partner with agri-tech ventures that seek to help farmers cut waste, increase productivity, and gain better market and distribution access. Apps like Farming Data give smallholder farmers real-time market information so they can more effectively reach markets and sell their crops. By helping to commercialize these tools, big retailers invest in the continued availability and affordability of quality food supply around the globe.

#3. Modify or eliminate traditional store practices that increase waste. Some traditional food retail practices can unintentionally increase food waste. Over the years, supermarkets have embraced high cosmetic standards for fruit and vegetables, leading them to reject even marginally imperfect-looking food (e.g., too short, long, big, small or uneven in shape, too red or not red enough, and so on). To curb this food waste, grocery chains such as Asda (Wal-Mart) and Morrisons are experimenting with selling “wonky” vegetables at discount prices.

Additionally, given the perishable nature of fresh food, stores regularly end up with some surplus produce. Instead of throwing out food that can’t be sold but are still edible, Kroger, M&S, and Sainsbury’s are in the process of building nationwide systems to distribute surplus edible food to charities.

Technology is an important enabler here too. For example, platforms like Neighbourly serve as a digital hub to bring together food donors and recipients; software programs like LeanPath let institutional kitchens such as Google Food identify sources of food waste (e.g., kitchen practices) and get rid of them; and for its remaining surplus food, Sainsbury’s is working with Entomics, a start-up firm that efficiently converts food waste into fertilizer.

Another practice that contributes to food waste is product labelling. For example, consumers often misinterpret “best by” dates to be expiration dates and prematurely discard food as a result. In many countries, these labels are not even standardized or regulated — manufacturers set these dates themselves, often as a way to ensure consumption at the peak of freshness. Major trade associations for food products are urging food processors to streamline these labels. Initiatives are underway but still remain voluntary and fragmented.

As owners of private label food products and shelf space, large food retailers can play a leadership role here. Retailers can urge food manufacturers to drop the “best by” labelling or replace it with “best if used by.” Also, “sell by” labelling can be used for highly perishable foods as an indication of expiration. Some retailers such as the East of England Co-op are also considering selling food beyond their “best by” dates. And retailers can experiment with better packaging technology to extend product shelf life of their own products.

Data analytics have also debunked the notion that consumers require well-stocked displays to make a purchase. After taking an in-depth look at its perishables departments, U.S. grocery retailer Stop & Shop discovered that piling produce high resulted in more damage as well as greater labor costs. Finding new ways to display produce while reducing stock levels ended up boosting customer satisfaction because produce stayed fresher for longer. It also helped Stop & Shop reach an estimated savings of $100 million per year. Trader Joe's uses a similar strategy by displaying their produce in narrow rows to indicate abundance.

#4. Team up with consumers. Food waste by consumers has escalated with rising disposable incomes. Young people struggle with what to do with leftovers, and only 3% of people attach a social stigma to throwing away food. Changing habits is a long-term endeavour, but food retailers can play a crucial role in educating consumers to cut household food waste.

Sainsbury's research shows that consumers view supermarkets as a source of inspiration and guidance for reducing food waste. Free food magazines that supermarkets such as the Co-operative in UK use to share food stories can also feature waste reduction tips and recipes to utilize leftovers. Supermarkets can sponsor and team up with chefs to demonstrate how to utilize leftover ingredients and food. Dinner events that feature food made from discarded food and scraps get significant social media attention and are a great way of educating and engaging customers, especially the young.

Food retailers can also organize "waste less" campaigns. For example, in the U.S., Kroger's recent initiative "Zero Hunger, Zero Waste" uses crowdsourcing to interact with consumers and gather ideas for food waste and hunger prevention.

Food retailers have a lot to gain from designing a circular strategy to reduce food waste across the supply chain, but they aren't expected to do this alone. Collaboration with farmers, food processors, nonprofit organizations, and agri-tech and social ventures in the broader food ecosystem will help food retailers achieve their food waste goals. And as food retailers take up a deeper interest in their communities' well-being, they can share the goal of reducing food waste and create a robust relationship with their suppliers and customers.

3.2.13.2.2 Wholesale and retail trade and repair of motor vehicles and motorcycles

Input in GDP (Mln GEL)	Input in GDP %
838.4	1.9

► **Georgia Motor Vehicle Sales: Passenger Cars**[75]

Key information about Georgia Motor Vehicle Sales: Passenger Cars

- Georgia Motor Vehicle Sales: Passenger Cars was reported at 2,804.000 Unit in Dec 2019.
- This records an increase from the previous number of 2,800.000 Unit for Dec 2018.
- Georgia Motor Vehicle Sales: Passenger Cars data is updated semiannually, averaging 2,802.000 Unit from Dec 2005 to Dec 2019, with 20 observations.
- The data reached an all-time high of 8,000.000 Unit in Dec 2008 and a record low of 1,000.000 Unit in Dec 2009.

[75] 2005 - 2019 | Semi-annually | Unit | International Organization of Motor Vehicle Manufacturers/ https://www.ceicdata.com/en/indicator/georgia/motor-vehicle-sales-passenger-cars

- Georgia Motor Vehicle Sales: Passenger Cars data remains active status in CEIC and is reported by International Organization of Motor Vehicle Manufacturers.
- The data is categorized under World Trend Plus's Association: Automobile Sector – Table RA.OICA.MVS: Motor Vehicle Sales: by Country and Type: Passenger Car (PC).

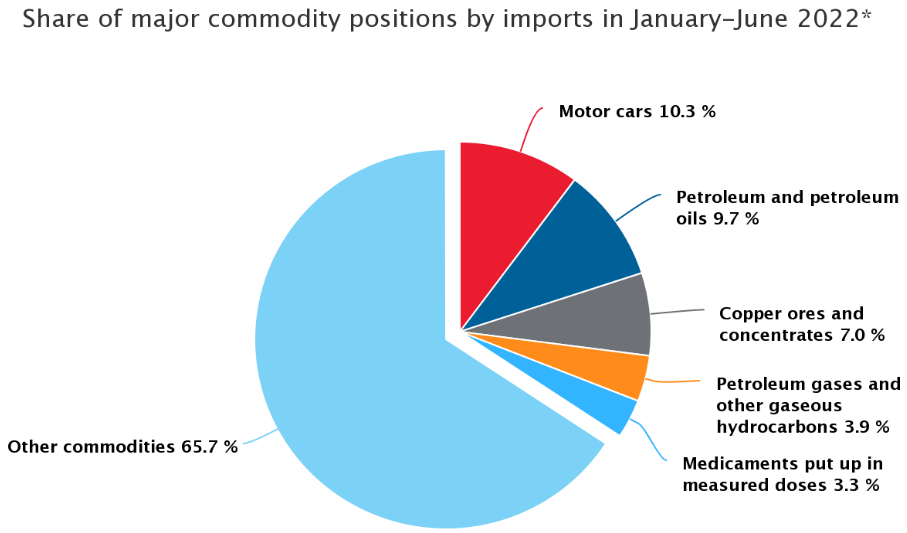


Figure 3.2-52 Share of major commodity positions by imports in January-June 2022

Import indicators:

- 2711 Petroleum and petroleum oils — 332,224.0 thousands USD (2021)
- 8703 Motor cars — 347,314.8 thousands USD (2021)
- 8708 Parts and accessories of the motor vehicles — 15,039.6 thousands USD (2021)

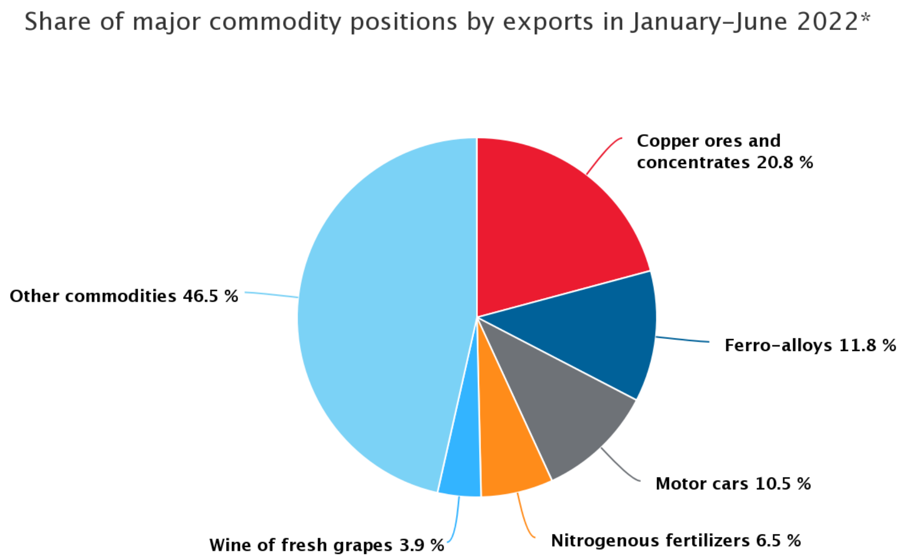


Figure 3.2-53 Share of major commodity positions by exports in January-June 2022

Export indicators[76]:

- 2711 Petroleum and petroleum oils — 0.5 thousands USD (2020) and no export in 2021
- 8703 Motor cars - thousands USD — 456,562.5 thousands USD (2021)
- 8708 Parts and accessories of the motor vehicles — 11,674.4 thousands USD (2021)

Provided above figures give some idea about the scale of imports, export and domestic trading of motor cars and associated accessories. No data on mass flow is available, but only monetary expression of material flows.

► Waste Flows Associated With the Motor Vehicle Sales[77]

The waste flows associated with the motor vehicles, are mostly generated at the level of consumers/users and repair facilities, rather than at the level of wholesale or retail trading facilities. The most important waste types generated by the motor car users is as follows:

- Tiers
- Used oils
- Used accumulators
- Metal scrap
- Electronic waste

There is no available data about the mentioned types of waste flows specifically in relation with the motor vehicle trading or repair. However, we can refer to the data regarding the entire volumes of wastes generated in country.

Tiers

According to data available for 2017, the waste tires generated during the whole year was equal to 31,272 tonnes. At present there are four active companies engaged in recycling the used tires. Total capacity of these enterprises is 7,000 tonnes of tires annually. However, the exact volumes of the recycled tires are not known.

Accumulators

According to data available for 2017, the new accumulators imported during the whole year was equal to 5,500 tonnes and their life cycle is 2 years. At present there are four active companies engaged in recycling the used accumulators. Total capacity of these enterprises is 18,800 tonnes of accumulators annually. However, the exact volumes of the recycled accumulators are not known.

[76] Geostat

[77] The Report on the Institutional Structure for Implementing the Extended Producers Responsibility in Georgia

Used Oils

According to data available for 2017, the new vehicle oil imported during the whole year was equal to 12,700 tonnes and approximately half of this amount (6,350 tonnes) turns into waste oil, while the rest is losses. At present there are three active companies engaged in recycling the used oil. Total capacity of these enterprises is 2,050 tonnes of used oil annually. However, the exact volumes of the recycled oil are not known.

It should be stressed that all of the mentioned waste flows, associated with the motor vehicle trading and repair, are regulated by the technical regulations developed under the Extended Producers Responsibility requirements set forth in the Waste Management Code of Georgia. Having in mind this basic fact, we can assume that the major further input in proper management of the mentioned waste flows is support to the Government and all stakeholders to efficiently implement the EPR regulations.

3.2.13.3 Circularity Profile: Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles

Sector nomination and NACE Index (NI): Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles (NI/ 35-47) **Input in GDP (Mln GEL):** 6161 / 14.3%
Energy Resources:
Data for the entire Commercial and public services, including sewage and waste collection, treatment and disposal activities; wholesale and retail trade and accommodation and food service **Energy Consumption:** 2,915.0 GWh **Natural Gas consumption:** Commercial and public services 176.8 mln.m3/year
Mass Flow Indicators:
<u>Food</u> – Food: total mass entering retail market is 250,044 tonnes/year – Consumption of food from retail: 187,533 tonnes/year – Food waste lost at retail level 62,511 tonnes/year – Recycled waste - 0 tonnes/year <u>Wholesale and retail trade and repair of motor vehicles and motorcycles</u> **Oil:** – Oil Import - 12,700 tonnes /year – Lost - 6,350 tonnes/year – Used oil as waste - 6,350 tonnes /year – Recycled and reused - 2,050 tonnes (max. 32%) **Accumulators:** – Import - 5,500 tonnes /year – Used accumulators as waste - 6,350 tonnes /year – Recycled and reused (locally or exported for recycling) - 6,350 tonnes /year (100%) **Tiers:** – Used tiers as waste - 31,272 tonnes /year

– Recycled and reused (locally or exported for recycling) - 7,000 tonnes /year (max. 22%)

Wastes and Losses:

Food waste generated in trade sector: Retail: 62,511 tonnes/year

Wastes produced in Motor vehicle trade and repair sector (consumer level):

Type of waste	Volumes of waste (tonnes)	Maximum Capacity to Recycle waste (tonnes)
Tiers	31,272	7,000
Used oils	6,350	2,050
Used accumulators	5,500	18,800

Gaps in Circularity:

A. Food Waste

1. The date range on food products is a significant reason that it is wasted in households. Consumers often misinterpret "best by" dates to be expiration dates and prematurely discard food as a result. These labels are not even standardized or regulated — manufacturers set these dates themselves, often as a way to ensure consumption at the peak of freshness.

2. Tonnes of food that goes to waste each year is still edible

3. Food waste is not recycled and reused.

B. Wholesale and retail trade and repair of motor vehicles and motorcycles

1. EPR regulations are developed but implementation is not yet efficient.

2. Recycling and reuse of materials is poor (tiers; used oil; used accumulators)

3. Vehicle repair activities and supply of spare parts is developed, but could be improved. Networking with the producers, training and capacity building programs seems to be useful;

4. Vehicle leasing practices, as well as municipal transport operations needs to be improved to reduce the private vehicle operations;

5. Stricter technical surveillance mechanisms and improvement of the emission and pollution prevention parameters of the vehicles is required.

C. Packaging

1. Technical regulations related to packaging materials, under the EPR regulations, are not approved and implemented

2. Recycling and reuse of the packaging waste is poor.

3. Production of the bio-degradable packaging materials is not yet implemented. Non-degradable packaging materials prevail on the market.

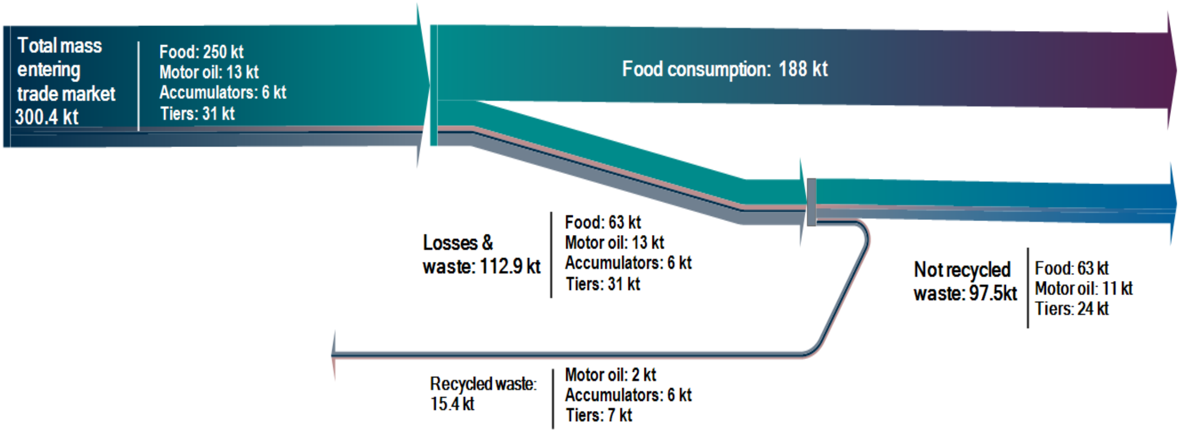


Figure 3.2-54 Mass flow diagram for Wholesale & retail trade and Repair of motor vehicles & motorcycles sectors

Potential for increasing level of circularity:

ReSOLVE FRAMEWORK

Regenerate	1. Food waste is highly biodegradable and has a much higher volatile solids destruction rate (86-90%) than biosolids. Food waste can be converted into energy in an anaerobic digester by using naturally occurring bacteria to break down organic waste into biogas and an organic fertiliser by product. 2. Collect and recycle food waste at retail facilities level. Use the food waste for production of animal fodder, compost or specific bioorganic compounds 3. Encourage implementation of the technologies aimed on recycling motor vehicle related wasters (tiers; used oil; used accumulators) and recovery of materials. 4. Approve and implement technical regulations related to packaging materials, under the EPR regulations. 5. Support the activities aimed on recycling and reuse of the packaging waste 6. Encourage production of the bio-degradable packaging materials. Introduce regulations for replacing non-degradable packaging materials by degradable.
Share	1. Support the vehicle repair activities and supply of spare parts. Facilitate networking with the producers, training and capacity building programs; 2. Support programs and activities aiming sharing of vehicles: a) develop vehicle leasing practices; b) improve municipal transport operations;
Optimise	1. Revise the use-by-dates concept introducing the latest possible sale date and intermediary dates. Monitor use-by-dates and revise prices accordingly. The closer the products are to the latest possible selling date, the lower the price is to enable dynamic pricing in food retail. Upgrade inventory and monitoring systems with the latest technology. 2. Redistribute Surplus Food. Companies, charities and individuals can all benefit from the redistribution of surplus food to those who need it. Food companies can often save money by donating food rather than paying the per tonne landfill tax and disposal cost

	3. Introduce law, which banns supermarkets from throwing away or destroying unsold food and must donate it to food banks or for animal feed. a Food Waste Prevention Roadmap that provides the pathway to help achieve Ireland's goal of reducing food waste by 50% 4. Engage social enterprises connects food retailers with charities so they can efficiently donate good food that would otherwise be thrown away. 5. Implement the EPR regulations to efficiently manage the wastes (tiers; used oil; used accumulators) 6. Update regulations and enforcement mechanisms according to the European standards to improve the emission and pollution prevention parameters of the vehicles
Loop	
Virtualise	
Exchange	

Key actors in implementing CE and direct beneficiaries:

- ► Private companies:

  Large, small and medium sized companies involved in the wholesale and retail trade. The companies may have their significant input in CE by:

  – improving management and minimizing losses and waste production

  – Implementing waste recycling and material recovery technologies

  – Participating in activities of PROs, aimed on implementation of the EPR regulations

- ► Central Government:

– Improving Policy and creation of incentives for the private sector to introduce CE elements in their businesses

– Legal requirements set forth to regulate redistribution of edible food products

– Legal requirements set forth to regulate collection and recycling of the food waste

– Approve technical regulations related to packaging materials, under the EPR regulations,

– Implement the technical regulations developed under the EPR

3.2.14 Waste Management

Sector nomination and NACE Index (NI): Sewerage; Waste collection, treatment and disposal activities; Waste utilization, remediation activities and other waste management services **(NI/ 37-39)**

Input in GDP (Mln GEL): 107 / 0.2%

3.2.14.1 Overview of Existing Situation in Waste Management Sector of Georgia[78]

3.2.14.1.1 Policy and Legislation

Strategy

The National Waste Management Strategy (NWMS) of Georgia, which has been prepared in accordance with the Waste Management Code and the EU-Georgia Association Agreement, was adopted in April 2016 by Ordinance #160 of the Government of Georgia. The NWMS aims at the development of the Georgian waste management to be in harmony with the European waste management policy. In addition to the Strategy, a National Waste Management Action Plan (NWMAP) is developed. The Strategy and the Action Plan are two integral parts of the waste

[78] This section is mainly based on National Waste Management Strategy (NWMS) of Georgia (2016)

management policy documents in Georgia. All actions in the Action Plan relate to the objectives and targets defined in the Strategy.

The NWMS is in line with the National Environmental Action Programme of Georgia 2012-2016 (NEAP), and has taken the recommendations of the Environmental Performance Reviews, Georgia, UNECE, 2015 into consideration.

The NWMS covers a period of 15 years (2016-2030) - and is a living document that might be revised – while the Action Plan covers a period of 5 years (2016-2020). A joint format forms the basis for the two integrated documents.

Legislation

The Waste Management Code was adopted 26 December 2014 and came into force in January 2015. Before that waste related issues were regulated by a number of separate legal acts and to some extend by international conventions. Although the newly adopted Code is based on the principles and approaches envisaged by the EU-Georgia Association Agreement (AA) and best international practices, it is necessary to develop and adopt a number of secondary legislation for the full implementation of the Code. In particular, the mining waste issues and waste export/import matters are not covered in compliance with AA. Not all administrative procedures for controlling medical institutions are defined by current legislation. Secondary regulations include also regulations related to the principle of the Extended Producers Responsibility (EPR), which was introduced by the Code. Adoption of the EPR principle is a significant achievement for Georgia. The principle implies that producers take over the responsibility for preventing, collecting, separating and treating used products (waste) for their eventual recovery.

The Code does not regulate waste generated from extractive industries (mining waste). Mining waste is supposed to be regulated by the Law on Mineral Resources. However, the law is not complete and does not correspond to the AA requirements. Mining waste poses a high risk to the environment and human health, and therefore is to be regulated based on the relevant EU Directive.

Georgia is a party to two main conventions in the field of waste, which set special requirements for its member states and their implementation requires special efforts from the country. These conventions are the:

- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal
- Stockholm Convention on Persistent Organic Pollutants

3.2.14.1.2 Waste Planning and Management in Georgia

Waste Data

A systematic data collection system on waste generated, collected, transported and treated and a subsequent national database are not in place. There exists no systematic data reporting mechanism for the generation and treatment of specific waste types and consequently, there is no regular information available for the amounts and composition of such waste. The same situation is with regard to waste generated from demolishing of buildings, which makes up a large portion of the total waste generated in Georgia. Neither the generation nor the treatment of industrial waste are reported to the competent authorities on a regular basis, and therefore accurate information on hazardous waste does not exist.

Until 2015 there was no legal requirement for data reporting by municipal authorities or waste management companies. The requirement has been established by the new Code and has entered into force from 2016.

Planning

The waste planning system in Georgia is under the development. There has been no legal requirement until the adoption of the new Code. None of the municipalities had municipal waste management plans. Companies were not obliged to have a waste management plan, and only some of those subject to the environmental permit were required to do so. Still, only few of the companies have a waste management plan.

The newly adopted Code requires the establishment of a comprehensive waste management planning system in the country. It defines the obligation of the MoEPA to develop a 15-year national waste management strategy, and a 5-year national waste management action plan. In relation with municipal level, it prescribes the obligation of municipalities to prepare municipal waste management plans. At present, some ongoing activities through donor support are observed to support municipalities in that regard. The Code also requests that the major companies (that produce waste above certain legally defined thresholds) shall develop a company waste management plan and also designate an environmental manager.

Waste Collection and Transport

Municipal waste management including household waste collection and transportation is the responsibility of the municipalities according to the Code. Currently waste collection services are offered mainly in the cities and mainly by public operators (LTDs or non-commercial legal entities with 100% state/municipal share). Some practice of private involvement in the waste management sector exists in Georgia, but no clear policy on public-private partnership exists on that. An operator that undertakes waste collection, transportation and/or treatment activities should possess the necessary permit or registration (this obligation entered into force from 1 September 2016).

Collection and transport of waste in the cities is made with relatively new waste trucks and waste containers, while in the small towns and rural settlements waste transportation, if any, is managed with extremely outdated vehicles which are in poor condition.

At present, there is yet poor source separation practice of municipal waste and their respective collection and transportation. However, with the support of international financial institutions (IFIs) first steps are made for gradual implementation of source separation practices. Obligation for this has entered into force from 2019.

The responsibility for sound management of healthcare waste within its premises lays with the medical institutions, and it is regulated and controlled by the Ministry of Labour, Health and Social Affairs together with the MoEPA.

Landfills

According to the Code, operation of the non-hazardous waste landfills is the responsibility of the LTD Solid Waste Management Company of Georgia (SWMCG) under the Ministry of Regional Development and Infrastructure of Georgia (except for the landfills of Tbilisi and Adjara AR).

In general, nearly every rural settlement has one or even more dumpsites. Totally about 60 official landfills (without a permit) and many more illegal dumpsites (small not official landfills) are recorded in Georgia. Several impose serious impacts to the environment and the surrounding communities.

As of 2015, there were only four landfills (one private and three public) in Georgia meeting international standards.

SWMCG takes steps to improve the state of the old landfills and construct new modern landfills. As of today the Company has rehabilitated 28 and closed down 13 landfills. Actions are taken to construct new sanitary landfills in Kvemo Kartli and Imereti regions.

The similar activities take place in Adjara Region, where works are ongoing aiming at closing the old and constructing a new landfill (the construction permit has already been issued). The Ministry of Finances and Economy of the Adjara AR is in charge of above mentioned activities. The construction of the modern sanitary landfill near the village Tsetskhlauri (Kobuleti municipality) is completed and soon after installing the separation facilities the landfill will become operational.

There are no landfills for hazardous or inert waste, including construction waste, and only few landfills have separate cells for specific waste, like asbestos waste.

Prevention, Reuse, Recycling and Recovery

Existing practice of waste preventing, reuse, recycling and recovery is very limited in Georgia. Data on these activities are also very limited. The reporting obligation for companies and treatment facilities has entered into force only from 1 August 2016.

Due to lack of fiscal incentives, reuse is limited in Georgia and applies only to e.g. glass bottles. A limited number of installations for recycling of waste materials such are paper, glass, plastic and others exist in Georgia; however, data on amounts of recycled materials is not available nor in this case. Recycling is only carried out by private companies for those waste materials for which the cost (per tonne) for collection and treatment is lower than the price of virgin materials.

Incineration of waste for recovery of energy does not exist in Georgia.

Hazardous Wastes

Hazardous waste (HZW) is a national issue. Actually, the country lacks hazardous waste treatment facilities. Only several incinerators are available to treat hazardous medical and veterinary wastes, as well as few types of special wastes. There are only facilities for temporary disposal of hazardous wastes and no other facilities, except the mentioned incinerators, for permanent disposal or treatment of such waste.

HZW can be a threat to the environment. A total new design of a national system should be considered. The international trend is that HZW systems should be centralised, national systems since special expertise is needed to ensure appropriate management of the many different kinds of HZW. The Waste Code entails the development of special action plans for selected waste streams, such as POPs, animal waste, healthcare waste, asbestos, etc.

3.2.14.2 Waste Streams and Key Actors

In order to analyse the degree of circularity and the potential for the development of circularity in terms of waste management, it would be useful to have an idea of the waste streams characteristic of the country, the relationship of these flows with different sectors of the economy, with the types of organizations that mainly generate this waste and organizations that can become the main actors in the transition to the principles of circularity (i.e. organizations that can contribute to the recycling, recovering and reuse of waste materials). For these purposes, waste streams should be classified not so much according to traditional categories (by degree of hazard, etc.), but according to a sectoral principle - i.e. by the types of activities that generate these flows. Such a classification includes wastes of different and complex composition into one group, but combines them into one group depending on the type of activity and on the type of organizations engaged in this activity.

3.2.14.2.1 Household Waste

Waste Amounts

It is estimated that total 900,000 tons of municipal waste is generated today in Georgia. All types of waste are disposed on the landfills or in dumpsites. No activities towards minimization of disposing the municipal biodegradable waste on landfills are observed).

Waste Producers

Current Waste Management Practice and Prospective for Reuse, Recycling, Recovery

Table 3.2-79 Amount of municipal waste disposed in landfills

	Units	2015	2016	2017	2018	2019	2020
Generated municipal waste	1000 tons	774.7	870.3	922.1	977.4	994.6	973.3
Population of the country	million people	3.73	3.73	3.73	3.72	3.72	3.73
Municipal waste generation per capita	kg	207.8	233.5	247.2	262.5	267.6	261.1
Data based on: LTD Tbilservice Group, LTD Solid Waste Management Company of Georgia, LLC Sandasuftaveba, NNLE Kobuletis Sandasuftaveba, LTD Keda Komunalurservice							

Source: Geostat

3.2.14.2.2 Manufacture

So far as for this report we are focused on manufacture subsectors having the major input in GDP and CE, we refer to waste production related to these sub-sectors of the entire Manufacture sector:

Manufacture of food products and beverages; Manufacture of the non-metal mineral products and manufacture of basic metals.

Table 3.2-80 Waste amounts generated by the manufacture sector

Manufacture	Byproducts and Tailings, (ths. tons)	Waste, (ths. tons)	Total of waste and by-product, (ths. tons)
Subtotal for food products and beverages	207.7	690.6	898.3
Subtotal Manufacture of the Non-metal Mineral Products		392.0	392.0
Subtotal for Manufacture of the Basic Metals	260.3		260.3
TOTAL MANUFACTURE	468. 0	1,082.60	1,550.60

Waste Producers

Basic-metals and non-metal mineral products are manufactured by just few large scale companies. Food and beverages are manufactured by large number of different scale enterprises: large, small and medium-sized companies. The companies importing row materials and the manufacture companies are responsible for the waste generated in this sector.

Food processing industry

The food industry plays an important role in the development of the Georgian economy. Statistic data related to food processing are poor and provide controversial figures, but main trends are visible. Prior to the transition to a market economy, the industry was dominated by large companies. According to National Statistics Office of Georgia, SMEs play the most important role in food industry. In 2017, 96% of enterprises were small-size companies, 2.8% of enterprises – medium size companies, and 1.2% of enterprises were large-size companies. The most SMEs have been concentrated in Tbilisi.

Table 3.2-81 Number of food processing enterprises of Georgia by main economic activities and size in 2017[79]

Economic Activity	Number of Enterprises			
	Total	Large	Medium	Small
Manufacture of meat products	171	5	10	156
Manufacture of fruit or vegetable juices	21	0	1	20
Processing and preserving of vegetables	234	1	10	223
Milk processing and manufacture of dairy products	131	2	5	124
Manufacture of bread; manufacture of fresh pastry goods and cakes	1782	3	19	1760
Manufacture of preserved pastry goods and cakes	230	1	3	126
Wine production	314	4	20	290

[79] Development Trends of Small and Medium Enterprises (SMEs) in the Food Industry of Georgia /Maia Sanikidze, Doctorate Student at Caucasus International University/ based on Geostat data

Economic Activity	Number of Enterprises			
	Total	Large	Medium	Small
Beer production	28	5	2	21
Manufacture of mineral waters and other non-alcoholic beverages	138	4	7	117
Manufacture of distilled alcoholic beverages	52	1	2	49
Processing of tea and coffee	98	0	2	96
Manufacture of cocoa, chocolate and sugar confectionery	24	1	0	23
Manufacture of ice cream	24	1	2	21
Manufacture of grain mill products	108	2	10	96

According to the information of the National Wine Agency of Georgia, there are 30 large enterprises, 6 medium and small and 25,500 individual households harvesting grapes in their vineyards and producing wine. Georgian Wine Association (GWA) counts 30 member wineries. However, number of wine producing companies is much higher. Almost 250 Georgian wine producers are listed in the directory Wines of Georgia. 314 wine producers are recorded in the above cited report of Caucasus International University.

Current Waste Management Practice and Prospective for Reuse, Recycling, Recovery

Current recycling and material recovery practice in manufacture sector is poor:

1. Tailings (about 260,300 t annually) are generated by basic metal manufacture sector and stored. The tailings could be used for recovering additional portions of valuable materials, using modern technologies;
2. By-products generated in food processing industry (207,700 t annually), as well as food waste and other organic wastes are not recycled and reused
3. Recycling and reuse of the packaging waste is poor. Technical regulation under the Extended Producer's Responsibility (EPR) is not yet approved.

3.2.14.2.3 Wholesale and Retail Trade

Waste Amounts:

Food waste generated in trade sector: Retail: 62,511 tonnes/year

Wastes produced in Motor vehicle trade and repair sector (consumer level):

Type of waste	Volumes of waste, (tonnes)	Maximum Capacity to Recycle waste (tonnes)
Tiers	31,272	7,000
Used oils	6,350	2,050
Used accumulators	5,500	18,800

Waste Producers

Food in the trade sector (62,511 tonnes/year) is generated by the wholesale and retail trading enterprises (small, medium-size and large organizations; small shops; large supermarkets; networks of supermarkets; wholesale storages etc.). 403,573 tonnes/year of food waste is generated at the household level and is accounted as household food waste, which equals to about half of the entire household waste

Current Waste Management Practice and Prospective for Reuse, Recycling, Recovery

Food waste generated in trade wholesale and retail trade sector is not recycled.

Wastes produced in Motor vehicle trade and repair sector (consumer level):

- Recycled used oil - 2,050 tonnes (max. 32%)
- Recycled and reused accumulators (locally or exported for recycling) - 6,350 tonnes /year (100%)
- Recycled and reused tiers (locally or exported for recycling) - 7,000 tonnes /year (max. 22%)

3.2.14.2.4 Waste Streams Generated in Accommodation and Food Services Sectors

Waste Amounts

<u>Waste generated in the food processing Value Chain:</u>

According to the Food Waste Index Report 2021 (UNEP), the distribution of food waste among households, food services and retail has following features in case of Georgia:

- Household food waste: 403 573 tonnes/year
- Food Services: 110,504 tonnes/year
- Retail: 62,511 tonnes/year

Thus Food Service sector is responsible for generation of 110,504 tonnes of food waste per year, which constitutes 19.2% of the entire annual values of the food waste (576,588 tonnes/year).

<u>Accommodation and Food Services Sectors</u>

The number of accommodation units registered in the database of the Georgian National Tourism Administration (GNTA) is 2,575. Out of this there are 20 large hotels of several international hotel brands. The rest accommodation facilities are small and medium size enterprises.

Current Waste Management Practice and Prospective for Reuse, Recycling, Recovery

In general, food waste (food and associated inedible parts removed from the human food supply chain) is the main type of waste generated in sectors of economy, such as accommodation and food services. Another important type of waste generated in this sector is packaging (plastic and glass bottles and other packaging wastes). At present most part of food waste is disposed at the landfills.

Separation of organic wastes and recycling is very poor. There is no practice of donating edible food remains. Part of the returned expired products are used by the farms for feeding animals. Only PET and glass bottles are to some extent separated and recycled. However, the share of recycled waste is small: total 180 900 tons of plastic products were manufactured and imported in Georgia in 2020. The analysis shows that 93% of these (i.e. 168 300 ton) becomes waste, and the recycling volume does not exceed 7% for plastic. In Georgia, 26 companies work on plastic recycling, and 15 of them produces intermediate products (shredded plastics, granulated plastics).

The sector has great potential for implementing waste separation, reuse and recycling:

- It is much easier to implement separation technologies at the source in hotels and food service organizations, as compared with the municipal and household level
- The charity type non-profit organizations can organize collection of edible but expired products, which are still usable, to donate it for poor and disabled people
- There is a great potential for collecting separated organic waste for composting, production of animal fodder or more sophisticated organic products demanded on the market
- Collection and recycling could be organized by large or medium sized companies engaged in the sector or by associations created by them

The government can create incentives for separation and recycling/reuse of food waste and other wastes generated in sector by:

- Approving technical regulations related to packaging waste under the Producer's Expanded Responsibility requirements, set forth in the Waste Management Code
- Develop and implement regulations enforcing and motivating food processing plants, hotels and food service organizations to separate organic wastes at source and make it available for the companies engaged in recycling organic wastes
- Create financial and other mechanisms for motivating companies or association of companies to develop food waste recycling plants
- Develop clear regulations enabling the companies donation of the food wastes for charity purpose

Through Implementation of the mentioned measures it is possible to achieve during the 5-years period:

- Increase recycling of the plastic and glass waste by 20% (30% of waste to be recycled)
- Increase recycling of food waste by 10% (15% of food waste generated during food processing, or in food services and accommodation facilities will be recycled)

3.2.14.2.5 Waste Streams Generated in Agricultural Sector

Waste Amounts

In case of annual crops, the most part of losses and produced wastes are related to the losses during harvest period and storage. **In total about 47,700 tons of wastes is generated associated with the annual crop production.** The major input has wheat (13,000 tons, maize 11,000 tons, vegetables 8000 tons and melons 8000 tons[80].

In case of permanent crops, the losses and wastes are generated at the harvesting stage (10 – 12%) and during the processing of the product (about 7%). Walnut and hazelnut wastes constitute 3,150 tons. Total wastes generated during citrus and other fruit production (except grapes) is about 38,000 tons. Out of this 23,500 tons of waste are generated during harvesting and storage. The losses during harvesting grapes equal approximately 10,000 tons. **Thus, the total amount of waste generated during the nuts and fruit harvesting is approximately 36,650 tons.**

Total annual wastes and losses associated with the fishery sector approximate to 11,025 tons:

- Marine fish: 10,900 tons
- Aquaculture:125 tons

About 14,500 tons of fruit wastes are generated during processing of fruits and about 40,500 tons during wine production. These streams of waste are already accounted as food waste in chapter **2.5.12.2.4 Waste Streams Generated in Food Processing, Accommodation and Food Services Sectors.** In this chapter it is also accounted wastes and losses associated with the livestock products generated in slaughterhouses and poultry farms.

Waste Producers

Size of enterprises in Georgia is determined by the following criteria:

- Large size enterprise is an enterprise, where average annual number of employed exceeds 249 persons and/or volume of average annual turnover - 60 million GEL.
- Medium size enterprises are enterprises, where average annual number of employed ranges from 50 to 250 persons and average annual turnover – from 12 million to 60 million GEL.
- Small size enterprises are enterprises, where average annual number of employed does not exceed 50 persons and average annual turnover - 12 million GEL.

To give a snap-shot of waste producers, we will base our estimations on several assumptions:

a) In order to estimate waste generation, we need to focus on active enterprises but not on number of registered enterprises
b) Arbitrarily, we will consider that the volume of generated waste (%) is proportional to the enterprise's turnover

80 Agriculture Scientific-Research Centre, under the MoEPA of Georgia

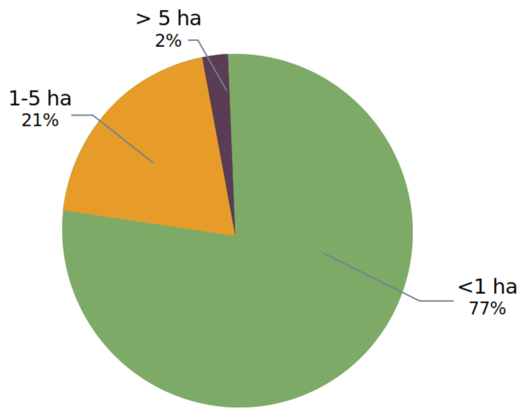
Taking into account that in this chapter we are focused on harvesting but not further food processing in plants, we can say that main waste producers in Agricultural sector are:

Table 3.2-82 Categorization of waste producers in agricultural sector

Type of Holding	Number	Turnover per company and land holding, GEL	Share in land holding and Waste Generation
Individual farms or households	639 963*		for 77% <1ha and for 22% <5ha
Small size enterprises	2,695	less than 12 million	>5 ha
medium size enterprises	40	12 - 60 million	>5 ha
Large enterprises	5	60 million and more	>5 ha

*Source: Geostat 2022 / * data on households is of 2014 year Geostat publications*

Over 40 percent of Georgia's population lives in rural areas. According to the most recent agricultural census conducted in 2014, the share of commercial farms in agricultural production remained low. The overwhelming majority of households (93.6 percent) own less than two hectares of agriculture land. Only 4.8 percent of households own two to five hectares of land, and 1.5 percent own more than five hectares. With such ownership structure, commercial farming remains underdeveloped.



Source: National Statistics Office of Georgia

Figure 3.2-55 Distribution of holdings by the size of owned agricultural land, 2014

Current Waste Management Practice and Prospective for Reuse, Recycling, Recovery

Agricultural waste generated by individual households is collected by the municipal services. Separation at source is poor. Part of organic waste is used for feeding animals and very small part is used for composting. 90% part of agricultural waste generated by households goes mixed with other types of waste to the official and illegal landfills. Potential for separation of waste at source is poor and according to experience of professionals, will take 10-20 years before the waist separation practices will be established in rural areas of Georgia.

Agricultural waste generated by large, small and medium size enterprises is also collected by the municipal services. However, in case of creating proper incentives, it is possible to stimulate the large and medium enterprises, as well as part of small enterprises, to collect and separate the organic wastes and use it for composting or for production of animal fodder and more sophisticated bioorganic products demanded on market, instead of disposing the waste on landfills.

The Government can support businesses creating incentives for waste separation and recycling, while the key actors for recycling and reusing agricultural wastes are first of all large and medium size businesses and to certain extent also small size enterprises. The companies who will implement the waste recycling technologies can also collect the organic wastes produced by other agricultural companies.

Target for 5-year program: During the 5 years it is possible to achieve recycling of the 10% of the annually produced agricultural wastes.

3.2.14.2.6 Waste Streams Generated in Mining

Annual Waste Amounts

The main types of mining waste in addition to topsoil and subsoil spoil can be classed into two categories:

- waste rock (mine rock piles);
- tailings (processing waste);

Waste rock is hence durably unused extraction products that is generally stored indefinitely in a dumpsite site. At a mine, an ore mill normally abuts on the extraction centre to produce the first marketable products (metallic concentrates, sorted ore, and ingots). The technological processes are very different according to the type of substance mined, and the modernity of the technologies employed (flotation, leaching, and biotechnology). These units produce various types of waste, which can include slurries of finely ground particles that have undergone one or more types of physical or chemical treatment. These tailings are normally dumped in a sort of lagoon or settling basin within an embankment at the exit of the mill. Amounts of mining wastes generated in Georgia are given below (for more details see chapter 3.2.7).

Table 3.2-83 Amount of mining wastes generated in Georgia

Waste description	Total Wastes, tons
Coal ore tailings	49,076
Manganese	1,349,000
Precious Metals (Gold and Silver) ore tailings	4,362,570
Copper ore tailings	3,818,601
Dimension Stones (Construction Stones)	Total waste: 430,042 Recycled waste: 71,672 Not recycled: 358,368

Waste Producers/Sources

At present the most important mining sites in Georgia include: Madneuli gold-polymetallic, Chiatura manganese, Tkibuli coal deposits. Just few large scale companies are involved in mining of coal, manganese, precious metal ores and copper. “Georgian Manganese” is licenced to operate Chiatura manganese mine. Tkibuli coal located in Tkibuli is licenced to the Georgia Industry Group (GIG) and produces thermal (lignite) coal. JSC RMG Copper and LTD RMG Gold (known as Rich Metals Group-RMG) have operated in partnership with the Georgian Mining Company and other companies in east Georgia, specifically in Bolnisi and Dmanisi to produce gold (Dore alloys (half fabricates) by mining and processing copper and gold containing ores.

Table 3.2-84 Annual production of the mines and quarries

	Average Production Volume, tons	Number of Licensees
Coal (coal and lignite)	174,000	1
Production of Ores:		
Manganese ore	1,749,000	1
Precious metals (gold and silver) ores	4,376,000	1
Copper ores	4,271,000	1
Total	**10,570,000**	

In relation with operation of the quarries and mining of construction materials: few large scale companies and many small and medium sized companies are involved in this type of activities.

As for large scale companies, Heidelberg Caucuses Cement has two operations in eastern Georgia that include mining of raw materials for clinker and cement production and factories. Geostone is another international company of Georgian origin and a reference in the Natural Stone sector. The company was founded in 2016 and has undergone progressive growth and strong international expansion, contributing innovation and technology to the industry. Production of high-quality Georgian Marble is the main activity of the company. Apart from these large companies, there are a lot of small and medium sized companies, having licenses for extraction of the construction materials.

- Dimension Stones: Number of Licensees 264
- Construction Materials (Volcanics): Number of Licensees 442
- Construction Materials (Sandstone, sand and gravel): Number of Licensees 1029

Current Waste Management Practice and Prospective for Reuse, Recycling, Recovery

The manganese ore, precious metals and copper mining units produce waste tailings, which can include slurries of finely ground particles that have undergone one or more types of physical or chemical treatment. These tailings are dumped in a sort of lagoon or settling basin within the territories of the mines at the exit of the mill. The tailings still contain a number of commercially valuable compounds but in small concentration. To recover these materials from tailings more sophisticated technologies and additional investments are required. At present the tailings are stored as a technogenic deposits and recovery of materials is postponed for future.

There is a great potential for recovering valuable materials from the metal ore tailings deposited near the mines. Significant investments and introduction of modern technologies is required for that purpose. This direction seems prospective from the CE standpoint, as there are only few large companies operating in this sector and in case of support from the Government, it is easier to manage the process of shifting to circular models of economy. The Government may support improving legislation and regulations and creating financial mechanisms to raise motivation of the mining companies for recovering materials from the deposited tailings. Efforts focused on supporting just few enterprises may have a significant effect in terms of total mass of the reprocessed materials and financial gain. For the next 5/10 years the target could be recovery of materials reprocessing at least 5% of tailings stored near the mines.

Total waste produced annually during extraction of construction materials, equals 430,042 tons. Out of this only 71,672 tons (16.7%) is recycled and 358,368 tons are disposed. There is a great potential to use the wastes for production of composite materials, artificial stones and other products demanded on the market of construction materials. However, so far as the extraction of the construction materials is performed by many small and medium sized companies, it is more difficult to manage the process of recycling and reusing materials. For efficient support to the entrepreneurs it seems to be feasible that the Government creates a business incubator type system, which is aimed to provide technological advice, access to financial resources and certification and access to local and international markets. For the next 5/10 years the target could be use and recycling of about 25% of waste generated during the extraction of construction materials.

3.2.14.2.7 Construction Waste

Waste Amounts

Annual inert waste generation volumes for Georgia is roughly estimated as 303,520 tons. This covers wastes produced during construction and during processing of raw materials and production of construction semi-products, like bricks, slabs, clinker etc. Mostly the construction waste consists of remains of concrete, blocks and bricks, cement/clinker products (78%), some part of wooden materials (10%), packaging (8%) and much less metal scarp (4%), as the latest usually is separated and removed at earlier stages.

Waste Producers

As of 1 March 2018, 17 013 enterprises were registered in Georgia's construction sector, out of which 6 944 enterprises had an active status. There were 43 large enterprises (0.6% of total number of enterprises registered in construction sector) out of which 12 were subsidiaries of foreign companies. 281 (4%) companies were labelled as medium enterprises out of which 26 were subsidiaries of foreign companies. Although number of large enterprises was quite small, in 2017, their annual turnover was 31 % of total turnover of this sector. During 2011-2013, there has been a trend of decreasing share (24%) of large companies' in total annual turnover. However, during the following years the trend of increase has been observed and this proportion reached its highest point in 2016. As for 2017, this figure decreased once again to 31 %. The share of medium and small enterprises in total turnover was 69%.

It should be noted, that the main part (about 75%) of the large construction companies mostly are engaged in large scale infrastructure projects and only 25% in housing sector. On the contrary, the great part of small and medium sized companies participates in construction activities under the housing subsector.

Current Waste Management Practice and Prospective for Reuse, Recycling, Recovery

At present construction wastes are disposed mostly at the official and illegal landfills and dumpsites. Apart from that, a lot of small illegal dumpsites are created in the vicinity of most of villages and settlements creating significant environmental problem. The construction waste disposal and treatment is not well regulated by legislation and no special landfills or other facilities are available.

In 2022 a thematic study on Sustainable Management of the Inert Wastes has been conducted by the Georgian Parliament and firs concept notes have been produced. However, this is only beginning of the long process for creating efficient waste management system for inert wastes.

Taking into account that the deposits of sand, gravel and other basic construction materials is limited in Georgia and export and transportation costs are high, there is a space for developing new plants, which can use materials of the demolished buildings and other inert wastes for production of construction materials. Crushed remains of concrete, stones and rocks could be used in replacement of gravel, as well as for producing artificial composite materials.

The role of the Government is:

- to develop inert waste disposal facilities and a proper system for managing inert waste collection and disposal
- to elaborate some strict but sound regulations enforcing the constructing companies to dispose the inert wastes on specially dedicated facilities
- to elaborate regulations and financial mechanisms motivating the constructing companies and waste operators to develop inert waste recycling enterprises

The key actors in transition to CE models could be large constructing companies or their associations and waste operators (municipal or private landfills).

For the next 5/10 years the target could be use and recycling of about 10% of waste generated annually during the construction activities and disposed on landfills.

3.2.14.3 Waste Management in Circular Economy Context and Clustering of Waste Streams

Circular economy cannot be reduced to the waste management matters. It comprises broader context, including resource management, minimization of losses, sharing of goods and facilities, as well as other resources, optimization of value chains and so on. However, recovery materials from wastes, reuse and recycling of wastes remains yet the key aspect of circular economy. Thus, in parallel with the prevention of environmental pollution and minimization of GHG emissions, the efficient waste management system and practice envisages introduction of modern technologies and managerial tools to improve material recovery, reuse and recycling of the wastes.

Different streams of waste have different features, which may have different priorities for CE transformation and different actors, that may participate and have a role in this process. It seems to be useful to cauterize the waste streams into several groups similar by the selected features.

One of the criteria for Clustering is the size and type of the organizations that have key role in waste stream management and its restructuring according to CE models. The key actors are subdivided on following categories:

- Governmental agencies and organizations or companies with 100% shares of the Government
- Municipal organizations
- Private companies
- Households

The private companies, in their turns are subdivided on large scale, medium size and small companies and this is the next criteria. Size of enterprises in Georgia is determined by the following criteria:

- Large size enterprise is an enterprise, where average annual number of employed exceeds 249 persons and/or volume of average annual turnover - 60 million GEL.
- Medium size enterprises are enterprises, where average annual number of employed ranges from 50 to 250 persons and average annual turnover – from 12 million to 60 million GEL.
- Small size enterprises are enterprises, where average annual number of employed does not exceed 50 persons and average annual turnover - 12 million GEL.

The third criteria are the locus of waste generation and possibility for waste separation at the source.

Based on these three criteria, the waste streams reviewed above could be subdivided in following clusters:

► Cluster 1

- Household waste
- Agricultural waste streams generated in by individual households and farms and small size companies
- Wastes generated during the extraction of construction materials
- Construction waste generated by housing construction sector (including small, medium size and few large companies dealing with the housing construction projects)

The household and agricultural waste is generated by households and small size companies, is collected by municipal services and disposed at the municipal landfills. Construction waste is delivered by producers to the landfill.

Feasible CE activities: In a short term prospective, separation of wastes is feasible at the landfill level. Organic wastes could be used for production of compost. The amounts and mixed form of organic waste make it less feasible to produce animal fodder or more complex bioorganic products from the organic waste entering landfills.

Plastic, metal and glass could be recovered and used for recycling by specialized companies.

The inert construction waste (demolished concrete, bricks, stones etc.) could be used for production of gravel or composite construction materials

The key actors for implementing CE activities related to the cluster 1 waste streams are the municipal landfills. The municipal landfills can accumulate additional investments under the CE supporting programs, to optimize landfill operations. Composting plants and construction waste recycling plants provide:

- reduction of raw material demand
- minimize the waste amounts to be disposed
- enhance the life time for landfills

► Cluster 2

- Manufacture of minerals and metals waste
- Mining of coal, metal ores

The wastes are generated by just few large scale companies. It is feasible to establish waste separation and temporary storages at site.

Activities under the CE context, like recovery of materials from tailings and wastes will be organized by the waste producers (companies).

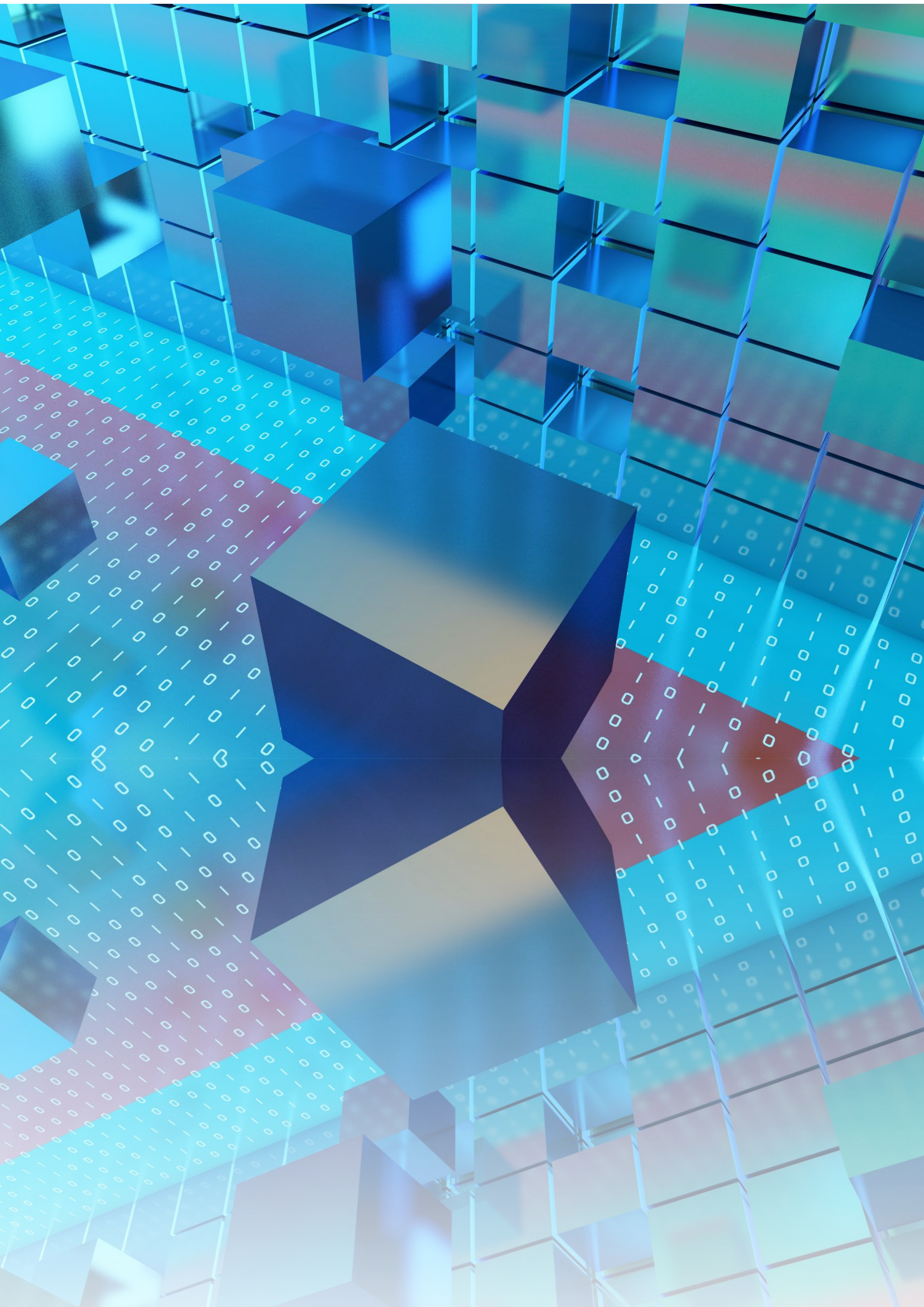
The role of the government could be only regulatory, aimed on optimization of regulations related to storage and use of tailings and status of tailings.

► Cluster 3

- Manufacture of other goods
- Wholesale and Retail Trade
- Waste streams generated in food processing, accommodation and food services sectors
- Waste streams generated in agricultural sector by medium size and large companies
- Construction waste generated by the large constructing companies involved in infrastructure and energy sectors

This cluster covers a large variety of wastes produced during manufacture of goods or at the consumption level – in wholesale and retail trading organisations and at the household level. Currently, most part of this type wastes enter the official or illegal landfills. However, significant part of the mentioned wastes falls under the competence of regulations connected to the Extended Producer's Responsibility, which has been established by the Waste Management Code of Georgia. At present only for several types of waste (tires, batteries, electronic wastes, oils) are established the technical regulations and requirements. The regulations for the packaging wastes are under the consideration and will be approved soon. The WM Code requires that the producers and wholesale trade organizations have to create special associations (PROs), who will be responsible for collection, disposal and treatment of the wastes covered by regulations. The manufacturers and trade organisations have their financial input for supporting PRO's operations. The PROs become the key actors for potential implementation of the CE oriented activities: collection, separation, recycling and reuse of the wastes before they enter the landfills and also collaborate with the landfills to get from there the separated wastes for further processing.

In principle, similar approaches and regulations could be developed in relation with food waste and construction waste streams generated by the large construction companies. Food manufacturers and food services could be obliged to create associations or organizations similar to PROs to manage the food wastes and implement project envisaging donation of edible products, processing and reuse of the non-edible wastes. Large construction companies could be also obliged to create associations or joint organizations aimed on proper management, reuse and recycling of construction wastes generated in infrastructure and energy sectors.



3.3 Mapping circular economy opportunities in each focus sector

For mapping circular economy opportunities, the ReSOLVE framework has been used as it offered a structure for a systematic screening of opportunities to identify and map opportunities. It has been an iterative exercise that began with a high-level mapping for each focus sector derived from existing circular economy literature. Thereafter, it has been verified and fine-tuned with sector stakeholders and experts to ensure that the mapping covered all relevant opportunities. The key focus of the mapping exercise has been to create an overview of opportunities by sector.

3.3.1 Agriculture, Forestry and Fishing

The sector profile is given in a chapters 3.2.1 - 3.2.6. Here we provide a brief summary focused on current status of circularity and estimation of opportunities and realistic ambitions for improving the circularity status during coming 5/10 years.

Agriculture, Forestry and Fishing is one of the significant sectors of the Georgian economy. It follows behind the trade, industry, construction, and real estate activities. In 2019 aggregated input in GDP of the entire sector equals GEL 3,239.4billion, which is 8.3% of the total economy. Separate subsectors under this overall title have different features and different input in country's economy and its circularity character. As far as the entire sector appeared to be the priority sector (maybe the only clear priority), further we will analyse the subsectors separately to have better understanding of gaps and potential for circularity. However, those indicators that are available only for the entire agriculture sector (energy consumption and GHG emissions) are given below, before the description of subsectors.

Annual indicators of energy consumption and GHG emissions for the entire agriculture sector:

- Electric power consumption: 83.8 GWh annually
- Natural Gas consumption: 10.3 mill. m^3 annually
- GHG Emissions (for 2017) - 3,488 Gg CO_2(eq.)

3.3.1.1 Crop and animal production, hunting and related service activities (NI – 1)

Agriculture is the one of the significant sectors of the Georgian economy. In 2018, more than GEL 3 billion of agricultural output was produced in Georgia, and this rate is maintained. Current input in GDP (2019-year data) of the sector equals GEL 3.050 billion, which is 7.8% of the total economy.

3.3.1.1.1 Annual crop production

Material Resource:	Production	Wastes Streams:
▪ Agricultural land (arable land, haylands) ▪ Area of Spring Crops (average 2018 – 2021) - 150,000 ha ▪ Area of winter crops (average 2018 – 2021) - 60,000 ha	▪ Average annual import - 819,000 tons ▪ Average annual production - 932,000 tons ▪ Average Internal Consumption – 1,736,000 tons ▪ Average Export – 15,000 tons	▪ Total Waste – 47,700 tons ▪ Used waste (mostly as additional animal fodder) – 10% / 4,770 tons ▪ Not recycled waste - 90% / 42,930 tons
Summary on circularity:		
▪ Current level of circularity is extremely low (10%) ▪ Recycling of wastes is minimal and spontaneous (part of organic waste is used as animal food) ▪ The land resources are not optimally used due to poor irrigation		

► Target level of circularity after 5/10 years: 15%

Table 3.3-1 Circularity improvement potential for Annual Crops sector

Potential for improving circularity:	RESOLVE: Regenerate; Share; Optimise; Loop; Virtualise; Exchange.				
	RESOLVE Indexes:	Key actors in implementing CE and direct beneficiaries:	Current % of circularity	Viable improvements	Target % of circularity
1. Collection and recycling of annual crop wastes	R;	**Private sector:** - Large agribusiness companies - Medium size agribusiness companies - Individual farms	10%	5%	15%
2. Modern crop storage facilities to minimize losses	R; O;	**Private sector:** - Large agribusiness companies - Medium size agribusiness companies			
3. Modern technologies optimizing production rate and resource restoration:					
– Modern agricultural technologies of plant production to improve productivity per ha	R;	**Private sector:** - Large agribusiness companies - Medium size agribusiness companies			
– Enhancing land resources: Modern, economically viable and resource saving schemes of irrigation and watering;	O;	- **Central government:**			
– Enhancing land resources (e.g. increase hay production through simple and non-costly interventions: seeding productive species of grass-plants on pastures)	R; O;	**Municipal authorities**			
4. Implementation of energy supply schemes based on local renewable power (solar; wind; thermal) and energy efficient technologies in greenhouses, agribusiness farms and food processing plants	R; O;	**Private sector:** - Large agribusiness companies - Medium size agribusiness companies			

3.3.1.1.2 Permanent crop production

Material Resource:	Production:	Wastes Streams:
▪ Agricultural arable Land: 86,700 ha	▪ Biomass extraction = 280.56 ths. tons ▪ Production (fruits and nuts): **252,500** tons ▪ Import: 110,800 tons/year ▪ total export: 148.7 tons/year ▪ Internal Consumption: 201,500 tons/year ▪ Share of Processed fruits: 65,000 tones/year	▪ Total losses and wastes: 41,150 tons (losses mostly during harvesting and wastes during processing) ▪ Used waste (mostly as additional animal fodder) – 12% / 5,000 tons ▪ Not recycled waste - 88% / 36,150 tons
Summary on circularity:		
▪ Current level of circularity is extremely low (12%) ▪ Recycling of wastes is minimal and spontaneous (part of organic waste is used as animal food) ▪ The land resources are not optimally used due to poor irrigation		

► Target level of circularity after 5/10 years is 25%

Table 3.3-2 Circularity improvement potential for Permanent Crops sector

Potential for improving circularity:	RESOLVE: Regenerate; Share; Optimise; Loop; Virtualise; Exchange.				
	RESOLVE Indexes:	Key actors in implementing CE and direct beneficiaries:	Current % of circularity	Viable improvements	Target % of circularity
1. Collection and recycling of permanent plant wastes	R;	**Private sector:** - Large agribusiness companies - Medium size agribusiness companies - Individual farms	12%	13%	25%
2. Modern crop fruit storage facilities and refrigerators to minimize losses	R; O;	**Private sector:** - Large agribusiness companies - Medium size agribusiness companies			
3. Introduction of modern technologies optimizing production rate and resource restoration: – Modern agricultural technologies of plant production and harvesting to improve productivity per ha – Enhancing land resources: Modern, economically viable and resource saving schemes of local irrigation and watering;	R; O;	**Private sector:** - Large agribusiness companies - Medium size agribusiness companies - Individual farms			
4. Arrangement of fruit processing plants (minimization of losses)	R;	**Private sector:** - Large agribusiness companies - Medium size agribusiness companies			
5. Resource management: Irrigation of land; increasing productivity of used land; Increasing area of viable land for agriculture;	O;	- **Central government:**			
6. Implementation of energy supply schemes based on local renewable power (solar; wind; thermal) and energy efficient technologies in greenhouses, agribusiness farms and food processing plants	R; O;	**Private sector:** - Large agribusiness companies - Medium size agribusiness companies - Individual farmers			

3.3.1.1.3 Grape Production and Winemaking

Material Resource:	Production:	Wastes Streams:
▪ Agricultural Land: 41,200 ha	▪ Extraction of biomass: 300,200 tons ▪ Harvested grapes: **290,200** tons ▪ Import of grapes: 1,000 tons/year ▪ export of fresh grape: 0.0 tons/year ▪ Internal Consumption of grape as a fruit 37,900 tons (13%) ▪ Grapes used for Wine Production - 253,300 tons of grapes ▪ Wine produced: 212,800 tons ▪ Internal consumption of wine: 130,500 tons of wine/year ▪ Export of wine: 82,300 tons of wine /year	▪ Loses during harvesting grapes: 10,000 tons ▪ Wastes generated during wine production: 40.500 tons ▪ Total losses and wastes: 50,500 tons (losses mostly during harvesting and wastes during processing) ▪ Share of Recycled wastes: 0%
Summary on circularity:		
▪ Current level of circularity is extremely low (0%). ▪ Recycling of wastes is minimal and spontaneous (part of organic waste is used as animal food) ▪ The land resources are not optimally used due to poor irrigation		

► Target level of circularity after 5/10 years is 40%

Table 3.3-3 Circularity improvement potential for Grape Production and Wine Making sectors

Potential for improving circularity:	RESOLVE: Regenerate; Share; Optimise; Loop; Virtualise; Exchange.				
	RESOLVE Indexes:	Key actors in implementing CE and direct beneficiaries:	Current % of circularity	Viable improvements	Target % of circularity
1. Collection and recycling of grape production and winery wastes	R;	**Private sector:** - Large agribusiness companies - Medium size agribusiness companies - Individual farms	0	40%	40%
2. Optimization of grape collection from households with minimal losses; Sharing of wine production facilities, juice production and bottling facilities;	R; O;	**Private sector:** - Large agribusiness companies - Medium size agribusiness companies			
3. Develop the winery strategy and plan for country and support creation of new vineyards and wineries according to the strategy and plan.	R; O;	**Central government:**			
4. Resource management: Irrigation of land; increasing productivity of used land; Increasing area of viable land for agriculture;	R; O;	**Central government:**			
5. Implementation of energy supply schemes based on local renewable power (solar; wind; thermal) and energy efficient technologies in greenhouses, agribusiness farms and food processing plants	R; O;	**Private sector:** - Large agribusiness companies - Medium size agribusiness companies - Individual farmers			

3.3.1.1.4 Livestock Production

Material Resource:

- Land: Pasture and hay-land is 300,000 hectares.

Annual Production:

Livestock products	Average Annual Production (2017 - 2020) (ths. tons)	Average Annual Import (2017 - 2020) (ths. tons)	Average Annual Export (2017 - 2020) (ths. tons)	Average Annual Consumption (2017 - 2020) (ths. tons)
Beef	21.0	8.0	2.0	27.0
Pork	18.0	22.0	1.3	38.7
Sheep and goat	6.5	0.5	4.0	3.0
Poultry	23.0	53.0	7.0	69.0
Milk and Milk Products	550.0	140.0	11.0	679.0
TOTAL	**618**	**223.5**	**25.3**	
Eggs	650 Mill eggs	25 Mill. eggs	5.8 Mill. eggs	669.2 Mill eggs

Wastes Streams:

- Total losses and wastes – 32,000 tonnes
- Share of Recycled wastes: 0%

Summary on circularity:

- Current level of circularity is extremely low (0%).
- Recycling of wastes is minimal and spontaneous (part of organic waste is used as animal food)
- The land resources are not optimally used due to poor condition of pastures

► **Target level of circularity after 5/10 years is 10%**

Table 3.3-4 Circularity improvement potential for Livestock Production sector

Potential for improving circularity:	RESOLVE: Regenerate; Share; Optimise; Loop; Virtualise; Exchange.				
	RESOLVE Indexes:	Key actors in implementing CE and direct beneficiaries:	Current % of circularity	Viable improvements	Target % of circularity
1. Collection and recycling of animal production and diary wastes;	R;	**Private sector:** - Large agribusiness companies - Medium size agribusiness companies - Individual farms	0%	10%	10%
2. Develop and implement regulations mandatorily regulating animal waste management	O;	**Central Government**			
3. Rehabilitation and improvement of pastures replacing the native, low-productive grass by high productive grass species	O;	**Municipal Authorities**			
4. Improvement of veterinary services.	O;	**Municipal Authorities**			
5. Introduction of modern technologies optimizing production rate and resource restoration: c. Modern agricultural technologies of cattle breeding, husbandry and dairy production d. Artificial breeding e. Improvement of veterinary services	R;	**Central government:** Policy, Strategy, Development Plans **Municipal Authorities:** Improvement of veterinary Services **Private sector:** - Large agribusiness companies - Medium size agribusiness companies - Individual farms			
6. Implementation of energy supply schemes based on local renewable power (solar; wind; thermal) and energy efficient technologies in agribusiness farms and food processing plants.	O;	**Private sector:** - Large agribusiness companies - Medium size agribusiness companies - Individual farmers			

3.3.1.2 Forestry and Manufacture of wood and of products of wood

Input in GDP (Mln GEL):

Forestry 117.6 Mln.GEL (0.3%) /

Manufacture of wood and of products of wood 49.2 Mln.GEL (0.1%)

Material Resource:

- Agricultural Land: 41,200 ha

Production:

Timber Extraction:

- Extraction of wood biomass: 2,856,000 **m^3 = 2,199,000 t**
- Total wood production **2,096,000 m^3** = 1,614 ths.t
- Timber Import: 28,440 **m^3** = 21,899 t
- Timber Export: 92 **m^3** = 71t
- Total Internal use of timber: Production–export+import–processing = 1,677 ths.m^3 = =1,291ths. t (firewood)

Processing of Timber (lumber and final products)

- Material used for processing wood products: 447,350 m^3 = 344,460 t
- Mass volume of the produced wood products: 268,410 m^3 = 206,680 tons.
- Average annual export of wood products: 134,205m^3 = 103,338 t
- Domestic use of wood products: 134,205m^3 = 103,338 t

Wastes Streams:

- Wastes generated during logging (Extraction–waste): 760 ths. m^3 = 585.2 ths. tons
  - Of them recycled - 38 ths. m^3 = 29.3ths. tons
  - Not recycled portion (95%): 722ths.m^3 = 555.9 ths. tons
- Wastes of wood processing: 178,940 m^3 = 137,780 tons
  - Recycled part of wood processing wastes: 8,950 m3 = 6,900 ths. tons
  - Not recycled part of wood processing wastes: 169,990 m^3 = 130,880 tons

  Total waste:

  - Total waste: 938,940 m^3 = 722,980 tons
  - Recycled portion (5%): 46,950 m^3 = 36,200 tons
  - Not recycled portion (95%): 891,990 m3 = 686,780

Summary on circularity:

- Current efficiency of timber harvesting and wood processing industries is very low (5%).
- Residuals and wastes of round-wood production and manufacture of wood products are used minimally (if any) and in a non-systemic manner
- The sustainability of forest harvesting is under the question due to illegal logging
- Lion's portion of harvested timber resources is used as fuel (firewood) that is a low value application

► Target level of circularity after 5/10 years is 15%

Table 3.3-5 Circularity improvement potential for Forestry and Manufacture of wood and of products of wood sectors

Potential for improving circularity:	RESOLVE: Regenerate; Share; Optimise; Loop; Virtualise; Exchange.				
	RESOLVE Indexes:	Key actors in implementing CE and direct beneficiaries:	Current % of circularity	Viable improvements	Target % of circularity
			5%	10%	15%
1. Collection and recycling of forest harvesting and wood processing remains and wastes to reduce the need for resource extraction	R;	**Private sector:** - Large business companies - Medium size business companies	5%	5%	10% 72,400 tonnes
2. Upcycling of wood wastes (i.e. recycle not for fuel) at the maximum economically viable level to ensure higher value and longer use of wood resources	R;	**Private sector:** - Large business companies - Medium size business companies			
3. Interlocution/ scale-up of modern wood technologies to increase the resource efficiency of the industry, as well as the quality and value added of wood manufacture products to improve the economy of the sector and gain access to better markets.	R; O;	**Private sector:** - Large business companies - Medium size business companies			
4. Improving of energy supply (preferably from renewable and affordable sources) of the population that depend on firewood to reduce low value use of timber resources and illegal logging, and increase sustainability of forest use.	R; O;	**Central government**			
5. Growing of plantation forests for timber harvesting to ensure sustainable use of native forests.	R;	**Private sector:** - Large business companies - Medium size business companies			
6. Control illegal logging	O;	**Central government** **Municipal government**			

3.3.1.3 *Fishing and Aquaculture*

Fishing and Aquaculture (NI/3)

Input in GDP (Mln GEL): 35.6 / 0.1%

Material Resource:	Production:	Wastes Streams:
▪ Marine Fish resources ▪ Total Land and surface water resources for Aquaculture 4,503.1 hectares	▪ Extraction of biomass (marine fish): 111,500 tons ▪ Import: 10,000 tons/year ▪ Export: 5,000 tons/year ▪ Internal Consumption: 28,877 tons/year ▪ Processing and export of processed materials: 87,623 tones/year	▪ Marine fish: 10%/ 10,900 tons losses during harvesting ▪ Aquaculture: 5%/ 125 tons losses during harvesting remains as waist ▪ Waist during processing: companies harvesting 109,000 tonnes of anchovy are producing 10% (10,900 tonnes) waste and byproducts (grease, proteins). At present this waste is not recycled. ▪ Total waste and losses: 21,925 t
Summary on circularity:		
▪ Loss of 10% of byproducts during the anchovy processing ▪ Damage of marine fishing aquatic habitats due to aggressive fishing technologies (trawl fishing) ▪ Aquaculture is underdeveloped and modern technologies for minimization of aquaculture losses and wastes are not applied. ▪ Current level of circularity is extremely low (0%).		

► Target level of circularity after 5/10 years is 2.8%

Table 3.3-6 Circularity improvement potential for Fishing and Aquaculture sector

Potential for improving circularity:	RESOLVE: Regenerate; Share; Optimise; Loop; Virtualise; Exchange.				
	RESOLVE Indexes:	Key actors in implementing CE and direct beneficiaries:	Current % of circularity	Viable improvements, %	Target % of circularity
			0%	2.8%	2.8%
1. Collection and recycling of byproducts and wastes generated during fish processing. The modern technologies can minimize emissions and other environmental impacts, and improve quality of the product.	R;	**Private sector:** - Large business companies processing fish - Medium size business companies processing fish	0% waste is recycled	6% waste could be recycled	6% waste
2. Resource management: Improving Policy, supervision and enforcement mechanisms to control trawl fishing and ensure sustainable practices of marine fishing and conservation of aquatic habitats	R; O;	**Central government:**			
3. Support for more intensive development of the aquaculture and implementation of technologies for minimization of aquaculture losses and wastes	R; O;	**Central government: Policy, Incentives** **Private sector:** - Large business companies processing fish - Medium size business companies processing fish			
4. Implementation of energy supply schemes based on local renewable power (solar; wind; thermal) and energy efficient technologies in fish farms, agribusiness farms and food processing plants	R; O;	**Private sector:** - Large business companies processing fish - Medium size business companies processing fish			

3.3.2 Mining (except oil and gas extraction)

Sector nomination and NACE Index (NI): Mining (NI/ 5 - 9)
Input in GDP (Mln GEL): 586.3 Mln GEL / 1.4%
Annual Production value: 974 Mln GEL
Includes: Mining of coal and lignite, Mining of metal ores, Other mining and quarrying

Material Resource:

Water consumption is less than 5.42 million m^3

- Total water consumption in mining, construction and logging/wood and wood products sector (2020): 5.42 million m

Energy Resources:

- Electric power: 126.6 GWh annually
- Natural Gas: 1.8 mill. m^3 annually
- Total GHG emissions for Logging and wood products, construction, manufacture and mining: 1,190 Gg CO2 eq.)

Production

Extraction of Materials (Products)	Average Production Volume, tons	Domestic Export, tons
Coal (coal and lignite)	174,000	0
Production of Ores		
Manganese	1,749,000	2,707.5
Precious Metals (Gold and Silver)	4,376,000	13,430
Copper	4,271,000	452,399
Dimension Stones (Construction Stones)	1,003,434	0
Construction Materials (Volcanic)	9,212,996	0
Construction Materials (sedimentary) (Sandstone, Sand and gravel)	28,979,644	0
Total Mass	**50,179,550**	**468,536.5**

Losses and Wastes Streams

Waste description	Total Wastes, tones
Coal ore tailings	49,076
Manganese	1,349,000
Precious Metals (Gold and Silver) ore tailings	4,362,570
Copper ore tailings	3,818,601
Dimension Stones (Construction Stones)	Total waste: 430,042 Recycled waste: 71,672 Not recycled: 358,368

Gaps in terms of circularity:

- Byproducts stored in tailings are not processed to recover valuable materials
- Remains of the construction stone production are not reused or recovered
- Environmental pollution during mining affects land and water resources
- Optimization of energy sources is possible but not assessed and implemented
- Current level of circularity is very low (0.85%)

► Target level of circularity after 5/10 years is 10%

Table 3.3-7 Circularity improvement potential for Mining sector

Potential for improving circularity:	RESOLVE: Regenerate; Share; Optimise; Loop; Virtualise; Exchange.				
	RESOLVE Indexes:	Key actors in implementing CE and direct beneficiaries:	Current % of circularity	Viable improvements	Target % of circularity
			0.85%	9.15%	10.0%
1. Implement modern technologies for mining to reduce pollution and emissions, and increase recovery of materials.	R; O;	**Central government: supervision and enforcement** **Private sector:** - Large mining companies			
2. Implement modern technologies to recover the materials from tailings.	R;	**Private sector:** - Large mining companies	0% material is recovered	5% material could be recovered from tailings	5% recovered
3. Recycle remains of the construction stone production	R;	**Private sector:** - Medium size business companies engaged in extraction of construction materials			
4. Implementation of energy supply schemes based on local renewable power (solar; wind; thermal) and energy efficient technologies.	R; O;	**Private sector:** - Large mining companies - Medium size business companies engaged in extraction of construction materials			
5. Develop and implement technical regulations related to mining tailings (similar to the EPR regulations)	R; O;	**Central Government**			

3.3.3 Construction

Sector nomination and NACE Index (NI): Construction (NI/ 41 - 43)
Input in GDP (Mln GEL): 3,680.8 Mln GEL / 8.5%

Annual Production value: 9,074.00 Mln GEL

Internal production of raw construction materials (sand, gravel, pebbles, stone, tuff etc.) is equal to 39,196,074 tons

Water consumption is less than 5.42 million m^3
Total water consumption in mining, construction and logging/wood and wood products sector (2020): 5.42 million m^3

Energy Resources:

- Electric power: 117.8 GWh annually
- Natural Gas: 28.6 mill. m3 annually

Total GHG emissions for Logging and wood products, construction, manufacture and mining: 1,190 Gg CO2 eq.)

Production

From 2018 to 2021, 12,054 constructions have been completed. On average 3,013.5 constructions have been completed annually.

During the last 4 years (2018 to 2021), in total 40,612 construction permits have been issued, therefore, on average 10,153 permits have been issued annually.

During 2018 - 2021, permits have been issued for construction of about 26,385,133 m2 buildings (in average 6,596,283 m2 annually). In reality, during these four years constructions have been completed for 8,093,865 m2 of buildings (three times less than planned). Annually this resulted in average in 2,023,466 m2 of constructed buildings.

Import – Export shows figures about 851,051 t of construction materials. This material is used for construction in Georgia.

Internal production of raw construction materials (sand, gravel, pebbles, stone, tuff etc.) is equal to 39,196,074 t.

Losses and Wastes Streams

Approximate volumes of construction wastes generated annually constitute 303,520 t. This covers wastes produced during construction and during processing of raw materials and production of construction semi-products, like bricks, slabs, clinker etc.

Gaps in terms of circularity:

- Inert construction wastes generated as a result of demolishing old structures and remain materials generated during construction are not properly collected. Separation, recovery of materials and recycling is not performed.
- Remains of the construction stone production are not reused or recovered
- Spoil generated during large scale infrastructure construction projects is usually disposed and not always used as a filling material for the needs of communities
- Energy efficiency principles are not always considered during designing and construction works
- A lot of abandoned building (not finished constructions or deteriorated old buildings) exist in large cities, as well as in smaller towns
- Current level of circularity is extremely low (0%).

► Target level of circularity after 5/10 years is 10%

Table 3.3-8 Circularity improvement potential for Construction sector

Potential for improving circularity:	RESOLVE: Regenerate; Share; Optimise; Loop; Virtualise; Exchange.				
	RESOLVE Indexes:	Key actors in implementing CE and direct beneficiaries:	Current % of circularity	Viable improvements	Target % of circularity
			0%	10%	10%
1. Implement modern technologies for production of new construction materials and other goods out of construction waste. Crushing stones and concrete remains and production of artificial gravel could be one example. Production of composite materials could be also thought as a version.	R;	**Private sector:** - Large mining companies - Municipal Waste Management companies and landfills	0%	8%	8% of construction wastes recycled
2. Where possible, reuse the spoil and other fine materials for slope stabilization and erosion control measures in the villages, or stones for river bank protection. This will minimize need of quarrying and will minimize resource waste.	R; O;	**Private sector:** - Large mining companies - Municipal Authorities	0% material is recovered	5% material could be used for community needs	5% recovered
3. Implement energy-efficiency principles during design and construction of buildings;	O;	Private sector: - Large construction companies			
4. Recycle remains of the construction stone production wastes and other wastes generated during production of construction materials. Production of composite materials could be thought as a option.	R;	Private sector: - Medium size business companies engaged in extraction of construction materials			
5. Implement new technologies in construction: - Solar panels for electricity and heat production - 3D Printing technologies of construction saving resources and materials	R;				

3.3.4 Energy Generation and Transport

3.3.4.1 General Overview of Sector

Sector profile is given in a chapter 2.5.9. Here we provide brief summary focused on current status of circularity and estimation of opportunities and realistic ambitions for improving the circularity status during coming 10 years.

Material Resource:

Water Consumption: 26300.78 million m3

Energy Consumption:

Annual Use of Electric Energy – for internal use of TPPs and HPPs: 21.4 Thousand tons of oil equivalent or 236,6 GWh
Natural gas consumption: 603.8 mil. m3

Annual Emissions of GHG – 10,726[81] Gg. CO^2 eq**.**

Generation:

Due to abundant hydro resources, hydropower dominates the electricity generation in Georgia Currently, 87 small, medium and large scale hydro power plants are operating with total of 3260.07 MW installed capacity

	Hydro	Wind	Geothermal	Solar	Electricity
Production	8 248.2	90.8	653.8	130.8	11 159.8
Imports	-	-	-	-	1 711.9
Exports	-	-	-	-	255.6
Stock Changes	-	-	-	-	-
DOMESTIC SUPPLY	8 248.2	90.8	653.8	130.8	12 616.1

Wastes and Losses

Losses in transmission lines and distribution networks (significant effect): 76.3 Thousand tons of oil equivalent or 887.7 GWh (7.7% of total annual consumption)

Losses due to absence of energy storages: The energy sector has seasonal limitations due to the dominant role of the hydropower generation: lack of water during the winter season and excess of water inflow during the flooding season. The excess water, which could be used for power generation, is spilled without use in power sector. The useless waste of water is recognized as a loss. In case of engaging the spilled water in hydropower generation, the need of import could be

[81] Data is for entire Energy Industry, but the lion's share here is connected to the emissions due to thermal plant generations

eliminated (GSE data). Thus the waste loss of resources could be estimated as minimum as value equal to import - 1 711.9 GWh annually (15% of total consumption).

Losses due to filing the reservoirs of HPP

Losses: The direct loss of electric power generation is relatively insignificant. Tangible impact is on stability of generation and ability of regulation, rather than generation capacity. Reduction of the generation potential roughly could be estimated as no more than 0,1- 0,2% of HPP generation.

Wastes: The exact figures are not available for all large HPPs and their reservoirs, but far more than 100Mm3 of debris and sediments are accumulated in the reservoirs as ballast. This is a waste that creates a problem for normal operations of HPPs and should be removed (flushed out or taken out).

3.3.4.2 Gaps in Circularity and potential for improvement

Waste spill of water resources and Storage Facilities

The dominance of hydropower generation and seasonal limitations associated with this, cause the necessity to import the electric energy. As we have mentioned, the useless waste of water is recognized as a loss. The waste loss of water resources could be estimated as minimum as value equal to import - 1 711.9 GWh annually (15% of total consumption).

The Government of Georgia is planning to achieve no import mode of operations for the energy system and fixed capacity of exported gas based power generation, assuming that current import level for the natural gas will be maintained as a constant capacity used in thermal plants. To achieve these goals it is proposed installation of the energy storage facilities of different type: Pumped Hydro Storage near the Enguri HPP and Battery Energy Storage Systems. Installation of the mentioned storages will enable the country power generation system to use the excess of water resources during the flooding season and store the needed amount of energy, sufficient for replacing the import. That means that the Energy generation system will be able to save and use water resources, which are currently spilled as waste. Saved resource value is about 1 711.9 GWh annually (15% of total consumption of electric power and about 0.30 – 0.35% of GDP/ 147,900,000GEL). This level could be reached during the target 10 years.

Losses in transmission lines and distribution networks

The annual losses of energy constitute 76.3 thousand tons of oil equivalent or 887.7 GWh (7.7% of total annual consumption). Government of Georgia is planning to rehabilitate the transmission lines and networks and minimize the losses in the network. The target for 10 years (till 2030) is to reduce the losses from 7.7% to 5.0% as minimum. Source: Georgian National Integrated Energy and Climate Plan (NECP). Reduction of losses by 2.7% means 311 GWh annually or 0,05% of current GDP (about 21,5 Mln GEL).

Sediments in HPP Reservoirs and Production of Construction Materials

The exact figures are not available for all large HPPs and their reservoirs, but far more than 100Mm^3 of debris and sediments are accumulated in the reservoirs as ballast. This is a waste that creates a problem for normal operations of HPPs and should be removed. At the same time there is significant demand on construction materials (sand, gravel, pebbles etc.) on internal and external markets. Georgia is importing annually about 4,074.5m^3, exports 8,889m^3 and explores internally 14,489,822m^3 of sand and gravel (market cost is roughly estimated as 15,000,000 GEL). The resources for quarrying are limited. Thus the recycling of the sediment waste stored in the HPP reservoirs and production of construction materials is recognized as the activity aimed on increasing circularity of energy sector.

Feasibility of removing sediments from the reservoirs and using it for production of construction materials needs further consultations with HPP Operating companies and companies producing construction materials.

- Current level of circularity is extremely low (0%)

► Target level of circularity after 5/10 years is 5%

Table 3.3-9 Circularity improvement potential for Energy Generation and Transport Sector

Potential for improving circularity:	RESOLVE: Regenerate; Share; Optimise; Loop; Virtualise; Exchange.				
	RESOLVE Indexes:	Key actors in implementing CE and direct beneficiaries:	Current % of circularity	Viable improvements	Target % of circularity
			0%	5%	5%
1. Pumped Hydro Storage near the Enguri HPP and Battery Energy Storage Systems. Installation of the mentioned storages will enable the country power generation system to use the excess of water resources during the flooding season and store the needed amount of energy, sufficient for replacing the import. That means that the Energy generation system will be able to save and use water resources, which are currently spilled as waste.	R; O;	**Central government and Governmental agencies:** Policy, Strategy, Action Plan, implementation of part of the projects (e.g. Battery storages) and support the others (e.g. Enguri Hydropumped storage) **Private sector:** - Large companies working in energy sector: **(e.g. Enguri Hydropumped storage)**		15% of total consumption)	Saved resource 1,711.9 GWh annually
2. Minimize Losses in transmission lines and distribution networks	R; O;	**Central government and Governmental agencies (e.g. GSE):** Policy, Strategy, Action Plan, implementation of the projects	7.7% of losses	**Reduction of losses by 2.7%**	5.0% of losses
3. Remove and use for production of construction materials more than 100Mm^3 of debris and sediments, which are accumulated in the reservoirs of large HPPs as ballast.	R;	**Private companies:** Feasibility of removing sediments from the reservoirs and using it for production of construction materials needs further consultations with HPP Operating companies and companies producing construction materials.			
4. Develop and Implement Strategies aimed on increasing energy-efficiency and usage of renewable sources of energy	R; O;	**Central Government:** Improving Policy and creation of incentives for the private sector introduce CE elements in their businesses			

3.3.5 Oil and Gas Production, Onshore Transport and Transport via Pipelines

Sector nomination and NACE Index (NI):

Extraction of crude petroleum and natural gas (NI/ 6);
Input in GDP (Mln GEL): 8.7 / 0.2%

Onshore transport and transport via pipelines (NI/ 49);
Input in GDP (Mln GEL): 1065.9 Mln GEL* / 2.5%

Material Resource:

Water consumption: 0.16 mil. m^3/year

Annual Use of Electric Energy and GHG Emissions

	Electric Energy Consumption	GHG Emissions*, Gg. CO2eq.
Natural Gas and Crude Oil production	0.1 GWh	-
Crude oil and Natural Gas transit and in country distribution by pipelines	22.3 GWh	190
Crude oil and refined oil transportation and distribution by railway	105.7 GWh (27% of railway transport)	1.1 (27% of railway transport)
Oil Refining	About 81.9[82] GWh	-
TOTAL	**210 GWh**	**191.1**

**Figures are based on the data of the National Greenhouse Gas Inventory Report of GEORGIA 1990-2017*

Production, Import, Export, Transit

Natural Gas Production (average annual for 2018 – 2020)

Inflow	Internal Consumption	Outflow
Production: 9,500,000 m^3	For Electric Energy Production (TPPs): 583,500,000 m^3	Export: 0
Imports: 2,579,900,000 m^3	Social and Commercial Consumption: 1,908,933,000 m^3	Waste and Losses: 96,967,000m^3 (3.7% of inflow and 5.1% of social and commercial consumption)

Natural Gas Transit (average annual for 2018 – 2020)

Inflow	Internal Consumption	Outflow
12,327,000,000 m^3	0	12,327,000,000 m^3
		Waste and Losses: 0 (negligible)

Crude Oil Production (for year 2020)

Inflow	Internal Consumption	Outflow
Production + Stock Changes: 33,100 tons	Petroleum Refineries: 37,300 tons	Refined Products:37,200 tons
Imports: 4,200 tons	Other Consumption: 0	Export: 0
		Waste and Losses: 100 tons

[82] Approximated based on data of Energy Balance of Georgia for 2020 and assumption that oil refining consumption is Total Chemical Industry consumption – consumption of Rustavi Azot.

Refined Oil Production (for year 2020)

Inflow	Internal Consumption	Outflow
Production: 37,200 tons	1,375,100 tons	
Imports: 1,354,600 tons		Export: 16,700 tons
		Waste and Losses: tons

Crude Oil and Refined Oil Product Transit (For year 2020)

Inflow	Internal Consumption	Outflow
Crude oil Pipeline Transit: 32,400,000 tons	0	Crude Oil: 38,395,800
Crude oil Railway Transit: = 5,995,800 tons	0	Refined product transit 1,691,400 tons
Refined product transit 1,691,400 tones	0	Waste and Losses: 0

Losses and Wastes in Oil and Gas Sector

Transit of the natural gas and oil by pipelines is not associated with losses. Certain amount of oil sludge is accumulating in oil terminals, which receive the crude oil by means of railway (as reported in the Batumi Oil Terminal's Waste Management Plan of 2019). Batumi Oil Terminal has stored about 5,000 m3 oil sludge during the recent 20 years. Composition of the sludge: 5-20% oil products; 45-50% mechanical contamination; 30-35% water. We can assume that annually the sludge production does not exceed 250 m3. Very rough estimation is that for Batumi and Poti oil terminals the annual sludge generation does not exceed 500m3, which is negligible amount and may be not accounted in the mass flow charts.

Natural gas distribution networks

Georgia's energy balance (Geostat) shows that average losses of natural gas during 2018 - 2020 accounted for 96,967,000m3 (3.7% of inflow and 5.1% of Final Consumption). According to the Georgian National Integrated Energy and Climate Plan (NECP), it is planned to reduce losses by 4% by 2030. To achieve this figure, it is planned to invest 144,140,000 GEL by 2030.

Gaps in Circularity:

- Losses: 96,967,000m^3 (5.1% of commercial and social consumption) is lost in gas distribution networks.
- During the recent years not more than 70% of the full capacity of oil pipelines is used for transit and about 83% of gas pipeline capacity.
- Absence of gas Storage facilities
- Current level of circularity is extremely low (1%)

► Target level of circularity after 5/10 years is 2%

Table 3.3-10 Circularity improvement potential for Oil and Gas Production, Onshore Transport and Transport Via Pipeline

Potential for improving circularity:	RESOLVE: Regenerate; Share; Optimise; Loop; Virtualise; Exchange.				
	RESOLVE Indexes:	Key actors in implementing CE and direct beneficiaries:	Current % of circularity	Viable improvements	Target % of circularity
			1%	1%	2%
1. According to the Georgian National Integrated Energy and Climate Plan (NECP), it is planned to reduce losses of gas in networks by 4% by 2030. To achieve this figure, it is planned to invest 144,140,000 GEL by 2030.	O;	**Central government and the governmental agencies (GIGC etc.).** **Private:** **Distribution companies**	5.1% of Final Consumption	by 4%	1.1% of current consumption
2. Construction of the gas storage will be carried out on the processed oil field of Samgori South Dome near Tbilisi and it will be possible to store up to 300 million cubic meters of gas in it.	O;	**Central government and the governmental agencies (GIGC etc.).** JSC "Georgian Oil and Gas Corporation" with support of IFIs.			
3. During the recent years not more than 70% of the full capacity of oil pipelines is used for transit and about 83% of gas pipeline capacity. Optimal planning may help to increase these indicators up to 90% of existing capacity.	O;	**Central government:** **Private sector:** - Large companies operating transit pipelines			

3.3.6 Tourism, Accommodation and Food Service Activities

Sector nomination and NACE Index (NI):
Accommodation and Food Service Activities (NI/ 55-56);
Input in GDP (Mln GEL): 2223 Mln. GEL / 8.4%/ Annual production value 2,100,000,000GEL (2019 year)

Travel Agencies, tour-operators and associated activities, (NI/ 79);
Input in GDP (Mln GEL): 154.4 Mln GEL / 0.36% (2019 year)

Material Resource:

Energy Resources:

Annual Energy Consumption and GHG Emissions Indicators for the Sector:

- Annual Use of Electric Energy for entire Commercial and public services - 2,915.0 GWh
- Natural gas consumption - 176.8 mil. m3

Tourism Statistics

Years	No of Foreign Visitors	Average Nights / Foreign visitor	Local Tourists Annual	Average Nights / Local visitor
2020	1,513,421		12,473,517	2.2
2019	7,725,774	4.1	14,251,973	2.0
2018	7,203,350	4.2	13,137,724	1.9
2017	6,482,830	4.3	12,637,215	1.9
2016	5,392,816	3.9	12,960,138	2.2
2015	5,255,999	3.4	12,360,678	2.2
2014	5,004,331			

Source: *Geostat / Georgian Tourism in Figures/ Georgian National Tourism Administration/ Annual Report for 2019 and 2020*

	Average Annual Number	Average Nights	Annual nights	Hotels %	Hotels Annual	Boutique Hotels and Guesthouses %	Small Hotels and Guesthouses Annual
International Visitors	7,500,000	4	30,000,000	35%	10,500,000	13%	3,900,000
Local Visitors	12,000,000	2	24,000,000	3%	720,000	4%	960,000
TOTAL					**11,220,000**		**4,860,000**

Source: Geostat

The number of accommodation units registered in the database of the Georgian National Tourism Administration (GNTA) is 2,575,

Food Consumption and Wastes Streams

Wastes and Losses: (significant effect):

The enormous amount of food/products, which is still edible, as well as non-edible products end up in the Landfills. Level of recycling is very low and in fact is limited to the use of non-edible food wastes for feeding animals. Composting is practiced in very rare cases.

- **Total food waste estimations: 450,000 tons annually**
    - Tourist's share in food wastes: 100,980 tons
- Total PET bottles - 40,000 tons annually
    - Tourist's share in PET bottles - 8,976 tons
- Total Glass bottles – 22,700 tons annually
    - Tourist's share in glass bottles - 5,094 tons annually
- Total Sanitary pads - 64,790 tons annually
    - Share of tourists in sanitary pads - 2,592 tons

<table>
<tr><th>Food</th><th>Consumption, tons</th><th>Total Food Waste, tons</th><th>Retail trade Food Waste (11%), tons</th><th>Food service Food Waste (22%), tons</th><th>Households Food Waste (67%), tons</th><th>Tourism related food waste</th><th>Household related Food Waste</th></tr>
<tr><td rowspan="2">Food except beverages (Annual and permanent crops, meat, milk and milk products, and eggs)</td><td rowspan="2">2,854,437</td><td rowspan="2">450,000</td><td>Tourists 0.44% 1,980</td><td>Tourists 99,000</td><td>Tourists 0</td><td rowspan="2">100,980 22.44%</td><td rowspan="2">349,020 77.56%</td></tr>
<tr><td>Households 10.56% 47,520</td><td>Households</td><td>Households 301,500</td></tr>
<tr><td rowspan="2">Beverages in Plastic Bottles</td><td rowspan="2">1,123,143 (including bottles)</td><td rowspan="2">plastic bottles 40,000</td><td>Tourists 0.44% 176</td><td>Tourists 8,800</td><td>Tourists 0</td><td rowspan="2">8,976 22.44%</td><td rowspan="2">31,024 77.56%</td></tr>
<tr><td>Households 10.56% 4,224</td><td>Households 0</td><td>Households 26,800</td></tr>
<tr><td rowspan="2">Beverages in glass Bottles</td><td rowspan="2">66,033 (including bottles)</td><td rowspan="2">glass bottles 22,770</td><td>Tourists 0.44% 100.2</td><td>Tourists 5,009</td><td>Tourists 0</td><td rowspan="2">5,109 22.44%</td><td rowspan="2">17,660 77.56%</td></tr>
<tr><td>Households 10.56% 2,404</td><td>Households 0</td><td>Households 15,256</td></tr>
<tr><td>TOTAL</td><td>4,042,813</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Gaps in Circularity:

1. The enormous amount of food/products, which is still edible, ends up in the Landfill on a daily basis. Three main factors impede the development of the food/product donation practice in Georgia in particular:

   - The strict financial regulations,
   - The low awareness of the business entities on their rights towards the food/product donation opportunity,
   - Additional transportation costs of the food/products to the beneficiary.

2. Non-edible food waste, as well as PET and glass bottles is the major component of waste flows generated by tourists. The food waste is not recycled. The level of recycling PET bottles and glass is very low.
3. Use of digital platforms, green-procurement, facility and resource sharing principles are not widely used in Tourism sector and associated sectors.
4. Current level of circularity is of medium level (5.2%)

► Target level of circularity after 5/10 years is 15%

Table 3.3-11 Circularity improvement potential for Tourism, Accommodation and Food Service Activities

Potential for improving circularity:	RESOLVE: Regenerate; Share; Optimise; Loop; Virtualise; Exchange.				
	RESOLVE Indexes:	Key actors in implementing CE and direct beneficiaries:	Current % of circularity	Viable improvements	Target % of circularity
1. Collect and use the edible food wastes: It is easier to organize separation of the edible food wastes in accommodation and food service facilities, rather than at the municipal level. In case of adjusted legal regulations, food/product waste can be significantly reduced by donating it for example to the Catharsis, Caritas Georgia and Social Canteens.	R;O;	**Central government: develop regulations;** **Private sector:** accommodation and food service facilities - Large companies - Medium size companies Charity organisations	5.2%	9.8%	15%
2. Collect and recycling of the non-edible food wastes: It is much easier to organize separation of the non-edible food wastes in accommodation and food service facilities, rather than at the municipal level. Separated food waste, glass, plastics could be collected and recycled by different waste operators. Demanded organic compounds, animal fodder, fertilizers or other products could be produced from the food waste	R;	**Central government: develop regulations;** **Private sector:** accommodation and food service facilities - Large companies - Medium size agribusiness companies			
3. Implement appropriate digital platforms, green-procurement procedures, facility and resource sharing principles in Tourism sector and associated sectors..	O;	**Central government: develop regulations;** **Private sector:** accommodation and food service facilities - Large companies - Medium size agribusiness companies			
4. Develop and implement technical regulations related to food waste (similar to the EPR regulations)	R; O;	**Central Government**			

3.3.7 Manufacture

Sector nomination and NACE Index (NI): Sewerage; Waste collection, treatment and disposal activities; Waste utilization, remediation activities and other waste management services **(NI/ 37-39)**

Input in GDP (Mln GEL): 107 / 0.2%

Resources used:

- **Water Consumption (mln.m3/year):**
- Manufacture of Food, beverages and tobacco - 2.56
- Manufacture of other non-metallic mineral products - 5.84 (chemical industry)
- Manufacture of basic metals - Manufacture of basic metals - 8.59

Sectors	Electric Power Consumption GWh	Natural Gas consumption (mil. m3)
Manufacture of Food, beverages and tobacco	246.5	47.5
Manufacture of other non-metallic mineral products	304.9	31.9
Manufacture of basic metals	1,739.5	21.3

Total GHG emissions for Logging and wood products, construction, manufacture and mining: 1,190 Gg CO2 eq.).

3.3.7.1 Manufacture of food products, beverages and tobacco product (NI 10-12)

Local production, import and export of annual crop products

Annual Crop	Average Annual Production, (ths.tons)	Average Annual Import, (ths. tons)	Average Annual Export (ths. tons)	Average Annual Processed Crops (ths. tons)
Wheat, total	102.4	561.0	0	663.4
Maize	255.0	121.0	1.0	375
Sunflower	1.9			1.9
TOTAL				

Waste and by-products produced during the manufacture of annual crop products in Georgia

Annual Crop	Average Annual Processed Crops (ths. tons)	Average Annual Product (ths. tons)	Bran and other by-products	Average Annual Solid Waste (ths. tons)	Total of waste and by-product
Wheat, total	663.4	504.184	132.68	26.536	158.216
Maize	375	285	75	15	90
Sunflower	1.9	0.95			
TOTAL					0.95

Manufacture of permanent crop products in Georgia in 2018 – 2020

Permanent Crops	Average Production for 2018 – 2020 (ths.tons/year)	Average Import for 2018 -020 (ths.tons/year)	Processed Fruits (ths.tons/year)	Internal consumption (ths.tons/year)	Average Export for 2018 - 2020 (ths. tons/year
Citruses (orange, tangerine, lemon, kiwi, feijoa)	62.3	10.0	15.0	12.5	49.8 Total 15.0 processed 34.8 Fresh
All other fruit	163.5	97.8	50.0	178.8 (out of this 5.0 processed)	81.6 (out of this 45.0 processed)
TOTAL Fruits	225.8	107.8	65	191.3	131.4

Losses and waste generated during processing harvested and imported fruits

Permanent Crops	Processed Fruits (ths. tons/year)	Processed Fruit Products (ths. tons/year)	Average waste generated for 2018 – 2020 (ths. tons/year)
Citruses (orange, tangerine, lemon, kiwi, feijoa)	15.0	13.95	1.05
All other fruit	50.0	46.5	3.5
TOTAL Fruits	**65.0**	**60.45**	**4.55**

Grape and Wine Making Value Chain

Input			
Grapes used for Wine Production, Average 2018–2020, ths.tons/year	Wine production, ths.tons /year	Glass bottles for internal market, tons/year	Plastic bottles for internal market, tons/year
253.3	212.8	1,800* tons	0.5* tons

Outcome				
Internal consumption of Wine, ths.tons/year	Average Export of Wine for 2018 – 2020, ths.tons/year	Organic Waste production, ths. tons /year	Plastic bottles remaining from internal consumption, ths.tons/year	Glass bottles remaining from internal consumption, ths.tons/year
130.5	82.3	40.5	0.5 tons	1,800 tons

**50,000 plastic bottle of 0.5l/9.9g is accounted and 3 mln glass bottles of 0.75l/600g (only 1.7% of wine consumed internally is bottled). Glass bottles produced and mostly imported for export share of wine is not accounted.*

Material flow in milk and milk products manufacturing sector

Average Annual Production (2017 - 2020), ths. tons	Average Annual Import (2017 - 2020), ths. tons	Average Annual Export (2017 - 2020), ths. tons	Average Annual Consumption (2017 - 2020), ths. tons	Average Annual products used during 2017 – 2020 (ths. tons)	Milk whey and other wastes Average Annual during 2017 – 2020 (ths. tons)
550.0	140.0	11.0	679.0	Total 78.0 7.0 milk 71.0 dairy products	601.0

Material flow data for beverage manufacturing industry

Product	Material inflow			
	Product value, GEL	Production amounts, tonnes	Plastic bottles, tonnes	Glass bottles, tonnes
Soft drinks	210,529,000	168,230	6,124	28,262
Mineral water	198,388,800	170,402	6,203	28,627
Beer	108,142,500	73,500	2,675	12,348
Total Beverages	2,200,000,000 (including wine)			

Product	Material Outflow			
	Internal consumption of Georgian product	Export	Waste remaining (plastic bottles), tonnes	Waste remaining (glass bottles), tonnes
Soft drinks	84,115	84,115	3,062	14,131
Mineral water	85,201	85,201	3,101.5	14,313.5
Beer	73,500	0	2,675	12,348

Wastes and Losses:

Manufacture of food products, beverages and tobacco product (NI 10-12)

Subsector	Waste and byproducts, ton
Annual crop processing	248,216
Processing permanent crops (except grapes)	4,550
Wine production	**42,300.5**
Milk whey	**601,000**
Beverages	**49,631**
Subtotal	**945,697.5 t**

3.3.7.2 Manufacture of the Non-metal Mineral Products (NI 23)

Manufacture of other non-metallic mineral products has significant input in GDP 423.7 Mln GEL, which is 1.0% of GDP (as of 2019). The sector is in principle mostly represented by JSC Rustavi Azot, which is the largest chemical company and only producer of industrial chemicals and mineral fertilizers in South Caucasus.

JSC Rustavi Azot produces approximately 450 000 tonnes of nitrogen based fertilisers (ammonium nitrate). Out of this amount 65 000 is sold on internal market, while the remaining portion is exported. The export of fertilisers comprised 120 Mln. GEL in 2021.

Wastes Generated

- Total Waste generated annually: 2,426.5 t

Recycled wastes

- **Plastic waste** – nitrogen fertilizers are transported to the port packed in big-bags. In most cases the big-bags are cut in the ports, and the fertilizer is transported as bulk cargo. The packaging material is returned to the Rustavi Azot, where it is recycled.
- **Waste oils** – Rustavi Azot regenerates all used oils produced during its operations
- **Different wastes** – the enterprise has own incinerator, where different hazardous wastes that are produced during operations (wiping materials, own medical waste, etc.) are burned.

3.3.7.3 Manufacture of the Basic Metals (NI 24)

Manufacture of basic metals has significant input in GDP 651.2 Mln GEL, which is 1.5% of GDP (as of 2019).

The ferroalloy plant of Zestaponi produces 220 000 tons of ferroalloys, of which 98% is exported. In 2021, ferroalloys of 477.44 Mln. GEL were exported.

Steel and iron products (mainly reinforcement) are manufactured by 2 companies – Rustavi Steel and GeoSteel – these companies manufactured 363 000 tons of steel and iron products in 2020, their price comprising 405.1 Mln. GEL. 95% of the production is consumed by the local market.

Wastes Generated

In 2020 Rustavi Steel JSC and GeoSteel LLC together produced 363 000 tons of steel. **Around 40 300 tons of tailing** can be generated during manufacturing **363 000 tons of this product.**

The annual production of Zestaponi Ferroalloy Plant is 220 000 tons of ferroalloys. The manufacturing of this volume of ferroalloys can produce the same amount of tailing – the output depends on the purification degree of the raw materials (concentrate).

Subsector	Waste and by-products, ton
Steel production	43,000 t tailings
Ferroalloy Plant	220,000 t tailings
Total	**263,000 t tailings**

- Current level of circularity is of medium level (5.0%)

► Target level of circularity after 5/10 yeas is 10%

Table 3.3-12 Circularity improvement potential for Manufacture Sector

Potential for improving circularity:	RESOLVE: Regenerate; Share; Optimise; Loop; Virtualise; Exchange.				
	RESOLVE Indexes:	Key actors in implementing CE and direct beneficiaries:	Current % of circularity	Viable improvements	Target % of circularity
1. Separate and recycle food waste (organic) for production of compost, bioorganic materials, fodder, biogas etc.	R;	**Private sector:** - Large business companies - Medium size business companies	5%	5%	10%
2. Separate and recycle glass and PET bottles	R;	**Private sector:** - Large business companies - Medium size business companies **Government or Municipality associated Landfills**			
4. Develop and implement technical regulations related to metal ore tailings and food waste (similar to the EPR regulations)	R; O;	**Central Government**			
3. Modern technologies could be implemented for the recovery of valuable materials from the tailings generated by metal production industry	R;	**Private sector:** - Large business companies - Medium size business companies			
4. Approve and implement technical regulations related to packaging materials, under the EPR regulations	R; O;	**Central Government**			
5. Implement the technologies and the activities aimed on recycling and reuse of the packaging waste	R;	**Private sector:** - Large business companies - Medium size business companies			
6. Encourage production of the bio-degradable packaging materials. Introduce regulations for replacing non-degradable packaging materials by degradable	R; O;	**Central Government**			
7. Switch on production of the bio-degradable packaging materials.	R;	**Private sector:** - Large business companies - Medium size business companies			

3.3.8 Wholesale and retail trade

Sector nomination and NACE Index (NI): Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles (NI/ 35-47)

Input in GDP (Mln GEL): 6161 / 14.3%

Energy Resources:

Data for the entire Commercial and public services, including sewage and waste collection, treatment and disposal activities; wholesale and retail trade and accommodation and food service

- Energy Consumption: 2,915.0 GWh
- Natural Gas consumption: Commercial and public services 176.8 mln.m3/year

Mass Flow Indicators:

<u>Food</u>

- Food: total mass entering retail market is 250,044 tonnes/year
- Consumption of food from retail: 187,533 tonnes/year
- Food waste lost at retail level 62,511 tonnes/year
- Recycled waste - 0 tonnes/year

<u>Wholesale and retail trade and repair of motor vehicles and motorcycles</u>

- Oil:
  - Oil Import - 12,700 tonnes /year
  - Lost - 6,350 tonnes/year
  - Used oil as waste - 6,350 tonnes /year
  - Recycled and reused - 2,050 tonnes (max. 32%)
- Accumulators:
  - Import - 5,500 tonnes /year
  - Used accumulators as waste - 6,350 tonnes /year
  - Recycled and reused (locally or exported for recycling) - 6,350 tonnes /year (100%)
- Tiers
  - Used tiers as waste - 31,272 tonnes /year
  - Recycled and reused (locally or exported for recycling) - 7,000 tonnes /year (max. 22%)

Gaps in Circularity:

A. Food Waste

- The date range on food products is a significant reason that it is wasted in households. Consumers often misinterpret “best by” dates to be expiration dates and prematurely discard food as a result. These labels are not even standardized or regulated — manufacturers set these dates themselves, often as a way to ensure consumption at the peak of freshness.
- Tonnes of food that goes to waste each year is still edible
- Food waste is not recycled and reused.

B. Wholesale and retail trade and repair of motor vehicles and motorcycles

- EPR regulations are developed but implementation is not yet efficient.
- Recycling and reuse of materials is poor (tiers; used oil; used accumulators)
- Vehicle repair activities and supply of spare parts is developed, but could be improved. Networking with the producers, training and capacity building programs seems to be useful;
- Vehicle leasing practices, as well as municipal transport operations needs to be improved to reduce the private vehicle operations;
- Stricter technical surveillance mechanisms and improvement of the emission and pollution prevention parameters of the vehicles is required.

C. Packaging

- Technical regulations related to packaging materials, under the EPR regulations, are not approved and implemented
- Recycling and reuse of the packaging waste is poor.
- Production of the bio-degradable packaging materials is not yet implemented. Non-degradable packaging materials prevail on the market.

▪ **Current level of circularity is of extremely low level (0%)**

► Target level of circularity after 5/10 yeas is 10%

Table 3.3-13 Circularity improvement potential for wholesale and retail trade sector

Potential for improving circularity:	RESOLVE: Regenerate; Share; Optimise; Loop; Virtualise; Exchange.				
	RESOLVE Indexes:	Key actors in implementing CE and direct beneficiaries:	Current % of circularity	Viable improvements	Target % of circularity
1. Recycle food waste (organic) for production of compost, bioorganic materials, fodder or used for production of biogas and organic fertilizer.	R;	**Private sector:** - Large business companies - Medium size business companies	0%	10%	10%
2. Separate and recycle glass and PET bottles	R;	**Private sector:** - Large business companies - Medium size business companies **Government or Municipality associated Landfills**			
3. Implement the technologies aimed on recycling motor vehicle related wasters (tiers; used oil; used accumulators) and recovery of materials.	R;	**Private sector:** - Large business companies - Medium size business companies			
4. Approve and implement technical regulations related to packaging materials, under the EPR regulations	R; O;	**Central Government**			
5. Implement the technologies and the activities aimed on recycling and reuse of the packaging waste	R;	**Private sector:** - Large business companies - Medium size business companies			
6. Encourage production of the bio-degradable packaging materials. Introduce regulations for replacing non-degradable packaging materials by degradable	R; O;	**Central Government**			
7. Switch on production of the bio-degradable packaging materials. I	R;	**Private sector:** - Large business companies - Medium size business companies			
8. Support the vehicle repair activities and supply of spare parts. Facilitate networking with the producers, training and capacity building programs;	S;	**CE Business Incubators**			

Potential for improving circularity:	RESOLVE: Regenerate; Share; Optimise; Loop; Virtualise; Exchange.				
	RESOLVE Indexes:	Key actors in implementing CE and direct beneficiaries:	Current % of circularity	Viable improvements	Target % of circularity
9. Support programs and activities aiming sharing of vehicles: a) develop vehicle leasing practices; b) improve municipal transport operations;	S;	**Central Government**			
10. Revise the use-by-dates concept introducing the latest possible sale date and intermediary dates. Monitor use-by-dates and revise prices accordingly.	O;	**Private sector:** - Large business companies - Medium size business companies			
11. Redistribute Surplus Food. . Companies, charities and individuals can all benefit from the redistribution of surplus food to those who need it. Food companies can often save money be donating food rather than paying the per tonne landfill tax and disposal cost	O;	**Private sector:** - Large business companies - Medium size business companies			
12. Introduce law, which banns supermarkets from throwing away or destroying unsold food and must donate it to food banks or for animal feed. a Food Waste Prevention Roadmap that provides the pathway to help achieve Ireland's goal of reducing food waste by 50%	O;	**Central Government**	0%	10%	10%
13. Engage social enterprises and connect them with food retailers with charities so they can efficiently donate good food that would otherwise be thrown away.	O;	**Central Government**			
14. Implement the EPR regulations to efficiently manage the wastes (tiers; used oil; used accumulators)	O;	**Central Government**			
15 Update regulations and enforcement mechanisms according to the European standards to improve the emission and pollution prevention parameters of the vehicles	O;	**Central Government**			

3.3.9 Estimation of Current Circularity of Georgia's Economy and Target Levels of Circularity

The aggregated input in GDP of the sectors of economy preselected at the screening stage and used in this assessment, constitutes 52.9% of Georgia's entire GDP. So far as the selected sectors are exactly those, which have tangible impact on circularity, the current and targeted levels of circularity have been calculated based on indicators related to these selected sectors. It is assumed, that the dismissed sectors have low impact on overall circularity.

Each sector has been weighted based on the share in GDP. The weight has been then multiplied on the individual indicators of current and target circularity and further summed to derive the integral figure of circularity for Georgia's economy.

Current level of circularity has been estimated as 1.3%, while target level after 5/10 years is estimated as 6.6%. The details of estimations are given below in a table:

► Target level of circularity after 5/10 yeas is 6.6%

Table 3.3-14 Circularity improvement potential for Georgian economy

	Sector	Used or Recycled Wastes %	Losses of Resources %	Current % of Circularity	% in GDP	Weight	Sectoral input in circularity	Target% of circularity by sectors	Sectoral input in improvement of circularity
1	Annual Crop Production	10		10				15	
2	Permanent Crop Production	12		12	7.1	0.071	0.52	25	1.18
4	Livestock Production	0		0			0	10	
3	Grape Production and Winemaking	0		0	3	0.03	0	40	1.2
5	Forestry and Manufacture of wood and of products of wood	5		5	0.3	0.003	0.015	15	0.045
6	Fishing and Aquaculture, Processing of Fish	0	9.80%	0	0.1	0.001	0	2.8	0.0028
7	Mining (except oil and gas extraction)	0.85%		0.85	1.4	0.014	0.012	10	0.14
8	Construction	0		0	8.5	0.085	0	10	0.85
9	Energy Generation and Transport		20.5	0	2.3	0.023	0	5	0.115
10	Oil and Gas Production, Onshore Transport and Transport via Pipelines		2.00%	1	2.5	0.025	0.025	2	0.05
11	Tourism, Accommodation and Food Service Activities	5.20%		5.2	5.2	0.052	0.27	15	0.78
12	Manufacture	5		5	8	0.08	0.4	10	0.8
13	Waste Management	17%		25	0.2	0.002	0.05	25	0.05
14	Wholesale and retail trade	0		0	14.3	0.143	0	10	1.43
	TOTAL				**52.9**		**1.292**		**6.6428**
							Actual level of circularity 1.29 %		Target level of circularity 6.6%

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3.3.10 Prioritization and Clustering of the Sectors of Economy

In chapter 2.4.1.1 we have mentioned that we expected two possible types of outcomes from the preliminary assessment of the different sector of economy in Georgia and mapping process: Prioritization of industries and Clustering of industries.

Prioritization of industries: Identification of a small group of clearly priority industries from the entire set of economic sectors represented in the country, which have the most favourable prospects for a significant increase in the degree of circularity

Clustering of industries: splitting the entire set of economic industries represented in the country into groups of the same type according to the criteria of circularity (economic and environmental indicators, resource consumption, material and waste flows), indicators characterizing key players and the process of sector administration.

2.6.8.1 Prioritization of industries

During the initial screening of sectors of economy in Georgia (see chapter 2.4), we have preselected 14 sectors, which seemed promising for developing circular models of economy. The preselected sectors are listed below:

1. Annual crop production
2. Permanent crop production and manufacture of food products
3. Grape cultivation and wine making
4. Animal husbandry and manufacture of food products
5. Logging and wood products
6. Fishery and fish processing
7. Mining and quarrying (except oil and gas extraction)
8. Construction
9. Manufacture of other non-metallic mineral products
10. Manufacture of basic metals
11. Electric power generation, transmission and distribution
12. Sewerage; Waste collection, treatment and disposal activities; Waste utilization, remediation activities and other waste management services
13. Oil and gas production and transportation
14. Accommodation and food service activities

Overview of the 14 sectors of economy listed above has demonstrated that:

- Current level of circularity is low in general and for each separate sector. The losses and waste generation is significant in each preselected sector, while reuse of materials, recycling of wastes or recovery of materials, as well as efficient use of resources is poor.
- At the same time most of the mentioned sectors have potential for improving performance and circularity indicators

We tried to follow the initial task that envisaged selection of the priority sector out of the preselected 14. However, the main conclusion is that all of the already preselected sectors have tangible resources for shifting towards the circular models of economy and no one of these sectors should be discarded during the developing CE transition strategy and action plans. In fact, have selected 14 sectors of economy out of 90 registered by National Statistics Office of Georgia, we already defined the priorities. Of course we can still say that Agriculture is a very important sector for Georgia, and could be also accepted as the priority sector for CE transition, as actually six sectors out of the preselected 14 represent subsectors of Agriculture.

Agriculture, forestry and fishing (NI – 1,2,3 according to Geostat) has total input in GDP equal to 3,203.8 mln GEL (7.7%) and comprises the six subsectors, which have been estimated as having from medium to extremely high potential for circular economy. Below we provide the estimation of the circular potential of all 14 sectors reassessed based on more detailed information that we have now, after preparing the snap-shot description of the different sectors.

Table 3.3-15 Circularity potential of 14 priority sectors

Economic Activities	Circularity Potential	Comments
1. Annual crop production	High	– Significant waste production; – Medium potential for recycling; – Potential for significant increase of productivity of land through rehabilitation of the irrigation system;
2. Permanent crop production and manufacture of food products	Extremely High	– Significant waste production; – High potential for recycling; – Potential for significant increase of productivity of land through rehabilitation of the irrigation system;
3. Grape cultivation and wine making	Extremely High	– Significant waste production; – High potential for recycling; – Potential for significant increase of productivity of land through rehabilitation of the irrigation system
4. Animal husbandry and manufacture of food products	Extremely High	– Significant waste production; – High potential for recycling; – Potential for significant increase of productivity through improving veterinary services, selection strategies and rehabilitation of pastures;
5. Logging and wood products	Medium	– Significant waste production; – Medium potential for recycling; – Regeneration through proper forestry practices;
6. Fishery and fish processing	Medium	– Low waste production; – Extremely high potential for recycling; – Easily manageable (few medium size enterprises)

Economic Activities	Circularity Potential	Comments
7. Mining and quarrying (except oil and gas extraction)	High	– Significant waste production; – From medium to high potential for recovering materials; – Easily manageable (few large size enterprises); – Waste collection and recycling could be supported by special regulations;
8. Construction	High	– Significant waste production; – From medium to high potential for recycling and recovering materials; – Easily manageable (landfills/waste operators); – Waste collection and recycling could be supported by special regulations;
9. Manufacture of other non-metallic mineral products	From low to medium	– Medium waste production; Wastes are eliminated through incineration; – Plastic wastes are recycled;
10. Manufacture of basic metals	High	– Significant waste production; – From medium to high potential for recovering materials; – Easily manageable (few large size enterprises); – Waste collection and recycling could be supported by special regulations;
11. Electric power generation, transmission and distribution	Medium	– High losses at present in networks; – Government plans to minimize losses;
12. Sewerage; Waste collection, treatment and disposal activities; Waste utilization, remediation activities and other waste management services		
13. Oil and gas production and transportation	Medium	– High losses at present in networks; – Government plans to minimize losses; – Medium waste generation and low potential for recycling;
14. Accommodation and food service activities	High	– Significant food waste production; – From medium to high potential for recovering materials; – Waste collection and recycling could be supported by special regulations;

Tourism is not represented in the Geostat classification of the sectors of economy, however the activities, which are closely connected to tourism are included in the list: this is Accommodation and food service activities (NI 55-56). Accommodation and food service activities comprises small, medium-sized and large hotels, restaurants, cafes, etc., which work mostly for foreign and internal tourists. The input of the sector in GDP is 2223.0 mln GEL (5.2%). Estimating the circularity potential of this sector as extremely high, we actually deem this estimation related also to Tourism.

The sectors attributed to category of extremely high circularity potential could be deemed as priority sectors. However, for efficient planning and development of road maps, it seems more productive to come back to the main conclusion: all of the preselected sectors have tangible resources for transition towards the circular models of economy and no one of these sectors should be discarded during the developing CE transition strategy and action plans. Each of these 14 sectors has its weak and strong aspects and specific features, which should be accounted while elaborating development plans. For this reason, we think it is important to give more space for the next task, which has been defined as “Clustering”.

3.3.10.1 Clustering of industries

The description of the "circularity profile" is multiparametric and includes not only basic economic and environmental indicators, but also indicators characterizing circularity aspects and key players and the process of sector administration.

- Criteria 1. Circularity aspects: RESOLVE framework was used to characterise sectors by following circularity aspects: Regenerate; Share; Optimise; Loop; Virtualise; Exchange.
- Criteria 2. Proponents that may have a key role in promoting the CE transition: Central Government and Governmental agencies and companies; Municipal authorities and affiliated agencies or companies; Large private companies; Small and medium businesses; Individual households;
- Criteria 3. CE aspects regulated by special regulations, which may support CE transition

Different activities within the same sector of economy, aimed on reconciling the gaps and developing certain aspects of circularity, may fall in different clusters. Thus one sector of economy could be represented in several clusters.

► Cluster 1.

- **Criteria 1.** RESOLVE framework: **Regenerate; Optimise;**
- **Criteria 2.** Key Proponent: Central Government and Governmental Agencies or companies 100% owned by the Government of Georgia
- **Criteria 3.** Regulations: not regulated by special regulations

Sectors	CE Activities for Cluster 1	Key Proponents
1. Annual crop production	– Rehabilitation of the irrigation system	Governmental Agencies
2. Permanent Crop Production	– Rehabilitation of the irrigation system	Governmental Agencies
3. Grape cultivation and wine making	– Rehabilitation of the irrigation system	Governmental Agencies

Sectors	CE Activities for Cluster 1	Key Proponents
11. Electric power generation, transmission and distribution	– Rehabilitation of power transmission lines and minimization of losses; – Development of power storage facilities;	Governmental Agencies
13 Oil and gas production and transportation	– Rehabilitation of gas distribution lines and minimization of losses – Development of the gas storage facilities;	Governmental Agencies

► Cluster 2.

- **Criteria 1.** RESOLVE framework: **Optimise (Recycle; Recover materials)**
- **Criteria 2.** Key Proponent: Municipal authorities and Agencies or companies 100% owned by the Government of Georgia
- **Criteria 3.** Regulations: not regulated by special regulations

Sectors	CE Activities for Cluster 2	Key Proponents
4. Animal husbandry and manufacture of food products	– Rehabilitation and improvement of the Pastures; – Support rehabilitation of the veterinary services: • artificial breeding • animal and bee protection	Municipal authorities;
8. Construction	Collection and recycling of inert construction waste	Municipal landfills;
12. Waste collection, treatment and disposal activities; Waste utilization, remediation activities and other waste management services	– Separation and treatment of special categories of waste: • bioorganic waste • glass • plastic • paper • metal	Municipal landfills; Municipal waste collection services;
12. Sewerage;	– Development of the wastewater treatment plants and associated facilities for recycling or reuse of the organic wastes (gas production; biodiesel etc.)	Municipal water supply and sewage services;

▶ Cluster 3.

- **Criteria 1.** RESOLVE framework: **Optimise (Recycle; Recover materials)**
- **Criteria 2.** Key Proponent: Associations of manufacturing and trading private companies;
- **Criteria 3.** Regulations: Regulated by special legislation and regulations

Sectors	CE Activities for Cluster 3	Key Proponents
12. Manufacture	– Collection and recycling of the special wastes as defined by regulations on Extended Producer's Responsibility	Associations of the private companies; ROs
13. Wholesale trading	– Collection and recycling of the special wastes as defined by regulations on Extended Producer's Responsibility	Associations of the private companies; ROs
4. Animal husbandry and manufacture of food products	– Collection and recycling of the special wastes: • animal remains; – Special regulations are not developed at present but are discussed	Associations of the private companies; PROs
5. Logging and wood products	– Collection and recycling of the special wastes: • Forestry wastes; – Special regulations are not developed at present but are discussed	Associations of the private companies; PROs
7. Mining and quarrying	– Recovery of materials from the special wastes: • Mining wastes; – Special regulations are not developed at present but the it is discussed in several strategies;	Associations of the private companies; PROs
10. Manufacture of basic metals	– Recovery of materials from the special wastes: • Tailings wastes; – Special regulations are not developed at present but the it is discussed in several strategies;	Associations of the private companies; PROs
14. Accommodation and food service activities	– Collection and recycling of the special wastes: • Food wastes (donation; recycling and recovery of materials) – Special regulations are not developed at present but the it is discussed in several strategies;	Associations of the private companies; PROs

► Cluster 4.

- **Criteria 1.** RESOLVE framework: **Optimise (Recycle; Recover materials)**
- **Criteria 2.** Key Proponent: **Small and Medium size companies;**
- **Criteria 3.** Regulations: Not regulated by special legislation and regulations

Sectors	CE Activities for Cluster 4	Key Proponents
1. Annual crop production	– Collection and recycling of bioorganic wastes	Private companies
2. Permanent crop production and manufacture of food products	– Collection and recycling of bioorganic wastes	Private companies
3. Grape cultivation and wine making	– Collection and recycling of bioorganic wastes	Private companies
4. Animal husbandry and manufacture of food products	– Collection and recycling of bioorganic wastes	Private companies
5. Logging and wood products	– Collection and recycling of wood and bioorganic wastes	Private companies
6. Fishery and fish processing	– Collection and recycling of bioorganic wastes	Private companies

Provided clustering is especially important so far as it is not possible to clearly identify several priority industries and the strategy has to comprise many different sectors. In this case, clustering may help in the subsequent planning of investments and their administration (engagement of different donors for different clusters and different management institutions).

4 KEY RECOMMENDATION FOR THE DEVELOMENT OF THE CIRCULARITY ROADMAP

Based on the finding of the circularity mapping project, the project team recommends a number of actions which in our view will need to be taken into account in further steps leading to the development of the Road Map to Circularity in Georgia. These recommendations, which supplement the specific recommendations stemming from the sectoral analysis, prioritising and clustering of industries, are driven by two core objectives:

- Objective one: Resource extraction from the Earth is minimised and biomass production and extraction is regenerative;
- Objective two: The dispersion and loss of materials is minimised, meaning all technical materials have high recovery opportunities, ideally without degradation and with optimal value retention; emissions to air and dispersion to water or land is prevented; and biomass is optimally cascaded.

These core objectives should be supported by four strategies we can use to achieve these objectives:

- Narrow flows—use less: The amount of materials (including fossil fuels) used in the making of a product or in the delivery of a service are decreased. This is through circular design or increasing the usage rates of materials and products. In practice: Sharing and rental models, material lightweighting, multifunctional products or buildings, energy efficiency, digitisation.
- Slow flows—use longer: Resource use is optimised as the functional lifetime of goods is extended. Durable design, materials and service loops that extend life, such as repair and remanufacturing, both contribute to slowing rates of extraction and use. In practice: Durable material use, modular design, design for disassembly, repair, remanufacturing, refurbishing, renovation and remodelling over building new structures.
- Regenerate flows—make clean: Fossil fuels, pollutants and toxic materials are replaced with regenerative sources, thereby increasing and maintaining value in natural ecosystems. In practice: Regenerative and non-toxic material use, renewable energy, regenerative agriculture and aquaculture.
- Cycle flows—use again: This encompasses the recycling and/or reuse of products and materials. The reuse of materials or products at end-of-life is optimised, facilitating a circular flow of resources. This is enhanced with improved collection and reprocessing of materials and optimal cascading by creating value in each stage of reuse and recycling. Downcycling, while still a form of cycling, is the least desirable option. In practice: Design for recyclability (both technical and biological), design for disassembly, recycling, upcycling, reuse.

There are potential overlaps between some of these strategies: for example, slow and cycle interventions often work together. By harvesting spare parts to use again, we are both cycling—by reusing components— and slowing, by extending the lifetime of the product the components are used for. And ultimately, slowing flows can result in a narrowing of flows: by making products last longer, fewer new replacement products will be needed—resulting in decreased material use. There are also potential trade-offs between the four strategies to be acknowledged. Fewer materials being used for manufacturing—narrow—means less scrap available for cycling. Similarly, if goods like appliances and vehicles are used for longer—slow—their energy efficiency falters in comparison with newer models, preventing narrowing. Using products for a long time—slowing flows—decreases the volume of materials available for cycling: this can have a significant impact on material-intensive sectors like the built environment, where boosting the availability of secondary materials is particularly important. What's more: some strategies to narrow flows, like material lightweighting, can result in decreased product quality and thus shorter lifetimes—making it more difficult to slow flows.

If we effectively deploy strategies focused on narrowing, slowing, cycling and regenerating the flow of materials, we may ultimately require a lesser amount and variety of materials to provide for similar needs. Because of this, fewer materials will be used by the economy, they will have a longer lifespan and can be reused more effectively and with less harm caused to the environment.

4.1 Bridging the circularity gap: 'What If' Scenarios

The selection of the scenarios was based on quantitative and qualitative research, which allowed the project team to recommend steps to be included in the preparation of the Roadmap to Circularity in order to analyse various scenarios of what is possible to model based on methodological limitations. Input from expert stakeholders helped guide the selection, and tailored the scenarios to the Georgian context. In calculating the total impact of the scenarios on the Georgian economy, we can only measure the improvement to the circularity metric and material footprint, taking a mass perspective. However, under each scenario, we also recommend to analyse and report the co-benefits of the circular strategies beyond only a reduction in the material footprint.

4.1.1 Building stock expansion

The most impactful intervention for the built environment would prioritise cutting new material inputs, making use of strategies that both **narrow** resource flows and **cycle** materials. In this intervention, renovation will extend building lifetimes and fewer new buildings will be erected. This will limit the amount of virgin materials harvested by the construction sector—and a higher proportion of those that are built will use waste as a resource, putting waste from construction and demolition to good use. The reuse of building materials (like steel and timber) and components (such as doors and window frames) could flourish if Georgia's government was to mandate disassembly—strictly limiting demolition—in the construction industry. This would create a repository of secondary materials in usable condition.

While the ultimate goal should be to cut construction figures overall and maximise the use of secondary materials, other circular strategies can be applied to lighten environmental pressures when construction does occur. Flows can be **slowed** and **narrowed** by making use of durable, long-lasting and lightweight bearing elements, like aluminium and steel. Currently, between one-fifth and one-sixth of materials are lost during construction processes. This is due to, for example, dimensional adjustments, poor planning where materials are ordered in excess to prevent costly delays in construction processes, and incorrect storage and handling. In cutting these figures substantially, flows can be further **narrowed** by decreasing material intensity. Prioritising local construction materials would cut emissions from transport—**narrowing** flows—while ensuring construction materials come from secondary sources will serve to further **cycle** flows.

In modelling resource efficient construction, it is recommended to assume an increase in the lifetime of metals like steel and aluminium, a reduction in the transport of materials to and from construction sites by increasing the share of local materials and supply chains, and a sharp decrease in material losses during construction processes. Cement use would drop, instead substituted with ashes from incineration and energy recovery processes. This intervention could result, based on experience in other countries in a 0.2% drop in the material footprint, and a small boost to the metric, of 0.2 percentage points (including extractive waste). This is due to rebound effects that lower overall impact: for example, lightweight and modular construction elements may cut the amount of steel and aluminium needed but may require more costly resource- and energy-intensive assembly and disassembly processes. This scenario's interventions could also largely tackle the inputs of the construction sector, rather than investment in new buildings—the latter is far more impactful as limiting stock expansion precludes resource use.

4.1.2 Food Production

Food production contributes to one-third of global GHG emissions and requires nearly 40% of our world's landmass to grow crops and animal feed and graze livestock. The food we grow often travels vast distances around the world, meeting people's demand for out-of-season produce or goods not locally available. The Georgian situation is no different: while the country produces more than enough to feed its population, large quantities of food—around half of the total—are still imported to make up for lacking crop variety. In addition, as demonstrated by the sectoral analysis, a vast proportion of food is wasted in Georgia, Georgia is, therefore, well-positioned to maximise the impact of strategies for the sector, especially as the topic gains more traction in public discourse for its connection to both human and environmental health.

Georgia should consume less. This recommendation to be included in the scope of the preparation of the Roadmap centres around food consumption: in an effort to **narrow** flows, Georgians could limit their consumption to around 2,700 calories a day on average—typically more than enough for the average man or woman. This, in turn, would cut demand for food. The second strategy targets food waste, with the ultimate aim of cutting food waste generation to begin with, or by directing food waste to anaerobic digestion. These strategies serve to **narrow** and **cycle** flows.

Currently, Georgia's food consumption sits above levels needed to sustain healthy adults of both genders, and has been on a steady upwards trend. Currently, the majority of this stems from the consumption of cereals, meat, dairy, sweets and alcohol—with the remaining contributed by vegetables and fruits. Food waste is also a significant problem throughout the nation, with the average Georgian discarding 576,588 tonnes of food waste per year of which, or around 403,573 tonnes, is attributed to household waste. More than one-quarter of what households throw away is edible—or avoidable—waste. These figures sit well above the global average of 74 kilograms of household food waste per capita, and above other European countries' estimates, such as Germany (75 kilograms per capita), France (85 kilograms per capita) and Spain (77 kilograms per capita).

This intervention to be analysed in the Roadmap preparation process assumes a flat reduction in food production—stemming from a cut in avoidable waste generation—across households, the largest source of avoidable food waste in Georgia. This will result in decreased food consumption. While the impact on circularity may not be significant, the real gains will materialise in the decrease in material consumption—which will have a further positive impact on land use dedicated to farming, in addition to emissions and human health.

By cutting resource and emissions-intensive foods like meat — or those that go through heavy processing — environmental impact per calorie would be greatly reduced, therefore **narrowing** flows: getting more, for less.

Recent research on the city of London found that city-dwellers' diets consist of 23% meat and dairy, which accounts for nearly half of emissions from households' food consumption. Fruits and vegetables are eaten in nearly equal proportions by weight — yet account for a mere 4% of emissions. These findings are particularly relevant to Georgia: between 2010 and 2020, meat consumption has risen steadily, growing with the average growth rate of 2%[83] to a total of 38 kilograms[84] per capita per year. From this, we see substantial opportunities for Georgia to improve the diet of its population, cutting resource consumption; from the extra feed, water and energy needed to raise livestock to the machinery, transport and packaging needed for processed goods. This intervention to be further analysed, assumes a sharp decline in the purchasing of meat and foods with low nutritional value, matched by an increase in the consumption of fruits, vegetables and cereals to match caloric intake. It could result in a sizable reduction of the material footprint of around 5%, based on the calculation already conducted for other countries.

Prioritising local food could cut transport distances for products — reducing the need for long-haul freight and thereby **narrowing** flows; while also opting for seasonal produce will cut the need for hot-housed fruits and vegetables, both **narrowing** and **regenerating** flows. Growing food organically — without the use of emissions-intensive artificial fertilisers — can also help **regenerate** nature. Forgoing artificial fertilisers in favour of natural options, like crop residues, food waste, and animal excrement will also open up new avenues for **cycling**, thus maximising the value of these materials often just considered waste.

4.1.3 Manufacturing Industry

The manufacturing industry is a massive global consumer of resources: making the machines we use to get through everyday life, the clothes we wear, the cars we drive and vast quantities of other products stocked on shelves around the world. Georgia has a robust and diversified manufacturing sector: it's pivotal for employment (84,600 persons employed) in the country, and it represents 1,545,032,900 US (2021; Geostat) 36.4% of the value of Georgia's exports — but its material and carbon footprint is substantial. Key sub-sectors — from steel, chemical and forestry to industrial machinery and food processing equipment — dominate the manufacturing landscape. The industry is gradually modernising, with the Georgian government encouraging circular production measures

[83] Several trends in meat consumption: Meat consumption of pork and poultry increases with 5.1% and 2.7% annual growth rate respectively; Meat consumption of cattle decreases; Meat consumption of sheep and goat is characterized by unstable temporary trends; Ref: "Meat Market in Georgia; PMO Business Consulting; 2020; https://www.pmo-bc.com/storage/app/uploads/public/5eb/d6a/42d/5ebd6a42d85b0923700015.pdf

[84] BULLETIN OF THE GEORGIAN NATIONAL ACADEMY OF SCIENCES, vol. 1 4, no. 3, 2020

from digitalisation to resource-efficiency. While circularity has ways to go in permeating the Georgian industrial sector, a cultural tendency towards innovation and reception to new technologies supports this transition.

Our first recommendation combines strategies to improve manufacturing's resource efficiency—both at early stages, where materials are formed, and later stages, where products are created. Gains in material efficiency, which narrows flows, should be ingrained in early stages: cutting yield losses involves making the most of technological advances to get more from less. This could be using less ore to create the same amount of steel (needed for production) and losing less raw material in the process, for example. Further along the value chain — where the steel will be used to make a product, process improvements will bring similar benefits. A reduction of scrap material typically generated from standard procedure — would also boost efficiency and reduce the need for virgin material inputs, further narrowing flows. Unavoidable scrap is reused, cycling flows.

Georgia has much to gain from actions that target internal processes in manufacturing companies — like education, improved communication and information sharing, and strategy deployment — and strong potential to optimise material efficiency in its manufacturing sector through the reduction of metals going from manufacturing industries to recycling, in tandem with an equal reduction in the consumption of both virgin and secondary metals across other sectors.

Georgia would also benefit from a single strategy intended to slow material flows: the creation of long- lasting machinery and equipment, from construction vehicles and lifting equipment to inventory transportation and medical equipment. Developing more durable equipment could boost complementary services, like repair and remanufacturing, and concurrently slash the need for material inputs for new equipment, positively affecting both resource use and emissions. This approach assumes a cut in machine sales, along with a boost in the repair and rental services needed to make extended lifetimes a reality. Circular business models, such as Product-as-a-Service systems, could play a crucial role. This lone intervention could have a fairly significant impact on Georgia's material footprint. Efficiency gains would see the advent of many co-benefits, from decreased energy use to lowered emissions. Increasing durability would bring about several new employment opportunities, ranging across practices like repair, refurbishment and remanufacturing. Georgia's manufacturing companies would benefit, too: the uptake of circular business models, from servitisation and reverse logistics to leasing and rental models, could strengthen Georgia's industries' position on the global market.

4.1.4 Extractive Industries

Resource extraction will continue to be necessary, even in a more circular world. As the earliest stage of many supply chains, extractive industries feed into a range of other material and emissions-intensive sectors. Georgia's rate of resource extraction is relatively high.

To this end, this 'what if' scenario for Georgia's extractive industries looks at the effects of cutting and regulating resource extraction — boosting its circularity while slashing its material footprint. We recommend to review in details the implications of implementing modern technologies in mining, the increased recovery of materials from tailings, recycling by-products from the construction stone production and the increased level of energy efficiency and renewable energy production. The detailed analysis is likely to result in recommendation to implement measures which could result in as much as 5 per cent increase of the circularity in the sector.

4.1.5 Mobility

Getting from A to B is one of the world's biggest contributors to both emissions and materials use—and the Georgian situation is no different, with transport accounting for the largest share of emissions in the country. The vast majority of these emissions — (24% of GHG emissions; Ref: Georgia's 2030 Climate Change Strategy stem from transport sector and Road passenger transport emissions accounted for approximately 68% of the total transport sector emissions is related to road transport). While fossil fuel-powered vehicles are still largely the norm, the use of renewable transport modes is growing, with the use of biofuels electric vehicles. Georgia's use of public transport is lower than their European counterparts.

First suggestion is promoting carsharing, car-pooling, trip-chaining and park and ride systems. By cutting the number of individually-owned cars on the road, Georgia will see a decrease in the materials (and resulting emissions) needed to manufacture vehicles, thereby **narrowing** flows. Cars, on average, remain parked as much as 97% of their lives: the vast majority of the time, the resources poured into creating these products aren't being used at their highest value. For this suggestion, we assume a substantial decrease in the number of cars on the road, prompted by disincentives such as, for example, a tax on car ownership. We also assume an increase in public transport use, acknowledging that this may be less efficient in rural areas. This intervention would see a slight decrease in the material footprint.

The advent of covid-19 has shown the world that a new way of working is possible; and telework has been on the rise across the EU even before the pandemic's outbreak. Our second suggestion proposes continuing along this trend once regulations are dropped. This will slash the number of vehicles on the road from residents' daily commutes, thereby **narrowing** material flows. However, it is important to note that there may be some moderate rebound effects from increased working from home, relating to changes in household energy consumption and mobility patterns. Doing so will bring benefits beyond the sphere of mobility: less energy will be needed, for example, to heat and light unused rooms in office buildings, and underutilised office spaces could serve other community functions, relieving some pressures from the need for new building stock. Pressures may also be relieved on transport infrastructure, such as roads.

Our final suggestion for mobility encompasses several distinct strategies to make vehicles more efficient: firstly, incentivising the use of fuel-efficient vehicles and improving lightweight vehicle design. These strategies **narrow** flows by gleaning more from less: the same distance travelled from less fuel, and the same vehicle made from fewer materials. Material flows may also be **slowed** through strategies that increase the lifetimes of cars, planes and trains through circular business models like rental and Product-as-a-Service systems, and more preventive maintenance.

For this strategy, we assume a substantial decrease of 50% in the average weight of vehicles purchased and used. We assume a reduction of the weight of steel and aluminium used for trains and a low aircraft fleet mass. All weight reductions are matched by fuel savings due to driving lighter, smaller vehicles. The lifetimes of cars, planes and trains would be substantially increased through increased preventive maintenance and rental models.

4.1.6 Consumables

The 'consumables' sector encompasses short-lived products that flow, like single-use plastics, to more durable products that Last, from furniture and textiles to appliances and machinery. As a country marked by a relatively high levels of consumption, this scenario explores options to significantly cut Georgia's material footprint — and make a mark on sectors gaining global notoriety for their impact on pollution, emissions and biodiversity, such as plastics and textiles. Strategies relating to design are particularly relevant: manufacturers have a responsibility to develop long-lasting, non-toxic, repairable and recyclable products to boost Georgia's circularity.

In our 'what if' scenario for conscious consumables, we recommend to review under the preparation of the Roadmap the opportunities for Georgia to cut its material footprint and boost its circularity by changing the way we use and design four categories of consumables: plastic and chemicals, textiles, furniture and appliances.

Our first suggestion comprises two strategies: reducing the number of plastic items in circulation— **narrowing** flows — and prioritising the use of bio-based chemicals, **regenerating** flows. With this intervention, we are not aiming to cut plastic production entirely, but rather a shift away from single-use plastics and towards greater reuse and **cycling**. For this, radical changes to the way plastic is produced are crucial. Acknowledging that plastic has some benefits (such as potentially being highly cyclable and energy efficient), this intervention also aims to tackle additional issues of chemical pollution and biodiversity protection: having now surpassed our planetary boundary for chemical pollution, scientists note that plastics are of particularly high concern. Based on this, the EU has formed policy initiatives — on-going and planned for the future — both to curb plastic use and increase recycling.

This strategy assumes a cut in plastic use. This could be achieved by, for instance, taxing plastic items bought by producers, and putting mandatory targets in place for reusability, recyclability and percentage of recycled content. It also models the impact of lowering fossil- and mineral-based chemical usage by swapping in bio-based alternatives, boosting the efficiency of chemical use through, for example, circular business models like chemical leasing, and the small-scale substitution of chemical fertilisers with organic options such as compost.

In an effort to transform textiles' impact, this strategy is composed of a number of strategies: ensuring textiles are free of animal products — which are extremely material- and land-intensive to produce — will serve to **narrow** and **regenerate** flows, as will cutting out petroleum-based fabrics. Boosting the content of recycled fibres will **cycle** flows, while encouraging high-quality, durable garment design, as well as do-it-yourself and clothing sharing, will serve to **slow** and **narrow** flows.

The global textiles industry has achieved infamy over recent years for its vast production of emissions, pollution to air and water, and waste. And in spite of Georgia's relatively low levels of domestic production, the consumption within the country has a major impact on emissions and pollution via hazardous substances. The vast majority ends up in unsorted household waste and is largely landfilled. It is estimated, based on experience in other countries, that around 60% of what's discarded is in satisfactory condition for reuse, indicating that a change in consumer behaviour is key to boosting circularity in the industry. Georgia recently passed Extended Producer Responsibility laws and is planning to include textiles and clothing in the next stages of its implementation. The ongoing plans to implement these laws will hike up clothing prices by incorporating the environmental costs of production.

The last suggestion is for circular furniture, which comprises two strategies, to **narrow** and slow **flows** respectively: encouraging the purchase of local and durable furniture. Local furniture cuts down on transport needs — lowering emissions — while furniture made to last will cut down on waste and keep materials in circulation for longer. Flows are also **cycled** through design that allows for components to be reused.

In this strategy, we assume that furniture is produced locally — and that it's made to last through high-quality and sturdy materials. We also assume a boost in furniture repair, reuse and refurbishing. These may all be enabled through new circular business models — and by increasing the demand for practices such as repair and remanufacturing, initial demand for such business models will grow. By employing these strategies, Georgia can lower its material footprint and boost circularity metric.

4.2 Policy Recommendations

A supportive, well-functioning, non-distortive policy and regulatory framework is a key precondition for the transition to a circular economic model. Such a framework should be designed to enable the intrinsic value of materials to be preserved or enhanced along production systems and value chains, and to minimise at the same time the level of inputs of virgin materials. There are several examples of effective EU[85, 86], national such as the Netherlands[87], Sweden[88], Denmark[89] and Finland[90] and regional policies which support the increasing 'circularity' of economic systems. However, there is a general consensus among the EU Commission's Expert Group on Circular Economy Financing[91], experts from investment funds as well as experts from national and supranational lending institutions, including the European Investment Bank that the current policy and regulatory framework is not sufficient for circular economy business models and value chains to thrive.

A well-functioning policy and regulatory framework ensures a level playing field for circular economy business models by eliminating legacy subsidies that reward linear behaviours and by fully pricing in risks and externalities associated with the linear production and use of materials. Such a framework facilitates and accelerates the allocation of capital to circular investments and activities. It stimulates private sector finance and allows optimal leverage of public funding.

There is a general consensus among the EU Commission's Expert Group on Circular Economy Financing as well as other groups of CE experts that the following four principles should be considered when formulating these policy interventions:

- value preservation/creation;

[85] https://circulareconomy.europa.eu/platform/

[86] For an overview of the 2015 and 2018 Circular Economy Packages, see, for instance http://ec.europa.eu/environment/ circular-economy/index_en.htm

[87] https://circulareconomy.europa.eu/platform/en/strategies/circular-economy-netherlands-2050

[88] Sweden transitioning to a circular economy - Government.se

[89] https://en.mfvm.dk/focus-on/circular-economy/strategy-for-circular-economy/

[90] https://www.ym.fi/en-US/The_environment/Circular_economy

[91] Accelerating the transition to the circular economy https://op.europa.eu/en/publication-detail/-/publication/02590134-4548-11e9-a8ed-01aa75ed71a1

- proportionality (to the level of externality);
- progressive dematerialisation;
- sensitivity to innovation.

In addition, any policy development should be coherent and well-integrated with the effective and timely implementation of existing related policies such as climate related policies. In any case the circular economy policy should avoid rebound or distorting effects, particularly with respect to other policy objectives to reduce greenhouse gas emissions and achieve the SDGs. The policy changes should also reflect the adaptive capacity of the businesses, and include appropriate phase-in and phase-out mechanisms.

The following have been identified as a priority for policy interventions by the EU Expert Group on Circular Economy Financing, which analysed barriers and identified the main areas that have the potential to encourage a greater allocation of finance to circular economy business models and systems. These recommendations have been reviewed by the Project Team and found highly relevant for Georgia:

- subsidies should be removed and the negative externalities of linear economic activities internalised; where this is not politically feasible, subsidies (in a suitable, non-distortive form) to circular economic activities proportionate to their positive externalities should be considered;
- public tools such as public procurement should be used to accelerate the market for circular economy products and services. The use of GPP should be incentivised;
- public funds should be activated as a ‘de-risking’ instrument to mobilise more private capital for scale-ups with a circular scope;
- technical assistance should be provided to help businesses and local administrations understand linear risks and the economic and societal benefits of the circular economy;
- ‘response measures’ which mitigate the economic and social impacts of communities, sectors and regions particularly exposed to the legacy of linear economic systems (e.g., mining) should be introduced;
- priority should be given to policy interventions that comprehensively address multiple environment, social and governance risks.

4.2.1 Recommendations to Financial Policy Makers

The current ‘linear’ consumption model of take (extract), make (produce), use and discard poses inherent risks to the sustainability of markets and companies that operate within them. Without the systematic recovery and reuse of materials, value chains remain dependant on the availability of cheap virgin resources. For an individual company, such linear business models, defined by the reliance on cheap virgin resources, can affect operations and overall profitability through multiple future scenarios, including: disruptions in resource supplies, volatility in resource costs, and decreasing costs of renewable/circular alternatives. Such scenarios have played out already, particularly in precious metals markets where the global supply of a number of materials (e.g.

cobalt) is already facing increasing availability risks. As these risks are associated with linear business practices, they are referred to as 'linear risks'.

Most companies and financial institutions are typically not taking these linear risks into consideration in their business decisions, investment credit evaluations, or reporting procedures. This is mainly because of the perception of current market stability and the time-tested success of linear business practices in adapting to changes in global markets. As a result, investors and consumers are largely unaware of the possible detrimental factors that these risks pose on the performance of their businesses or investments.

In order to trigger a shift to a circular economy, the full risk profile of current linear business practices must be disclosed. By evaluating linear risks, the benefits of circular economy models can be better understood in relation to 'business-as-usual' scenarios. The main mechanism for articulating these risks would be through risk and credit evaluations conducted by financiers and investors to provide a better understanding of strengths and weaknesses of linear or circular investments. Specific incentives need to be created to address the inertia of current, well established and time-tested linear business practices, which do not incorporate linear risks in financial evaluations.

Key Recommendations

- *Develop reporting standards for Georgian companies aligned with those proposed within EU for linear risks of investments and businesses and incorporate them into standard accounting practices could help to ensure that linear risks are sufficiently evaluated and disclosed. The reporting standards would provide a methodology for corporates and financial institutions to identify the exposure to linear risks within their portfolios or operations.*[92]

Relevant recent work on the definition of linear risks can be found in the paper Linear Risks by Circle Economy, PGGM, KPMG, EBRD and WBCSD, June 2018[93]. The paper proposes an initial definition of 'Linear Risks' and a framework to help investors and businesses better understand the exposure to effects of linear economic business practices, which will negatively impact an organisation's ability to operate in the market place.

Dedicated linear risk standards could build on current best practice within climate-related risk disclosure systems. A good example is represented by standards developed within the Task Force on Climate-related Financial Disclosures (TCFD)[94] to develop disclosure recommendations for risks related to climate change. The task force states its mission as "to develop voluntary, consistent climate-related financial risk disclosures for use by companies in providing information to investors, lenders, insurers and other stakeholders." Set up at the end of 2016, the Task Force presented its recommendations report on best methods and practices for disclosing climate-related risks in the summer of 2017. Companies and investors are now using these

[92] https://www.ellenmacarthurfoundation.org/resources/apply/circulytics-measuring-circularity

[93] https://www.circle-economy.com/news/linear-risks-how-business-as-usual-is-a-threat-to-companies-and-investors

[94] https://www.fsb-tcfd.org/

recommendations to incorporate climate risk disclosures in their reporting to shareholders and other stakeholders.

Stemming from the TCFD's recommendations, linear risk disclosures could be documented in terms of companies' governance, strategy, risk management measures, and metrics and targets used to evaluate impacts of these risks. For metrics and targets, linear risk standards would emphasise potential material impacts on companies' income statements and balance sheets.

The targets for these recommendations are financial regulators, policy makers and representatives of the financial sector. They can all play an active role in Georgia in incorporating linear risk reporting into financial disclosure practices:

- **The Technical Expert Group (TEG) on Sustainable Finance**[95] focus on four areas: i) a taxonomy to define whether an activity is environmentally sustainable; ii) green bonds standards; iii) benchmarks for low-carbon investment strategies; and iv) recommendations on how to improve corporate disclosure of climate-related information. As environmental sustainability and the circular economy are complementary concepts, integrating linear risk considerations in the TEG's working areas would help to make the group's outputs more comprehensive. With respect to the future development of sustainability benchmarks, this would incorporate circular economy concepts into their development of benchmarks to measure the environmental sustainability of investment strategies. The resulting benchmarks would help to link corporations' reliance on materially intensive value chains, scarce resources or volatile commodity markets to the climate impacts of these value chains, resources and markets. Corporations that demonstrate higher levels of circularity in their operations or investments would therefore be more likely to meet the benchmarks.
- **International Financial Reporting Standards (IFRS) Foundation**[96] provide a common set of principles for companies to prepare and publish their financial statements. Companies would then be commonly required to examine their portfolios and operations to determine their exposure to linear risks, and to examine their mitigation measures. Similar to the proposed work with the EU TEG, linear **risk** disclosure standards would need to be developed with the IFRS Foundation, particularly their International Accounting Standards Board. Georgia should actively participate and adapt the standards in its national requirements.
- **Network for Greening Financial Systems (NGFS)**[97] could introduce obligatory reporting standards through Central Banks which could play a critical role in disseminating linear risk reporting standards. Central banks define the financial reporting standards that companies registered within the country need to follow in preparing and publishing their financial statements. Central banks can expand on international best practices, like the IFRS, and put forward guidance to locally registered **corporations** to disclose their linear risks within their portfolios and operations. The NGFS could facilitate the introduction of these standards through central banks. The NGFS is a collation of a growing number of central banks to 'enhance the role of the financial system to manage risks and mobilise capital for

[95] https://ec.europa.eu/info/publications/sustainable-finance-technical-expert-group_en

[96] https://www.ifrs.org/

[97] https://www.ngfs.net/en

green and low-carbon investments. Within the EU, the central banks of Austria, Belgium, Finland, France, Germany, the Netherlands, Spain and the UK are members as are the Swedish Finansinspektionen (Sweden's financial regulatory agency) and the European Central Bank. The NGFS has a clear mandate to develop tools for financial systems to scale up finance for environmentally sustainable development, including the design and integration of climate and environmental risk analysis tools for supervisory practices. Linear risks and the potential development of reporting standards would fit well within this work stream. Some of these aspects have already been incorporated in the work carried out by the National Bank of Georgia in their initiative on sustainable financing.

Adopting standards for the disclosure of linear risks can help Georgia to accelerate the transition of businesses to a circular economy. This is because, first of all, companies that previously did not consider their exposure to the availability of critical resources or other linear risks begin to evaluate the sustainability and efficacy of their current business and risk management practices from a new perspective. By doing that, companies can then begin to consider circular alternatives to mitigate these risks. Second, investors can benefit from increased transparency and more complete information on risks of their investments. This can act as an incentive for investors to invest in more circular practices as these can mitigate linear risk. Last, value chains would benefit from identifying their potential weaknesses due to linear risks. Value chain actors would be more willing to collaborate to address these weaknesses.

The concept of the circular economy is increasingly refined thanks to the theoretical and analytical work conducted by several academic and research organisations. Still, the link between the circular economy and investments and technologies is less established. There are companies that demonstrate how circular economy concepts can be embedded successfully into existing business models. These companies are exemplary but do not reflect the current market understanding of circular economy approaches. One of the issues preventing a more widespread adoption of circular economy practices is that businesses and financial institutions lack a common framework for guiding whether an investment supports the circular economy or not. Without this definition or guidance, companies struggle to identify circular economy opportunities within their own portfolios or operations.

A clear definition of what constitutes circular finance, and therefore circular economy investments, needs to be developed to give markets and companies guiding principles for identifying and structuring their investments and business models. This definition needs to be specific in order to provide a clear scope of what constitutes circular finance, while providing sufficient flexibility for companies from all sectors to be able to customise this definition for their individual operations.

Key Recommendations

► *Further refine the definition for the circular economy and develop a definition of circular economy finance.*

This could be done in the form of a taxonomy, based on the currently on-going work in the EU, of circular economy activities and benchmarks for their environmental performance. This should build on the most authoritative work on the circular economy, and be compatible with and complementary to the ongoing work of both the TEG for Sustainable Finance and the initiatives of

IFIs. The resulting definition of the circular economy finance would establish a common framework for businesses to guide their own identification and reporting of circular economy finance. One of important sources for this work is the EIB Circular Economy Guide. Beyond the TEG, the multilateral development banks have set up a cross-institutional working group to define and track climate finance among the banks. Like with the TEG, circular economy technologies and business models could be introduced in the working group's discussions to become a subset of what is defined as climate finance.

A common definition for the circular economy would be an invaluable tool for identifying circular economy investments. While companies have an increasingly good understanding of the concept of the circular economy, giving concrete expression to these principles in their business is less evident. A common and widely acknowledged definition of circular economy finance, which outlines the value chain solutions and business models that contribute to a circular economy, would give companies an idea of how the circular economy works in practice. Within the EU, this definition will be critical for tracking and reporting the EU's own investments in the circular economy. Beyond the EU, the definition would have highly relevant applications for Georgia where GoG, other institutions and any firm could learn from the EU's best practice to guide their own investments and policies.

Gaining access to finance for circular business models and investments is an essential hurdle that needs to be overcome in the transition to a circular economy. Part of the challenge comes from the inability of businesses to clearly identify and communicate benefits of their circular concepts in terms of profitability, risk mitigation and increased sustainability of operations. Potential circular businesses often have limited capacity to articulate benefits of their circular economy business models to financiers and investors. Strengths of circular businesses, such as decreased exposure to resource price volatility or a more consistent cash flow through 'product-as-service' models, are not being embedded in business plans and proposals shared with financiers.

This lack of capacity and experience in communicating circular economy benefits has a negative impact on financiers' perception of circular economy businesses. In using the same evaluative methods as a linear investment to articulate circular economy project's benefits, businesses entrench the concept that linear business practices are the most profitable and present less risk. If circular economy businesses were able to provide more comprehensive assessments of their business plans to financiers that take into consideration the reduction of linear risks and increased stability of cash flows, then financiers would be able to understand advantages of pursuing and supporting circular economy investments. An interesting platform to support circular businesses is being provided by London Waste and Recycling Board (LWRB).[98] The LWRB provides support to businesses of all sizes and at different stages of their lifecycle, from startup to maturity which includes creation of jobs through developing new business models and revenue streams from waste products and circular technologies, with the potential to add significant GDP to London's economy.

Companies also often lack capacity to identify circular economy opportunities in their current operations. Shifting away from linear production and consumption models requires firms to view their inputs and outputs from a different perspective in which materials and products are only a means to providing a service and where there is a potential additional value to capture in all

[98] https://www.lwarb.gov.uk/what-we-do/circular-london/circular-economy-investment-for-businesses/

resource flows. Therefore, companies that could potentially benefit from adopting circular business models and technologies are unaware of opportunities they are missing.

In order to overcome these issues, the capacity of businesses should be increased to enable them to identify circular opportunities in their operations, and assess and communicate benefits of circular practices to financiers and investors. Circular business models and technologies often do not have sufficient levels of market penetration for firms to consider them as viable alternatives to current practices. Cost-effective e-waste recycling is a relevant example of a technology that has a significant market value but is underutilised to date despite this fact. Recovering gold, copper and other metals from e-waste is now cheaper than extracting these metals from virgin sources in mines.[99] Despite these advantages, less than 20 per cent of e-waste today is properly recycled.[100] Businesses must have tools and training is needed to communicate competitive advantages of circular economy investments in comparison to linear practices. The objective is to have a market of circular economy businesses that can successfully access finance to expand their operations due to their competency in and awareness of the inherent strengths of their circular economy approaches.

Key Recommendations

► *Establish in Georgia technical and financial advisory services to support the development of business models for circular economy businesses or projects seeking finance that effectively capture and articulate the benefits of circular economy strategies.*

The technical assistance for circular economy businesses should address multiple barriers to scaling up the use of circular technologies:

- provide support to businesses to identify, disclose and where possible mitigate linear risks in their portfolios and operations. Beneficiaries would receive training and expert input to assess their level of exposure to linear risks. Companies that already employ circular economy business models would receive support to communicate benefits of these approaches to potential financiers using the mitigation of linear risks to demonstrate their competitive advantage. Technical and financial advice would help to make linear risk evaluations a mainstream part of companies' reporting and increase market understanding of operational and potential financial benefits of pursuing circular strategies that mitigate these risks;
- provide support for existing businesses to introduce circular economy technologies and business models in their operations. Companies would receive expert input to identify opportunities to extract additional value from waste streams and reduce their material intensity while increasing their ability to create value. Both larger corporates and SMEs should benefit from this support. Large corporates would be able to address inefficiencies

[99] Global E-waste Recycling Sales Market 2018 and Industry Forecast 2025.

[100] Zeng, Mathews and Li. 'Urban Mining of E-Waste is Becoming More Cost-Effective Than Virgin Mining.' Environmental Science and Technology. 52, 8, 4835-4841.

or linear risks in their supply chains, while SMEs would have the potential to transform their business model to align with circular economy principles;

- increase the capacity and market representation of start-ups pursuing circular economy business models. Circular economy technologies and business models have the ability to transform markets; however, young companies need access to capital in order to invest in and scale up their operations. Technical and financial advice will help start-ups to develop business plans focused on circular economy approaches to share with financiers. This support will promote the adoption of circular business models and technologies and increase finance for circular economy businesses;
- make sure that SME organisations have the necessary capacity to provide specialised advisory or counselling services to their members and SMEs in general to become more circular. Since SMEs would first turn to their own organisations to have support on how to go from linear to circular, it is important that SME organisations are in a position to respond to this demand in order not to delay the systemic chance that the circular economy needs to take off.

The most relevant players for providing circular economy advisory services are: public financial institutions such as multilateral development banks and promotional banks, specialised agencies, consultancies and experts as well as educational institutions such as technical universities. A very important role has also been assumed by international donors through their support programmes such as the Circular Economy awareness programme supported by the Swedish Government and implemented by the GSNE “Orchis”. There are several potential avenues for these actors to provide technical and financial assistance to businesses seeking to adopt or scale up their use of circular technologies and measures.

The strengthened technical and financial advisory services could increase the uptake of circular economy technologies and business models while facilitating access to finance for circular economy businesses. This could have two major impacts. First, it could stimulate the market of circular economy businesses that employ similar strategies to gain competitive advantage using resource management. The market for circular economy technologies would then benefit from the increased economies of scale as technologies become more widely adopted. Second, it could help to communicate benefits of circular economy approaches to financiers. Investors who currently prioritise support for linear business models would see financial benefits of supporting circular investments. This would help to build financial institutions’ and financiers’ understanding of circular economy approaches and their understanding of potential risks of supporting linear business models. In addition, a well-structured technical assistance programme could accelerate the emergence of new competences and skills and create growing market opportunities for providers of circular economy advisory services. A useful example of this approach is a toolkit for policymakers led by the Ellen MacArthur Foundation, with the Danish Business Authority and the Danish Environmental Protection Agency as key contributors.[101] It is also worth reviewing examples to stimulate circular economy initiatives at the municipal level provided by the Finnish Innovation Fund – SITRA.[102]

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101 https://www.ellenmacarthurfoundation.org/assets/downloads/government/EMF_TFPM_FullReportEnhanced_11-9-15.pdf

102 https://www.sitra.fi/en/projects/interesting-initiatives-taken-municipalities-support-circular-economy/

Moving to the circular economy will require a significant increase in demand for finance to support circular economy businesses and products. The current volume of 'circular finance' is insufficient to support a transformation in how the value of materials is captured and preserved. While circular economy technologies and business models exist, they cannot reach the level of market penetration necessary to have impact on the operations of value chains. In order to transform value chains, companies with circular economy business models and products need to be able to access finance to scale up their operations. Access to finance must be available across all sectors, as the transformation to the circular economy must take the form of a systematic shift.

In the transitional period when the mainstream financial institutions are not fully willing or able to consider the potential of the circular economy and do not invest in circular economy projects, the objective is to ensure the access to finance to a growing number of businesses that develop viable projects; although they will require a specific approach for managing financial risks. Public finances that aim to stimulate national and regional economies, job creation, infrastructure development and environmental mitigation could be deployed in such a way that they also support the circular economy. Ideally this is done through suitable financial instruments that are designed with the circular economy in mind so that all important barriers and challenges to circular economy projects are considered in the design of the instrument.

For example, at the EU level, the provision of circular economy finance could be channelled through the new or existing instruments such as the EU InvestEU[103]. Specifically, a share of the EUR 38 billion InvestEU budget could be dedicated to circular economy investments. A combination of equity, guarantee and risk-sharing financial instruments could be introduced in InvestEU to target circular economy investments. The four windows of InvestEU all speak to the potential benefits of the circular economy. Therefore, a common proportion of each window could be dedicated to supporting the circular economy. This is promoted by the approach that determines the overall proportion of InvestEU for climate change and the environment, where 50 per cent of the sustainable infrastructure window must contribute to the EU's objectives on climate change and the environment, while a common 30 per cent target is applied overall.

If InvestEU finance for the circular economy follows this approach, where a common percentage of the fund's resources are dedicated to the circular economy, it should be done preferably as a dedicated allocation separate from the 30 per cent for climate change. Taking a cross-cutting approach to the allocation of circular finance across InvestEU's windows reflects the multi-sectoral realities of the circular economy, where its application cannot be defined solely within the label of sustainable infrastructure, innovation or SMEs.

The InvestEU circular economy funding would be disseminated through the instrument's designated implementing partners, namely the EIB group, national promotional banks and multilateral development banks. These institutions have both the capacity and the connections to local business communities to effectively deliver the circular economy finance to help companies apply or scale up their use of circular economy business models and technologies.

[103] https://europa.eu/investeu/home_en

Key Recommendations:

► *Establish a dedicated proportion of finance within selected financial instruments existing or planned in Georgia to support circular economy investments and businesses.*

The provision of circular economy finance could be channelled through new or existing financial instruments. A combination of equity, guarantee and risk-sharing financial instruments could be introduced to target circular economy investments. Funds or instruments for the circular economy would help to scale up finance for circular economy businesses and products. The budgetary guarantee and its contribution to equity investments and risk-sharing instruments would help to leverage additional external finance attracted to the decreased risk of investments. This would help to increase the market penetration of circular technologies and business models, with the goal of reaching a scale sufficient to have a meaningful impact on how supply chains operate and retain the value of materials. Businesses seeking finance for circular economy investments would also benefit from increased access to and availability of finance.

The circular economy plays a crucial role in helping companies and governments build back better from the Covid-19 pandemic. Financial institutions can support businesses to capture new growth opportunities and build resilience to future shocks. This is why many banks and funds are actively helping clients to transition to new circular economy models, financing circular deals and investments and strengthening the knowledge base in this area. While there are costs involved in this transition, the increased resilience gained should result in long-term material gains for everyone involved. The last two years have seen a steep increase in the creation of debt and equity instruments related to the circular economy. While no such fund existed in 2017, by mid-2020 ten public equity funds focusing partially or entirely on the circular economy have been launched by leading providers including BlackRock, Credit Suisse, and Goldman Sachs. Since 2016, there has been a tenfold increase in the number of private market funds, including venture capital, private equity and private debt, investing in circular economy activities. A similar trend is visible in bank lending, project finance, and insurance.

Existing examples provide early indications as to how the circular economy can create value for asset managers, banks, and other financial services firms. They demonstrate its potential to attract inflows. The circular economy can help meet demands from regulators and other stakeholders. In addition, building circular economy expertise and know-how can help financial institutions to engage with corporate clients, for whom the circular economy has increasingly become a boardroom topic.

Now is the time for finance to capitalise on this momentum and help accelerate the circular economy transition. While the recent growth in financing is promising, far more capital and activity will be needed to scale the circular economy and fully seize its opportunity. All aspects of finance will play an important role in bringing forward the transition to a circular economy. Investors, banks, and other financial services firms have the scale, reach, and expertise to stimulate and support businesses to make the shift. This is not just about investing in perfectly circular companies or divesting from extractive ones, but about engaging with and encouraging companies in every industry to make the transition. Some of the activities carried out bu the National Bank of Georgia and selected commercial banks can be conducive to acceleration of financing of circular economy projects.

Obviously, the key issue for the financial sector is risk and how it could be managed. When measuring risk, two main factors have to be taken into account:

- Creditworthiness of the borrower (or the risk profile of the project).
- Value of the collateral (e.g. underlying assets or contracts).

As discussed previously, new circular business often does not have a strong track record, these companies can easily be labelled as highly risky. Often initial investments to innovate and access the market are high, which may have implications for margins in the short run but may lead to a quite profitable company in the longer run. The value of the collateral is measured by the market value of the company, where the valuation of assets (and their residual value) plays an important role. Asset valuation in a linear system is quite different from valuation in a circular system. It is clear that the current development is an opportunity for many countries, including Georgia to create and shape the markets.

Key Recommendations

► *The Government of Georgia could consider scaling up the circular economy by setting direction, providing incentives, financing infrastructure and innovation, and using blended finance mechanisms to de-risk investments and attract private sector capital. This approach should be based on experiences of other countries to both follow their successes and avoid their mistakes.*

4.2.2 Recommendations to Non-Financial Policy Makers

Public fiscal, industrial, environmental and regional policies do not yet provide a clear societal goal for the circular economy and a coherent definition of the role of different actors and affected stakeholders in this regard. Typically, economic operators tend to avoid risks of disruption and defer costs of the initial changes that need to be made for the transition to the circular economy. They will continue in their 'business-as-usual' practices as long as price signals favour the linear model. From the perspective of the classical market theory, scarcity of resources will be solved through the economic mechanism of higher prices and therefore lower demand. But recent analyses of true price and true cost show that the price mechanism quite often results in non-optimal valuation, and therefore inefficiency in allocation[104]. One of the reasons is that markets fail to internalise externalities, especially if the consequences occur in the long run. These failures tend to be even stronger when property rights cannot be easily assigned to certain resources, like air or water. Some call this market failure, because of the limited responsibility of businesses. Others call it system failure, because only governments can be responsible for including external effects into price mechanisms. In the end, the impact remains the same: an optimal situation in the market economy can lead to a suboptimal situation in a broader societal and environmental perspective.

[104] 'A New Vision of Value: Connecting corporate and societal value creation' or Trucost, see www. trucost.com

In the case of the market failing to give correct price signals, public policy should provide the right incentives. While there is a positive development, public policy does not yet stimulate sufficiently changes in economic operators' behaviour. Most notably, the 'polluter-pays' principle is not properly applied in the form of a suitable market-based instrument to internalise externalities associated with the linear material consumption.

For the shift to a circular economy to occur, the following policy elements are missing:

- the metrics are insufficient for measuring the progress towards the circular economy at EU, national and regional level or within individual sectors and supply chains, and for helping with the risk assessment of linear versus circular approaches. For example, quantifying through material flow analysis has already provided data relevant to monitoring the circularity of an economy, and provides a useful baseline to allow comparison between different countries and to provide a metric to inform decisions on national targets of circularity. However, subsets of material flow data may also provide useful indicators - for instance, comparison of imports and exports of virgin raw materials and their scrap (for instance aluminium, steel); flows of specific substances or elements; levels of reuse and recycle; methods of disposal of waste; recycling indicators for separate waste types and elements; and industry/sector-specific indicators, for example construction/demolition waste recycling. Non-material measures are also relevant to the circular economy - particularly those associated with social change (e.g. sustainable consumption, growth of sharing, extent of reuse/repair) or changes in business models (e.g. making durable and repairable equipment, remanufacturing).
- the existing waste recycling and landfilling targets doubtlessly contribute to promoting material recycling. However, these are aggregated high-level national targets and often do not provide sufficient incentives for local authorities and waste producers (businesses and final consumers) to engage more strongly in achieving the targets and more generally in promoting the circular economy;
- instruments that could give clear price signals to economic operators and make secondary materials more competitive are lacking. On the contrary, there are still subsidies that reward the linear model, and the price of primary materials do not internalise negative environmental externalities;
- with the exception of some products, the extended producer responsibility (EPR) principle is not applied to the full extent in support of the circular economy. For example, most countries concentrate on packaging, waste electrical and electronic equipment (WEEE), end-of-life vehicles (ELV), batteries and accumulators (B&A), waste oils and graphic papers, while food processing/agribusiness is only randomly considered. The responsibility of dealing with the collection and disposal of many end-of-life products and materials is allocated to public authorities and not to their producers, which is against the 'polluter-pays' principle;
- in many countries, a significant proportion of recyclable materials is still either landfilled or incinerated due to a lack of proper economic incentives for their separation and segregated collection at source, thus leading to the loss of valuable resources;
- performance criteria and benchmarks for materials and products are absent: many products are still designed as single use, disposable, and non-recyclable and include hazardous substances, which prevents upcycling, reuse, or recycling. Many of these

products enter markets without any barrier or price disadvantage. Information on circular aspects of products is not available for downstream clients and consumers.

Policy makers have many tools in hand to address these policy gaps, change the perception, attitudes and behaviour of economic actors, and set rules and requirements for products on the market in order to accelerate the transformation to a circular economy. Both at national and regional level, the policy framework needs to be updated and, if necessary, transformed in order to have a coherent and comprehensive set of environmental, fiscal, industrial, and regional development policies. In this way, policy makers can stimulate economic operators to consider circular economy approaches and business models, and apply them.

Key Recommendations

- *Develop metrics and indicators to complement the existing in Georgia macroeconomic indicators adopted at national level, in order to measure, monitor and benchmark the circular economy performance also at regional, local, sector and corporate level. Circular economy indicators should become a mainstream part of statistical reporting. The new indicators should, as much as possible, build on and complement the existing statistical and reporting systems.*[105]

- *Consider setting targets using suitable indicators, possibly developing a cascade system of national, regional and sectoral targets. Where mandatory targets are not politically feasible, set non-binding aspirational targets that can serve as a basis for voluntary agreements with industries and/ or facilitate the emergence of market-based compliance instruments. These new targets need to be reviewed in relation to exiting commitments and obligations, and need to pursue a growing level of ambition not only in terms of quantities but also in terms of quality, e.g. targets for the quality of secondary materials.*

- *Map where national fiscal policies in Georgia provide subsidies and price signals in favour of the linear economy. On this basis, set in motion a process of reviewing and removing linear economy subsidies to create a level playing field for the circular economy. Consider fiscal incentives for the sustainable management of materials and products with a circular design, e.g. through VAT.*

- *Expand the scope of EPR schemes, currently under implementation in Georgia, to additional products in order to raise funds for the waste collection and recycling of these products. Analyse where the existing EPR systems need to be modified in order to favour the production of high-quality secondary materials, e.g. via modulated fees. More importantly, use EPR schemes to encourage innovative business models with growing levels of circularity which aim at increasing the integration of materials loops.*

- *Consider setting ambitious national target dates for ending landfilling. Reduce landfilling and incineration by applying increasing taxes on these activities and using revenues from these taxes to fund the development of separate waste collection and management systems. It is*

[105] https://www.ellenmacarthurfoundation.org/resources/apply/circulytics-measuring-circularity

important to calibrate taxes well and accompany them with policy measures to increase the demand for recycled materials, so that waste diverted from landfills and incinerators is recycled and used as secondary raw materials.

- *Develop benchmarks for circular aspects of product performance, including benchmarks for durability, reparability, recyclability, minimum recycled content and hazardous substances content, and apply these benchmarks to remove underperforming products from the national market (e.g. via implementing measures such as those stipulated by the EU Eco-design Directive that extend to non-energy related products). Stimulate the adoption of high-performance products through fiscal and 'reputational' incentives (e.g. reduced VAT, eco-labels). Make the information about circular aspects of products available in business to business and business to consumers transactions through product information requirements (e.g. the product passports) or publicly accessible databases.*

- *It is also recommended to conduct checks and revisions of existing and planned relevant sectoral policies which may conflict with the objectives and actions described above. Contradicting policy provisions could introduce a bias in favour of the linear economy and reduce the effect of policy interventions which support long-term circular economy objectives.*

A policy framework, consisting of coherent sectoral policies, creating a level playing field and additional stimuli for the circular economy, will greatly reduce the risk associated with circular economy projects. Businesses and their investors will understand the long-term policy objectives. A clear regulatory environment providing certainty about regulatory requirements for products and their environmental performance will gradually ensure that circular projects are able to compete with linear ones. The reduced market and policy risks will reduce financial risks of circular economy projects, thus making them more bankable.

When the market and regulation fail to generate favourable conditions for the transition to the circular economy, public authorities can play a critical role as facilitators of change. They may have the best information to identify the potential for the circular economy at different regional scales. They have the ability to bring together potential circular business partners who do not normally interact on the market. They can use public funds to create revenues for circular economy projects, as such funds can help achieve public objectives, e.g. through public procurement. Public authorities currently rarely assume this facilitating role despite their unique position. Often, public authorities are not aware of their potential role, or may not have sufficient technical and human capacity and political support. Public tenders are usually focused on the procurement of new assets which exclude reused and upcycled materials and products. Public tenders are typically focused on price, not on the total cost of ownership/total cost of use, and do not include 'externalities' including end-of-life, disposal costs.

Public authorities at all levels should realise their unique position to influence the transition to a circular economy. They should invest in building capacity both internally and externally within areas under their administration to enable and support circular economy projects. Promoting an organisational culture of 'circular economy enablers' will support the introduction of innovative models of public governance that stimulate the circular economy and improve service to the public.

Key Recommendations

- *Undertake analyses of circular economy potential in Georgia at the local, regional and national scales including major material flows, industrial capacities and new business models. Develop regional and national circular economy strategies that include collaboration with other countries and regions; on the regional level, ensure that regional authorities include circular economy opportunities in their smart specialisation strategies. Provide information to the business sector to make it easier for businesses and especially SMEs to exploit the potential of the circular economy.*

- *Link the circular economy to other societal challenges and transitions, such as climate change in order to create a coherent strategic environment for businesses and facilitate synergies across different public initiatives. As an example, public authorities can promote the introduction of advanced collection, sorting and recycling technologies, efficient materials processing technologies and production methods that support the integration of increasing circularity within new and existing business models, and they can facilitate the creation of new types of expertise and jobs. The positive externalities (reduced greenhouse gas emissions, electricity from renewable resources, etc.) should be recognised, favoured and rewarded. In turn, the circular economy can help improve the sustainability of the 4th industrial revolution and its acceptance by society.*

- *Create collaborative and interactive platforms for closer connections between businesses that normally do not interact on the market. Develop innovative forms of collaboration within and between value chains and innovative ways of sharing costs and benefits of circular economy projects between companies who otherwise have no market incentive to collaborate. Act as a guarantor if the risk for individual companies of being engaged in circular projects is too high. A good example is the Platform for Accelerating the Circular Economy (PACE) which is a public-private collaboration platform and project accelerator. PACE currently includes over 40 committed partners who are leading a portfolio of projects. Project focus areas include plastics, electronics, food & bioeconomy and business model and market transformation across China, ASEAN, Europe and Africa.*[106]

- *Introduce circular economy approaches in the public sector, e.g. by applying circular business models in public enterprises.*

- *Allocate public funds to circular projects that bring significant benefits to the community to ensure that these projects materialise and are financially viable. This may include direct payments for public services but also indirect support such as guarantee schemes.*

- *Stimulate demand and create new markets for circular products and services through Green Public Procurement. Apply lessons learned from experiments in the past and experience of other countries (e.g. green deals on circular procurement in Flanders and the Netherlands)*[107].

[106] http://www3.weforum.org/docs/WEF_PACE_Platform_for_Accelerating_the_Circular_Economy.pdf

[107] https://www.inno4sd.net/green-deal-for-circular-procurement-in-the-netherlands-434#:~:text=To%20stimulate%20the%20circular%20economy,arrangements%20inspired%20by%20circular%20principles.

The national and regional authorities have a key responsibility in creating national and regional circular economy strategies and linking them to national and regional industrial development and innovation strategies. National, regional and local authorities will also play a critical role in developing innovative governance models and tools to facilitate circular economy collaboration between sectors and businesses. All public authorities who spend public funds through public procurement can play a role in creating markets for circular products. All public sectors with substantial annual spending, e.g. infrastructure, health and education, should introduce circular economy procurement policies.

If public authorities and organisations assume the role of enablers, they can create conditions for scaling up markets for circular economy products and services. Their intervention can also reduce the risk that goes with circular economy projects and make projects financially viable. The involvement of an organisation with a statutory role can by itself provide more certainty about the quality or viability of the project. Financial commitments by a public organisation may provide certainty for financial revenues from the project and public procurement contracts typically present a lower risk of non-payment, which in turn facilitates access to finance and reduces risk for investors. Public enterprises whose objective is to deliver public service may be more open to circular economy projects because they look for long-term sustainability rather than any short-term maximisation of profit.

4.2.3 Policy Barriers and Enablers

Although increasing numbers of companies have begun their journeys towards circularity, a more widespread implementation of circular business models is needed. To facilitate this process, it is important to identify in Georgia what can support circular economy business model implementation and what, instead, represents a barrier to such a process. Public sector policy makers play an important role in developing policies which direct the private sector towards business transformation. As such, policy enablers, barriers and recommendations, both at national and local levels, can inform the transition from linear to circular business models. This section of the Report identifies key enablers and existing and potential barriers and provides top level recommendations to better utilise the enablers and overcome the barriers.

From the national and local policy perspective, **important enablers are**:

- **Governmental Circular Economy priorities in developing smart specialization strategies.** Through partnerships between public institutions, businesses and research institutions, national smart specialization strategies aim at supporting sustainable and inclusive growth. By including the transition to a circular economy as a priority in these national strategies, national and local authorities can promote innovation in favour of circular business models.
- **Multi-stakeholder platforms.** Government and other policy making bodies should collaborate with universities and industry associations in conducting relevant research. Thanks to additional collaboration with businesses and citizens, policies and projects can be viewed from both private and societal perspectives, allowing value to be maximized for all.

- **Citizen engagement and individual level of awareness.** The active participation of citizens is essential in pushing local sustainability agendas forward. Citizen bottom-up initiatives in favour of a circular economy contribute to achieving the systemic change needed for circular business transformation to occur.
- **Plans and targets.** For example, climate plans and carbon neutral targets, especially at city level, to guide local council efforts.
- **Engagement in policy development.** Bottom-up approach to policy development that leads to greater social engagement. Policies in favour of key national clusters to foster cooperation and innovation by promoting the agglomeration of economic entities collaborating towards circularity.
- **Awareness raising.** Awareness raising campaigns, possibly focused on action-based initiatives (clean-up activities, hands-on workshops, etc.).
- **Dedicated support.** Encouragement of local artisans to promote reusing and repairing of materials/goods (e.g. supporting cobblers, tailors, etc.).

Key policy barriers include:

- **Taxation and regulatory barriers to the use of secondary raw materials.** Market-based incentives supporting the transition towards circularity are lacking. Most importantly, due to current taxation patterns, virgin raw materials are often cheaper than secondary ones, weakening incentives to engage in business transformation. Other than costs, regulations also get in the way of using secondary raw materials.
- **Absence of integrated recycling plan.** Many countries, including Georgia have no integrated recycling plans. The development of such a plan would allow for the collection of sufficient waste volumes required for efficiency to be achieved.
- **Prices.** Externalities not being included in cost-benefit analysis, meaning environmentally-damaging products are relatively cheap. Lack of distinction in regulations between circular and non-circular businesses (e.g. double tax for upcycled products).
- **Piecemeal approach.** Lack of a holistic approach to circular economy initiatives (e.g. reused products do not diminish recovery targets).
- **Public procurement led by financial criteria.** Public procurement decisions are based predominantly on financial criteria, often without consideration of the environmental costs associated with linear business models. Given their important contribution to an economy's Gross Domestic Product (GDP), by not shifting demand from 'traditional' to 'circular' goods, local authorities do not contribute to incentivizing the shift of businesses to circular business models.
- **Poor waste management legislation.** Poor and inconsistent legislation concerning waste management represents a barrier for the achievement of a circular economy. In the absence of strong and consistent legislation, the risk occurs of having to face the inefficient high costs associated with the recycling of mixed waste, which ultimately reduces the residual value of recycling.
- **Lack of mandatory goals around circular targets.** In addition to the lack of specific measurements enabling firms to assess their circularity progress, precise mandatory goals

are missing. Setting clear, mandatory objectives can help project promoters in implementing projects linked to circular economy.

- **Generally weak policy support.** Changing priorities due to electoral/political cycles. Policies not allowing to take residual value into consideration for circular economy business models.
- **Poor policy communication and enforcement.** Lack of transparency in collective schemes, as well as of information and statistics of collecting systems.
- **Poor infrastructure, economies of scale.** Lack of infrastructure constraining individuals' ability to engage in pro-environment behaviour and possibilities for circularity to emerge.
- **Legal barriers.** Legal barriers to making new products from waste streams. Procurement laws based on ownership challenging circular economy business models (i.e. leasing).

Many recently carried out surveys[108] indicate that strengthening local governmental policies to support the widespread implementation of circular business models through, among other things, setting quality standards for recycled and reused materials, or by pushing for innovative initiatives brings quick and measurable results. Further work is required to ensure circular business models become the best option for companies willing to gain competitive advantage and maintain their market share while aligning their goals with society's goals. Since the adoption of the EU Action Plan for the Circular Economy in 2015, changes in favour of circularity have been numerous and impressive in many countries both EU Member States and others. Yet, barriers both at the company level and along the value chain, as well as from a policy perspective persist. Overcoming these obstacles and seizing existing opportunities is key for the transition towards a more sustainable and competitive economic model.

A review[109] of various national, regional and local strategies to enable the transition to the Circular Economy identified synergies, differences and skills gaps which require actions and mitigating measures. These have been summarised in Table 4.2-1.

[108] Stakeholder Views Report Enablers and Barriers to a Circular Economy by R2pi http://www.r2piproject.eu/wp-content/uploads/2018/08/R2pi-stakeholders-report-sept-2018.pdf

[109] Circular economy strategies and roadmaps in Europe: Identifying synergies and the potential for cooperation and alliance building https://www.eesc.europa.eu/sites/default/files/files/qe-01-19-425-en-n.pdf

Table 4.2-1 Summary of Public Sector Skills Gap and Mitigation Measures

Public Sector Skills Gap	Mitigation Measures
Information and Awareness	
Insufficient awareness of the role of public authorities to promote CE	• Invest in building capacity both internally and externally within areas under their administration to enable and support CE projects • Contribute to the formation and strengthening of collaborative CE communities, partnerships and networks ('Communities of Circular Economy Practice') within economic sectors, value chains and regions as a means of increasing the knowledge base and sharing experiences on CE policy, strategy, business models and projects
Insufficient inclusion of CE principles in the national curriculum and other public information programs	• Policy makers could consider how existing educational and information programs can be improved to provide individuals with a better understanding of the unintended consequences of their consumption choices.
Lack of advisory capacities to assist businesses, in particular SMEs	• Establish technical and financial advisory services to support the development of business models for CE businesses or projects seeking finance that effectively capture and articulate the benefits of CE strategies
Regulatory Framework	
Lack or insufficient regulatory framework supporting CE	• Remove subsidies and internalize externalities of linear economic activities • Introduce Green Procurement Rules • Develop reporting standards for linear risks of investments • Provide a common set of principles for companies to prepare and publish their financial statements
EPR principle does not exist or is not applied to the full extent in support of the circular economy	• Expand the scope of EPR schemes to additional products in order to raise funds for the waste collection and recycling of these products • Analyse where the existing EPR systems need to be modified in order to favour the production of high-quality secondary materials, e.g. via modulated fees • Use EPR schemes to encourage innovative business models with growing levels of circularity which aim at increasing the integration of materials loops

Public Sector Skills Gap	Mitigation Measures
Unclear definition of CE	• Develop taxonomy of CE activities and benchmarks for their environmental performance
Taxonomy, Standards and Targets	
Insufficient metrics to measure progress towards CE	• Develop metrics and indicators to complement the existing macroeconomic indicators adopted at national level, in order to measure, monitor and benchmark the CE performance also at regional, local, sector and corporate level
Lack or insufficient provision within public financial instruments to promote CE	• Review the rules and priorities of the existing public funds and establish a dedicated proportion of finance within selected financial instruments to support CE investments and businesses.
Lack of unified standards for Eco-Design	• Develop benchmarks for circular aspects of product performance, including benchmarks for durability, reparability, recyclability, minimum recycled content and hazardous substances content • Stimulate the adoption of high-performance products through fiscal and 'reputational' incentives (e.g. reduced VAT, eco-labels). • Make the information about circular aspects of products available in business to business and business to consumers transactions through product information requirements (e.g. the product passports) or publicly accessible databases. • Develop reliable and standardised environmental and social impact assessment methods and tools applying systemic and life-cycle approaches
Insufficient application of CE principles to public investments	• Introduce circular economy approaches in the public sector, e.g. by applying circular business models in public enterprises • Allocate public funds to circular projects that bring significant benefits to the community to ensure that these projects materialise and are financially viable. • Stimulate demand and create new markets for circular products and services through public procurement.
Waste recycling and landfilling targets are insufficient to promote CE activities at regional and local levels	• Consider setting targets using suitable indicators for national, regional and sectoral targets.

Public Sector Skills Gap	Mitigation Measures
Insufficient co-ordination between various regulatory authorities and governing bodies	• Establish a coordinating function at a high level to ensure coherent and consistent approach. Conduct checks and revisions of existing and planned relevant sectoral policies which may conflict with the objectives and actions of CE approaches.
Coordination and Partnerships	
Insufficient mapping of CE potential	• Undertake analyses of CE potential at the local, regional and national scales including major material flows, industrial capacities and new business models. • Develop regional and national CE strategies that include collaboration with other countries and regions. • Ensure that regional authorities include CE opportunities in their smart specialisation strategies. • Provide information to the business sector to make it easier for businesses and especially SMEs to exploit the potential of the CE.
Insufficient coordination with other policies	• Link the circular economy to other societal challenges and transitions, such as climate change in order to create a coherent strategic environment for businesses and facilitate synergies across different public initiatives. • Promote the introduction of advanced collection, sorting and recycling technologies, efficient materials processing technologies and production methods that support the integration of increasing circularity within new and existing business models, and they can facilitate the creation of new types of expertise and jobs.
Lack or insufficient work through partnerships	• Create collaborative and interactive platforms for closer connections between businesses that normally do not interact on the market. • Develop innovative forms of collaboration within and between value chains and innovative ways of sharing costs and benefits of CE projects between companies who otherwise have no market incentive to collaborate. • Act as a guarantor if the risk for individual companies of being engaged in CE projects is too high

4.2.4 Summary of Key Recommendations

Table 4.2-2 Summary of Key Recommendations

Recommendation	Expected Results
Characterise circular economy projects through metrics and taxonomy	Definitions, metrics and taxonomy will enable better assessment of circular risks versus linear risks. Also, social and environmental benefits of the circular economy should become explicit, quantifiable and disclosed, and should be taken into account in financing decisions.
Promote and clarify the enabling role of public authorities	Public authorities, on all levels, can provide incentives to promote circular economy models via, for example, public procurement, subsidies, taxation and funding. They have the legitimacy and means to reward positive externalities. Work also has to be undertaken to set circular economy performance requirements for products and services.
Build capacity to make the transition to a circular economy	Public authorities and project promoters play an important role in creating circular business. The principal objective should be to succeed in correctly identifying, conceptualising and developing circular business models and projects that are both sound and bankable, and congruent with a long-term development vision and strategy for the transition to a circular economy. Awareness-raising both at the level of internal organisations and external stakeholders (including the value chain network) is crucial in this context. They can advise and improve the economic viability and bankability of projects; and visualise collaborative arrangements within the supply chain.
Ensure cooperation and coordination between governing bodies	Weak policy coordination remains a common feature across countries. At governmental level, responsibility for the areas of policy relevant to circular economy tends to be distributed across more than one ministry. The country studies[110] indicate that processes to facilitate systematic policy coordination across ministries are rare. In general, coordination tends to occur for specific purposes, with inadequate monitoring and follow-up. There continue to be weak links in the chain from environmental policies down to the level of skills and training. Ministries dealing with education and training and employment are weakly represented in policy-making on climate change and environment. Often, existing decision-making structures and processes do not deal effectively with cross-ministerial topics. Better coordination and cooperation between governing bodies would result in addressing the above issues.
Ensure appropriate level of partnership	Policy coordination requires involvement of stakeholders outside government. The importance of involving private-sector stakeholders, both employers and workers, in policy decisions and in the design of skills development measures is essential.

[110] https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---ifp_skills/documents/publication/wcms_709121.pdf

Below diagram provides a summary of the key steps which national and local governments need to undertake in the process of development of policies conducive to the implementation of the circulatory measures.

Step 1: Align on starting point, ambition and focus

- A simplified baselining exercise could eliminate quantitative benchmarking of resource efficiency and/or circularity metrics. It could also limit the policy surveying effort – especially where very few policies are known or suspected to be in place.
- Sector selection could be achieved without quantitative economic analysis, instead taking the country's priority sectors, regardless of their resource and/or GDP impact – it being unlikely that the GDP impact of a priority sector would be negligible. A qualitative review of the resource profile might be included, but such a profile matters less if, for instance, the aim is to use circular economy principles to render sectors more competitive in other ways than limiting raw material imports (e.g. by shifting to larger share of services), or if the proposed outcome is to create more employment.

Step 2: Assess sector circular economy opportunities

- Mapping and prioritising circular economy opportunities in each sector could be simplified by referring to existing inventories and reports to get a quick overview of relevant possibilities.
- One of the biggest analytical tasks, assessing the various impacts of the selected levers, could be reduced by relying more on standard impact assessment figures taken from other studies. At least a minimum of localisation is necessary, i.e. to consider whether the inventoried levers would be similarly attractive and feasible in the country under study. Local factors to take into account when considering the inventoried levers include different starting points (e.g. organics recovery may be an important part of an otherwise underdeveloped waste management system), different industry structures and different access to (export) markets.

Step 3: Analyse national and policy implications

- Instead of quantifying national economy-wide impact through macroeconomic computational general equilibrium modelling, policymakers could choose to use partial equilibrium sector-level modelling and/or rely on existing studies assessing the national economy-wide impact.
- Policymakers could decide to rely on informal assessments of policy impact, cost and political feasibility, such as stakeholder consulting methods – or use assessment methods more commonly deployed in their territory.

Figure 4.2-1 Key steps and timing for the development of a Road Map for policies targeting the change to more circular economies.[111]

[111] Steps 1 and 2 have been largely accomplished through the CE mapping presented in this report

Short Term	***Medium Term***	***Long Term***
• Prepare implementation of policy packages to support 1-2 ‘quick win’ sector opportunities: - Conduct further consultation with businesses and other stakeholders - Conduct detailed policy cost-benefit and feasibility analysis - Gather political support for policy intervention • Investigate which economywide policy options and potential sector packages could be implemented at a later stage	• Implement selected ‘quick win’ opportunities; track progress and adapt implementation as needed • Building on momentum of ‘quick wins’, prepare implementation of (and start implementing) 2-3 economy-wide policy options and potential sector packages	• Continue implementation, track progress and adapt implementation as needed • Assess overall program success and determine next steps

Figure 4.2-2 Example of Policy Implementation Roadmap

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82. Zeng, Mathews and Li. ‘Urban Mining of E-Waste is Becoming More Cost-Effective Than Virgin Mining.’ Environmental Science and Technology. 52, 8, 4835-4841.

ANNEXES

Annex 1. Co-ordinating Panel of the Government of Georgia

No	Name	Entity	Position
The Ministry of Environmental Protection and Agriculture of Georgia			
1.	Solomon Pavliashvili	Ministry	Deputy Minister
2.	Alverd Chankseliani	Ministry	Head of Waste and Chemicals Management Department
3.	Davit Markozashvili	Ministry	Advisor of the Minister
4.	Irma Gurguliani	Ministry	Head of Waste and Chemicals Management Department
5.	Lasha Inauri	Ministry	Head of Department of International Affairs and European Integration
6.	Nino Chikovani	Ministry	Head of the Division for Land Resources Protection of the Department of Hydroamelioration and Land Management
7.	Karlo Amirgulashvili	Ministry	Head of the Biodiversity and Forestry Department
8.	Nino Tkhilava	Ministry	Head of the Environment and Climate Change Department
9.	Ekaternine Zviadadze	Ministry	Head of Policy and Analytics Department
10.	Ilia Tamarashvili	Non-Entrepreneur (Non-Commercial) Legal Entity Rural Development Agency	Director
11.	Vasil Basiladze	LEPL National Food Agency	Deputy Chief
12.	Tamar Aladashvili	LEPL Environmental Information and Education Centre	Director
13.	Nodar Khatiashvili	LEPL Scientific-Research Center	Deputy Director
14.	Mariam Chachua	Ministry	Assistant of the Deputy Minister
The Ministry of Finance of Georgia			
15.	Pridon Aslanikashvili	Ministry	Deputy Head of Macroeconomic Analysis and Fiscal Policy Planning Department
16.	Shota Gunia	Ministry	Head of Fiscal Risk Management Division
The Ministry of Economy and Sustainable Development of Georgia			
17.	Salome Mekvabishvili	Ministry	Head of Strategic Development Department
18.	Vakhtang Tsintsadze	Ministry	Head of Economic Analysis and Reforms Department
19.	Davit Advadze	Ministry	Acting Head of Sustainable Development Division

No	Name	Entity	Position
20.	Zaza Chikhradze	Ministry	Head of Energy Reforms and International Relations Department
21.	Tatia Berekashvili	Ministry	Deputy Head of Construction Policy Department/ Head of Legal Regulation of Construction Activity
22.	Medea Janiashvili	LEPL Georgian National Tourism Administration	Acting Head
23.	Nana Zamtaradze	LEPL National Agency of Mines	Acting Head
24.	Mikheil Khidureli	LEPL Produce in Georgia	Director
The Ministry of Regional Development and Infrastructure of Georgia			
25.	Vakhtang Baramia	Ltd Solid Waste Company of Georgia	Deputy Director
26.	Maka Goderdzishvili	Ltd United Water Supply Company of Georgia	Head of Environment Protection and Permits Department
27.	Davit Kalatozishvili	Ministry	Deputy Head of European Integration Department
28.	Nikoloz Rosebashvili	Ministry	Head of Local Self-Governance Development and Policy Department
The Ministry of Education and Science of Georgia			
29.	Mindia Okujava	Ministry	Acting Head of Science and Technology Division of Higher Education and Science Development Department
The Parliament of Georgia			
30.	Nana Gogitidze	Environmental Protection and Natural Resources Committee	Chief Specialist
31.	Marina Metreveli	Sector Economy and Economic Policy Committee	Lead Specialist
Tbilisi City Hall			
32.	Ekaterine Khajavelidze	Municipal Department of Environment Protection	Specialist
33.	Khatia Chkhetiani	International Projects and Waste Management Division	Consultant
Batumi City Hall			
34.	Tamta Tavartkiladze	Municipal Policy Division	Chief Specialist
National Statistics Office of Georgia			
35.	Lia Dzebisauri	National Statistics Office of Georgia	Deputy Executive Director
Office of the Business Ombudsman of Georgia			
36.	Davit Kochiashvili	Office of the Business Ombudsman	Legal Expert of the Office

Annex 2. Additional Data for Annual Crop Production Sector

Table 1. Sown areas of winter and spring crops (ths. hectares) during 2006-2022

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021*
Sown area, total	330.2	297.2	329.3	289.7	256.7	262.4	259.6	310.7	274.9	263.7	240.0	220.3	207.1	203.0	209.9	212.1
Of which:																
Winter crops (wheat, barley)	76.6	55.0	58.6	60.5	58.8	50.8	54.1	52.5	58.4	56.2	60.5	53.6	54.5	53.8	59.4	64.3
Spring crops	253.6	242.2	270.7	229.2	197.9	211.6	205.5	258.2	216.5	207.5	179.5	166.6	152.7	149.2	150.5	147.8
Of which:																
rain and leguminous crops (wheat, barley, rye, oats, maize, pulses)	150.8	151.0	176.9	156.3	132.6	140.6	132.8	183.8	154.6	142.7	119.5	108.3	98.8	98.6	102.1	100.6
Maize	129.1	125.5	146.2	130.1	108.6	121.2	114.8	150.4	129.1	114.1	95.5	84.8	72.8	74.7	82.4	79.4
Potato, vegetables and melons	56.4	58.9	54.8	44.3	48.3	45.3	52.6	48.6	41.2	43.8	38.9	37.0	34.3	32.1	31.5	30.8
Other crops	46.4	32.3	39.0	28.6	17.0	25.7	20.1	25.8	20.8	21.0	21.1	21.3	19.6	18.5	16.9	16.4

* Preliminary data.

The sown area of winter crops includes the area under winter crops sown in autumn of the previous year, which are to be harvested in the current year.

The final data of 2021 will be available on June 15, 2022. The preliminary data of 2022 will be available on April 15, 2023, while the final data of 2022 will be available on June 15, 2023.

The discrepancy between the totals and the sum in some cases can be explained by using rounded data.

Note: The main source of sample frame for 2006-2015 years of surveys was Agricultural Census 2004. The sample frame for 2016-2022 years of survey has been updated and is based on Agricultural Census 2014. Consequently, in order to ensure comparability of data of 2014-2022 years, reconciliation of the data has been made for the years of 2014 and 2015. Therefore, the data of 2014-2022 years are not comparable to the data of 2006-2013 years.

Table 2. Production of annual crops (ths. tons) during 2006-2021

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021*
Wheat, total	69.7	74.9	80.3	53.9	48.4	96.8	80.7	81.0	47.5	125.6	126.6	97.9	107.1	100.6	102.4	136.1
Of which:																
Winter wheat	-	-	-	-	-	-	-	-	-	-	121.0	93.5	100.1	94.8	96.6	128.6
Spring wheat	-	-	-	-	-	-	-	-	-	-	5.6	4.3	7.0	5.8	5.8	7.5
Barley, total	30.6	40.3	49.3	19.9	23.3	30.3	20.7	35.0	26.7	40.9	47.2	43.9	57.7	53.5	45.4	58.3
Of which:																
Winter barley	-	-	-	-	-	-	-	-	-	-	26.4	23.3	34.3	28.2	25.7	38.8
Spring barley	-	-	-	-	-	-	-	-	-	-	20.8	20.6	23.4	25.2	19.7	19.5
Oats	1.3	1.6	2.9	4.2	2.0	0.7	1.6	3.4	5.1	5.1	6.5	3.7	4.7	3.0	2.3	3.2
Maize	217.4	295.8	328.2	291.0	141.1	269.6	267.0	363.9	291.6	184.6	243.7	142.5	194.2	207.1	255.0	233.0
Haricot Beans	7.6	10.5	11.6	10.2	5.8	8.9	9.6	10.5	7.6	5.5	5.8	5.7	5.8	5.9	5.2	4.2
Sunflower	12.3	16.1	15.1	2.3	2.6	4.0	3.0	8.6	1.6	4.3	3.2	2.2	3.0	2.6	1.9	2.1
Potato	168.7	229.2	193.4	216.8	228.8	273.9	252.0	296.6	215.3	186.5	249.0	180.1	237.5	194.7	208.6	235.1
Vegetables, total	179.7	190.3	165.0	170.3	175.7	185.8	198.5	204.8	153.6	152.3	141.7	125.9	142.2	161.1	176.1	149.0
Of which:																
Cabbage, floral cabbage, broccoli	35.5	34.3	41.9	39.6	27.1	35.2	34.5	26.0	19.3	21.8	19.7	17.4	18.5	29.3	29.5	20.9
Greens	8.0	7.4	5.2	8.3	9.1	11.4	10.1	12.7	7.9	13.4	7.7	7.9	7.4	7.5	6.7	8.5
Tomato	69.9	80.2	62.6	51.4	56.0	61.6	63.9	75.0	54.9	58.1	54.1	49.9	51.7	62.6	69.5	56.8
Cucumber	19.4	20.3	18.6	30.9	28.6	25.5	38.7	31.5	24.3	22.2	18.7	23.0	33.0	30.4	32.8	30.4
Green beans	-	-	-	-	-	-	-	-	-	-	4.5	2.9	3.5	3.9	4.5	4.3
Eggplant	11.6	13.0	5.1	10.2	11.4	11.2	10.6	6.7	7.2	4.5	4.2	2.6	3.7	4.4	4.1	3.0
Pepper	4.6	4.3	5.8	3.2	3.3	5.6	3.8	4.0	4.6	2.6	5.2	4.8	5.8	7.1	8.2	7.6
Red beet	3.5	10.9	3.1	3.6	4.3	3.4	6.6	7.7	4.1	4.3	2.5	2.1	2.1	2.3	3.7	4.4
Carrot	1.2	2.8	5.6	4.1	5.5	8.5	2.9	9.9	4.9	2.6	1.8	1.2	1.9	1.2	1.6	1.5
Onion (dry)	16.0	12.1	11.1	10.2	19.0	14.6	17.8	17.0	16.5	12.8	18.5	9.1	8.9	8.9	11.6	8.4

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021*
Garlic	3.0	3.1	2.3	2.4	5.7	5.0	5.7	7.2	6.0	5.5	2.9	3.5	4.6	2.1	2.7	2.3
Other vegetables	7.0	1.9	3.7	6.4	5.7	3.8	3.9	7.1	4.1	4.6	1.9	1.5	1.1	1.4	1.1	1.0
Melons	37.8	73.5	52.8	43.7	40.9	42.8	36.7	66.4	86.1	72.5	72.8	80.1	70.2	79.9	83.6	83.6
Of which:																
Watermelon	-	-	-	-	-	-	-	-	72.5	60.7	60.0	68.0	57.4	67.6	71.3	...
Melon	-	-	-	-	-	-	-	-	9.9	9.6	9.6	9.0	8.2	9.1	9.0	...
Pumpkin	-	-	-	-	-	-	-	-	3.6	2.1	3.2	3.1	4.5	3.3	3.3	...
Hay of annual grasses	26.5	20.5	5.0	14.6	11.2	18.1	5.0	2.7	5.9	9.4	5.9	7.4	9.2	10.0	10.4	16.4
Hay of perennial grasses	25.8	8.8	30.2	23.0	25.9	48.5	31.9	38.4	35.6	51.8	49.2	48.9	49.9	45.7	41.0	33.9

* Preliminary data. The final data of 2021 will be available on June 15, 2022.

"-" The data is not available due to small sample size of the survey. Survey sample size has been increased since 2016.

"..." The data of 2021 will be available on June 15, 2022.

The discrepancy between the totals and the sum in some cases can be explained by using rounded data.

Note: The main source of sample frame for 2006-2015 years of surveys was Agricultural Census 2004. The sample frame for 2016-2021 years of survey has been updated and is based on Agricultural Census 2014. Consequently, in order to ensure comparability of data of 2014-2021 years, reconciliation of the data has been made for the years of 2014 and 2015. Therefore, the data of 2014-2021 years are not comparable to the data of 2006-2013 years.

Table 3 The main indicators of cold storage facilities

	2014	2015	2016	2017	2018	2019	2020	2021 Q I	2021 Q II
Number of Customers, which were provided by service, Total (Unit)	1,089	1,915	1,974	478	654	516	524	243	299
The number of producers and/or resellers, from whom the product was purchased, Total (Unit)	267	226	277	353	372	359	673	307	254
Average monthly number of persons employed (Unit)	844	1,168	1,279	1,062	907	994	1,497	1,086	1,263
Refrigerator's annual cost, except remuneration of personnel (Gel)	...	11,643,589	8,068,292	6,125,854	8,246,706	5,234,919	7,187,874	...	...
Number of cameras in the refrigerator (Unit)	222	363	365	379	434	401	610	...	...
Capacity of cameras in the refrigerator (m3)	99,587	96,971	102,491	108,893	154,878	162,478	205,975	...	...

Table 4 The main indicators of elevators

	2014	2015	2016	2017	2018	2019	2020	2021 Q I	2021 Q II
Number of customers, which were provided by service, Total (Unit)	361	130	133	42	16	31	43	10	43
The number of producers and/or resellers, from whom the product was purchased for the further realization, Total (Unit)	80	67	88	102	108	143	247	94	101
Average monthly number of persons employed (Unit)	1,379	995	1,055	1,087	1,091	957	932	912	783
Elevator's annual cost, except remuneration of personnel (Gel)	...	985,040	1,055,788	2,631,384	3,472,755	2,815,024	2,472,095	...	...
Capacity of storages (m3)	167,722	231,331	246,566	318,032	325,172	350,252	343,915	...	...
Dryer's volume (m3)	6,874	7,035	7,090	7,344	7,650	6,700	25,359	...	...

Annex 3. Additional Data for Permanent Crop Production Sector

Table 1. GEOSTAT data on Production of permanent crops (ths. tons) in 2006 - 2021

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021*
Pome fruit	**56.4**	**122.4**	**59.1**	**94.1**	**35.3**	**82.9**	**62.2**	**87.9**	**97.4**	**37.9**	**77.1**	**25.8**	**93.3**	**52.7**	**102.1**	**85.6**
Of which:																
Apple	32.8	101.3	41.5	80.7	21.1	64.3	45.0	68.6	82.3	25.7	65.2	19.7	82.7	44.3	89.0	73.1
Pear	22.5	19.6	16.4	11.1	13.7	17.6	16.1	17.0	14.2	11.6	10.7	5.6	9.4	6.8	11.3	10.4
Quince	1.1	1.5	1.2	2.2	0.5	0.9	0.9	2.1	0.8	0.5	1.2	0.5	1.0	1.4	1.6	2.0
Stone fruit	**47.7**	**48.9**	**49.0**	**35.3**	**30.1**	**40.2**	**38.2**	**49.5**	**53.3**	**42.8**	**57.2**	**47.1**	**54.2**	**38.5**	**60.7**	**57.4**
Of which:																
Plum, prune and damson	12.8	16.3	12.6	6.3	6.7	7.2	10.7	8.7	13.1	4.5	8.5	3.8	9.5	4.2	11.3	10.1
Cherries	4.8	5.5	4.0	4.0	3.0	2.7	5.1	5.6	5.4	2.5	3.7	2.1	4.4	3.0	5.4	6.9
Apricots	0.5	0.3	0.7	0.2	0.8	0.3	0.7	0.7	1.0	0.7	1.5	0.6	0.9	1.2	1.9	2.0
Peach, nectarine	5.3	8.2	13.7	17.6	6.9	19.1	7.1	23.7	24.9	23.1	33.3	32.3	27.5	22.3	28.2	26.9
Of which:																
Nectarine	-	-	-	-	-	-	-	-	-	-	5.9	6.1	7.5	3.7	4.0	7.7
Sour plum, cherry plum	24.3	18.6	18.0	6.9	11.9	9.7	13.7	10.3	8.4	10.9	9.5	7.8	10.9	7.1	12.6	9.8
Nuts	**27.3**	**33.0**	**24.9**	**30.0**	**35.1**	**37.1**	**30.1**	**51.0**	**38.1**	**41.1**	**33.4**	**24.9**	**23.1**	**30.9**	**40.8**	**53.8**
Of which:																
Walnut	3.9	11.8	6.2	8.2	6.1	5.7	4.8	10.8	4.2	5.6	3.6	3.3	5.7	6.6	7.5	7.2
Hazelnut	23.5	21.2	18.7	21.8	28.8	31.1	24.7	39.7	33.8	35.3	29.5	21.4	17.0	24.0	32.7	45.9
Subtropical fruit	**21.2**	**22.1**	**23.7**	**21.4**	**22.4**	**25.3**	**26.2**	**27.8**	**20.1**	**21.4**	**15.8**	**13.0**	**16.0**	**20.3**	**22.3**	**23.0**
Of which:																
Persimmon	-	-	-	-	-	-	-	-	-	-	10.0	8.9	10.0	14.3	15.4	15.7

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021*
Fig	-	-	-	-	-	-	-	-	-	-	1.5	1.1	1.4	1.5	1.9	1.6
Feijoa	-	-	-	-	-	-	-	-	-	-	1.4	0.8	1.3	1.5	1.7	1.9
Kiwi	-	-	-	-	-	-	-	-	-	-	1.0	1.0	1.3	1.5	1.5	1.6
Pomegranate	-	-	-	-	-	-	-	-	-	-	0.9	0.6	0.7	0.7	1.0	1.0
Loquat	-	-	-	-	-	-	-	-	-	-	0.8	0.4	0.7	0.5	0.3	0.9
Mulberry	-	-	-	-	-	-	-	-	-	-	0.1	0.1	0.3	0.2	0.4	0.2
Berries	**0.6**	**1.1**	**0.9**	**0.4**	**0.8**	**1.8**	**1.2**	**0.7**	**1.1**	**1.1**	**3.0**	**3.2**	**1.8**	**2.0**	**2.7**	**2.9**
Of which:																
Strawberry, musk strawberry	-	-	-	-	-	-	-	-	-	-	2.6	2.7	1.2	1.0	1.2	1.5
Raspberry	-	-	-	-	-	-	-	-	-	-	0.2	0.3	0.4	0.6	0.5	0.6
Grapes	**162.5**	**227.3**	**175.8**	**150.1**	**120.7**	**159.6**	**144.0**	**222.8**	**172.6**	**214.5**	**159.2**	**180.8**	**259.9**	**293.8**	**316.9**	**269.2**
Of which:																
White grapes	-	-	-	-	-	-	-	-	-	-	111.8	121.6	179.3	203.1	224.1	184.8
Red grapes	-	-	-	-	-	-	-	-	-	-	47.4	59.2	80.6	90.7	92.8	84.4
Citrus	**52.2**	**98.9**	**55.2**	**93.6**	**52.1**	**54.9**	**77.0**	**110.4**	**69.8**	**77.6**	**65.5**	**58.2**	**66.3**	**64.0**	**56.8**	**61.5**
Of which:																
Tangerine	48.4	93.6	51.6	90.5	48.6	53.1	71.1	107.1	65.9	71.0	60.0	54.9	62.3	59.8	53.1	57.1
Orange	1.9	3.7	1.9	1.5	1.4	0.6	3.5	1.4	1.7	3.5	2.5	1.8	1.6	2.0	2.2	2.3
Lemon	1.9	1.6	1.7	1.6	2.1	1.2	2.4	1.9	2.2	3.0	3.0	1.4	2.4	2.2	1.5	2.1

* Preliminary data. The final data of 2021 will be available on June 15, 2022.

"-" The data is not available due to small sample size of the survey. Survey sample size has been increased since 2016.

The discrepancy between the totals and the sum in some cases can be explained by using rounded data.

Note: The main source of sample frame for 2006-2015 years of surveys was Agricultural Census 2004. The sample frame for 2016-2021 years of survey has been updated and is based on Agricultural Census 2014. Consequently, in order to ensure comparability of data of 2014-2021 years, reconciliation of the data has been made for the years of 2014 and 2015. Therefore, the data of 2014-2021 years are not comparable to the data of 2006-2013 years.

Table 2. Georgian domestic exports by commodity positions (Thsd. USD)

Code	Name of position	2015	2016	2017	2018	2019	2020	2021*
	Total Domestic Exports	**1,602,542.1**	**1,620,359.8**	**2,007,794.9**	**2,226,238.6**	**2,324,482.8**	**2,408,051.9**	**3,127,090.1**
	of which:							
0802	Hazelnuts and other nuts	175,472.4	178,407.7	80,255.9	54,136.6	65,064.7	93,119.6	116,169.1
0805	Citrus fruit, fresh or dried	11,850.9	10,416.5	10,659.5	13,748.8	16,150.7	17,869.1	21,852.3
0808	Apples, pears and quinces, fresh	600.7	240.7	890.0	1,043.5	4,533.2	4,578.2	8,608.0
0809	Apricots, cherries, peaches, plums and sloes, fresh	1,714.2	2,852.2	4,296.8	7,859.4	12,911.8	23,893.4	31,962.5
0810	Other fruit, fresh	2,927.1	2,927.4	3,058.5	3,508.6	6,674.3	12,033.6	14,405.6
0813	Fruit, dried	629.3	783.7	912.5	1,268.8	1,232.2	1,947.7	2,732.4
0902	Tea	1,743.5	1,275.9	2,050.1	3,417.1	3,860.0	1,238.7	1,803.3

Sources: LEPL Revenue Service of the Ministry of Finance of Georgia; *Source*: GEOSTAT

Note: Domestic exports include exports of goods produced in the country, as well as imported from abroad, the value of which has significantly changed or increased as a result of domestic processing.

Table 3. Georgian Imports by Commodity Position (Thsd. USD)

Code	Name of position	2015	2016	2017	2018	2019	2020	2021*
0801	Coconuts, Brazil nuts and cashew nuts, fresh or dried	224.1	228.3	275.4	998.6	665.3	795.0	1,273.5
0802	Hazelnuts and other nuts	4,213.8	5,578.4	12,286.3	29,105.9	14,562.6	9,613.0	13,471.4
0803	Bananas	14,323.4	14,424.4	18,582.8	20,335.7	21,370.2	17,604.5	19,355.0
0804	Dates, figs, pineapples, avocados, guavas, mangoes and mangosteens	2,662.6	2,311.1	2,784.8	2,503.0	3,686.2	2,874.8	3,781.0
0805	Citrus fruit, fresh or dried	10,821.6	7,797.5	6,938.5	8,318.5	12,605.3	14,604.0	14,627.2
0806	Grapes	2,776.4	2,995.4	2,768.5	3,805.5	3,485.6	2,882.4	3,638.9
0807	Melons and papaws, fresh	760.9	428.4	597.7	596.9	1,437.4	928.6	1,075.1
0808	Apples, pears and quinces, fresh	3,857.5	6,090.2	3,750.7	6,140.6	2,570.3	5,074.3	2,043.5
0809	Apricots, cherries, peaches, plums and sloes, fresh	757.9	1,050.2	993.4	1,819.4	965.4	802.8	456.4
0810	Other fruit, fresh	2,451.5	2,148.9	2,636.7	2,556.2	3,038.2	2,786.4	3,864.6
0811	Fruit and nuts, frozen	256.1	410.0	516.3	767.3	667.3	748.4	1,021.3
0812	Fruit and nuts, provisionally preserved	-	8.3	1.3	0.2	-	0.1	-
0813	Fruit, dried	722.0	848.8	924.5	1,170.3	1,032.6	792.5	1,679.6
0814	Peel of citrus fruit or melons	5.0	0.4	0.2	0.1	-	0.0	0.3

* Preliminary data.

Source: GEOSTAT

Annex 4. Additional Data for Wine and Grape Production Sector

Table 1. GEOSTAT data on grape production in 2006-2021, ths. tons

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021*
Grapes	**162.5**	**227.3**	**175.8**	**150.1**	**120.7**	**159.6**	**144.0**	**222.8**	**172.6**	**214.5**	**159.2**	**180.8**	**259.9**	**293.8**	**316.9**	**269.2**
Of which:																
White grapes	-	-	-	-	-	-	-	-	-	-	111.8	121.6	179.3	203.1	224.1	184.8
Red grapes	-	-	-	-	-	-	-	-	-	-	47.4	59.2	80.6	90.7	92.8	84.4

* Preliminary data. The final data of 2021 will be available on June 15, 2022.

"-" The data is not available due to small sample size of the survey. Survey sample size has been increased since 2016.

The discrepancy between the totals and the sum in some cases can be explained by using rounded data.

Note: The main source of sample frame for 2006-2015 years of surveys was Agricultural Census 2004. The sample frame for 2016-2021 years of survey has been updated and is based on Agricultural Census 2014. Consequently, in order to ensure comparability of data of 2014-2021 years, reconciliation of the data has been made for the years of 2014 and 2015. Therefore, the data of 2014-2021 years are not comparable to the data of 2006-2013 years.

Table 2. GEOSTAT data on Georgian Domestic Exports (Thsd. USD) for Grape and Wine Production Subsector in 2015-2021

Code	Name of position	2015	2016	2017	2018	2019	2020	2021*
	Total Domestic Exports	**1,602,542.1**	**1,620,359.8**	**2,007,794.9**	**2,226,238.6**	**2,324,482.8**	**2,408,051.9**	**3,127,090.1**
	of which:							
2204	Wine of fresh grapes	93,317.6	111,842.9	169,879.0	194,649.1	221,460.4	209,061.8	237,690.3

** Preliminary data.*

Table 3. GEOSTAT data on Georgian Imports (Thsd. USD) for Grape and Wine Production Subsector in 2015-2021

Code	Name of position	2015	2016	2017	2018	2019	2020	2021*
0806	Grapes	2,776.4	2,995.4	2,768.5	3,805.5	3,485.6	2,882.4	3,638.9

** Preliminary data.*

Annex 5. Additional Data for Wine and Grape Production Sector

Table 1. Number of livestock in 2010-2021, ths. heads

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021*
Bovine animals	1 049.4	1 087.6	1 128.8	1 229.7	970.0	992.1	962.7	909.7	878.9	869.5	925.8	935.2
Of which:												
Above 2 years	-	-	-	-	-	-	577.7	541.5	518.4	501.4	512.9	...
Dairy cows and buffaloes	561.7	587.7	602.4	641.1	563.0	545.0	509.3	477.4	458.0	441.8	450.8	434.4
Pigs	110.1	105.1	204.3	191.2	169.7	161.5	136.2	150.7	163.2	155.5	165.7	161.0
Sheep and goats	653.9	630.4	742.6	856.8	919.6	891.4	936.5	907.0	869.5	891.5	946.5	750.0
Of which:												
Sheep	596.8	576.8	688.2	796.0	865.9	841.6	875.9	855.9	819.1	841.9	896.2	...
Poultry, ths. Heads	6 521.5	6 360.2	6 159.1	6 760.7	6 657.8	8 308.6	8 237.8	8 386.0	8 110.9	9 466.4	10 146.5	9 039.8
Beehives, ths. Hives	311.5	328.0	347.5	398.6	190.7	197.1	205.3	240.6	257.8	257.3	228.5	...

Source: Geostat

Table 2. Production of livestock products in 2010-2021, ths. tons

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021*
Meat, total	**56.4**	**49.3**	**42.6**	**48.4**	**59.3**	**66.7**	**66.1**	**66.2**	**72.6**	**69.5**	**69.4**	**72.1**
Of which:												
Beef	26.7	21.3	16.2	20.2	22.8	24.4	21.5	21.4	22.9	22.1	20.1	...
Pork	12.8	11.6	11.8	14.9	17.3	18.7	16.1	15.5	17.6	18.3	19.8	...
Sheep and goat	4.9	4.0	2.5	2.8	4.1	4.8	4.6	6.7	9.1	5.9	4.9	...
Poultry	**11.6**	**12.0**	**11.7**	**10.1**	**14.6**	**18.4**	**23.5**	**22.3**	**22.6**	**22.8**	**24.2**	**...**
Of which:												
Chicken	-	-	-	-	-	-	22.9	21.8	22.1	22.4	23.7	...

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021*
Turkey	-	-	-	-	-	-	0.4	0.3	0.3	0.3	0.4	...
Duck and goose	-	-	-	-	-	-	0.2	0.1	0.1	0.1	0.1	...
Other meet	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	...
Milk (mill. litres)	**587.7**	**582.1**	**589.5**	**604.7**	**588.8**	**566.3**	**540.1**	**528.4**	**555.3**	**561.8**	**569.0**	**577.5**
Of which:												
Dairy cow and buffalo milk	581.0	575.7	582.6	595.9	578.9	556.5	530.2	518.1	545.3	552.0	558.7	...
Sheep and goat milk	6.7	6.4	6.9	8.8	9.9	9.8	9.9	10.3	10.0	9.8	10.3	...
Egg (mill. pieces)	**444.5**	**483.1**	**474.0**	**495.3**	**551.9**	**602.5**	**590.4**	**600.1**	**634.8**	**661.2**	**674.5**	**637.7**
Wool	**1.7**	**1.7**	**1.6**	**1.6**	**2.1**	**2.3**	**2.0**	**2.0**	**1.9**	**1.8**	**1.9**	**...**
Honey	**4.2**	**2.7**	**4.1**	**3.9**	**1.9**	**2.0**	**2.1**	**2.5**	**2.5**	**2.5**	**2.4**	**...**

Source: Geostat

Table 3. The main indicators of livestock and poultry slaughterhouses

Indicator name	2014	2015	2016	2017	2018	2019	2020
Average number of persons employed (Unit)	620	777	862	1,060	1,032	957	906
The number of slaughtered livestock and poultry, total (Soul)	240,438	9,702,591	9,931,879	10,666,994	11,562,743	11,523,403	12,294,151
Produced meat, total (Slaughtered weight, Kg)	15,990,638	32,941,801	36,487,573	42,105,277	43,774,740	40,329,080	37,180,385
Of which, purchased by slaughterhouse for the further realization (Kg)	...	2,322,815	2,546,850	6,039,242	5,445,539	2,697,249	1,530,361
Average cost of service (Gel/Per each unit)	...	22.7	22.4	21.2	21.3	21.5	23.0
Number of persons, which were provided by service, Total (Unit)	55,825	80,794	80,542	70,369	42,905	40,346	27,538
Of which, household (Unit)	13,996	15,924	18,395	27,354	19,413	15,562	10,245
Maximum daily volume of slaughtered	22,192	31,662	34,457	41,359	43,768	54,421	58,523

Source: Geostat

Table 3. Share of family holdings and agricultural enterprises in livestock production in 2017-2020

	Share of family holdings				Share of agricultural enterprises			
	2017	2018	2019	2020	2017	2018	2019	2020
Bovine animals	99.2	99.3	98	97.9	0.8	0.7	2	2.1
Of which:								
Dairy cows and buffaloes	99.3	99.1	97.5	97.5	0.7	0.9	2.5	2.5
Pigs	94.7	91.3	90.4	83.5	5.3	8.7	9.6	16.5
Sheep and goats	95.9	96.6	97.1	96.8	4.1	3.4	2.9	3.2
Poultry	48.8	44.3	35.7	38.3	51.2	55.7	64.3	61.7
Beehives	98.8	95	93.5	91.1	1.2	5	6.5	8.9

Annex 6. Additional Data on Forestry Sector

Table 1. Forest area of Georgia by regions in 2020

	Forest Area, ths. ha	Of which covered by forest, ths. ha
Georgia	**3 063.6**	**2 801.8**
Forest Area of Abkhazia AR*	**423.4**	**423.4**
Forest area under the Forestry Agency of Adjara	**149.6**	**141.3**
Guria	85.5	82.1
Imereti	312.1	300.8
Kakheti	288.3	268.1
Mtskheta-Mtianeti	237.7	222.7
Racha-Lechkhumi and Kvemo Svaneti	281.6	267.6
Samegrelo-Zemo Svaneti	272.0	256.0
Samtskhe-Javakheti	129.8	125.1
Kvemo Kartli	146.3	133.1
Shida Kartli	237.2	213.5

*The data were evaluated by satellite observation as a result of spectral analysis.
** Including Autonomous Republic of Abkhazia and Tskhinvali region. In 2019, the forest areas under the Agency of Protected Areas was specified.
*** Including Tskhinvali region.
Source: MoEPA. LEPL Agency of Protected Areas. LEPL Forestry Agency of Adjara. LEPL National Forestry Agency.

Table 2. Volume of felled timber in cubic metre in 2015-2020 according to Geostat

	2015	2016	2017	2018	2019	2020
Georgia	**712 336**	**628 035**	**630 462**	**578 031**	**593 235**	**488 773**
Tbilisi	...	...	...	...	...	...
Adjara AR	75 510	65 422	69 034	58 631	58 490	58 828
Guria	12 269	8 526	13 185	9 268	7 253	4 121
Imereti	80 775	57 443	53 277	45 483	41 973	33 088
Kakheti	140 086	121 773	132 067	97 051	102 493	69 632
Mtskheta-Mtianeti	74 956	63 545	66 790	52 485	56 658	40 824
Racha-Lechkhumi and Kvemo Svaneti	60 919	59 145	49 523	50 114	55 252	39 313

	2015	2016	2017	2018	2019	2020
Samegrelo-Zemo Svaneti	29 019	39 538	49 564	54 202	59 652	53 180
Samtskhe-Javakheti	89 170	79 784	81 956	102 682	105 335	88 132
Kvemo Kartli	52 496	44 222	42 799	34 343	46 107	36 536
Shida Kartli	76 661	71 284	58 267	58 257	44 689	49 948
Protected areas	20 475	17 353	14 001	15 515	15 333	15 170

Source: MoEPA. LEPL Agency of Protected Areas. LEPL Forestry Agency of Adjara. LEPL National Forestry Agency.

Table 3. Illegal logging data for 2015-2020 (cubic metre)

	2015	2016	2017	2018	2019	2020	Average Annual
Georgia	**44 612**	**28 586**	**35 022**	**32 494**	**38 507**	**16 998**	**32 703**
Tbilisi	...	...	...	...	38	22	**30**
Adjara AR	1 880	1 044	1 514	1 250	1 587	663	**1 323**
Guria	729	647	331	194	224	89	**369**
Imereti	3 087	3 958	4 539	6 947	410	1 043	**3 331**
Kakheti	18 686	9 568	9 685	5 769	1 517	2 416	**7 940**
Mtskheta-Mtianeti	1 576	993	447	362	988	551	**820**
Racha-Lechkhumi and Kvemo Svaneti	1 993	320	2 032	1 717	10 151	1 611	**2 971**
Samegrelo-Zemo Svaneti	1 766	2 119	3 928	1 562	8 023	823	**3 037**
Samtskhe-Javakheti	10 648	7 170	9 022	6 253	808	7 113	**6 836**
Kvemo Kartli	1 783	1 738	1 227	6 015	1 007	656	**2 071**
Shida Kartli	1 581	845	1 975	1 632	13 670	1 841	**3 591**
Protected areas	883	185	324	793	84	170	**407**

Source: MoEPA. LEPL Agency of Protected Areas. LEPL Forestry Agency of Adjara. Department of Environmental Supervision.

Table 4. Exports of secondary wood products (Thsd. USD)

Code	Name of position	2015	2016	2017	2018	2019	2020	2021*	Annual Average
4401	Fuel wood, wood waste and scrap, briquettes, pellets or similar forms	199.9	362.8	386.0	370.9	15.4	6.4	49.9	199
4402	Wood charcoal	26.4	74.7	43.4	90.5	75.4	-	25.0	56
4403	Wood in the rough, whether or not stripped of bark or sapwood	15.1	11.9	15.9	0.5	-	22.2	-	13
4404	Hoopwood; split poles; piles, pickets and stakes of wood	3.1	7.0	18.9	-	-	-	-	10
4406	Railway or tramway sleepers of wood	389.4	24.8	52.7	124.7	27.8	66.4	-	114
4407	Wood sawn or chipped lengthwise, sliced or peeled, sanded or finger-jointed	10 937.2	13 613.5	16 808.1	15 235.3	15 177.0	9 970.8	14 160.1	13,700
4408	Veneer sheets and sheets for plywood and other wood sawn lengthwise	-	-	-	95.2	130.2	484.0	322.5	258
4409	Planed (shaved) wood	193.8	71.2	164.9	110.9	98.7	83.8	413.4	162
4410	Particle board and similar board of wood or other ligneous materials	3 952.4	3 369.9	7 199.2	5 904.0	5 778.8	4 383.3	8 458.2	5,578
4411	Fibreboard of wood or other ligneous materials	752.9	804.1	1 042.2	1 009.6	1 607.0	1 397.4	2 958.8	1,367
4412	Plywood, veneered panels and similar laminated wood	8.6	3.1	36.8	21.9	144.9	651.5	1 535.2	343
4413	Densified wood	2.0	-	0.0	-	4.5	-	-	2
4414	Wooden frames	3.6	1.9	3.7	1.8	0.4	0.1	0.2	2
4415	Packing cases, boxes, drums and similar packings, cable-drums, pallets of wood	6.9	12.7	27.8	25.7	105.5	159.6	643.8	140
4416	Casks, tubs and other coopers' products and parts thereof, of wood	0.3	0.3	16.4	10.3	68.0	11.9	22.7	19
4417	Tools, tool bodies, tool handles, broom or brush bodies, of wood	48.7	54.4	59.4	59.4	48.7	30.8	27.8	47
4418	Builders' joinery and carpentry of wood	245.1	253.3	1 323.8	1 055.3	1 331.6	514.4	777.6	786
4419	Tableware and kitchenware, of wood	0.9	1.5	1.3	15.7	6.3	7.6	1.2	5
4420	Marquetry and inlaid wood; caskets, cases and other articles, of wood	99.2	56.0	4.5	24.4	11.4	10.4	8.9	31
4421	Other articles of wood	1 296.7	8 150.2	10 339.8	10 093.8	10 871.8	15 177.9	12 631.0	9,794
4501	Natural cork, raw or simply prepared; waste cork; crushed, granulated or ground	-	-	-	-	0.0	-	-	-
4503	Articles of natural cork	12.9	-	6.5	9.3	82.1	85.1	10.4	34
4504	Agglomerated cork and articles of agglomerated cork	80.7	71.4	29.9	62.7	93.6	27.6	190.2	79
	Total Export	**18,276**	**26,945**	**37,581**	**34,322**	**35,679**	**33,091**	**42,237**	**32,740**

Table 5. Imports of secondary wood products (Thsd. USD)

Code	Name of position	2015	2016	2017	2018	2019	2020	2021*	Annual Average
4401	Fuel wood, wood waste and scrap, briquettes, pellets or similar forms	225.0	330.8	382.4	491.8	478.3	446.9	475.1	404
4402	Wood charcoal	173.0	155.5	159.0	259.7	98.6	60.4	209.4	159
4403	Wood in the rough, whether or not stripped of bark or sapwood	4 058.3	3 043.1	4 019.4	5 448.1	5 015.9	3 091.7	5 360.7	4,291
4404	Hoopwood; split poles; piles, pickets and stakes of wood	83.1	1 829.7	1 932.5	841.2	368.4	451.1	409.5	845
4405	Wood wool; wood flour	0.0	-	2.4	4.1	6.8	-	2.6	3
4406	Railway or tramway sleepers of wood	1 469.2	1 094.0	523.3	1 339.1	1 109.2	339.4	254.3	876
4407	Wood sawn or chipped lengthwise, sliced or peeled, sanded or finger-jointed	2 359.1	6 762.0	6 001.6	9 876.1	7 355.2	5 224.2	2 601.2	5,740
4408	Veneer sheets and sheets for plywood and other wood sawn lengthwise	256.5	266.6	423.4	289.2	264.2	398.1	258.1	308
4409	Planed (shaved) wood	2 391.9	3 032.3	3 881.5	4 279.2	5 231.8	4 423.0	5 575.3	4,116
4410	Particle board and similar board of wood or other ligneous materials	18 718.1	23 217.4	28 592.4	31 785.3	33 219.0	28 185.8	41 200.4	29,274
4411	Fibreboard of wood or other ligneous materials	26 890.3	24 614.2	30 881.6	33 646.5	31 381.5	29 074.1	39 255.8	30,821
4412	Plywood, veneered panels and similar laminated wood	9 702.5	11 653.0	13 913.6	13 968.4	17 066.9	13 276.4	19 007.8	14,084
4413	Densified wood	484.1	376.3	160.0	129.2	70.0	83.4	68.0	196
4414	Wooden frames	151.6	144.6	165.1	195.0	221.2	93.6	83.6	151
4415	Packing cases, boxes, drums and similar packings, cable-drums, pallets of wood	682.2	973.6	746.9	1 464.4	1 464.9	1 095.3	1 321.9	1,107
4416	Casks, tubs and other coopers' products and parts thereof, of wood	232.3	304.4	1 149.7	1 558.1	1 358.3	2 122.8	981.0	1,101
4417	Tools, tool bodies, tool handles, broom or brush bodies, of wood	69.2	68.3	81.7	94.5	126.1	109.8	120.3	96
4418	Builders' joinery and carpentry of wood	15 027.3	14 700.2	17 017.8	22 014.8	24 648.5	16 534.3	15 829.5	17,967
4419	Tableware and kitchenware, of wood	396.3	473.5	561.0	777.2	919.6	655.5	987.0	681
4420	Marquetry and inlaid wood; caskets, cases and other articles, of wood	523.8	972.1	1 274.1	1 081.1	3 037.2	1 712.7	1 727.1	1,475
4421	Other articles of wood	2 237.3	1 589.5	1 984.9	1 970.3	2 229.0	1 956.0	1 512.6	1,926
4501	Natural cork, raw or simply prepared; waste cork; crushed, granulated or ground	7.4	-	0.0	3.4	-	-	-	4
4502	Natural cork, debarked or roughly squared, or in rectangular blocks or strip	1.7	-	0.1	2.4	0.7	3.2	-	2
4503	Articles of natural cork	1 422.0	2 487.1	2 908.9	4 650.6	5 024.3	4 119.2	3 239.6	3,407
	Total	**87,562**	**98,088**	**116,763**	**136,170**	**140,696**	**113,457**	**140,481**	**119,034**

Annex 7. Additional Data for Mining Sector (except for oil and gas extraction)

Table 1. Annual production rates of construction materials

	Average Production Volume	Unit	Average Production Volume, tons[112]	Number of Licensees
Dimension Stones				
Andesite-basalt	34,430	m3	68,860	12
Andesite-dacite	49,160	m3	98,320	9
Basalt	131,870	m3	263,740	133
Gabbro-diabase	5,600	m3	11,200	1
Granite	152,880	m3	305,760	7
Dacyte	12,452	m3	24,904	6
Diabase	7,200	m3	14,400	9
Dollerite	40,000	m3	80,000	1
Porphire	9,310	m3	18,620	9
Teshenite	24,535	m3	49,070	35
Tuff	1,685	m3	3,370	14
Tuffbrechia	31,195	m3	62,390	15
Tuff-sandstone	1,400	m3	2,800	13
TOTAL	**501,717**		**1,003,434**	**264**
Construction Materials (volcanic rocks)				
Volcanic ash	1,301	m3	2,602	2
Volcanic gravel	204,487	m3	408,974	3
volcanic slag	232,640	m3	465,280	50
Gypsum	87,655	T	87,655	12
Plaster with clay (Limnocalcite)	56,940	T	56,940	40
Clay for cement	117,445	T	117,445	5
Clay for bricks	14,260	T	14,260	15
Benthonite	24,219	T	24,219	3
Quarts-feldspar sand	583,120	m3	1,166,240	55
Limestone	390,520	m3	781,040	76
Limstone for cement	2,125,500	m3	4,251,000	14
Marblelike limestone	63,495	m3	126,990	11
Limestone for flux	381,920	m3	763,840	2
Limestone for gravel	84,826	m3	169,652	37
Limestone for lime	2,041	m3	4,082	6
Limestone for decoration	16,521	m3	33,042	25

[112] For ths purpose of this report, to describe total material flows, we need all input data in tons. As the density of the stone materials varies from 1,4 ton/m^3 to 3 ton/m^3, the average density of 2.0 ton/ m^3 has been used here for the conversion.

	Average Production Volume	Unit	Average Production Volume, tons[112]	Number of Licensees
Dolomitic limestone	9,610	m3	19,220	4
Conglomerate	238,195	m3	476,390	9
Shale and slate	800	m3	1,600	2
Bolders	20,455	m3	40,910	20
Marble	568	m3	1,136	2
Technogenic wastes	8,375	T	8,375	13
Perlite	31,736	T	31,736	8
Peat	23,770	T	23,770	18
Travertine	700	m3	1,400	5
Trachite	123	m3	246	1
Zeolite	67,476	m3	134,952	4
TOTAL	**n/a**		**9,212,996**	**442**
Construction Materials (sedimentary rocks)				
Sandstone	9,122	m3	18,244	7
Sand and gravel	14,480,700	m3	28,961,400	1022
TOTAL	**14,489,822**		**28,979,644**	**1029**

Source: LEPL National Agency of Mineral Resources

Table 2. Domestic export of copper, manganese and precious metal ores and concentrates by months

	Copper ores and concentrates, tonnes	Manganese ores and concentrates, tonnes	Precious metal ores and concentrates (Gold and silver), tonnes
Jan	27170.9	0	598.653
Feb	25114.856	44	619.788
Mar	33978.5	0	1725.037
Apr	105334.5	131.3	543.648
May	34283.2	557.5	2292.987
Jun	31744.9	1.173	1135.739
Jul	35325	22	567.565
Aug	25130.42	41.548	610.406
Sept	24378.234	536	1414.29
Oct	40400.434	809	1242.5
Nov	42669.612	543	1312.404
Dec	26868.683	22	1366.728
Annual Export	**452,399.2**	**2,707.5**	**13,429.7**

Source: Customs department of revenue service of Georgia

Annex 8. Additional Data for Construction Sector

Table 1. Production value in construction by size of enterprises

Year	Total	Large-Size Enterprise	Medium-Size Enterprise	Small-Size Enterprise
	Mln. GEL			
2008	1,434.8	498.6	718.8	217.4
2009	1,756.6	526.3	797.7	432.6
2010	1,746.4	651.4	649.0	446.0
2011	3,389.9	1,441.9	1,095.7	852.3
2012	4,691.9	1,853.9	1,713.8	1,124.2
2013	3,623.5	794.1	1,330.4	1,499.0
2014	4,244.2	1,261.0	1,354.2	1,629.0
2015	5,712.5	1,964.0	1,734.7	2,013.8
2016	7,381.9	2,866.8	2,073.8	2,441.3
2017	7,611.0	2,210.0	2,368.6	3,032.4
2018	7,789.5	1,739.5	2,899.8	3,150.2
2019	8,910.4	2,294.4	3,255.3	3,360.7
2020	9,074.2	2,039.8	3,333.1	3,701.3
2021	9,022.5	2,097.4	3,149.4	3,775.7

Table 2. Value added in construction by size of enterprises in 2006-2020

Year	Total	Large-Size Enterprise	Medium-Size Enterprise	Small-Size Enterprise
	Mln. GEL			
2006	401.6	111.5	170.8	119.3
2007	630.6	185.0	323.7	121.9
2008	482.4	136.0	269.8	76.6
2009	606.3	156.7	289.0	160.6
2010	629.7	171.7	255.5	202.5
2011	1,187.1	405.6	417.2	364.3
2012	1,730.0	612.7	630.8	486.5
2013	1,643.5	302.9	571.8	768.8
2014	1,529.5	325.9	511.9	691.7
2015	2,296.2	741.3	625.2	929.7
2016	2,819.8	1,072.3	730.6	1,016.9
2017	3,133.0	860.2	942.6	1,330.2
2018	3,220.8	634.2	1,248.3	1,338.3
2019	3,560.6	919.7	1,270.4	1,370.5
2020	3,473.3	652.4	1,261.0	1,559.9

Figure 1 Production value in construction in 2006-2020

Figure 2 Value added in construction in 2006-2020

Table 3 Total purchases of goods and services in construction by size of enterprises in 2007-2021

Year	Total	Large-Size Enterprise	Medium-Size Enterprise	Small-Size Enterprise
	Mln. GEL			
2007	1,130.2	326.7	584.7	218.8
2008	952.1	332.4	467.6	152.1
2009	1,123.5	354.5	484.3	284.7
2010	1,201.8	483.2	407.8	310.8
2011	2,246.7	1,043.7	708.5	494.5
2012	3,073.0	1,267.3	1,143.1	662.6
2013	2,162.9	514.1	827.2	821.6
2014	2,888.9	990.9	895.7	1,002.3
2015	3,656.4	1,266.6	1,181.6	1,208.2
2016	4,610.0	1,851.1	1,328.9	1,430.0
2017	4,618.5	1,346.0	1,483.8	1,788.7
2018	4,631.7	1,091.1	1,664.8	1,875.8
2019	5,490.7	1,442.6	1,994.9	2,053.2
2020	5,922.4	1,608.3	2,137.5	2,176.6
2021	6,228.6	1,261.3	2,142.9	2,824.4

Table 4 Investments in construction by size of enterprises in 2006-2020

Year	Total	Large-Size Enterprise	Medium-Size Enterprise	Small-Size Enterprise
	Mln. GEL			
2006	276.6	133.3	59.0	84.3
2007	240.4	159.1	60.7	20.6
2008	142.2	74.8	51.1	16.3
2009	110.7	53.2	33.2	24.3
2010	183.2	41.8	75.5	65.9
2011	114.6	44.0	42.2	28.4
2012	300.1	70.4	111.9	117.8
2013	349.1	68.6	47.8	232.7
2014	644.7	159.7	92.6	392.4
2015	485.0	175.7	63.0	246.3
2016	489.5	186.1	131.7	171.7
2017	456.4	76.0	98.4	282.0
2018	540.6	105.3	158.9	276.4
2019	759.4	201.0	144.9	413.5
2020	822.9	89.9	341.6	391.4

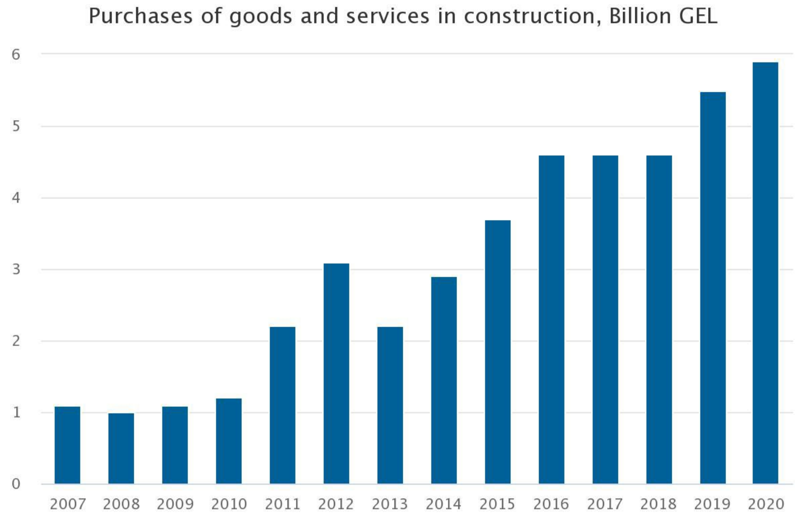

Figure 3 Purchases of goods and services in construction in 2007-2020

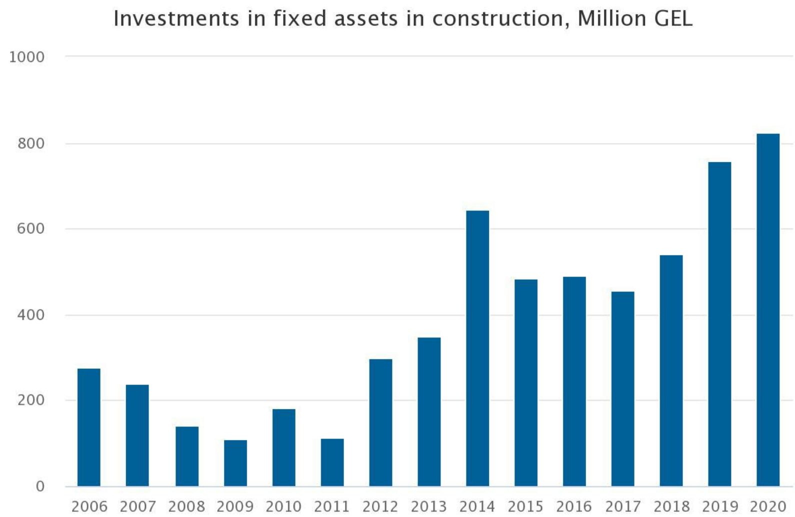

Figure 4 Investments in fixed assets in construction in 2006-2020

Table 5 Permissions granted for construction by regions in 2018-2020 (declared data)

Region	2018		2019		2020		2021	
	number	space, m2	number	space, m2	number	space, m2	number	space, m2
Georgia- total	10,204	6,206,009	10,749	7,538,398	9,564	5,206,256	10,095	7,434,470
Tbilisi	4,918	2,518,302	5,248	2,779,877	5,114	2,307,402	4,923	5,041,555
Adjara AR	1,391	2,303,900	1,261	3,045,775	562	1,395,123	623	573,586
Guria	150	40,347	167	46,069	114	41,143	140	53,764
Imereti	658	378,720	610	324,231	658	287,774	794	389,273
Kakheti	478	173,046	534	200,260	514	224,356	528	186,083
Mtskheta-Mtianeti	442	167,486	661	239,416	674	208,887	926	293,987
Racha-Lechkhumi and Kvemo Svaneti	41	11,797	42	11,040	62	15,410	58	18,294
Samegrelo-Zemo Svaneti	443	82,527	474	172,708	384	120,171	474	152,771
Samtskhe-Javakheti	289	166,754	289	161,099	255	136,939	369	141,029
Kvemo Kartli	1,088	264,642	1,142	441,698	923	357,986	859	350,617
Shida Kartli	306	98,488	321	116,225	304	111,065	401	233,511

Table 6 Completed construction objects by regions in 2018-2021 (Declared data)

Region	2018		2019		2020		2021	
	number	space, m2	number	space, m2	number	space, m2	number	space, m2
Georgia- total	2,518	2,091,861	2,508	2,547,924	2,134	1,694,301	2,347	1,759,779
Tbilisi	744	1,229,317	870	1,530,113	593	777,383	692	820,923
Adjara AR	116	307,967	130	451,839	88	275,336	94	274,888
Guria	66	58,369	80	39,481	68	29,467	82	28,678
Imereti	235	99,027	205	111,036	203	126,730	198	177,834
Kakheti	385	110,112	355	104,995	312	102,167	290	107,046
Mtskheta-Mtianeti	221	80,825	203	63,163	200	109,748	274	77,719
Racha-Lechkhumi and Kvemo Svaneti	26	5,648	33	5,738	21	3,521	33	8,911
Samegrelo-Zemo Svaneti	157	37,961	105	30,222	171	65,275	147	44,676
Samtskhe-Javakheti	123	69,456	132	83,474	134	80,799	142	44,691
Kvemo Kartli	282	57,398	241	87,572	215	86,306	224	79,495
Shida Kartli	163	35,781	154	40,291	129	37,569	171	94,918

Table 7 Completed objects by type in Georgia 2022 I (the declared data)

	Unit	Total	Administrative buildings	Residential buildings	Trade buildings	Refuelling stations	Cafes and restaurants	Car parkings	Sports buildings and grounds	Hotels	Educational institutions	Pre-schools establishments	Cultural establishments	Health establishments	Industrial buildings and warehouses	Farm buildings	Other
Georgia- total	number	552	8	313	66	1	10	4	1	12	2	1	1	2	32	34	65
	area m²	545,939	2,175	438,020	25,570	251	3,761	256	231	30,432	1,256	238	2,221	1,578	22,297	10,879	6,774
Tbilisi city	number	185	4	160	7	...	2	...	1	1	...	...	...	1	6	...	3
	area m²	421,496	1,591	404,127	5,297	...	1,030	...	231	1,180	...	...	...	508	7,158	...	374
Adjara AR	number	10	1	3	...	1	...	...	...	2	1	1	...	1	...	...	...
	area m²	12,584	350	4,127	...	251	...	...	...	6,206	342	238	...	1,070	...	...	...
Guria	number	13	...	6	1	...	...	...	...	3	...	...	...	...	1	...	2
	area m²	6,168	...	2,827	685	...	...	...	...	1,780	...	...	...	...	876	...	...
Racha-Lechkhumi and Kvemo Svaneti	number	3	...	1	...	...	...	...	...	...	...	...	1	...	...	...	1
	area m²	2,283	...	62	...	...	...	...	...	...	...	...	2,221	...	...	...	...
Samegrelo-Zemo Svaneti	number	37	...	2	4	...	...	1	...	...	...	...	...	...	4	7	19
	area m²	9,476	...	357	598	...	...	88	...	...	...	...	...	...	4,006	778	3,649
Imereti	number	46	1	4	21	...	3	1	...	...	...	...	...	...	5	1	10
	area m²	13,944	82	654	9,444	...	947	35	...	...	...	...	...	...	2,262	125	395
Kakheti	number	75	1	27	13	...	3	...	...	1	...	...	...	...	8	12	10
	area m²	16,248	102	4,384	2,254	...	969	...	...	341	...	...	...	...	3,250	4,253	695
Mtskheta-Mtianeti	number	58	...	52	2	...	...	...	...	...	1	...	...	...	1	2	...
	area m²	18,149	...	12,202	2,842	...	...	...	...	...	914	...	...	...	896	1,295	...
Samtskhe-Javakheti	number	32	...	16	2	...	1	...	...	5	...	...	...	...	...	6	2
	area m²	25,765	...	3,360	186	...	360	...	...	20,925	...	...	...	...	...	832	102
Kvemo Kartli	number	58	1	32	5	...	1	...	...	...	...	...	...	...	3	1	15
	area m²	9,384	50	3,916	1,038	...	455	...	...	...	...	...	...	...	1,533	1,336	1,056
Shida Kartli	number	35	...	10	11	...	...	2	...	...	...	...	...	...	4	5	3
	area m²	10,442	...	2,004	3,226	...	...	133	...	...	...	...	...	...	2,316	2,260	503

Table 8 Export and import of bricks, blocks, ceramic tiles in 2021

Code 6902/ Bricks, blocks, ceramic tiles	Export kg	Import, ton
January	0	851.7
February	0	219.7
March	0	461.2
April	0	326.0
May	0	441.3
June	0	634.9
July	0	244.2
August	0	543.1
September	0	394.8
October	0	788.7
November	0	660.0
December	0	194.3
TOTAL 2021	0	5,760

Table 9 Export and import of sand, gravel, pebbles etc. in 2021

Code 2517/ Sand, gravel, pebbles etc.	Export, ton	Import, ton
January	656.6	747.2
February	660.0	181.4
March	792.5	181.0
April	985.3	347.5
May	675.0	240.1
June	1,032.2	319.0
July	779.1	292.7
August	770.0	366.6
September	686.6	287.2
October	937.3	530.0
November	508.0	270.6
December	407.1	311.4
TOTAL 2021	8,889.8	4,074.6

Table 10 Export and import of cement, cement clinkers etc. in 2021

Code 2523/ Cement, cement clinkers etc.	Export, ton	Import, tons
January	0	41,246.6
February	0	44,054.0
March	0	59,996.1
April	0	76,205.6
May	0	55,116.6
June	0	61,582.3
July	0	89,894.9
August	0	99,838.7
September	0	90,346.9
October	0	87,397.1
November	0	78,915.9
December	0	65,511.7
TOTAL 2021	0	850,106.3

GSNE "Orchis"

Ministry of Environmental Protection and Agriculture of Georgia

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