European Commission

Background Report
Specific Support to Georgia

Horizon 2020 Policy Support Facility

Research and Innovation

Background Report – Specific Support to Georgia

European Commission

Directorate-General for Research and Innovation
Directorate A — Policy Development and Coordination
Unit A4 — Analysis and monitoring of national research and innovation policies

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EUROPEAN COMMISSION

Background Report

Specific Support to Georgia

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Directorate-General for Research and Innovation
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EXECUTIVE SUMMARY

On 20 September 2016, the Minister of Education and Science of Georgia, Mr Aleksandre Jejelava, addressed the Policy Support Facility (PSF) under Horizon 2020 (H2020) for further support for the implementation of key recommendations of a Policy Mix Peer Review, which was carried out in 2015 by a team of mostly governmental experts from EU Member States and countries associated with H2020. In particular, the new request asks for tailored advice and concrete recommendations to the Georgian authorities on the following issues:

1) *Support in the identification of promising research fields;*
2) *Measures for narrowing the gap between research and industry/business;*
3) *Proposal for the performance-based funding of research entities.*

The report at hand serves as a background document to facilitate the work of the panel of six independent experts. It provides an overview of the Georgian economy, an analysis of available statistics related to the research and innovation (R&I) system in Georgia, hints to potential interview partners, and provides information on recent legislation and implementation measures.

In view of the issues guiding this PSF exercise, the Georgian R&I system can be characterised in a nutshell by:

- *low overall financial investments in the field of R&I;*
- *a comparatively high share of competitively awarded research funding for projects which clearly differentiates the research landscape in Georgia;*
- *an institutional funding for research institutes (which are mainly operating under the umbrella of research universities) which, however, lacks clear performance-based criteria;*
- *a relatively high share of foreign funding for research and development (R&D) but a still very low participation in Horizon 2020 to which Georgia became associated in 2016;*
- *some strong publication areas in the fields of mathematics, physics and astronomy, earth and planetary sciences (and some high-cited areas such as the ones mentioned above – except mathematics – plus business, management and accounting, immunology and microbiology, and medicine);*
- *an unclear competence on who is responsible for the definition of research priorities (this task is assigned to the Research and Innovation Council, the*

Ministry of Education and Science and also the Academy of Sciences, not forgetting the autonomy of universities);

- *a recently improved, but historically burdened institutional fabric of public R&D delivery, which was caused by an insufficient integration of the former research institutes of the Academy of Science into the research universities;*

- *a higher education system which, with a few exceptions, is mainly devoted to provide only teaching (not research);*

- *severe statistical problems in the field of R&I which makes it almost impossible to assess the actual R&D personnel capacity and engagement as well as the business expenditures on R&D (BERD);*

- *an on-average over-aged research staff, but promising developments in the field of doctoral (PhD) education despite a not very dynamic labour market for researchers;*

- *only ad-hoc or even absent science-industry relations and a lack of collaborative R&D support programmes which proved successful until now;*

- *some newly established innovation infrastructures (e.g. fabrication labs and innovation labs, TechPark) for which it seems too early to assess their results and impacts;*

- *a liberal economic regime which offers supportive framework conditions to do business, especially when compared to other Eastern Partnership countries;*

- *lacking venture capital on the supply side but also a low number of high-tech start-ups on the demand side;*

- *an obvious skills mismatch in the labour market and in general a rather poor educational output;*

- *a fast-changing foreign trade and export market pattern, which was not in the least caused by the latent tensions with Russia and the signing of the free trade agreement with the EU;*

- *a patent structure that reveals strong comparative advantages in the fields of pharmaceuticals and organic fine chemistry, but also a decline in technological knowledge output in terms of patents over the last couple of years.*

The following starting situation needs to be taken into account when approaching the three issues requested by the Georgian authorities to the PSF:

<u>Additional support for the identification of promising research fields</u>

'It is difficult to prioritize fields of research everywhere, but in the case of Georgia it is even more sensitive, because the size of the research budget means that non-priority areas will be virtually abandoned' (Bregvadze et al., 2014, p. 37).

In addition, priority-setting attempts are aggravated by a lack of information as regards R&D in the private sector, as well as the R&D needs of the business-enterprise sector. This lack could also impede the Government's intention to re-orientate the higher education system more towards the needs of the economy. Patent data is limited in its overall relevance for the identification of priority fields, but it reveals strong fields in pharmaceutics and organic fine chemistry. Bibliometric data as the most referenced output of the scientific community is a valuable source for benchmarking, but the differences of publication predisposition between the different epistemological disciplines needs to be carefully taken into account. Nevertheless, thematic comparative specialisation patterns could be detected (see Chapter 5). Data on competitively acquired projects, which may help to differentiate stronger areas from weaker ones, has to rely on project participation in open programmes, such as the major Shota Rustaveli National Science Foundation (SRNSF) schemes. Participation in the Seventh Framework Programme (FP7) and Horizon 2020 is still rather limited and thus probably not very indicative yet. Participation in most other international programmes (other than FPs) is often thematically biased and thus cannot be taken as a reliable source for comparative cross-thematic analysis.

Measures for narrowing the gap between research and industry/business

The identification of suitable (i.e. relevant, efficient, effective) measures to bridge the gap between science and industry is aggravated by the fact that no information about R&D in the business-enterprise sector (BES) has been comprehensively recorded by GEOSTAT yet. Thus, the needs of the BES are only anecdotally known. It would be worthwhile to learn from the more or less failed collaborative schemes which SRNSF was implementing (one together with CRDF Global) and from the companies which are supported through the innovation infrastructures funded by the Georgian Innovation and Technology Agency (GITA). Also no clear public demand-sided measures are currently in place and indirect tax-based funding schemes are not used in Georgia.

Proposal for the performance-based funding of research entities

This exercise needs to start with a definition of research entities (e.g. research universities as such or only the research institutes operating within them, out of which many were transferred from the Academy of Science of Georgia). An assessment was delivered by the Academy of Science, but the criteria used were not clear. Since the institutional funding of the research institutes was modest throughout the last 10 years, it seems important to also scrutinise their physical and technical infrastructure (in terms of quality and quantity) and to put a strong emphasis on their participation (and success) in competitively awarded domestic and international R&D programmes.

1 SOCIAL AND ECONOMIC SITUATION IN GEORGIA

1.1 Political development

Caused by the **breakdown of the former Soviet Union**, Georgia became independent again in 1991 with the status of a semi-presidential republic. Its development since then has significantly differed from any of the other new independent states of the former Soviet Union. Soon after its independence Georgia was confronted with separatist's movements and civil unrest in Abkhazia, South Ossetia and Adjaria. While Adjaria could be reintegrated under the state's authority, the Autonomous Republic of Abkhazia and parts of South Ossetia, which is not recognised as a political entity by Georgia[1], remained by and large outside the authority of the state. The country has approximately 70 000 square kilometres, of which around 13 000 are located in the breakaway regions of the Autonomous Republic of Abkhazia and South Ossetia.

In November 2003, public protests against corruption and ineffective government services, followed by an attempt by the incumbent Georgian Government to manipulate parliamentary elections in November 2003, led to the resignation of Eduard Shevardnadze. In the aftermath of that popular movement, which became known as the **Rose Revolution**, new elections in early 2004 swept Mikheil Saakashvili into power along with his United National Movement (UNM) party. Progress on market reforms and democratisation has been made in the years since independence, but this progress has been complicated by Russian assistance and support to the separatist regions of Abkhazia and South Ossetia. Periodic flare-ups in tension and violence culminated in a 5-day conflict in August 2008 between Russia and Georgia. In late August 2008 Russia unilaterally recognised the independence of Abkhazia and South Ossetia. The 'independence' of Abkhazia and South Ossetia is only recognised by a handful of countries, none of them from the EU.[2]

The 'Georgian Dream Coalition' (backed by the billionaire Bidzina Ivanishvili) replaced the UNM party in 2012. In 2013 Giorgi Margvelashvili was inaugurated as president and Irakli Garibashvili replaced Ivanishvili then was himself replaced by Giorgi Kvirikashvili in December 2015. In the October 2016 parliamentary elections the Georgian Dream succeeded with a constitutional majority. The next elections are planned for 2020, which offer a window of opportunity to undertake reforms in the field of R&I.

In the **current parliament** the following parties are represented:[3]

- Georgian Dream-Democratic Georgia (Giorgi Kvirikashvili) (115 seats in Parliament)
- European Georgia (Davit Bakradze) (split from UNM) (21)

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[1] It is sometimes informally referred to as the legally undefined Tskhinvali Region.

[2] This paragraph is almost entirely taken from the World Factbook, https://www.the-world-factbook; accessed on 17 October 2017

[3] Ibid.

- Alliance of Patriots (Irma Insashvili) (6)
- United National Movement (Nikandro Melia) (6)
- Industry Will Save Georgia (Giorgi Topadze) (1)
- and 1 independent.

In general, both popular and governmental support for integration with the West is high in Georgia, and joining the EU and NATO are among the country's top foreign policy goals.

The EU is providing substantial technical cooperation (more than EUR 100 million per year) mainly via the European Neighbourhood Instrument (ENI) for issues such as public administration reform, agriculture and rural development, and justice sector reform.

1.2 Social structure and challenges

The **population** of Georgia according to GEOSTAT (2016) (without the two breakaway regions) was around 3.7 million in 2014 (52.3 % female; 47.7 % male). The percentage share of persons aged 0-14 in the total population decreased by 2.4 percentage points compared to the 2002 census data and equalled 18.6 %. The share of persons aged 15-64 increased by 0.8 percentage points. In addition, the share of persons aged 65 and older increased by 1.6 percentage points. Since 2002, the average age of the population has increased by 2 years and equals 38.1 years.

Based on the results of the General Population Census of 2014, 86.8 % of the population are ethnic Georgians, 6.3 % Azeris and 4.5 % Armenians. With regard to religion, 83.4 % of the population of Georgia are Orthodox Christians, 10.7 % are Muslims and 2.9 % belong to the Armenian Apostolic Church.[4]

In 2014, the urban population was 2 122 623 persons, and the rural population was 1 591 181 persons. The share of the urban population increased by 4.9 % since the last census in 2002. Most of the urban population is living in Tbilisi (1 108 717 persons).[5]

According to the United Nations, Georgia is a lower mid-income country.[6] In the **Human Development Index** (HDI), Georgia is ranked 70 out of 188 countries and territories and thus positioned in the high human development category. Between 2000 and 2015, Georgia's HDI value increased from 0.673 to 0.769,

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[4] GEOSTAT (2016). 2014 *General Population Census. Main Results. General Information*. National Statistics Office of Georgia, 28.04.2016;http://www.geostat/population/Census_2016.pdf; accessed on 17 October 2017.

[5] Ibid.

[6] http://www.un.org/en/development/desa/policy/country_classification.pdf; accessed on 4 October 2017.

an increase of 14.3 %. Georgia's 2015 HDI of 0.769 is above the average of 0.756 for countries in Europe and Central Asia.[7]

The GINI index – which expresses **inequality** in a society – is high at 40.1 (2014) but improving (for comparison, Austria was 29.2 in 2013).[8] In terms of the Gender Equality Index 2015, Georgia ranks 76 out of 159 countries. Female participation in the labour market is 57.3 % compared to 78.4 % for men. In 2015 only 11.3 % of parliamentary seats were held by women.[9]

No actual data on the Multidimensional Poverty Index (MPI) is available for Georgia. Available MPI data refers to 2005, indicating that almost 10 % of the population are below the income poverty line. Georgia's gross **national income** (GNI) per capita increased by about 17.1 % between 1990 and 2015.[10] The economic growth, however, did not change the living conditions for the major part of the population.[11] GNI per capita amounted to a purchasing power parity (PPP) in dollars of 8 856 (basis: 2011).[12] Life expectancy is 76.2 years[13] and 99.8 % of the population can read and write.

In the **Sustainable Development Dashboard**, Georgia ranks at lower levels in terms of social sustainability but in the middle third in terms of environmental sustainability.[14]

Finally, it should be noted that Georgia ranks 44 among 176 countries in the **Corruption Perception Index** 2016 (thus positioned between Spain and

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[7] UNDP (2016): *Human Development Report 2016. Human Development for everyone*. Briefing note for countries on the 2016 Human Development Report. Georgia. http://org/sites/all/themes/theme/country-notes/GEO.pdf; accessed on 15 October 2017.

[8] http://www.un.org/en/development/desa/policy/2014wesp_country_classification.; accessed on 4 October 2017.

[9] UNDP(2016): *Human Development Report 2016. Human Development for everyone.* Briefing note for countries on the 2016 Human Development Report. Georgia. http://hdr.undp.org/sites/themes/country-notes; accessed on 15 October 2017.

[10] http://www.un.org/2014 wesp country classification; accessed on 4 October 2017.

[11] Government of Georgia (2014): Social-economic Development Strategy of Georgia 2020.

[12] UNDP(2016): *Human Development Report 2016. Human Development for everyone.* Briefing note for countries on the 2016 Human Development Report. Georgia. http://hdr.undp.org/sites/all/themes/hdr_theme/country-notes/es/GEO.pdf; accessed on 15 October 2017. It is important to note that the Global Competitiveness Report 2017-2018 indicates a GDP per capita for Georgia of USD 3 824.40.

[13] https://www.cia.gov/library/publications/the-world-factbook/geos/gg.html; accessed on 14 October 2017.

[14] UNDP(2016): *Human Development Report 2016. Human Development for everyone*. Briefing note for countries on the 2016 Human Development Report. Georgia. http://hdr.undp.org/sites/all/themes/hdr_theme/country-notes/es/GEO.pdf; accessed on 15 October 2017.

Latvia, constantly improving its position and far ahead of other Eastern Partnership countries).[15]

1.3 *Structure of the Georgian economy*

The **institutional foundations** for a new economic system were carried out after the crises of the first half of the 1990s.[16] Since the Rose Revolution Georgia focused consistently on free market liberalisation reforms (reducing regulations, taxes and corruption) and introduced New Public Management principles in public administration. Its economic development is currently based on a 4-year economic plan targeting the tax system, educational standards, infrastructure and governance.

Around 650 000 businesses are registered in Georgia, out of which around 168 000 (25 %) are active.[17] The highest share of registered active business is engaged in 'trade and repair services' (36 %), 'real estate operations' (8 %), industry (7 %) and 'transport and communications' (5 %). In terms of volumes, 47 % of business turnover was generated by businesses engaged in 'trade and repair services', followed by 'industry' (17 %) and 'transport and communications' (10 %).[18]

After high growth rates in the years following the new millennium, the Georgian economy experienced a sharp decrease in the years 2008 and 2009.[19] The **economic development** since 2010 has again been positive, showing real growth rates in gross domestic product (GDP) of 2.7 % in 2016; 2.9 % in 2015; and 4.6 % in 2014. This was made possible partly due to ongoing economic reforms which have included overhauling tax collection procedures, the fight against corruption, opening up the country to foreign trade and investment, improving infrastructure and simplifying the business environment.[20] Also the forecast of the National Bank of Georgia for the next few years is optimistic. Although the economy rebounded in the period 2010-2016, foreign direct investment (FDI) inflows could not be fully recovered.

In **macro-economic** terms, the country has a rather low but steadily increasing public debt (42.4 %) and a budget deficit of 1.9 % in 2016 (estimate).[21]

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[15] https://www.transparency.org/country/GEO; accessed on 13 October 2017.

[16] Government of Georgia (2014): *Social-economic Development Strategy of Georgia – GEORGIA 2020*.

[17] USAID (2017): *Innovation and Technology in Georgia*. Annual report: 2017, 31 August 2017.

[18] Ibid.

[19] PWC (2011): *ICT sector. Invest in Georgia ... explore strong market growth prospects*. August 2011.

[20] https://eeas.europa.eu/delegations/georgia/1237; accessed on 2 October 2017.

[21] https://www.cia.gov/library/publications/the-world-factbook/geos/gg.html; accessed on 13 October 2017.

The service sector accounts for 68.3 % of GDP (est. 2016) and industry accounts for 21.6 %. Although the majority of the labour force works in agriculture (55.6 %, est. 2016) this sector's GDP contribution is a mere 9.2 % (est. 2016), which is caused by a high rate of subsistence agriculture.

Georgia's **main economic activities** include cultivating agricultural products such as grapes, citrus fruits and hazelnuts; mining manganese, copper and gold; and producing alcoholic and non-alcoholic beverages, metals, machinery and chemicals in small-scale industries. The country has a sizeable hydropower capacity that now provides most of its energy needs. Georgia is also an important transit hub for gas, oil and other goods.

A report recently identified a nascent information and communication technology (ICT) community in Georgia with prospects for development that was also impeded by a lack of managerial and soft skills; these should be addressed by cluster formation and other measures.[22]

In the **SME Policy Index** 2016, Georgia ranks first among the Eastern Partnership (EaP) countries.[23] The main problems according to this index (see also Chapter 8) are:

- access to finance;
- skills mismatch in the labour market;
- low job creation;
- insufficient innovation policies for SMEs;
- low level of entrepreneurial culture.

1.4 Integration in the global economy

The political tensions with Russia also materialised in economic terms through energy and transport blockades, causing, to a high extent, the loss of traditional markets and suppliers. While trade between the EU and Georgia has been growing steadily over the years, it remained difficult for the Georgian economy to establish new connections to markets and suppliers. Today the European Union is Georgia's main trading partner: 31 % of Georgia's trade is with the EU, followed by Turkey (around 17 %), Azerbaijan (over 10 %) and Russia (around 7 %).[24]

Georgia's export of goods and services is around 45 % of GDP. The export structure is not very diversified and the growth of imports significantly

[22] EU4Business (2017b): *Georgian ICT Cluster Potential*, June 2017.

[23] EU4Business (2017): *Country Report Georgia*, May 2017.

[24] https://eeas.europa.eu/delegations/georgia/1237; accessed on 3 October 2017.

outweighs that of exports.[25] The country imports nearly all of its required supplies of natural gas and oil products (now mainly from Azerbaijan instead Russia).

Georgia mainly **exports** ferro-alloys, fertilisers, nuts, scrap metal, gold and copper ores. Its main export partners are Azerbaijan (10.9 %), Bulgaria (9.7 %), Turkey (8.4 %), Armenia (8.2 %), Russia (7.4 %), China (5.7 %), USA (4.7 %) and Uzbekistan 4.4 % (2015).[26]

The country mainly **imports** fuels, machinery and parts, grain and other foods, as well as pharmaceuticals. The main import partners are Turkey (17.2%), Russia (8.1%), China (7.6%), Azerbaijan (7%), Ireland (5.9%), Ukraine (5.9%), and Germany (5.6%) (2015).[27]

Table 1: High-tech merchandise exports (2008 and 2013)

	Total in million USD		Per capita in USD	
	2008	2013	2008	2013
Armenia	7	9	2,3	3,1
Azerbaijan	6	42 -1	0,7	44 -1
Belarus	422	769	44,1	82,2
Georgia	21	23	4,7	5,3
Moldova	13	17	3,6	4,8
Turkey	1900	2610	27	34,8
Ukraine	1554	2232	33,5	49,3

Source: UNESCO 2015 refering to the comtrade database of the United Nations Statistics Division,July 2014

Note: +n/-n= data refers to n years before or after reference year

The manufactured exports account for 8 % of GDP (2012) (in comparison with Armenia: 3.2 %, Belarus: 33.8 %, Moldova: 11.0 %, Turkey: 15.0 %).[28] Table 1 shows that Georgia was only able to slightly improve its high-tech exports between 2008 and 2013.

In mid-2014, the **association agreement with the EU** was signed and went into force as of 1 July 2016. The Deep and Comprehensive Free Trade Area (DCFTA) deepens Georgia's economic ties with the EU, systematically removing all import duties on goods and opening up markets for services, investment and

25 Government of Georgia (2014): *Social-economic Development Strategy of Georgia – Georgia 2020*.

26 https://www.cia.gov/library/publications/the-world-factbook/geos/gg.htm; accessed on 3 October 2017.

27 Ibid.

28 UNESCO (2015): *UNESCO Science Report, towards 2030*. Chapter 12 by D. Eröcal and I. Yegorov(2015).https://unesco.org/sites/files/countries_in_the_black_seabasin.pdf; accessed on 2 October 2017.

public procurement. It also includes agreements on issues such as common customs' rules, along with technical and sanitary standards for goods such as food items, intellectual property rights (IPR) and competition rules.

EU-Georgia trade increased by 0.75 % year-on-year, reaching EUR 2.58 billion in 2015. EU imports from Georgia increased by 12 % (to EUR 742 million), whereas EU exports slightly decreased by 3.5 % (to EUR 1.84 billion). Georgia mostly exported mineral products (ferro-alloys), agricultural products (hazelnuts), base metals (copper ores) and chemicals (organic as well as fertilisers) to the EU. The main EU imports to Georgia were fuel and mining products, machinery and transport equipment, pharmaceuticals (almost 50 % of imports), as well as chemicals and fertilisers, plastics, optical and medical equipment, furniture, meat, and beverages and spirits.

Georgia also signed an agreement with the European Free Trade Association (EFTA) and concluded a free trade agreement with China in 2016. It is currently negotiating a free trade agreement with Hong Kong and an expansion of the free trade agreement with Turkey.[29]

2 GOVERNANCE OF THE R&I SYSTEM

2.1 Policymaking structure

There is no specific single entity in Georgia that solely defines the policy of science, technology and innovation (STI) development on a national level. There are, like almost everywhere, several responsible bodies and institutions.
The main policymaking bodies are two parliamentary committees (the committee on education, science and culture and the committee on sector economic policy), the Research and Innovation Council (RIC), the Ministry of Education and Science (MES), and, in a small way, the Ministry of Economy and Sustainable Development (MESD). The major implementing bodies are the Shota Rustaveli National Science Foundation (SRNSF), the Georgian Innovation and Technology Agency (GITA) and – to a much lesser extent – the Georgian IPR Center 'Sakpatenti'.

The **Research and Innovation Council** was created in 2015[30] and has the following aims:

- to support the development of STI in Georgia;

[29] Government of Georgia (2016): *Freedom, Rapid Development, Prosperity. Government Platform 2016-2020*. November 2016.

[30] Government decree No 32 on the establishment of the Research and Innovation Council (in Georgian, GL) – http://gov.ge/files/pdf Amended on 13 February 2017, Government decree No 78, http://gov.ge/files/pdf, accessed on 1 October 2017.

- to elaborate the stages of development of scientific disciplines in support of the economic development of the country;
- to facilitate a knowledge-based and technology-driven economy;
- to contribute to the development of an information-based society;
- to facilitate IPR and the export of innovations;
- to increase ICT development for the benefit of Georgia's economic growth and worldwide competitiveness;
- to identify the short-, mid- and long-term priorities, and to define concrete programmes and support their implementation;
- to create an ecosystem for innovation, technology transfer and start-ups using increased state budget allocations as well attracting international donors and financial institutions;
- to support the existing excellent science clusters and develop new ones via supporting new ideas and people involved in the STI sector, particularly the young generation of scholars, inventors and developers.

The RIC is chaired by the prime minister and its members are the ministers of the MESD, MES, finance, foreign affairs, justice, regional development and infrastructure, defence, labour, health and social affairs, and agriculture, the heads of the two parliamentary committees, three business representatives, the president of the National Academy of Science,[31] the director of the SRNSF,[32] the director of the IPR Agency (Sakpatenti),[33] and four scientists. The executive secretary is the director of GITA.[34] The RIC has no own budget. One of its main tasks is to identify the thematic priorities of Georgia by government decree, which has not been done so far. The RIC's operational support structure is GITA.

The **Ministry of Education and Science of Georgia** is the main body implementing government policy in education and science. The mission statement of MES is as follows: '... establishing the modern and innovative educational and scientific environment in close cooperation with civic society. The Ministry advocates freedom of choice, fair competition, equal opportunities,

[31] Georgian National Academy of Science (GNAS); accessed on 1 October 2017

[32] Shota Rustaveli National Science Foundation – http://www.rustaveli.org.ge/en/, accessed on 1 October 2017

[33] National Intellectual Property Center of Georgia – http://www.sakpatenti.gov.; accessed on 1 October 2017

[34] Georgian Innovation and Technology Agency – https://www.facebook.com/GITA.gov.ge/; accessed on 1 October 2017

civil integrity, and respect for cultural identity.'[35], MES has been functioning in its current organisational form since 2004 and more than half of the 398 persons working in MES are contract-based.

MES consists of 10 departments and one division. These departments are: vocational education development, higher education and science development, international relations and programmes, general education management and development, national curriculum department, economic department, administration, public relations, legal issues and internal audit, and a human resources division.[36] The minister has four deputies. Currently the position of head of the higher education and science development department is vacant. For the time being the higher education division is led by Dr Maia Chuskoshvili and the science division is led by Dr Nugzar Chitaia. The department for international relations and programmes is led by Mr Kakha Khandlishivili.

According to MES' statutory document, the ministry is obliged to identify priorities of science development, is responsible for implementing the overall science policy, maintaining the existing scientific schools and their development, and supporting the internationalisation of science and the integration of research and education.

In 2016, the ministerial order No 527 – MES mid-term implementation plan for 2017-2020[37] – defined goals to support the re-establishment of science and research institutes, and to support research activities and the popularisation of science. The three major actors fulfilling this goal are SRNSF, the National Academy of Sciences of Georgia (GNAS) and the Georgian Academy of Agrarian Science.[38]

In the last week of October 2017, MES published a new strategic document on education and science, which – provided it is approved by the Government – should become an official strategy of MES (see section 2.3 for details).

The **Ministry of Economy and Sustainable Development** is, by law, responsible for economic policy, analysis of economic growth, sustainable development, trade and investments, support of industry and services, tourism, management of state property, urban and spatial development, construction, communication, innovation ecosystem and ICT support and development, the post, transport and logistics, standards and metrology, accreditation, development of capital market, reform of the pension system, and development of the country's branding.[39]

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35 Mission statement Ministry of Education and Science – http://mes.gov.ge/content.php; accessed on 1 October 2017.

36 http://mes.gov.ge/content.php?id=9&lang=eng; accessed on 16 October 2017.

37 MES mid-term implementation plan for 2017-2020; accessed on 1 October 2017

38 The Academy of Agrarian Science - http://www.gaas.dsl.ge/en/; accessed on 1 October 2017

39 http://www.economy.ge/?lang=en; accessed on 16 October 2017.

The **Shota Rustaveli National Science Foundation**[40], the major national funding agency of research, is organised as a Legal Entity of Public Law (LEPL) and comes under the MES. It was created in 2010 by merging the National Science Foundation and the Foundation for Humanities, which were themselves created in 2006.[41] The SRNSF funds basic and applied research on a competitive basis and runs more than 20 different programmes.[42]

The foundation's mission is to support innovative, high-quality research in Georgia. The main priorities are improving the quality of scientific research, and the internationalisation and support of young scientists. The budget for SRNSF was GEL 32 million for 2017.[43] Currently 38 persons are working in SRNSF. All the proposals are evaluated by either peers or an expert panel. Peer review evaluation is done for the major grants for basic research, post-doctoral proposals, applied research proposals and collaborative research grants with compatriots. The SRNSF contracted CRDF Global (an American based institution) to help in evaluating the proposals. This is done to avoid conflict of interest within the relatively small academic community in Georgia. The second type of evaluation is done by expert panels for smaller grants like PhD scholarships, research grants for master theses, conference grants, travel grants, etc.

By law, all grants awarded by SRNSF are competition-based. Only special programmes like the one on integration and the return of academics to/within Georgia are not operated on a competitive basis. These are regulated by special decrees from the Minister of Education and Science.

The SRNSF main programmes can be clustered in the following way:[44]

1) Support for scientific research: research grants in all fields of science and in applied research;

2) Promotion of young scientists: research grants for post-docs, PhD fellowships, young scientists' research internships abroad; structured PhD programmes;

3) Support for international cooperation and mobility: international travel grants and international conference grants for institutions;

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[40] Shota Rustaveli National Science Foundation – http://www.rustaveli.org.ge/en; accessed on 1 October 2017. See also the recently published SRNSF Annual Report 2016.

[41] For more detailed information on the latest developments in SRNSF, see the PowerPoint slides of Mikaberidze, M., Khandolishvili, K. and Gabitashvili, N., presented at the kick-off meeting for the PSF support for Georgia on 5 October 2017.

[42] The Shota Rustaveli National Science Foundation was the only funding agency for research until 2015, when another agency, GITA, was created.

[43] GEL – abbreviation for Georgian currency Lari.

[44] For more detailed information on the latest developments in the SRNSF, see the PowerPoint slides of Mikaberidze, M., Khandolishvili, K. and Gabitashvili, N., presented at the kick-off meeting for the PSF support for Georgia on 5 October 2017.

4) Support for Georgian studies: research on Georgia's cultural and material heritage; support provided for centres for Georgian studies and programmes abroad.

Georgian Innovation and Technology Agency[45] was established in 2014 as a LEPL under the MESD. Currently 35 people are employed by GITA. The main objective for GITA is to support the development of an ecosystem for technology transfer and innovations. Accordingly, the first steps of implementation were focusing on ecosystem development (with the support of the World Bank) and on developing an innovation infrastructure basis throughout Georgia (two techno parks and 22 fabrication labs were developed in 2016).[46]

GITA has successfully supported several small-scale start-up projects, business incubators and fabrication labs since 2014. In 2015 the first technological park in Georgia, the Tbilisi Technological Park, was completed. In 2016, the Zugdidi Technological Park became operational. GITA regularly provides training, consultancy and coaching, and the agency also operates an online platform ('friendly start-ups') to enable connections between established businesses and start-ups. The GITA initiative 'start-up Beats' connects compatriots working abroad in different businesses with local start-ups for sharing knowledge and experiences. GITA is also engaged in technology transfers, aiming to commercialise inventions by connecting inventors and technology projects with investors.

Overall, GITA is financed through the state budget. Funds from international donors are used for travel and participation in international conferences, and for activities supporting the exchange of experiences and up-grading staff qualifications. In 2015, the budget of GITA was GEL 6.3 million. The highest expenditures during this year were allocated to the establishment of the TechPark Tbilisi.

In 2015, GITA, Sakpatenti and the SRNSF signed a Memorandum of Understanding (MoU) for collaboration on the support of applied R&D, but the MoU is not yet implemented due to a lack of networking and coordination.

2.2 Legal acts and implementation

Research and innovation are regulated mainly by the following laws[47]:

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[45] Georgia Technology and Innovation Agency– https://www.facebook.com/GITA.gov.ge/; accessed on 1 October 2017.

[46] See the infrastructure development timeline in USAID(2017): *Innovation and Technology in Georgia. Annual report: 2017*, 31 August 2017, p.. 48.

[47] The two laws on grants and science-technology development, which were passed in the 1990s, were caused by the creation of the intergovernmental funding organisation International Science Technology Center (ISTC) with its target to finance former military scientists from the countries of the former Soviet Union and to help them transfer to civilian science and technology development.

- Law on science, technology and their development, passed in 1994;
- Law on grants, passed in 1996;
- Law on higher education, passed in 2004
- Law on the Georgian National Academy of Science, passed in 2007
- Law on innovations, passed in 2016

All the dates for the laws mentioned above are initial dates. All of them, except for the law on innovation, have been changed due to amendments in order to attain a better complementarity with governmental policies or changed realities. All the laws are current and are implemented by the respective state institutions.

With regard to the evolution of laws and their implementation it is important to note that the so-called Rose Revolution caused an important break with history with a clear message of liberalisation and the start of a new democratic state. The philosophy underlying these reforms was reflected in the policy to fight corruption at all levels of public institutions and to establish efficient, accountable and transferable management models in Georgia. Higher education institutions (HEIs) were also affected by this.

In 2004, the new law on higher education[48] completely changed the existing **system of higher education**[49]**.** It also had a serious impact on the Georgian Academy of Science (GNAS), in particular by abolishing the PhD award system at research institutes (which were under the umbrella of GNAS) and by providing it with the authority to only award degrees to universities. The result was that the GNAS almost vanished mid-term as a major source for the creation of new knowledge and the placement of a young generation of scholars. However, by 2010, most of the GNAS research institutes were transferred into research universities.

Since, by law, only three main academic positions at HEIs existed, namely professor, associate professor and assistant professor, the research staff at the institutes lost their previous status and became support staff, leading to a general degradation and decline of research. Since the law did not recognise research staff at HEIs, universities had to dismiss a substantial number of researchers from their respective institutions. For a couple of years the remaining researchers were paid scholarships equal to GEL 50 per month, which

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[48] The law of higher education (in Georgian) – https://matsne.gov.ge/ka/document/view/; accessed on 1 October 2017.

[49] Two ministries of education were in operation in the former Soviet Union: one for school education and one for higher and specialised (vocational) education. Since independence, Georgia has had only one ministry of education covering all forms of education, starting from pre-school through to postgraduate education. Science has remained mainly under the Academy of Science. There was a special state committee for science and technology at the Ministry of Economic and Sustainable Development that oversaw applied research and innovation. The state committee was abolished around 10 years ago.

were covered by lump-sum payments from the MES to the universities. In addition, the institutes continued to receive direct public funding to cover their running costs.

Since research was hardly treated as an integral part of higher education, the university-based research institutes lost their role in graduate education, became marginalised and were often perceived as a financial burden.

In 2015, the amended higher education law introduced and re-established the position of a researcher and re-defined the status of research institutes by bringing back the remaining research staff in teaching processes at graduate level. The main reason for making an amendment was the unclear status of research institutes by the former GNAS, which were first put under the MES in 2007 and then merged with different universities in 2010[50] with no clear status as organisational units at universities. In 2016, the universities finally had to extend their academic councils by involving one representative from the research institutes in the academic councils and senate of the respective institution. However the re-integration of research and teaching is still considered as a painful issue at HEIs, both in academic and organisational terms.

The **Law on innovations**[51] was passed in 2016 and defines the main actors in innovation policy development. Under Article 3 of the Law, i.e. the state policy in innovation, the Georgian Government has to approve the state policy on innovations, which has to be prepared and submitted by the RIC. The Government is also obliged to identify the main responsible bodies for the fulfilment of the action plan of priorities of innovation policy. Article 4 of the innovation law defines the functions of the RIC in the development process of the innovation strategy. The law stipulates that the RIC has a central coordination function.

2.3 Strategy development and assessments

Despite several influential state institutions and a quite sufficient legislative basis, neither a strategic focused R&I state policy document nor a vision for research and innovation was available to guide the reform processes for a long time. In October 2017, however, a **strategic document on education and science** was published by MES. This document[52] summarises the difficult conditions for STI in the past and emphasises the objective of the Government to support the country's sustainable development through furthering STI and high-tech industries. It is highlighted in the strategy that this requires further

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[50] The former research institutes of the Academy of Science are now integrated into seven different universities in Georgia. Those are Tbilisi State University, Ilia State University, Medical State University, Georgian Technical University, Batumi State University, Kutaisi State University (all these are LEPL) and Agrarian University (a non-profit organisation). http://www.mes.gov.ge/content.php accessed on 1 October 2017.

[51] Georgian Law on Innovations – https://matsne.gov.ge/ka/document/view/; accessed on 1 October 2017.

[52] MES Education and Science Strategy, available at http://mes.gov.ge/content; accessed on 31 October 2017

institutional, structural, financial and legal enforcements, as well as strengthened cooperation mechanisms with the EU. The strategy outlines the main challenges for STI in Georgia as being the low quality of research and human capacity, and the need for strengthening innovation culture and technology transfer mechanisms in HEIs. The document also emphasises the lack of cooperation between universities and research centres, public-private partnerships, etc. To overcome the current situation, the strategy proposes:

1) developing a functioning STI ecosystem to ensure high-quality research outputs;

2) improving the role and value of STI for the country's economic development;

3) furthering the internationalisation of Georgia's STI and diversification of funding.

At a more abstract level, the *Social-economic Development Strategy of Georgia – Georgia 2020*, which was issued by the Government in 2014, is an important strategic reference. This document, which outlines the **major political priorities of the Government in a mid-term perspective,** emphasises the need for an inclusive economic growth through policies that will (i) increase the competitiveness of the private sector, (ii) strengthen the development of human resources and (iii) improve access to finance. It also refers to developing innovations and entrepreneurial skills. In this respect the Georgia 2020 strategy states that it will 'facilitate the transfer and introduction of innovative activities and modern technologies both at the national and regional levels',[53] especially by putting emphasis on environmentally friendly technologies and industrial projects with social-economic effects. To attain the goal of technological catching-up, the strategy stipulates that it will:

- improve access for the funding of R&D for private companies by introducing various new instruments (through GITA);
- foster science-industry connections;
- establish an innovation infrastructure (e.g. incubators, innovation centres);
- facilitate training of the workforce;
- improve R&D infrastructure and labs in research universities and institutes;
- integrate R&D in the tertiary education system;
- monitor R&D activities and launch result-orientated funding models;
- strengthen the legislative and institutional framework for IPR protection;

[53] Government of Georgia (2014): *Social-economic Development Strategy of Georgia – Georgia 2020*, p. 25.

- facilitate a broad use of ICT in the economy;
- attract FDIs orientated towards modern technologies.[54]

Evaluations of the STI system in Georgia have been carried out several times at different levels. The most comprehensive evaluations of the STI system were executed under the **TACIS/2006-123052 project: *Creating an effective model of science administration: review of EU best practices and elaboration of policy recommendations with the Ministry of Education and Science of Georgia***; and under the **IncoNet EaP Project** in 2015 which was funded by FP7. Both reports provided an external view on the Georgian STI system.

The first one was conducted in 2006 after the first wave of reforms in higher education. The report identified strengths and weaknesses of the then existing system and provided recommendations for further development. The TACIS report states that the negative outcomes of reorganisation have been especially noticeable in the outflow of qualified personnel from R&D and HEIs, the degradation of the status of intellectual labour and its social importance, and the formation of a negative public opinion about the image of research.

The report identified the following most important intervention areas for upgrading the system:

- Strengthening the material and technical basis of universities and research institutions;
- Integration of academic research and higher education;
- Cooperation of researchers and support to researchers' mobility;
- Support to access R&D information by HEIs and research institutions.
- Increase of salaries.
- Increasing financing to research institutions, and support for human resource development;
- Forming a national system of grants, scholarships and foundations, and the agencies delivering them.
- Development of new branches of research important for the Georgian economy, and the setting up of targeted programmes;
- Commercialisation of research outcomes.[55]

[54] Ibid.

[55] Saluveer, M. and Khlebocith, D. (2006): *Creating an effective model of science administration: review on EU best practices and elaboration of policy recommendations with the ministry of Education and Science of Georgia*.

The second evaluation which **assessed the STI policy mix in Georgia** in 2015, highlighted the following:

- The necessity of a coherent STI policy and strategy development;
- The need to define STI priorities;
- A relatively low involvement of various stakeholders (business, industry, etc.) in STI governance;
- Weaknesses in STI indicators for evidence-based policymaking.

The key findings of the policy mix review panel are as follows:

- *'The STI system should not be considered to be in a transition period anymore: there is a need to look forward, to develop a vision and a strategy that will consolidate and gradually strengthen the STI system as an integral element for a knowledge-based society and for sustainable growth of the country.*
- *A broader consultation process involving policymakers, the academic and research communities but also the business sector and the civil society, will largely contribute to the identification of the most suitable policies and instruments but also to the acceptance and efficient implementation of them.*
- *By reducing the fragmentation, removing barriers and improving the planning, a considerable jump forward could be observed in the system's performance.*
- *Certainly, and despite recent initiatives, an increase in the level of funding for STI is necessary. However, such an increase in the funding should be mainly orientated to carefully selected priorities where either strong research capabilities or promising economic potential exist.*
- *The ongoing process of Association of Georgia to the EU's Framework Programme Horizon 2020 renders the introduction of substantial changes in the STI system urgently necessary, in order to fully benefit from the advantages that such an Association can bring.'*[56]

Although there are several improvements from 2006, (i) the need for better communication between governmental structure and businesses, (ii) barely developed science-industry relations, (iii) no coherent policy on prioritising fields of research, and (iv) low funding of STI in general remain major challenges for a clear implementation roadmap that would be able to contribute to the fulfilment of the *Social Economic Development Strategy – Georgia 2020*

[56] Bonas, G., Curaj, A., Gajdusek, F., Nedovic, V. Schlicht, M. and Kechagiaras, Y. (2015):*Policy Mix Peer Review of the Georgian STI System*. Report published by the INCO NET Eastern Partnership Project, funded under FP7.

with its aim to transform Georgia into a knowledge-based and high-tech-driven society.

In the context of this PSF project, the **research performance assessment project** of Bregvadze et al. (2014) has to be referenced.[57] This project, which was financed by USAID, should help the MES to identify stronger and weaker thematic research areas in Georgia. The authors concluded, that for a thorough assessment a sophisticated, multi-layered framework involving a peer-review process that goes beyond conference proceedings and scientific articles should be put in place. Special attention should be devoted to the transparency and the legitimacy of the assessment process, which would require the inclusion of a significant and visible pool of international experts and also further monitoring by more stakeholders. They suggest for the short-term a three-layer system, consisting of a block grant (which should be fixed and input-based and transformed in the medium term into a contractual output-based system), a second layer of competitive and contractual priority grants (for the identified priority areas) and a competitively awarded third layer of excellence grants.

Bregvadze et al. (2014) also refer to the ongoing quality assurance processes at HEIs, which they appreciate for containing 'a dose of self-assessment' (p. 39). However, although they should also encompass research activities, they were focusing mostly on teaching activities.

In terms of priority setting, the current government programme explicitly mentions in the section on agriculture that special attention will be paid to research of degraded soils and their effect on restoration and improvement, while it stipulates in the same document that priority scientific directions will be identified and supported by taking into consideration the requirements of strategic economic development and the needs of society.[58]

3 FINANCING OF R&D

3.1 Public funding of R&D

In general, the dominant R&I policy mix in Georgia is still very much focused on public R&D and a technology-push concept with some emphasis on technology transfer. Attempts to increase business R&D and/or to engage new companies more in R&D are, in contrast, quite humble.

Although no data on business expenditures on R&D are available, the Georgia 2020 strategy states that 'both government and private sector spending on R&D

[57] Bregvadze, Ta., Medjad, K. and Bregvadze Ti. (2014): *Research performance in Georgia:analysis and recommendations*, 2 June 2014

[58] Government of Georgia (2016): *Freedom, Rapid Development, Prosperity. GovernmentPlatform 2016-2020*, November 2016.

remain low'.[59] In the last 2 years, the situation on the public side has slightly improved but remains at an overall low level. Public spending on R&D was estimated to be 0.3 % of GDP in 2016 (GEL 72 m). Most of the public funding originates from the MES, out of which around 50 % has been disbursed through competitive funding procedures by the SRNSF. The MESD contributed GEL 5.6 m of the GEL 72 m.

Around half of the state's R&D funding can be regarded as institutional funding which directly subsidises (part of) the salaries and running costs for research institutes at universities. The other half is competitively awarded by the SRNSF. The SRNSF's budget tripled to GEL 32 m in 2016 (compared to 2012). Within the circa 20 schemes implemented by the SRNSF, the most important are State grants for fundamental studies, State grants for applied research, and State grants for international research cooperation.[60]

In 2014, the MES made an evaluation of research institutions and proposed long-term strategic plans,[61] which was followed up by an increase of research funding. In January 2015, the salaries of researchers were increased by 2.5 times.

The core funding of the MES (2016) was allocated as follows:[62]

- Academy of Sciences: GEL 4.25 m
- Agrarian Academy of Sciences: GEL 1.214 m
- Research institutes outside universities (Scientific Organisations Programme): GEL 5.145 m
- Research institutes within universities (Restoration and Development of Science Programme): GEL 22 m

The majority of HEIs in Georgia are funded through **tuition fees**, although it is not fully known how much of the income from tuition fees is used by the research universities for R&D activities. The example of Tbilisi State University (TSU) shows that its own R&D financing is comparable to the state budget financing for R&D.[63] It should be noted, however, that most universities supposedly invest considerably less in R&D.

Approximately 25 % of students receive a state grant in the form of a voucher to cover the tuition fee (at varying percentage levels: 100 %, 70 % and 50 %).

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59 Government of Georgia (2014): *Social-economic Development Strategy of Georgia – Georgia 2020*, p. 24.

60 Taken from http://www.increast.eu/en/157.php; accessed on 24 October 2017.

61 The evaluations are only in Georgian and the indicators used are not known to us.

62 Taken from http://www.increast.eu/en/157.php; accessed on 24 October 2017.

63 39 % of the R&D funding for TSU and its institutes comes from the state budget, 37 % from own sources and 24 % from the SRNSF. Information taken from USAID (2017): *Innovation and Technology in Georgia. Annual report: 2017*, 31 August 2017.

Therefore, most students (or their families) have to finance tuition fees as well as living expenses from their own resources. Some students take loans (usually high-interest) to top-up government grants for tuition.

The state grant used to cover tuition fees is distributed to those students who passed the admission exams on a merit base. In practice, the MES is transferring the student's fees directly to the respective universities where the students are enrolled. In all state HEIs, the tuition fee is standard and equal to GEL 2 250 (= EUR 879) per academic year. When students are enrolled at private HEIs where the tuition fees are higher, those HEIs receive the regular state funding and individuals have to pay the remainder.

The tuition fees for programmes in foreign languages are significantly higher than in those in Georgian. There are also differences in tuition fees depending on the field of study; law, business administration and medical education can be considered as the most expensive fields in higher education.

All HEIs are eligible to receive state tuition funds. State funding is based on the 'money follows student' principle (also when the student changes university). There are no part-time studies envisaged by the Georgian legislation.

Third-cycle students may receive funding from a particular HEI, or from the Shota Rustaveli National Science Foundation; however, the number of scholarships and their value is limited. As an incentive, some HEIs offer reduced fees for third-cycle students or free doctoral programmes.

While public research universities also receive state grants to cover their running costs and the basic salaries of the researchers working in their research institutes, the 55 private HEIs in Georgia (2015) are fully self-funded and function without governmental subsidies (except state-funded tuition fees). Their income is generated by (usually higher) student tuition fees, individual or group grants, participation in international projects or private donations.

3.2 Private and international funding of R&D

There are no robust R&D statistics available yet in Georgia for business expenditure on R&D (BERD) or on the **R&D performance of the business enterprise sector** (BES). BERD were measured for the first time by the national statistics office in 2016, but due to terminological, sampling and response rate/quality issues, the data was not fully published.[64] Although some R&D is carried out by the BES (see section 4.3), it is generally assumed that BERD are very low. Preliminary GEOSTAT data suggests in-house R&D at GEL 15.7 m and extramural R&D at GEL 13.1 m.[65]

The SRNSF organised two public-private joint funding programmes, the State Grants for Applied Research, where financial contributions (at least 20 %) from other sources was initially required, and, together with CRDF Global, the

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64 USAID (2017): *Innovation and Technology in Georgia. Annual report: 2017*, 31 August 2017.

65 Ibid.

Science and Technology Entrepreneur Programme to which the involved business partners had to contribute 15 % of the projects' budgets.[66] These schemes, however, were not taken up sufficiently by the BES.

A tax-based R&D funding system in Georgia does not exist.

It is estimated that **foreign funding of R&D** plays an important role in Georgia. According to the Global Innovation Index (GII), Georgia ranks 34 out of 127 countries in terms of international funding of R&D,[67] which is close to Austria (ranked 28) and Croatia (ranked 33) and far ahead of Armenia (74) and Azerbaijan (97).

Table 2 lists the tentative accumulated budgets from selected international sources, which are estimated to total EUR 67.5 m since Georgia's independence.

Table 2: International funding sources for R&D

Programme	Number of projects (est.)	Accumulated budget (est.) in Euro
ISTC	150	30 m
STCU	100	15 m
NATO Science for Peace	150	10.5 m
CRDF	170	8 m
INTAS	220	5.5 m
FP7	44	4.5 m

Source: Increast[68]

[66] http://www.increast.eu/en/157.php; accessed on 26 October 2017.

[67] Cornell University, INSEAD, and WIPO (2017): *The Global Innovation Index 2017: Innovation Feeding the World*, Ithaca, Fontainebleau and Geneva.

[68] http://www.increast.eu/en/157.php; accessed on 26 October 2017. Please note that the starting point of this accumulation is not indicated. The update was done in 2016 but the figures, e.g. for FP7, are not reflecting the full participation and budget transfer to Georgia. Please compare with section 7.1, in which more up-to-date data is provided.

4 RESEARCH PERFORMERS

4.1 Higher education institutions

Seventy-five higher education institutions (HEIs) are authorised by the state to operate in Georgia, 55 of them being private (2016) (see Table 3). There are three types of HEIs in Georgia:

- Research universities, which are authorised to award all three academic degrees (Bachelor, Master and PhD);
- Teaching universities, without a notable research function, which are implementing first- and second-cycle higher education programmes;
- Colleges that are implementing higher professional and Bachelor programmes.

Table 3: Number and types of HEIs in Georgia[69]

HEIs	Public	Private	Total
University	12	20	32
Teaching university	7	21	28
College	1	14	15
Total	20	55	75

It is important to note that 68 % of the HEIs are located in the capital city, Tbilisi, which shows a high concentration of tertiary education in Georgia.

The main research performers are 7 research universities out of 32, from which 6 are LEPL and 1, the Agricultural University of Georgia, is a non-profit organisation.[70] There is hardly any R&D performed in private universities. All universities are only marginally embedded in the economy.

[69] Overview of the Higher Education System. Georgia. (2017). European Commission. Available at: https://europa/eacea-site/files/countryfiche_georgia_2017.pdf;accessed on 17 October 2017.

[70] http://www.mes.gov.ge/content.php?id=599&lang=eng; accessed 1 October 2017.

Tbilisi State University (TSU) is the largest research university in the country. Fifteen former research institutes of GNAS, operating in the field of natural and exact sciences, were merged under TSU in 2010. TSU is also the only university in the South Caucasus region that is ranked among the best 1 000 universities in the world (800+ place) by the Times Higher Education World University Ranking in 2016-2017.[71] By subject, TSU ranks within the best 200 programmes in the field of physics. Also in terms of scientific productivity and international collaboration TSU ranks first in Georgia. The fields of studies where TSU publishes most are: mathematics, physics, biology and biotechnology, chemistry, clinical medicine and social sciences.

Alongside TSU, the following HEIs (all of them research universities) are considered to belong to the major grantees of the SRNSF: Technological University of Georgia, Ilia State University, Tbilisi State Medical University, Akaki Tsereteli State University, Shota Rustaveli State University and the Agricultural University of Georgia.

4.2 Public research institutes

The **Georgian National Academy of Science** (GNAS) was once the most powerful organisation for scientific research in Georgia with more than 50 institutes. It currently comes, by law,[72] under the Georgian Government (before it was under the Ministry of Education and Science) and should consult the Georgian Government on defining the policies of Georgian STI development. The change from the MES to the Government occurred in 2016 with an amendment to the existing law. The amendment also introduced the new organisational form for GNAS and a new system of stipends within GNAS for selected researchers on a competitive basis for 5 years. The system resembles the Estonian model for the Academy of Science[73], but there is no clear strategy document or implementation plan available for the activities of GNAS. Nowadays, GNAS is a LEPL, fully funded by the Government. By law, the GNAS goals are:

- to support the STI development in Georgia according to world standards;
- to support basic and applied research;
- to define STI priorities;
- to forecast the STI development in Georgia;
- to provide recommendations to the Government and the broader public on socio-economic projects implemented abroad.

[71] http://bpi.ge/index.php/tsu-times-is-msoflios-universitetebis; accessed on 1 October 2017

[72] The law on the Georgian National Academy of Science has been passed by the Parliament of Georgia in 2007 and has been amended several times: in 2008, 2011, 2013, 2015 and lastly in 2016. https://matsne.gov.ge/ka/document/view, accessed on 1 October 2017.

[73] Estonian Academy of Sciences – http://www.akadeemia.ee/en/, accessed on 1 October 2017.

The above-mentioned goals should be implemented through the following tasks:

- Popularising scientific achievements and scientific heritage;
- Organising scientific conferences, symposia, workshops and seminars in schools, vocational and higher education institutions;
- Publishing scientific periodicals;
- Participating in international academic networks;
- Establishing scientific awards;
- Establishing different commissions in all fields of science and technology, collecting archive materials in STI;
- Evaluating the research performance of HEIs and to operate additional economic activities in the frame of Georgian legislation.[74]

Several of these tasks currently remain unfulfilled (e.g. identification of priorities), because GNAS does not have sufficient operational capacity. The full members of the Academy, the candidate members and the scholarship holders are working in different places (mostly universities and a few remaining research institutes). However, GNAS has already given assessments about the scientific quality of research in HEIs in 2014 and 2015.[75]

The **Georgian Academy of Agrarian Science** (GAAS) is a LEPL (established in 1957) and comes under the MES. The law on GNAS (Article 16.1) regulates the GAAS status and organisational structure[76]. The main goals and objectives of GAAS are:

- contributing to the development of agrarian sciences in Georgia;
- carrying out fundamental and applied research;
- forecasting the development of agrarian sciences in the country and developing state priorities and recommendations to the Government;

[74] In 2007 the number of research institutions under the Academy of Science in Georgia was 52. Ongoing reforms in higher education - following the new law of higher education in 2004 - and the transformation of the entire system downsized this once powerful institution. The research institutes first were subordinated to the MES and nowadays more than 40 of the former research institutes of the Academy of Science are part of universities.

[75] The reports are in Georgian language only and the criteria were not clear (according to Bregvadze et al., 2014, p. 39).

[76] The law on Georgian National Academy of Science – https://matsne.gov.ge/ka/document, accessed on 01-10-2017

- expertise of scientific research results;
- disseminating scientific achievements to the broader society, locally and internationally.

As in the case of the GNAS, the GAAS is also financed as an overarching institution with the state budget covering only the basic salaries and running costs. In 2015, GAAS created a training centre for farmers and agricultural specialists, providing qualification courses based on the materials they have developed.[77]

Apart from the research universities and their research institutes mentioned above, the following three research centres come directly under the MES: Korneli Kekelidze National Center of Manuscripts, Ivane Beritashvili Center for Experimental Biomedicine, Giorgi Eliava Institute of Bacteriophage, Microbiology and Virology. Furthermore, the following two public research organisations are implementing R&D in Georgia: the National Center for Disease Control falls under the Ministry of Labour, Health and Social Affairs, and the Science Technology Center DELTA falls under the Ministry of Defence.

Research is also carried out by the Georgian National Museum and the National Research Centre for History of Georgian Culture and Monuments Protection. These two institutes fall under the Ministry of Culture and they also report to the GNAS. Another, the National Botanical Garden of Georgia, which has the legal status of a non-profit non-governmental organisation, could also be mentioned.

4.3 Business enterprise sector

GEOSTAT does not provide data on R&D conducted by the business enterprise sector (BES). GEOSTAT is aiming to establish a more or less comprehensive directory of companies, which systematically conduct R&D activities in Georgia. It is possible that some companies, especially in the manufacturing sector, are operating R&D labs but for the time being only anecdotal evidence, e.g. from TV footage, is available. Examples of this are two companies: GMP and Aversi-rational.

GMP is a local pharmaceutical company[78] that started to produce its first drugs in Georgia in 2000. Since then the volume of its exports has been increasing annually. The plant produces approximately 150 new-generation medicines of different groups. GMP is considered to be the only pharmaceutical enterprise in the Caucasus where medicines are produced across all the technology steps locally, and it is the only pharmaceutical plant in Georgia that is certified by experts from the EU.

[77] The Academy of Agrarian Sciences training center - http://www.gaas.dsl.ge/en/stuff/study center , accessed on 01-10-2017

[78] http://psp.ge/new/pages/page/1; accessed on 17 October 2017.

Aversi-rational[79] is another pharmaceutical manufacturing plant, which started in 2002 and has been accomplished with the support of European experts. The first Aversi-rational medicine was introduced in May 2005, and today more than 144 products are produced. Since 2006, the company has been exporting its products to a number of post-Soviet states and countries in the near East, and exports are constantly increasing.

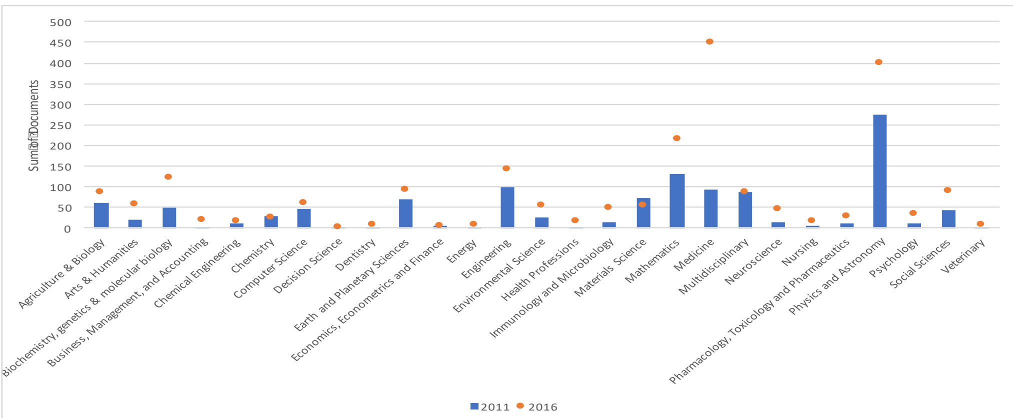
5 QUALITY OF THE SCIENCE BASE

5.1 Positioning Georgian scientific excellence along bibliometric indicators

This section describes Georgia's bibliometric profile, based on data extracted from SCImago. Data show Georgia's aggregate number of publication counts, citable documents, citations, self-citations, citations per document and the H-index[80] (for the period 2011-2016).

Georgia's five subject areas with the highest number of publication counts are in physics and astronomy with 23 % of all publications (1 970 publications in total between 2011 and 2016), medicine: 13 % (1 103), mathematics: 10 % (887), engineering: 7 % (643) and biochemistry, genetics and molecular biology: 5 % (462). Georgia's lowest levels are found in dentistry and veterinary sciences with 0.2 % of the publications (respectively 14 and 17 publications), and in decision science and energy with 0.3 % (respectively 26 and 29 publications). Figure 1 presents the number of publications in 2011 and in 2016.

Figure 1: Publications (2011 and 2016)



Source: SCImago

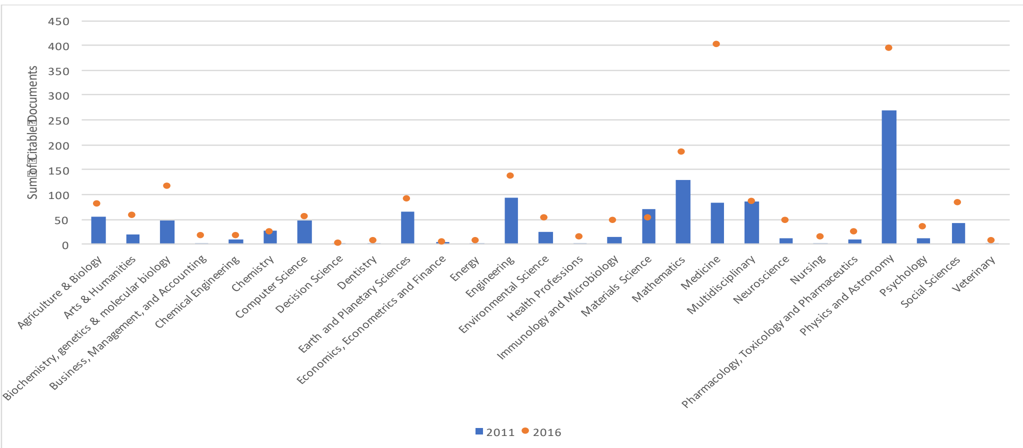
[79] https://www.aversi.ge/en/301/About-Us; accessed on 17 October 2017.

[80] The H-index is an index that attempts to measure both the scientific productivity and the apparent scientific impact of a scientist. It can be read as the highest number of publications of a scientist that received h or more citations each, while the other publications do not have more than h citations each.

Overall, there is a 46 % increase in the number of publications between 2011 and 2016, with a particular increase in the year 2016, when two Georgian electronic journals (*Annals of Agrarian Science* and *Transactions of Andria Razmadze Mathematical Institute*) were added to Scopus' list of journals.

Similar figures for the number of publications emerge when considering the number of citable documents presented in Figure 2. Across the 6 years considered in the analysis, the subject area of physics and astronomy ranks 1st with 23 % of citable documents (1 923), medicine ranks 2nd with 12 % (1 017), mathematics 3rd with 10 % (819), engineering 4th with 7 % (611), and biochemistry, genetics and molecular biology rank 5th with 5 % (445). Georgia exhibits low levels of citable documents for the considered time period in dentistry and veterinary science with 0.2 %, and decision science and energy with 0.3 %. Overall, the number of citable documents for Georgia shows an increase of 44 % between 2011 and 2016. As observed for the total publications, there is also a notable increase for citable documents between 2015 and 2016, particularly in the field of medicine.

Figure 2: Citable documents (2011 and 2016)*Source: SCImago*

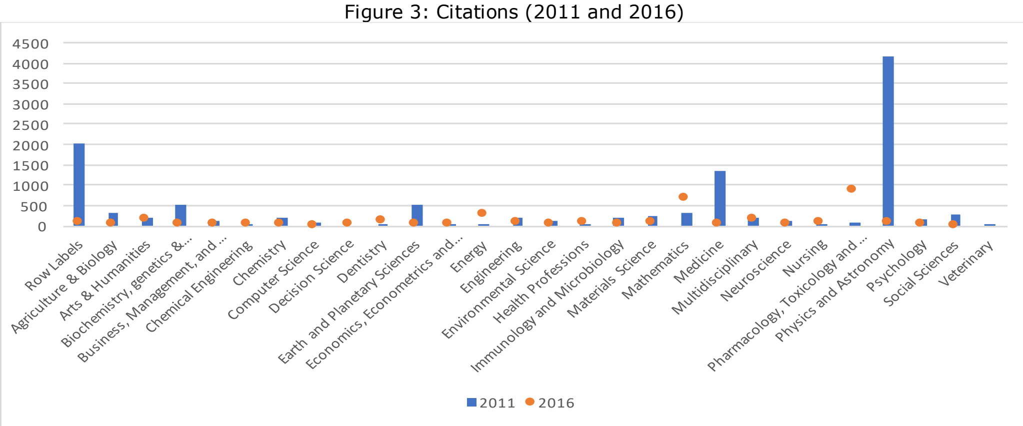


Source: SCImago

With regard to Georgia's citations from 2011 to 2016, the highest subject area is physics and astronomy with an average of 53 % (4 020 citations), followed by medicine with 13 % (964), earth and planetary sciences with 7 % (525), and biochemistry, genetics and molecular biology with 5 % (353). The subject areas with the lowest figures are in dentistry with 0.01 %, decision science with 0.0 4%, and veterinary science as well as economics, econometrics and finance with 0.1 %. The high number of citations in physics and astronomy is mainly due to the number of citations in 2012 (12 992). After 2012, all subject areas show a considerable decrease until 2015, while an increase is observed between 2015 and 2016.

Figure 3 presents the number of citations for 2011 and 2016.

Figure 3: Citations (2011 and 2016)



Source: SCImago

5.2 Results of the bibliometric benchmarking

This section presents the bibliometric indicators collected/calculated for Georgia, and 5 additional benchmark countries: Armenia, Austria, Azerbaijan, Croatia and Slovenia. The bibliometric data, retrieved in September 2017 from the SCImago Journal and country ranks, cover a 5-year period from 2011 to 2016 for the journals and country scientific indicators developed from information contained in the Scopus database. These journals are grouped by subject area (27 major thematic areas) and deliver the total number of documents, citable documents, citations, self-citations, average citations per document and average H-indexes. Specialisation was calculated for the period 2007-2016 using data from Scopus.

Table 4 shows **specialisations by subject area** compared to the world using counts of peer-reviewed publications and reviews from the period 2007-2016. According to this data, Georgia's specialised subject areas are mathematics, physics and astronomy, earth and planetary sciences, and multidisciplinary subject areas (the multidisciplinary area covers journals that publish work from practically any discipline).

These results confirm the analysis done by Bregvadze et al. and published in 2014 to a rather high extent.[81] They revealed relative specialisation profiles of Georgia in the fields of physics, mathematics and chemistry (which were similar to those of Russia, Ukraine and Azerbaijan), but also (in contrast to the countries just mentioned) a significantly larger output in mathematics and a slightly larger output in medical sciences.

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[81] Bregvadze, Ta., Medjad, K. and Bregvadze Ti. (2014): *Research performance in Georgia:analysis and recommendations*. 2 June 2014.

Table 4: Specialisation by country (2006-2017)

Subject area	Georgia	Armenia	Austria	Azerbaijan	Croatia	Slovenia
Agriculture & biology	**-18**	**-74**	**-9**	**-62**	**25**	**-3**
Arts & humanities	**10**	**-50**	**-29**	**-85**	**69**	**38**
Biochemistry, genetics and molecular biology	**-47**	**-50**	**-3**	**-67**	**-41**	**-32**
Business, management and accounting	**-44**	**-94**	**-1**	**-86**	**5**	**37**
Chemical engineering	**-77**	**-73**	**-48**	**44**	**-14**	**-10**
Chemistry	**-64**	**-2**	**-38**	**40**	**-25**	**-5**
Computer science	**12**	**13**	**77**	**64**	**55**	**62**
Decision science	**-46**	**-55**	**35**	**-45**	**-24**	**21**
Dentistry	**-24**	**-98**	**-50**	**-99**	**3**	**-62**
Earth and planetary sciences	**52**	**10**	**22**	**38**	**2**	**0**
Subject area	Georgia	Armenia	Austria	Azerbaijan	Croatia	Slovenia
Economics, econometrics and finance	**-48**	**-94**	**14**	**-47**	**12**	**3**
Energy	**-84**	**-51**	**-17**	**60**	**-22**	**5**
Engineering	**-11**	**13**	**8**	**23**	**23**	**23**

Environmental science	-33	-82	2	-65	0	11
Health professions	-22	-96	-9	-86	-34	-12
Immunology and microbiology	-41	-66	8	-94	-58	-40
Materials science	-30	18	-16	47	-48	19
Mathematics	83	71	46	70	5	47
Medicine	-47	-83	-9	-54	-8	-52
Multidisciplinary	94	-32	-22	-34	-78	-56
Neuroscience	-14	-55	2	-98	-57	-69
Nursing	-57	-99	-50	-100	-87	-83
Pharmacology, toxicology and pharmaceutics	-66	-50	-46	-44	-12	-15
Physics and astronomy	79	93	13	73	-16	24
Psychology	-30	-97	-28	-99	-36	-67
Social sciences	3	-59	-23	-65	55	44
Subject area	Georgia	Armenia	Austria	Azerbaijan	Croatia	Slovenia
Veterinary	-84	-89	1	-89	15	-5

Source: own calculations based on Scopus

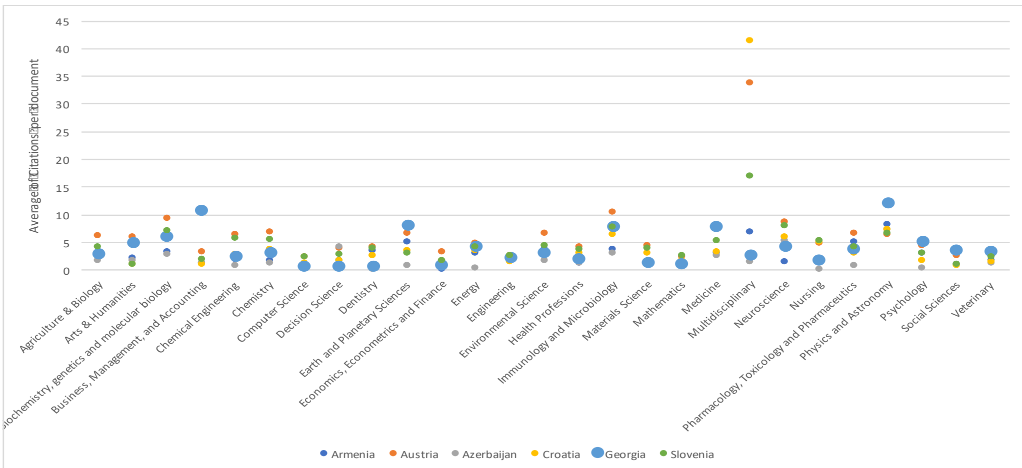
Notes: Specialisation indices are calculated based on the relative weight of the peer-reviewed publications and reviews of the benchmarked countries compared to the weight in the world with transformations applied to the measure in order to centre the indices around zero and fix their range between -100 and 100 (based on logarithmic and hyperbolic tangent functions). Large positive (resp. negative) values illustrate high (low) specialisation in the subject area.

With respect to **multidisciplinary,** Georgia is the only specialised country among the scrutinised countries. In the case of **physics and astronomy,** all scrutinised countries show a comparative specialisation, excluding Austria and Croatia. Georgia ranks second in terms of this particular specialisation when compared to the benchmarked countries, ranked after Armenia. Concerning the subject area of **mathematics,** Georgia is the most specialised country among the benchmarked countries, which are nonetheless all specialised in that subject, except for Croatia. Finally, the subject area of **earth and planetary sciences** shows that Georgia is the most specialised country when compared to the benchmark countries.

Overall, Georgia's specialisations are situated within the subject areas of natural sciences, as it specialises in mathematics, physics and astronomy, and in earth and planetary sciences. Georgia is also most specialised in the area of 'multidisciplinary'. Since none of the benchmarked countries are specialised in this subject area, this is a singular specialisation. Mathematics and earth and planetary sciences are the two areas in which Georgia leads by a substantial distance compared to the other benchmarked countries.

On the other hand, the country is under-specialised in the fields of biochemistry, genetics and molecular biology; business, management, and accounting; chemical engineering, chemistry; decision sciences; dentistry; economics, econometrics, and finance; energy; environmental sciences; health professions; immunology; material sciences; medicine; nursing; pharmacology; psychology; and veterinary science.

Figure 4: Citations per publication (2011-2016)



Source: SCImago

Figure 4 shows the average number of citations per publication for Georgia as well as for the benchmark countries of Armenia, Austria, Azerbaijan, Croatia and Slovenia (for the time period 2011-2016). According to the data collected from SCImago, Georgia's highest averages of citations per document (higher than 5) are in **physics and astronomy** (12 citations per publication); **business, management and accounting** (10.8); **earth and planetary**

sciences (8); **immunology and microbiology** (7.9); **medicine** (7.8); **biochemistry, genetics and molecular biology** (5.9); and **psychology** (5).

Moreover, Georgia has the highest number of average citations compared to the benchmarked countries in the fields of physics and astronomy; business, management and accounting; earth and planetary sciences; and medicine.

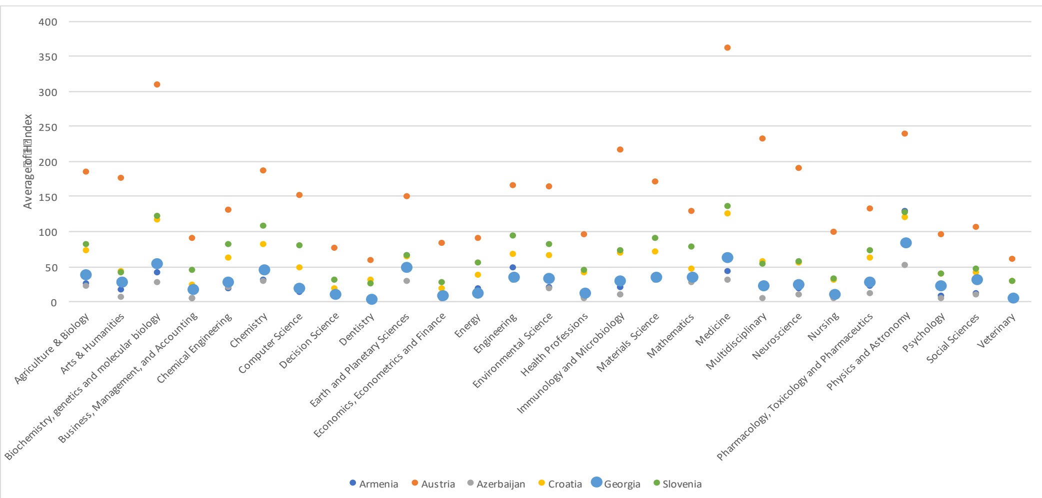
The country’s lowest averages in terms of citations are in **decision science** (0.6); **computer sciences** (0.65); **economics, econometrics and finance** (0.96); **mathematics** (1.16); and **nursing** (1.76).

5.3 H-index

The H-index is based on the researcher's set of most cited papers and the number of citations that these have received in other people’s publications.

Figure 5 represents the average number of H-index for Georgia, Armenia, Austria, Azerbaijan, Croatia and Slovenia between 2011 and 2016. Overall, Georgia ranks fifth in terms of **all subject categories**, accounting for a 118 average H-index, after Austria (496), Croatia (479), Slovenia (209) and Armenia (138).

Figure 5: H-index (time period 2011-2016)



Source: SCImago

Georgia’s index is highest (over 50) in the subject areas of physics and astronomy (84); medicine (63); and biochemistry, genetics and molecular biology (53). In the subject area of physics and astronomy, Georgia nevertheless ranks fifth behind Austria, Slovenia, Croatia and Armenia. In medicine, though, Georgia ranks fourth after Austria, Slovenia and Croatia.

The countries lowest index (lower than 10) is in dentistry (3); veterinary science (5); and decision sciences (9.5). Georgia’s lowest averages of H-index (dentistry and veterinary sciences) are comparatively lower than those of Austria, Slovenia and Croatia, equal to Armenia, and higher than Azerbaijan.

In general, the subject areas of **dentistry** and **veterinary science** show the lowest total average for all benchmarked countries, accounting for 21.7 and 24.5 respectively. On the other hand, **medicine** and **physics and astronomy** mark the highest averages at 126.1 and 124.8 respectively.

To conclude, Georgia performs better than Azerbaijan and Armenia. Austria exhibits the highest average of H-index among the benchmarked countries, while Slovenia and Croatia rank second and third.

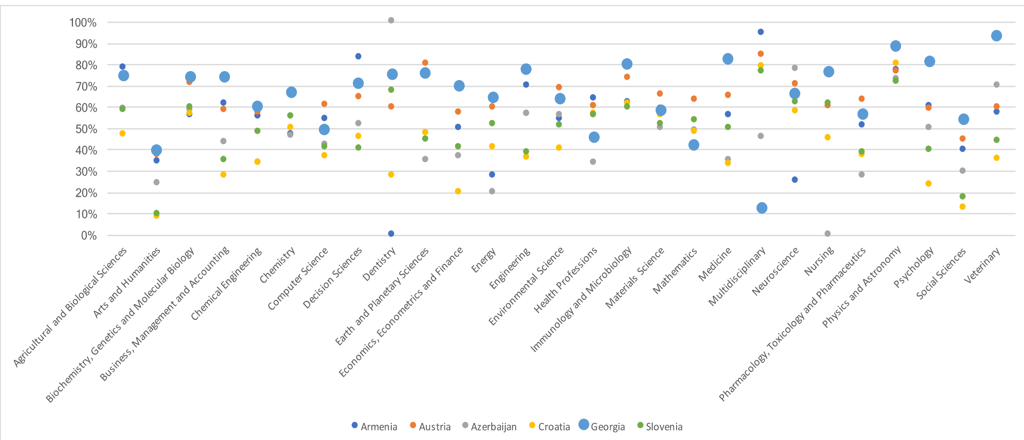
5.4 International co-publications

Based on data extracted from Scopus, the number of exclusively international co-publications was computed. This was made possible by subtracting the total number of publications of a country by the number of exclusively national publications. Data for the period 2012-2016 was processed for Georgia and its benchmark countries Austria, Armenia, Croatia and Slovenia.

In general, Georgia exhibits the highest share (69 %) of international co-publications when compared to the benchmarked countries. Austria ranks second with 66 %, followed closely by Armenia at 65 %.

Figure 6 shows the share of international co-publications among total publications by subject area for Georgia and the other countries.

Figure 6: Share of international co-publications (2012-2016)



Source: Own extract based on Scopus

Veterinary science, with a very low number of total publications, has the highest share of international co-publications across all thematic fields with 93 %.

With 88 %, Georgia's second highest share of international co-publications lies in the subject area of physics and astronomy. This is also the highest share among all the benchmarked countries. With 82 %, medicine represents the third highest share of international co-publications. This is also the highest share among the benchmarked countries.

Georgia's lowest share of international co-publications is in the multidisciplinary subject area (12 % share of international co-publications). This is the only field in which there is a substantial gap between Georgia and the rest of the benchmarked countries. The second lowest share of international co-publications is in arts and humanities (39 %). In this field, however, Georgia ranks first compared to the benchmarked countries.

6 HUMAN RESOURCES

6.1 Education overview of the Georgian population

The overview shows that 26.7 % of the population (older than 10 years) has a higher education, 17.4 % has a professional degree, while 36.7 % achieved the general education (secondary education) level. The basic and primary levels of general education were achieved by 8.4 % and 5.7 % of the population, respectively. Urban settlements show a much greater share of higher educated persons.

Figure 7: Government expenditure on education

GEOSTAT shows that 2.9 % of GDP was spent on education in 2015. Although public expenditure on education increased in the last few years, the level is still comparatively low if compared to other countries in the region (see Figure 7).

The largest share of education expenditure is invested in general education (69.4 %), followed by higher education (12.6 %), professional education (2.1 %), educational support services (3.1 %) and other non-classified activities (12.9 %).

School education in Georgia is divided into three stages, primary (grades 1-6), basic (grades 7-9) and secondary (grades 10-12). Primary and basic education is obligatory.

According to the Global Competitiveness Report 2017-2018, Georgia has a **severe problem with the quality of its education system**. The country ranks 107 as regards the quality of the education system (out of 137 countries), 106 as regards the quality of primary education, 87 as regards higher education and training, 103 as regards the quality of education of mathematics and science, 113 as regards the quality of business schools, 131 as regards the local availability of specialised training activities.[82] On the positive side, the report features internet access in schools where Georgia ranks 68, the secondary education enrolment rate (rank 33) and the tertiary enrolment rate (rank 66).

The low-level of Georgia's secondary education system is also evidenced by the results of the Programme for International Student Assessment (PISA) and Trends in International Mathematics and Science Study (TIMSS).

6.2 Tertiary education

Currently 75 state-recognised (authorised) higher education institutions (HEIs) operate in Georgia, 55 of these being private (see also section 4.1). The number of state-recognised HEIs is not stable and fluctuations reflect the dynamic process of authorisation and accreditation.

The effective government programme stipulates a reorientation of higher education (HE) based on the needs and requirements of the economy. Thus, higher education priorities should be defined and funded based on labour market analysis.[83]

The Parliament of Georgia defines the key guidelines of the policy and management in the field of HE and passes respective legislative acts. The Government of Georgia defines the amount of state education grants and draws up social programmes and state programmes in the field of HE. The MES implements a unified policy in HE, develops basic documents reflecting the indicators used in the HE system and proposes the amount of state education grants. There are two small exceptions to this: the Ministry of Culture and Monument Protection co-funds HEIs teaching fine arts (Tbilisi State Conservatoire, the State University for Theatre and Film, and the Tbilisi Academy of Arts), and the Ministry of Sport and Youth Affairs is co-funding the Georgia State Teaching University of Physical Culture and Sport.

The establishment and operation of HEIs, both state and private, is monitored by the National Centre for Educational Quality Enhancement of Georgia, which also ensures external quality assurance. HEIs can be either publicly or privately

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82 World Economic Forum (2017): *Global Competitiveness Report 2017-2018*.

83 Government of Georgia (2016): *Freedom, Rapid Development, Prosperity. Government Platform 2016-2020*. November 2016.

founded, but the quality criteria are the same for all institutions regardless of their legal status.

The Georgian higher education system is regulated by the following main legal acts:

- Georgian Law 'on Higher Education' (December 2004)[84];
- Georgian Law 'on Development of Quality of Education (July 2010)[85].

The Law of Georgia on Higher Education, adopted in December 2004, created a legal basis for reforms, defining the roles and responsibilities of all players involved, the levels of HE, rules for admission, licencing/authorisation and accreditation procedures, types of educational institutions, introduction of credits, etc.

Amendments to the Law on Higher Education (2011) enabled different legal status of HEIs, according to which the responsibilities of the state authorities differ. There are three legal forms of HEIs, namely the legal entity of public law, the legal entity of private law and the non-commercial non-profit legal entity (the last can also be established by the state). HEIs that have the status of legal entities of public law are subject to a greater control by the MES[86] than private institutions, which have a higher level of autonomy in financial management. Their financial management depends to a great extent on their organisational and legal status. Private universities are not accountable to the state bodies.

In 2014, the MES, in collaboration with other governmental and non-governmental organisations, developed a document for discussion entitled *Strategic directions of development of education and science in Georgia*.[87]

[84] Law of Georgia on Higher Education (2004); http://eqe.ge/res/docs/pdf; accessed on 10 October 2017.

[85] Law on Development of Quality of Education (2010); http://eqe.ge/res/docs/pdf; accessed on 10 October 2017.

[86] The HEIs having the status of legal entities of public law are subject to a greater control by the Ministry of Education and Science: the MES approves the charter of the public HEIs upon the proposal of the Council of Representatives (HEI elective body, developing statute and internal regulations of the institute, as well as approving budget, academic staff recruitment procedures, code of ethics, etc.); the MES exerts state control over them and is responsible for enforcing the normative acts enacted in the field of higher education. In the ‚case of a non-commercial non-profit legal entity, founded by the state, the governmental control is significantly reduced. At the same time, the HEIs, independently of their legal form, are free to develop and approve the study, research and creative work policies, develop and approve the rules for the recruitment of staff, their internal regulations, elect their management bodies and officials, and manage their finances and property.

[87] http://www.mes.gov.ge/uploads/strategia.pdf – available only in Georgian; accessed on 17 October 2017.

The **development of lifelong learning (LLL**) is one of the priorities of the *Strategic directions of development of education and science in Georgia*. The idea of LLL is integrated into the 'Government Programme of Georgia, basic data and directions', and is strengthened by the framework legislation regulating the educational system of Georgia. In these documents the importance of social inclusion and civil integration is emphasised, but, at this stage, no separate LLL concept at national level has been designed, although different LLL aspects are reflected in the Law of Georgia on Higher Education and are being developed accordingly (National Qualifications Framework, learning outcomes as a basis for curriculum development, etc.). At the same time, several HEIs have elaborated their own LLL strategy policy and regulations. It is worth noting that a number of Tempus projects significantly contributed to the development of LLL in Georgia.

The **National Qualifications Framework** (NQF) was approved by decree No 120/N of the Minister of Education and Science of Georgia in December 2010. The draft of the NQF was elaborated by the National Centre for Educational Quality Enhancement on the basis of a series of consultations and discussions with all interested parties. The document includes all qualifications and levels of general, vocational and higher education competences that exist in Georgia.

The principle of **autonomy** of the higher educational institutions is stipulated in the Law of Georgia on Higher Education as one of the leading principles of the national HE system. The formal autonomy of the HEIs granted by law is increasingly evolving into an effective autonomy. The establishment of a Council of Rectors of the Public HEIs and a Council of Rectors of the Private HEIs in 2009 is perceived as a clear sign of the growing self-confidence of HEIs.

The **total number of students** in all HEIs amounted to 190 057 in October 2016. The breakdown of students in the different higher education cycles is given below in Table 5.

Table 5: Number of students enrolled in Georgian HEIs (October 2016)[88]

	Bachelor	Medical education	Master	PhD	Total
Number of students	146 662	12 454	24144	6797	190057
% of total	77.16 %	6.54 %	12.70%	3.60%	100%

6.3 *The situation of researchers in Georgia*

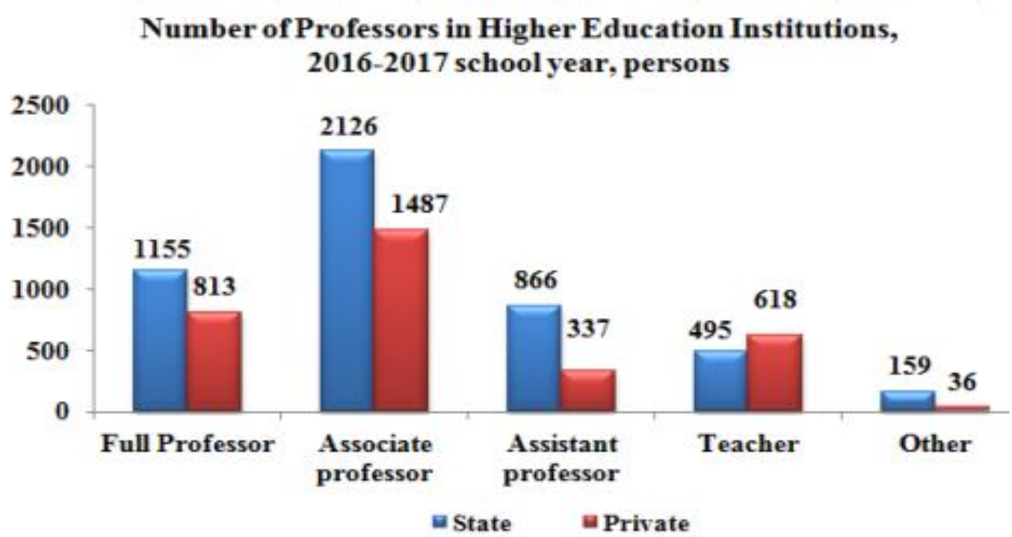
[88] European Commission. (2017): *Overview of the Higher Education System. Georgia.* Available at: https://.europa.eu/georgia_2017.pdf; accessed on 17 October 2017.

GEOSTAT does not provide information on the number of researchers in Georgia. The available public data only include academic staff employed at HEIs, which amount to around 6 800. Academic staff employed at HEIs is defined by three categories of professors – regular professor, associate professor and assistant professor – and the category of 'assistants' (see Figure 8). The latter are performing research and lead seminars under the supervision of professors. PhD candidates and post-docs can take over the position of assistants for 3 to 4 years. Post-docs are financed either by the HEIs (contract-based) or they receive grants as young researchers from SRNSF and are affiliated with the respective HEI they choose. The SRNSF grant includes overheads for HEIs to which the post-docs are affiliated.

Academic staff is, by law, responsible for carrying out teaching and research.[89] In the SRNSF database 5 300 researchers are listed, of whom 44 % are female. The number of researchers working at the scientific institutes integrated within the universities is around 2 000.[90]

After a long period of very low salaries, which made it very unattractive to become an academic member of staff in Georgia, the salaries were increased by approximately 250 % in 2015. This increase, however, cannot retrospectively remedy the problem of over-ageing in Georgia: 30 % of the academic staff are over 65 and the average is 56 years.

Figure 8: Number of professors in higher education institutions in Georgia



Source: GEOSTAT

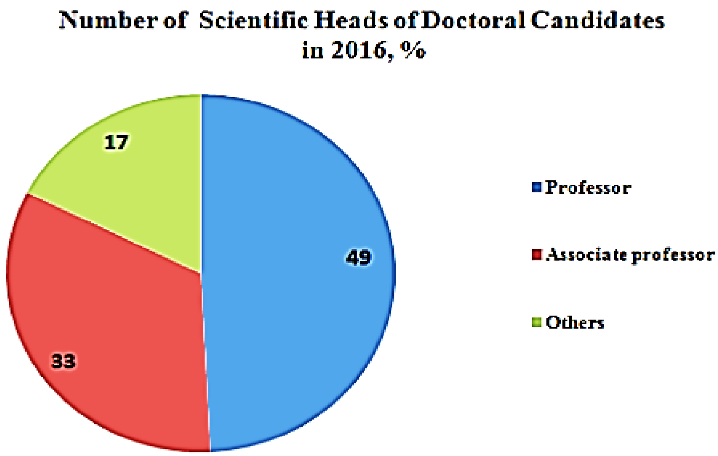
[89] http://www.geostat.ge/index.php; accessed on 1 October 2017.

[90] http://www.increast.eu/en/157.php accessed on 25 October 2017.

Approximately half of the **PhD candidates** in Georgia are supervised by professors as shown in Figure 9.[91] The remainder are supervised by associate professors and other staff. Lack of proper supervision of PhD candidates has been identified as a major problem in raising a new generation of researchers.[92] Since 2016, researchers from the research institutes gained the right to supervise MA and PhD candidates. It is important to note that SRNSF also started to support structured PhD programmes (eight new programmes were supported in 2016), and the Volkswagen Stiftung, together with SRNSF, aims to support four more PhD programmes starting in 2018. The final results will be announced in November 2017.

The labour market for research positions at research institutes affiliated to HEIs in Georgia is very limited and new positions are rarely announced. The specific scope and term of a new position is defined by the university or the non-university research institute, based on internal regulations. Usually the institutes also include merit-based criteria in the selection process.

Figure 9: Number of professors in Higher Education Institutions in Georgia



Source: GEOSTAT

[91] Ibid.

[92] Bregvadze, Ta., Medjad, K. and Bregvadze Ti. (2014): *Research performance in Georgia:analysis and recommendations*. 2 June 2014.

7 INTERNATIONAL R&D COOPERATION AND MOBILITY

At the political level, international R&D cooperation is mainly exercised by the MES and SRNSF; it became one of four overarching goals of SRNSF in the last year.

7.1 Cooperation with the EU

The association of Georgia with Horizon 2020, which became effective in 2016, was an important milestone in the field of R&I cooperation with the EU. Widening the participation in Horizon 2020 is among the key objectives of SRNSF. The access costs to Horizon 2020, ERASMUS+ and Creative Europe are subsidised via the EU Regional and Multi-country Action Programmes.[93]

The participation of Georgian researchers in **Horizon 2020** is still low; it numbers 22 participations in 19 signed grants for collaborative Marie Sklodowska-Curie Actions (MSCA), European Research Council (ERC) and Small and medium-sized enterprise (SME) Instrument actions, which received EUR 1.8 m of direct EU contribution, while the non-EU budget is EUR 0.1 m.[94]

Regarding non bottom-up collaborative actions (and therefore excluding projects under the ERC, MSCA and SME Instrument) of Horizon 2020, Georgian applicants are involved 153 times in 129 eligible proposals (but not as coordinators). Out of the 52 high-quality proposals (above threshold), 16 were selected, leading to a success rate (selected over eligible) of 12.4 % (as compared to 14.9 % for associated countries and 14.7 % overall). Georgian entities have 18 participations in 15 signed grants, receiving EUR 1.3 m from the EU and EUR 0.1 m from the non-EU budget.

Regarding the MSCA, Georgian applicants are involved 56 times in 45 eligible proposals (but not as coordinators). Out of the 24 high-quality proposals (above threshold), 5 were selected. Georgian entities have participated 4 times (2 of these as beneficiaries) in MSCA actions (0 in Individual Fellowships, 2 in RISE, 2 in ITN and 0 in the COFUND programme). Also, there is zero involvement in MSCA-NIGHT and zero involvement in the MSCA-National Contact Point programmes. Georgian beneficiaries have received EUR 0.5 m as a direct EU financial contribution.

Regarding grants funded by the SME Instrument, Georgian applicants were involved 3 times in 3 eligible proposals, but none of them passed the threshold.

At the time of writing (data from 17 October 2017), no Horizon 2020 ERC grant has been awarded to a researcher working in Georgia.[95]

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[93] https://eeas.europa.eu/delegations/georgia/1237; accessed on 1 October 2017.

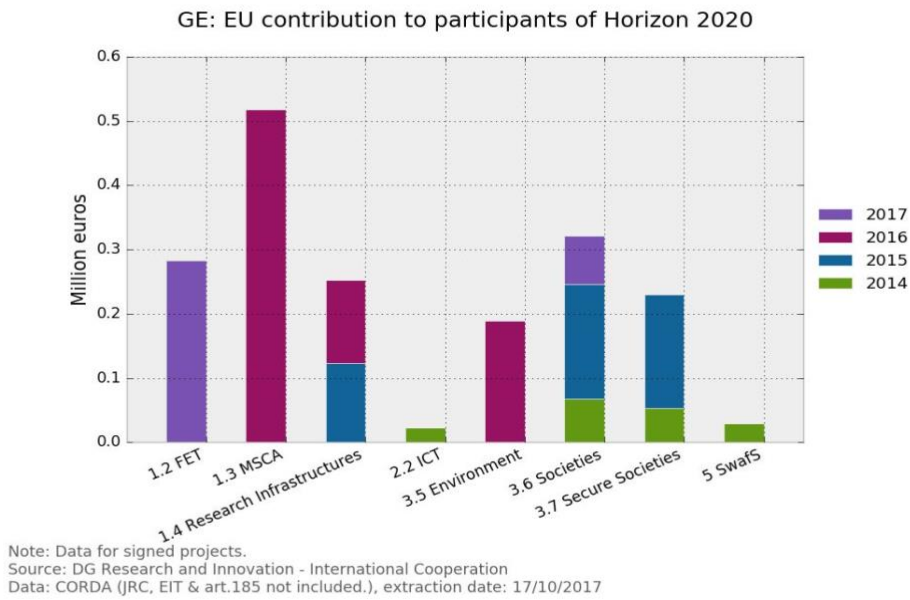
[94] Data from 17 October 2017, provided by DG RTD.

[95] In this context, however, it is worthwhile to mention that Dr Gia Dvali, a Georgian citizen, is an ERC grant holder from LMU, Germany. Sometimes he is counted as a Georgian, working in Munich, and holding an ERC grant.

These results are low compared to a total of 76 participations in 60 grants of collaborative **ERC and MSCA actions under FP7**, receiving a total of EUR 5.9 m from the EU. To summarise, Georgian applicants were involved 283 times in 225 eligible collaborative proposals under FP7 (excluding the ERC and Marie Curie), leading to 48 funded collaborative projects that involved 62 Georgian participations. Georgian participants received EUR 4.7 m from the European Commission within the funded collaborative projects. Regarding the Marie Curie actions (MSCA) of FP7, Georgian entities participated 15 times to signed actions and received EUR 1.2 m. There was no Georgian application for an ERC grant in FP7, although one Georgian national did acquire one.[96]

Figure 10 shows the financial contribution of the European Commission to Georgia disaggregated by instruments and themes.

Figure 10: Financial contribution gained by Georgia under Horizon 2020 by year, theme/instrument



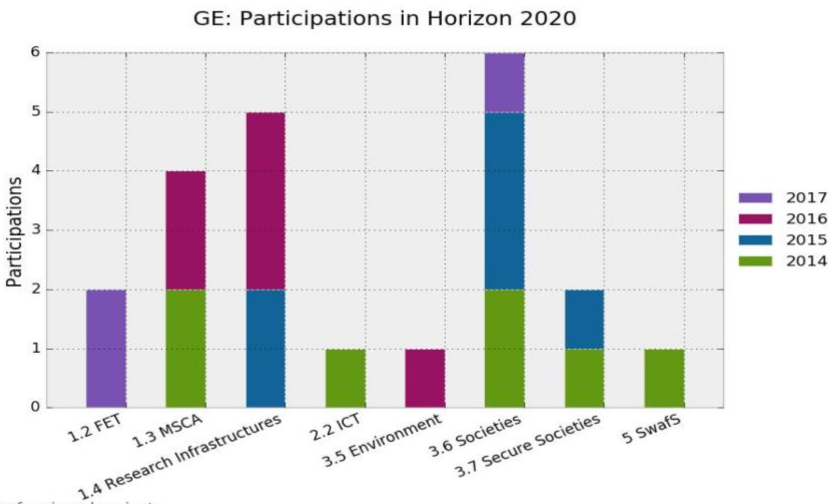
As shown in Figure 10, most contributions to Georgian researchers and entities were generated by MSCA participation (Excellence Science), followed by SC6 (Societal Challenge 6): Europe in a Changing World – Inclusive, innovative and reflective societies, (Societal Challenges), the Future and Emerging Technologies (FET) instrument and Research Infrastructures (Excellence Science), SC7: Secure societies – Protecting freedom and security of Europe and its citizens, and SC3: Environment (both part of Societal Challenges).

Figure 10, showing the financial contributions, corresponds roughly to Figure 11 below, which shows the participation of Georgia in Horizon 2020 by theme/instrument. Participation from Georgia in Horizon 2020 was mostly in SC6: Europe in a Changing World – Inclusive, innovative and reflective societies, Research Infrastructures, and the Marie-Sklodowska-Curie Actions.

[96] Ibid.

The highest success rates were achieved in Research Infrastructures but due to the very low number of granted projects with Georgian participation in Horizon 2020, a disaggregation of the overall success rate by theme/instrument is not robust.

Figure 11: Participation from Georgia in Horizon 2020 by year, theme/instrument



Note: Data for signed projects.
Source: DG Research and Innovation - International Cooperation
Data: CORDA (JRC, EIT & art.185 not included.), extraction date: 17/10/2017

As shown in Figure 12, most of the successful **participants** in Horizon 2020 seem neither to be directly related to universities nor to research institutes. Private company participation is also very low. This might lead to the assumption that Horizon 2020 is not yet perceived as a feasible research cooperation opportunity by Georgian scientists and innovators. To counteract this, the MES has established a task force to elaborate tailor-made Horizon 2020 support services and incentives. The SRNSF plans to implement a preparatory grant scheme for widening participation in Horizon 2020 at the end of 2017, worth GEL 1.7 m. This scheme also includes support for upgrading research management capacities and skills at universities.[97]

The participation of Georgia in **COST**, where it is considered to be a Near Neighbourhood Country, is low too (7 actions). However, cooperation under **Erasmus+** was very actively taken up by participants from Georgia. With 885 ICM scholarships (695 outgoing to the EU + 190 incoming from the EU), Georgia is one of the most popular countries for credit mobility according to the 2015 call results. In 2016, the number of scholarships increased to 1 559 (989 + 570) and Georgia ranked 8th among 131 partner countries.[98]

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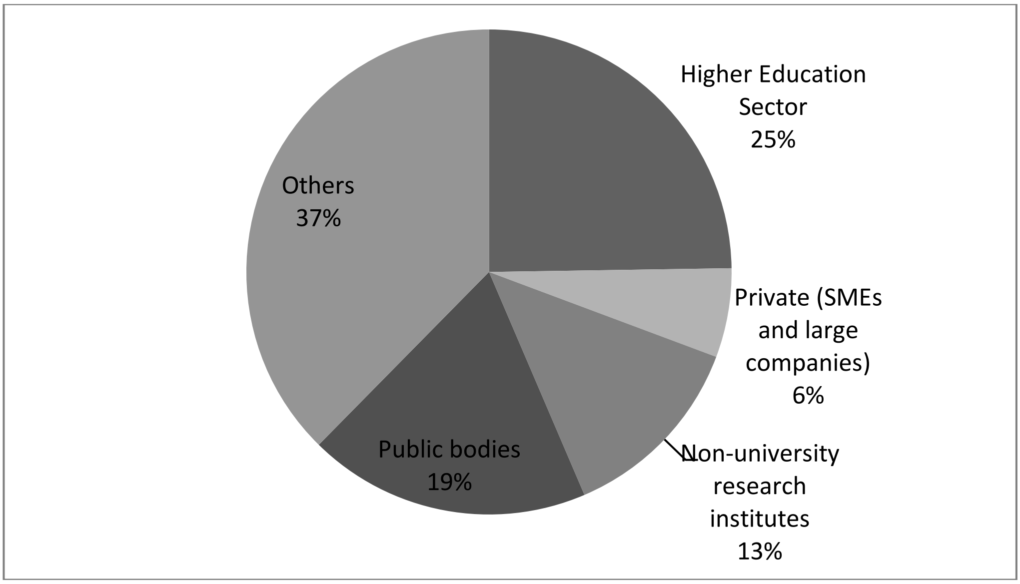
[97] See presentation of Mikaberidze, M., Khandolishvili, K. and Gabitashvili, N. at the kick-off meeting of the PSF support for Georgia.

[98] This information was provided by the MES.

Figure 12: Participation by Georgia in Horizon 2020 by organisational background



Source: Data from the Austrian EU Performance Monitor, Horizon 2020. Basis is 14 projects, cut-off date was 31 May 2017.

7.2 Cooperation with other countries and regions

By analysing the international co-publications[99], one can identify that Georgian scientists publish mostly with their research fellows from the USA, followed by Germany, Russia, Italy, UK, France, Spain, Poland, Switzerland, Austria, Greece, Turkey, Portugal, China, Armenia, Brazil, Czech Republic, Hungary, Serbia, Taiwan, Belarus, Colombia, Romania and Australia.[100]

In terms of short-term individual travel grants awarded by SRNSF in 2016, the USA, Italy, Austria, UK and Germany were the most popular host countries.[101]

The co-publication and mobility patterns also resemble, to a certain degree, the official bilateral cooperation agreements. The USA, especially through the CRDF (the Civilian Research and Development Foundation), has invested steadily for many years in bilateral R&D projects[102] and structural R&D activities, and also partners with the SRNSF and the Georgian Research and Development Foundation (GRDF) in an early career support programme for Georgian

[99] International co-publications with Georgian participation are almost 70 % of the total scientific output in Georgia, which is a very high value. This indicates on the one hand a certain dependency on international collaboration and funding (especially given the overall rather low output of publications with Georgian involvement), but points, on the other hand, to an internationally well-integrated research community.

[100] Bregvadze, Ta., Medjad, K. and Bregvadze Ti. (2014): *Research performance in Georgia: analysis and recommendations*. 2 June 2014.

[101] SRNSF (2016): *Annual Report 2016*.

[102] CRDF funded a total of 170 projects with an overall budget of EUR 8 m. Information taken from http://www.increast.eu/en/157.php; accessed on 26 October 2017.

research. The SRNSF has also cooperated with DAAD, Volkswagen Stiftung and the Forschungszentrum Jülich (all from Germany), CNR (Italy), CNRS (France), TUBITAK (Turkey) and other agencies. Of particular importance is also the cooperation with Oxford University (UK) on Georgian studies (see also section 3.2).

Georgian researchers were and still are frequently participating in ISTC/STCU projects, first as a beneficiary country and nowadays as a partner country. In total, ISTC funding, accumulated over the years, is probably the most important international funding source for Georgian researchers so far. During the last 20 years, ISTC has funded 168 different grants and activities in different fields of science and technology, and granted USD 32 622 818 to Georgia between 1994 and 2015.[103]

Other programmes in which Georgian researchers regularly participate are the NATO science for peace programme, SCOPES (Switzerland) and SATREPS (Japan). Until its termination, the International Association for Cooperation with Scientists from the former Soviet Union (INTAS) was also a major international funding source.[104]

In terms of access to international research infrastructures, the agreements with CERN and DUBNA (the Joint Institute for Nuclear Research) are of particular importance.

8 FRAMEWORK CONDITIONS FOR R&I

8.1 General policy environment for business

As stipulated in the Government's mid-term strategy *Georgia 2020*, the 'guiding principle of the country for economic development is establishing the necessary conditions for a free private sector operating under an optimal, efficient and transparent government'.[105] The state's involvement in entrepreneurial activities should be minimal and limited to sectors where the private sector remains weak and inefficient. The strategy identifies the following as the most critical problems hindering economic development:

- Weak competitiveness of the private sector;
- Weak development of human capital;

[103] Source: *ISTC annual report 2015*. Available at: http://www.istc.int/upload/files/pdf, p. 12; accessed on 25 October 2017.

[104] For more information on the rough budget allocations through international R&D programmes to Georgia, see http://www.increast.eu/en/.php

[105] Government of Georgia (2014): *Social-economic Development Strategy of Georgia – Georgia 2020*, p. 4.

- Limited access to finance.

According to the SME Policy Index 2016, Georgia ranks first among EaP countries. This very positive position for Georgia is also emphasised by the Ease of Doing Business Index of the World Bank. In this index, Georgia has a very high score of 80.2 in 2017, which represents a very friendly regulatory environment for doing business (in 2010 it was 74.2). This score is almost equal with that of the United States of America and above all EU countries with the exception of Denmark and the United Kingdom.

In the Ease of Doing Business Index, Georgia scores especially well in terms of

- ease of starting a business (96.1 in 2017; 94.3 in 2010);
- ease of enforcing contracts (73.2 in 2017; 68.7 in 2010);

However, the country reveals problems in terms of ease of solving insolvency (40.0 in 2017; 30.0 in 2010).

In addition, the Executive Opinion Survey 2017 of the World Economic Forum indicates that the most problematic factors for doing business in Georgia are:

- inadequately educated workforce;
- access to finance,
- poor work ethic;
- insufficient capacity to innovate;
- inefficient government bureaucracy.

By reviewing Georgia's position in the Global Competitiveness Index (2016-2017) published by the World Economic Forum, Georgia ranks comparatively well in the field of government efficiency[106] (compared to the rankings of Belgium and France), and comparatively bad in the fields of competition environment (compared to the lowest positioned EU countries in this field, i.e. Hungary and Croatia) and intellectual property protection (compared to the lowest positioned EU countries in this field, i.e. Croatia and Bulgaria).

The most problematic pillars[107] according to the Global Competitiveness Index (2016-2017) in Georgia are:

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[106] This seems to contradict the results of the above-mentioned Executive Opinion Survey 2017

[107] The Global Competitiveness Index uses the following 12 pillars: Institutions, Infrastructure, Macroeconomic Environment, Health and Primary Education, Higher Education and Training, Goods Market Efficiency, Labour Market Efficiency, Financial Market Development, Technological Readiness, Market Size, Business Sophistication and Innovation.

- innovation,
- market size,
- business sophistication,
- higher education and training (see Chapter 6 for more details),
- technological readiness.

Access to finance is aggravated by high interest rates in Georgia, which makes it nearly impossible for companies to obtain bank loans. Although the Central Bank discount rate was 6.5 % (7 September 2016), the Commercial Bank's prime lending rate was 12.9 % (31 December 2016 est.) according to the World Factbook.[108] EU4Business data shows an even higher actual interest on loans for legal entities (15.5 %) and especially for individual entrepreneurs (23 %). In addition, the banks in Georgia have very high collateral requirements (220 % of the loan value) and the problem to cope with the deteriorating exchange rate ('dollarisation') caused by Georgia's free-floating exchange rate policy is continuing.[109] The *Georgia 2020* strategy clearly states in this respect that the free-floating exchange rate will be continued.[110]

Banks are especially refraining from issuing loans to technological and innovative start-ups, because these companies have almost no fixed assets and are often also unable to demonstrate income.[111]

Another problem for start-up financing is that the existing micro-finance capital market in Georgia is almost entirely dependent on donors.

To support new business development through venture capital, the MESD introduced a 'StartUp Venture Finance' scheme in 2016[112], which is co-implemented by GITA and the JSC Partnership Fund (PF). The total amount of funds allocated to these schemes is GEL 11 m and it is planned to increase it to GEL 35 m.[113] Within this programme, the selected applicants can receive between GEL 15 000 and GEL 100 000 for the implementation of their innovative business ideas without going through regular banking processes. In 2016 and 2017, 79 companies were financed, of which 20 received additional venture financing. The participating investment funds were Venrock, Alloey

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108 https://www.cia.gov/library/publications/the-world-factbook/geos/gg.html; accessed on 22 October 2017.

109 EU4Business (2017): *Country Report Georgia*, May 2017.

110 Government of Georgia (2014): *Social-economic Development Strategy of Georgia – Georgia 2020*.

111 USAID (2017): *Innovation and Technology in Georgia. Annual report:2017*, 31 August2017.

112 See http://www.increast.eu/en/157.php; accessed on 23 October 2017.

113 USAID (2017): op. cit.

Ventures, VTF Capital, IBM Capital, NEA, Enterprise Investors and Sparklabs Global.[114] The success rate is mixed: only a handful of grantees have established companies and even less consider themselves successful.[115]

GITA is funding only high-tech innovation start-up ideas and the PF is funding broader innovation start-up projects. Within the funded start-up projects, GITA is involved as a partner organisation for 7 years, but does not participate in administration. In addition, GITA provides for all the beneficiaries' training, coaching, mentoring and consultations. The innovative projects are rooted in various thematic fields, such as rocket science and industry, automobiles, artificial intelligence, biotechnology, bioinformatics, computer engineering, computer science, information technologies, nanotechnology, nuclear physics, electromagnetic radiation, robotics, semiconductors and telecommunication.

Despite this public venture capital initiative, the local venture capital market is still very limited. However, a dozen companies have been supported under the umbrella of the Liberty Bank and the Smartex Group-managed accelerator with several successes.[116] An important support for start-up development was recently agreed through the GENIE project. Also a first agreement was signed between the ProCredit Bank and the European Investment Bank in February 2017 to provide financing opportunities for innovative SME businesses.

8.2 Patent analysis of the Georgian economy

Within the Global Innovation Index (2017) Georgia ranks comparatively high in terms of knowledge and technology outputs measured by IPRs. Georgia is ranked 36 among 127 countries in the indicator 'patents by origin', 44 in terms of 'PCT patent applications' (Patent Cooperation Treaty) and 18 in terms of 'utility models by origin'. These figures are comparable (or slightly even better) than those of Croatia (46; 41; 31) or Slovenia (48; 27; 43). They are clearly above Azerbaijan (59; 99; 46), but mostly below the corresponding rankings of Armenia (25; 45; 13) and especially Austria (11; 13; 19).[117]

Our analysis confirms this rather positive output.

Figure 13 presents the total number of patent applications between 2005 and 2015 by filing offices in Georgia and four benchmarked countries: Austria, Armenia, Azerbaijan and Croatia. On average, Georgia ranks second in the total number of patent applications compared to the benchmarked countries, while Austria ranks first and Croatia ranks third.

[114] Ibid.

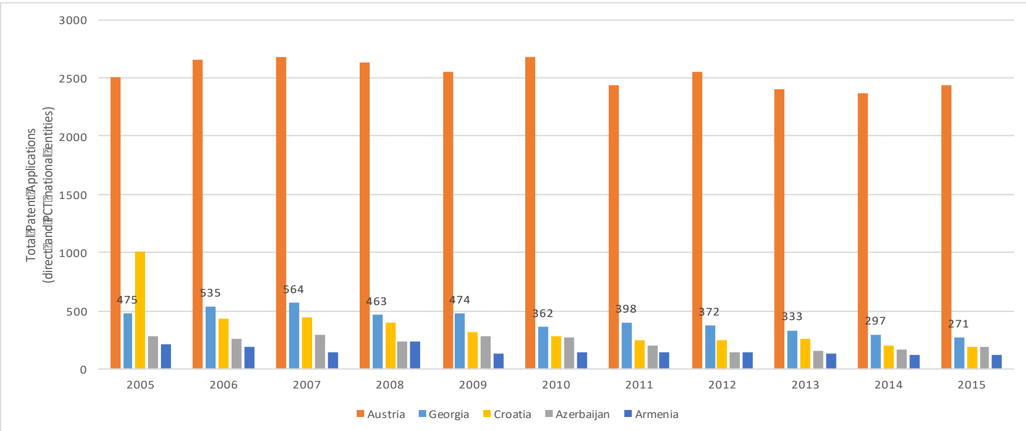
[115] Ibid.

[116] In USAID (2017): *Innovation and Technology in Georgia. Annual report: 2017*, 31 August 2017 Several financial sector lending opportunities are listed on p. 51.

[117] Cornell University, INSEAD and WIPO (2017*): The Global Innovation Index 2017: Innovation Feeding the World, Ithaca*, Fontainebleau and Geneva.

Overall, there is a decreasing trend in the number of patent applications in each benchmarked country between 2005 and 2015. However, in Austria and Azerbaijan the total number of applications increased from 2014 to 2015. Georgia reached its peak in the number of patent applications in 2007 with 564 applications, while from 2008 until 2015 the number of applications dropped. In 2015, only 271 patent applications were filed in Georgia.

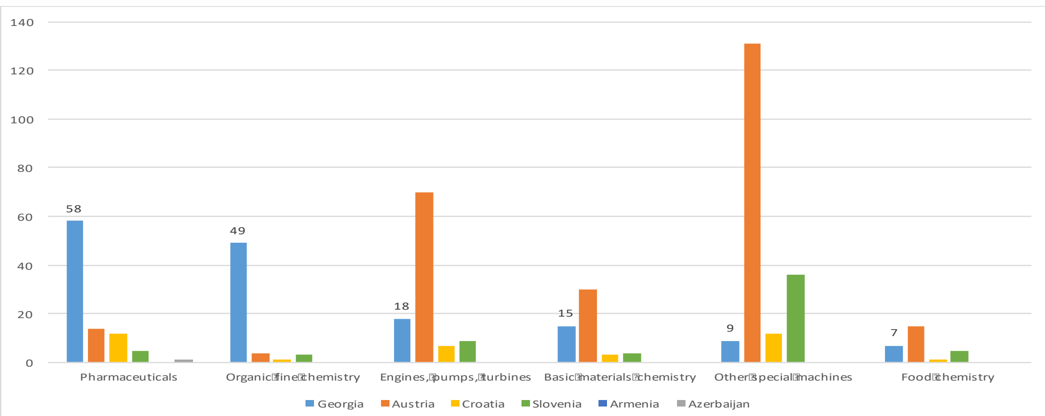
Figure 13: Patent applications from 2005 to 2015 by country – total count by filing office



Source: WIPO

Patent costs are considered to be high for physical persons and legal entities in Georgia. Recent incentives for universities facilitated increasing the patent filings originating from research institutions.[118] Figure 14 shows the number of patent applications by the top technology fields for Georgia and all the five benchmarked countries: Armenia, Austria, Azerbaijan, Croatia and Slovenia.

Figure 14: Patent applications in 2015 by country and top field of technology – total count by filing office



Source: WIPO

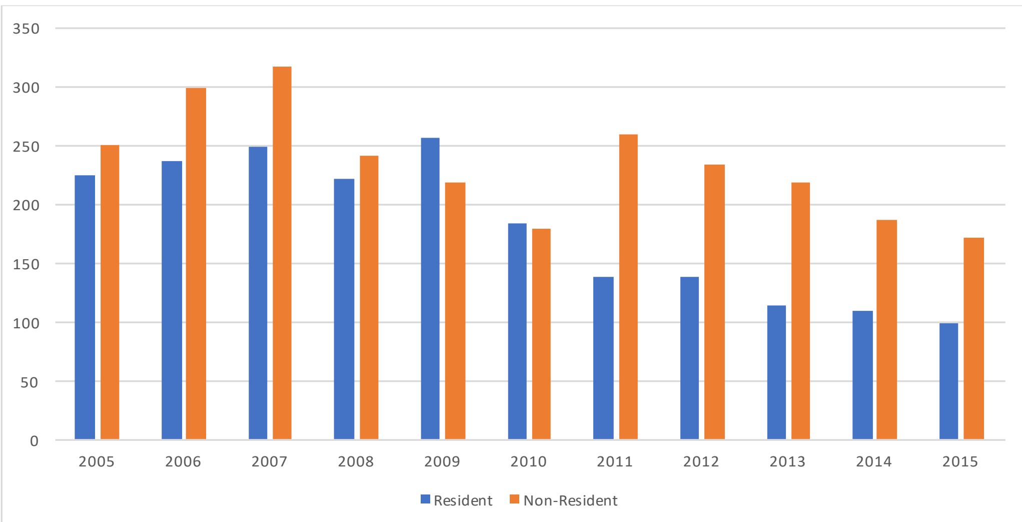
[118] USAID (2017): *Innovation and Technology in Georgia. Annual report: 2017*, 31 August 2017.

In 2015, the top technology fields for Georgia regarding patent applications were **pharmaceuticals** (58 applications); **organic fine chemistry** (49); **engines, pumps, turbines** (18); **basic materials chemistry** (15); **other special machines** (9); and **food chemistry** (7).

Moreover, in **pharmaceuticals** and **organic fine chemistry**, Georgia ranks first compared to the benchmarked countries, with a substantial difference from the second one (Austria). This is not the case for the other technology fields; in the fields of **engines, pumps, turbines**, **basic materials chemistry** and **food chemistry** Georgia ranks second after Austria; while for **other special machines**, Georgia ranks fourth below Austria, Slovenia and Croatia.

On average, 57 % of Georgia's patent applications between 2005 and 2015 were filed by non-residents and 43 % by residents. The difference between resident and non-resident patent applications became substantial between 2011 and 2015, with 63 % patents being filed by non-residents in 2015 (see Figure 15). Taken together with a decreasing overall number of patent applications, this might hint at a decline in domestic technical knowledge production.

Figure 15: Patent applications in Georgia by resident and non-resident (2005-2015)



Source: WIPO

8.3 Knowledge markets and science-business relations

Knowledge market and science-business relations are not very well developed in Georgia. The Government, being aware of this (see the *Georgia 2020* Strategy), put applied R&D, technology transfer and innovation higher on the political agenda. The establishment of GITA and its activities (e.g. establishment of FabLabs, iLabs, training, TechPark Tbilisi, etc.) are the first outcomes of this policy.

GITA's still financially limited investments, however, need time to bear fruit and are not yet mirrored in international rankings. As already highlighted in section 8.1, the most problematic pillars in Georgia according to the Global Competitiveness Index (2016-2017), with the exception of market size, are all related to the field of research and innovation (see also Table 6).

In the pillar 'Innovation', the country scores are especially bad in the following indicators:

- Quality of scientific research institutions (127 out of 137 countries) (see Chapter 4);
- Availability of scientists and engineers (125/137) (see Chapter 6);
- Company spending on R&D (122/137) (see section 3.2).

In the pillar 'Business sophistication' the country scores are especially bad in the following indicators:

- Local supplier quantity (129 out of 137 countries);
- State of cluster development (127/137);
- Local supplier quality (115/137).

In the pillar 'Technological readiness' the country scores are especially bad in the following indicators:

- Availability of latest technologies (111 out of 137 countries);
- Firm level technology absorption (108/137);
- FDI and technology transfer (94/137).

Table 6: Applied R&D and innovation rankings of Georgia in the Global Competitiveness Index

Indicator	Value (2017/2018)	Rank (2017/2018) (out of 137 countries)	Rank (2015/2016) (out of 140 countries)
Capacity for innovation	3.7	99	121
Quality of scientific research institutions	2.7	127	119
Company spending on R&D	2.7	122	127

Indicator	Value (2017/2018)	Rank (2017/2018) (out of 137 countries)	Rank (2015/2016) (out of 140 countries)
University-industry collaboration in R&D	2.8	116	128
Government procurement of advanced technology products	3.2	78	95
Availability of scientists and engineers	3.0	125	113
PCT patents applications/million pop.	1.0	70	60

Source: WEF, Global Competitiveness Index 2017/2018 and 2015/2016; the latter has been taken from www.increast.eu/en/132.php

As shown in Table 6, Georgia improved in the last few years in some indicators, such as 'capacity for innovation' and 'government procurement of advanced technology products' (albeit from low scores), but most indicators remained more or less unchanged on lower ranking numbers.

In the Global Innovation Index (GII), Georgia ranks 68 out of 127 countries. The composite indicators dealing with knowledge markets and science-business relations reveal a weak performance for Georgia in this field (see Table 7). Georgia ranks least among the scrutinised benchmarking countries in terms of the composite indicators 'Knowledge workers' and 'Knowledge diffusion'. While the category 'Knowledge workers' points – according to the sub-indicators used by the GII – to a profound human resource problem as well as a lack of BERD, the 'Knowledge diffusion category' points to a weak position in international terms of trade on knowledge-intense products and services. In the category 'Knowledge creation', however, Georgia ranks even better than Croatia and Slovenia (but worse than Armenia). This good position is caused by comparatively high outputs and results from patents (see section 8.2) and scientific articles (see Chapter 5).

Table 7: Rankings in the Global Innovation Index (n=127)

Indicator	Georgia	Armenia	Austria	Azerbaijan	Croatia	Slovenia
Knowledge workers	90	65	17	88	32	19
Indicator	Georgia	Armenia	Austria	Azerbaijan	Croatia	Slovenia
Innovation linkages	98	114	23	107	89	61
Knowledge absorption	88	90	24	112	70	39
Knowledge creation	44	32	18	108	48	45
Knowledge impact	66	91	40	109	60	25
Knowledge diffusion	77	57	29	48	52	65

Source: Cornell University, INSEAD, and WIPO (2017): The Global Innovation Index 2017: Innovation Feeding the World*, Ithaca, Fontainebleau and Geneva.*

The high-tech industry is under-developed in Georgia. Exceptions are the sub-sectors of biotechnology with a high local production of GEL 142.8 m (2015) and an export value of GEL 63.1 m (2015), and the automotive and aviation sub-sectors with an approximate GEL 25 m export value for each in 2015. Other high-tech sub-sectors, such as nanotechnology, nuclear physics, robotics and semiconductors show low or no results for the period 2014-2016. [119]

The largest high-tech sector in Georgia is the ICT sector. Within this, the telecommunication sector is the most developed sub-sector (around GEL 300 m revenue in 2016). Magticom is the market leader with a 39 % market share, followed by Geocell and Mobitel with 35 % and 25 % respectively. Internet usage revenues show an increasing trend (GEL 196 m in 2016): the market leader is Silknet with 41 % market share, followed by Magticom (24 %). Computer programming and data processing have also shown high increases and values in turnover during the last couple of years (GEL 144.5 m in 2015). The manufacturing of information and communication equipment accounted for around GEL 66 m in 2015.[120]

[119] USAID (2017): *Innovation and Technology in Georgia. Annual report: 2017*, 31 August 2017.

[120] All data from USAID (2017): *Innovation and Technology in Georgia. Annual report: 2017*, 31 August 2017. This report references data from Geostat.

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10 GLOSSARY

Abbreviation	Explanation
BERD	business expenditures on research and development
BES DCFTA	business enterprise sector Deep and Comprehensive Free Trade Area
EaP EFTA	Eastern Partnership European Free Trade Association
ENI	European Neighbourhood Instrument
ERC FDI FET FP7 GAAS	European Research Council foreign direct investment Future and Emerging Technologies Seventh Framework Programme Georgian Academy of Agrarian Science
GDP	gross domestic product
GEL	Georgian Lari
GEOSTAT	Georgian Statistical Office
GII	Global Innovation Index
GITA	Georgian Innovation and Technology Agency
GNAS	National Academy of Sciences of Georgia
GNI GRDF H2020	gross national income Georgian Research and Development Foundation Horizon 2020
HDI	Human Development Index
HE	higher education
HEI	higher education institutes
ICT ICM INTAS	Information and Communication Technologies International Credit Mobility International Association for Cooperation with Scientists from the former Soviet Union

IPR ISTC	intellectual property rights International Science Technology Center
LEPL	Legal Entity of Public Law
LLL	lifelong learning
MES	Ministry of Education and Science
MESD MoU MPI	Ministry of Economy and Sustainable Development Memorandum of Understanding Multidimensional Poverty Index
MSCSA	Marie Sklodowska Curie Actions
NQF	National Qualifications Framework
PCT	Patent Cooperation Treaty
PF PISA PPP	Partnership Fund Programme for International Student Assessment purchasing power parity
PSF	Policy Support Facility under Horizon 2020
R&D	research and development
R&I	research and innovation
RIC SC	Research and Innovation Council Societal Challenge
SME	small and medium-sized enterprise
SRNSF	Shota Rustaveli National Science Foundation
STI TIMSS TSU	science, technology and innovation Trends in International Mathematics and Science Study Tbilisi State University
UNM	United National Movement Party
WIPO	World Intellectual Property Organisation

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This report summarises evidence on the situation in the field of science, technology and innovation (STI) in Georgia and provides a background for the PSF Specific support, as requested by the Georgian authorities, which will advise on building blocks for identifying research priorities, on strengthening science-business links, and on the development of performance-based funding of research entities in Georgia

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