Supporting inter-sectoral collaboration possibilities between Research and Industry
GE 18 ENI OT 02 19

Indicator of achievement:
Availability of analysed data/mapping on science productivity by scientific fields
Baseline study

Mandatory result 1:
Science - business links strengthened through supportive collaborative activities and funding schemes
Sub-result 1.2.: Scientific priorities identified and set

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Bibliometric Analysis

Table 1 shows Georgia's aggregate number of publication counts, citable documents, citations, self-citations, citations per document and the H-index for the period 1996-2019. Furthermore specialisation indices are calculated for citable publications and a benchmarking analysis is conducted between Georgia, Armenia, Austria, Azerbaijan, Croatia, and Latvia.

Table 1: Basic Bibliometric indicators for Georgia, 1996-2019

	Documents	Citable documents	Citations	Self-citations	Citations per document	H index	Citable documents in %
Total	21188	19303	331828	39155	15,66	184	
Agriculture and Biological Sciences	1097	1059	11031	1119	10,06	42	5,5%
Arts and Humanities	585	553	5089	415	8,7	33	2,9%
Biochemistry, Genetics and Molecular Biology	1380	1322	23367	1699	16,93	65	6,8%
Business Management and Accounting	283	274	5665	48	20,02	35	1,4%
Chemical Engineering	387	371	4296	604	11,1	37	1,9%
Chemistry	978	946	12743	2125	13,03	54	4,9%
Computer Science	934	913	6836	794	7,32	32	4,7%
Decission science	124	119	673	133	5,43	13	0,6%
Dentistry	42	38	345	6	8,21	11	0,2%
Earth and Planetary Science	1365	1338	27888	3477	20,43	67	6,9%
Economy and Econometrics	167	160	1791	77	10,72	19	0,8%
Energy	205	201	1321	151	6,44	17	1,0%
Engineering	2201	2146	24364	7350	11,07	68	11,1%
Environmental Science	733	694	8393	717	11,45	42	3,6%
Health Professions	206	182	1925	53	9,34	22	0,9%
Immunology and Microbiology	474	447	7905	301	16,68	43	2,3%
Material Science	1456	1447	11043	1781	7,58	44	7,5%
Mathematics	3063	2978	25135	8494	8,21	50	15,4%
Medicine	5152	4743	110415	2802	21,43	119	24,6%
Multidisciplinary	926	913	10854	725	11,72	34	4,7%
Neuroscience	416	395	6011	410	14,45	39	2,0%
Nursing	240	224	1190	70	4,96	19	1,2%
Pharmacology	333	316	4619	377	13,87	35	1,6%
Physics and Astronomy	5817	5735	141549	26224	24,33	133	29,7%
Psychology	287	279	5196	208	18,1	37	1,4%
Social Sciences	1193	1136	10718	628	8,98	43	5,9%
Veterinary	48	47	189	10	3,94	8	0,2%

Source: SCImago

Georgia's five subject areas with the highest number of citable publications are in physics and astronomy with 29.7 % of all publications (5,735 publications in total between 1996 and 2019), medicine: 24.6 % (4,743), mathematics: 15.4 % (2,978), engineering: 11.1 % (2.146) and material science: 7.5 % (1,447). Georgia's lowest levels are found in dentistry and veterinary sciences with 0.2 % of the publications (respectively 38 and 48 publications), and in decision science (0.6 %) and economy and econometrics (0.8%) with respectively 119 and 160 citable documents.

A view on Georgia's citations from 1996 to 2019 shows that the subject area with the highest number is physics and astronomy with a relative share of 42.7 % (141,549 citations), followed by medicine with 33.3 % (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 0.04%, 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.

Table 2 presents the bibliometric specialisation patterns for Georgia and its benchmarking countries (i.e. Croatia, Latvia, Armenia, Azerbaijan, and Austria). Overall, Georgia's specialisations are situated within the subject areas of science, it specialises in mathematics, physics and astronomy, and in earth and planetary sciences. Georgia is also most specialised in the area of 'multidisciplinary'. Mathematics and earth and planetary sciences are two further areas in which Georgia leads compared to the other benchmarked countries.

Table 2: Bibliometric specialisation patterns for Georgia and benchmarking countries

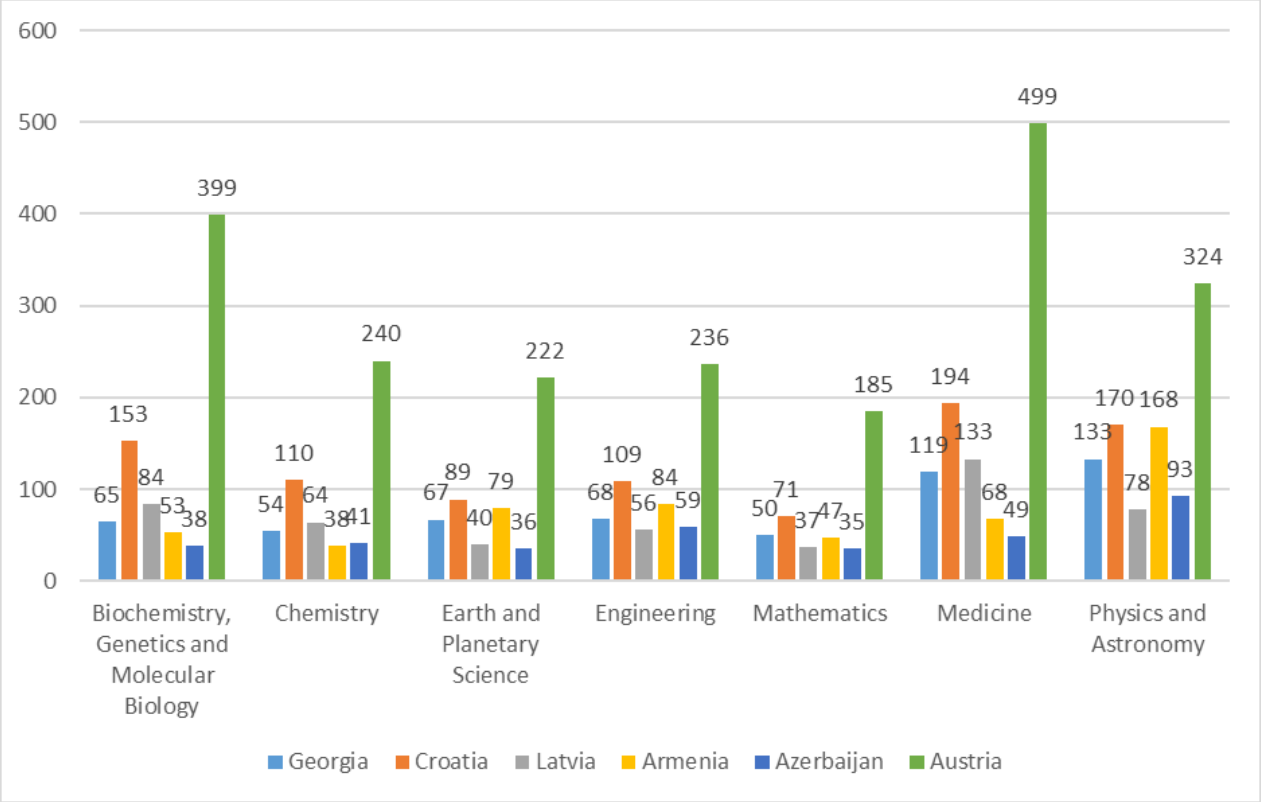
	Croatia	**Latvia**	**Georgia**	**Armenia**	**Azerbai-jan**	**Austria**
Agriculture and Biological Sciences	25	59	-35	-103	-69	-7
Arts and Humanities	104	-27	1	-48	-83	-9
Biochemistry, Genetics and Molecular Biology	-37	-59	-61	-251	-122	8
Business Management and Accounting	11	19	-39	-88	-122	-11
Chemical Engineering	-12	33	-87	64	-65	-34
Chemistry	-11	-3	-67	2	67	-17
Computer Science	-31	20	-94	-68	-22	10
Decission science	-50	12	-66	-117	-44	4
Dentistry	15	-106	-100	-192	-189	-23
Earth and Planetary Science	-13	-32	21	-54	13	5
Economy and Econometrics	24	27	-56	-130	-24	10
Energy	-23	-39	-115	-71	63	-32
Engineering	-17	167	-59	34	-6	-24
Environmental Science	1	26	-43	-17	-85	1
Health Professions	-26	-112	-45	-123	-163	4
Immunology and Microbiology	-63	-39	-37	-57	-161	18
Material Science	-57	46	-42	30	27	-15
Mathematics	-32	21	69	44	68	16
Medicine	13	-84	-16	-95	-53	13
Multidisciplinary	-93	32	96	-47	-89	4
Neuroscience	-80	-150	-34	-61	-245	15
Nursing	-107	5	-21	-16	-196	-631
Pharmacology	11	-116	-73	-44	-60	-21
Physics and Astronomy	-35	36	67	130	67	-3
Psychology	-226	-339	-236	-212	-219	-18
Social Sciences	65	-56	-95	-75	-85	-20
Veterinary	44	-402	-414	-145	-133	28

Source: SCImago, own calculations

Georgia shows in contrast no specialisations in the subject areas 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.

The h-index is an author-level metric that measures both the productivity and citation impact of the publications of a scientist or scholar[1]. Figure 1 displays those subject areas in which Georgia shows relatively high values. H-index values are displayed in comparison with its benchmarking countries.

Figure 1: h-index for Georgia and benchmarking countries in selected subject areas, 1996-2019



Source: SCImago, own calculations

Georgia reveals relatively high productivity in the subject areas of physics and astronomy (133) and medicine (119). Nevertheless it should noted that Austria and Croatia do fare better in all respective subject areas, while Armenia does better in Earth and Planetary Science, Engineering, and Physics and Astronomy. Latvia shows a slightly higher index values for Biochemistry, Genetics and Molecular Biology, Chemistry, and Medicine.

Georgia's lowest values for the h-index can be found in veterinary science (8); dentistry (11); and decision sciences (13). Georgia's lowest averages of the h-index are comparatively lower than those of Austria, Latvia and Croatia. Georgia does slightly than better than Armenia and Azerbaijan in dentistry (both 4), better than Armenia in decision sciences (11) and better than Azerbaijan in veterinary science (7).

[1] The h-index is defined as the maximum value of h such that the given author/journal has published at least h papers that have each been cited at least h times. The h-index is derived from the number of times a scientist's publications are cited in other papers, but is calculated in a way to avoid some of the problems associated with counting large numbers of marginal papers or high-profile coauthors.

Analysis of patenting data

Within the Global Innovation Index (2020) Georgia ranks comparatively high in terms of knowledge and technology outputs measured by IPRs. Georgia is ranked 34th among 127 countries in the indicator 'patents by origin', 56th in terms of 'PCT patent applications' (Patent Cooperation Treaty) and 19th in terms of 'utility models by origin'. These figures are mostly below the corresponding rankings of Austria (12; 11; 26) but clearly above Azerbaijan (64; 74; 50). Georgia has a mixed position compared to Croatia (59; 38; 34) Armenia (29; 62; 22) and Latvia (47; 31; n/a).

Table 3 displays patent applications for Georgia and its benchmarking countries (i.e. Armenia, Austria, Azerbaijan, Croatia and Latvia) for the period of 2010-2019.

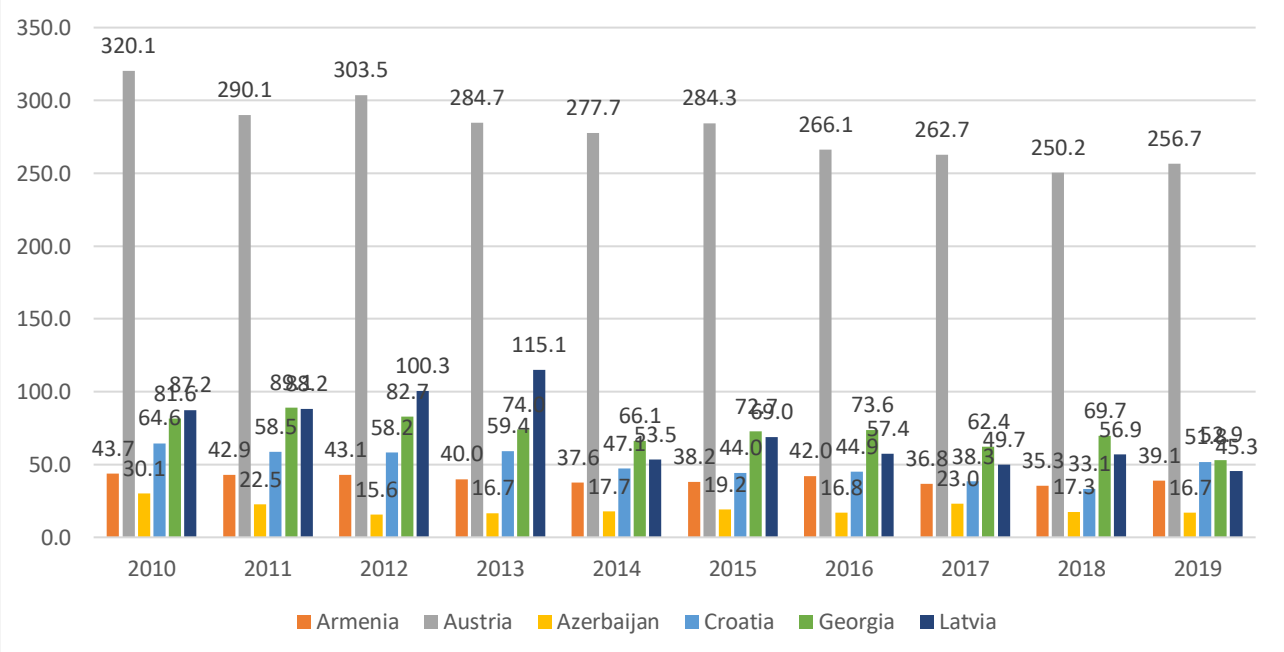
Table 3: Patent applications in absolute numbers, 2010-2019

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
Armenia	142	140	141	131	123	115	126	110	105	116	1249
Austria	2673	2430	2552	2406	2363	2441	2315	2305	2207	2274	23966
Azerbaijan	271	205	144	156	168	184	163	226	171	167	1855
Croatia	278	251	249	253	200	186	188	159	136	211	2111
Georgia	362	398	372	333	297	271	274	232	260	197	2996
Latvia	185	183	205	233	107	137	113	97	110	87	1457

Source: WIPO

In absolute numbers of patent applications, Georgia ranks second compared to the benchmarked countries, while Austria ranks first and Croatia ranks third. Overall, a decreasing trend in the number of patent applications in all benchmarked countries between 2010 and 2019 can be observed. However in Latvia the number of patent applications increased in 2012 and reached its peak in 2013. In 2019, only 197 patent applications were filed in Georgia.

Figure 2: Patent applications per 1 million inhabitants, 2010-2019



Source: WIPO, Eurostat, own calculations

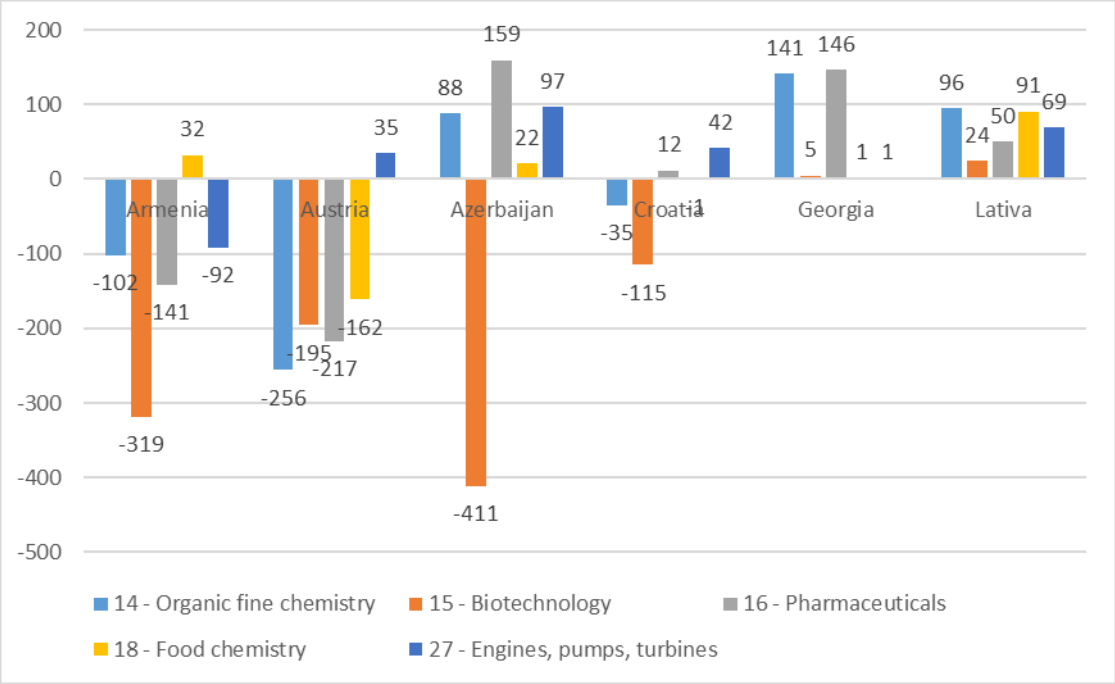
Figure 2 presents the total number of patent applications per 1 mio. inhabitants between 2010 and 2019 by filing offices in Georgia and the four benchmarked countries: Austria, Armenia, Azerbaijan,

Latvia and Croatia. As can be seen, the overall picture does not change much by normalizing the available data.

The main technology fields for Georgia in the period 2010 – 2019 in terms of patent applications were pharmaceuticals (425 applications); organic fine chemistry (273); civil engineering (84); other special machines (82); basic materials chemistry (76); engines, pumps, turbines (67); and biotechnology (61).

Figure 3 shows the revealed technological advantage[2] based on patent applications from 2010 to 2019 in the most relevant technology fields for Georgia and the corresponding values for the five benchmarked countries: Armenia, Austria, Azerbaijan, Croatia and Latvia.

Figure 3: Revealed technological advantage for Georgia and its benchmarking countries



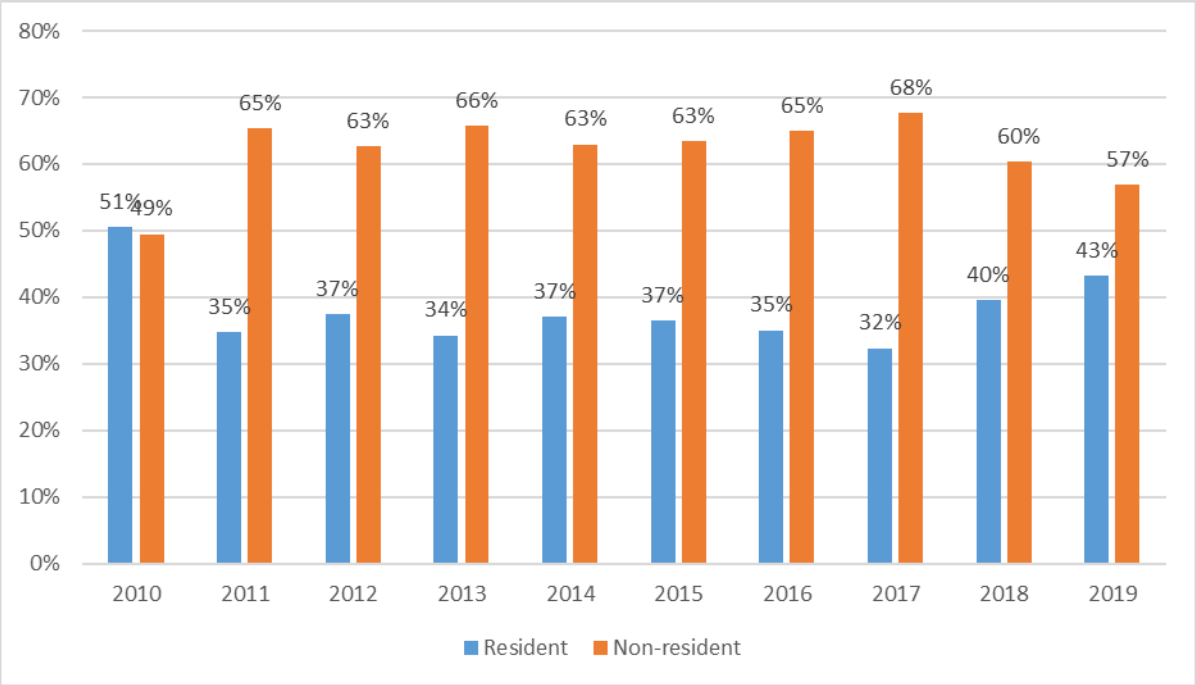
Source: WIPO, own calculations

Georgia shows the highest specialisation in organic fine chemistry compared to the benchmarked countries, and ranks second in pharmaceuticals and biotechnology. This is not the case for the other technology fields: in the fields of engines, pumps, turbines, and food chemistry Georgia shows positive specialisation index values but is less specialised than Azerbaijan and Lativa.

On average, 62 % of Georgia's patent applications between 2010 and 2019 were filed by non-residents and 38 % by residents. The difference between resident and non-resident patent applications became substantial between 2011 and 2017, with 68 % patents being filed by non-residents in 2017 (Figure 4). Taken together with a decreasing overall number of patent applications, this might hint at a decline in domestic technological knowledge production.

Figure 4: Share of resident and non-resident patent applications in Georgia, 2010-2019

[2] The revealed technology advantage (RTA) index provides an indication of the relative specialisation of a given country in selected technological domains and is based on patent applications filed under the Patent Cooperation Treaty. It is defined as a country's share of patents in a particular technology field divided by the country's share in all patent fields, normalised by the world share of patents in a partciculat technology field divided by the world's share in all patent fields. A value above 0 indiciates a specialisation while negative values refer to technology fields with no sepcialisation.



Source: WIPO, own calculations

5. Conclusions / Open Issues / Next Steps

The results of the performed analyses confirm to a large extent older studies on the subject (i.e. Bregvadze et al.2014, Schuch et al. 2017), and show particular strength and potential for the Georgian science system in (natural) science. This basis offers the advantage of providing generic knowledge for several technology fields.

Future priority setting should build on these strengths but needs also to take into account needs of the enterprise sector and/or societal needs. Accordingly the issue of the Green Deal and the circular economy offer areas in which more in-depth work could be performed.

Annex 1: Methodological notes

Data sources used

Bibliometric data have been obtained from The SCImago Journal & Country Rank. It is a publicly available portal that includes the journals and country scientific indicators developed from the information contained in the Scopus® database (Elsevier B.V.). These indicators can be used to assess and analyze scientific domains. Journals can be compared or analysed separately. Country rankings may also be compared or analysed separately. Journals can be grouped by subject area (27 major thematic areas), subject category (313 specific subject categories) or by country. Citation data is drawn from over 34,100 titles from more than 5,000 international publishers and country performance metrics from 239 countries worldwide[3]. The SCImago Journal & Country Rank offers for each country the following indicators:

1. Documents
2. Citable documents
3. Citations
4. Self-citations
5. Citations per document
6. H-index

Data on patenting have been obtained from WIPO statistics database[4]. It provides statistics on intellectual property activity worldwide, based on an annual statistics survey of national and regional intellectual property offices. Data points include the number of patents/trademarks/industrial designs/utility models filed/granted, along with detailed breakdowns by technology/sector as well as applicant origin. In total data for 35 technology fields is provided. Furthermore data are offered in the following categories:

1. Total count by filing office;
2. Resident and non-resident count by filing office;
3. Total count by applicant's origin;
4. Resident and abroad count by applicant's origin;
5. Count by filing office and by applicant's origin.

Indicators

Absolute specialisations have been identified by calculating for publications the share of a certain application area of all publications and in a similar manner for patent applications. As absolute specialisations are not comparable across different countries the analysis is also complemented by the identification of relative specialisation patterns.

Relative specialisation patterns have been calculated for publications and patent applications using a modified version of the Balassa-Hoover Index for Revealed Comparative Advantage (RCA). Initially RCA is an index used in international economics for calculating the relative advantage or disadvantage of a certain country in a certain class of goods or services as evidenced by trade flows. It is based on the Ricardian comparative advantage concept. The index has been also adopted to identify relative specialisations of countries in science and technology by using publications and

[3] SCImago, (n.d.). SJR — SCImago Journal & Country Rank, https://www.scimagojr.com/
[4] https://www.wipo.int/ipstats/en/

patents instead of trade flows. We have used the following version to calculate the Revealed Technological Advantage (RTA):

$$\boldsymbol{RTA = 100 * ln((P_{ij}/P_{it})/(P_{nj}/P_{nt}))}$$

$\mathbf{P_{ij}}$ depicts the number of patent applications in the technology field **j** for country **i**, while $\mathbf{P_{it}}$ shows the number of patent applications in all technology fields (**t**) for country **i**. $\mathbf{P_{nj}}$ shows the number of patent applications in the technology field **j** for all countries (**n**), while $\mathbf{P_{nt}}$ shows the number of patent applications in all technology fields (**t**) for all countries **n**.

Positive values above 0 indicate a relative specialisation, values below demonstrate that country I has no relative specialisation in a certain technology field.

The index can be calculated in a similar manner by using citable publications for each defined application area.

Annex 2: Bibliometric Data

Table 4: Bibliometric Output data and key indicators for Georgia by application area, 1996-2019

Application area	Documents	Citable documents	Citations	Self-citations	Citations per document	H index	Citabable documents in %	Citations in %
Total	21188	19303	331828	39155	15,66	184		
Agriculture and Biological Sciences	1097	1059	11031	1119	10,06	42	5,5%	3,3%
Arts and Humanities	585	553	5089	415	8,7	33	2,9%	1,5%
Biochemistry, Genetics and Molecular Biology	1380	1322	23367	1699	16,93	65	6,8%	7,0%
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Chemistry	978	946	12743	2125	13,03	54	4,9%	3,8%
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Decission science	124	119	673	133	5,43	13	0,6%	0,2%
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Mathematics	3063	2978	25135	8494	8,21	50	15,4%	7,6%
Medicine	5152	4743	110415	2802	21,43	119	24,6%	33,3%
Multidisciplinary	926	913	10854	725	11,72	34	4,7%	3,3%
Neuroscience	416	395	6011	410	14,45	39	2,0%	1,8%
Nursing	240	224	1190	70	4,96	19	1,2%	0,4%
Pharmacology	333	316	4619	377	13,87	35	1,6%	1,4%
Physics and Astronomy	5817	5735	141549	26224	24,33	133	29,7%	42,7%
Psychology	287	279	5196	208	18,1	37	1,4%	1,6%
Social Sciences	1193	1136	10718	628	8,98	43	5,9%	3,2%
Veterinary	48	47	189	10	3,94	8	0,2%	0,1%

Source SCImago, own calculations

Table 5: Bibliometric Output data and key indicators for benchmarking countries by application area, 1996-2019

Application Area	Country	Documents	Citable documents	Citations	Self-citations	Citations per document	H index
Veterinary	Croatia	1493	1476	9585	1946	6,42	37
Veterinary	Latvia	74	72	951	73	12,85	15
Veterinary	Armenia	38	36	230	33	6,05	9
Veterinary	Azerbaijan	35	35	195	9	5,57	7
Veterinary	Austria	4559	4473	55593	9980	12,19	77
Social Sciences	Croatia	14129	13700	49056	15991	3,47	57
Social Sciences	Latvia	2325	2273	8741	1534	3,76	33
Social Sciences	Armenia	554	542	1765	383	3,19	20
Social Sciences	Azerbaijan	428	419	1700	180	3,97	18
Social Sciences	Austria	21915	20528	238928	30865	10,9	161
Psychology	Croatia	1773	1720	17342	2252	9,78	53
Psychology	Latvia	144	135	2333	161	16,2	18
Psychology	Armenia	46	45	232	39	5,04	8
Psychology	Azerbaijan	37	36	159	11	4,3	7
Psychology	Austria	7314	6868	131704	17299	18,01	132
Physics and Astronomy	Croatia	11679	11535	236015	38857	20,21	170
Physics and Astronomy	Latvia	5786	5740	56768	12633	9,81	78
Physics and Astronomy	Armenia	10178	10052	220258	44322	21,64	168
Physics and Astronomy	Azerbaijan	4476	4442	61978	13328	13,85	93
Physics and Astronomy	Austria	57384	56391	1393508	211358	24,28	324
Pharmacology	Croatia	4195	4081	52769	10427	12,58	82
Pharmacology	Latvia	522	507	9003	1162	17,25	44
Pharmacology	Armenia	401	389	3863	463	9,63	28
Pharmacology	Azerbaijan	281	276	1342	157	4,78	20
Pharmacology	Austria	10946	10425	275943	36604	25,21	167
Nursing	Croatia	577	532	8525	791	14,77	44
Nursing	Latvia	76	76	2399	90	31,57	21
Nursing	Bulgaria	238	219	4871	211	20,47	30
Nursing	Armenia	31	30	433	11	13,97	9
Nursing	Azerbaijan	11	10	160	0	14,55	4
Nursing	Austria	4524	4022	92640	9357	20,48	129

Application Area	Country	Documents	Citable documents	Citations	Self-citations	Citations per document	H index
Neuroscience	Croatia	1503	1399	30413	4058	20,23	76
Neuroscience	Latvia	174	167	3379	221	19,42	31
Neuroscience	Armenia	285	278	1970	505	6,91	22
Neuroscience	Azerbaijan	40	37	662	31	16,55	14
Neuroscience	Austria	13942	12775	522080	53030	37,45	249
Multidisciplinary	Croatia	814	772	36919	1577	45,36	86
Multidisciplinary	Latvia	661	654	9940	477	15,04	34
Multidisciplinary	Armenia	204	202	8787	413	43,07	37
Multidisciplinary	Azerbaijan	121	111	414	50	3,42	10
Multidisciplinary	Austria	7683	7150	426737	31725	55,54	298
Medicine	Croatia	37602	35340	427752	57711	11,38	197
Medicine	Latvia	3412	3270	105893	4594	31,04	133
Medicine	Armenia	2110	1997	36939	2323	17,51	68
Medicine	Azerbaijan	2613	2543	28592	473	10,94	49
Medicine	Austria	139002	125103	3785781	373963	27,24	499
Mathematics	Croatia	6199	6055	50898	15474	8,21	71
Mathematics	Latvia	2533	2491	11099	3915	4,38	37
Mathematics	Armenia	2169	2151	21800	7575	10,05	47
Mathematics	Azerbaijan	2303	2272	12701	4336	5,51	35
Mathematics	Austria	36350	34792	446419	83929	12,28	185
Material Science	Croatia	6971	6909	77758	13370	11,15	90
Material Science	Latvia	4751	4710	42566	8932	8,96	70
Material Science	Azerbaijan	2771	2750	13342	4715	4,81	41
Material Science	Armenia	2246	2215	14072	4131	6,27	43
Material Science	Austria	37819	37118	745327	107257	19,71	225
Immunology and Microbiology	Croatia	2016	1913	46295	5046	22,96	92
Immunology and Microbiology	Latvia	604	588	15572	1173	25,78	59
Immunology and Microbiology	Armenia	349	337	3395	520	9,73	27
Immunology and Microbiology	Azerbaijan	99	99	712	50	7,19	15
Immunology and Microbiology	Austria	16189	15302	675507	79342	41,73	275
Health Professions	Croatia	1284	1219	14313	2307	11,15	53
Health Professions	Latvia	132	125	936	120	7,09	18
Health Professions	Armenia	32	32	113	22	3,53	6

Application Area	Country	Documents	Citable documents	Citations	Self-citations	Citations per document	H index
Health Professions	Azerbaijan	45	43	648	21	14,4	8
Health Professions	Austria	6171	5814	107151	13100	17,36	124
Environmental Science	Croatia	6188	6030	69248	15043	11,19	93
Environmental Science	Latvia	1912	1878	19624	2476	10,26	53
Environmental Science	Armenia	363	347	3051	365	8,4	25
Environmental Science	Azerbaijan	363	351	2815	243	7,75	24
Environmental Science	Austria	22279	21275	541747	70137	24,32	229
Engineering	Croatia	18548	18220	108560	22912	5,85	109
Engineering	Latvia	8319	8192	33344	9485	4,01	56
Engineering	Armenia	2761	2714	33043	9297	11,97	84
Engineering	Azerbaijan	2858	2810	20054	7081	7,02	59
Engineering	Austria	62012	60123	738048	121034	11,9	236
Energy	Croatia	2876	2805	21483	3723	7,47	59
Energy	Latvia	2285	2273	9965	2631	4,36	38
Energy	Armenia	291	289	2183	506	7,5	24
Energy	Azerbaijan	918	915	2488	542	2,71	24
Energy	Austria	9433	9067	128673	16393	13,64	130
Economy and Econometrics	Croatia	2042	1993	5716	1701	2,8	27
Economy and Econometrics	Latvia	369	357	2693	170	7,3	19
Economy and Econometrics	Armenia	76	71	174	19	2,29	7
Economy and Econometrics	Azerbaijan	175	170	546	70	3,12	11
Economy and Econometrics	Austria	6398	6099	100971	11395	15,78	124
Earth and Planetray Science	Croatia	5408	5310	63722	16539	11,78	89
Earth and Planetray Science	Latvia	935	918	9299	1145	9,95	40
Earth and Planetray Science	Armenia	977	960	27015	2992	27,65	79
Earth and Planetray Science	Azerbaijan	955	944	5976	860	6,26	36
Earth and Planetray Science	Austria	23196	22399	519644	80384	22,4	222
Dentistry	Croatia	692	665	7613	981	11	42
Dentistry	Latvia	49	48	1091	31	22,27	16
Dentistry	Armenia	14	14	439	18	31,36	4
Dentistry	Azerbaijan	13	12	30	2	2,31	4
Dentistry	Austria	1652	1614	33204	2927	20,1	80
Decission science	Croatia	804	778	2968	643	3,69	25

Application Area	Country	Documents	Citable documents	Citations	Self-citations	Citations per document	H index
Decission science	Latvia	359	350	1235	378	3,44	16
Decission science	Armenia	68	66	333	48	4,9	11
Decission science	Azerbaijan	120	114	821	157	6,84	13
Decission science	Austria	5119	4707	75508	9144	14,75	110
Computer Science	Croatia	9795	9605	46343	9488	4,73	69
Computer Science	Latvia	3998	3878	13404	4704	3,35	38
Computer Science	Armenia	1105	1097	2484	882	2,25	19
Computer Science	Azerbaijan	1480	1453	4537	1374	3,07	27
Computer Science	Austria	53466	51221	622127	103579	11,64	226
Chemistry	Croatia	9503	9222	130104	26528	13,69	110
Chemistry	Latvia	2480	2434	30142	5127	12,15	64
Chemistry	Armenia	1821	1746	11300	2956	6,21	38
Chemistry	Azerbaijan	2808	2783	11413	3499	4,06	41
Chemistry	Austria	31292	30688	807247	116959	25,8	240
Chemical Engineering	Croatia	4605	4381	50998	8701	11,07	86
Chemical Engineering	Latvia	1677	1663	12165	1974	7,25	46
Chemical Engineering	Azerbaijan	1560	1545	4905	1489	3,14	30
Chemical Engineering	Armenia	354	354	2128	414	6,01	23
Chemical Engineering	Austria	12941	12435	275562	40032	21,29	177
Business Management and Accounting	Croatia	2601	2519	11126	2134	4,28	41
Business Management and Accounting	Latvia	678	663	3649	560	5,38	23
Business Management and Accounting	Azerbaijan	160	155	401	67	2,51	11
Business Management and Accounting	Armenia	97	92	336	51	3,46	9
Business Management and Accounting	Austria	7685	7149	123984	11997	16,13	140
Biochemistry, Genetics and Molecular Biology	Croatia	9889	9457	196337	25922	19,85	153
Biochemistry, Genetics and Molecular Biology	Latvia	1887	1826	44835	4030	23,76	84
Biochemistry, Genetics and Molecular Biology	Armenia	1351	1316	13422	2553	9,93	53
Biochemistry, Genetics and Molecular Biology	Azerbaijan	564	556	5746	543	10,19	38
Biochemistry, Genetics and Molecular Biology	Austria	55249	52200	2026314	225913	36,68	399

Application Area	Country	Documents	Citable documents	Citations	Self-citations	Citations per document	H index
Arts and Humanities	Croatia	8819	8653	32826	9317	3,72	51
Arts and Humanities	Latvia	579	565	4324	351	7,47	22
Arts and Humanities	Armenia	320	315	3824	346	11,95	25
Arts and Humanities	Azerbaijan	188	184	386	64	2,05	10
Arts and Humanities	Austria	10475	9845	203823	18787	19,46	198
Agriculture and Biological Sciences	Croatia	11001	10799	112894	24747	10,26	104
Agriculture and Biological Sciences	Latvia	3696	3661	24260	4667	6,56	59
Agriculture and Biological Sciences	Armenia	511	498	4529	413	8,86	30
Agriculture and Biological Sciences	Azerbaijan	593	581	3725	300	6,28	27
Agriculture and Biological Sciences	Austria	28653	27800	744641	97795	25,99	245

Source: SCImago

Annex 3: Data on patenting

Table 6: Patent publications by technology for Georgia, 2010-2019

Field of technology	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total	Share in %
1 - Electrical machinery, apparatus, energy	1	1	4	2		5	3	3		5	24	1,5%
2 - Audio-visual technology		2	1								3	0,2%
3 - Telecommunications	2	6	6	1			2	2			19	1,2%
4 - Digital communication	3	9	14	2							28	1,7%
5 - Basic communication processes		1	3								4	0,2%
6 - Computer technology		1	2	2			2	1		1	9	0,6%
7 - IT methods for management			2	1		1				1	5	0,3%
8 - Semiconductors		2		1			1	2		1	7	0,4%
9 - Optics	2	2	1			2	3			1	11	0,7%
10 - Measurement	2	2	6	1		1	2		3		17	1,0%
11 - Analysis of biological materials			2					1			3	0,2%
12 - Control		1	2	1		1		3	1		9	0,6%
13 - Medical technology		2	4	1		6	7	7	5	3	35	2,2%
14 - Organic fine chemistry	10	33	46	22	4	49	23	40	24	22	273	16,8%
15 - Biotechnology	3	6	12	2		6	10	14	2	6	61	3,8%
16 - Pharmaceuticals	14	50	64	35	4	58	47	82	34	37	425	26,1%
17 - Macromolecular chemistry, polymers		3	2				2	3			10	0,6%
18 - Food chemistry	4	17	10	4		7	9	5		2	58	3,6%
19 - Basic materials chemistry	2	13	8	16	1	15	6	6	5	4	76	4,7%
20 - Materials, metallurgy	2	7	4	6	1	6	8	4	6	7	51	3,1%
21 - Surface technology, coating		4	1	3			3	1	1	6	19	1,2%
22 - Micro-structural and nano-technology									1		1	0,1%
23 - Chemical engineering	3	6	11			8	5	5	4	2	44	2,7%
24 - Environmental technology	2	2	2	2	1	6	3	2	3	3	26	1,6%

Field of technology	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total	Share in %
25 - Handling	1	6	11	4		2	3	2	1	3	33	2,0%
26 - Machine tools	1	1	7	1			1	2	4	2	19	1,2%
27 - Engines, pumps, turbines	3	9	16	8	1	17	4	3	1	5	67	4,1%
28 - Textile and paper machines			1			1				1	3	0,2%
29 - Other special machines	5	15	13	6	1	9	16	8	5	4	82	5,0%
30 - Thermal processes and apparatus	1		4	3		3		2		2	15	0,9%
31 - Mechanical elements	5	5	15	1		2			1		29	1,8%
32 - Transport	4	5	3	2	2	7	4	5	1	6	39	2,4%
33 - Furniture, games		2	1	1					3	5	12	0,7%
34 - Other consumer goods		5	4	2		2	4	1	2	5	25	1,5%
35 - Civil engineering	4	11	17	9	1	14	7	11	3	7	84	5,2%

Source: WIPO database

Table 7: Patent publications by country and per 1 mio. inhabitants, 2010-2019

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Armenia	43,7	42,9	43,1	40,0	37,6	38,2	42,0	36,8	35,3	39,1
Austria	320,1	290,1	303,5	284,7	277,7	284,3	266,1	262,7	250,2	256,7
Azerbaijan	30,1	22,5	15,6	16,7	17,7	19,2	16,8	23,0	17,3	16,7
Croatia	64,6	58,5	58,2	59,4	47,1	44,0	44,9	38,3	33,1	51,8
Georgia	81,6	89,1	82,7	74,0	66,1	72,7	73,6	62,4	69,7	52,9
Latvia	87,2	88,2	100,3	115,1	53,5	69,0	57,4	49,7	56,9	45,3

Source: WIPO database

Table 8: Revealed Technology Advantage, 2010-2019

	Armenia	Austria	Azerbaijan	Croatia	Georgia	Lativa
1 - Electrical machinery, apparatus, energy	-187	-34	-267	-35	-205	-4
2 - Audio-visual technology	-110	-133		-117	-336	-134
3 - Telecommunications	-321	-199	-141	-310	-114	-53
4 - Digital communication	-328	-251	-207	-194	-152	-183
5 - Basic communication processes	18	-424	-241	-145	-151	13
6 - Computer technology	-239	-186	-140	-162	-314	-136
7 - IT methods for management		-193		-33	-224	-49
8 - Semiconductors	-157	-165	-174	-239	-258	-141
9 - Optics	-123	-125	-175	-139	-191	-45
10 - Measurement	-182	-28	26	-96	-206	19
11 - Analysis of biological materials		-113	85	-67	-171	141
12 - Control		-31	-6	18	-180	-51
13 - Medical technology	-145	-77	94	-21	-125	41
14 - Organic fine chemistry	-102	-256	88	-35	141	96
15 - Biotechnology	-319	-195	-411	-115	5	24
16 - Pharmaceuticals	-141	-217	159	12	146	50
17 - Macromolecular chemistry, polymers		-182	182	-239	-153	-81
18 - Food chemistry	32	-162	22	-1	1	91
19 - Basic materials chemistry	-128	-128	103	-106	-2	13
20 - Materials, metallurgy	-220	-43	-17	-83	-25	46
21 - Surface technology, coating	-295	-52	-126	-128	-88	33
22 - Micro-structural and nano-technology		-133	91		-165	102
23 - Chemical engineering	-335	-42	75	-83	-44	48
24 - Environmental technology		-24	-60	21	-60	53
25 - Handling	-35	16	-144	0	-82	-46
26 - Machine tools	-132	23	-114	-35	-145	-49
27 - Engines, pumps, turbines	-92	35	97	42	1	69
28 - Textile and paper machines		2		-100	-265	-47
29 - Other special machines	-98	29	-109	57	-16	53
30 - Thermal processes and apparatus	-295	44	-115	42	-111	91
31 - Mechanical elements	-339	28	26	3	-90	-77
32 - Transport	-400	16	-20	39	-106	19
33 - Furniture, games	-52	49	-19	83	-174	26
34 - Other consumer goods		3	-140	71	-74	13
35 - Civil engineering	-51	76	122	94	-13	70

Source: WIPO database, own calculations