The state of scientific research in Finland 2016 –
selected figures and tables from the bibliometric analysis in the report

For more information:
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The Academy of Finland's reviews of the state of scientific research in Finland

- Support Finnish universities and research institutes in their efforts to further develop their operations
- Serve to strengthen the knowledge base for policy-making
- The Academy has produced reviews regularly since late 1990s, at two-year intervals since 2012
- Complementary analyses between the publication years
- Active collaboration with stakeholders

- www.aka.fi/tieteentila > EN

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The 2016 review

Themes:

- Research personnel and funding

- Publishing, scientific impact and co-publications
  - The bibliometric analyses compare Finland to twelve research-intensive countries (AU, BE, CH, DK, IE, NL, NO, SE, and DE, FR, GB, US).

- The review includes a separate section on the impact of research beyond academia
  - Data collected both by qualitative and quantitative methods.
  - *Special theme: Broader impact of research in society* (available in English)
  - Read more: www.aka.fi/en/research-and-science-policy/state-of-scientific-research/broader-impact-of-research-in-society

- The review as a whole is available in Finnish at www.aka.fi/tieteentila .

How does Finland compare to other research-intensive countries in terms of publication output?

- Indicator: **Number of publications per capita**

- Finland has a high number of scientific publications per capita in comparison to many OECD countries.
- Finland's number of publications has increased 1.5-fold in the 2000s.
- Many comparison countries have shown a higher increase in the 2000s.

- Note: The figures only include publications in the Web of Science data.

Finland has a high number of scientific publications per capita

	Publications per 100,000 capita		Relative change	Proportion of publications in which the country's researchers have participated	
Country	2001–2004	2011–2014	01/04–11/14	2001–2004	2011–2014
Switzerland	875	1,452	1.7	1.7%	1.8%
Denmark	658	1,196	1.8	0.9%	1.0%
Sweden	762	1,091	1.4	1.8%	1.6%
Norway	511	1,017	2.0	0.6%	0.8%
Finland	662	969	1.5	0.9%	0.8%
Netherlands	564	966	1.7	2.5%	2.4%
Belgium	483	815	1.7	1.3%	1.3%
Ireland	355	757	2.1	0.4%	0.5%
United Kingdom	552	745	1.3	8.8%	7.1%
Austria	443	742	1.7	1.0%	0.9%
Germany	380	570	1.5	8.3%	6.8%
USA	424	538	1.3	33.2%	25.3%
France	353	490	1.4	5.9%	4.8%

Note: Publication numbers are based on whole counting. Population data are from 2004 and 2014.

Source: Clarivate Analytics, Web-of-Science-based data, bibliometric computing CSC Ltd, 2016; OECD Stat. Main Science and Technology Indicators.

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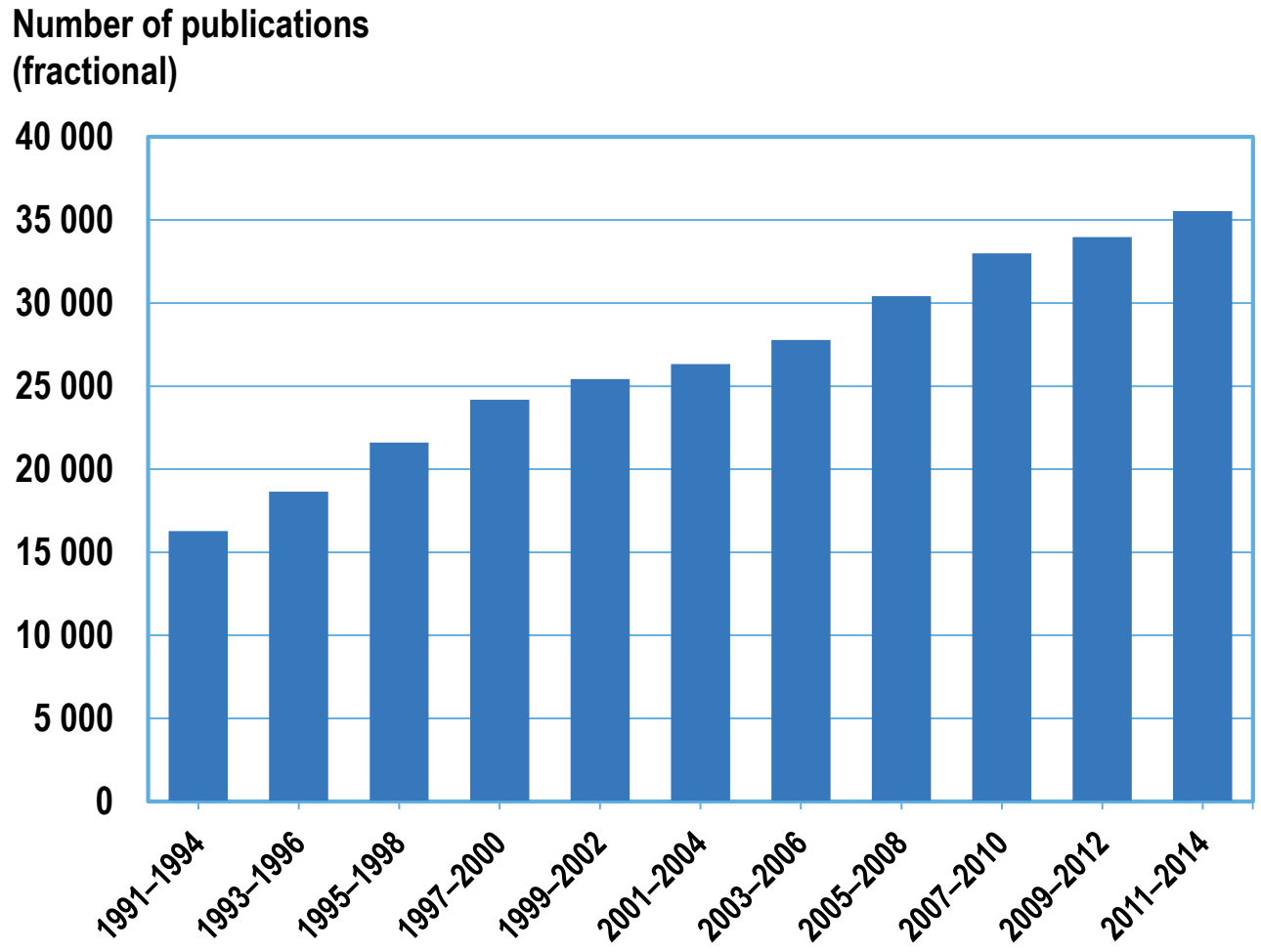
How has Finland's publication output developed?

- Indicator: **Number of publications**

- Finland's number of publications has increased in absolute terms since the beginning of the period under review, 1991–2014.
- In the 1990s, the increase was faster than in the world on average, but the pace has slowed down in the 2000s.
- Compared to the OECD countries, Finland has witnessed a somewhat faster growth during the whole period.

- Note: The figures only include publications included in the Web of Science data.

Finland: Development of publication numbers in 1991–2014



Source: Clarivate Analytics, Web-of-Science-based data, bibliometric computing CSC Ltd, 2016.

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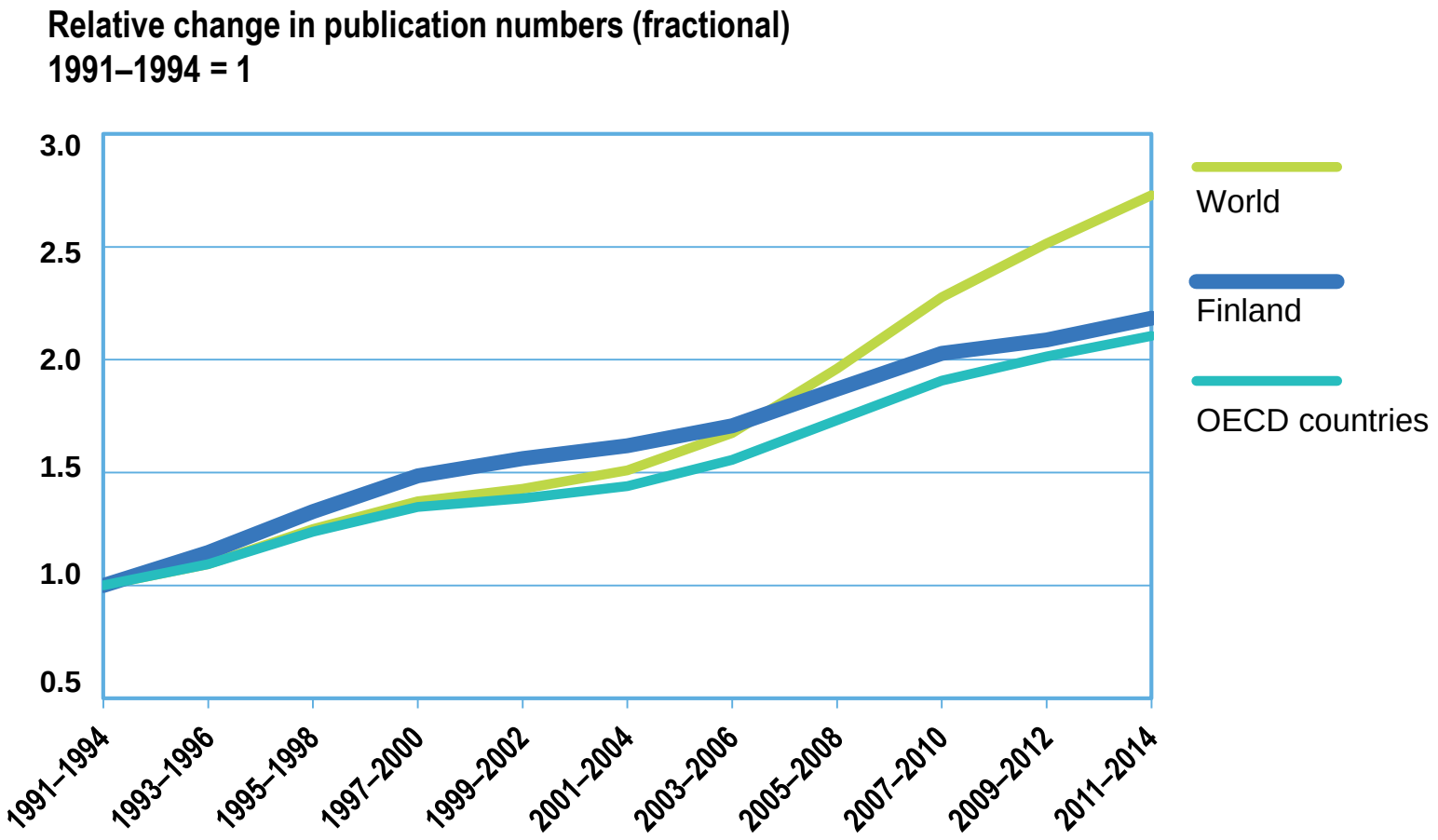
Relative change in number of Finland's publications compared to the world and OECD countries in 1991–2014



Source: Clarivate Analytics, Web-of-Science-based data, bibliometric computing CSC Ltd, 2016.

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Are there differences in Finland's publication profile compared to the comparison countries?

- Indicator: **Publication profile based on disciplinary proportions of country's publications**
- Note: Publication numbers cannot be compared across disciplines!
  - International citation databases do not cover the publications of all disciplines in the same way. Scientific articles in research books or edited scientific books (monographs) are not included. The material is not as appropriate for a detailed examination of publication activities in the social sciences or the humanities (SSH) as in many other disciplines.
- Comparing countries within the same discipline makes more sense.

- Finland: ICT and electrical engineering; Ecology, environmental science, plant biology; Business studies and economics
  - Greater proportion than in any comparison country
- Finland: Clinical medicine; Biomedicine, biosciences
  - Smaller proportion than in any comparison country (except Norway in biomed.)

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Publication profile of Finland and 12 comparison countries in 2011–2014

	Publication number (fract.)	Proportion of country's publications, %													
Disciplinary group	**Finland**	**FI**	**NL**	**BE**	**IE**	**GB**	**AT**	**NO**	**FR**	**SE**	**CH**	**DE**	**DK**	**US**	**WORLD**
Mathematics and statistics	**812**	2.3	1.4	2.5	2.0	2.0	3.6	2.3	4.5	1.8	2.1	2.7	1.3	2.2	2.8
Physics, geosciences, space science	**4,747**	13.4	10.2	12.9	10.9	11.9	14.4	11.8	18.7	11.8	16.9	18	11.1	11.9	14.2
Chemistry, chemical engineering	**2,366**	6.7	4.6	6.8	6.7	5.3	6.4	4.6	8.4	6.1	7.7	9.0	5.5	5.3	9.1
ICT and electrical engineering	**4,386**	12.3	6.6	8.9	9.8	6.7	11.4	7.5	10.7	9.1	8.2	8.5	6.9	7.3	9.9
Engineering, other fields	**2,598**	7.3	5.8	7.4	7.9	6.6	7.9	9.9	8.4	8.6	7.0	8.4	7.2	7.1	11.3
Business studies and economics	**1,214**	3.4	3.0	2.3	2.2	2.9	2.3	3.1	1.8	2.4	2.1	2.1	2.5	2.3	2.1
Ecology, environmental science, plant biology	**3,115**	8.8	6.3	7.8	6.5	5.9	7.3	8.6	6.8	7.3	7.1	6.2	8.1	6.8	6.9
Agricultural and forest sciences	**1,306**	3.7	2.3	4.0	5.4	2.0	2.9	4.1	2.1	2.3	2.6	2.3	3.8	2.2	3.0
Biomedicine, biosciences	**3,462**	9.7	12.4	12.1	10.9	11.5	11.6	9.0	10.8	11.9	13.3	11.9	13.7	14.3	11.2
Clinical medicine	**5,673**	16.0	26.6	18.4	19.3	21.1	21.0	16.9	18.1	20.2	20.1	19.5	23.9	20.8	16.5
Health sciences	**1,708**	4.8	5.6	3.1	5.1	5.1	2.1	7.6	1.9	6.6	3.1	2.0	5.3	5.3	3.2
Behavioural sciences	**1,168**	3.3	4.9	3.7	3.5	4.1	1.9	3.5	1.3	2.5	2.2	2.6	1.6	4.2	2.6
Social sciences, other fields	**1,268**	3.6	4.5	3.5	4.3	6.2	2.5	5.7	1.3	4	2.4	2.0	3.8	4.1	2.7
Humanities	**903**	2.5	2.7	4.5	3.6	6	2.4	3.0	3.0	2.3	2.0	2.3	2.3	3.4	2.2
General scientific journals	**801**	2.3	3.0	2.1	1.8	2.8	2.4	2.3	2.3	3.2	3.2	2.5	2.9	3.0	2.3
All fields	**35,529**	100	100	100	100	100	100	100	100	100	100	100	100	100	100

The proportion of publications has been highlighted when it is 0.5 percentage points higher than in the world on average.

Source: Clarivate Analytics, Web-of-Science-based data, bibliometric computing CSC Ltd, 2016.

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What is the scientific impact of Finnish research and how has the impact developed compared to OECD countries?

- Indicator: **Top 10 index**

- The level of scientific research in Finland has remained stable.
- Finnish research performs above the world average.
- Although the level of Finnish research has climbed slightly over the past ten years, many OECD countries have outperformed and outpaced Finland.

- Compared with the results of the 2014 review, there have been only marginal changes in the state of scientific research in Finland.

The scientific impact of research in Finland is stable and above the world average, but competition has become stiffer

Scientific impact based on top 10 index in selected OECD countries in 1991–2014

	Top 10 index			Publication number (fract.)
Selected OECD countries	1991–1994	2001–2004	2011–2014	2011–2014
Switzerland	1.27	1.37	1.50	71,727
USA	1.42	1.38	1.43	1,409,660
Netherlands	1.23	1.29	1.40	107,936
Denmark	1.10	1.32	1.39	43,419
UK	1.05	1.16	1.35	338,129
Australia	0.93	1.04	1.22	167,865
Belgium	0.92	1.06	1.21	57,370
Sweden	1.15	1.12	1.19	68,630
Canada	1.05	1.11	1.18	205,558
Luxembourg	0.32	0.71	1.17	2,313
Ireland	0.78	0.95	1.15	23,730
Norway	0.93	1.07	1.09	34,341
Germany	0.80	0.96	1.09	330,270
Austria	0.74	0.90	1.06	39,807
Finland	0.99	1.00	1.06	35,529
France	0.84	0.95	1.04	227,430
Iceland	0.97	1.04	1.03	2,207
Israel	0.93	0.99	1.03	42,019
New Zealand	0.85	0.88	1.02	26,054

Selected OECD countries are countries with the top 10 index **above the world average** (index value > 1) in 2011–2014.

Source: Clarivate Analytics, Web-of-Science-based data, bibliometric computing CSC Ltd, 2016.

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Scientific impact based on top 10 index in selected OECD countries in 1991–2014

Selected OECD countries are countries with the top 10 index **below the world average** (index value < 1) in 2011–2014.

	Top 10 index			Publication number (fract.)
Selected OECD countries	**1991–1994**	**2001–2004**	**2011–2014**	**2011–2014**
Spain	0.59	0.81	0.95	184,460
Italy	0.73	0.83	0.94	212,462
Greece	0.48	0.76	0.90	38,295
South Korea	0.64	0.77	0.86	192,487
Portugal	0.59	0.80	0.80	43,643
Slovenia	0.55	0.56	0.79	12,274
Estonia	0.34	0.54	0.69	5,165
Japan	0.73	0.69	0.65	319,229
Hungary	0.43	0.59	0.60	19,575
Chile	0.41	0.60	0.57	18,441
Turkey	0.46	0.55	0.53	105,784
Mexico	0.45	0.45	0.46	40,693
Czech Republic	0.35	0.46	0.44	46,148
Poland	0.32	0.37	0.43	87,609
Slovakia	0.17	0.28	0.37	13,764
All OECD countries	**1.11**	**1.09**	**1.14**	**4,574,023**

Source: Clarivate Analytics, Web-of-Science-based data, bibliometric computing CSC Ltd, 2016.

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Top 10 index as a citation indicator (1/2)

- Research with the greatest scientific impact can be analysed by examining the most highly cited publications.
- **The top 10 index** describes a country's/organisation's relative proportion of the 10% most cited publications in the world.
- The citation indicator is scaled so that the **world average in each discipline is always one**.
- Top 10 index > 1: The proportion of a country's publications that belong to the most highly cited 10% of publications in their field is greater than in the world on average.
  - World = publications covered in the citation database and included in the analysis.

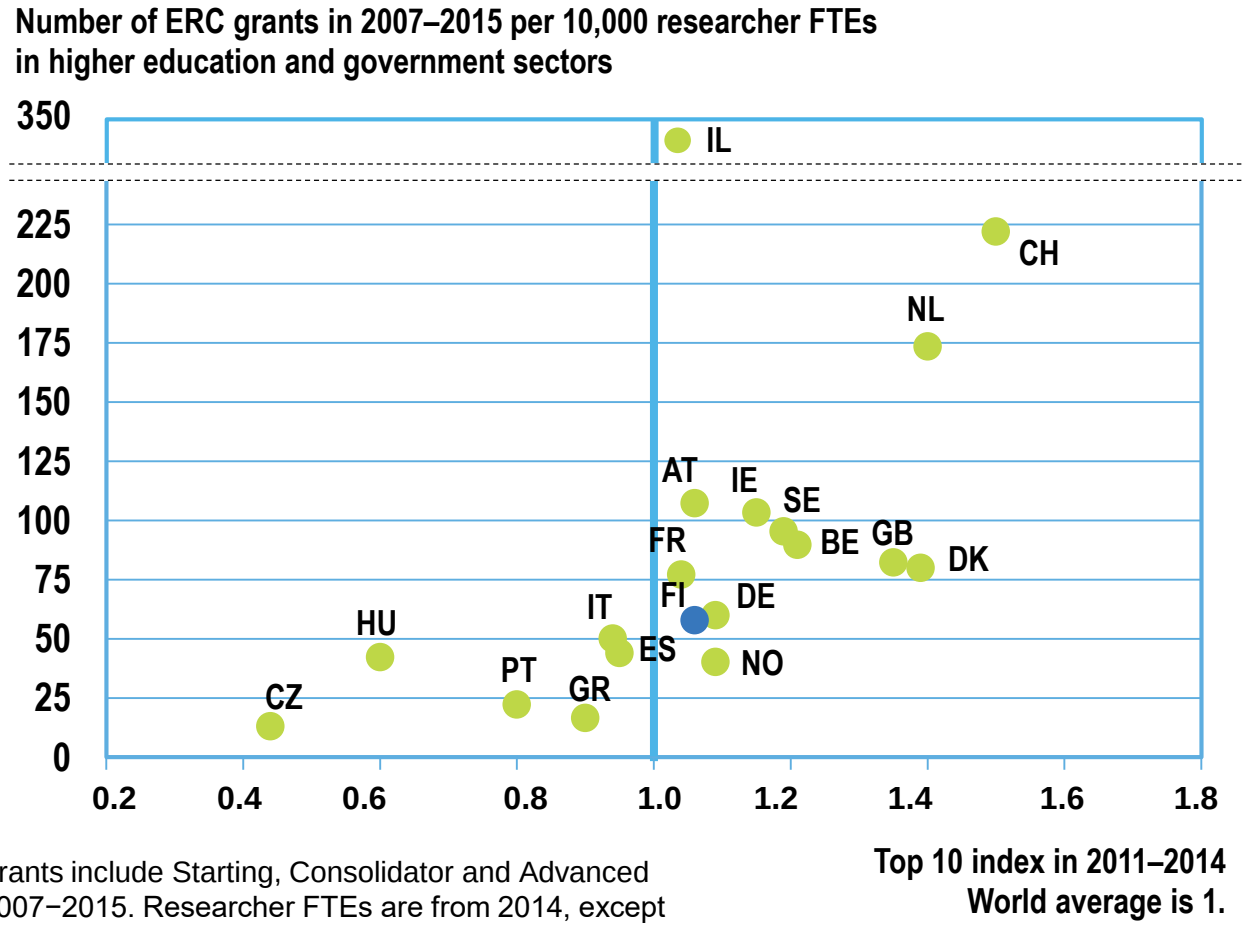
Top 10 index as a citation indicator (2/2)

- Citations are accumulated with a delay that varies greatly between disciplines.
- **The number of citations** gained by publications is **normalised**.
  - Publications are compared to the international level within the same discipline, publication type (e.g. article, review article) and the same publication year.
  - Self-citations are excluded from the analysis.

- **Publications are fractionalised** according to discipline, country and organisation.
  - One publication can belong to more than one discipline (subject category).
  - Fractional counting leads to the most proper field normalisation.
  - E.g. a Finnish-Swedish publication results in 0.5 publication points for both countries.
  - If researchers from three Finnish universities have contributed to the publication, each organisation gains 1/3 x 0.5 publication points.

Number of ERC grants per researcher FTEs in higher education and government sectors, and the top 10 index

The figure includes countries with a minimum of 20 ERC grants in 2007−2015



Country codes

AT	Austria
BE	Belgium
CH	Switzerland
CZ	Czech Republic
DE	Germany
DK	Denmark
ES	Spain
FI	Finland
FR	France
GB	Great Britain
GR	Greece
HU	Hungary
IE	Ireland
IL	Israel
IT	Italy
NL	Netherlands
NO	Norway
PT	Portugal
SE	Sweden

The ERC grants include Starting, Consolidator and Advanced Grants in 2007−2015. Researcher FTEs are from 2014, except for Israel and Switzerland from 2012.

Sources: ERC funding statistics (https://erc.europa.eu/projects-and-results/statistics); OECD Stat, Main Science and Technology Indicators; Clarivate Analytics, Web-of-Science-based data, bibliometric computing CSC Ltd, 2016.

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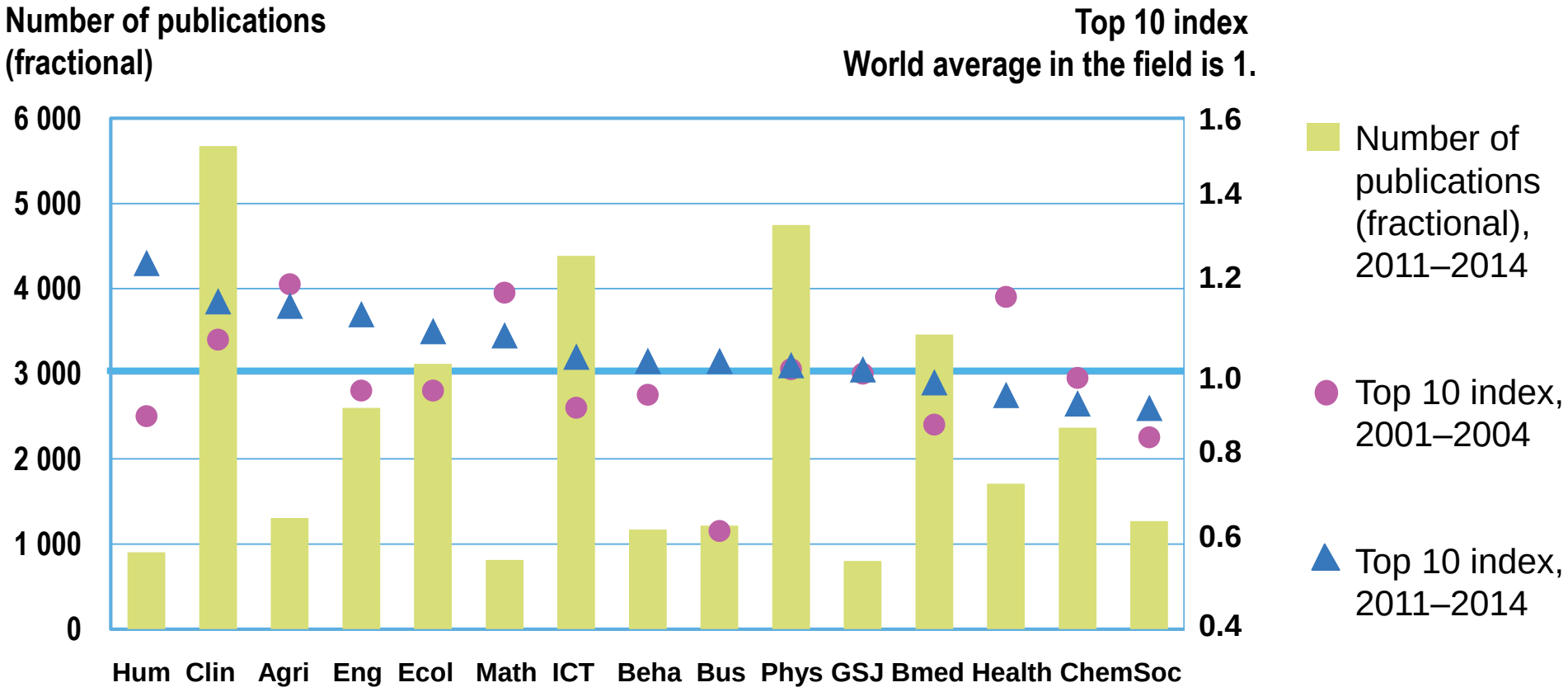
What is the scientific impact of different disciplinary groups and how has it developed?

- Indicator: **Top 10 index by disciplinary group**

- In Finland, the top 10 index was higher than or similar to the world average in 11/15 disciplinary groups in 2011–2014.
- In the 2000s, the index value has increased in six disciplinary groups and decreased in two (the change in the index value was at least +/-0.1).
- Other disciplinary groups showed smaller changes.

Finland: Scientific impact based on top 10 index by disciplinary group in 2001–2004 and 2011–2014



Humanities
Clinical medicine
Agricultural and forest sciences
Engineering, other fields
Ecology, environmental science, plant biology

Mathematics and statistics
ICT and electrical engineering
Behavioral sciences
Business studies and economics
Physics, geosciences, space science

General **s**cientific **j**ournals
Biomedicine, biosciences
Health sciences
Chemistry, chemical engineering
Social sciences, other fields

Source: Clarivate Analytics, Web-of-Science-based data, bibliometric computing CSC Ltd, 2016.

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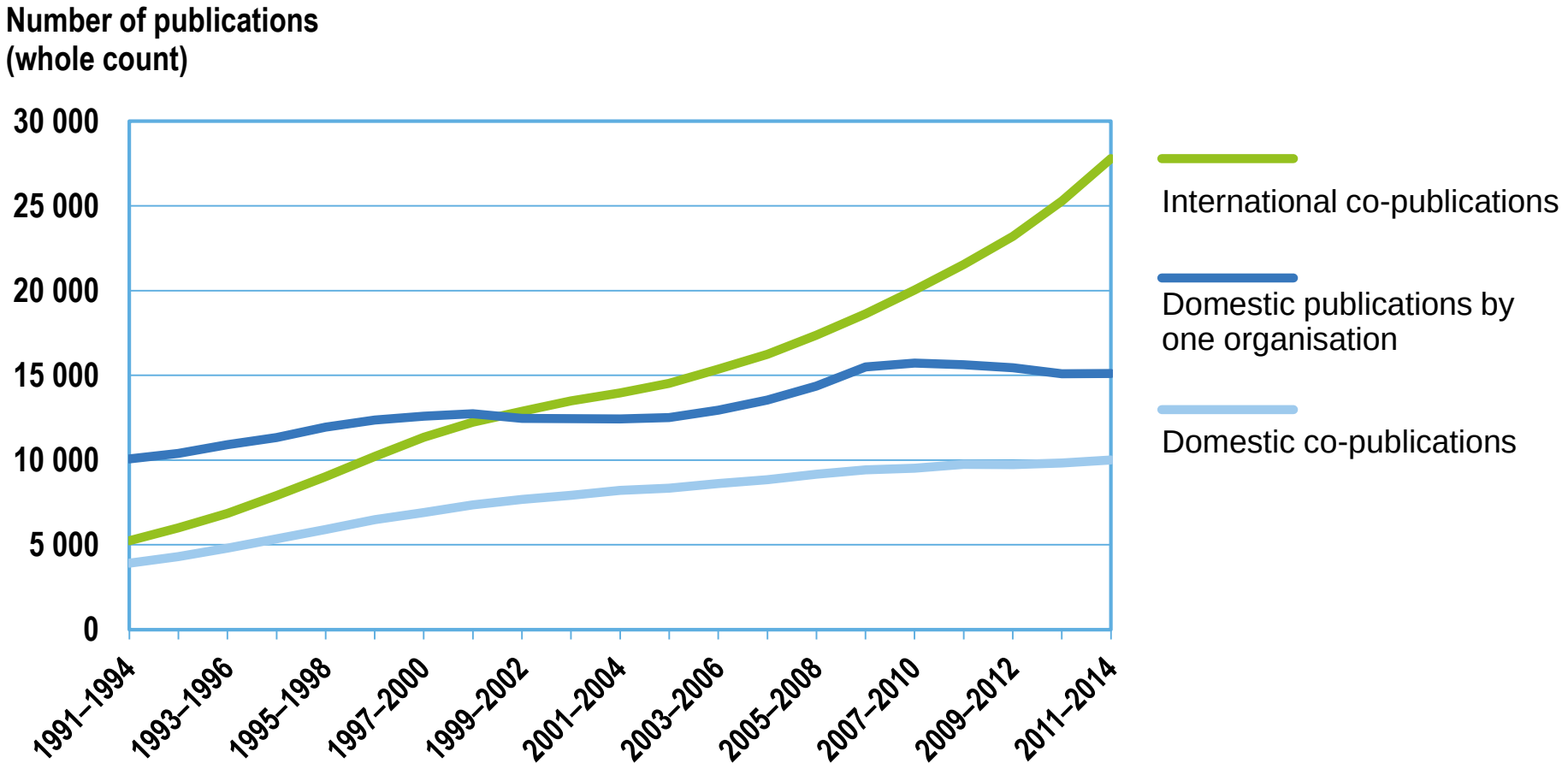
How has research collaboration, especially international collaboration, developed in Finland?

- Indicator: **International and domestic publications**

- The number of international co-publications has increased five-fold in 1991–2014.
- The number of domestic co-publications and domestic publications by one organisation have seen a smaller increase.
- The proportion of international co-publications by Finnish researchers has seen a visible increase in recent years.
  - International co-publications accounted for more than 50% of all scientific publications produced in Finland in 2011–2014.
  - In the early 1990s, the corresponding figure was only 27%.

Development of Finland's publication number by collaboration type in 1991–2014



Source: Clarivate Analytics, Web-of-Science-based data, bibliometric computing CSC Ltd, 2016.

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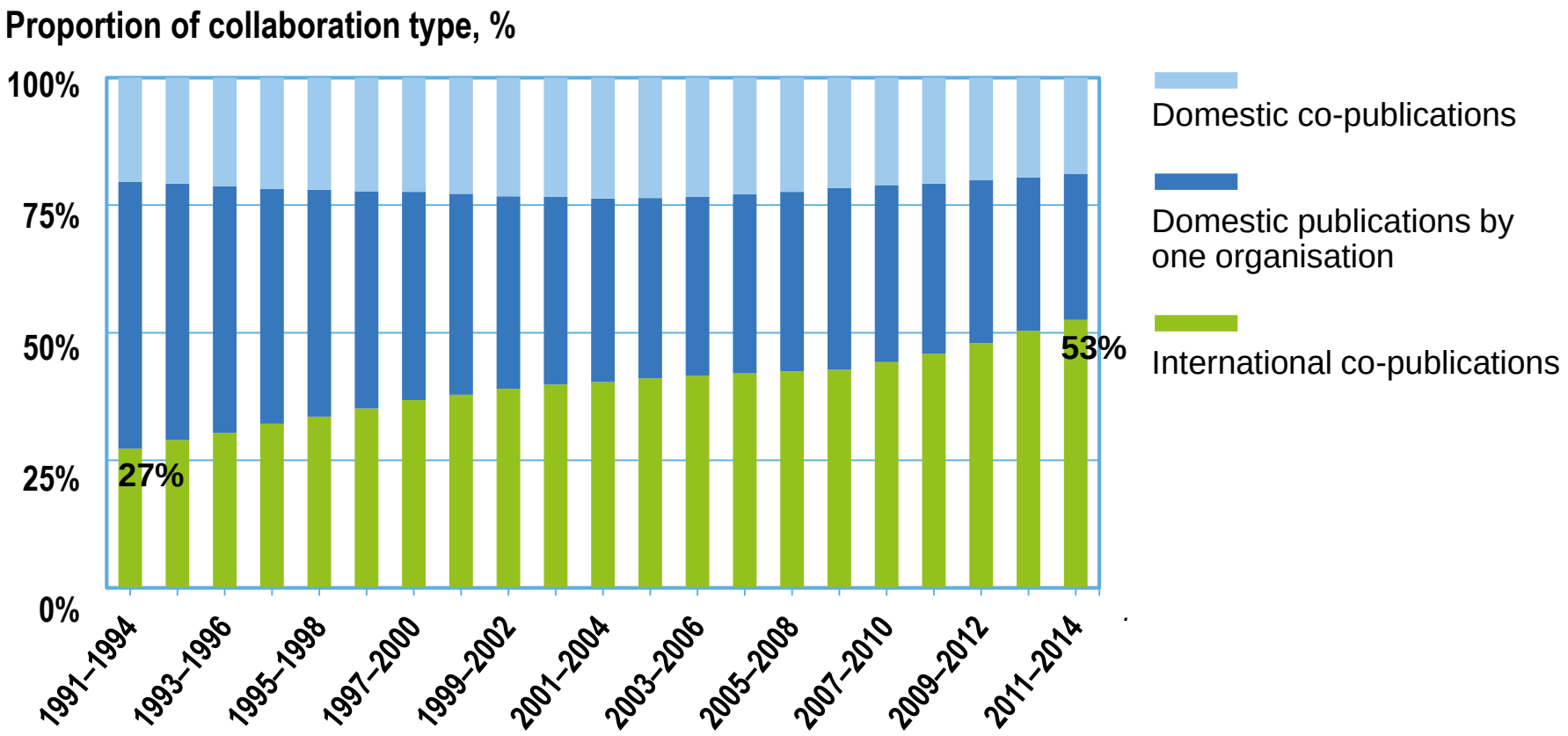
The proportion of international co-publications has seen a visible increase in Finland



Publication numbers are based on whole counting.

Source: Clarivate Analytics, Web-of-Science-based data, bibliometric computing CSC Ltd, 2016.

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Collaboration types

- **Domestic co-publication**: all authors are affiliated with a Finnish organisation
- **Domestic publication by one organisation**: all authors work in the same organisation in Finland
- **International co-publication**: at least one of the authors is affiliated with a non-Finnish organisation

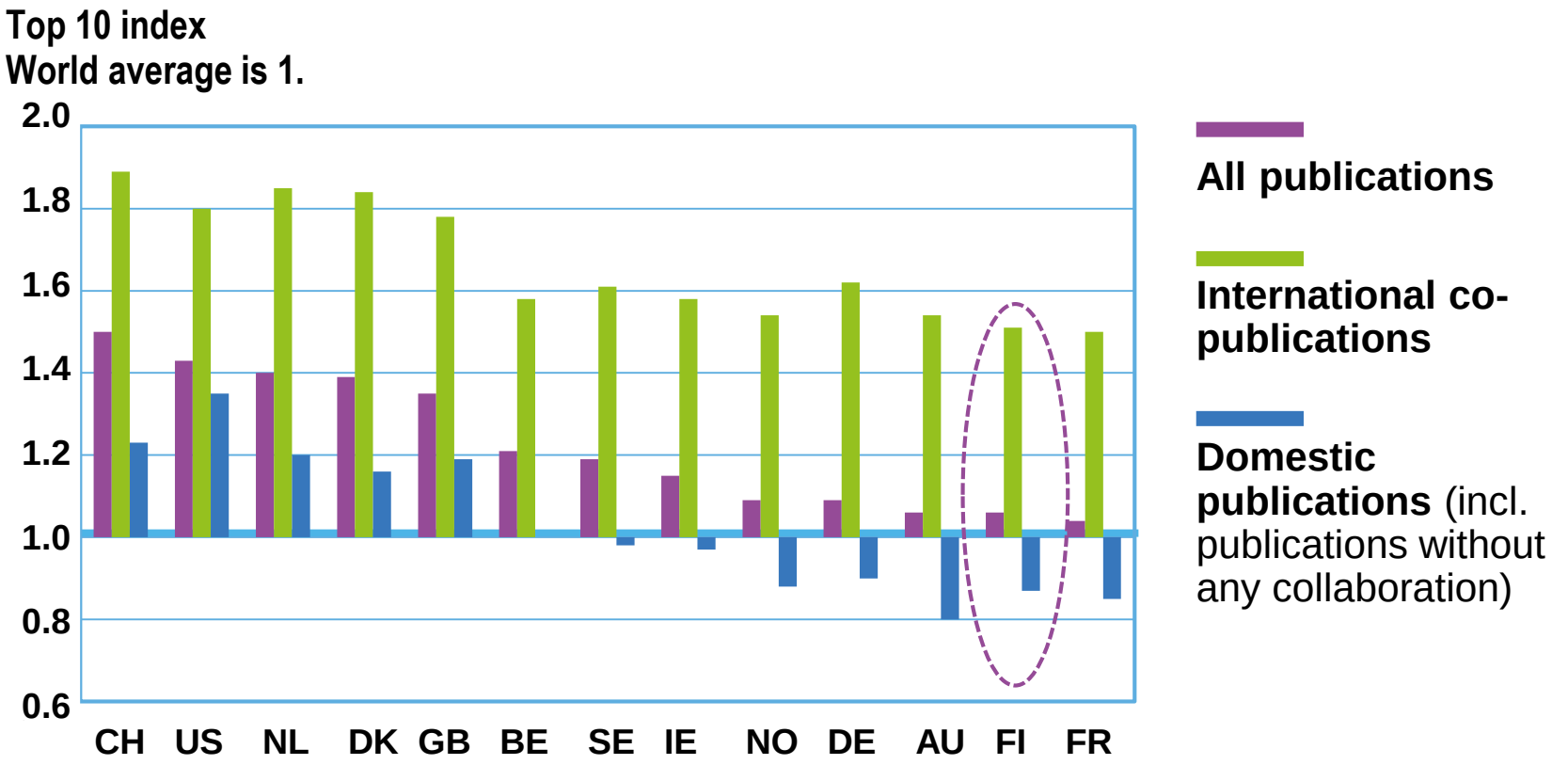
What is the scientific impact of publications representing different types of collaboration?

- Indicator: **Top 10 index by collaboration type (international co-publications vs domestic publications)**

- International co-publications yield a higher top 10 index than domestic publications in Finland and in all comparison countries, even for the US and the UK.
- International co-publications have a greater scientific impact than domestic publications.
- The top 10 index of international co-publications has increased in all comparison countries in the 2000s.

International co-publications more highly cited than domestic publications

Scientific impact by collaboration type in Finland and in comparison countries in 2011−2014.



The top 10 index for Belgium's domestic publications was 1.0 in 2011−2014.
Source: Clarivate Analytics, Web-of-Science-based data, bibliometric computing CSC Ltd, 2016.

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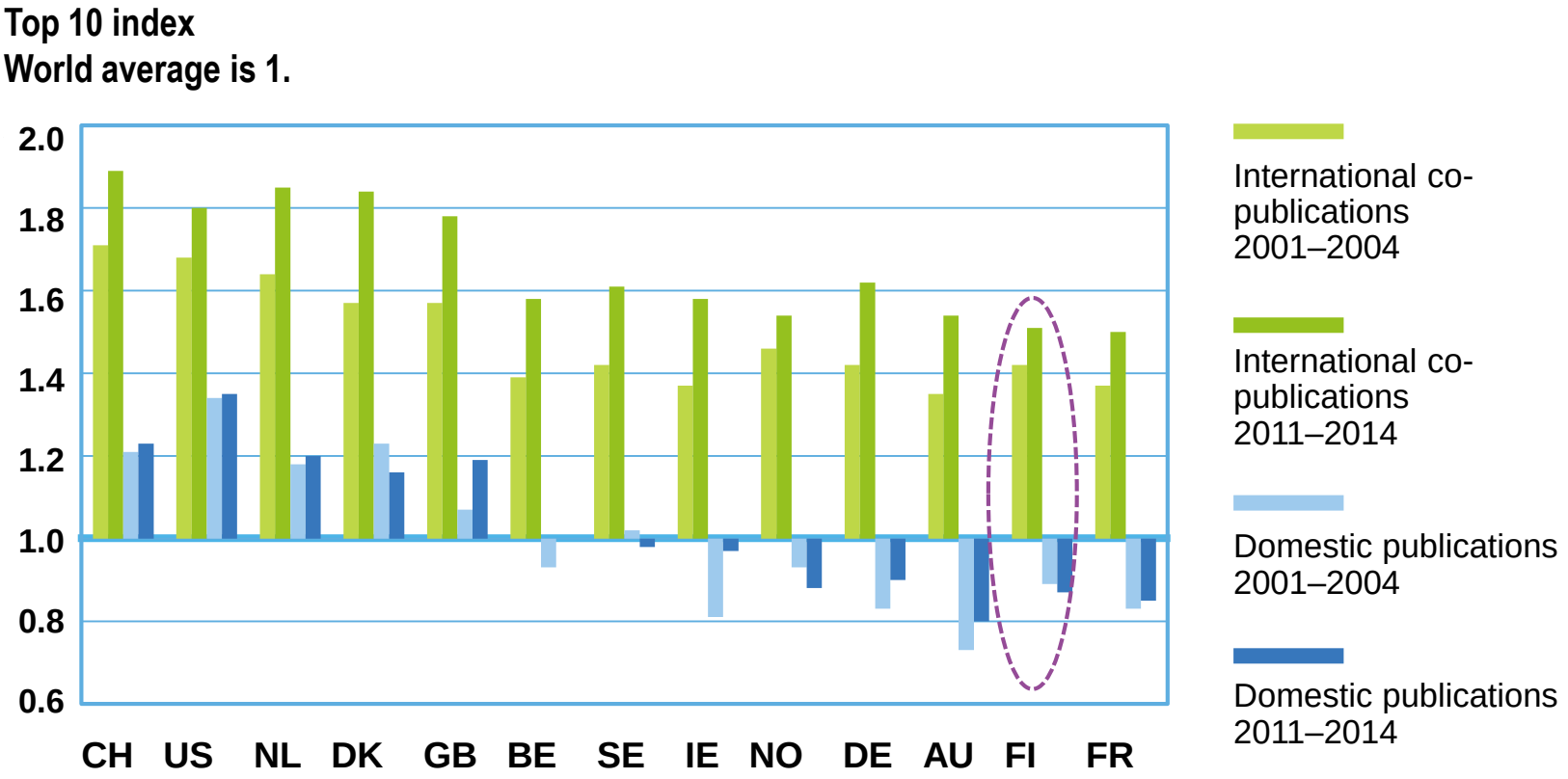
Scientific impact by collaboration type in Finland and in comparison countries in 2001–2004 and 2011–2014



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Source: Clarivate Analytics, Web-of-Science-based data, bibliometric computing CSC Ltd, 2016.

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