

How good are Japan's research universities in global terms, and how much does it matter?

Simon Marginson
Centre for Global Higher Education/ UCL IOE

Osaka University, Japan
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How good are Japan's research universities in global terms, and how much does it matter?

1. Open globalization in higher education and science
2. The spread of science
3. Rankings systems
4. Japan's position
5. Interpretations and implications

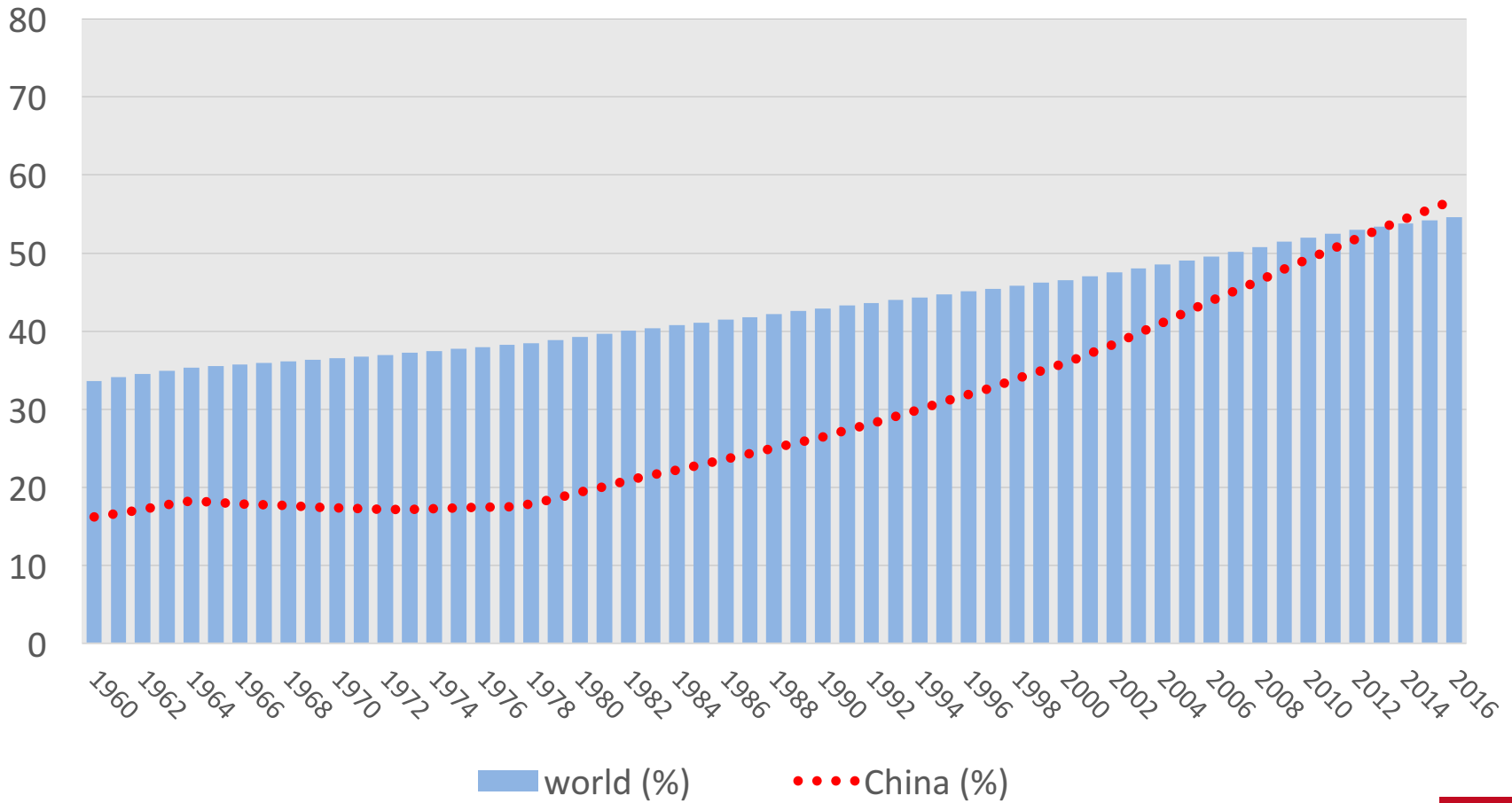
1. Open globalization in higher education and science

1990s and after globalization has shown us

- the world is a convergent relational environment
- there is continuous globalization in knowledge/science, culture, communication and data transfer
- globalization is uneven by sector and country, dynamic and does not stay still
- it is limited in the sphere of politics, there's no global state - the political economy of globalization is more nationally variant than the globalization of science
- global visibility is high and comparisons prevalent,
- globalization quickens modernization and development and fosters greater equality between nations
- globalization fosters cities, inequalities within nations

More, larger, stronger cities = more universities

Urban share (%) of world population, 1960-2016: World Bank data



Globalization in higher education and research

- higher education is shaped by larger global trends
- surge in migration, global business and cheaper transport magnify demand for international education
- global science dominant vis a vis national systems
- homogenizing of science and template of 'best university', power of comparison, hold of rankings
- globalization win-win in higher education and science (*but* English as one global language is exclusive)
- WCUs compete for global prestige, and must advance the global interest of their nations
- yet WCUs collaborate, more globalized than nations
- WCUs produce global common goods

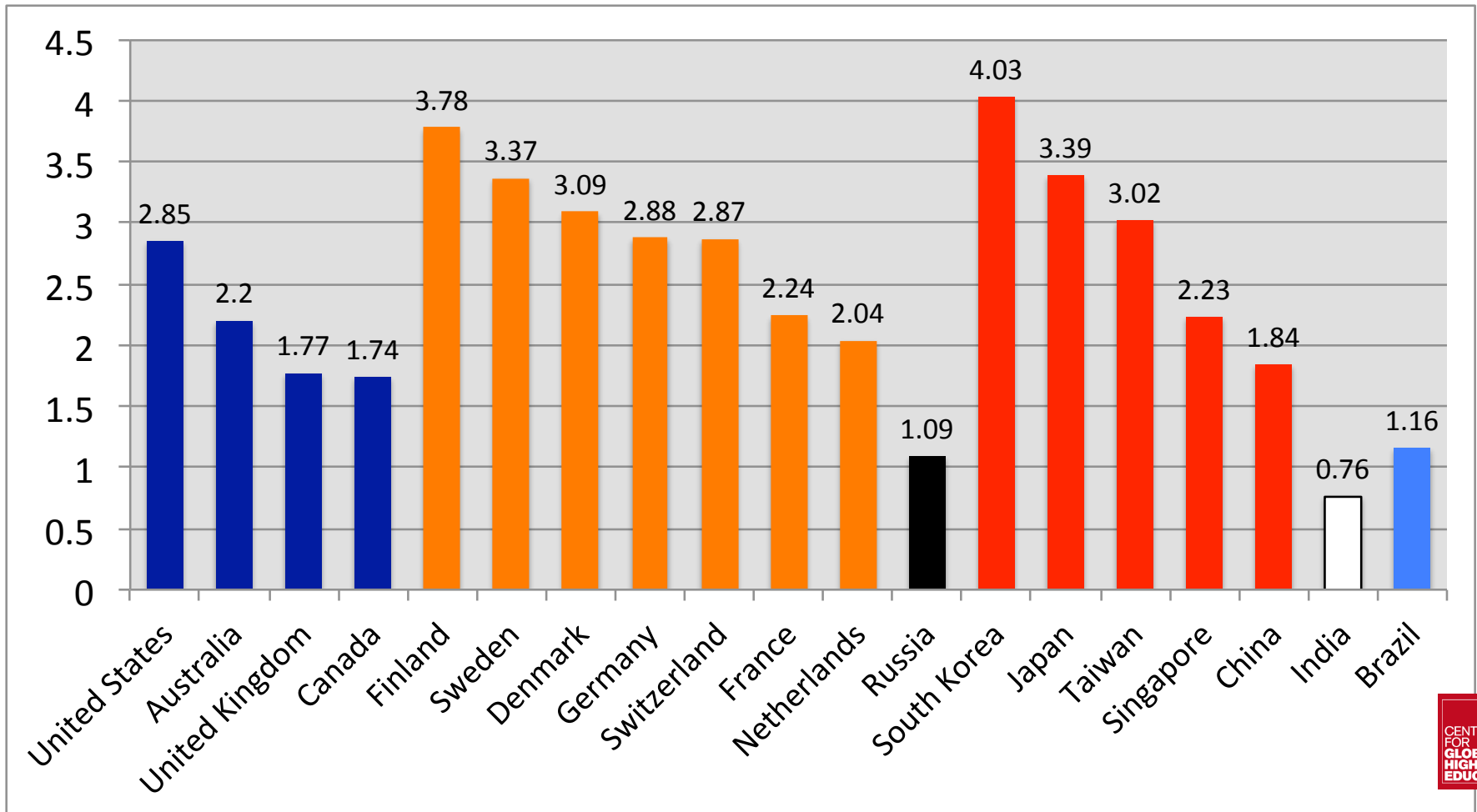
2. The spread of science

Components of a national innovation system



Investment in R&D, selected countries

Investment in R&D as a proportion of GDP, 2011 (OECD data 2013)



51 countries with over 1000 science papers p.a.

US National Science Foundation data

ANGLO-SPHERE	EUROPE EU NATIONS		EUROPE NON-EU	ASIA	LATIN AMERICA
Australia	Austria	Italy	Croatia*	China	Argentina
Canada	Belgium	Netherlands	Norway	India	Brazil
N. Zealand	Czech Rep.	Poland	Russia	Japan	Chile*
UK	Denmark	Portugal*	Serbia*	Malaysia*	Mexico
USA	Finland	Romania*	Switzerland	Pakistan*	M.E/AFR
	France	Slovakia	Turkey	Singapore	Iran
	Germany	Slovenia*	Ukraine	South Korea	Israel
	Greece	Sweden		Taiwan	Saudi Arab.*
	Hungary	Spain		Thailand*	Sth. Africa
	Ireland	Sweden			Egypt
					Tunisia*

* Reached 1000 papers since 1997 (11 out of 51 nations)

Growing number of WCUs with over 10,000, 5000 and 1200 papers in Web of Science: 2006-09 to 2012-15 (Leiden University data)

Number of universities that published more than	2006 to 2009	2007 to 2010	2008 to 2011	2009 to 2012	2010 to 2013	2011 to 2014	2012 to 2015
10,000 papers	25	26	31	34	39	46	50
5000 papers	122	128	135	143	154	171	190
1200 papers	594	629	657	682	712	743	780

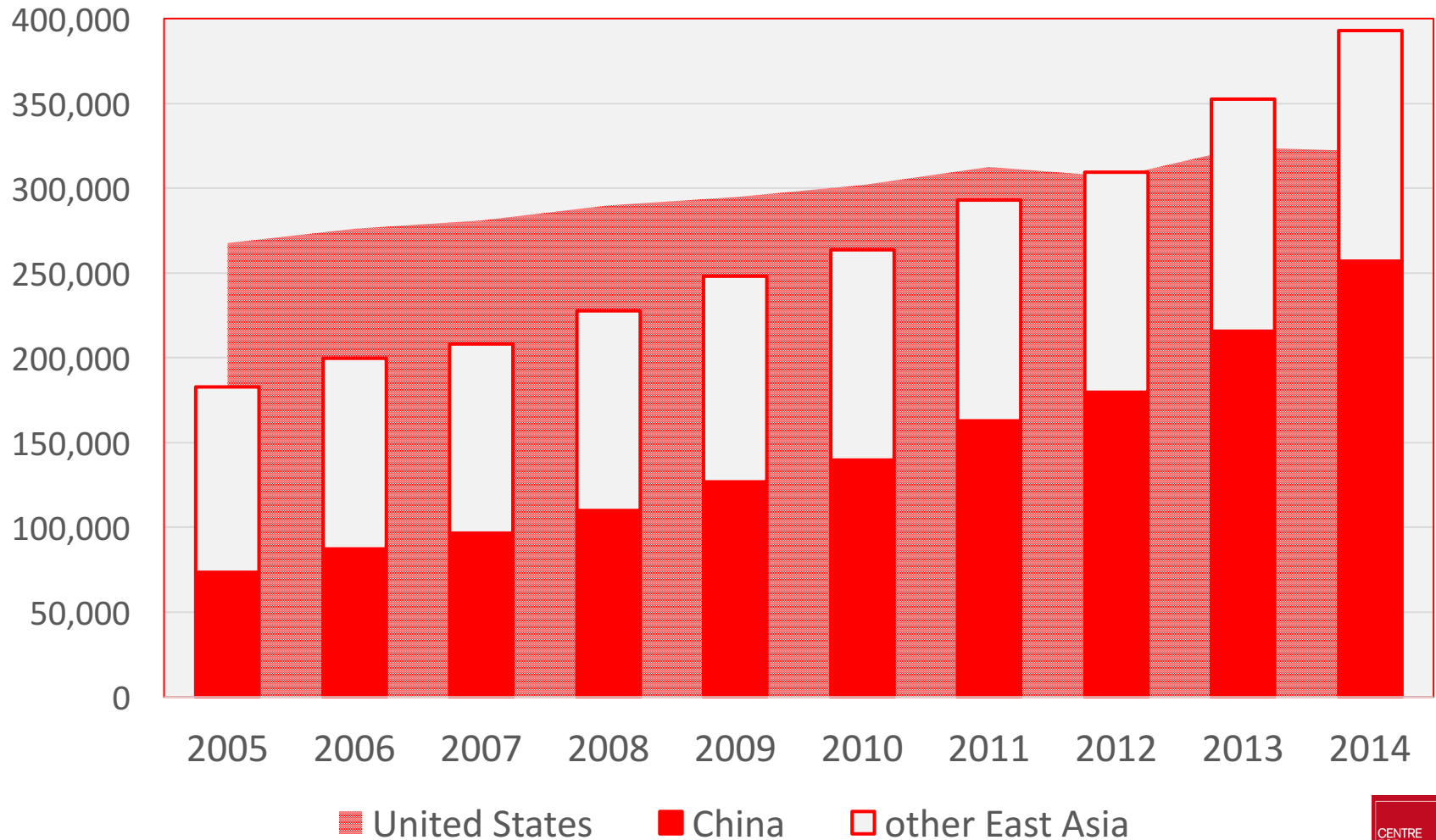
Largest research universities

number of science papers produced 2012-2015

	university	country	papers 2012-15
1	Harvard U	UNITED STATES	31,678
2	U Toronto	CANADA	21,737
3	Zhejiang U	CHINA	19,061
4	U Michigan	UNITED STATES	18,270
5	Shanghai Jiao Tong U	CHINA	18,245
6	Johns Hopkins	UNITED STATES	16,368
7	U Sao Paulo	BRAZIL	15,314
8	Stanford U	UNITED STATES	15,113
9	Seoul National U	SOUTH KOREA	15,004
10	U Tokyo	JAPAN	14,943
11	Tsinghua U	CHINA	14,930
12	U Washington - Seattle	UNITED STATES	14,163
13	U Oxford	UNITED KINGDOM	13,981
14	U California Los Angeles	UNITED STATES	13,898
15	Peking U	CHINA	13,779
63	Osaka U	JAPAN	9129

Number of science papers 2005-2014: USA, China, other East Asia

Web of Science/UNESCO. Papers include reviews and notes. Other East Asia = Japan, Korea, Singapore, Vietnam



Growth in number of top 10% papers, leading East Asian universities, 2006-09 to 2012-15

university	system	2006-2009	2012-2015	growth
Tsinghua U	CHINA	819	1768	115.9%
Zhejiang U	CHINA	730	1762	142.4%
Peking U	CHINA	622	1538	147.3%
Shanghai JT U	CHINA	664	1403	111.3%
Fudan U	CHINA	469	1224	161.0%
Huazhong UST	CHINA	241	1045	333.6%
NU Singapore	SINGAPORE	1042	1597	53.3%
Nanyang TU	SINGAPORE	568	1413	148.8%
U Hong Kong	HONG KONG	558	741	32.8%
Seoul National U	SOUTH KOREA	742	1182	59.3%
National Taiwan U	TAIWAN	604	786	30.1%
U Tokyo	JAPAN	1323	1333	0.7%
Osaka U	JAPAN	738	722	- 2.2%
MIT [<i>for comparison</i>]	USA	2091	2565	22.7%

Shanghai ARWU top 500 universities Chinese systems 2005 and 2017

	2005	2017
China mainland	8	45
Hong Kong SAR	5	5
Taiwan China	3	7
Singapore	2	2
United States	168	135
Japan	34	17

High citation papers, in top 10% of research field, in maths and physical sciences, 2012-2015 (Leiden data)

World rank	University and system	Mathematics and Computing
1	Tsinghua U CHINA	367
2	Nanyang TU SINGAPORE	259
3	Zhejiang U CHINA	256
4	Huazhong UST CHINA	250
5	MIT USA	245
6	Harbin IT CHINA	236
7	National U SINGAPORE	226
8	Stanford U USA	208
9	Xidian U CHINA	205
10	Shanghai JT U CHINA	196
11	City U Hong Kong HK	188
12	U Texas Austin USA	187
13	South East U CHINA	184
14	UC Berkeley USA	184
15	Beihang U CHINA	177

World rank	University and system	Physical Sciences and Engineering
1	UC Berkeley USA	1176
2	MIT USA	1175
3	Tsinghua U CHINA	1054
4	Stanford U USA	976
5	Nanyang TU SINGAPORE	931
6	Harvard U USA	875
7	Zhejiang U CHINA	857
8	U Cambridge UK	801
9	National U SINGAPORE	749
10	U Science & Tech. CHINA	720
11	ETH Zurich SWITZERLAND	678
12	U Tokyo JAPAN	649
13	Shanghai JT U CHINA	638
14	Peking U CHINA	636
15	Caltech USA	635

Combining all top 10% papers in maths, computing, physical sciences, engineering, 2012-2015 (Leiden data)

World rank	University and system	Top 10% papers in Maths, Computing, Physical Sciences, Engineering
1	Tsinghua U CHINA	1421
2	MIT USA	1420
3	UC Berkeley USA	1360
4	Nanyang TU SINGAPORE	1190
5	Stanford U USA	1184
6	Zhejiang U CHINA	1113
7	Harvard U USA	1008
8	National U SINGAPORE	975
9	U Cambridge UK	936
10	ETH Zurich SWITZERLAND	842
11	U Science and Technology CHINA	835
12	Shanghai Jiao Tong U CHINA	834
13	Peking U CHINA	791
14	U Texas Austin USA	780
15	Harbin IT CHINA	776
19	U Tokyo JAPAN <i>[for comparison]</i>	725

High citation papers, in top 10% of research field, in biomedical and health sciences, 2012-2015 (Leiden data)

World rank	University and country	Top 10% papers in Biomedicine and Health
1	Harvard U UNITED STATES	4972
2	Johns Hopkins U UNITED STATES	2053
3	U Toronto CANADA	1857
4	U California San Francisco UNITED STATES	1766
5	Stanford U UNITED STATES	1481
6	U Michigan UNITED STATES	1466
7	University College London UNITED KINGDOM	1462
8	U Pennsylvania UNITED STATES	1446
9	U Washington Seattle UNITED STATES	1336
10	Columbia U UNITED STATES	1217
11	U Pittsburg UNITED STATES	1217
12	U Texas Health Science Cen. UNITED STATES	1213
13	Yale U UNITED STATES	1213
14	U California Los Angeles UNITED STATES	1197
48	Shanghai Jiao Tong U CHINA	597
134	Osaka U JAPAN	293

3. Rankings systems

Shanghai Jiao Tong University (ARWU)

Nobel Prizes and Field Medals won by alumni (sliding scale, more recent prizes score higher)	10%
Nobel Prizes and Field won by current members of academic staff	20%
Members of academic staff who are HiCi researchers, in top 250 in world field by citations	20%
Number of papers published in <i>Nature</i> and <i>Science</i> in previous five years	20%
Papers indexed in Science citation index and Social Science citation index in previous year	20%
Per capita indicator: above indicators divided by number of full-time equivalent academic staff	10%

QS

Academic reputation (survey)	40%
Employer reputation (survey)	10%
Student-staff ratio	20%
Citations per faculty	20%
Internationalization (faculty 5%, students 5%)	10%



Times Higher Education

- Research reputation, citations, volume and income, international collaboration, plus indicators related to PhDs – 73.25%
- Teaching reputation, income, staffing levels – 21.75%
- Internationalization – 5.00% (7.50% if international research collaboration is included here not above)


The 13 separate indicators are weighted, standardized and spliced together to create the composite index and final positions.

Reputational surveys for research and teaching constitute 34.5% of the index, bibliometric indicators 34.5%, income indicators 10.75%, PhD studies 8.25%, internationalization indicators 7.5% and the student-staff ratio 4.5%.

Times Higher: The more the merrier?


- Main world ranking
- Subject rankings in Arts and Humanities, Social Sciences, Life Sciences, Physical Sciences, Medicine, Engineering and Technology
- Reputation ranking (surveys only)
- Top 100 under 50 years old
- Asia, BRICS and emerging economies, Middle East and North Africa, etc etc

Old World Cup single metric ranking— the winner is determined by:



100% whichever team
scores the most goals

New World Cup multi-indicator ranking— the winner is determined by:



50% whichever team
scores the most goals
20% size of team's fan-
base
10% player endorsement
revenues
20% media coverage for
team

The Leiden ranking



- The Leiden Ranking is based on publications in the Web of Science database produced by Clarivate Analytics. The most up-to-date statistics made available in the Leiden Ranking are based on publications in the period 2012–2015, but statistics are also provided for a number of earlier periods. Web of Science includes a number of citation indices. The Leiden Ranking uses the Science Citation Index Expanded, the Social Sciences Citation Index, and the Arts & Humanities Citation Index. Only publications of the Web of Science document types *article* and *review* are taken into account. The Leiden Ranking does not consider book publications, publications in conference proceedings, and publications in journals not indexed in the above-mentioned citation indices of Web of Science.

- The Leiden Ranking takes into account only a subset of the publications in the Science Citation Index Expanded, the Social Sciences Citation Index, and the Arts & Humanities Citation Index... Core publications are publications in international scientific journals in fields that are suitable for citation analysis... [They] must satisfy the following criteria:
- The publication has been written in English.
- The publication has one or more authors. (Anonymous publications are not allowed.)
- The publication has not been retracted.
- The publication has appeared in a core journal.
- ... a journal is considered a core journal if it meets the following conditions:
- The journal has an international scope, as reflected by the countries in which researchers publishing in the journal and citing to the journal are located.
- The journal has a sufficiently large number of references to other core journals, indicating that the journal is situated in a field that is suitable for citation analysis. Many journals in the arts and humanities do not meet this condition. The same applies to trade journals and popular magazines.

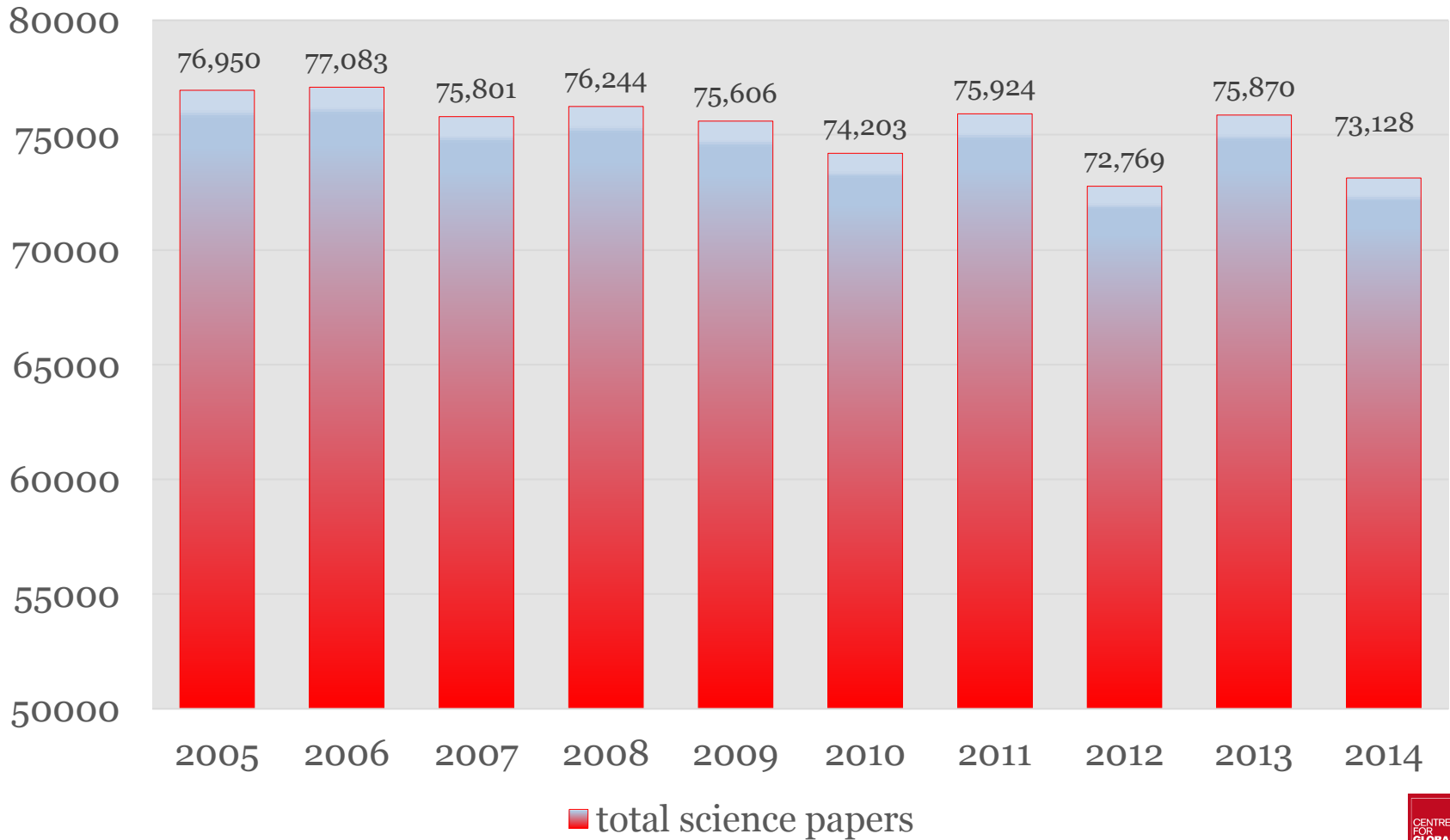
Leiden indicators of impact

- *P (top 1%) and PP(top 1%)*. The number and the proportion of a university's publications that, compared with other publications in the same field and in the same year, belong to the top 1% most frequently cited.
- *P (top 10%) and PP(top 10%)*. The number and the proportion of a university's publications that, compared with other publications in the same field and in the same year, belong to the top 10% most frequently cited.
- *P (top 50%) and PP(top 50%)*. The number and the proportion of a university's publications that, compared with other publications in the same field and in the same year, belong to the top 50% most frequently cited.
- *TCS and MCS*. The total and the average number of citations of the publications of a university.
- *TNCS and MNCS*. The total and the average number of citations of the publications of a university, normalized for field and publication year. An MNCS value of two for instance means that the publications of a university have been cited twice above the average of their field and publication year.

4. Japan's position

Research output, Japan 2005-2014

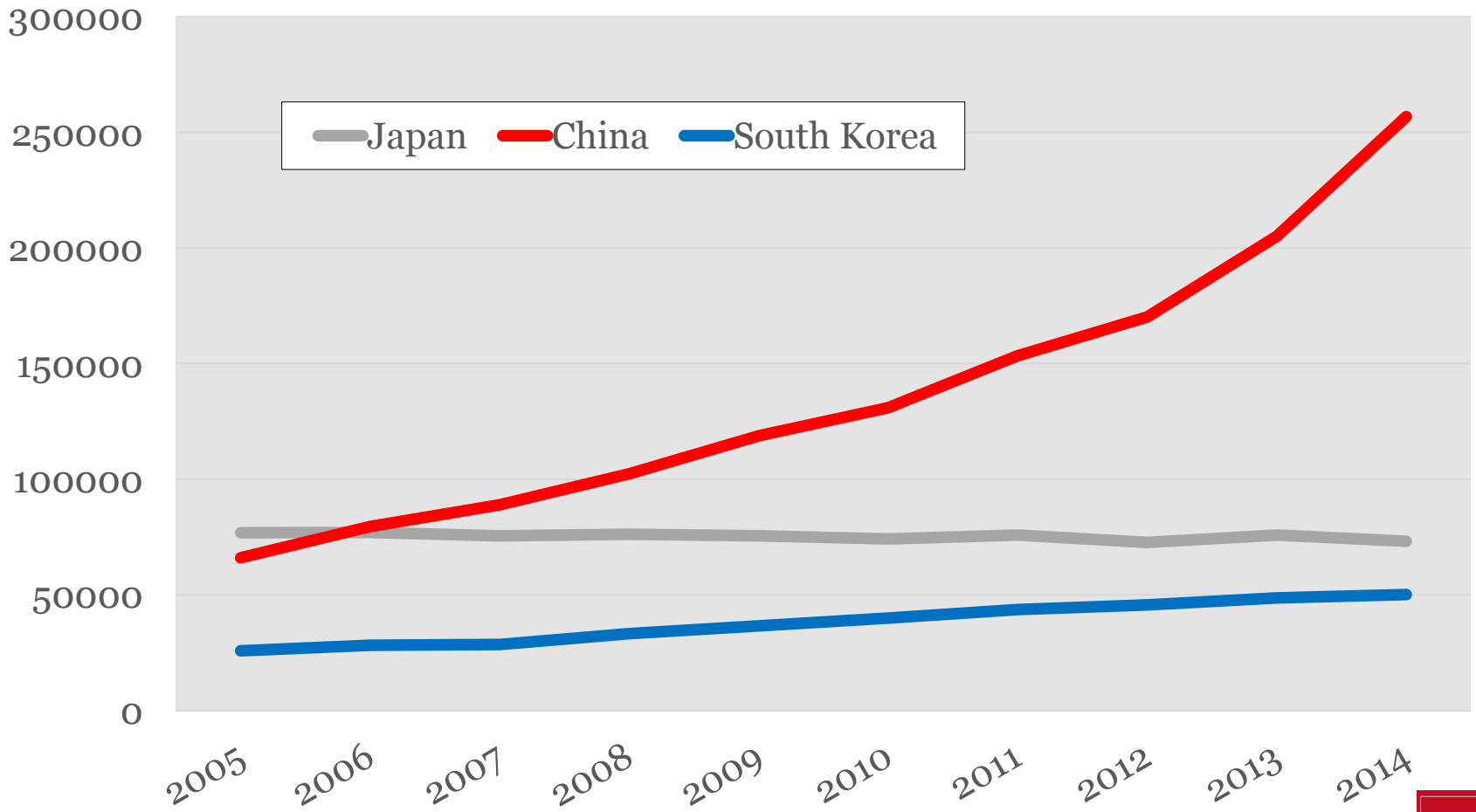
Web of Science/UNESCO, includes notes and reviews



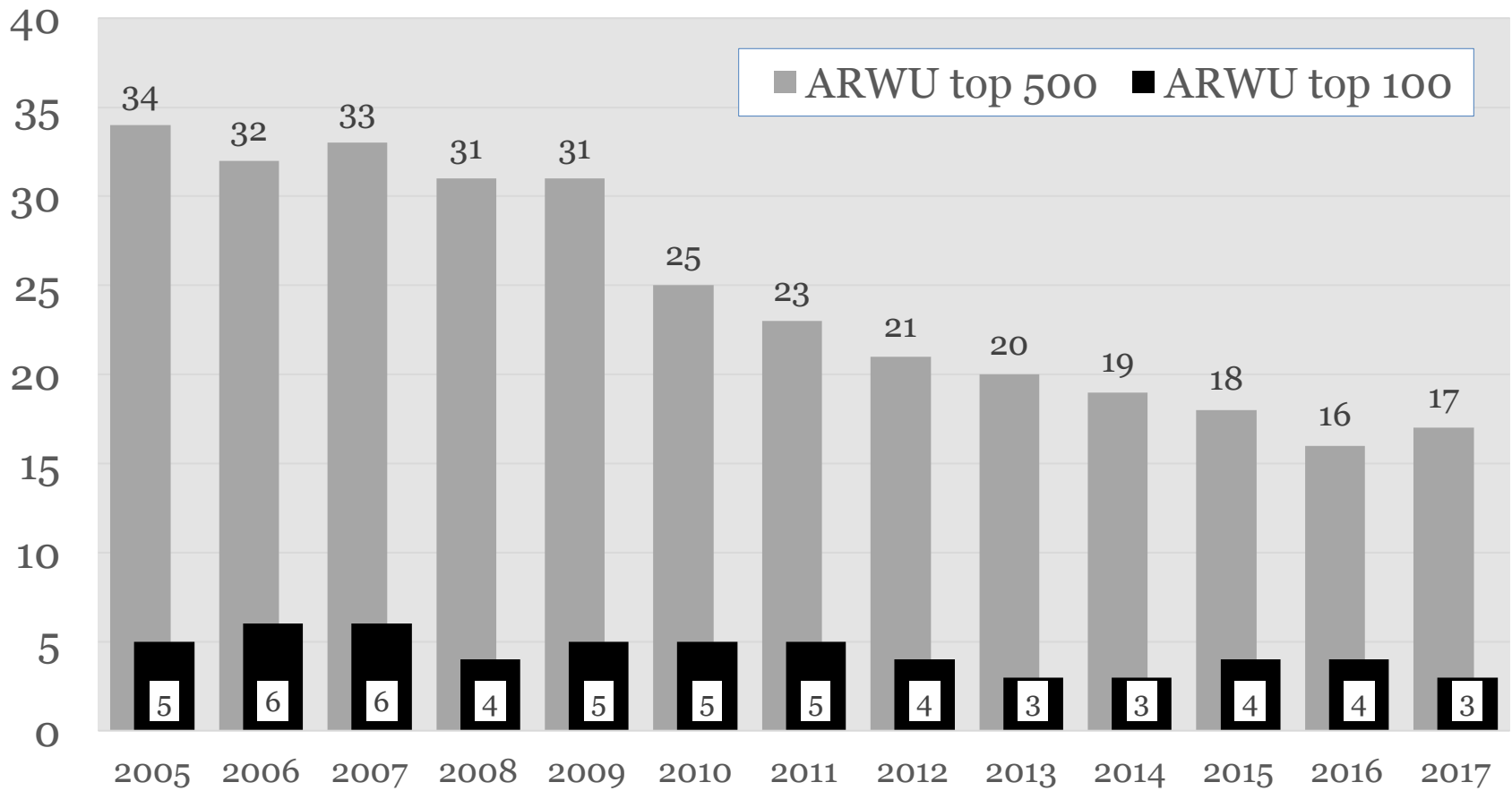
Change in research output by field, 2008-2014

Research field	papers 2008	papers 2014	Percentage change
Medical Sciences	17,478	17,360	- 0.7%
Biological and Life Sciences	15,006	11,912	- 20.6%
Physics	12,553	9287	- 26.0%
Chemistry	9949	8762	- 11.9%
Engineering	8104	6766	- 16.5%
Geosciences	3644	3514	- 3.6%
Mathematics	1560	1565	+ 0.3%
Agriculture	1853	1438	- 22.4%
Computer Science	787	832	+ 5.5%
Astronomy	783	919	+ 17.4%
Psychology and Social Sciences	384	373	- 2.9%
Unidentified papers	4143	10,350	+ 149.8%
Total papers, all fields	76,244	73,128	- 4.1%

Research output Japan, China, Korea 2005-2014



Japan in the Shanghai AWRU 2005-2017



Leading nations in ARWU, 2017

Countries	Top 100 universities	Top 500 universities
United States	48	135
United Kingdom	9	38
Australia	6	23
Switzerland	5	8
Germany	4	37
Canada	4	19
Netherlands	4	12
France	3	20
Japan	3	17
Sweden	3	11
China (mainland)	2	45
Belgium	2	7
Denmark	2	5

The following nations have one top 100 university: Israel, Norway, Finland, Singapore, Russia

Japan in ARWU 2005 and 2017

Ranking	Japan 2005	Japan 2017
1-50	Tokyo (20), Kyoto (22)	Tokyo (24), Kyoto (35)
51-100	Osaka (62), Tohoku (73), Tokyo IT (93)	Nagoya (84)
101-150	Hokkaido, Kyushu, Nagoya, Tsukuba	Osaka, Tohoku
151-200		Hokkaido, Tokyo IT
201-300	Hiroshima, Keio, Kobe, Okayama	Kyushu, Tsukuba
301-400	Chiba, Gunma, Kanazawa, Nagasaki, Nihon, Niigata, Tokushima, Tokyo Medical & Dental, Tokyo Agriculture & Technology, Waseda, Yamaguchi	Chiba, Hiroshima, Keio, Okayama
401-500	Ehime, Gifu, Juntendo, Kagoshima, Kumamoto, Nara IST, Osaka City, Osaka Prefecture, Graduate IAS, Tokyo Metropolitan	Kobe, Osaka City, Tokushima, Tokyo Science

Osaka University in the ARWU

- Ranked in the world top 100 every year till 2017 (101-150)
- In broad research fields at Osaka, Science is consistently ranked in the top 51-75 in the world, Life Science is mostly ranked 51-75 and is currently in that group, but Engineering moved down from 39 in 2007 to 101-150 in 2016. Medicine is in the 101-150 group having improved from its placing in the 151-200 group in 2013
- In the detailed subject rankings Physics has moved from the top 50 down to the 51-75 group while Chemistry rose to the top 50 in 2015 and is currently at 39 in the world.

Japan in 2017 Leiden ranking (*papers 2012-15*)

World rank	University	Total papers	Top 1% by cites	Top 10% by cites	Papers in top 10%
10	Tokyo	14,943	129	1333	8.9%
32	Kyoto	11,461	84	932	8.1%
63	Osaka	9129	53	722	7.9%
67	Tohoku	9054	46	664	7.3%
110	Kyushu	6747	43	440	6.5%
120	Hokkaido	6415	28	366	5.7%
136	Nagoya	6047	34	477	7.9%
202	Tokyo IT	4845	22	308	6.4%
259	Japan AIST	3941	25	283	7.2%
320	Keio	3445	16	231	6.7%
327	Tsukuba	3385	10	188	5.6%
328	Hiroshima	3381	8	191	5.6%
367	Kobe	3052	9	168	5.5%
15	Peking U CHINA	13,779	121	1403	10.2%
57	Seoul National U S. KOREA	15,004	94	1182	7.9%

High citation papers, 2006/09 to 2012/15

Number of papers that were in the top 10% of their field on the basis of citation rate, selected universities. Leiden University data from Clarivate Analytics

university/ country	2006- 2009	2007- 2010	2008- 2011	2009- 2012	2010- 2013	2011- 2014	2012- 2015
Tokyo	1323	1332	1325	1336	1313	1333	1333
Kyoto	968	990	998	994	995	972	932
Osaka	738	725	714	734	769	735	722
Tohoku	650	646	661	621	657	663	664
Nagoya	402	403	431	434	443	444	477
Kyushu	406	414	390	387	427	436	440
Tsinghua U	851	943	1041	1132	1311	1521	1768
Peking U	632	714	803	899	1068	1245	1403
Seoul NU	763	789	844	953	1023	1128	1182
N Taiwan U	647	673	716	733	766	758	786

Maths and Computing (*papers 2012-15*)

World rank	University	Papers in top 10% of field by citation rate
98	Tokyo	76
143	Kyoto	61
204	Tokyo IT	43
231	Osaka	40
262	Tohoku	37
363	Nagoya	27
400	Kyushu	24
416	Waseda	23
477	Kobe	19
487	Keio	18
547	Hiroshima	15
578	Tsukuba	14
21	Peking University CHINA	155
80	Seoul National U KOREA	88

Physical Sci/Engineering (*papers 2012-15*)

World rank	University	Papers in top 10% of field by citation rate
12	Tokyo	649
34	Kyoto	470
49	Tohoku	382
58	Osaka	353
113	Nagoya	236
122	Japan AIST	224
124	Tokyo IT	217
130	Kyushu	212
175	Hokkaido	173
352	Tsukuba	83
416	Hiroshima	72
460	Tokyo Science	62
14	Peking University CHINA	636
42	Seoul National U KOREA	437

Life and Earth Sciences (*papers 2012-15*)

World rank	University	Papers in top 10% of field by citation rate
59	Tokyo	177
198	Kyoto	73
218	Hokkaido	67
222	Tohoku	65
290	Nagoya	50
418	Kyushu	32
422	Osaka	32
456	Okayama	28
472	Tsukuba	26
503	Hiroshima	24
504	Japan AIST	24
515	Tokyo IT	23
54	Peking University CHINA	185
120	Seoul National U KOREA	106

Biomedical and Health Sciences (*papers 2012-15*)

World rank	University	Papers in top 10% of field by citation rate
86	Tokyo	405
123	Kyoto	313
134	Osaka	293
221	Tohoku	170
233	Nagoya	161
236	Kyushu	159
263	Keio	140
305	Hokkaido	112
330	Tokyo Medical & Dental	97
378	Hiroshima	77
391	Chiba	74
392	Kobe	73
98	Peking University CHINA	372
63	Seoul National U KOREA	515

Social Sciences/Humanities (*papers 2012-15*)

World rank	University	Papers in top 10% of field by citation rate
298	Tokyo	25
416	Kyushu	13
486	Tohoku	8
515	Osaka	5
519	Tsukuba	5
521	Kobe	5
1	Harvard UNITED STATES	706
3	Oxford UNITED KINGDOM	365
80	NU Singapore SINGAPORE	94
151	Peking U CHINA	56
178	Seoul National U KOREA	46
195	Tsinghua U CHINA	43

High citation papers published at Osaka University, 2006/09 to 2012/15

Number of papers that were in the top 10% of their field on the basis of citation rate, selected universities. Leiden University data from Clarivate Analytics

Broad research field	2006-2009	2007-2010	2008-2011	2009-2012	2010-2013	2011-2014	2012-2015
maths/ computing	28	19	21	25	32	38	40
physical sci/ engineering	385	383	378	368	368	353	353
life/earth sciences	33	37	36	36	44	37	32
biomedical/ health sci	290	282	274	301	318	301	293
social sci/ humanities	2	4	4	5	7	7	5
All fields	738	725	714	734	769	735	722

5. Interpretations and implications

Optimization of rankings: the virtuous circle

