

National Research University – Higher School of Economics
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**Science and higher
education in a
more global era
and how Russia is positioned**



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after 28 October: Institute of Education, University of London, UK

... 7th May 2012

President Putin declares that by 2020 there will be five Russian universities in the world's top 100 ...



$$+ ? ? ? ? = 5$$

(but ... can it be done?
Is 2020 realistic?
Is this the main strategic goal?)

Since 1990 we have seen not just transition from USSR to Russia, but also . . .

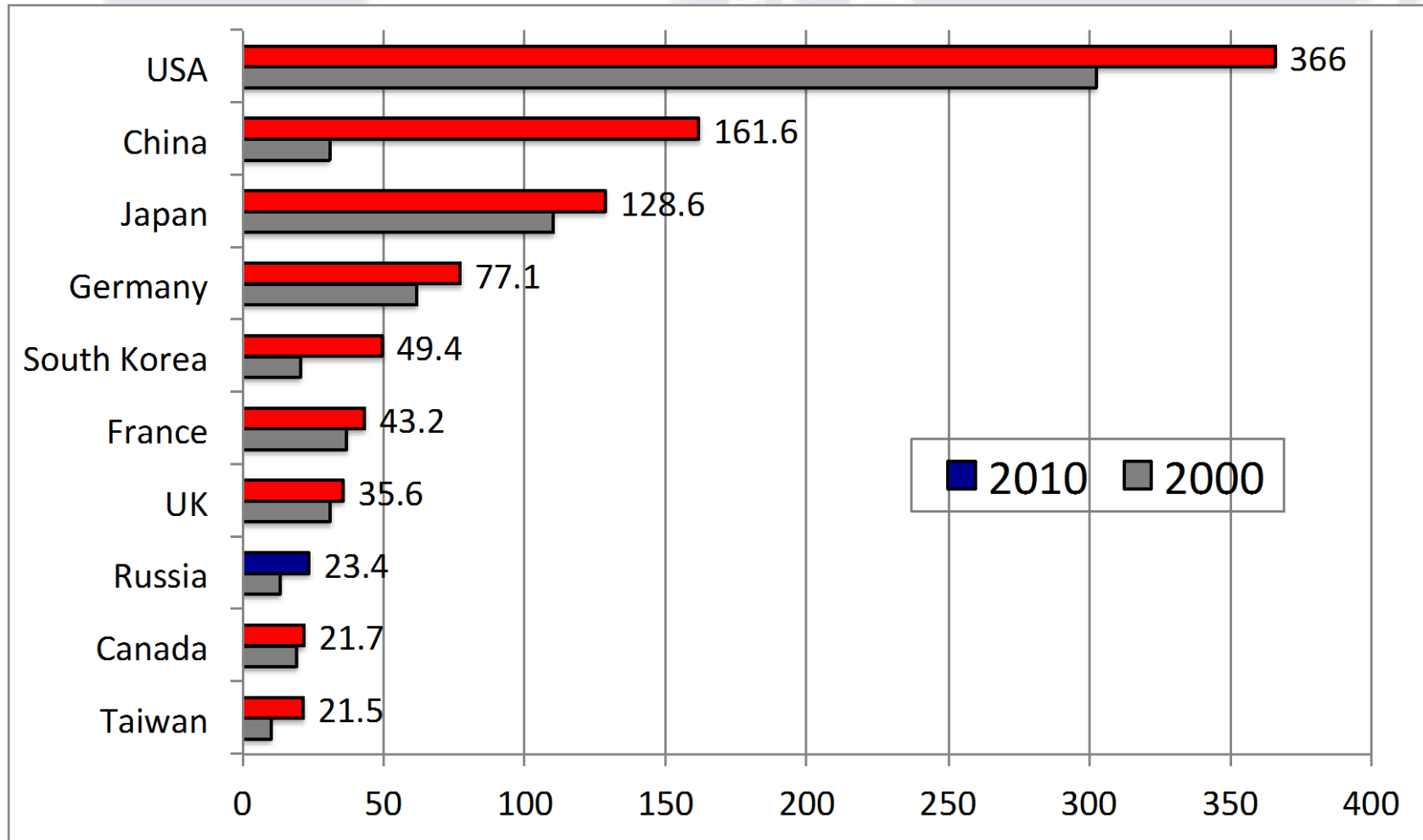
- Communicative globalization has transformed science, technology and industrial innovation everywhere
- A one-world system of basic research has evolved, based on science publishing in English. Ideas and product innovations are drawn from this world system, not just from national sources
- To draw benefits from the global system, all scientists must contribute, exchange and collaborate across national borders
- Global competition in science is increasingly (1) driven by internationalization, (2) competition for the top research talent
- There has been 50% growth in research active countries, and
- 200% growth in the number of joint international articles

Components of a national innovation system



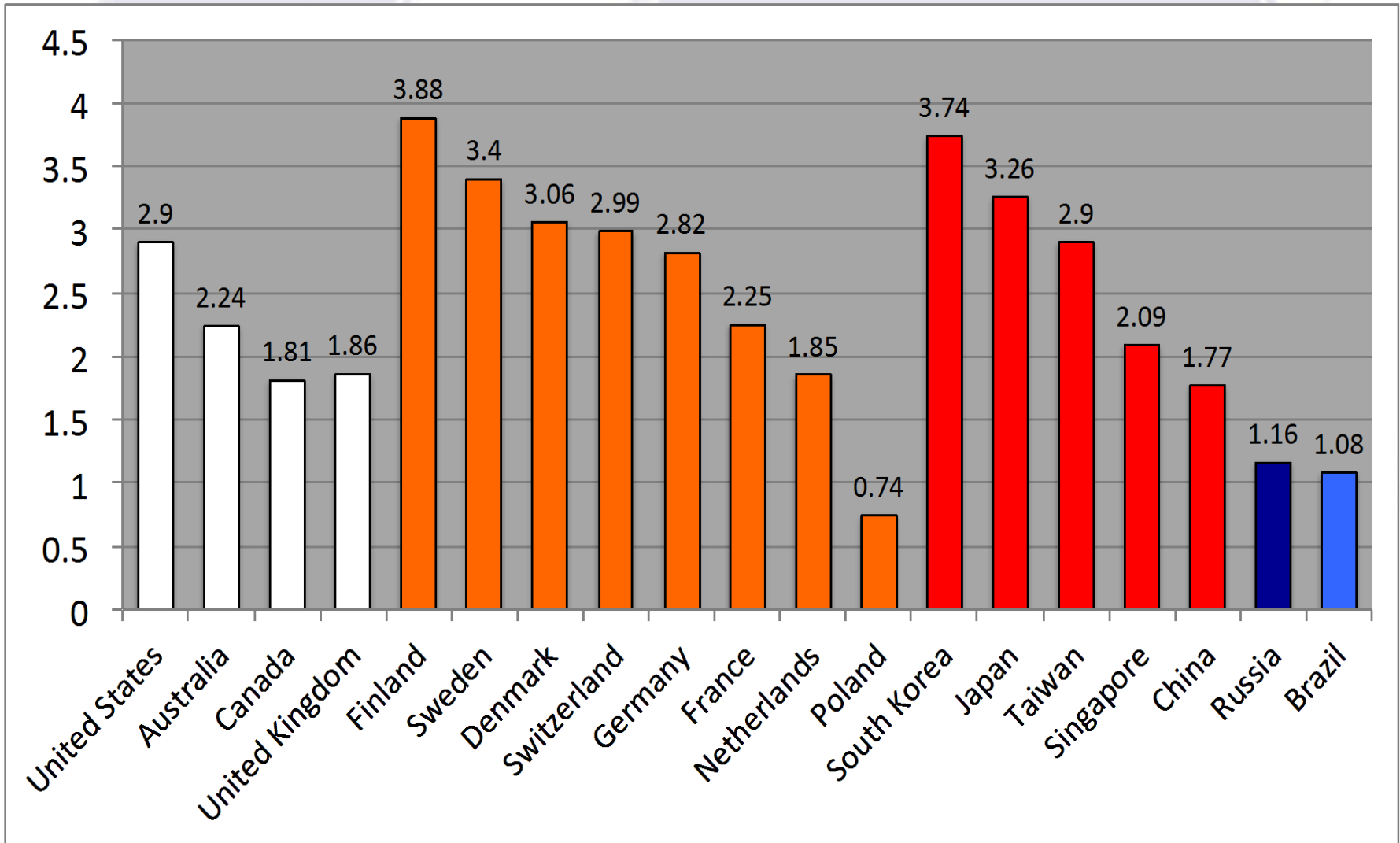
Total R&D spending 2000 & 2010 (\$s bill.)

Top ten countries. Constant 2005 USD. 2010 or nearest year. Data: OECD



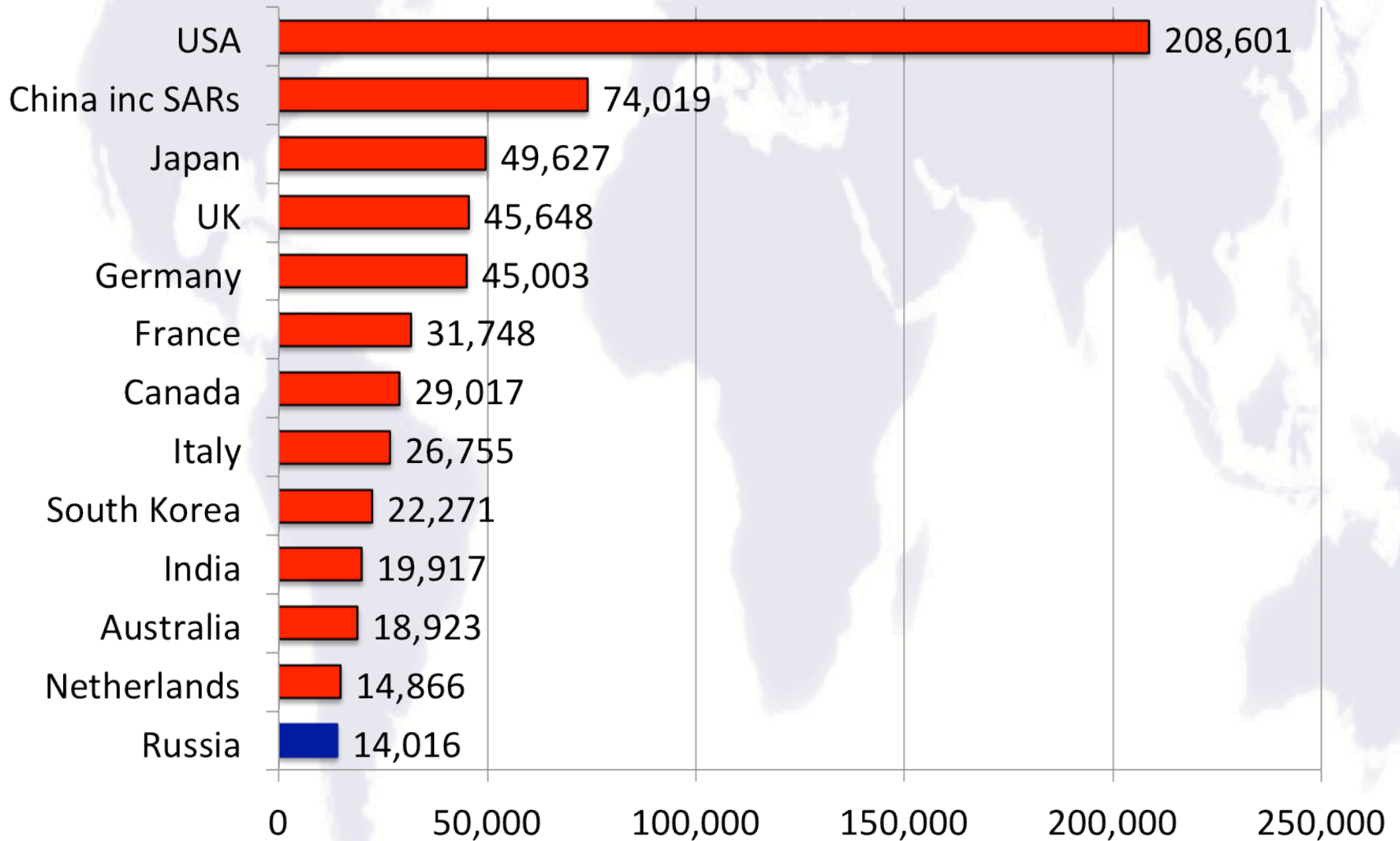
R&D as a proportion of GDP, 2010

Or nearest year. Data from OECD 2013



Science papers in global journals 2009

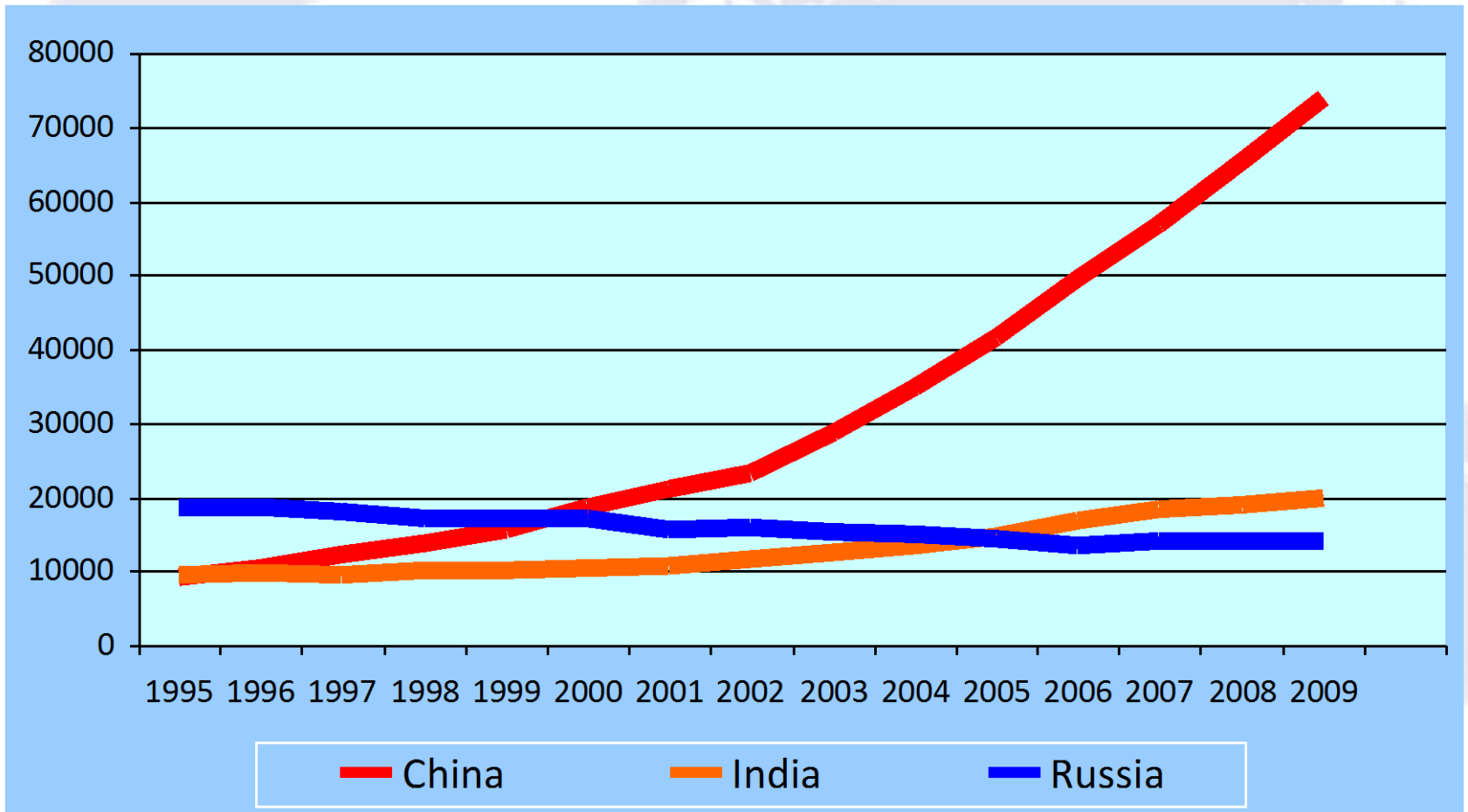
US National Science Foundation data



Research papers per year, 1995-2009

China, India & Russia

US National Science Foundation data



Shanghai ARWU top 500 Chinese systems & Russia, 2005 & 2013

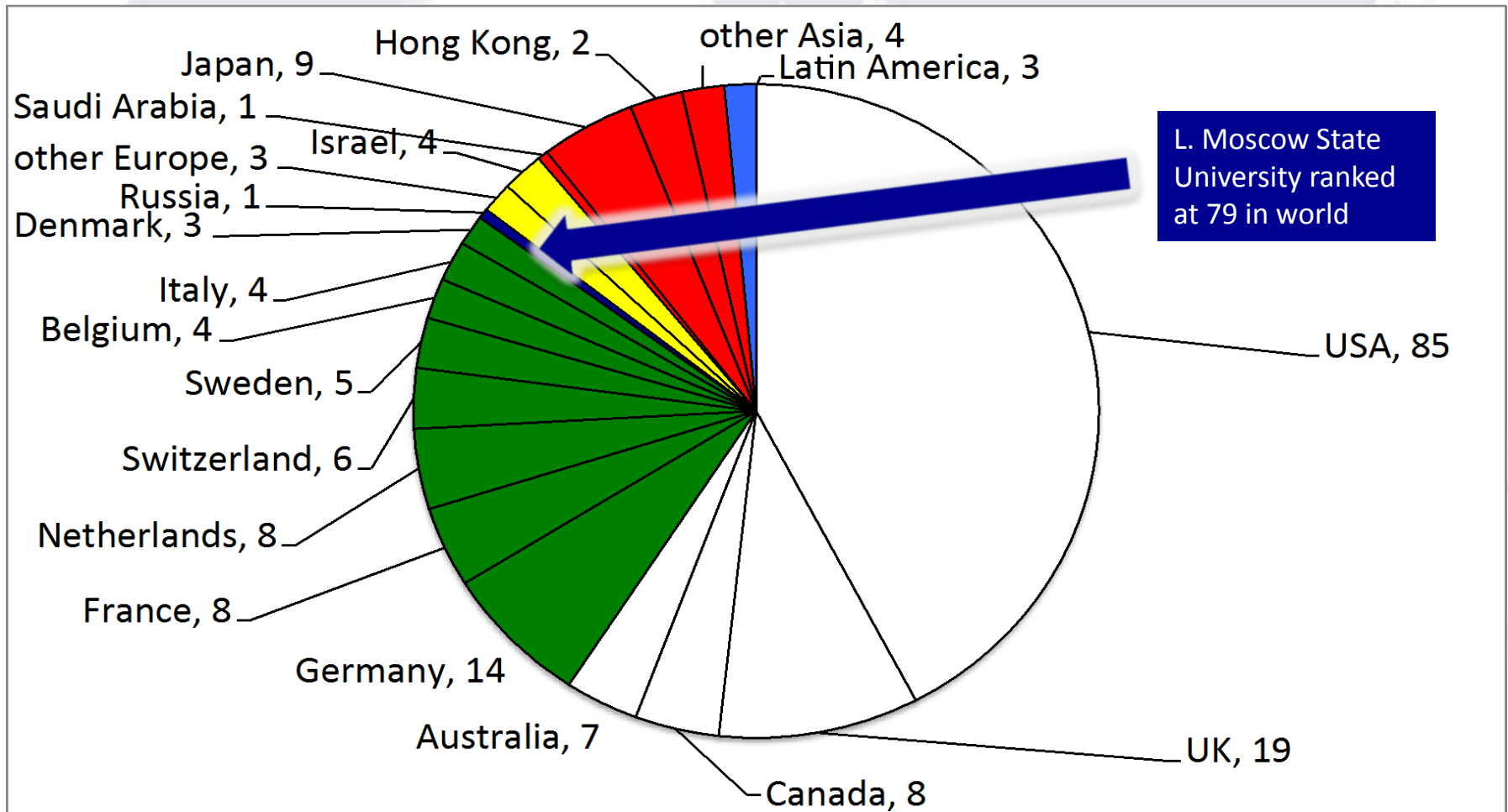
	2005	2013
China mainland	8	28
Hong Kong SAR	5	5
Taiwan China	5	9
total	18	42
Russia	2	2



Since 1990 China, Taiwan, South Korea and Singapore have transformed their research and higher education. How?

- Strong Confucian commitment to education in the family
- World leading student achievement in PISA maths and science
- Advance in tertiary participation towards universal levels
- Coherent tertiary system design and restructuring
- Internationalization—open doors, publishing in English, collaboration, going abroad, attracting diaspora, paying global salary rates, drawing on ideas for institutional design
- Fostering world class universities
- Focused state policy—invests growing resources, sets clear ambitious targets, achieves these, moves on to new targets

Shanghai Academic Ranking of World Universities top 200, 2013



Leiden University ranking for 2008-11

University			total papers	cites per paper normalized world av =1.00	papers in top 10% of research field, field-normed cites	
1	Harvard U	USA	29,812	1.80	6492	21.8%
2	U Toronto	CANADA	18,114	1.23	2410	13.3%
3	U Michigan	USA	15,928	1.39	2501	15.7%
4	U Tokyo	JAPAN	14,175	0.93	1274	9.0%
5	U California (LA)	USA	13,861	1.52	2370	17.1%
6	Johns Hopkins U	USA	13,620	1.52	2173	16.0%
7	U Washington, Seattle	USA	12,883	1.48	2198	17.1%
8	Stanford U	USA	12,841	1.92	2826	22.0%
9	U Oxford	UK	12,208	1.44	2013	16.5%
10	U Pennsylvania	USA	12,007	1.50	2100	17.5%
11	U Cambridge	UK	11,742	1.50	2009	17.1%
12	U Sao Paulo	BRAZIL	11,564	0.68	619	5.4%
326	L Moscow State U	RUSSIA	2518	0.65	135	5.4%

China and Russia:

Top four research producers for each

Papers published in 2007-2011 period, Scimago data (from Elsevier)

World rank	Research institution	Papers 2007-2011	Normalized impact (average = 1.00)
2	Chinese Academy of Sciences CHINA	157,814	1.01
11	Tsinghua University CHINA	48,396	0.96
19	Zhejiang University CHINA	42,606	0.87
24	Shanghai Jiao Tong University CHINA	39,399	0.81
3	Russian Academy of Sciences RUSSIA	97,105	0.54
115	L. Moscow State University RUSSIA	20,151	0.63
624	Russian Academy of Medical Sci. RUSSIA	5694	0.63
660	St Petersburg State University RUSSIA	5404	0.61

Russia:

Top eight university research producers

Papers published in 2007-2011 period, Scimago data (from Elsevier)

World rank	Research institution	Papers 2007-2011	Normalized impact (average = 1.00)
115	L. Moscow State University RUSSIA	20,151	0.63
660	St Petersburg State University RUSSIA	5404	0.61
1207	Novosibirsk State University RUSSIA	2609	0.58
1509	Ural Federal University RUSSIA	1872	0.51
1567	Moscow Engineering Physics Institute RUSSIA	1771	1.11
1592	Southern Federal University RUSSIA	1726	0.36
1698	Moscow Institute of Physics & Technology RUSSIA	1547	0.60
1698	Kazan Federal University RUSSIA	1547	0.45

Russia:

High citation impact research producers

Papers published in 2007-2011 period, Scimago data (from Elsevier)

Rank on citation impact	Research institution	Papers 2007-11	Normalized impact (av. = 1.00)
62	Institute for High Energy Physics	1215	2.65
138	Institute for Nuclear Research, Academy of Sci.	1029	1.85
140	Kostantinov Petersburg Nuclear Research Inst.	1896	1.84
140	Alikhanov Inst. Theoretical & Experimental Physics	2435	1.84
181	Budker Inst. Nuclear Physics, Academy of Sci.	1438	1.43
196	Joint Institute for Nuclear Research	5072	1.28
211	Landau Inst. for Theoretical Physics, Academy of Sci.	769	1.13
213	Moscow Engineering Physics Institute	1771	1.11

The global indicators under-estimate Russia's S&T potential

- The small concentrations of exceptional science outside Russia's universities do not show in university rankings
- Much other research in Russia is published only in Russian, mostly applied in nature, and focused on national industries in manufacturing, energy/extraction, and defence
- When all of this work is counted, Russia's measured national output increases sharply
- But the Russian innovation system cannot draw full benefit from national knowledge that is not exchanged in the world circuits: 'you have to be in it, to win it'
- Continued isolation of Russian science also weakens Russia's global status, e.g. makes goal of five in top 100 impossible

Elements of a strategy

Russia's science capacity is stronger than it looks and a base for future development, providing

- existing capacity is consolidated, with no further erosion
- investment is increased and also tightly targeted, and
- the innovation system is internationalized

- Note that there are significant lags between investment in science, and later gains in numbers of science papers and world-class universities (10-15 years in the case of the latter)

- Russian policy should maintain a double set of performance indicators, using both (a) globally-defined targets, and (b) national indicators based on national needs

Internationalization is the key

Above all, internationalization plus focused investment have driven the miraculous rise of science in China/ East Asia

- Global engagement and global standards (1) lock in local institutions and national science system to internationally competitive performance (2) allow Russia to source the maximum possible benefits from collaboration
- Maximum English language publication, including translation of work done in Russian for global audiences
- Output goals should be based on publication and citation numbers (objective data), not survey-based ranking
- International benchmarking of disciplines and institutions
- Facilitation of global mobility, especially attraction of talent
- Stepped up international collaboration, e.g. in publishing

Internationally co-authored articles

selected countries, 1995 & 2010

US National Science Foundation data

nation	1995	2010	2010 (1995=1.0)
WORLD	79,128	185,303	2.3
Singapore	359	3424	9.5
China	2914	24,164	8.2
Korea	1283	8064	6.2
Germany	14,694	34,869	2.4
Finland	1762	4111	2.3
United States	36,361	79,581	2.2
Russia	5509	6791	1.2