

Education & Science Innovation (ESI) Subcommittee Membership and Study Areas

Members:

- Jade Morton, Chair
- Terry Moore, 1st Vice-Chair
- Dorota Grejner-Brzezinska, 2nd Vice-Chair
- Penny Axelrad
- Renato Filjar
- James Geringer
- Russ Shields

Role/ Study Areas:

- STEM & future PNT workforce
- GNSS science applications (space weather, radio occultation, surface reflectometry, natural hazards warning, etc.)

ESI Subcommittee Proposed Study Areas

1. US STEM and future PNT workforce education and training; bring in world-wide views into the discussions.
 - Current landscape
 - Recommendations
 - Opportunities
2. Awareness of PNT/GNSS scientific applications

US STEM and Future PNT Workforce Education and Training Landscape: May 2022 Presentation

- An open letter highlighted the crisis in the field of geodesy. This crisis is also playing out in the broader field of PNT, and generally in STEM education.
- NSF National Science Board (NSB) report on the State of U.S. Science and Engineering 2022: <https://nces.nsf.gov/indicators>
- NSB vision to remain the world innovation leader in 2030: <https://www.nsf.gov/nsb/publications/2020/nsb202015.pdf>

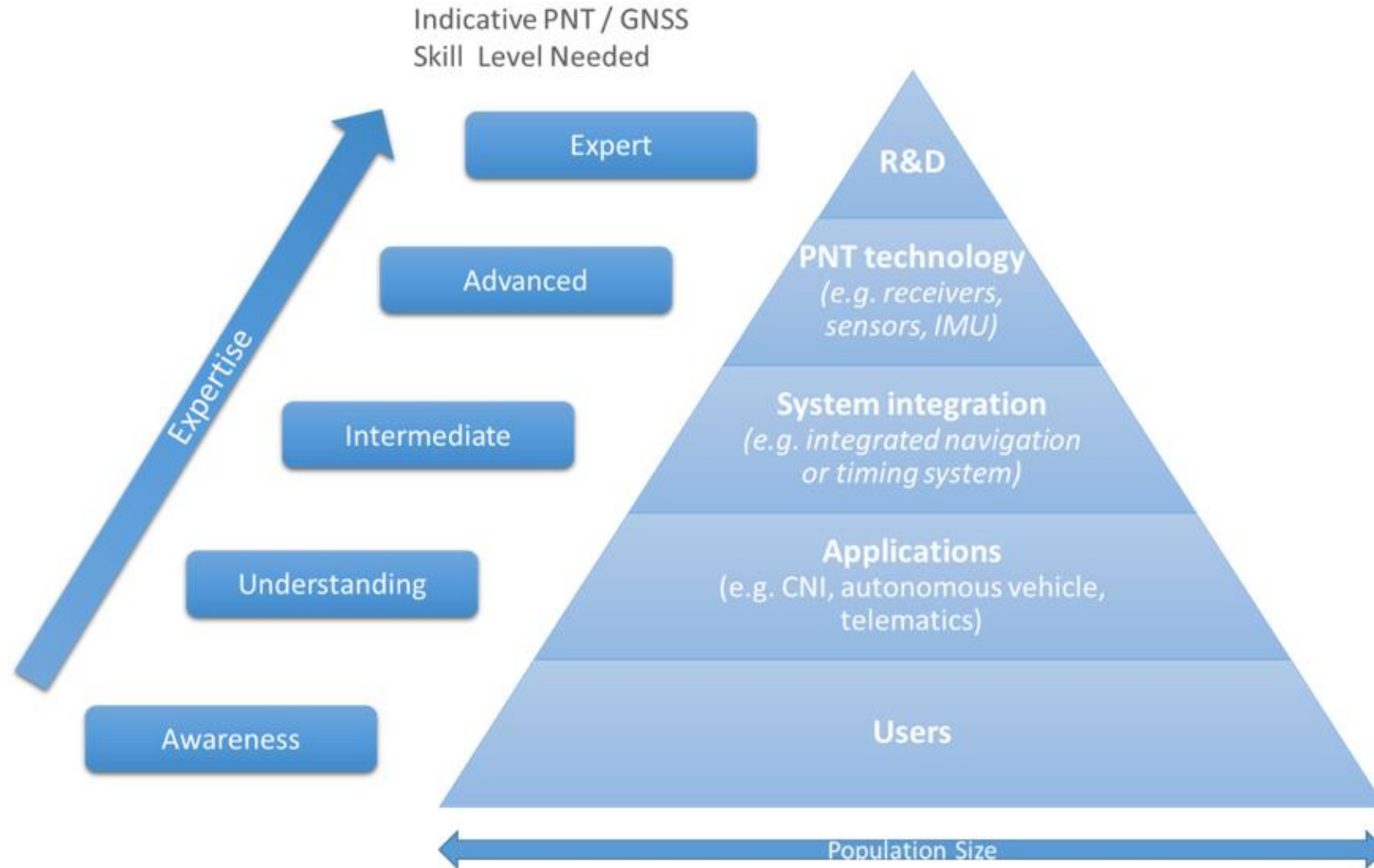
ESI Subcommittee Actions from May 2022 Meeting

- Survey on Research Fundings.
- Survey on PNT publications by US and international authors.
- Obtain findings from:
 - Dr. Nikki Markiel (NGA): Geodetic Science Shortage of Researchers & Scientists
 - Prof. Terry Moore (UK): PNT Skills, Education, and Training Strategy: Findings from a UK Government-Sponsored Study
- Provide recommendations to improve future US work force education and training.

UK PNT – SET Working Group

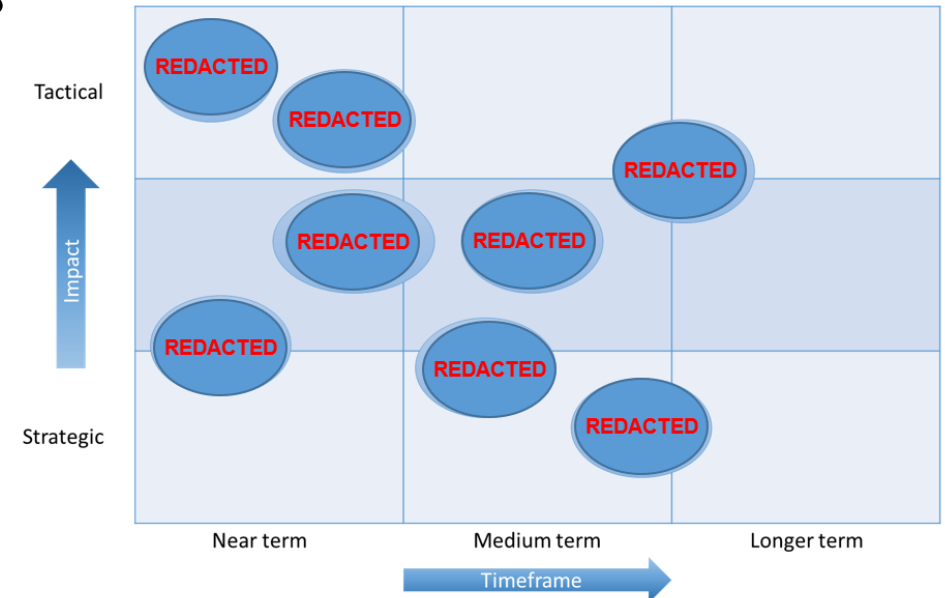
- Draft UK PNT Strategy developed 2020/21 – Not UK Govt Policy
- Skills, Education and Training Working Group – led by RIN
- Education
 - Learning provision from an institution, normally a school, college or university.
- Training
 - Increasing specific skills or knowledge, typically provided on a transactional basis, such as a short course. This can be provided on a commercial basis as well as from colleges and universities.
- Skills
 - The ability to perform a task well and with expertise – often the outcome of education and/or training.

UK PNT – SET Working Group



UK PNT – SET Working Group

- Key Findings
 - Close industry-academia collaboration drives innovation, discovery, and growth.
 - Education Provision
 - Training Provision
- 8 Recommendations and 2 ‘red flag’ conclusions
 - Short Term, Medium Term and Long Term



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Regulated Qualifications Framework

		UNIVERSITY	
LEVEL 8	Doctorate PhD		
LEVEL 7	Master's Degree MA, MSc, MPhil		
LEVEL 6	University Degree BA, BSc		
LEVEL 5		Foundation Degree FdA, FdSc	HND
LEVEL 4			HNC
LEVEL 3	A-Level	A2	AS
		L3 Extended Diploma (National Diploma)	L3 Diploma (National Certificate)
LEVEL 2	GCSE Grades A-C	L2 Diploma (1st Diploma)	
LEVEL 1	GCSE Grades D-G	L1 Diploma (Foundation)	
ENTRY LEVEL 3	Key Stage 3	E3 Diploma (Foundation)	
SCHOOL / 6TH FORM		F.E. COLLEGE	

← Recommendation 2

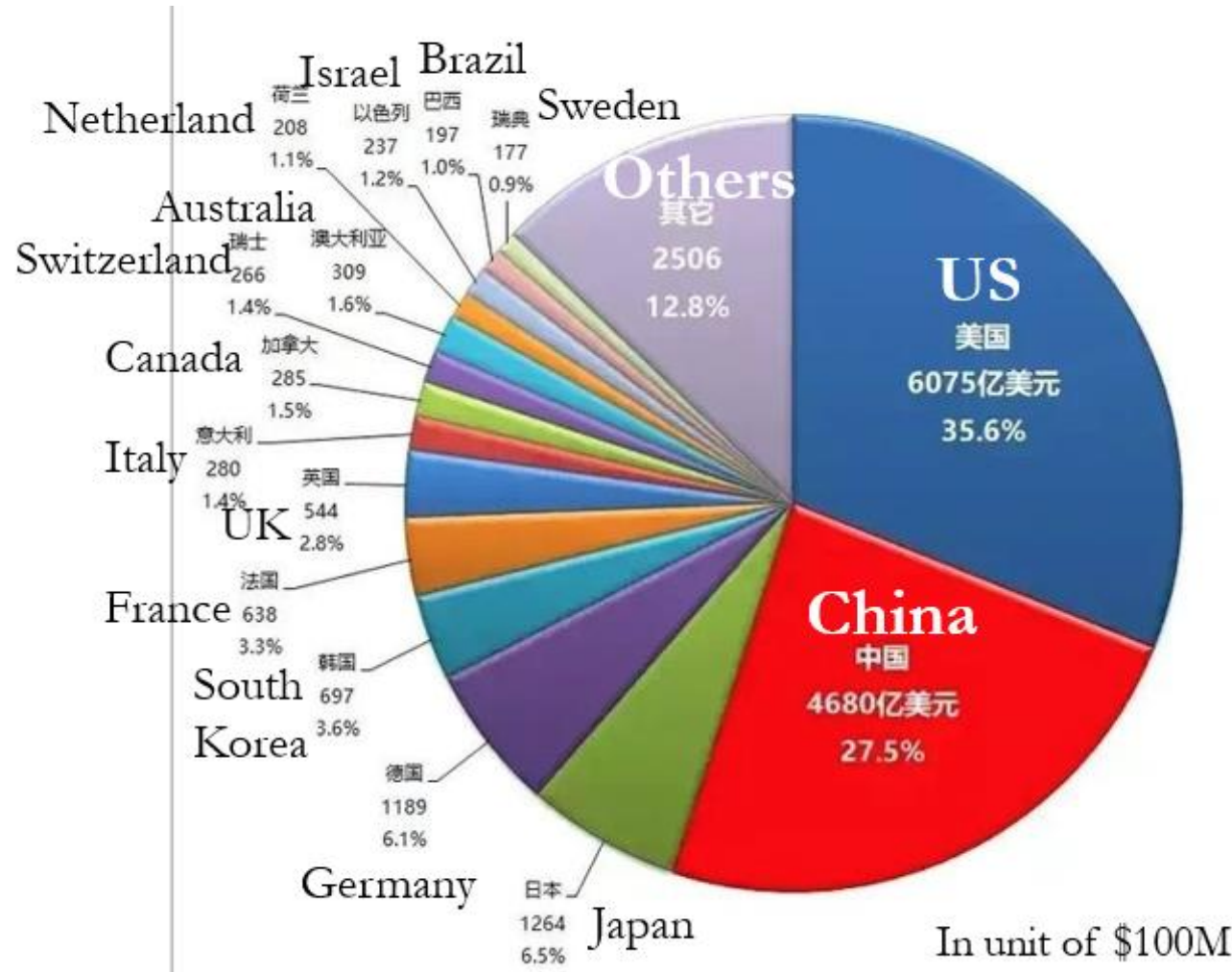
← Recommendation 3

Recommendation 4

Recommendation 5

















Global Scientific Research Funding Ranking by Country 2021



(Source Chinese website)

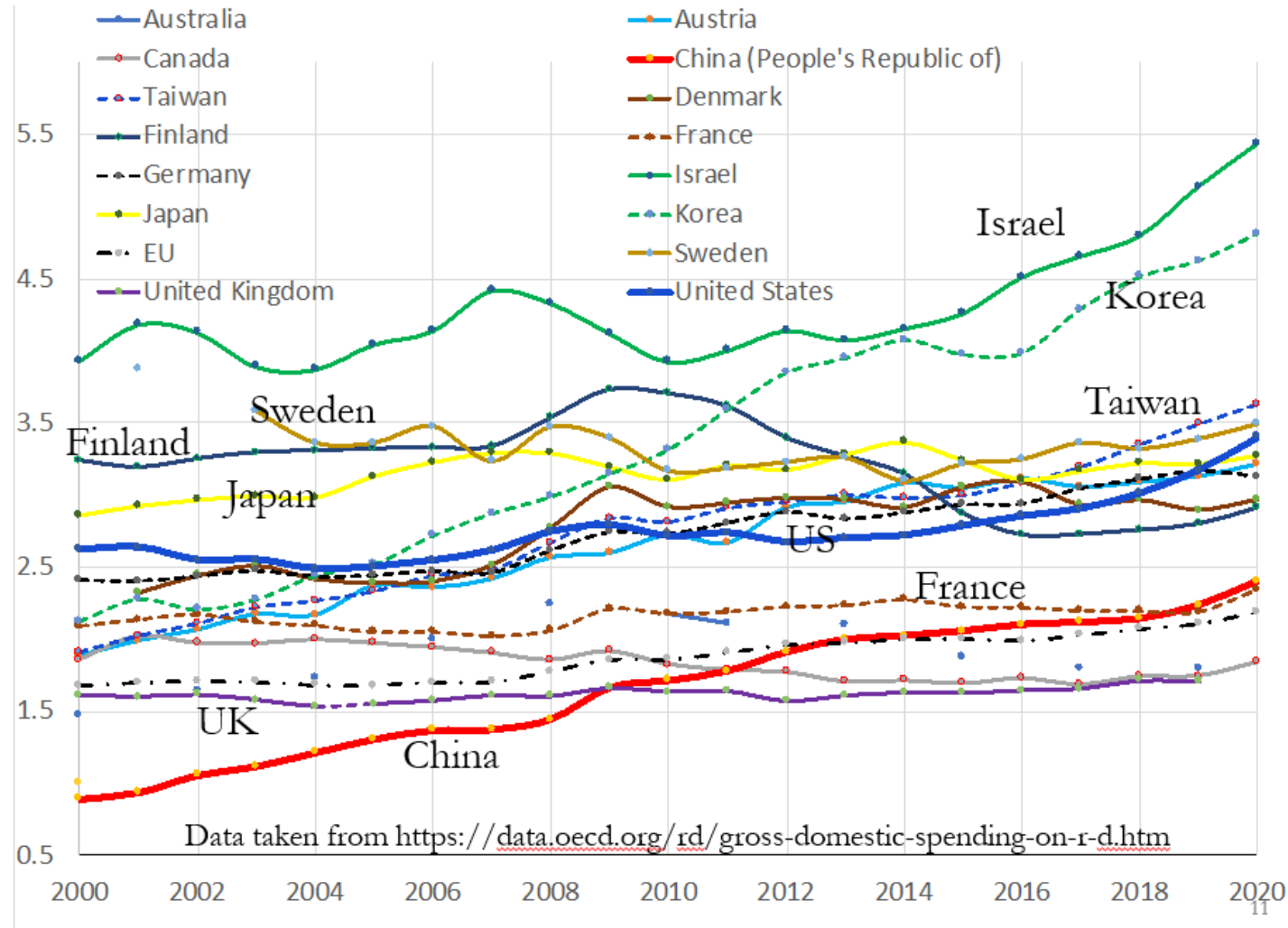


Percentage of GDP Spent on R & D

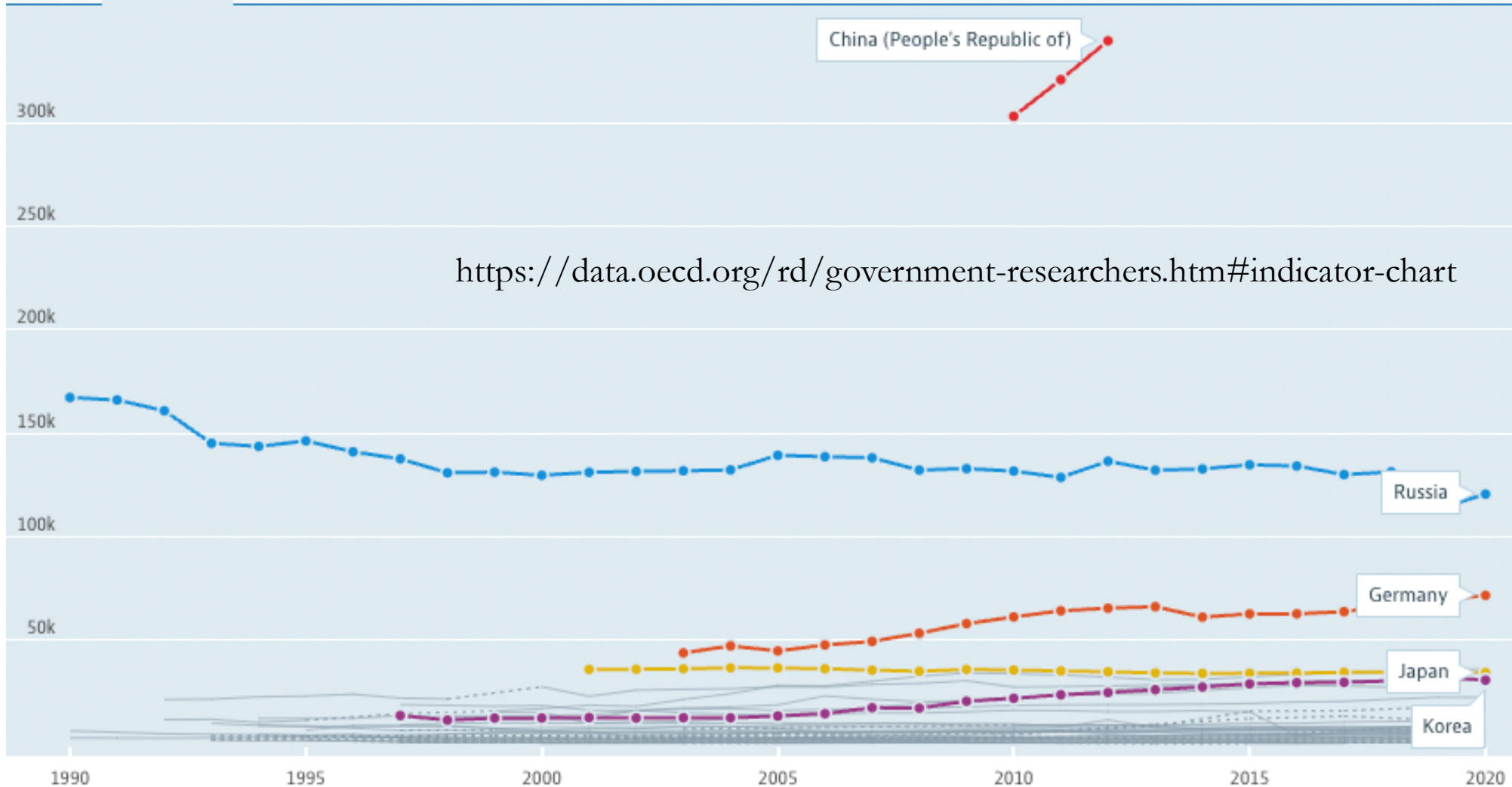
◆	Country/Region ◆	Expenditures on R&D (billions of US\$, PPP) ◆	% of GDP PPP ◆	Expenditures on R&D per capita (US\$ PPP) ◆	Year ◆
1	 United States	612.714	3.1	1,866	2019
2	 China	514.798	2.2	368	2019
3	 Japan	172.614	3.2	1,375	2019
4	 India	158.691	1.3	120	2022
5	 Germany	131.932	3.2	1,586	2019
6	 South Korea	100.055	4.6	1,935	2019
7	 France	63.658	2.2	944	2019
8	 United Kingdom	51.702	1.8	762	2019
9	 Taiwan	42.945	3.5	1,822	2019
10	 Russia	38.549	1.0	263	2019
11	 Brazil	38.0	1.3	181	2017
12	 Italy	33.840	1.4	561	2019
13	 Canada	26.636	1.5	700	2019
14	 Australia	25.58	1.8	1,008	2019















Percentage of GDP Spent on R & D



Head Count of Government Research Staff



Scientific and Technical Journal Articles

Rank ↕	Country ↕	Number of scientific publications (2020) ↕	Scientific publications per capita (in ppm) ↕
1	 China	744042	527
2	 United States	624554	1875
3	 United Kingdom	198500	2959
4	 India	191590	138
5	 Germany	174524	2097
6	 Italy	127502	2159
7	 Japan	127408	1016
8	 Russia	119195	819
9	 France	112838	1664
10	 Canada	121111	3184
11	 Australia	106614	4109
12	 Spain	104353	2202

https://en.wikipedia.org/wiki/List_of_countries_by_number_of_scientific_and_technical_journal_articles



New Chinese PNT Publications and Society (in English)

www.news.cn
新华网
NEWS
www.xinhuanet.com


XINHUANET

Sunday, Nc

China's international journal Satellite Navigation launched

Source: Xinhua | 2020-01-21 16:11:38 | Editor: mingmei

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 **CAST**

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China Institute Of Navigation Was Appraised As A Standard Unit in the Publication and Management of National Society Journals

2022-03-01

Summary of Findings on Education & Research Funding

- Previous slides show that China and other countries are gaining on the U.S. or are already ahead in general R&D investment.
- Specifically true for PNT with the rise of Galileo, Beidou, QZSS, etc.
- To be competitive, the U.S. needs to expand PNT education.
- The following slides show some schemes that could be used to direct additional funding for PNT education

Existing U.S. Graduate Student Fellowship Programs that *could* be used to support work in PNT

- National Geospatial-Intelligence Agency Office of Geomatics
 - Geomatics Emerging Scientist Consortium for Geomatics Education, Research, and Capabilities Enhancement (GEO-ESCON)
- US Dept of Education Graduate Assistantships in Areas of National Need (GAANN)
- National Science Foundation Graduate Research Fellowship Program (NSGRFP)
- Future Investigators in NASA Earth and Space Science and Technology (FINESST)
- NASA Space Technology Graduate Research Opportunities (NSTGRO)
- National Defense Science and Engineering Graduate Fellowships (NDSEG)
- Science, Mathematics, and Research for Transformation (SMART) Scholarships (Both graduate and undergraduate – requires civilian government service after graduation)

Example Funding Mechanism

- National Geospatial-Intelligence Agency Office of Geomatics
 - One outcome from *Geodesy in Crisis* paper
 - Geomatics Emerging Scientist Consortium for Geomatics Education, Research, and Capabilities Enhancement (GEO-ESCON)
 - The Ohio State University
 - \$28.5 million for a three-year base period with option for additional four years.

Example Funding Mechanism

- US DoEd GAANN:
 - Graduate Assistantships in Areas of National Need
 - Eligibility: U.S. students, PhD studies, with demonstrated financial need
 - Total funding: \$30M in 2012, decreased to \$23M in 2020
 - Provides 3 years of funding at up to \$300K/yr/institution – requires 25% matching and no overhead
 - Priority topics for each year are included in the call
 - Opportunity for PNT to become a priority topic

Scientific Applications

- Objectives:
 - Bring awareness of GNSS-enabled scientific applications to the PNT community
 - Understand the technology limitations
- However, focus for this meeting has been on Education
- One example application
 - Soil Moisture through GNSS Reflectometry, Dr Clara Chew, UC Boulder
 - <https://www.youtube.com/watch?v=nAJMpjVjJYc>
- Emerging Key Finding
 - Scientific applications also need protection for GNSS signals.



