

SMALL COUNTRY, GREAT SCIENCE: LESSONS FROM ESTONIA

Anu Realo

Talk presented at the Seminar on “Science Diplomacy” at the Estonian Academy of Sciences, 24 March 2026



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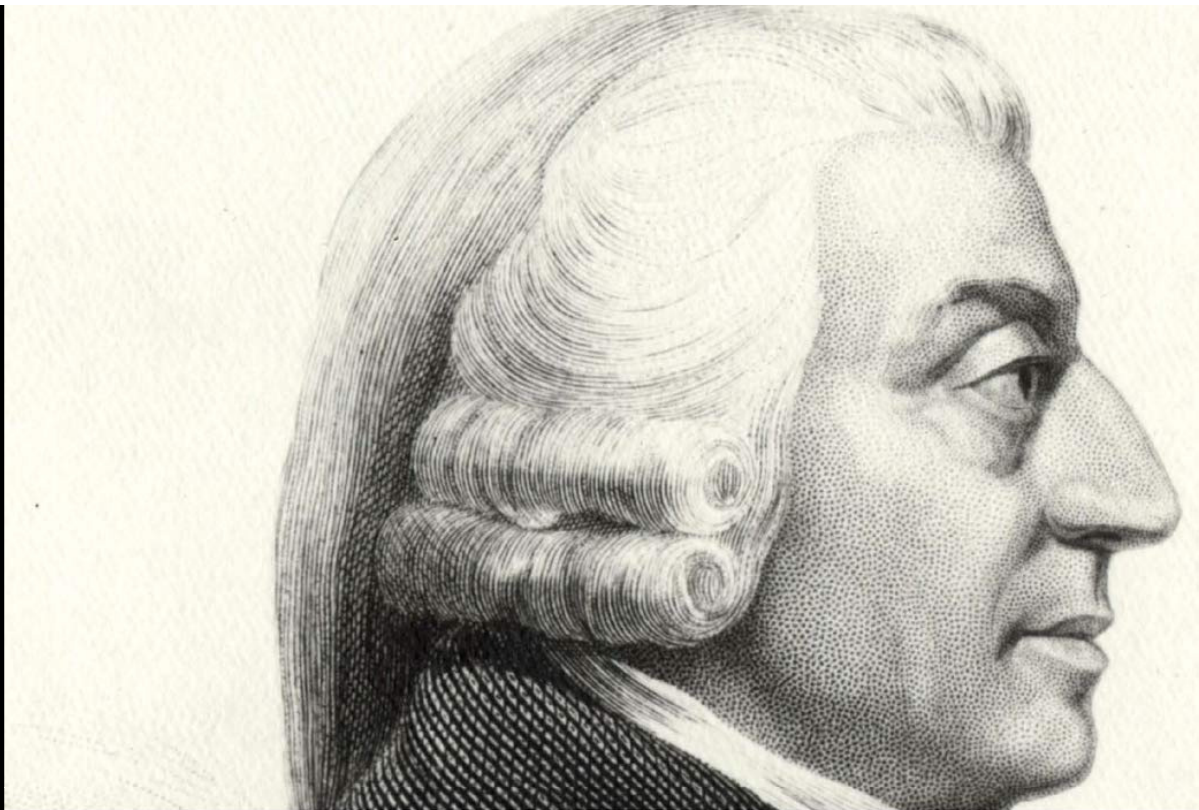
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THE WEALTH OF NATIONS

ADAM SMITH



1776

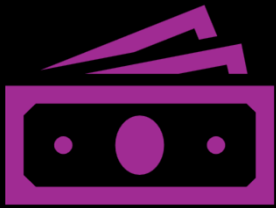
 POLICY FORUM

The Scientific Wealth of Nations

Robert M. May

SCIENCE • VOL. 275 • 7 FEBRUARY 1997 • <http://www.sciencemag.org>

The Scientific Wealth of Nations



What a country invests

R&D expenditure

Number of researchers per million inhabitants

Research infrastructure

Availability of funding programs and grants

...



What a country produces

Publications

Patents

Startups, spin-offs from universities

...

The Scientific Wealth of Nations



Structural strength

Institutional autonomy and governance

Stability of funding

International mobility of scientists

Collaboration with industry

Diversity of scientific portfolio

....



How influential the science is

Citations

Societal impact

International collaboration

Rankings

....

The Scientific Wealth of Nations

Robert M. May



**Robert May, Baron May of Oxford
(1936-2020)**

The concept of scientific wealth is defined as **the average number of citations per paper** published by scientists from a given country or territory over a fixed period

ESI: Bibliometric tool for identifying top-performing research in the Web of Science Core Collection

Measures performance across:

- Institutions, countries, journals, researchers, research fields

Coverage:

- 11,000+ journals in **22 fields**
- Research articles only
- Only the most highly cited individuals, institutions, journals, countries, and papers qualify: researchers and institutions must rank in the 1% in their field, while countries and institutions must be in the top 50

Latest release:

- March 2025 update (2014–2024 data)

Essential Science Indicators

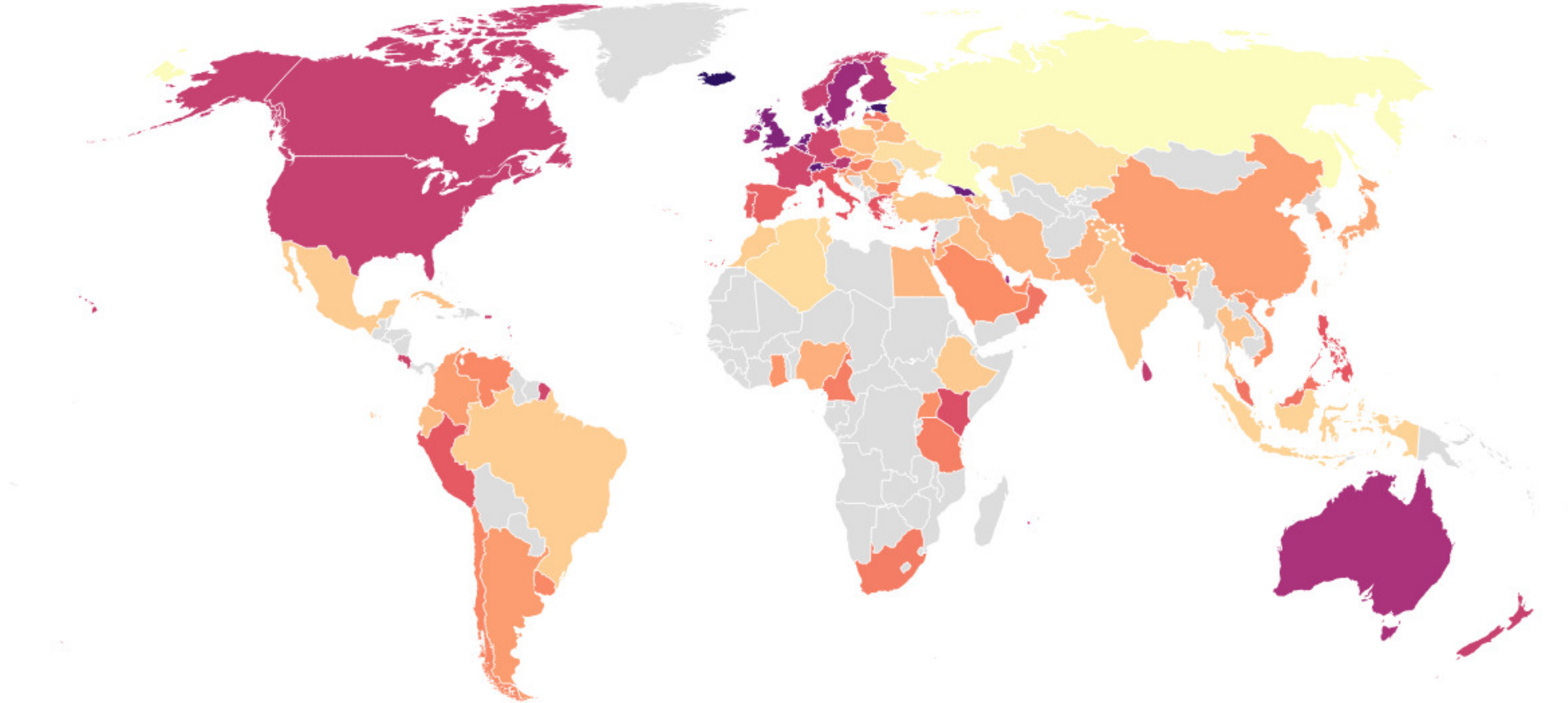
See where science is going and who is leading the way

Web of Science Core Collection

Power your programs with the world's most trusted citation database



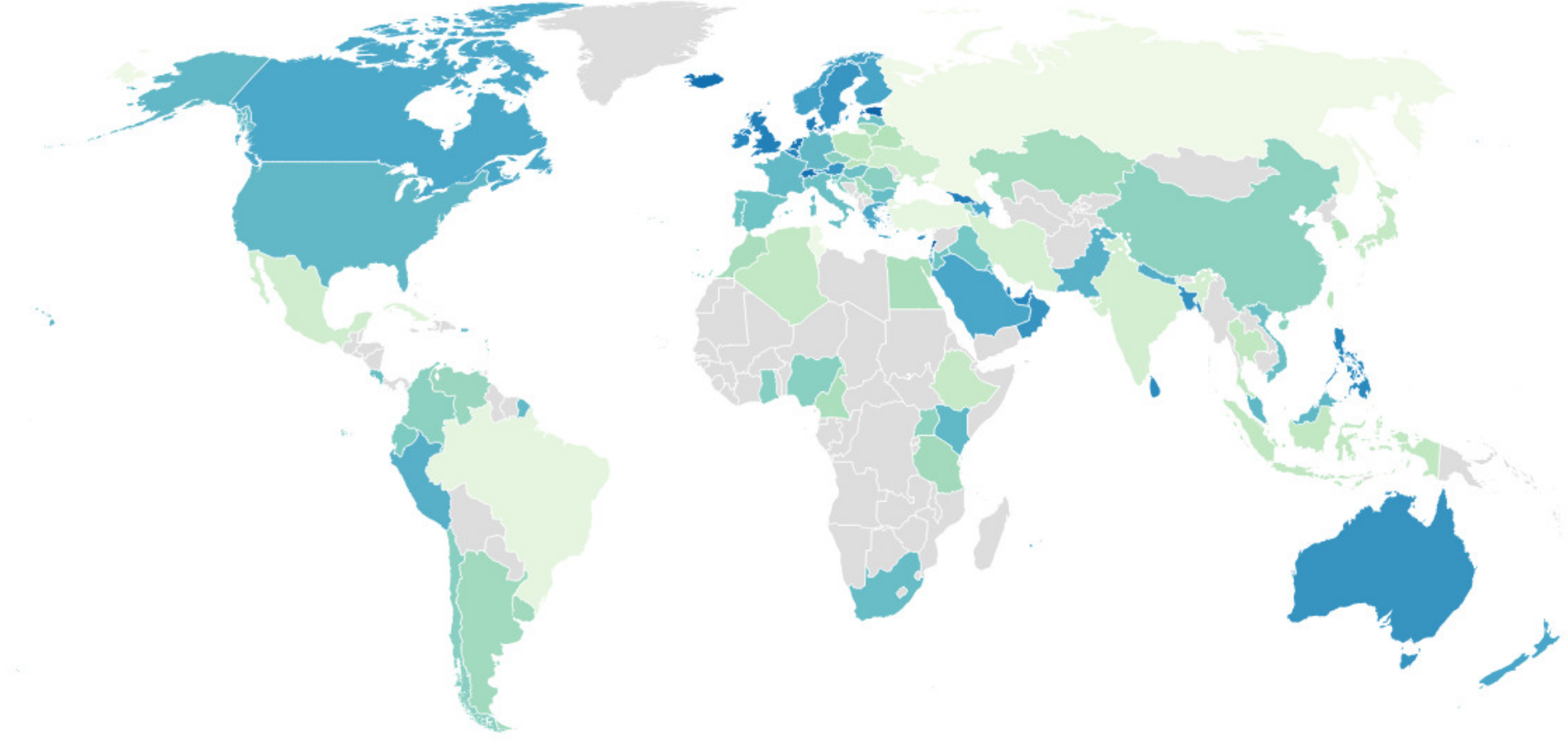
Average Citations per Article (ESI Data, 2014-2024)



Created with Datawrapper

Allik, Saarma, & Realo, 2025

Percentage of top 1% most cited papers among all ESI papers (2014-2024)



Factors Predicting the Scientific Wealth of Nations

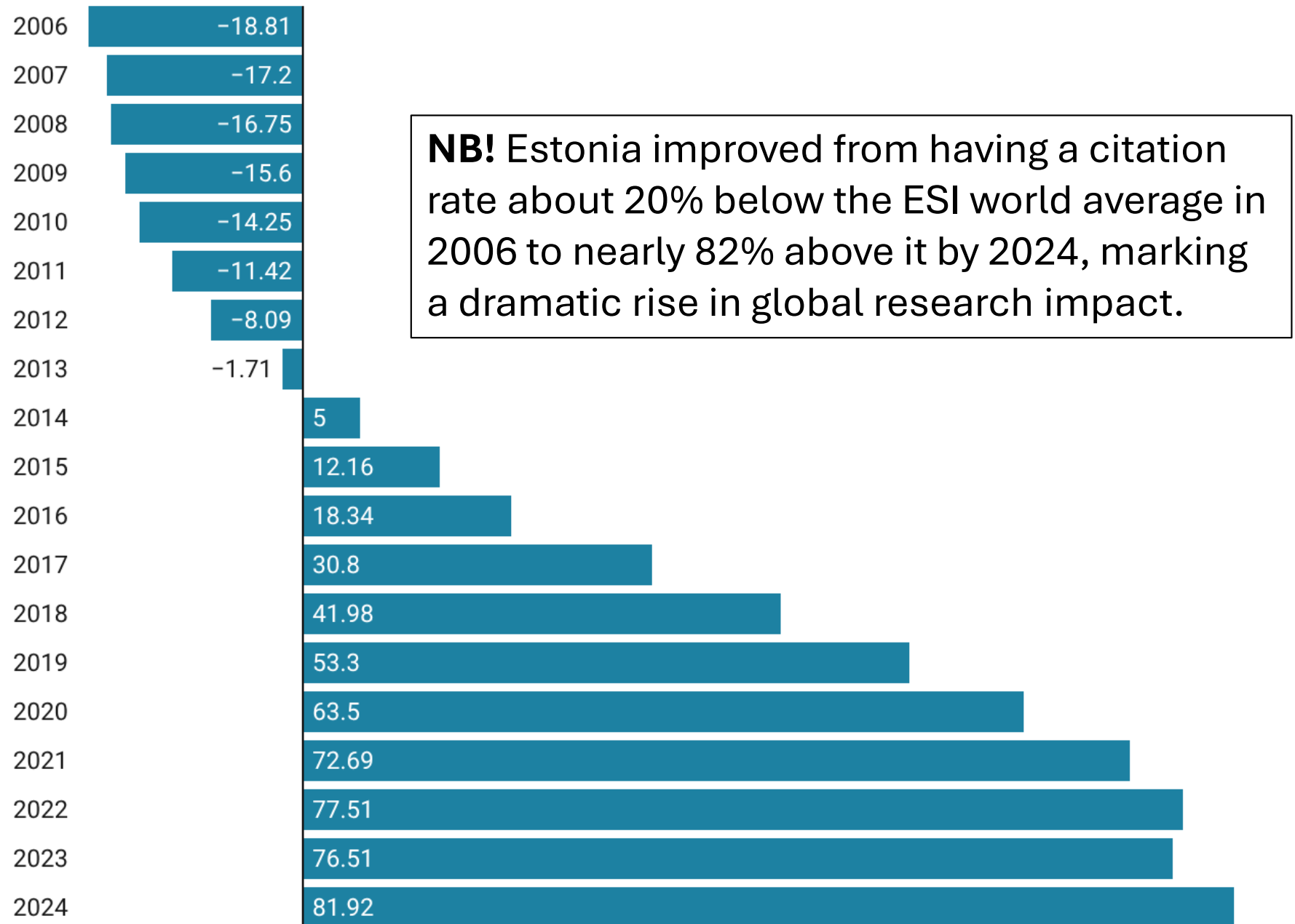
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and Anu Realo^{1,2}

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„... it is small and well-governed countries with a long-standing democratic past that seem to be more efficient in translating economic wealth into high-quality science.“

Allik, Lauk, & Realo, 2020

The average citation rate of Estonian publications relative to the ESI world average since 2006



The Key Drivers of Scientific Excellence in Estonia



Science policy
decisions



Foreign aid



The research
ethos of
scientists

Science Policy Decisions

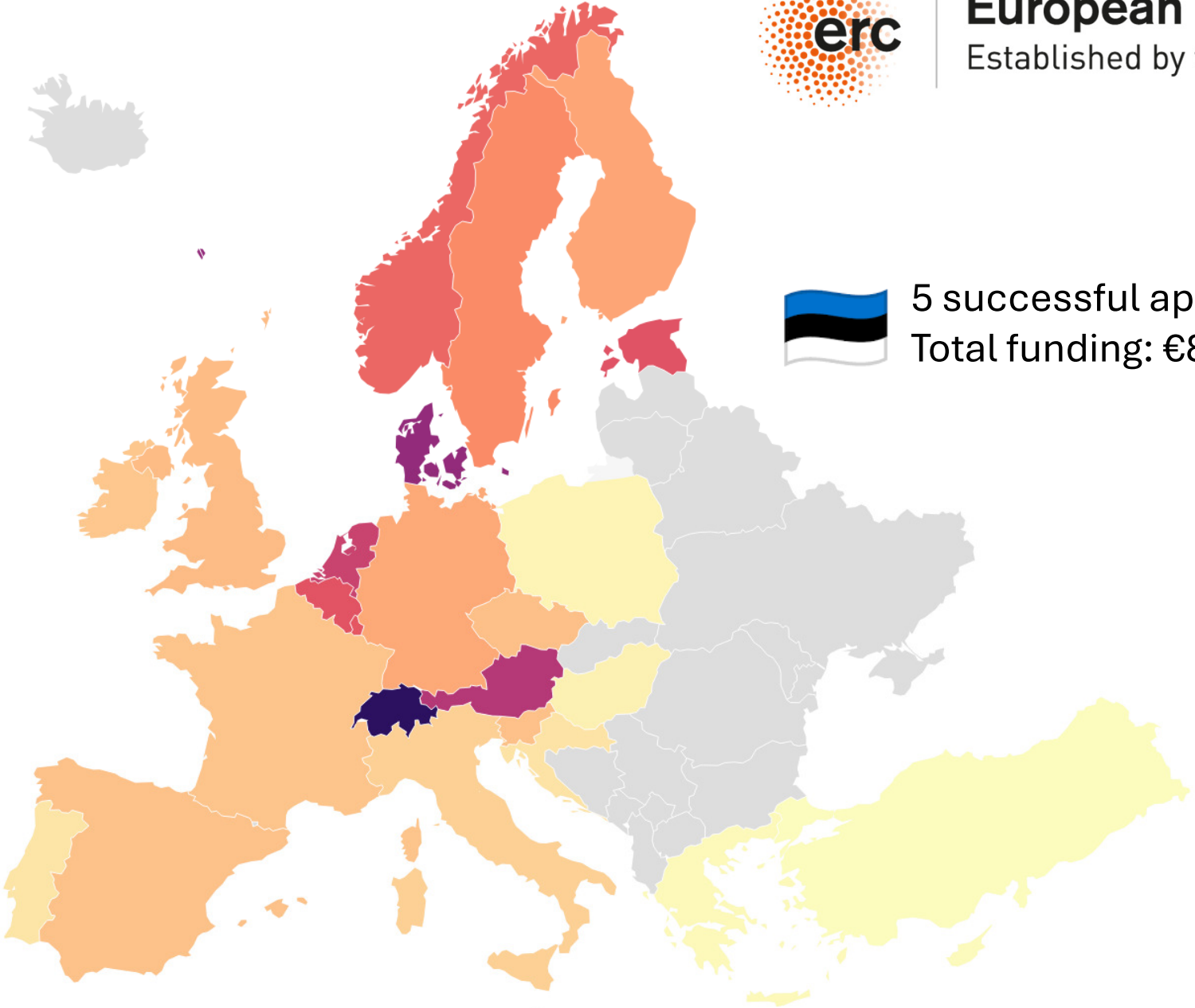


- ❖ After 1991, Estonia aligned with international standards: PhD system introduced and universities regained autonomy
- ❖ PhD reform required 3 peer-reviewed international publications, raising research quality and global visibility -> reduced reliance on local journals encouraged publishing in high-impact international outlets
- ❖ The Estonian Science Foundation (est. in July 1990) ensured independent funding, trained researchers in grant writing, and enabled Estonia to join EUROHORCs, linking science to European networks.
- ❖ Early evaluation by the Royal Swedish Academy of Sciences in 1992 strengthened international credibility.
- ❖ **Strong governance (low corruption, effective policies, high trust) supported long-term scientific success!**

ERC Funding Per Capita (€) in 2025



European Research Council
Established by the European Commission



5 successful applications
Total funding: €8.8 million



International Support & Collaboration

- ❖ Many researchers pursued doctoral studies and training abroad supported by various scholarship programmes
- ❖ Generous donations from international colleagues supported research (e.g., access to research literature, equipment, chemicals, computing resources)
- ❖ Support from émigré scientists helped integrate local researchers into global networks and served as role models
- ❖ Participation in international consortia (e.g., CERN and many others) and international collaboration demonstrated and enhanced top-level scientific competence



Research Ethos

“Too small to publish papers without great impact.”

- ❖ Science in Estonia gradually embraced a global mindset, leaving behind former ideological and centralised practices
- ❖ Focus shifted to publishing in top international journals and engaging with the global scientific community
- ❖ Leading scientists modeled international recognition and collaboration
- ❖ Databases and bibliometrics guided research direction and maximised publication impact

Challenges in Estonia's R&D Funding System

1. Modest R&D investment

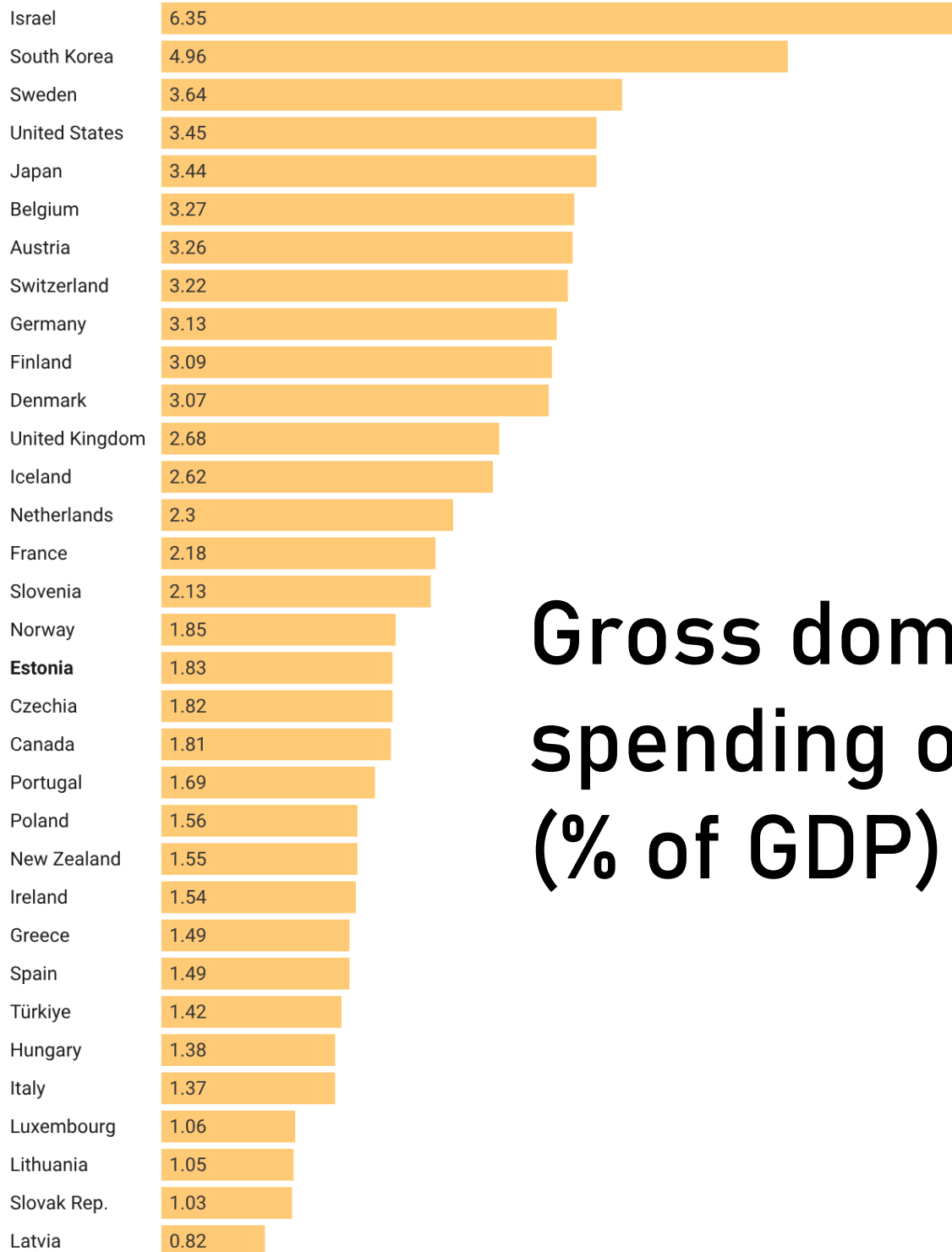
- 1.8% of GDP vs. Finland 3.1%, Sweden 3.6% in 2023

2. Most funding targets basic research

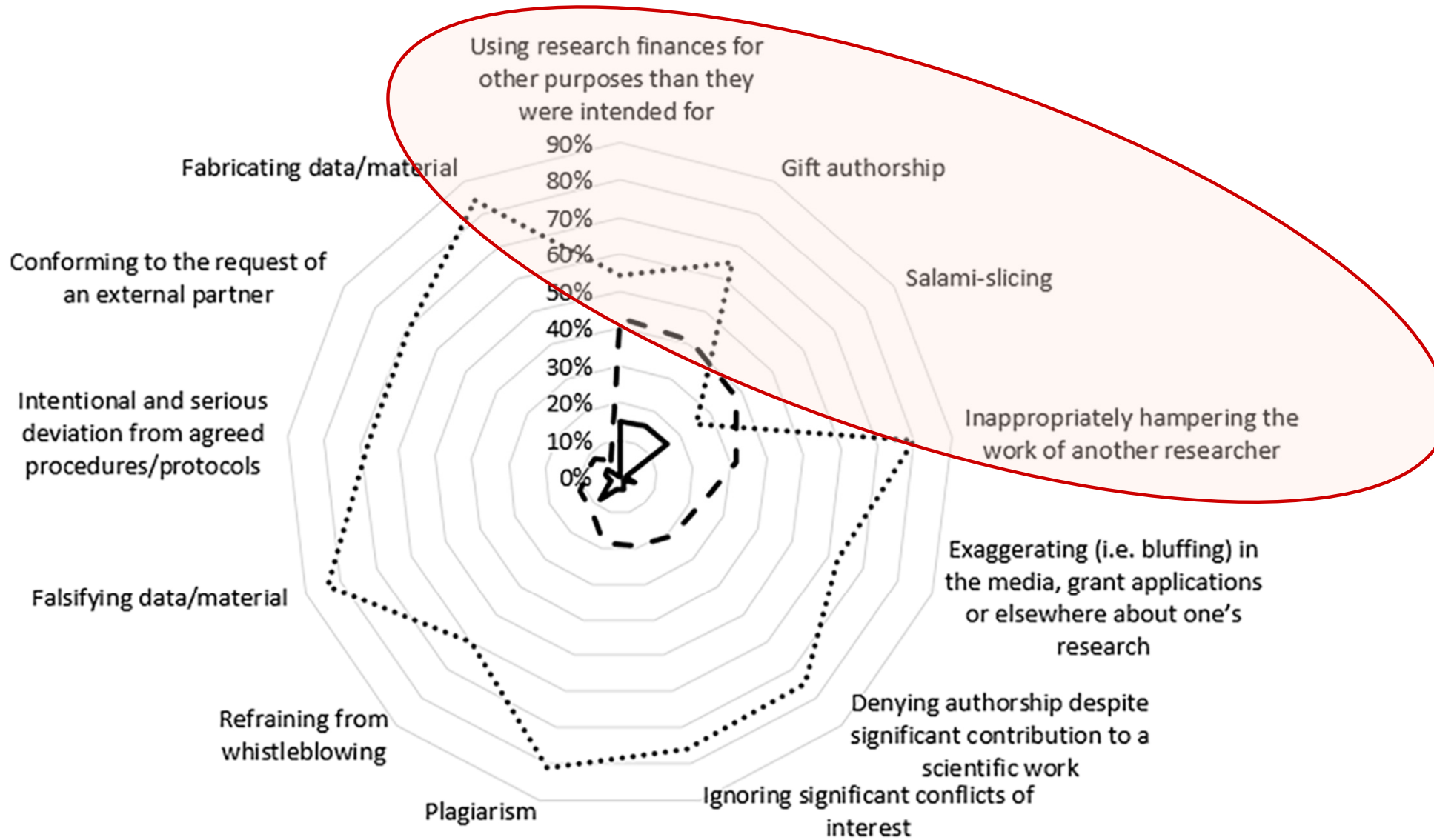
- Supports foundational knowledge but risks long-term sustainability, innovation, and economic relevance

3. Heavy grant dependence

- Scarce funding leads to fragmented work and shifts researchers toward readily fundable topics
- Raises job insecurity, drives brain drain, and lowers wellbeing
- Creates a highly competitive environment and fosters distrust among colleagues

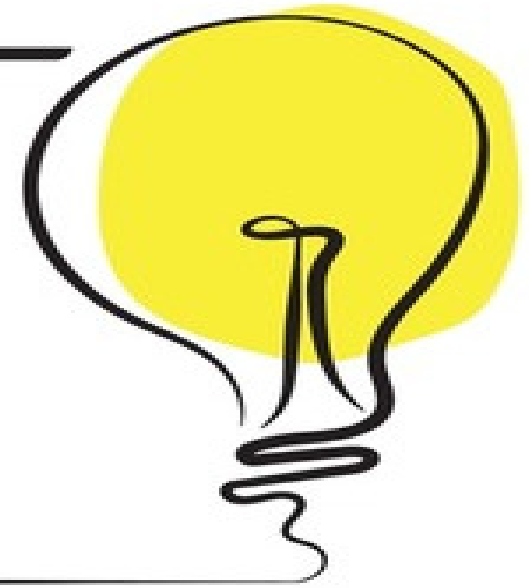


Gross domestic spending on R&D in 2023 (% of GDP)



- - - Colleagues have engaged this type of practice
- Researcher has engaged this type of practice
- This practice is very problematic or quite problematic

Conclusion






- No single factor fully explains Estonia's rapid growth in scientific wealth: growth shows a positive feedback loop, each success fuels the next
- A favorable environment — good governance, strong institutions, excellent education — supports scientific success and impact
- **International support and collaboration during the transition years was crucial — now it's time to PAY IT FORWARD!**



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How did Estonia become the world's fastest-growing country in scientific wealth?

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FURTHER READING:

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THANK YOU!



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