# The Dynamics of Global Science and New Tensions in Academic Knowledge Production

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# 1. Global Science: Introduction (1/2)

- **Science goes global:** global **collaboration, readership, problems & production**, increasingly!
- **Universities – perhaps most globalized social institutions today!**
- **All national science** systems are embedded in **emergent global science**.
- States want **to harness global knowledge** to **national** economic needs.
- However, accessing global knowledge can occur **only through us - scientists**.
- Consequently, **the research power of nations** relies on **the research power of individual scientists**. Their capacity to tap into the global networked science is key.
- Global science: constantly **evolving, bottom-up, autonomous, and self-regulating.**


# 2. Global Science: Introduction (2/2)

- **Why** academic scientists collaborate with other academic scientists? Simply: "**scientists collaborate because they benefit from doing so**" (Olechnicka et al. 2019, 45).
- Benefits come in terms of **promotion, tenure, prestige or access to research funding (world vs. USA).**
- Science today means **self-organizing networks**, spanning the globe.
- Networks consist of researchers "who collaborate **not because they are told to** but because they want to … **Scientific curiosity and ambition** are the principal forces" (Wagner 2008, 2).
- The globalization of science is "**the most potent aspect of modern globalization**." (Freeman 2010, 393).

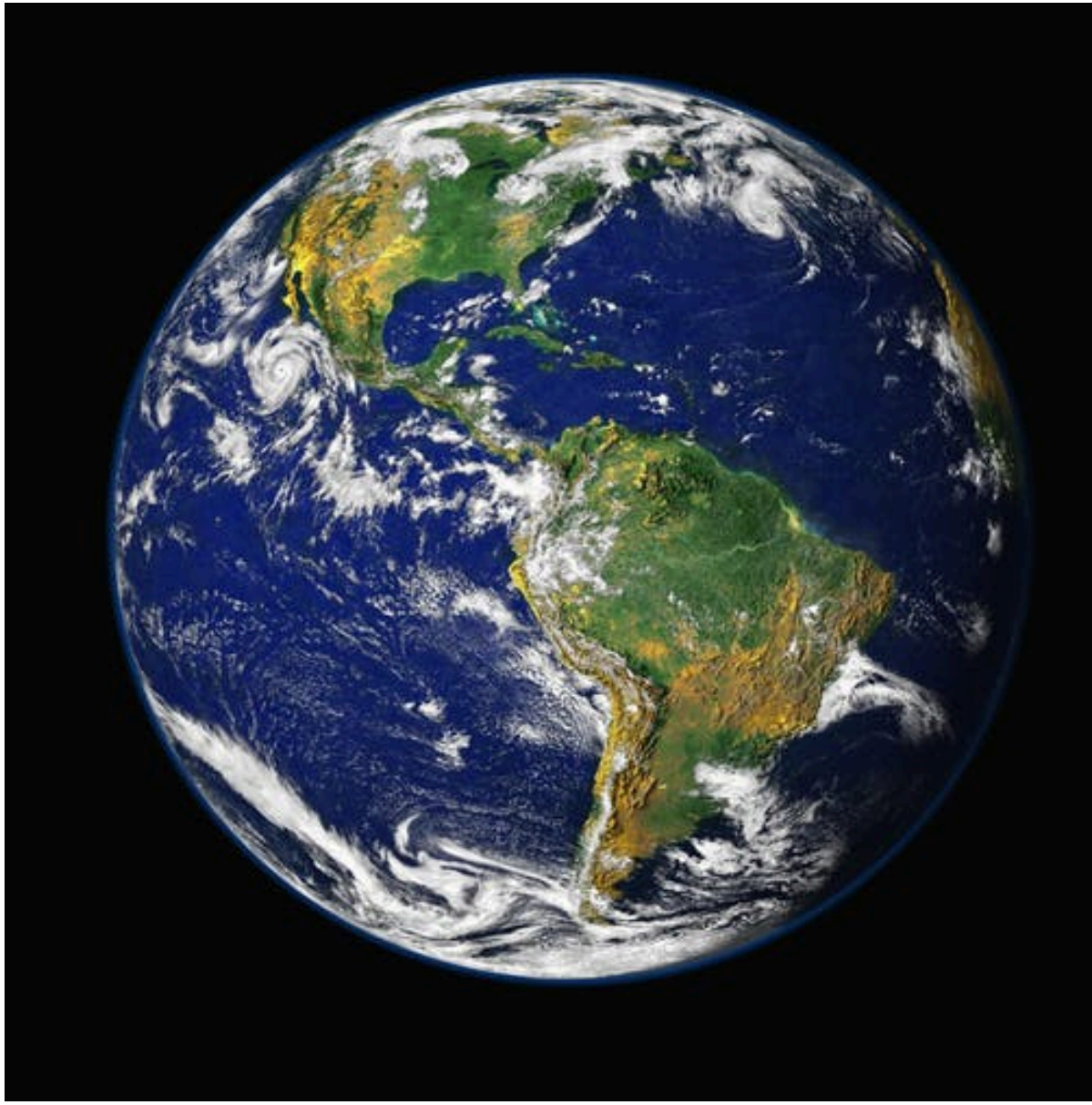
- *Note*: *science* here means *science*, *scholarship*, and *research*.

# 3. What Drives Global Science?

- The primary driver of global science is **individual scientists (who wish to collaborate with the best of their peers)** (Royal Society 2011).
- **Global science and collaboration - (mostly) curiosity-driven!**
- Global science reflects “the **ambitions** of individual scientists for **reputation and recognition” (for works & ideas!).**
- **Scientists may be increasingly collaborating as they wish**, if they wish, and in the areas they wish. On a massive scale, **new** from a historical perspective!
- **Scientists as free agents?**
- A new problem:
  - While linking global science to **national economic competitiveness, national interests** and **national science priorities** is becoming increasingly **difficult…**
  - … states view global science (and universities) as necessarily linked to **national economic prosperity**.
- The ”collaboration age” (Wagner 2018): we have radically **increasing individual autonomy** regarding the **modalities** and **intensities** of collaboration.

# 4. The Changing Map of Science

- The global science system: **a larger, more competitive, multicentric core**.
- **A bipolar world of science led by Anglo-Saxon countries** is gradually being replaced by a **tri-polar world (Europe, North America, Asia-Pacific).**
- The **distribution of publication impact between traditional science powerhouses** and the **new entrants** differs from decade to decade.
- The **traditional Anglo-American academic hegemony** is being **challenged** in an **increasing number of academic fields**.
- The **ties between countries are much closer than before**, leading to **decentralization of science**(Gui et al. 2019) or its **pluralization** (Marginson 2018).
- Collaboration remains **dominated by science superpowers (such as the US, the UK, Germany, and several European countries)**, but **China** ever more **influential in the global network of science**.
- So – the **global map of science** changes radically!



# 5. Global Science Studies and Its Labels

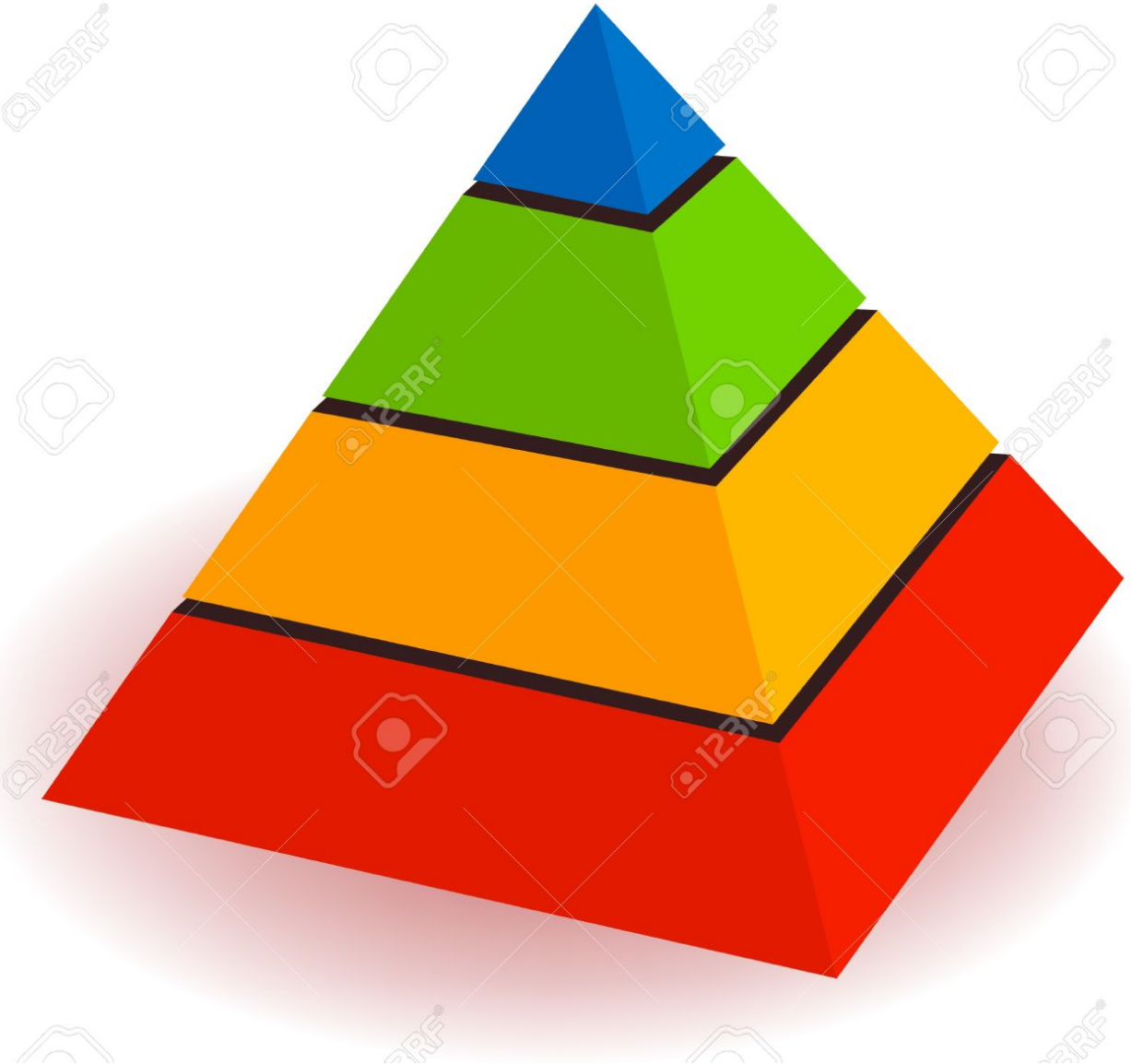
- The most important factor: **digital data** (research funding, productivity, collaboration, citations, academic mobility etc).
- **New data and computer power at fingertips - unprecedented opportunities to explore the structure and evolution of science!**
- **The globalization of science explored under different conceptual labels and research agendas**:
  - **the science of science,**
  - **meta-research (or research on research)**,
  - **quantitative science studies,**
  - **studies of science and technology (STS and its indicators)** and
  - others.
- **Complementary contributions** from related fields such as **scientometrics, informetrics, economics of science, and sociology of science**.
- **The globalization-driven Big Data revolution in science** is utilized to study **the globalization of science itself**!

# 6. Nationally-Funded Global Science

- **Despite globalizing pressures, science career paths, universities, and research funding** - are **overwhelmingly national!**
- There is **no global science without a national funding base for research and training**: global science requires **national funding** to keep research infrastructure running and personnel costs covered**!**
- The relationship between **science and the nation-state** **has traditionally been strong:** nation-states were the **main patrons and sponsors of research** (Kwiek book, 2005).
- Under the pressures of globalization, **nation-states are less able than before to control their destinies** (in many areas).
- They are **more dependent upon universities** for their **knowledge production** and their **human capital.**
- Universities and academic **scientists** - in the center stage!

# 7. How do Global Academic Networks Operate? (1/2)

- The development of a global science system has its own **dynamics of network formation and visibility**.
- Both national and global science is structured by the **university hierarchy.**
- The knowledge produced in **universities with prestige and resources** has higher **visibility and status** than the knowledge produced elsewhere.
- Global science is produced in **most** institutions, countries, languages, and disciplines, but its **highest impact** is reserved for **publications originating from**:
  - **World-class** universities (ca. 1,000-1,200).
  - Located mostly in **Anglo-Saxon** countries.
  - Published in **English**.
  - In **STEMM** disciplines.



# 8. How do Global Academic Networks Operate? (2/2)

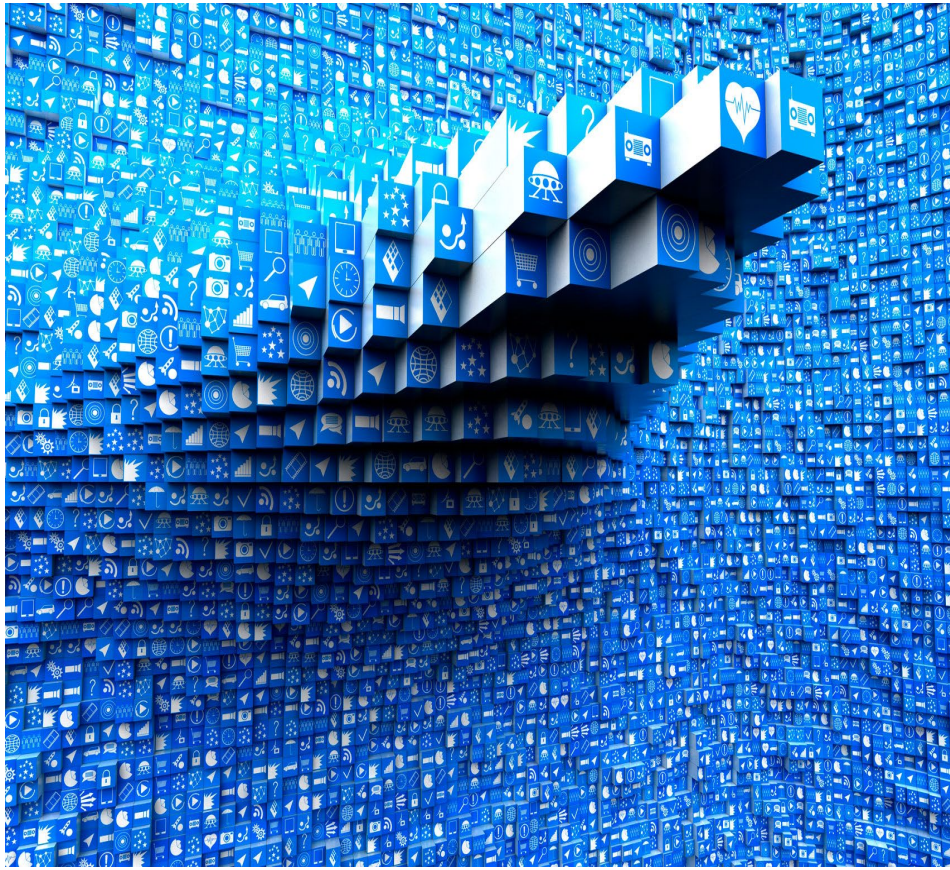
- Global science is a **constantly emergent system** in the sense that it **is the outcome of the numerous interdependent, individual, and decentralized normative decisions** of individual scientists.
- Science is comprised of "**interacting individuals and networks reproducing norms and standards**" (King 2011: 365). Norms of the academic profession.
- A new problem for governments sponsoring research: **governing the academic community** and **steering its academic behaviors** (including **collaboration behavior)** - is a **tricky issue.**

# 9. The Globalization of Science: Institutions, Sectors, Individuals

- Scientists involved in academic knowledge production **leave traces in their printed publications!** We can examine them!
- Our **knowledge regarding the globalization of science** is based on:
  - **Heterogeneous data sources** (biographical, administrative, financial, publications, citations etc.)
  - **Data produced at different levels** (micro-, mezo-, macro-level)
  - **Data produced** with **different methodologies** (interviews, surveys, analyses of bibliometric data sets).
- The globalization of science can be traced using **temporal, topical, geographical, and network analyses.**
- It can be **traced over the years, countries, and institutions, research teams and individual scientists**, as well as academic **disciplines** by the expanding databases (with all commonly discussed limitations).

# 10. Globalization of Science: Impact on HE Research (1/3)

- The **increasing availability of digital data on inputs and outputs** in scholarly activities - is bound to have **powerful impact** on HE research.
- There may be **increasing pressure to use much larger datasets** (and much higher numbers of observations) to draw valid conclusions.
- We **do not mean statistically significant results** – we mean **relevant, attractive, convincing** scholarly results, with policy implications.
- For instance, the pressure **to quantify more intensively academic careers** is understandable in the context of the **declining attractiveness** of small-scale academic **surveys**.
- If a standard sample in a national survey-based study of the academic profession is **1,000-1,500 observations per country (CAP, EUROAC, APIKS)**, then the resultant picture of the national science workforce out of necessity **needs to be very general**.
- To **go beyond standard analyses** in academic profession studies - **future surveys need to use big data and large numbers of observations** much more often (in the way data scientists already use it).



# 11. Globalization of Science: Impact on HE Research (2/3)

- HE research faces **huge opportunities** if only the field understands how globalization-related opportunities are **already used by its competitors** for **scholarly** and **policy attention**.
- **Digital data (on research productivity**, collaboration, citations, & academic mobility) – can be explored today **at a scale unimaginable** in HE research 5-10 years ago.
- **New competition to study science, scientists** and their institutions **emerges between the various fields and disciplines**; and HE research becomes **one among many**.
- Staying away from big data (like Scopus and the Web of Science), **HE research may be losing the competition** about where **data**, **interpretation** and **knowledge** of the academic sector will be **located in the future**.
- Specifically, the **traditional issues** examined in HE research (such as collaboration, productivity, and mobility patterns) are being increasingly studied **in scientometrics & quantitative studies of science**.
- HE research **may stay away from big data revolution – but only at a cost.**
- HE research has been **focused on similar issues for decades** and it needs to be aware of what **competing fields offer today** to **academic** and **policy** communities.

# 12. Globalization of Science: Impact on HE Research (3/3)

- The best way forward:
  - to keep its **highly sophisticated theorizations** and to **incorporate new tools and datasets** for its purposes.
  - **to ask largely the same fundamental questions** (and new ones) using **data-intensive approaches,** made possible by globalization.
- **The major competitor** to HE research in this area **today is data science** (and a general move in social science research toward big data).
- That contest is about **what is valued in scholarly terms** and what is **more publicly fundable**.
- **Theoretical awareness** and **theory production and testing** in the past five decades - are **the capital** on which attractive future of HE research can be built.
- **The keyword** for HE research in the future is **complementarity**: in the case of academic profession studies, **big data** can accompany **surveys and interviews.**
- HE research needs to **consider new tools & datasets arriving at its doorsteps.**
- The global age in science requires **more global data among key sources** and **more complementarity in methods.**
- To keep the HE field **attractive** to young generations of scholars & to funders!

# 13. Lessons from the Dynamics of Global Science (1/2)

- It is increasingly the **researchers**, rather than national authorities, who **set the rules of how science is conducted**.
- **The global science system** is **self-organized**: embedded in the rules created by scientists themselves.
- The networked model of science is an **open system**, with **opportunities open to new entrants**.
- Collaboration patterns emerge from the **choices of hundreds of thousands of scientists** who shape the evolution of science networks.
- **Self-organization and individual autonomy** has never been so powerful in the history of science! **(How long will it last?).**


- However:
- **New tensions** emerge: global networks in science are **self-regulatory (semi-private) in nature**.
- Scientists "**seek to maximize their own welfare**" (Wagner 2008, 10): and motivations are far from "**national interests**" and "**economic prosperity**"; may have negative implications for future **public funding**.
- Scientists indeed satisfy their "**individual curiosity and the career desire for esteem, reputation, and scientific autonomy**" (King 2011, 370). May be not tenable in the future?

# 14. Lessons from the Dynamics of Global Science (2/2)

- **Networks in science cannot be (easily) controlled** (by institutions, countries, public sponsoring organizations)!
- Networks evolve continuously according to the **needs of scientists** (and the **incentives** made available to them by states).
- **Incentives matter**: harnessing global science to **local needs** (and national interests, economic prosperity) is important! But how to achieve this?
- **Scientists need to use their autonomy in research** now (historically, the best time ever) - and **protect** it in the future.
- **Policymakers need to**:
  - Understand **what drives** academic scientists in their work;
  - Understand the mechanisms of **academic recognition (peers matter!).**
  - Use these mechanisms to make global science **nationally relevant, locally important**!