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.

• 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?).

CAUTION

- 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?
• 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!