

Public-private research co-publications: an indicator of European science-based innovation performance?

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1 Introduction

The European Commission's *Innovation Union* concept sets out a strategic approach to innovation policies driven by the highest political level (EC, 2010). The Innovation Union is a “flagship” in the Europe 2020 Strategy. The EC has established an *Innovation Union Scoreboard* (IUS) to help monitor the implementation and progress of Innovation Union. This scoreboard provides comparative country-level assessments of innovation performance within Europe within an international context. The first scoreboard report was published in February 2011 (EC, 2011). It describes the relative strengths and weaknesses of national research and innovation systems with statistical information and a series of graphs depicting the performance of individual EU-27 member states. IUS's analytical framework consists of 25 performance indicators, 8 innovation dimensions and 3 innovation types (enablers, firm activities, outputs). The comparison includes data for EU-27 and selected non-EU countries, including the USA, Japan and China.

The dimension ‘Linkages & entrepreneurship’ is one of the 8 innovation dimensions referring to firm activities. This particular ‘linkage’ dimension consists of three performance indicators: SMEs innovating in-house (as % of SMEs); Innovative SMEs collaborating with others (as % of SMEs); Public-private co-publications (per million population). The latter focuses on knowledge-based interactions and cooperation between business enterprises and public sector partners. More specifically, between R&D-active companies and their research partners among universities and government institutes. In that sense, this single indicator fills a crucial gap in the understanding on how science and scientific research may contribute to R&D and technological innovation within the private sector. It informs us on how knowledge ‘spills over’ from knowledge-producing organizations to knowledge-using organizations within Europe, which is considered one of the key elements of a competitive European innovation system and a critical factor in a well-functioning *European Research Area* (EC, 2007).

2 Research questions

A public-private co-publication (PPC) involves R&D-staff at businesses, or other private sector organizations, co-authoring a research publication with partners at a public sector organization – either in the home country or elsewhere. These publications represent (successful) public-private research cooperation and associated research-related interactions and knowledge transfer (‘knowledge spillover’). PPCs contain a wealth of empirical information on the nature and outcome of these collaborative relationships. The author addresses enable detailed analyses at the institutional level of individual organisations (universities, research Institutes, Large enterprises, SMEs) as well as geographical domains (cities, regions, countries, worldwide). This source of information offers sufficient comprehensiveness and detail to unearth and examine the trends and patterns hidden beneath the macro level of countries.

The fundamental issue dealt with in this presentation is whether or not these countries are the most appropriate unit of analysis for comparative measurements and monitoring of the Innovation Union. What relevant information and new insights can be revealed at meso levels of aggregation, such as regions, cities or universities? Moreover, how to deal with regionalization and globalization processes within research and innovation systems of (advanced) European countries. These systems are increasingly affected by multinational enterprises engaged in outsourcing and internationalizing and their research activities. Much of this happens within an increasing dynamic environment where urban regions and cities are competing to create attractive 'knowledge clusters' of R&D-intensive companies and public sector partners. These regions may determine national performances.

In this presentation will address two classes of research questions, which both critically assess the analytical justification for country level innovation statistics:

- 1) Is the IUS choice of PPC productivity measure (i.e. PPC count per million inhabitants of a country) the best one? Will alternative measures significantly affect the outcomes?
- 2) Does PPC-information at the level of regions or institutions add value in an innovation policy context? To which degree, for example, does the PPC score actually reflect within-country public-private cooperation and local knowledge spillovers?

To answer these questions, secondary analyses are done on the CWTS data for the UIS 2010, while adding novel data on PPC patterns at the meso levels of European NUTS2 regions and large research universities.

3 Methodology

This study will apply the *Web of Science* database (WoS), more specifically October 2010 edition of CWTS' upgraded 'bibliometric version' of WoS which is housed and operated by CWTS under a full international license from the database producer *Thomson Reuters*.

The WoS is a broad multidisciplinary database covering about 1 million new research publications per year. The database indexes some 11,000 international and regional journals, Open Access journals, and book series, and over 110,000 conference proceedings. The WoS focuses on journals with the highest scholarly impact within the sciences and engineering. Its coverage spans all subject areas of science, across the natural sciences, medical and life sciences, engineering and technology, social and behavioral sciences and humanities.

The WoS database has its pros and cons. In this particular study it is important to note that the bulk of the research publications are issued in peer-reviewed international scientific and technical journals, which mainly refer to discovery-oriented 'basic' research of the kind that is conducted at universities and research institutes. Hence, publications referring to 'applied research' or 'strategic research' are underrepresented.

All count data used in the indicators are based on a 'whole counting' method, where a PPC is attributed in full to each country or main organization listed in the author addresses.

The PPCs refer to the following 'research-based' document types within the WoS: articles, notes, reviews, conference proceedings papers, and letters.

The delimitation of private sector organization identifies private sector organisations within author affiliate address information. The definition of 'private sector' may differ from what is generally seen as 'business sector'. These organizations are usually business companies operating within manufacturing industries, but also services industries or for-profit contract research organizations. The definition includes for-profit 'contract' research organizations, but excludes the medical sector (hospitals, medical centers and clinics and other medical practitioners).

This PPC methodology, along with an application at the level of university-industry co-publications for 350 research universities worldwide, is presented in Tijssen et al. (2009).

4 Preliminary results

The first results of the productivity analysis, presented in Table 1, show fairly robust data in the sense that the Dutch performance is about twice that of Germany in most cases. However, normalizing the PPC output by the number of business sector researchers produces a value almost three times the German score. This in itself questions the choice within IUS for a relative crude measure based entirely on a country's total number of inhabitants.

Table 1. PPC productivity measures: Germany and the Netherlands (2008)

| PPC frequency per unit of: | Germany | Netherlands |
|------------------------------------|---------|-------------|
| Population (000) | 0.048 | 0.095 |
| Total researchers (fte) | 0.014 | 0.038 |
| Total R&D personnel (fte) | 0.008 | 0.017 |
| Business sector researchers (fte) | 0.024 | 0.068 |
| Higher Education researchers (fte) | 0.060 | 0.145 |

Data sources: PPC frequency counts in 2008 (CWTS, Web of Science); human resources in 2005 (OECD, MSTI database).

Table 2. PPC statistics of Dutch Universities (2006-2008)

| | % PPCs in total publication output | Rank category in World Top 500/ Europe Top 300 | % of national private sector partners |
|-----------------------------------|------------------------------------|--|---------------------------------------|
| Delft Univ. Technol | 10-20% | 1-10 | 63% |
| Eindhoven Univ. Technol | 10-20% | 1-10 | 66% |
| Univ. Twente | 10-20% | 11-25 | 65% |
| Wageningen Univ. | 10-20% | 11-25 | 63% |
| Univ. Maastricht | 10-20% | 26-50 | 45% |
| Erasmus Univ. Rotterdam | 5-9% | 51-100 | 45% |
| Univ. Groningen | 5-9% | 51-100 | 54% |
| Univ. Utrecht | 5-9% | 51-100 | 50% |
| Vrije Univ. Amsterdam | 5-9% | 51-100 | 51% |
| Leiden Univ. | 5-9% | 101-200 | 45% |
| Radboud Univ. Nijmegen | 5-9% | 101-200 | 53% |
| Univ. Amsterdam | 5-9% | 101-200 | 46% |
| Univ. Tilburg (Europe Top 300) | 2-4% | 201-300 | 57% |

Source: CWTS (Web of Science) and CWTS University-Industry Research Cooperation Scoreboard 2011 (<http://www.socialsciences.leiden.edu/cwts/products-services/scoreboard.html>).

As for geographical distribution of private sector partners within PPCs, the data in Table 2, on the PPC performance of the individual Dutch universities, indicates that only about half of these partners are located in the Netherlands. The share of

local partners is relatively high at the technical universities (each among the world top-25 in terms of PPC-intensity!) with shares above the 60%. In other words, a very considerable share of their public-private research cooperation might involve knowledge spillovers to foreign countries. A large part of those partners will no doubt be located within Europe, at relatively close proximity. This is not an atypical outcome for small countries such as the Netherlands, with an advanced and open science system. It does however raise the issue of possible (dis)balances among national science systems, in terms of acting (predominantly) as PPC knowledge producer or as a knowledge user.

Further results will be presented at the conference, including information on level of European regions.

References

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