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The black eagle soars: Germany's bibliometric trends 2004-2013

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Section 6:
Country Trends

The black eagle soars: Germany's bibliometric trends 2004-2013

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Since the scientific revolution, Germany has been a major contender in Science and Technology, and throughout the 19th Century, German was a preponderant language in scholarly communications around the globe. Although two World Wars took their toll on Germany's scientific progress, in the modern era the country is still the home or birthplace of many Nobel Laureates. In today's world, Germany remains a major scientific hub, producing over 6% of the world's scholarly output in 2012, and German scholars are particularly active in disciplines such as Mathematics and Physical Sciences (1). In recent years, the country has seen a fairly steady rise in internal R&D expenditure, approaching 80 billion Euros in 2012 (2). Germany exceeded 10% of the world's citations in 2012, leading to high relative citation impact of its research in all fields. German research also leads to technological innovations – Germany is second only to the USA in patent citation share (1). In this piece Research Trends takes a bibliometric look at trends in German research during the past decade.

Germany now

In the past five years (2009-2013), 497,212 Germany-based authors published 726,090 papers which were cited 5,045,807 times, resulting in a Field Weighted Citation Impact (FWCI) of 1.43. The country is highly internationally collaborative, with 48.3% of 2013 German scholarly papers resulting from international collaborations (source: SciVal).

Measuring Impact: Citation Windows and Field-Weighting

Citations accrue to published articles over time, as articles are first read and subsequently cited by other authors in their own published articles. Citation practices, such as the number, type and age of articles cited in the reference list, may also differ by research field. As such, in comparative assessments of research outputs, citations must be counted over consistent time windows, and publication and field-specific differences in citation frequencies must be accounted for. Field-weighted citation impact is an indicator of mean citation impact, and compares the actual number of citations received by an article with the expected number of citations for articles of the same document type (article, review or conference proceeding paper), publication year and subject field. Where the article is classified in two or more subject fields, the harmonic mean of the actual and expected citation rates is used. The indicator is therefore always defined with reference to a global baseline of 1.0 and intrinsically accounts for differences in citation accrual over time, differences in citation rates for different document types (reviews typically attract more citations than research articles, for example) as well as subject-specific differences in citation frequencies overall and over time and document types. It is one of the most sophisticated indicators in the modern bibliometric toolkit. (1)

Germany 2004-2013

Germany has seen increases in international collaboration over time, as have several of its European neighbors (see Figure 1). The UK in particular has seen a higher increase rate than Germany in the past decade: while the UK was less internationally collaborative than Germany in 2004, by 2013, nearly half of its scholarly output (49.7%) was the result of international collaboration. That same year, more than half of the scholarly outputs of France and the Netherlands were internationally collaborative. Meanwhile, Spain and Italy show parallel increasing trends but lower percentages of international collaboration over the whole period, whilst Poland, the least internationally collaborative country selected, shows overall decreases in international collaboration over time, amounting to less than a third of its 2013 output.

Germany's scholarly output has grown to reach 137,865 papers in 2013. Among its selected European neighbors it is second only to the UK, which published about 10,000 more papers that same year. Other selected European countries also see growth over time, but their scholarly outputs remain significantly below that of Germany and the UK (see Figure 2).

Some of the German outputs show high and increasing citability; for instance, German publications that are amongst the top 1% cited papers rose strongly over time, to reach nearly 2.4% of the country's scholarly output in 2013. For comparison, 2.5% of the UK's scholarly output was in the top 1% cited papers in 2013, and a significantly higher 3.1% of the Netherlands' (see Figure 3). Germany and the UK have higher absolute numbers of papers in the top 1% cited papers than the Netherlands, but normalizing for output size reveals that a higher proportion of the Netherlands' scholarly output is in the top 1% cited papers.

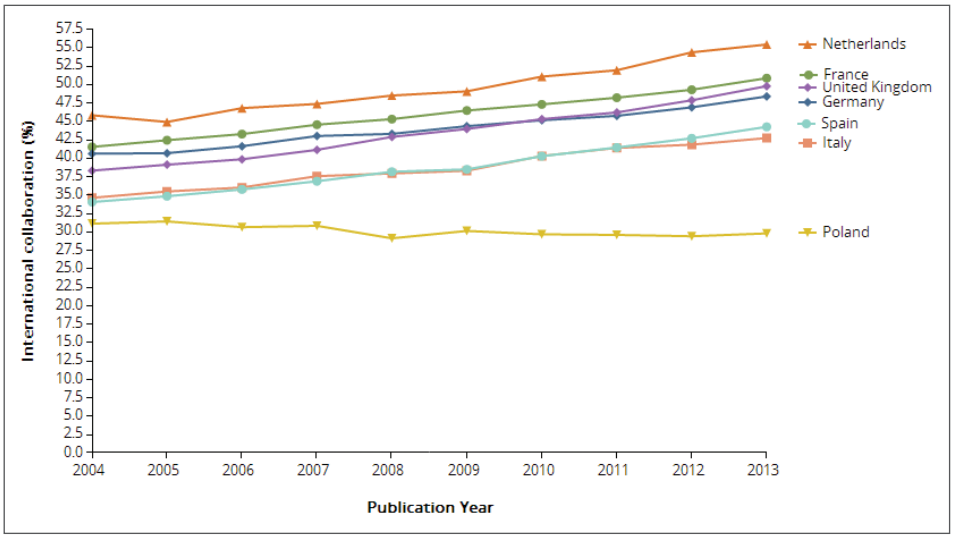

Figure 1: Germany and selected European countries' 2004-2013 international collaboration percentages. Source: SciVal (Scopus data)

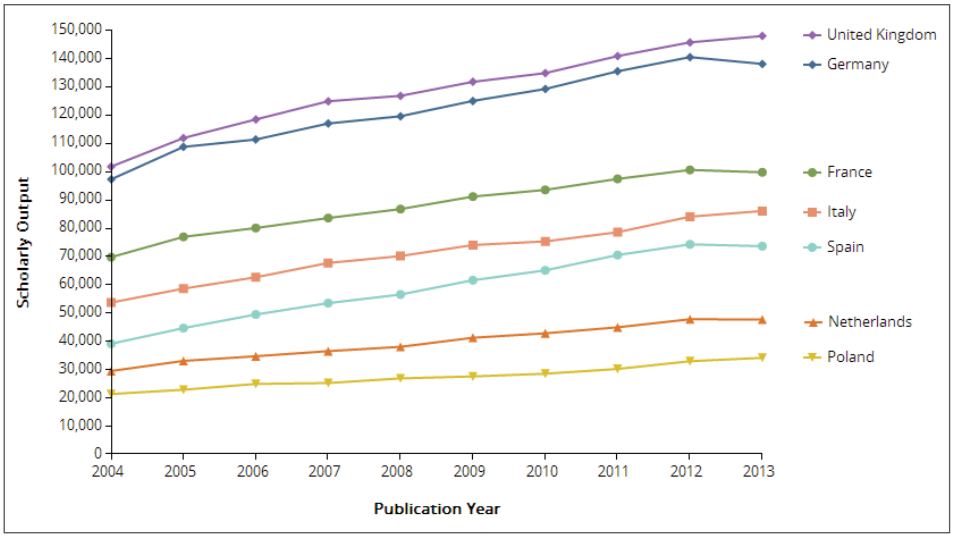

Figure 2: Germany and selected European countries' 2004-2013 scholarly output. Source: SciVal (Scopus data). (Note: Owing to usual indexing lags for some recently-published content at the time of data extraction (mid 2014), the 2013 data point may not reflect a complete view of the final 2013 publication outputs of each country shown).

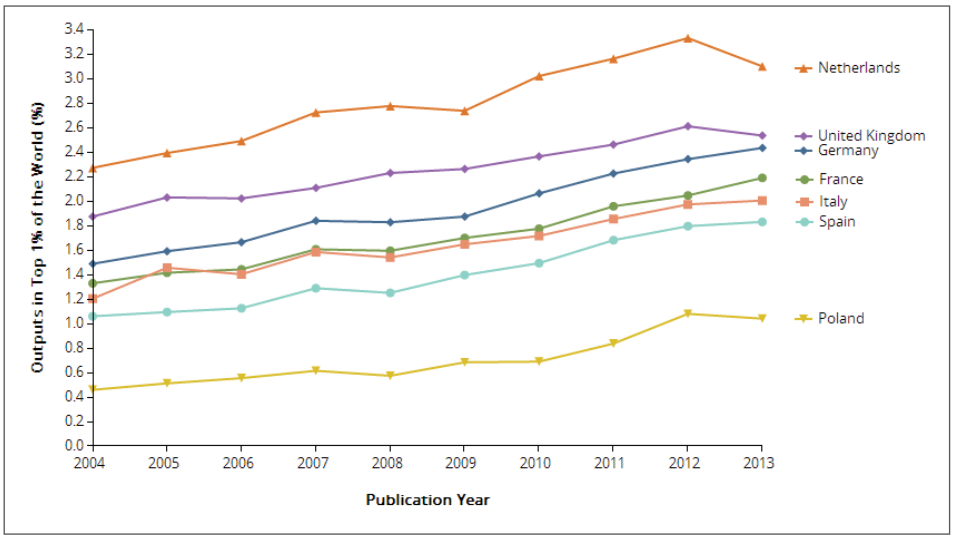

Figure 3: Proportion of 2004-2013 German and selected European countries' publications in the top 1% cited papers. Source: SciVal (Scopus data)

Germany's growth is not limited to the top cited outputs either, as demonstrated by the rising trend of Germany's FWCI, from an already high 1.27 in 2004 to an impressive 1.49 in 2013. The Netherlands and the UK have higher FWCIs across the whole decade, and so does Italy in 2013 (1.60). Although in 2004 Italy's FWCI was inferior to Germany's, it has seen strong increases over the past 10 years, catching up to Germany in 2010 and 2011 before clearly overtaking it in 2012 and 2013, when it even marginally surpassed the UK's (see Figure 4).

Finally, looking at the language diversity of scholarly publications, research has shown that non-English outputs tend to have lower citation impact (3). Taken together with the steadily decreasing proportion of German research published in German (see Figure 5), this may help explain some of the increase observed in FWCI.

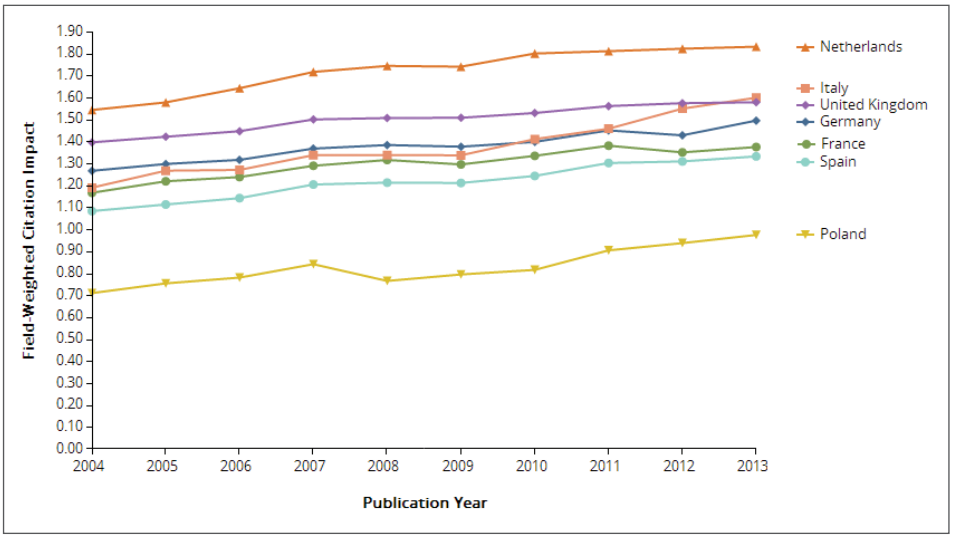

Figure 4: Germany and selected European countries' 2004-2013 FWCI. Source: SciVal (Scopus data)

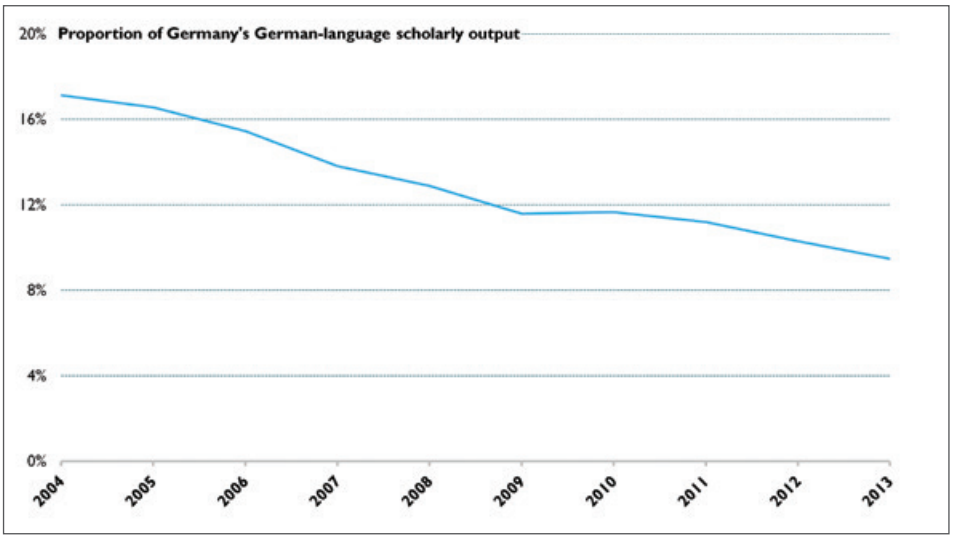

Figure 5: Proportion of German-language German output 2004-2013. Source: Scopus

Conclusion

Germany's academic achievements are long-standing, and despite some historical turbulence, Germany has managed to maintain its status as one of the main scientific powers in Europe and on the global scene. Compared to selected European neighbors, Germany remains a solid contender with a robust performance, in particular in terms of output, even though in the last decade it has been overtaken by the UK in terms of international collaboration and by Italy in terms of FWCI. Recent trends such as increases in funding and output bode well for the bibliometrics future of the country, while boosting international collaboration could help further improve the nation's citation impact (4).

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