Evidence from the latest BIS report indicates that international collaboration on articles boosts impact through citations and adds to the UK's position as a 'world-class' research nation.

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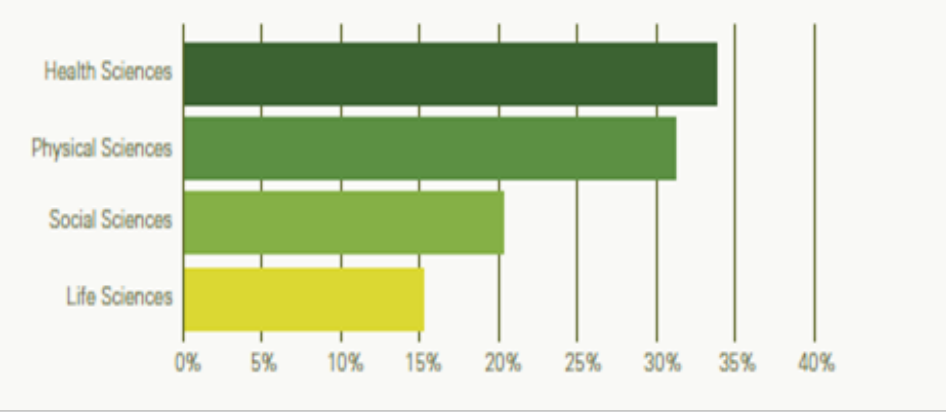
*In October 2011 the UK Government commissioned a report on the UK's research performance within the global field, the results of which affirmed the position of the UK as a leading research nation. LSE Impact Project researcher **Dr Joan Wilson** summarises the report's conclusions on research outputs and the social sciences, and finds that international collaboration will have a larger role to play in increasing research quantity and quality.*

In October 2011 academic publishing giant Elsevier released a report commissioned by the UK Department of Business, Innovation and Skills (BIS) presenting evidence on investment in and the performance of the UK research system relative to the world picture. The findings from this study highlight the comparative international strength of the UK and have important implications for the social sciences, which face ever-increasing pressure to prove their contribution and therefore their value to the UK economy.

Research outputs, which form a key consideration of the report, are determined by the annual volume of published articles and their citation – capturing *research intensity* and *research quality* respectively – as well as by research efforts involving international collaboration. The main bibliometric tool used to measure outputs is Scopus, a human-edited system for tracking citations that is produced by Elsevier. As highlighted in the LSE's Handbook on Maximizing Impact and illustrated in figure 1 below, coverage of social sciences and humanities citations are limited in the Scopus database, since the system (like the ISI Web of Knowledge) includes fewer journal titles from these fields. Additionally, Scopus does not index books, which are a major publication source within these disciplines.

Figure 1: Percentage of titles in Scopus by subject area (July 2010)



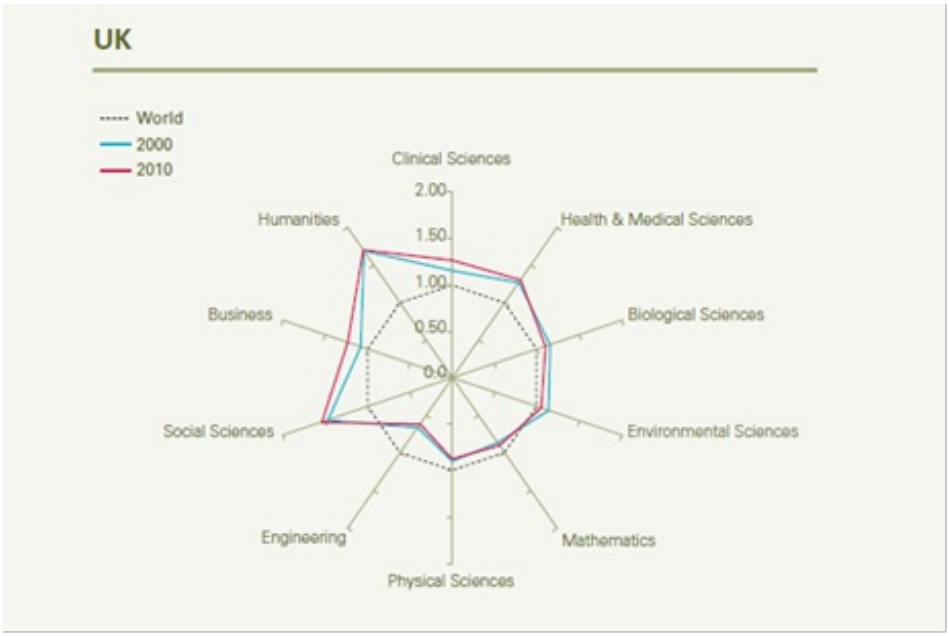
Note: The total percentages add up to over 100% because titles may be attributed to more than one subject category. **Source:** BIS (2011). *International Comparative Performance of the UK Research Base: 2011. Appendix C: Data Sources*, pp. 3.

Notwithstanding these database drawbacks, the report findings still bring home the vital influence of the UK social sciences on the world research arena. On the *research intensity* side, the report shows that overall the UK has experienced positive but slower growth in the volume of articles published relative to the

world average, with article output rising by 2.9 per cent per year on average since 2006, compared to a world mean growth rate of 4 per cent per year in that time frame. Consequently the UK's share of world article output fell slightly from 6.67 per cent in 2006 to 6.38 per cent in 2010, so that the UK ranks 3rd in the world in terms of global articles shares. The drive up in the global average is attributable to rising research output volume in the BRICs group – Brazil, Russia, India and China – with China especially pushing ahead as a powerful new competitor.

Yet despite slowing growth, the activity index for the UK, which measures research papers outputs, reveals a share of publications volume in the clinical, health and medical sciences, as well as in the social sciences, humanities and business that has remained positive and above the world average over the period 2000 to 2010, as figure 2 shows:

Figure 2: Activity Index for the UK across Ten Research Fields in 2000 and 2010



Notes: The Activity Index measures outputs of (published) research papers (BIS, 2011, pp. 4). The chart depicts the share of the UK's total articles relative to the world's share of articles in each of the 10 research fields. A value of 1.00 indicates that research effort in that field corresponds precisely with the world average (BIS, 2011, pp. 31). **Source:** BIS (2011), pp. 32.

Research quality in the UK is 'world-class' (BIS, 2011, pp. 34), with average annual growth of 7.2 per cent since 2006 relative to world average growth of 6.3 per cent per year since then, placing the UK second in the world on this measure behind the US. Citation counts may inaccurately reflect relative research prowess if some countries publish large numbers of articles in highly-citing subject fields more than others. To account for this, the report provides a 'field-weighted citation impact' indicator, where citation counts are adjusted for differences between countries in their strength of focus on differing fields of research. This measure sits above the world average for the UK in all subject areas and has grown at 1.1 per cent annually since 2006, compared to a decline of -0.5 per cent over the same time period for the US.

An indicator of national research excellence is offered through the proportion of highly-cited articles – measured as those in the first citation percentile. In terms of world shares the UK's performance is robust, ranking second globally after the US, with particular strengths in the social sciences and humanities, as table 1 shows.

Table 1: Highly-cited articles share (world) by discipline for the UK

Discipline	2006	2010	Change 06-10	CAGR 06-10
Clinical sciences	13.80	15.95	2.15	3.7%
Health & medical sciences	9.88	11.50	1.62	3.9%
Biological sciences	12.76	14.54	1.78	3.3%
Environmental sciences	12.95	13.86	0.91	1.7%
Mathematics	10.65	10.22	-0.44	-1.0%
Physical sciences	9.70	11.06	1.36	3.3%
Engineering	6.59	7.03	0.44	1.6%
Social sciences	15.29	16.43	1.14	1.8%
Business	12.10	12.72	0.62	1.3%
Humanities	19.61	21.51	1.90	2.3%
World Average	**12.09**	**13.80**	**1.71**	**3.4%**

Notes: The table shows the percentage shares of published world research output for each discipline according to the most highly-cited articles, defined as those in the 1st citation percentile (BIS, 2011, pp. 28). CAGR = Compound Annual Growth Rate. **Source:** BIS (2011). *Appendix F: Supplementary Data*, pp. 92-102.

Taken together, research intensity and research quality *per researcher* are high in the UK, with articles and citations per researcher growing at 4.8 per cent and 2.8 per cent annually since 2006 respectively. Resource use therefore excels on efficiency grounds among UK researchers, who produce a larger volume of higher quality output per researcher than their international counterparts. Evidence from the LSE Impact project and elsewhere on the nature of highly-cited articles suggests that they "are mostly research articles, are typically multi-authored and often involve international collaboration, and may be more likely to be interdisciplinary (or at least, relevant to more different research fields)" (BIS, 2011, pp. 37). Both citations per researcher and highly-cited articles owe their growth to *international collaboration* on articles, which in itself is gaining momentum in the UK research system. Collaboration – most commonly proxied by the proportion of UK researchers engaged in the co-authorship of publications with non-UK based researchers – stood at 46 per cent of UK authored articles in 2010, second in line to France in the international setting. The relative weight of national and institutional co-authorship is instead decreasing, measuring 38 per cent and 16 per cent respectively in 2010. Report evidence indicates that international collaboration accounts for a 2.0 fold-increase in citations per article compared to institutional co-authorship, thereby having a vital influence on citation success. National research alliances also supersede institutional collaboration in terms of citations performance, with national co-authorship producing a 1.4-fold rise in per article citations over and above institutional teamwork efforts. Over the five year period of 2006-2010 researchers in the UK frequently co-authored with fellow academics in countries that were also prolific in terms of article volume: the US, Germany, France and Italy being top collaborating partners.

Two key conclusions are drawn from the evidence on international collaboration that have major

implications for the future context of UK research. Firstly, cross-country co-authorship is said to be flattening out differences in citations patterns between countries, given that both parties benefit from the generally higher amount of citations to their globally produced output, suggesting that frequent country collaborators may exhibit converging citations behaviour as this method of working grows in significance. Secondly, and even more crucially, international partnerships pose important questions for the approach to research funding and accountability in the UK and elsewhere. As the report argues, with "the increasingly distributed nature of research, it has been suggested that it will become more and more difficult to relate research and development inputs to outputs at the national level, and that public accountability for research may need to shift to a global scale" (BIS, 2011, pp. 55).

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