International collaborations produce more influential science, analysis finds

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Science is increasingly a global pursuit, with more and more collaborations spanning national and continental boundaries. A new analysis calculating the scientific impact of 1.25 million journal articles finds that papers with authors from multiple countries are cited more often and more likely to both appear in prestigious journals.

The study, published in *PLOS ONE* by scientists at the University of Chicago, the University of Florida, and the Computation Institute, also provides a new perspective on the changing global landscape of scientific influence.

"Some of the countries that we don't necessarily think of as leaders of science are now rising quite rapidly both in how many papers they're putting out and how well those papers are doing once they're published," said first author Matthew Smith, a graduate student in Ecology & Evolution at the University of Chicago. "Whereas some more established countries, such as the United States, are decreasing in both the proportion of papers published and how well their papers are performing."

The rise of international scientific collaborations has been called "the fourth age of research," shaking up traditionally insular science practices and bringing more countries into the global science community. Previous studies have found that papers with authors from more than one country attract more citations, proportional to the total number of papers published.

For their new analysis, Smith, senior author Stefano Allesina, and co-authors Cody Weinberger and Emilio Bruna introduced an additional measure of scientific impact: journal placement. In addition to serving as a marker of impact itself, the prestige of the journal where a paper appears also influences its eventual citation performance.

"I think this is a more democratic measure of ranking countries," said Allesina, Professor of Ecology & Evolution at the University of Chicago and faculty at the Computation Institute. "This tells you a little bit more of the story because it uses two steps, and one of them is really to do not with the country itself, but with the way science works. Looking at how you are doing once you published is a better measure of the relative quality of the paper itself."

The authors analyzed 1.25 million articles from 1996 to 2012, acquired through the Scopus database, concentrating on eight scientific fields ranging from condensed-matter physics to psychology. On both journal placement and citation performance, international collaborations outperform domestic papers.

"International papers do better than non-international papers across all the fields we looked at," Smith said. "There are differences in the magnitude of the effect, but it's always better to have authors from various countries, even after controlling for the effect of just having more authors."

The study then looked at the performance of individual countries on these two measures. Overall, they found that citation performance correlates with journal placement, but some countries earned more (China, Brazil, Egypt) or fewer (Japan, Israel) citations than expected in some fields.

Potential causes for these outliers include bias for or against countries

during the peer review process or in citations, language barriers, or differences in academic culture. For example, a scientist in a developing country may not have the same incentives to publish in a top-tier journal as scientists in more established regions.

"Publishing in top journals is a lot of work; for the same exact paper, you have to do twice as much, because the reviewers are very skeptical," Allesina said. "Now imagine that the effect of having a paper in Nature versus a smaller journal is exactly the same for your career and for your funding level, what would you do? That's one thing that changes quite a bit from country to country."

Over time, the analysis shows a shift away from traditional science powers in North America and Europe towards a more widely distributed map of scientific participation. Decreases in publication and citation share from the United States, United Kingdom, and France are mirrored by increases in those measures from China, India, and South Korea.

Examining both citation performance and journal placement may provide countries with new metrics for assessing their strengths and weaknesses in different scientific fields. But for underperforming countries, a boost in research spending may not be the solution. An analysis of the effect of GDP and national research and development spending found a positive effect on journal placement, but not citation performance.

"Economic drivers had a very asymmetric effect on how they influenced these performances," Smith said. "They were more correlated with the journal placement than they were with citation performance, which was interesting. It seems that richer countries get into better journals, but they don't necessarily get better citations."

More information: Smith MJ, Weinberger C, Bruna EM, Allesina S

(2014) "The Scientific Impact of Nations: Journal Placement and Citation Performance." *PLoS ONE* 9(10): e109195. DOI: 10.1371/journal.pone.0109195