Research Trends

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United States research output continues to decline

Research Trends Editorial Board

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cycles" *(1)*. Schmoch argues that several domains, such as robotics and immobilized enzymes, evolved through an initial period of great patenting activity, followed by a slowdown and a less publicized follow-up cycle of high-frequency patenting. It is therefore possible that nanotechnology would be undergoing a slowdown after an initial boom in publishing and patenting and that a second boom would be forthcoming.

Obliteration by incorporation

The fourth hypothesis is that the use of nanoscale R&D is increasingly incorporated into mainstream S&T, which means that it is no longer being specifically mentioned as often or as prominently by researchers in their scientific publications and patents. This would mean that nanotechnology is undergoing a process analogous to "obliteration by incorporation". This concept, described by Robert Merton *(2)*, suggests a process by which the origin of an idea is forgotten due to prolonged use, as it enters the mainstream language of academic disciplines, and is thereafter no longer linked with its originators. An analogous situation in the development of a scientific discipline is provided by developments in the field of genomics. In this field, it was common in the 1990s to mention the use of the polymerase chain reaction (PCR) method in the title and the abstract of papers, but this was subsequently obliterated by incorporation. Indeed, it is now considered obvious that if one carries out gene sequencing, the PCR method is used. The same may be true of nanotechnology today and researchers may not mention that they are working at the nanoscale level as it may be deemed obvious to knowledgeable practitioners.

For further information about these reports, please **click here**.

References:

(1) Schmoch, U. (2007) "Double-boom cycles and the comeback of science-push and market-pull", *Research Policy*, Vol. 36, issue 7, pp. 1000–1015.

(2) Merton, R.K. (1949) *Social Theory and Social Structure*. New York: Free Press.

Country trends

United States research output continues to decline

An extensive body of research has consistently demonstrated that the US share of scientific articles published in peer-reviewed journals has been in decline over the last decade (see Figure 1). This has typically been ascribed to the effect of the developing knowledge economies of China and the four Asian Tiger nations, Taiwan, Singapore, Hong Kong and South Korea, and has not been considered a policy concern *(1)*. However, since the 1990s the absolute number of articles published by US-based researchers has plateaued (see Figure 2).

This flattening of scholarly output has been confirmed by the "Science and Engineering Indicators" (SEI) 2008 *(2)*, published in January by the US National Science Board. This biennial report contrasts this finding with strong annual growth in research funding in the US over the same period, from US$200 billion in 1997 to around US$340 billion (or 2.6% of GDP) in 2006. A companion policy statement, "Research and Development: Essential Foundation for U.S. Competitiveness in a Global Economy" *(3)*, nevertheless calls for a "strong national response" by further increasing the level of US government funding for basic research.

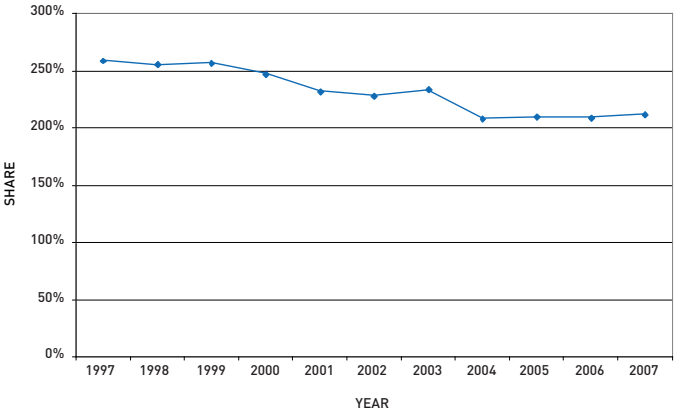

Figure 1 – Share of world articles published by US researchers, 1997–2007. Source: Scopus

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Despite these trends in article output, the SEI 2008 report demonstrates that the US continues to produce the best-cited research in the world, as indicated by its dominant share of articles in the top 1% of cited articles across all fields. This finding is borne out by comparing the **h-index** of the US with those of selected world regions (see Figure 3).

By any measure, the US remains the world's dominant scientific nation. The question facing government policymakers in the age of knowledge-based economies is: for how much longer?

References:

(1) Hill, D., Rapoport, A.I., Lehming, R.F., and Bell, R.K. (2007) "Changing U.S. output of scientific articles: 1988–2003", National Science Foundation special report.

(2) "Science and Engineering Indicators 2008", National Science Board report.

(3) "Research and Development: Essential Foundation for U.S. Competitiveness in a Global Economy", National Science Board report.

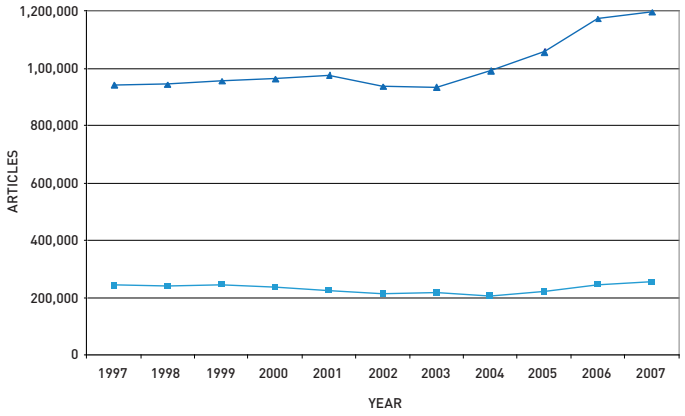

Figure 2 – Number of articles published by US researchers (light blue) versus world (dark blue), 1997–2007. Source: Scopus

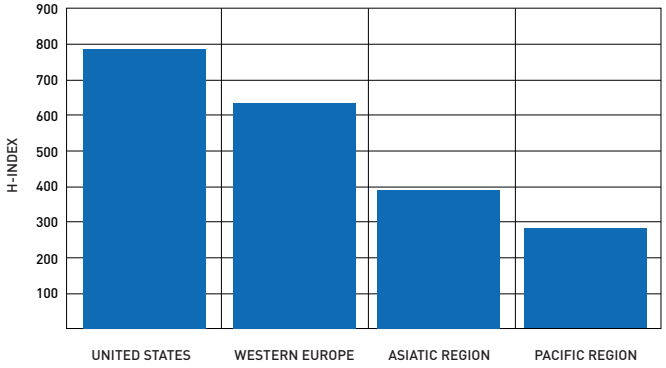

Figure 3 – H-index of US versus selected global regions. Here, the h-index defines the number of documents published in the period 1996–2006 that receive the same or greater number of citations during the same period. Source: **SCImago SJR – SCImago Journal & Country Rank**

Expert opinion

The h-index and its variants: which works best?

Dr. Lutz Bornmann

The h-index was originally proposed by Jorge Hirsch in 2005 to quantify the scientific output of an individual researcher. It was conceived as an improvement on previous indices, which tended to focus on the impact of the journals in which the researcher had published, and so assumed that the author's performance was equivalent to the journal's average. If a scientist's publications are ranked in order of the number of lifetime citations they have received, the h-index is the highest number, h, of their papers that have each received at least h citations.

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