

Resource-starved stars

Germany's focus on conducting research in independent institutes is holding the country back, say four academics

Scientists in Germany publish more articles in top journals than those in any other nation except the US and China. But unlike academics in most countries, Germany's scientific community is significantly split between universities and independent research institutes.

Under the country's dual-pillar approach, universities are supposed to specialise in training new scientists; leading research is the preserve of hundreds of renowned – and much better resourced – independent research institutes within the Max Planck, Leibniz, Helmholtz and Fraunhofer associations. In 2017, for example, even though Germany spent 3 per cent of its considerable gross domestic product on research and development (the highest in the European Union), its universities received only 17 per cent of these funds; a significantly larger share went to the institutes.

Despite their lower funding and less than optimal research environments – not to mention their teaching and training responsibilities – universities belie the myth that research institutes are where almost all significant science is conducted. In fact, universities produce the great majority of new German scientific and technological research. As we show in our recent paper, "University vs. Research Institute? The dual pillars of German science production, 1950–2010", published in the journal *Minerva*, for every new discovery the institutes publish, universities produce three.

Since the 1960s, chronic underfunding and rising student numbers have forced German universities to direct most of their allotted funding to teaching, not research, and professors have heavy teaching loads. Now more than ever, university scientists must compete for scarce research funding, which has become crucial to sustaining university infrastructure. Several rounds of the national Excellence Initiative programme have emphasised this competitiveness but have provided only modest, fixed-term funding boosts for the universities involved.

Another cherished myth in Germany is that relieving researchers of teaching and administrative responsibilities makes them more productive. While it is true that institute scientists are more productive than university scientists, it is only by a quarter of a paper per year. To match universities' huge output, Germany's already high spending on institutes would need to double.

Nor, as another myth suggests, are university-authored papers necessarily

of lower quality. Institutes do produce many high-impact papers, but universities publish twice as many. And while institutes expand scientific enquiry and collaborate with leading scientists across the world, universities publish on a broader array of scientific topics and collaborate more intensely. And scientists from both sectors win Nobel prizes.

In some ways, none of this is surprising. After all, there are far fewer institute scientists. But the universities' achievement is remarkable given the limits imposed by policy's failure to keep pace with the remarkable rise in student enrolments. If that policy were to change, they could do so much more.

Another myth is that institute scientists will use their ample resources to collaborate with their busier university colleagues. But, despite several initiatives, this has been slow to happen: institute-university collaboration increased from just 3 per cent to 12 per cent of all publications between 2000 and 2010.

Elsewhere, country after country has emulated Germany's Humboldtian model of the research university, integrating teaching and research. The scientifically leading US and the rising powers of China, South Korea and others have all increased their science capacity by focusing their research efforts on developing their higher education systems – and not just a few prominent universities.

This has been the secret behind the amazing, sustained explosion in new discoveries over the past century; worldwide, universities now produce between 80 per cent and 90 per cent of the more than 2 million articles published annually.

Yet, ironically, while Germany gave the world the Humboldtian model, in recent decades it has not supported its own universities' research capacity at world-class levels. If it does not soon rectify that mistake, increasing funding and building stronger bridges between institutes and universities, the country's ability to make optimal use of its R&D budget and remain competitive in a world of ever-greater scientific competition may be threatened.

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