論説 Commentary

The Grand Voyage for Universities: German Perspectives on Managing Research for International Competitiveness

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German Universities Competing in the Worldwide Research and Education "Marketplace"

Universities worldwide are today faced with similar challenges: to maintain, or increase, educational and research excellence in an increasingly competitive worldwide "marketplace" for research and higher education. To remain competitive, often requires radical organizational changes. But, for academic organizations with their long tradition of democratic decision-making, organizational changes are difficult and often painstakingly slow.

Yet, there are examples of universities that have successfully reinvented themselves. And, often, a key success factor was a shift in leadership style from "administrating" a university as a democratic community of scholars, to a more conscious "management" of universities as a competitive enterprise operating in a global market. In Germany, the necessity of this shift towards a more conscious research management became obvious about 15 years ago. Since then, the egalitarian tradition of German academia has been challenged by the German "Initiative for Research Excellence", an effort launched in 2005, that provides large, highly competitive external funding incentives.

The outcome speaks for itself: With a share of 11.3% of the top 10% publications indicated in the Web of Science for the years 2009–2011, Germany is now third, after the US and UK, while Japan, with a share of 5.8% occupies now rank 7, a steep decline from a decade ago when Japan was fourth[1]. In chemistry, a similar tendency can be observed: in 1989–1991 Germany ranked third, Japan had (after the US) the second highest share of the top 10% publications. 10 years later, Germany ranked second and Japan third, and for the years 2009–2011, Germany ranks third after the US and China, Japan ranks 5th[1]. In the editorial of Chemistry & Chemical Industry Vol. 66-2 February 2013, Yasuhiro Iwasawa is also referring to this tendency; for further data see also Reference 2).

While Japan lost considerable ground in chemical research over the past decade, Germany has actually been advancing. What had happened?

A Tradition of Chemical Research

The German "research market" is characterized by an institutional diversity. At the centre there are around 400 mostly public Higher Education Institutions with a total of almost 2.5 million registered students; there are 105 universities, 234 universities of applied sciences, and 74 universities and colleges of theology, music and art[3], most of which are engaged in both research and education. Public sector research outside of higher education plays a major role, with over 250 institutes of the Fraunhofer Society (FhG), the Helmholtz Association (HGF), the Leibniz Association (WGL) and the Max Planck Society (MPG). Research positions at universities and non-university research institutions together increased by 15% between 2005 and 2012, to a total of around 550,000.

Since the 1998s, Germany's R&D expenditure is increasing remarkably. With around 2.8% of GDP for 2010, total R&D expenses in Germany are behind Japan's (3.26% of GDP), but still extremely high in international comparison. Enterprises account for around 70% R&D spending (in Japan around 75%), while the remaining 30% are distributed almost equally between universities and non-university public sector research. Funding for universities comes mainly from state governments, but third-party funding has increased from 16% to over 26% (during 1998–2009). 35% of third-party funding was contributed by the German Research Foundation (DFG), 21% by the federal government, 23% by industry and business, 10% through EU funding, 10% by other sources[3].

In chemistry, Germany has a long-standing tradition of excellence in education and research, and German Unification provided a further boost to chemical research. Today, over 150 universities and non-university research institutions are engaged in research in chemistry, and German companies that are world market leaders in the chemical industry complement the picture.

The German Initiative for Research Excellence as an Accelerator of Change

Since the 1990s, the higher education system in Germany (and in most parts of Europe) has been undergoing profound changes. The traditional mode of governance based on the interplay of strong state regulation and academic self-governance has been replaced by new public management structures, aimed at increased efficiency and effectiveness. Universities gained more autonomy as governance shifted from the state and central governments to university presidents. New actors, such as accreditation and evaluation bodies, and new governance structures, such as boards of trustees, have emerged. Funding allocation has shifted from historical distribution models towards performance-based funding.

Universities have started a process of transformation from loosely organized communities of scholars towards more focused organizations, with more clearly defined goals, and hierarchical leadership. There is an ongoing debate in Germany whether academic research can or should be managed. In reality, this debate has long been won by a new class of university presidents, supported by a new group of professional research administrators and science managers, practicing management for science and research.

Many of these changes were triggered by the changing global research environment and the accelerating pace of innovation, as well as by a series of structural reforms introduced by the German federal government. Among these, the German Excellence Initiative stands out as a veritable "Big Bang" for German universities. Its approach was simple: To improve the global attractiveness and international status, as indicated by various university rankings, of German research universities through an organized competition.

The German government provided a large sum of money as incentive: 1.9 billion Euro for the first funding phase (2006/7–2012) and 2.7 billion Euro for the second funding phase (2012–2017). Around 75% of the money was provided by the German federal government while the remaining 25% comes from the 16 state governments which, by law, are mandated to provide base funding to universities. Funding was offered for: 1. Graduate Schools, 2. Clusters of Excellence, and 3. Institutional Strategies, also called "future concepts", a unique approach to foster novel organizational arrangements.

The Excellence Initiative allowed for a high degree of flexibility, encouraged variety, and emphasized the cooperation with non-university institutions, support of early career researcher, and international networking. More than one-third of all German universities submitted proposals in the framework of this Initiative, proposals were then reviewed by a number of expert panels, organized by the German Research Foundation (DFG) and the German Council of Science and Humanities (for funding decisions see Table 1).

Table 1 Results of the Excellence Initiatives' second funding phase (2012–2017)

Graduate Schools (GS) 45 (33 from the 1st funding phase)	11% of overall funding	Average funding/ GS 1.6 million Euro/ year
Clusters of Excellence (ExC) 43 (31 from the 1st funding phase)	60% of overall funding	Average funding/ ExC 6.6 million Euro/ year
Institutional Strategies (IS) 11 (6 from the 1st funding phase)	29% of overall funding	12.5 million Euro/ year

Source: own compilation according to information on the homepage of DFG (www.dfg.de)

Effects of the Excellence Initiative

The Excellence Initiative has challenged the traditional egalitarian approach of German universities, by choosing a path of inequality and by intentionally creating a small group of "elite" institutions, all while maintaining Humboldtian principle that excellent teaching is based on excellent research and of the freedom of research.

With the Excellence Initiative, the challenge of global competition was for the first time openly addressed. The dynamics triggered by the Excellence Initiative exceeded expectations: Once considered as inflexible and slow moving, German universities put forward an impressive range of proposals for organizational innovation and reforms. Most importantly, well beyond the institutions selected for funding, the initiative has impacted the organization and governance of the entire university sector in Germany.

The Excellence Initiative resulted in a vertical and horizontal differentiation of the German university landscape. The "Institutional Strategy" funding line successfully created a small tier of 11 highly visible research universities. At the horizontal level, thematic priority setting was achieved through funding of Clusters of Excellence. Internationally visible and competitive research "hubs" at universities were thus established, promoting interdisciplinary collaboration and cooperation with non-university research institutions and industry to tackle cutting-edge scientific problems.

One of the most striking effects of the Excellence Initiative is the increase in collaboration, both across institutional and international boundaries. Collaboration among universities and non-university research institutes has markedly increased. International co-authorship increased for Germany in all areas of science, in chemistry it accounts for 46.8% (2009–2011), but only 21.2% for Japan[1].

The funding of Graduate Schools aims at training outstanding young researchers within a high-powered research environment. The graduate schools are in itself a departure from the traditional German doctoral-training model based largely on the professor-student relationship. Moreover, the Excellence Initiative triggered the establishment of a tenure track system in research and other innovative forms like career centers to establish own research groups. Altogether, over 4,000 new positions for doctoral student postdocs and early career researchers were created throughout the first funding phase.

The Excellence Initiative also changed the relationship between research and education: New instruments and possibilities were introduced, including a temporary exemption from educational duties for highly competitive academics, while also enlarging the involvement of non-university research institutes in higher education.

How has the Excellence Initiative affected university research in chemistry? Here are a few examples (around 14 Excellence Clusters and 15 Graduate Schools are currently linked to chemical sciences):

- The University of Heidelberg, Germany's oldest university, founded a clus-

ter of research excellence on cellular networks that brings together a team of renowned scientists from countries all over the world and integrates more than 70 research groups working in biosciences, medicine, mathematics, chemistry and physics, as well as external partners including the German Cancer Research Centre, EMBL, and a Max Planck Institute. Joint international PhD and postdoctoral programs (including a joint summer school for doctoral students with Japan) and a central technology platform, supported by industry, are also part of the cluster.

- The Cluster of Excellence for "Unifying Concepts in Catalysis" (UniCat), founded in 2007 at the Technical University Berlin (TUB), brings together more than 250 chemists, physicists, biologists, and process engineers from 50 research groups at the TUB, the Free University Berlin, the Humboldt University Berlin, the University of Potsdam, and two Max-Planck research institutes, and thus tries to forge stronger links between chemical and biological catalysis. Since late 2011, the cluster also supports a dedicated laboratory (called "BasCat") to accelerate transfer toward industry.
- The Ludwig-Maximilian University Munich (LMU) established a new Graduate School and three Clusters of Excellence linked to research in chemistry, partly in cooperation with the Technical University Munich, the University of Augsburg, and various Max-Planck Institutes and Helmholtz Centers. In addition to streamlining its governance, the LMU also set up the "Center for Advanced Studies" as a platform for interdisciplinary academic exchange, and established a "Center for Leadership and Management" to help meeting the challenges associated with collaborative research.
- With just 10,000 students and 184 full professors, the University of Constance, established in 1966, is small by German standards and has been traditionally strong in humanities and social sciences. Nevertheless, the university successfully established a new Graduate School in chemical biology as cornerstone of its institutional strategy, focusing on interdisciplinary research, fostering the independency of early career researchers and with a specific outreach to female scientists.

Conclusions

The Excellence Initiative has unleashed a new dynamic, reshaping Germany's higher education by demolishing the pretense of egalitarianism and forcing universities to better define their mission and to sharpen their focus. Many universities had to undergo an at times painful process of self-examination, and, faced with a stagnation in spending by state governments, many were encouraged to begin looking for new sources of funding.

As a result, many German universities managed to change, and sometimes radically, their outlook in a relatively short period of time—a scenario unimaginable several years ago. The very idea of "elite universities" is not without its critics, and many universities do not yet feel pressure to change or adapt. Moreover, questions linger regarding the sustainability of the changes given the short-term nature of the funding provided by the Initiative and many are wondering what will come next.

Still, today, the Excellence Initiative is regarded as a success story, resulting in new organizational structures at universities; innovative collaborations between universities and other organizations; the modernization of university administration; and a renewed focus on nurturing research excellence. The Excellence Initiative has helped to transform the multifaceted German research system and strengthened Germany's international position in research.

The trigger for change(s) might differ in Japan and Germany as it has to match the specific education and research landscape. Nevertheless, the pressure for change is the same, and universities in our current "global science era" have to go on a risk-taking journey similar to the one Christopher Columbus once took. Experiences of universities in Germany show the potential such a new journey could have. One of the most important success factors on this journey is a shift to an efficient and effective science management (meaning: management *for* science and research) at all involved levels (e.g. government, top and middle management of universities, researcher and research manager).

1) Ayaka SAKA and Terutaka KUWAHARA, *Benchmarking Scientific Research 2012-Bibliometric Analysis on Dynamic Alteration of Research Activity in the world and Japan*, National Institute of Science and Technology Policy (NISTEP), Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan, March 2013.
2) Ayaka SAKA, Terutaka KUWAHARA and Iris WIECZOREK, *University benchmarking focused on research papers—Japan and Germany in comparison*, National Institute of Science and Technology Policy (NISTEP), Ministry of Education, Culture, Sports, Science and Technology (MEXT), 5th NISTEP Review Seminar, 7.12.2012.
3) Deutsche Forschungsgemeinschaft (DFG), *Funding Atlas 2012, Key Indicators for Publicly Funded Research in Germany*, Weinheim: Wiley-VCH Verlag, 2013.

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