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Cultures of Creativity: The Challenge of Scientific Innovation in Transnational Perspective

Proceedings of the Third Forum on the Internationalization
of Sciences and Humanities

November 19–20, 2009 · London

Cultures of Creativity: The Challenge of Scientific Innovation
in Transnational Perspective

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What do researchers need in order to take risks and pursue innovative, open-ended frontier research? What institutional structures are necessary to support integrative, innovative and transformative research and facilitate more significant breakthroughs? How must research be organized to meet the challenging complexity of scientific problems in the 21st century, and what could be the role of funding organizations in general and international academic exchange in particular? These were questions discussed by more than fifty participants during the third Forum on the Internationalization of Sciences and Humanities, organized by the International Advisory Board of the Alexander von Humboldt Foundation from 19 to 20 November 2009 at the Royal Society, the Foundation's distinguished partner organization in London.

The Forum has been established as an annual conference for public debate on global developments in science and academia and matters of science policy that impact on international initiatives. Bringing together eminent international experts and top representatives from research and higher education, science policy and science management, it provides a forum to address issues relevant to the further development of the Foundation's funding strategy and to its mission: the global mobility of researchers and the internationalization of higher education and research cooperation. While the first Forum discussed international developments in academic careers and career planning, the second Forum used Germany as a lens to discuss how nation states and world regions can raise the attractiveness of their research systems and draw international expertise into the country. In the light of the German Federal Government's "Initiative for Excellence" and its "Strategy for the Internationalization of Science and Research", the discussion of "Strategies to Win the Best" also served as a platform for participants to reflect upon the newly created Alexander von Humboldt Professorships, which were conferred for the first time in 2008 and gained the Foundation great attention. The extraordinarily positive feedback from both the media and the German and international research community confirmed: We can provide German universities and research institutions with unprecedented opportunities and prospects for excellent research conditions, which helps them to hold their own in the ever stiffer global contest to win the world's brightest minds.

And yet, while this contest will not slow down, money is not everything. Quite in contrast – the Alexander von Humboldt Foundation has continuously attracted public attention to the significance of soft location factors, e.g. by launching an initiative to establish Welcome Centers for international scientists and researchers at German universities. It is on the same grounds that, in 2009, the International Advisory Board decided to discuss challenges of scientific innovation. With the social cost of failure being much higher in Germany than in the U.S., for example, Germany can surely learn from other countries. A culture of creativity, therefore, might begin right here.

The volume you are holding in your hands presents the proceedings of the third Forum – food for further thought, we hope, to ponder upon the question as to what a culture of creativity entails. Our thanks go to the Forum's speakers and contributors to this volume, to the staff at the Alexander von Humboldt Foundation supporting the International Advisory Board's work, and – last but not least – to our distinguished partner organization in London, which was not only one of the founders of the first Alexander von Humboldt Foundation in 1860, but also provided a unique setting for the third Forum on the Internationalization of Sciences and Humanities, almost 150 years later.



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Kenneth Prewitt Helmut Schwarz



INTRODUCTION

Cultures of Creativity: The Challenge of Scientific Innovation in Transnational Perspective

Though a naïve belief in linear scientific progress has long become obsolete, science-based innovation remains at the heart and center of humanity's endeavour to take on present and future challenges. This innovation heavily relies on individual and institutional creativity.

One of the nine German universities whose institutional strategies to advance top-level university research were successful in the so-called Initiative on Excellence is the rather small and comparatively young University of Konstanz. Its application was explicitly entitled: "Modell Konstanz – Towards a Culture of Creativity". Though all research institutions as well as funding organizations should aim at establishing and fostering such a culture,

it is not at all easy to grasp. In fact, 'creativity' just like 'innovation' is one of the most overused and underdefined terms in research literature as well as research policy-making. The common denominator seems to be that creativity manifests itself in a piece of work that requires not merely mechanical skills to produce it, but intelligence and imagination. To indicate what is meant by a "culture of creativity" the following three questions should be asked and answered: Why do we have to move towards a culture of creativity? What are its main ingredients? And how can research organizations and institutions foster it?

Today, we already live in a highly complex, largely science and technology-driven world. However, the enormous changes of the last two decades seem to be merely a foretaste to the challenges ahead. During the next 20 years, Europe's economic paradigm will change fundamentally. While



Wilhelm Krull

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the manufacturing base will continuously shrink, future growth and social welfare will rely increasingly on knowledge-intensive products and services. As a consequence of this crucial development, the European Union has vowed to develop into a knowledge-driven society and to create a European Research Area (ERA) following the Lisbon European Council in March 2000 which had set out a daring strategic goal for the European Union, namely to become the most competitive and dynamic knowledge-based economy in the world by 2010. Declarations and agreements named after cities like Bologna (1999), Lisbon (2001), and Barcelona (2003) are just publicly acknowledged signposts of new policies and approaches implemented in the higher education and research landscape of Europe.

However, despite the joint effort to create a successful European Higher Education and a European Research Area, Europe is still quite far away from achieving the ambitious goal set in Lisbon ten years ago. Though the EU is the world's largest "producer" of graduates, Ph.D.s, and scientific publications, it has been losing ground in the field of basic breakthroughs. Fifty years ago, European scientists dominated the lists of the Nobel Prize awardees and of other prestigious prizes as well. Today, Nobel Prizes and similarly renowned awards are mainly won by scientists working in the U.S. And the gap in R&D investments per capita between the EU and the U.S. is steadily increasing. Apart from a few research areas such as astro-

physics, space research, nuclear physics, and molecular biology, Europe suffers from an almost total lack of transnational support of basic and strategic research. In particular, risky, open-ended frontier research is not supported sufficiently, and it still remains to be seen whether the European Research Council (ERC) will be able to substantially change this.

Science-based innovation remains at the heart and center of humanity's endeavour to take on present and future challenges.

The message for European higher education and research in an environment of global competition seems pretty clear: Achieving more breakthroughs requires a great effort to establish new creative milieus, not only in research institutions but also in research funding and research policy-making organizations. Europe can only be successful in establishing and maintaining a globally competitive knowledge-based society if it continuously strives to enhance the quality of its research base, to strengthen the structural dynamics of the various re-

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search and innovation systems, and to support frontier research in carefully selected areas. Each institution will have to review its own processes of priority-setting and quality assurance, and to respond to the question whether it provides a stimulating training and research environment which encourages risk-taking and enables its members to leave the beaten tracks of well-established research areas and to break new ground.

The creation of new ideas ultimately is about seeing things differently, about breaking the rules, and about being tolerant to errors made.

In view of the increasing complexity of knowledge production, many universities and research institutions have tried to expand in size and diversity, and subsequently created an increase in hierarchic structures and bureaucracy. More and more it has become clear that such increases in size and diversity have negatively impacted on performance, and produced a great deal of unproductive heterogeneity, a decrease in interdisciplinary interaction, or transdisciplinary integration, and ultimately led to considerable losses in innovation-friendly experimentation and flexibility.

To counteract this development and to establish a culture of creativity, there are at least seven aspects which have to be considered.

1. Competence

The first precondition of a culture of creativity is to provide the best training for the future generation of academics and to enable researchers in general to develop their skills as freely as possible.

2. Courage

Not only researchers, but also the institutional leadership and funders must be both courageous and adventurous. One can only encourage people to enter new fields and leave the beaten track if one is prepared to share the risks. The readiness to take risks must be complemented by a high degree of error tolerance.

3. Communication

Thought-provoking discussions are essential for achieving progress in research, in particular cross-disciplinary and transcultural exchanges, but also interactions with the outside world.

4. Diversity

Also in academia, monocultures do not provide an adequate breeding ground for exceptional thoughts. New knowledge is usually formed at the boundaries of established fields, so the interfaces between these areas of expertise must be activated. To be successful, it is essential to provide ample opportunities for all the researchers to interact intensively so that new paths can be developed and breakthroughs achieved.

5. Innovativeness

The fifth precondition of success in achieving breakthroughs is to foster innovativeness. We have to make sure that we identify and encourage those researchers who are prepared to take a risk with unconventional approaches. Academic leaders as well as heads of foundations and other funding organizations must appreciate unconventional approaches and encourage risk-taking by providing incentives such as additional funding and long-term commitments.

6. Persistence and Perseverance

To forge new paths in a barely known territory often takes longer than two or three years, the usual lengths of project funding. Mistakes must

be allowed as well as changes of direction. To put it in the words of Albert Einstein: "Two things are indispensable for our research work: untiring persistence and the readiness to dispose of something in which we have invested a lot of time and hard work."

7. Serendipity

It is impossible to plan the precise moment at which a radically new idea emerges or a major scientific discovery occurs. The philosopher Ludwig Wittgenstein once said: "Sometimes we do not know what we are looking for, until we have finally found it." But there are numerous examples in the history of research which prove that it is possible to establish a particularly stimulating environment more conducive to scientific breakthroughs than others. Although there is no one-size-fits-all kind of recipe we can apply, it is certainly worthwhile to try and try again.

Trying to achieve and maintain such a culture of creativity in research institutions and funding organizations is not at all straightforward, but full of paradoxes and contradictions. Whilst every institution, not least in order to secure its own survival, has to insist that its members adhere to its rules, quality standards etc., the creation of new ideas ultimately is about seeing things differently, about breaking the rules, and about being tolerant to errors made. Epistemologically speaking, radically new ideas can often not be phrased in terms of the initial question, and the openness for "fresh thinking" is not only required by those who produce new ideas, but also by those who are expected to pick them up. The readiness to listen to independent voices inside and outside of one's own institutional network, to encourage risk-taking in "off-the-beaten-track" areas, and to foster a climate of mutual learning are prerequisites for successfully establishing a true culture of creativity.

Research-funding organizations can play a crucial role in helping to establish such a culture. However, current modes of research funding are rather adverse to fostering risk-taking and to encouraging researchers to set sail into the great unknown. When assessing the prevalent research-funding policy, we see too much agenda-setting, not by researchers but by politicians and research-funding organizations, too much trust in the viability of ever larger clusters, programs, and research units, and distrust in the ability and creativity of the individual researcher. However, it is the specific combination of intelligence and imagination inherent in the most talented individual researcher and his

or her colleagues/collaborators which is the key to innovation and progress in science. The crucial questions that every professional research policy and research-funding organization should ask and respond to are: How and where does talent blossom? How can we encourage creativity and innovativeness and discourage the routinization and fossilization of research structures? How can we foster more breakthroughs in basic research? What are the most stimulating environments – and the appropriate funding instruments – that permit researchers to discover and explore new fields of knowledge?

One of the absurdities in the field of research policy-making and funding is the reluctance by policy-makers and funding organizations to accept and apply research results about how best to foster innovative and creative research.

One of the absurdities in the field of research policy-making and funding is the reluctance by policy-makers and funding organizations to accept and apply research results about how best to foster innovative and creative research. In many ways, the current mode of research funding is exactly the opposite of what it should be. Currently, a "We don't trust you – we know better – and we want results now" approach is being pursued which successfully extinguishes small flames of creativity and certainly prevents them from turning into a strong fire of transformative research and scientific innovation.

The results of research on successful research show that it is important to focus not on large clusters but on small teams of five to seven researchers embedded in an adequately enriched environment, and supported by modes of funding which provide medium- to long-term financing of some seven to ten years. Such time and space for some thorough rethinking of common wisdom is urgently needed and has to be expanded. This also

calls for a reconfiguring of the review process, including personal presentations and interviews, and last, but not least – in order to counteract the deficiencies of the peer review process – the actively communicated readiness of the leadership of the institutions involved to take risks.

To establish a culture of creativity takes a joint effort by researchers, their institutions and research-funding organizations. The latter should support talented people, innovative projects and research-friendly structures in order to create an environment conducive to creativity. There are numerous examples of how this is done very successfully by research organizations in Europe and abroad. Just to name a few: the International Award for Research in Germany of the Alexander von Humboldt Foundation, the MacArthur Fellows Programme ('Genius Awards') of the John D. and Catherine T. MacArthur Foundation, the Investigator Awards and the Janelia Farm research campus of the Howard Hughes Medical Institute, the Rapid Response Innovation Awards of the Michael J. Fox Foundation, the Reinhart Koselleck projects of the German Research Foundation, and the new funding scheme of the Wellcome Trust focussing entirely on excellent researchers.

To conclude: Today's knowledge-based society needs to foster and fund transformative research. Without major breakthroughs in basic research many of the world's problems – current and future – cannot be solved. To enable transformative research we need to foster a culture of creativity – of communication, cooperation, and courage – in our research institutions. This culture of creativity needs to be supported by adequate funding instruments. Three of the most important ingredients for successful high-risk research funding are high trust, medium- to long-term funding, and relatively small-size groups.

In the 21st century, the rapidly evolving global political and economic architecture creates numerous challenges for international cooperation in higher education and research. They call for greater flexibility and, among other things, intercultural sensitivity. Coping with changes and challenges of such a huge dimension not only requires flexibility and spiritedness, but also creativity. Ultimately it is only the ability to see beyond one's own horizon, and to collaborate effectively beyond borders – be they national ones, or those set by academic disciplines or generational differences – that will result in the creation of new knowledge.

Without major breakthroughs in basic research many of the world's problems – current and future – cannot be solved. To enable transformative research we need to foster a culture of creativity – of communication, cooperation, and courage – in our research institutions.

If Europe wants to meet the challenges involved in the increasing processes of globalization, it must act swiftly and at the same time take a long view. It must also be prepared to make long-term commitments whilst maintaining the flexibility to respond to new challenges. The most important prerequisites for performing successfully at the global level clearly are new, Europe-wide arenas of competition for some of the most prestigious grants, more coherent approaches to higher education and research policy-making at the national level, and at the institutional level an innovation-friendly governance and decision-making structure. Universities and research institutions have to constantly tap their resources and realize their potential, ensure efficiency in their spending practices, accelerate and simplify their processes, and intensify communication within the organization and beyond it. Ultimately, we should not feel overwhelmed by the complex and sometimes quite complicated issues involved. Rather we should take an optimistic view, just like Albert Einstein who once said: "Amidst all the difficulties, there is also room for opportunities."



SISYPHUS WORK?
SCIENTIFIC INNOVATION AND
SYSTEMIC CHALLENGES

Cultures of Creativity: Nanotechnology as Example

To start, a personal account of my own career as a researcher may illustrate what is needed for a culture of scientific creativity: at the time of German reunification, around 1990, I was regarded as being “too old for a scientific career”. I had a three-month-old baby, but the iron will to make up for the years I lost to do research. My first international publication appeared in 1993, nine years after my Ph.D. thesis and after I had changed my research field completely for the third time. It happened that I was able to start off as an independent researcher already at a very early stage, during my Ph.D., and that, because my former professor retired after the reunification, I lacked an academic mentor for the “Habilitation”, as well. With the memory of writing the research proposals for someone else, without getting the honour for it, still fresh, I was excited by the sudden

freedom which I immediately wanted to use. At the time the institute got a new professor, I had already secured funding for my first own project in a field independent from the new direction of the institute, and I was allowed to continue to pursue my ideas. If a young researcher knows how to make use of it, therefore, independence at an early career stage is very important. By contrast, to force someone to move into a certain direction will block the flow of ideas and make him or her uncreative. In my own case, early independence was the key not only to survive as a researcher, but also to make use of the tremendous chances German reunification offered me. The still well-developed child care system in Eastern Germany that was still available at that time, however, was another mandatory, and not less significant, condition for my work. In 2000, finally, I was appointed to a C3 professorship at the Max Planck Institute of Microstructure Physics in Halle in the course of a highly competitive program of the Max Planck Society for female researchers.



Margit Zacharias

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Excellence is driven by people moving to suitable research environments

Excellence is at all times driven and maintained by excellent scientists and researchers. The crucial question is how to identify, win, and support them, and how to provide them with the best conditions they need to be creative. In the end, the selection may be easy. What takes time is identifying scientific talent. It is therefore necessary to support people who

- are sparked by their work,
- are driven by curiosity,
- like to do something unconventional,
- and who are attracted by the delights of research.

These are the people who are willing to change locations and research fields, and who take risks. A fast career may have its advantages, but if there is the evidence for sparkle and creativity, support without a limit in age, especially for women/men taking care of children, is advisable. Responsibility for child care certainly leads to a certain delay in research careers (from my experience it accounts for more than a year per child), but to found and take care of a family should not hinder a scientific career. It is not least social intuition that is needed to build up a group and keep an excellent international research group together. If the spirit

of the group is high, especially among the young, their enthusiasm for doing science, their supreme motivation, their team spirit and the way they work and have fun doing research together will ensure that research goals are reached fast. Again, from my own perspective, it was exactly this point, the open and creative atmosphere, the exquisite and stimulating research conditions, and the enthusiasm for doing research at the Max Planck Institute of Microstructure Physics under the late director Professor Ulrich Gösele that helped us to become a leading group in a number of fields such as Si nanocrystals or ZnO nanowires.

Developing the right conditions to do excellent research, however, is not easy, particularly in the light of the financial constraints enforced on German universities. The reduction of permanent staff and tenured positions at university institutes renders it more and more difficult to maintain the high-level technical infrastructure needed for cutting-edge research in the natural sciences. Especially in the top fields of physics and nanoscience the necessary equipment is often very expensive and can

Margit Zacharias has been Professor of Nanotechnology at Albert-Ludwigs-University in Freiburg since 2007. She holds a diploma in solid state physics from the University of Leipzig (1980) and a Ph.D. in engineering from the Faculty of Technical Science, Department of Electrical Engineering at the Technical University of Magdeburg (1984), which in 1993 became part of the newly founded Otto von Guericke University of Magdeburg. After returning from maternity leave in 1990 – the year of German reunification – Margit Zacharias, who had done research in electronic photography during the 1980s, began working in the field of nanoscience. She was a visiting professor at the University of Rochester in New York in 1996 and completed her German post-doctoral lecturing qualification in 1999 with a thesis on silicon and germanium nanostructures in 1999. From 2000 to 2006 she held a position at the Max Planck Institute of Microstructure Physics in Halle, and in 2006 she became professor of applied physics at the University of Paderborn. More recently, in February 2009, she was awarded funding under the DFG's Reinhart Koselleck Projects program, which aims at promoting outstanding researchers who have adventurous ideas and are willing to undertake higher-risk research.

easily cost several million euros. Getting start-up funding is the first prerequisite, but training and keeping skilled people to operate the equipment at high level is mandatory in order to do internationally competitive research. To get top results within a short period of time, one needs people with long-term experience. Yet with an annual university budget of less than 10,000 euros (often the standard per professor at departments of physics), the question is how to be able to maintain and support technical equipment worth several million euros? International competitive research is only possible in environments offering excellent infrastructure with top-level experimental equipment and at least some basic support by technicians and permanent staff. Only excellent experimental conditions attract top-level international students to a research group, carrying out and enhancing international competitive research.

Show trust, delegate responsibilities and give praise

It is necessary to look for creative and highly motivated students at very early stages of their career. In Germany only a very limited number of funds for students in their early stages are available, such as the stipends offered by "Studienstiftung des deutschen Volkes" (German National Academic Foundation). Funding for excellent students to cover part of their living expenses should be expanded, for instance based on university-funded stipends for the top 5% students of each year. Students should be selected on the basis of grades and progress in their studies. There would be a tremendous increase in student competition, but it would also depend on the individual supervisors how successful his or her students

would be. Some of the most fundamental principles to follow are: give good Ph.D. students some freedom in the choice of their topic, show trust, delegate responsibilities, and give praise for good achievements. The sparkle can be nourished by careful "coaching" and through personal promotion. In addition, depending on achievements, different levels of financial support may be introduced, and good students should be given the opportunity to attend international conferences to meet their later peers at an early stage. In this context, supervisors should be involved in and promote research cooperation, let students organize workshops and take initiatives. In the framework of the priority program funded by the German Research Foundation (DFG), which I coordinate since 2004, there are special workshops organized completely by Ph.D.s and post-docs. Thus, evaluating the individual student's strength, "coaching" for confidence, showing trust and creating opportunities to gain international experience are important issues with regard to student recruitment.

Germany needs universities of excellence

In the course of the German "Excellence Initiative" a number of universities were selected. Hitherto, trust in the "good name" of a university, in the faculty, and the leading researcher, made top people want to join its research groups. The "Excellence Initiative" also awarded credit for future projects and initiatives. Good administrative structures for project administration and fund management, and support for technical infrastructure are needed. In fact, the support I received for technical installations at my current institute was almost crucial to set up the nanotechnology group at the Institute of Microsystems Engineering (IMTEK) of the University of Freiburg and to be able to start doing research from scratch. The science center of the university provided administrative support and assistance with regard to the tedious negotiations for an agreement on a European project. This support and assistance is essential as it helps scientists to concentrate on science and research. In addition, I found a well-established culture of creativity already in place at IMTEK, which was founded as an interdisciplinary department with 20 professors coming from engineering, physics, chemistry, materials science, biology, and neuroscience, and which has excellent research connections to the local Fraunhofer institutes. The "Initiative of Excellence" provided further financial support for interdisciplinary and interdepartmental cooperation. The FRIAS School of Soft Matter at Freiburg is a very good example. As a result, three out of five Junior Professors were successful in achieving a tenure professorship at other German universities.

Some of the most fundamental principles to follow are: give good Ph.D. students some freedom in the choice of their topic, show trust, delegate responsibilities, and give praise for good achievements.

Make dual research careers possible

What is still missing in the German academic system is a form of support for dual careers. While in Germany we are just beginning to discuss this issue, dual career possibilities were already in place in the United States in 1996, when I held a guest professorship at New York State University. Up to now it is very often the woman who gets a later start in her career. In addition, in most parts of Germany child care opportunities at or near universities are not well organized. The discussion and changes initiated by former Family Minister Ursula von der Leyen point to the right direction. Moreover, daycare at schools and preschool care are needed. Finally, there is also the issue of the federal German school system: Moving with a child from Magdeburg to Halle, to Dresden, and to Freiburg means three different school systems, sometimes not compatible, with different times at which school starts, different topics at different levels and at different times. A child can easily be taught the same topic three times, others not at all. A high degree of flexibility is expected from top-level scientists, but families, and most often women and children, have to carry the burden.

More flexibility in rewarding good science

Up to now the German system has been quite rigid. The newly established W2/W3 pay scale does not offer internationally competitive salaries and does not reward good science. Rather, it increases the fluctuation of younger researchers hopping from one position to another. Compared to Austria or Switzerland for example, the starting salary may be higher for young professors in Germany, but to increase it you have to apply for the next position at another university. It took me two years to build up the nanolabs at Freiburg University with equipment worth around at least 1.5 million euros, and it would take at least the same amount of time to move the labs again. While I received excellent technical support by the IMTEK technical staff, which is not the case everywhere, building up a lab inevitably leads to a certain delay with regard to the results you want to generate and publish in top-level journals. Universities and faculties, however, have no real budget for rewarding good research, have no funds for upgrading positions from W2 to W3 or raise the salary in case of exceptional achievements. Research awards on top of the regular budget, allowing the researcher to freely choose and pursue a not evaluated project, would also allow for a faster reaction with regard to newly emerging fields. Personal rewards for attracting third-party funding, significant publications, and industrial achievements could also be considered: In China, researchers are being rewarded for high citation rates of papers and

for the publication of papers in high-ranking journals. In the U.S., researchers with high-level research funding can be freed from part of their teaching loads and get better labs. If achievements decline, a researcher may lose his or her lab, yet on the other hand, if someone is doing research on the same topic for 20 years, his or her scientific creativity should be questioned.



The Reinhart Koselleck Projects of the DFG

Of course, there are some awards offered by different organizations for high-level research that can serve as examples of how to grant exceptional researchers a promotion. Numbers are quite limited, as they should be. The Reinhart Koselleck Projects of the German Research Foundation (DFG) and the Starting and Advanced Grants of the European Research Council (ERC). In the case of the Reinhart Koselleck Projects a project should be outlined on only five pages, instead of detailed proposals. The award is valued at up to 1.25 million euros available for a period of five years. This allows researchers to build up excellent working conditions and to pursue new and risky ideas. Administrative work is reduced to a minimum which helps the researcher to concentrate on his research. The program this offers exceptional conditions for researchers with no age limit: it applies to young researchers as well as those shortly before or after retirement, yet it is based on exceptionally good ideas and an exceptionally evaluated former performance – in other words: on scientific creativity.

Cultures of Creativity in the Humanities

NB: I will keep the following in the first person singular since I believe that life stories and ethnographic description serve as useful counterweights to programmatic statements and empirical sociology of science.

“Cultures of creativity” is a topic I have often thought about since I moved back to Germany in the year 2000 after eleven years abroad.¹ A few words about myself are in order to better situate what I will have to say. I grew up and attended school in Germany with the exception of two grades (first and eleventh) in the U.S. After my *Abitur* I went off to the States for a B.A. in History, then did peace service in Russia (in lieu of my

German military service) and returned to the U.S. for graduate school at UC Berkeley. I never really studied in Germany and only got to know the German

university system from the inside when starting to teach Russian history as *Wissenschaftlicher Assistent* in Tübingen. So while being German, my academic socialization is American. I also have a strong Russian connection, having lived there for a total of four years.

When thinking about cultures of creativity in the humanities, the first thing that comes to my mind is, whether we should be talking about this at all, whether “creativity” doesn’t lose its mystique by uttering the word or by declaring it a concrete goal (like a “twenty-percent increase in revenue” or some such). Creativity seems more like an outcome of unplanned, chaotic action. I have similar concerns about “excellence” in the German *Exzellenzinitiative* and would love to hear a sociolinguist’s thoughts about this. But anyway, here goes, and let me start with the bad

Creativity seems more like an outcome of unplanned, chaotic action.



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news – after all, I am a Russianist. My sense is that in a German humanities discipline like history, creativity and originality do not really flourish. On the whole, institutionalized history in Germany rewards synthesis of existing knowledge, rather than pushing the boundaries methodologically, thematically, etc. Why this is the case would merit a separate study, but let me quickly run through the main reasons: First, looking at practices, from their first term paper (*Hausarbeit*) onward, German historians are educated to synthesize rather than innovate. The *Hausarbeit* is not supposed to “go beyond the limits of existing scholarship” (*soll nicht über den Forschungsstand hinausgehen*). When I first heard this phrase I was flabbergasted; at Brandeis, where I did my B.A., a Pulitzer Prize-winning historian was publishing a journal with original undergraduate term papers, arguing that undergrads could think more wildly than established professors because they had undergone less *déformation professionnelle* and did not have a reviewer hanging over their head. Second, until their early to mid-forties, German historians are locked in webs of dependency – on their professor, on their doctoral advisor, or on the advisor for their second thesis, the *Habilitation*. Their structural independence starts much later than in the British or American systems. Powerful rites of passage (such as those connected with the *Habilitation*) ensure that they themselves start acting in a hierarchical manner once

they are in power; thus the system reproduces itself. Strong clientelism and school-building (think only of *Stallgeruch*, a word derived from horse-keeping that refers to the “smell of a stable”, i.e. a school's readily identifiable intellectual, behavioural, linguistic, etc.

One ends up investing a lot of intellectual energy in building up defenses against possible attacks rather than thinking creatively, which always presupposes trying out several things and failing on many of them.

markers) breed intellectual conservatism and incest. Third, the way in which German historians discuss each other's work in speaker series or at conferences is not very conducive to innovation. Some give it a positive ring and call it *Streitkultur* (culture of dispute), but to outsiders – say, from Britain – it seems like a bunch of guys (it is also a very macho thing) brutally clubbing each other. One consequence of this communicative culture is that one ends up investing a lot of intellectual energy in building up defenses against possible attacks rather than thinking creatively, which always presupposes trying out

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several things and failing on many of them.² Fourth, history-publishing exacerbates the problem because it is not geared toward producing crisp, tightly argued books. Publishing is state-funded (with subventions, although these are becoming a fact of U.S. academic publishing in the current economic crisis) and there are hardly any limits on space – I have heard colleagues joke that at hiring committees the most “objective” measure for quality is quantity, namely by placing scales on a table and weighing who produced the heaviest tomes. What is more, creativity in narrative – the “art” side of history, history being after all a “messy mixture of art and science”, as Anthony Grafton once put it – is not really encouraged.³ Richard Evans, the new Regius Professor at Cambridge, summed it up: “While there is no incentive for German historians to write books that are readable, British historians cannot publish a book unless a publisher thinks that someone is going to be able to read it from beginning to end without too much pain.”⁴

SFBs may work fine for the natural sciences and some social sciences, but in most of the humanities they kill creativity.

Now, after painting this rather dark picture in very broad brushstrokes (I generalized and was obviously unfair to some outstanding historians), let me turn to the good news. In the past the good news used to be that a system that is this retrograde turns off a lot of people who then start doing good history outside the institutions. And indeed, some of the internationally recognized methodological breakthroughs in German historiography come from the margins, such as *Alltagsgeschichte*, the history of everyday life, which grew out of the grassroots *Geschichtswerkstätten* (history workshops, who would study, say, their own Berlin district under Nazism) and whose spiritus rector, Alf Lüdtke, was a superstar in the U.S. and a guest professor at the University of Michigan before he ever became a regular professor at a German university (this happened at the age of fifty-six). The more recent piece of good news is that public funding bodies and private foundations have identified the problem – otherwise this Humboldt Foundation Forum would not be devoted to the topic. They have implemented a number of programs – the Koselleck fellowships at the DFG and the Dilthey and opus magnum fellowships of the Thyssen and Volkswagen Foundations – that, together with the mushrooming of institutes of advanced study, create interstitial spaces within, or close to, universities to foster innovative thinking. I may be wrong on this, but it seems to me that the funding bodies are actually ahead of historians; most historians have internalized the DFG principle of large research structures like the topically driven, multidisciplinary research units called *Sonderforschungsbereich* (abbreviated *SFB*), which superimpose natural science principles (with a strong division of labour rather than individual work, etc.) on the discipline of history. SFBs may work fine for the natural sciences and some social sciences, but in most of the humanities they kill creativity.

Let me illustrate with history doctoral dissertations produced under the auspices of an SFB and contrast these with American history Ph.D. dissertations. SFBs are huge and the application process for one involves many faculty members and takes several years. The backbone of every collective application for an SFB are three-year fellowships for doctoral theses on set topics. Since the time scales between the grooming of doctoral students and the release of SFB funds are incommensurate, the original collective application does not tie doctoral projects to concrete names but rather leaves them vacant (*N.N.* – *non nominatus* or *non nominata*). If the SFB is accepted and the funding comes through, the doctoral fellowships – again, on set topics! – either go to a professor’s students who have reached the doctoral stage or are advertized. Outside students then

apply to “execute” a topic. If they receive the fellowship, they are officially termed *Projektbearbeiter* or “project processor” – with a ring of the term for office clerk, *Sachbearbeiter*. The result is rarely cutting-edge work, but mostly “bread-and-butter” dissertations. How does it work in the U.S.? There, students enter prestigious graduate schools on the basis of their entire academic record. They do two to three years of coursework, pass their oral exams, and devise a topic in dialog with their advisor and graduate student cohort. Only after this do they advance to candidacy and go off to the archives. U.S. history graduate students do not “execute” a topic but are supposed to be personally passionate about it. An American Ph.D. student’s “market value” largely depends on her or his ability to formulate a new and interesting topic, and one that is not only “hot” when designed, but that becomes red-hot three to five years later when the student files the thesis and enters the job market and especially another five or so years later when the revised thesis is published as a monograph. The ideal Ph.D. student does not start a dissertation on Afghanistan in 2003. Instead, in 2003 she publishes a revised dissertation she began in 1993. This system, in other words, is one of planned originality and iconoclasm.

The Koselleck, Dilthey, opus magnum etc. incentives of the German foundations, then, are truly wonderful, but they are drops in the ocean. What we really need are major structural changes at the university. I do not believe in reinventing the wheel but think we should simply import what has been successful elsewhere, above all the tenure-track system. This way, people will achieve tenure and thus some level of autonomy after revising and publishing their first monograph, in history usually at the age of thirty to forty. A wholesale import of the tenure-track system would also be much more conducive to those women who want to have children; in the German system these women need to be prepared to show a high degree of geographic mobility and do not reach material security until their mid-forties, the net effect (in combination with a number of other factors) being a small number of female professors in history and an even smaller number of women professors with children. These structural changes can only be successful if the funding of humanities programs improves. It is no secret that the humanities have been notoriously underfinanced for decades. You simply cannot be creative if, as professor, you have to expend your intellectual energy writing endless grant proposals to

finance the day-to-day operations of your *Lehrstuhl*, i.e. chair or institute (money for the library and the research assistants who do the photocopying). To wrap things up, if the right structural changes are implemented, the funding improves, and the many opportunities to branch out from the university – the fellowships and institutes for advanced study – remain in place, “cultures of creativity” might indeed develop.

It is no secret that the humanities have been notoriously underfinanced for decades. You simply cannot be creative if, as professor, you have to expend your intellectual energy writing endless grant proposals.

Notes

1 See Jan Plamper, “Zwischen dem Land der unbegrenzten Möglichkeiten und dem Land der unbegrenzten Unmöglichkeiten: Die deutsche Osteuropaforschung,” in “Grenzgang in der Geschichte. Wissenschaftskulturen im internationalen Vergleich,” ed. Jan Plamper, *Zeitschrift für Geschichtswissenschaft* 52, no. 10 (2004): esp. 900-902. For an online version see www.metropol-verlag.de/_ftp/zfg_heft_10_2004.pdf

2 I use the military metaphors deliberately; the language surrounding the presentation of a paper in a German history department is replete with them. While the speaker enters the room prepared to fend off *Querschüsse*, at minimum one (ambitious young) man in the audience sits poised to *abschießen* the speaker. Military metaphors also figure prominently in other areas of academic discourse. The evaluation commission of a *Sonderforschungsbereich* can *rausschießen* a specific project or *Projektbereich*; professors go into a faculty meeting *mit heruntergelassenem Visier*, and at the meeting two rivalling professors will *die Klingen kreuzen*.

3 Anthony Grafton, *The Footnote: A Curious History* (Cambridge, Mass., 1997), 235.

4 Richard Evans, “From Historicism to Postmodernism: Historiography in the Twentieth Century,” *History and Theory* 41 (February 2002): 83

Systemic Barriers and the Effect of New Structures

New structures can be immensely supportive and stimulating, and creativity can flourish.

Although I am a theoretical physicist, my theories do not extend to the administration of research – these observations are rather experimental! I am a New Zealander, but have studied and worked abroad as an academic all my adult life. Residence has included the UK, France, the USA, and also Germany for periods associated with a Humboldt-Forschungspreis. I am evidently biased toward the international view.

Intellectual creativity is a precious flower. In Physics for the past 130 years, an international aspect, and the willingness of relatively young academics to throw over the existing order, have been vital in fostering a remarkable vitality in the subject. Germany in particular was the setting for a golden age from 1870-1930. I shall briefly mention three examples from my own personal experience where institutional and systemic barriers (including age discrimination) have limited activity and international cross fertilization. However new structures can be immensely supportive and stimulating, and creativity can flourish. I am currently associated with two institutes with a strong international and cross-disciplinary flavor that work very well and that are clear examples of good practice.

It is a cliché that many foreign scientists experience on visiting Germany – being received by the senior Professor who turns out to have little or no knowledge of the contents of publications that go out from his group and with his name attached. It can often hinder a budding interna-



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tionalization of a piece of science, at least until as a foreigner one comes to understand the way of the world! In my own case, the weeks spent earnestly reading the group's research papers before arrival did not then lead to a fruitful collaboration. But rather more importantly, one asks what the effect can be on the younger people (Habilitationen, post-docs and research students) that have participated in the work? It is not a problem limited to Germany – I have seen examples in large research groups in Japan for instance. However, I wonder to what extent such scientific dependencies are cemented by a system of large groups and the relatively long path to true independence, a hierarchy re-enforced by the Habilitation system in Germany. Not that the system in Germany has always hindered younger people. One thinks of the golden age of Physics and the revolutionary steps that overthrew 500 years of traditional thinking. Indeed much of the system I have experienced in Germany has shown most fruitful collaborations between senior and junior members of a research group. Many of my happiest and most productive periods were spent in Freiburg – an international center for Polymer Chemistry that has thrived on innovation, on the exchange of younger researchers with groups abroad, and from the active involvement of older researchers with front-line research. Much depends on the personalities involved that can sometimes overthrow some of the systemic inhibitions of the system.

Difficulties of an inverse nature are inherent in the British system. Young lecturers in their first permanent appointments in, say, their late 20s, are encouraged to be research independent. Sometimes they are alone, sometimes they have some startup funds, sometimes they can be loosely associated with larger research groups.

Much depends on the personalities involved that can sometimes overthrow some of the systemic inhibitions of the system.

They can, however, lack the seniority to compete nationally for research grants. Some young UK scientists then turn to the European stage where they will find their home situations uniquely ill-suited to the European model. European grants often aim at social engineering, for instance to weld geographically and socially different areas of Europe together and to encourage science that has a particular technological promise. To this end they provide funds for mobility and sometimes salary, but not for infrastructure which is assumed to be locally

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Mark Warner shared the 2003 Europhysics Prize with a German Chemist – an example of transnational and interdisciplinary collaboration. He was awarded an AvH research prize which further strengthened bonds to Germany where he is now on the Advisory Board of the Freiburg Institute for Advanced Studies (FRIAS). Another such institute, also with an International dimension, the MacDiarmid Institute for Advanced Materials and Nano-technology in New Zealand, occupies some of his research and administrative time. Formerly, he directed an EU INTAS project for science in the former Soviet Union.

available, and sometimes funds for meetings to stimulate discussion and collaboration. The European financial contributions are thus welcome additions to a large, well-funded group already with means and the ability to absorb and encourage exchange visitors and students. By contrast to many large German groups, many in the British system are ill-placed to derive benefit from the European model – internationalization is thereby hindered and with it many chances for creative interactions. What I have seen so far of European Science Foundation (ESF) plans would seem to make matters still worse. The ESF would press for priority for grants from national science funders to research teams that belong to approved large (6-8+ member) pan-European consortia. These target groups would already have to be prominent in their own (national) funding systems. As we would say in physics, there is “an impedance mis-match” between small groups of independent young people and the funding mechanisms to support them.

However, there is also very good news on the institutional front. As a member of an International Advisory Board, I have had good occasion to observe the activities of the Freiburg Advanced Study Institute (FRIAS) in Germany. FRIAS has 4 schools within it, spanning arts and science. The school to which I am attached itself spans a wide range of disciplines, from theoretical physics to material science and engineering, to physical and synthetic chemistry. The disciplines are encouraged to interact and to bring complementary insights. Senior internal and external fellows are supported while on leave at FRIAS for periods of a year or more. The internals are freed from their existing duties in their Freiburg departments. Some are quite senior. Externals are totally independent. They bring with them expertise not directly found in Freiburg, but often with some overlap with home research groups, and sometimes also manpower at the post-doc or research student level. More junior fellows have the freedom to start research programs supported by FRIAS. The turnover of the latter is quite high – they are outstanding and highly productive and therefore are strong candidates for established academic posts elsewhere. Their creativity is strongly supported by the free environment they find themselves in. There is a strongly international flavor to the programs and personnel of the institute, as a couple of examples serve to show.



I have been impressed by the innovative and open-ended research goals of many of the fellows. An outstanding chemist in his late 30s from the USA has come to research, among many themes, the direct photo-chemical capture of energy from the sun – an artificial alternative to photosynthesis and a possibly important component to zero-carbon, hydrogen-based energy. These ambitions mesh well with complementary chemical and physical interests and experience already in Freiburg.

Internationalization of research is vital in any community.

Another interesting model is that of a German who is a professor in a leading UK university. He returns to Germany for a few months a year as a Senior External Fellow. He has local staff in Freiburg and a constant exchange of people and ideas between his UK and Freiburg laboratories. The young people working in this research environment do so with much independence and with the advantages of both laboratories. As part of the renewal of themes and programs, areas of activity are energetically reviewed. I have the feeling this too is a vital part of fostering a climate of innovation in research.

I am also on the International Advisory Board of the MacDiarmid Institute for Advanced Materials and Nanotechnology in New Zealand – named after a New Zealander Nobel laureate in Chemistry, Alan MacDiarmid. The Institute is delocalized to several university and other research sites. It has academics on secondment who are thereby freed of some of their normal obligations in order to pursue research, and also provides post-doc and student manpower and scientific equipment to these academics who must bid for resources. It is also a route to early independence for younger academics who draw resources from the MacDiarmid. It encourages blue-skies research in a very free environment. Resources (mostly equipment) are shared which gives a wide infrastructure for particularly younger people to use. The sharing of resources, and thus necessarily the movement of manpower, often leads to collaborations between otherwise unconnected centers. In many ways FRIAS has taken the same route, but in New Zealand the question of mobility is much more central. The country is thinly populated (4 million only) and communication and exchange has to be good between centers. Video seminars, as far as Australia too, are regular. A considerable budget, particularly for student and post-doc collaborations and conferences, is set aside for travel to Asia, Europe

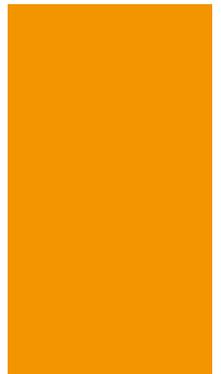
and North America so that the geographic isolation of New Zealand is overcome. Since internationalization of research is vital in any community, the MacDiarmid is in effect turning a necessity into a virtue. It is also important to attract researchers from a wider pool than that available domestically. For instance grants and the waiving of fees are available in particular to young Germans intending to study in New Zealand universities in fields affiliated to MacDiarmid activities.

I thus see new structures, for instance along the FRIAS line, emerging which offer hope for innovation by young and older academics, and where an international element certainly helps to erode old, systemic barriers to creativity.



The sharing of resources, and thus necessarily the movement of manpower, often leads to collaborations between otherwise unconnected centers.





FOSTERING CURIOSITY:
THE CHALLENGE OF ASSESSING CREATIVITY
IN RESEARCH AND TRAINING

Creativity and Curiosity as Drivers of Scientific Innovation¹

The originality of ideas is perhaps the key element of creativity; such ideas defy the past and show the way in a new intellectual or practical direction.

Concepts are often slippery and have multiple meanings. Terms such as creativity, originality, curiosity, intellect, and innovation form a set of expressions that cluster together, but point in different directions. The concept of creativity is used to suggest that a certain idea has evolved from one's thought or imagination, that something original and innovative has been produced. In most areas of creative activity, a person must have intellect to be able to create new ideas and things. Intellect is a very relative term and its products do not need to be original or innovative. It can also be misused.

The originality of ideas is perhaps the key element of creativity because such ideas defy the past and show the way to new intellectual or practical directions, or ways of assessing them. Peter Watson has stressed, however, that originality requires the notion of tradition as it cannot exist without it; "for it is only against tradition that originality becomes perceivable".² The word "originality" is sometimes used in a pejorative sense, but it does not need to be. In any case, originality cannot exist without an element of surprise. Original ideas must make a difference to the established ways of thinking; in the most demanding sense, they must give rise to a new paradigm.

Historically, creativity has been considered an individual property; splendid authors and painters, pioneering scientists, or politicians develop strikingly new ideas. The "great man" theory of innovation has obviously some merit; there are intellectuals and artists who break the wall of tradition which especially in hierarchical societies is an obstacle to change. Creative



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people have indeed historically been adversaries of static habits of the aristocracy and the bourgeoisie.

It is probably fair to say that the path-breaking ideas of Sigmund Freud or Ludwig Wittgenstein would not have received the same contents and implications in the mind of any other person. Yet, it is important to keep in mind that ideas, both old and new, are social in nature. Louis Menand has written a wonderful book on the Metaphysical Club which had as its members Oliver Wendell Holmes, William James, Charles S. Peirce, and John Dewey; the first generation of modernists and pragmatists in the United States. Their accomplishments, and mutual controversies, cannot be understood without placing them in the larger contexts of social and cultural change in the United States in the period between the Civil War and World War I.³

In a related manner, one can say the ideas of Freud and Wittgenstein were social in nature. The reception of Freud's ideas in Vienna was very controversial and they were rejected by practically everyone in the medical society there. Only gradually, his views were accepted and the Vienna Psychoanalytic Society was established around him. Thus, scientific circles can have advocacy functions to promote a particular system of unconventional ideas.

The Wiener Kreis, established in the 1920s, to commemorate Ernst Mach – with Moritz Schlick, Rudolph Carnap, Kurt Gödel, and Otto Neurath as key members – worked to replace in the philosophy of science old metaphysical traditions with logical positivism and the concept of unified science as the leading scientific method. Creativity and innovation can also be suppressed by political authorities. Thus, the Vienna Circle was dispersed in the 1930s after the Nazis came to power and perceived the logical method to be politically dangerous.⁴

The Vienna Psychoanalytic Society and the Vienna Circle are examples of scientific sects, or tribes, who coalesce on the basis of common ideas around some leading thinkers and their ideas. Their function is quite different from academies of science and scientific societies which usually are general fora for scientific presentations and debates on specific topics. Sects and tribes are important because they help propagate novel ideas which pioneering scientists and small communities of scholars have developed.

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In science, creativity has been institutionalized since at least the 19th century. This development has coincided with the expansion and professionalization of science. In particular in natural science, engineering, and medicine the demand for proper infrastructures – laboratories, computing power, and data bases – and their costs have escalated. Now there is a growing need to establish not only national, but also regional and even global infrastructures. Innovation is more and more driven by organizations, technology, and money.

Ideally, scientific research is an open-ended process in which results are not known in advance. The closure of the research process may eliminate the moment of surprise and undermine the originality in the work which is a necessary condition for scientific breakthroughs. Thus, there may be an internal contradiction in the manner in which large-scale research is organized today; on the one hand, we need cumulative and well-organized research environments, but on the other hand the focus on the effective organization of research may take place at the expense of creativity. It is a huge challenge for the leaders of research communities and the funding agencies, to strike the right balance between organization and innovation.



Today, it is realized that stationary research centers, with hierarchical organization and funding patterns, are not always the most innovative and productive places to work. Sharing ideas and information across institutional, disciplinary, national, and cultural barriers helps to combine them in novel ways and thus produce original results that may also go against the tradition. New ideas emerge and materialize increasingly at interfaces and networks, and benefit from the diversity of people involved. The bulletin (Research EU) published by the Research Directorate of the European Commission strikes the cord in its July 2009 issue by writing that “together, we are more intelligent”.

The internationalization of research environments is an important condition for creativity and innovation.

As a result, scientific research has been increasingly converted into institutional, and even industry-like processes in which scholarly productivity is measured by various objective criteria. This has been in many ways a useful and necessary path of development, but it also has the downsides as it may stifle individual creativity and even collective innovation. It is not unusual to hear complaints from people working in laboratories that they have become cogs in a large machine in which they perform their expected assignments, but have only a limited role in designing the work process and its potential results.

For this reason, the internationalization of research environments is an important condition for creativity and innovation. Internationalization can these days happen, however, in several different ways. While communication by computers and other devices has become so much easier, personal face-to-face contacts also matter, sometimes immensely. I am somewhat afraid that we will lose something essential if we do not have, with our partners in other countries and fields, also opportunities to go to a concert or to have a few beers. Such personal encounters can be more creative and productive than the transmission of data between computers. The tribal element in research still matters. Often common scholarly interests have formed a basis of life-long friendships which go well beyond research.

In a similar manner, companies involved in technological research and development have started to stress the importance of open innovation environments. Instead of concentrating R&D in a few centers, they tend to establish strategic partnerships and transnational networks and draw upon the local talents and experiences in a coordinated manner. This also means that the research laboratories of leading multinational companies are increasingly diverse work places in which the management of talent requires a very different approach than in the old industrial companies.

One can perhaps speak of a new law of comparative advantage where the organization of corporate research across various divides matters more than the performance of individual units. It appears, to paraphrase Lenin, that the transnational organization of R&D is, so far, the highest stage of globalization.

The internal organization of the research place, whether located in a university or a company, matters indeed. Obviously, the objectives of research, and its underlying motivations, differ; in business, competitiveness through innovations in the market place is the key determinant of success, while in the academic community the ability to produce creative and original findings that enhance the reputation of the scholar or the research group is more pivotal.

The way a business magazine describes the work environment of Google, which now has close to 20,000 employees, is perhaps a lesson for all of us; the company has “a sense of creative fearlessness and ambition”.⁵ A scientific expert can have the same degree of freedom to generate new ideas in the company's research laboratory as in the academic community.

Personal encounters can be more creative and productive than the transmission of data between computers.

Questions about creativity and originality in science lead us, in fact, to difficult terrain; who are the scientists, what is their vocation, and what is the relationship between authority and morality in the scientific enterprise? How deep is the difference between academic and industrial researchers? Do they have the same moral standards and how, for instance, scientific fraud is handled in these two environments?⁶

The well-known cases of Hwang Woo-Suk, who falsely reported making embryonic stem cells by cloning, and Jan Hendrik Schön, who for years fabricated results on semi- and superconductors, indicate that fraud in science today is not impossible. The yearning for originality and innovation can exact a high price if the established scientific and ethical standards are violated.

The yearning for originality and innovation can exact a high price if the established scientific and ethical standards are violated.

It is often impossible to detect all scientific fraud, especially if it happens on a small scale. Despite the improving quality control in science, the emergence of new fields of research, the multiplication of actors involved, and the growing complexity of research itself make the detection of fraud an uphill struggle.⁷ Thus, the demand for creativity and productivity can also lead to moral blind alleys. The moral integrity and sustainability of science remains its most important asset, one that needs to be protected.

Notes

- 1 I would like to thank Dr. Pekka Väyrynen (Senior Lecturer in Philosophy, University of Leeds) for useful and insightful comments on the earlier draft of this paper.
- 2 Peter Watson, *The Modern Mind. An Intellectual History of the 20th Century*. New York: HarperCollins 2001.
- 3 Louis Menand, *The Metaphysical Club. A Story of Ideas in the United States*. New York: Farrar, Straus and Giroux 2001.
- 4 See Friedrich Stadler, *Studien zum Wiener Kreis. Ursprung, Entwicklung und Wirkung des Logischen Empirismus im Kontext*, Frankfurt a. M.: Suhrkamp 1997.
- 5 Fortune.
- 6 These issues are discussed, for instance, in Steven Shapin, *The Scientific Life: A Moral History of a Late Modern Vocation*. Chicago: Chicago University Press 2008.
- 7 For interesting evidence, see “Fraud in Science. Liar! Liar!”. *The Economist*, June 6, 2009, pp. 75–76.

Fostering Curiosity: The Role of Research Funders

Scientific innovation is the possible and ultimately intended outcome of scientific research, i.e. of a systematic process to create objective knowledge and, using the rules of logic, to combine it with existing knowledge. In this picture, research is a process, innovation its result.

Scientific Innovation

This year's Forum of the Alexander von Humboldt Foundation addresses the challenge of scientific innovation. What does *scientific* innovation mean in contrast to other kinds of innovation?

Scientific innovation is the possible and ultimately intended outcome of scientific research, i.e. of a systematic process to create objective knowledge and, using the rules of logic, to combine it with existing knowledge. In this picture, research is a *process*, innovation its *result*.

There are other kinds of innovation, not necessarily inferior to scientific innovation, in some cases even more creative, such as the production of art (an innovative act *sui generis*), innovation by association as intended by brainstormings, innovation by intuition, and innovation by aimless trial and error, i.e. by chance, the way how evolution seems to work. The history of science and technology is full of astounding discoveries which did not result from scientific research in the strict sense. And yet, for good



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reasons modern society believes in the supremacy of the scientific process. Due to scientific research, in the past centuries the pace of technological evolution has outrun natural evolution by several orders of magnitude.

Nonetheless, nature teaches us an important lesson for the success of scientific research. In fact, scientific knowledge progresses by different means. At one end of the spectrum is the purely curiosity-driven research, i.e. scouting for unknown territory. In many aspects, this resembles the trial-and-error method of natural evolution. Often an unfruitful desert is found instead of the holy land, or one ends up in a dead end. Evolution is full of attempts which failed. But in other cases, one unexpectedly stumbles upon a treasure when something much less spectacular was looked for – remember Christopher Columbus. Thus, curiosity-driven research resembles the work of the discoverer who sailed the oceans to find new land. However, there are limits to this metaphor, since in contrast to the final size of our Earth, the Ocean of Knowledge seems to be boundless. At the other end of the spectrum, research serves a well-defined target where the elements to achieve the goal are all in place – at least in principle. Research then means to adjust and combine existing knowledge in order to construct a solid solution to the problem. This kind of research, by no means less important than the other one, could be compared with the work of the surveyors who fully explore and develop the land found by the discoverers.

A creative and sustainable research system needs both, discoverers and surveyors. Although it is true that the work of the surveyor is less risky and its result of more direct and immediate use, without the discoverers the surveyors would eventually lose their right to exist.

Curiosity-driven research resembles the work of the discoverer who sailed the oceans to find new land.

Research Funding Organizations

A central task of *Research Funding Organizations (RFO)* is to identify and support high-quality and creative research. In turn, the *creativity of RFOs* is reflected in the way how (a) funding instruments are designed by which good research can evolve; (b) quality of research projects is assessed; (c) talented individuals are identified. Since research projects greatly vary in their nature, there is no unique best solution for the design of the optimal funding system. To the contrary, funding instruments must be diverse.

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Prof. Imboden studied theoretical physics in Berlin and Basel and in 1971 received his doctorate at the ETH Zurich following a dissertation on theoretical solid-state physics. His interest for the environment, particularly water, brought him to the Swiss Federal Institute for Environmental Sciences and Technology (EAWAG) and to the Scripps Institution of Oceanography, California. Since 1974 he has been teaching at the ETH Zurich. In 1982 he completed his habilitation requirements in the field of mathematical modelling and environmental physics. From 1998 to 1999 he was the director of *novatlantis*, an interdisciplinary project on sustainable development within the domain of the Swiss Federal Institutes of Technology, where he initiated the pilot project “2000 Watt Society”. He has been visiting professor at various universities such as MIT and Caltech.

In most European research systems people drop out of research not because they were evaluated and failed but because their job simply ended and nobody 'in the system' noticed.

A few basic principles should be kept in mind:

1. The ultimate basis for innovation is the 'primary production' of knowledge – the work of the discoverers, to remain in the metaphoric language of the previous paragraph. Discoveries occur primarily by *bottom-up driven basic research*. Wilhelm von Humboldt in his university project for Berlin allegedly said that two things are necessary for good research: solitude and freedom. Therefore, the principal instrument of the portfolio of every RFO should be the support of basic research without any thematic restrictions, either by financing project ideas or people. The latter option is especially important for young scientists who are not yet fully integrated in academia and do not yet have a permanent position.
2. *Top-down* research programs have their role as well. They are vital for:
 - targeted research and development aiming at developing well-defined products with societal importance and/or with commercial potential;
 - the construction and operation of medium to large infrastructure which lies beyond the capabilities of individual research units or of universities;
 - the initial phase of a research system in a country which has to newly build or rebuild its research system and thus must concentrate on a few research areas in order to produce the necessary critical mass needed to become internationally competitive. Yet, even in these cases the ultimate goal in order to achieve long-term sustainability must be to later transform the funding system to an open bottom-up system.
3. Special attention should be paid to research projects in which the boundaries between disciplines are crossed. Often this kind of research is risky and may need several attempts. It is also often slower than 'traditional' monodisciplinary research since the dialog between researchers who were brought up in different traditions needs time. The creation of special instruments which allow for the cooperation between different research groups helps to create such cooperation schemes. They have to be simple and designed with a long-term perspective. Results should not be claimed too early (see also following point).
4. A similar category of research which deserves special attention are so-called 'high risk – high reward' projects, i.e. projects which are speculative and aim at stepping over established methods and theories. Such projects should be part of the portfolio of every major research-funding organization, though they ask for special skills of the reviewers.
5. The backbone of every research-funding organization is the mechanism of review. Peer review of external experts – in panels or in writing – combined with the assessment of the reviews by 'internal' specialists – active researchers themselves – should be the standard. In smaller countries, the external reviewers should be recruited predominantly abroad to avoid (negative or positive) bias.
6. Except for the support of very specific development projects, the support of basic research should not be looked at in terms of a contract in which the contractor must promise to deliver a well-defined product. The *ex post* evaluation of a research grant should be restricted to a few basic financial checks and to formal criteria, e.g. whether the contractor has successfully employed the promised numbers of Ph.D. students etc., but not on the scientific outcome. The latter should only play a role when the contractor intends to prolong the project or when he or she submits a new project. The failure of a project should not be a reason to refuse a new grant to the same person, although a series of failures from the same person may become a critical element of evaluation for any new projects from the same person or group.

Research careers

One should not forget: research and innovation are the products of people. The most ingenious research system remains without effect if researchers do not make use of it and academics, especially young ones, cannot be convinced to engage into research as a profession. Thus, making a research career attractive and predictable is one of the most important tasks of institutions involved (governmental administration, research funders, research institutions, and universities). The government has to provide for adequate social security and health insurance schemes, the funders for a consistent offer of support instruments without gap, and the research institutions and universities for adequate working conditions, salaries and promotion schemes.

Due to unfavourable perspectives in research, in countries with a well-developed and successful economy, many highly talented people are lost from the research system to non-research jobs in private industry and public administration. The following issues deserve special attention:

- Salaries, social security and health insurance are often inadequate, especially regarding transnational compatibility and transfer.
- Obviously, a predictable career does not mean that promotion from the bottom to the top, i.e. from Ph.D. to professorship, is a hundred percent guaranteed. In the contrary, as in sport and art, at every promotion step there is a selection process, and in many cases it is extremely severe. For instance, the chance to get tenure at one of the highly ranked universities in the U.S. can be as low as 20%. Yet, what makes the system predictable is the 'right of being evaluated' at every career step. In most European research systems people drop out of research not because they were evaluated and failed but because their job simply ended and nobody 'in the system' noticed.
- In most European countries one of the main impediments for scientists is the growing load of administrative work resulting from the increasing complexity of the self-organization of research institutions and universities. The growing pressure for harmonization, output evaluation, and coordination creates a comparative disadvantage relative to, e.g. researchers in the U.S. In addition, research units of professors or group leaders are often too large. As a result, the leaders become research managers while in turn young scientists have to wait for too long until

they get the chance to conduct their own independent research. We should be extremely concerned about a research system which 'honours' success by 'promoting' researchers to managers.



Knowledge transfer

As discussed above, basic curiosity-driven research is ultimately the most important long-term resource for scientific innovation. However, the transfer of research results from the scientists to the economic system is often complicated. Potentially important knowledge is lost, unless special transfer offices take care of it. It is naive to believe that the gifted basic researcher also has the talent to exploit his results and to make them economically productive – though excellent counter-examples exist.

Knowledge transfer is the domain of the specialist who should be located close to the place of knowledge production, i.e. in the universities and research institutions. Under special circumstances, research funding organizations can also engage in knowledge transfer, but the primary responsibility should be with the institutions where knowledge is produced.



INSTITUTIONAL CREATIVITY:
CHANGES AND CHALLENGES

Universities as Unique Places of Knowledge Creation

Universities are unique places of knowledge creation. Their raison d'être is "being one step ahead" and going beyond established knowledge; their intrinsic logic is the questioning of time-honoured ideas and therefore they are trying not only to solve current problems but also to proactively identify issues of future relevance and to cultivate a high sensitivity.

Of course, we usually refer this understanding and accredited role to the scientists and scholars and the students alike (on an individual level), but it is a rather new phenomenon – and here I'm talking about Germany – to expect it from the university as a whole in an institutional sense. Even though rapid and complex changes in contemporary society and an increased competition call for innovative concepts and for enhancing creativity, universities should be enabled to be per se unique places of knowledge creation. In order to cope with this mission and requirements, staff and students need to be provided with a favourable environment and with appropriate institutional structures.

Over the past decades especially the German universities have experienced an enormous expansion of tertiary education.



Peter Strohschneider

Chairman, German Council of Science and Humanities,
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A novel funding program providing an attractive setting for outstanding researchers is the German Excellence Initiative. To understand this program it is necessary to know something about the specific structure of the German academic system. Traditionally, basic research in Germany is conducted by the universities. They are set up to be research institutions. In addition, basic and applied research is performed at non-university research institutes, e.g. the institutes of Max Planck Society, Fraunhofer Society, Helmholtz and Leibniz Society, at some governmental research institutes, at the academies and within the 'universities of applied sciences' ("Fachhochschulen").

Over the past decades especially the German universities have experienced an enormous expansion of tertiary education. After years of flat and shrinking budgets, universities are largely seen as burdened with unfavourable teaching ratios, ageing infrastructure, a lack of capacity to act, and a hierarchical faculty system that leaves little room for up-and-coming researchers. The universities' academic performance has seriously suffered due to this. The German universities could not be de facto what they are required to be normatively. Moreover the massive expansion of student capacity did not go along with an appropriate growth of financial resources and a needed institutional differentiation. Whereas the research and higher education system as a whole is highly differentiated,

the German university system is often conceptualized as homogeneous – in big contrast to future functional needs, but in accordance with its history of a certain egalitarianism and decentralization. And in fact, it is rather homogeneous in terms of financial endowment and institutional mission and particularly with regard to quality of teaching and learning. Outstanding research is neither structurally nor institutionally supported as it might be necessary. Traditionally, German universities intended to offer equal opportunities to all members of society for a university education and until recently

In 2005 the federal government and the 16 state governments launched the Excellence Initiative, a program that addresses especially one desideratum in German universities: a lack of time and of opportunities for excellent researchers.

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By and large one could say that the Excellence Initiative has shaken up the German university landscape in many respects.

did not charge tuition fees. Furthermore a part of the problem with the German university system lies in its decentralization: The federal government, to put it briefly, can only introduce nationwide programs with regard to research (not to teaching) and can support individual university projects only if all 16 states agree.

In 2005 the federal government and the 16 state governments launched the Excellence Initiative, a program that addresses especially one desideratum in German universities: a lack of time and of opportunities for excellent researchers. Additional funding of 1.9 billion euros over 5 years is given to promote top-level research. The program offers a wide range of incentives to improve the institutional conditions for the development of internationally competitive research. The Excellence Initiative includes three funding categories: Firstly, the Graduate Schools which are intended to develop structured paths

and research training for Ph.D. students. Secondly, the Clusters of Excellence encouraging collaborations of the strongest research areas at an institution. And thirdly, Institutional Strategies intended to reorganize the university as a whole to enable it to compete internationally; this funding line is being administered by the German Council of Science and Humanities (Wissenschaftsrat), which is nevertheless an Advisory Board instead of a funding agency. The prerequisite for the funding of an Institutional Strategy was at least one Graduate School and one Cluster of Excellence. In that competition a total of 37 universities were awarded with 39 Graduate Schools, 37 Clusters of Excellence and 9 Institutional Strategies.

What is the impact after three respective two years of funding? By and large one could say that the Excellence Initiative has shaken up the German university landscape in many respects. I would like to highlight seven aspects:

- Set up as a competition of ideas it has triggered an enormous dynamic of change and has induced a creativity boost. The Excellence Initiative encourages to question established ideas of research organization.
- With the Excellence Initiative, competition and differentiation between and within universities gains momentum. The Excellence Initiative already represents something like a paradigm shift in Germany's higher education and research policy: It breaks with the idea of homogeneity and the fiction that all universities are equal. It promotes and accelerates the process of differentiation with regard to the functions of universities and with regard to the quality of research.
- Universities are more than the sum of its individual parts. Within the Excellence Initiative they perform as an entity and as an actor of institution building. More autonomy for the universities and an increased strategic planning provide a framework for a research-conducive institutional setting. Especially the funding category "Institutional Strategy" has given a strong impetus to bring about institutional change that leads to new organizational sense-making. Institutional leadership embraces overall responsibility. It has to balance top-down management with delegation of specific decisions to faculties or institutes (as appropriate) in order



to ensure wide ownership for change processes within the university community. Institutional self-observation and self-reflection are rather new for German universities (e.g. the applicants had to submit a SWOT analysis). Another example concerns defining priorities: Almost all nine universities funded for their institutional strategies initiated university-wide calls and selection procedures to identify research topics or new priority research areas (as a bottom-up process). The funded universities explore – especially in the current phase of implementation – concepts of “learning organizations”.

- The funded universities establish new research-beneficial structures particularly for young researchers. They are striving towards a creative mix of newly recruited talents and senior researchers, providing a favourable framework for researchers from different disciplines. In addition to an academic stimulating environment and favourable working conditions, universities offer attractive career paths for young researchers (although tenure track options are rather new in Germany and not yet common, some positions are offered within the Excellence Initiative). Novel approaches of setting up research units and interdisciplinary platforms are funded: in five universities, for example, Institutes for Advanced Study are established – one out of a sample of funding instruments for very good senior and junior researchers inside German universities.

- New strategic alliances between universities and extra-university research institutions help to bridge the two-pillar system in Germany. These newly formed links with non-university research institutions attracted public interest. Revolutionary is for sure the merger of university Karlsruhe with the Helmholtz research center Karlsruhe. New types of strategic research cooperation are underway in Aachen and Göttingen as well. In Aachen the university and the research center Jülich have signed a strategic cooperation agreement for several research areas. The university of Göttingen aims to create a joint research campus with the extra-university institutions located in Göttingen. They developed a new strategic performance – the establishment of a joined committee of university and seven external research centers. These examples show that universities intensify teaming up with research-partners outside, create joint research locations and perform as “organizational centers” of the higher education and research system.



New strategic alliances between universities and extra-university research institutions help to bridge the two-pillar system in Germany.

- The Excellence Initiative gives an impulse towards greater internationalization, improved gender balance, more diversity. Diversity was identified as a crucial factor for strengthening creativity at a number of levels: composition of research teams, among staff, joint projects with external partners etc.
- And last but not least: The Excellence Initiative has brought an increased awareness for universities and research issues in the media and the general public.

It is too early to evaluate the impact of the program on the whole as the first phase of funding is still running. Nevertheless it is noticeable that the German university system is not without creativity in finding new answers to some old questions.



On Supply and Demand in the Knowledge Economy

The hypothesis of this paper is that, in considering the questions raised by the Forum of the Alexander von Humboldt Foundation, we are like someone who has lost a shilling in the dark and is now looking for it under the lamppost because that is where the light is. We ask questions and search for answers in a domain we are familiar with, yet the certainty we feel we have lost lies as much in a domain we are unfamiliar with.

**We create and disseminate knowledge
in the confident belief that an invisible
hand will in the fullness of time make supply
meet up with demand.**

The domain we are familiar with is the supply side of the knowledge economy. Our preference for the supply side manifests itself most clearly in our knowledge-creation function – i.e. research. Our preferred methodology is curiosity-driven research, and our assessment of quality is via peer evaluation. We believe in the intrinsic worth of the free creation of knowledge, as well as its long-term practical value. We create and disseminate knowledge in the confident belief that an invisible hand will in the fullness of time make supply meet up with demand. In support, we can cite many examples of how “pure” research brought societal benefit, albeit unpredictably and often accidentally. Ever since Aristotle, we have grounded our pursuit of knowledge in a taxonomy of scientific disciplines. Accordingly, the university, defined as a research institution by Wilhelm von Humboldt, structures itself into discipline-based departments and faculties. From this basis we pursue, as a paradigmatic activity, the



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big questions of science: What is the universe made of? Can the laws of physics be unified? How did life originate? What is consciousness? Is the Riemann hypothesis true? We pursue such questions because we want to know, not because there is a pressing need for an answer.

**The supply side is about understanding the world.
The demand side is about making a difference.**

**The supply side rests on academic freedom.
The demand side requires academic responsibility.**

The demand side of the knowledge economy is less familiar to us. While the supply of knowledge originates within the university, the demand for knowledge originates in society. Beyond the big questions asked by science, there are the grand challenges facing society. Climate change, environmental sustainability, HIV/AIDS, malaria and other tropical diseases, ageing and health, poverty and hunger, fundamentalism, migration and refugees – these are global challenges. When we respond to such

questions we are working on the demand side of the knowledge economy. Here it is not our curiosity that drives us, but our need, and for many their survival. On the demand side we don't make up the questions, they confront us. Can we arrest global warming? Can we invent a vaccine against HIV/AIDS? What are the sources of renewable energy, and how can we exploit them? Responding to such questions is needs-driven and goal-oriented, not curiosity-driven or open-ended. The goal is not set by us, but recognized by us.

On the demand side our language of discourse, and hence our methodology and our structures, are less developed than on the supply side. There is, for example, no familiar demand-side analogy for the metaphor of blue-skies research. Likewise, when we say that demand-side research is of an interdisciplinary nature, we implicitly defer to an assumed primacy of the supply side. We do not have anything other than a supply-side vocabulary to discuss demand-side issues. We are searching under the lamppost because that is where the light is.

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Before taking up his position at Newcastle in 2007, Professor Brink was Rector and Vice-Chancellor of Stellenbosch University in South Africa, where he led a transformation agenda which attracted national and international attention. Before that, he served as Pro Vice-Chancellor (Research) at the University of Wollongong in Australia. Earlier he was Professor and Head of the Department of Mathematics and Applied Mathematics at the University of Cape Town. After the first democratic elections in South Africa in 1994 he was involved in the restructuring of UCT, during which time he served as Coordinator of Strategic Planning. Earlier he held a Senior Research Fellowship at the Australian National University.

He is a logician with a Cambridge Ph.D., an interdisciplinary DPhil, Master's degrees in philosophy and mathematics, and a Bachelor's degree in computer science, and he has published in all these fields. He is a Fellow of the Royal Society of South Africa and a former President of the South African Mathematical Society. Before moving into management he held the prestigious "A"-rating of the National Research Foundation, which ranked him as one of South Africa's leading scientists.

The demand side of the knowledge economy is a matter of consciously steering and directing our academic work to respond to the needs and demands of civil society.

There is however a gradual recognition, not just of the societal legitimacy, but also of the academic merit, of demand-side research. It is worth, therefore, beginning to develop a demand-side language of discourse. To do so we may identify some basic features distinguishing the demand side from the supply side of the knowledge economy.

1. The supply-side methodology is based on the ideal of the dispassionate observer and objective thinker standing outside the phenomena. On the demand side, however, we have to acknowledge that we ourselves are participants in and agents of the very phenomena we are studying. Understanding climate change is different from understanding the laws of physics, because nothing we do will alter the laws of physics, but many things we do could change the climate.
2. The supply side prizes individual genius, and makes heroes of Aristotle, Galileo, Newton, Darwin, Einstein, Turing and Hawking. The demand side acknowledges the need for a collective response to societal challenges.
3. The supply side is about understanding the world. The demand side is about making a difference. On the supply side, we strive for truth. On the demand side, we strive to make life better, or to prevent it getting worse. On the supply side, we may postulate a Platonic reality, as in the laws of physics or the nature of numbers. On the demand side we would more commonly assume a Heraclitean flux.

4. The supply side rests on academic freedom. The demand side requires academic responsibility. If our work makes a difference, we have to accept responsibility for that difference being beneficial or deleterious. There is a dimension of decision-making in tackling the grand challenges which does not exist when tackling the big questions.

5. Demand feeds upon itself in a way that supply does not. Aristotle remained the supreme authority for two millennia. Once Newton had formulated his laws, many scientists thought that that was the end of the matter. Proving Fermat's Last Theorem did not stimulate number theory in the way that posing the question did. But meeting a demand raises expectations, and thus stimulates further demand. Moreover, the more we meet a demand on making life better, the more we raise a challenge on not making it worse. The industrial economy demanded energy to drive the machines to manufacture the products that made life more comfortable. But so successful were we in extracting energy from the earth that we polluted the atmosphere, creating the challenge of global warming.

These contrasts help us to understand what the demand side is. In addition, we must be clear on what it is not.

- It is not new. Any doctor searching for a cure, any engineer looking for a solution, any economist proposing policy, is in some measure working on the demand side. However, our research ethos, our esteem indicators and our academic structures are heavily weighted towards the supply side.
- Articulating the demand side does not call into question the legitimacy or value of the supply side. It is not a call to decrease curiosity-driven research, or an attempt to belittle it. The point is just that supply-side work may no longer suffice to meet societal needs and demands – at least not in a timeframe within which solutions to the grand challenges must be sought.
- Distinguishing between the supply of, and demand for, knowledge does not suggest, much less create, any kind of dichotomy. The ideal position is mutual feedback and reinforcement between supply and demand.

- The distinction between supply and demand in the knowledge economy is not another version of the distinction between “pure” and “applied” research. Much of the so-called applied science of the 20th century lies on the supply side – Applied Mathematics, for example, was for a long time just Theoretical Physics by another name. Even when applied research was a conscious effort to connect pure research with the everyday world, the methodology was one of knowledge-push, rather than needs-pull. But knowledge-push is not a suitable methodology for addressing societal challenges, because it does not give us a way of reasoning backwards from the challenge to the knowledge that is required for addressing it.
- “Demand side” does not mean “market forces” – at least not if market forces are equated with the corporate sector, or the bottom line. The demand side of the knowledge economy is not a matter of increasing the share value of multinational corporations, or meeting a demand for more products or services, or the corporatization of the university. It is a matter of consciously steering and directing our academic work to respond to the needs and demands of civil society.
- Likewise, responding to the needs and demands of civil society is not a matter of falling in line with governmental pressure, or participating in social engineering. It does not compromise academic freedom. It acknowledges, in a way that the supply side does not, that the university is an integral part of civil society, and on that basis calls for the university to exercise its freedom with a sense of civic responsibility. It is a reciprocal interaction with civil society, from which the university stands to gain as much as it gives.
- The distinction between the supply side and the demand side in the knowledge economy, and the attempt to contribute on both sides, is not an issue in our research portfolio only. It is relevant as much to the dissemination of knowledge as to its creation. In our portfolio of teaching and learning, we focus both on broadening the mind and on preparing for a career. When they graduate, we want our students to have enjoyed two benefits: the accumulation of knowledge for its own sake, and the skills and expertise attractive to employers. The former is a supply-side endeavour, the latter a demand-side one.
- As for structures, by and large the supply-side discipline-based division of a university into Faculties/Schools/Departments has served us well. The challenge is not to replace the supply-side structures, but to define and acknowledge an orthogonal demand-side taxonomy, which is functional rather than structural. “Does your university have a Physics Department?” is a supply-side question about structures. “Does your university deal with climate change?” is a demand-side question about functionality. In academia, these two questions, and what they represent, do not yet enjoy parity of esteem. We do not ask, for example, what difference a university has made in terms of policy or programs to improve the quality of life or the wellbeing of society. We only ask where it ranks in the Research Assessment Exercise. When we reach the stage where a university defines itself not only by what disciplinary knowledge it puts out into the world, but also which societal challenges it has chosen to respond to, then we will have found our shilling – not under the lamplight, but in the dark where we lost it.



The Quest for Fresh Talent

"The important thing is not to stop questioning. Curiosity has its own reason for existing." (Albert Einstein)

For centuries, the idea of the individual genius pursuing his or her academic research has prevailed successfully as the driving force for scientific innovation. Since research projects are becoming more and more complex, and a trend towards interdisciplinary research is obvious, co-operation in groups of experts previously working alone is often becoming a necessary pre-condition to accomplish challenging goals. To provide the right setting for scientists, universities and funding bodies therefore need to offer a constructive and flexible research environment as well as a whole range of funding tools. Institutional creativity and a constant exchange of experience with the peer group are a pre-requisites to effectively create and enhance new programs which meet the needs of innovative scientists. This includes the classical fellowship schemes as well as the funding of clusters or networks.

While a lot of funding is available in a bottom-up process, started by the original application of the scientist or group, the new funding regime might include targeting specific research topics according to current discussions in science and society. Thus, all institutions involved face new challenges and changes. All parties involved agree that there cannot be one or the other, but rather that we need both systems to pave the way for productive, exciting new research results: funding for high-risk research as well as funding for agenda-driven research.

But before funding comes the application: And here we face yet another challenge – the quest for fresh talent! While it is seemingly easy to identify and hence sponsor the top-down approach – by following John F. Kennedy's Apollo example of setting a goal, a man on the moon in less than ten years – and then clustering all the necessary resources in one place, the question of how and where and most importantly for whom to provide the funds in the bottom-up approach still needs to be discussed. The overarching questions are: What nurtures the young and unspoiled free spirit so that it can fly? What helps to foster or even stimulate "the unexpected"?



Nina Lemmens

Director, Department for Internationalization and Communication, German Academic Exchange Service (DAAD), Bonn



If a funding body does not want to provide the funds for a project which is already at a certain stage of development, but rather wants to help making way for something nobody can predict, it can only evaluate the person behind the funding application. This puts much more emphasis on the prior accomplishments of the applicant and on his or her academic record, as well as on the personality. As Fred M. Cowan put it: "While genius cannot be predicted, it can be promoted, discovered, and recognized." (The Scientist 9/1995, 11) This implies at the same time a greater responsibility for the selection committee, its members having to assess fewer hard facts and more soft skills – to simplify things a little bit.

If one looks at the typical fellow of the Humboldt Foundation, just to name an obvious example, this might not be too difficult, since most applicants already sport significant projects under their belts. But how does one identify truly "new blood"? How can one make sure that we do not miss out on a talented person who might still be living and working on the fringes of the academic spectrum – who, for example, has not found a way into one of the super universities because he or she comes from a deprived background and hence has not even dared apply to the Yales, Oxfords, ETH Zurich, or LMUs of our time?

To get some good ideas about well-functioning selection it helps to have a look at a completely different, yet as competitive a field in society: football. It is no secret that the Ballacks and Rooneys do not simply fall from heaven, but they are the result of a rather sophisticated system of scouts visiting countless small football clubs all over the world, spending endless hours watching presumably boring games, finally inviting a few potential talents to junior training camps, followed by trial periods for the

Co-operation in groups of experts previously working alone is often becoming a necessary pre-condition to accomplish challenging goals.

aspiring stars, assessing and re-assessing etc. etc. This whole selection process is based on the fact that there is an endless supply of passionate kids kicking around a ball, and that the football professionals can make use of a well-oiled machine to separate the wheat from the chaff.

Nina Lemmens has been appointed Director of the Department for Internationalization and Communication of the German Academic Exchange Service (DAAD) in Bonn as of July 2009. Her department comprises of three sub-departments dealing with the Internationalization of Higher Education Institutions, the Internationalization of Research and Marketing and Communication. Before, she was Director of the Asia-Pacific Department from September 2006. From 2000 to 2006, she was the Director of the DAAD London office; previously she acted as head of the department dealing with placements of academic staff in Western Europe and North America in the DAAD. Prior to this she was the assistant to the DAAD Board and Management as well as press officer. After finishing her Ph.D., Nina worked as personal assistant for an MP in the German Parliament for one year. Nina studied art history and worked as a freelance journalist for ten years.

One might state that some comparable techniques are already in place in science and academia, for instance with competitions like “Jugend forscht” in Germany, some of the winners being invited for internships at Max Planck Institutes etc., thus brought to a higher level of scientific recognition. Whatever projects may exist, they are still not as closely meshed as the football example. But maybe the academic institutions need not start with teenagers anyway, it might be early enough to catch the “targets” while they are already at university.

in mind a certain regional or subject-driven focus. Although the DAAD’s traditional and still highly valued program is the funding for the brilliant doctoral student – both international and German – the whole range of its scholarship programs and funding schemes also reach out to both the well-established professor as well as the youngster in his or her first or second year – without ever compromising the tough selection processes which is strictly excellence driven. The program presented here was created only a few years ago and bears the title “RISE (Research Internships in Science and Engineering)”, originally put into practice for B.A.-students from North America only. RISE offers undergraduate students a summer internship in the fields of biology, chemistry, physics, earth sciences and engineering. They work with research groups at universities and top research institutions across Germany for a period of 1.5 to 3 months and are matched with doctoral students whom they assist and who serve as their mentors. The working language is English. Although one normally knows American undergraduates as being rather un-adventurous – just like young Britons – this program hit the nail on the head with the number of applications soon rocketing sky-high. It became so successful that the DAAD as of very recently now also offers RISE to British and German undergraduate students alike. The beauty of course is that not only does RISE mobilize a cohort notorious for its immobility – the STEM students – but it also helps to qualify their hosts, the Doctoral students who for the first time in their career are in the driving seat and have to take responsibility for their young guests. In addition, the DAAD gathers the participants of the RISE program in summer meetings to link the students, their hosts, their host institutions and of course their home universities, thus creating added value.



One of the new programs of the German Academic Exchange Service (DAAD) may serve as a useful reference to this hypothesis, especially since it demonstrates the DAAD’s trademark in reacting flexibly to demands and new challenges by creating new funding opportunities – for the individual genius *per se* as well as bearing

Why is this program so important? Because what the DAAD achieves through RISE is exactly what the football scouts do: the scanning of a very wide sample of young students, looking for those who have that little bit extra motivation, that little bit more enthusiasm, and of course intellectual and academic qualities which single them out of the greater flock. After inviting them to the internship – the academic “training camp” – they are not left alone. On the contrary, an ever closer look is being taken, giving them, the funding body and especially the participating universities, a chance to find out if there is even more to the individual than that first impulse of applying to the program. Of course, here is where the work really starts: At the next stage, promising students must find more

“While genius cannot be predicted, it can be promoted, discovered, and recognized.” (Fred M. Cowan)

interesting offers to apply for, and the academic system as a whole must keep an eye on them. As for the next stage, the RISE-alumni – preferably from different countries – might possibly be invited to summer courses where they can work not only with Ph.D. students, but with post-docs and professors. Those who perform exceptionally well and who want to continue will find it much easier to find a tutor for their own Ph.D. – hence leaping into stage three. For stage four – the creation of their own research group – they will already have potential partners in more than just one university or country. These research groups later may be in a position to jointly apply for an EU grant – yet another stage.

The whole time, the academic system – the teachers at home, the hosts abroad, the funding bodies etc. – act like “business angels”, by investing time and money into somebody they in the beginning do not really know. But because the “system” has some experience in looking for talent, it believes that by singling out this one young man or this bright girl to be starting off a value-added chain – and to be proven right in a few years’ time, when the young talents can be congratulated on winning a major award. It is of course very important, that the “business angels” look at excellence in another dimension than just a mere research proposal could provide. The players look at the personality behind the proposal – even more so since proposals at that “infant” stage of the academic life might not exist anyway. This is truly the search, the quest for potential, and consequently fostering and nurturing this potential.

One important aspect for funding bodies like the Humboldt Foundation and the DAAD is that mobility is seen not only as a pragmatic approach to a project – books

The overarching questions are: What nurtures the young and unspoiled free spirit so that it can fly? What helps to foster or even stimulate “the unexpected”?

that can only be found in the library of university X or labs that only hold the super centrifuge at the research institute in Y. Moreover, mobility is seen as a conscious decision to broaden one’s own mind by exposing oneself to an unknown research (and living) environment, by exploring new shores in many ways – this being true for the young students of the RISE program as well as the established Oxford Don. To be internationally mobile, it takes courage, preparation (for instance learning a new language), one has to overcome some obstacles, last but not least one’s own laziness, taking the initiative – in the quest for the unexpected, yet again!





CREATIVITY AND DIVERSITY:
POLICIES AND PERSPECTIVES

The Value of Higher Education Diversity in an Era of Homogenization

Three broad caveats serve to frame and explain the choice of focus and approach adopted in this paper to address the topics of cultures of creativity and the challenges of innovation: First, it is important to note that the International Association of Universities (IAU) is a highly inclusive association whose membership reflects the full spectrum of higher education institutions around the world, rather than one type of institution rather than others. Unsurprisingly, the second framing caveat is therefore the fact that diversity, in all its dimensions, is considered a value and worthy of protection and celebration by the IAU. For the Association, the promotion of institutional diversity, diversity in student profiles, diversity in academic or research programs and linguistic diversity, among others, is deemed an ingredient for securing the quality of higher education, a basic

cornerstone for innovation. The third caveat may be deemed a cliché but must be stated nevertheless – the global race for competitiveness which has succeeded, as perhaps never before, in placing higher education and research in the limelight and which is, to some extent, driving the search for innovation and creativity, is a race in which no nation wants to be left behind. Yet it is a race being run on a very unbalanced and unequal playing field with hurdles that are practically insurmountable for some and where, in some respects, all the runners are tied together through a very complex web of interdependencies. As in any race, there can be surprises, but winning is not so much a matter of luck, but rather a matter of clarity of goals, strategy, long-term commitment and most of the time a team effort.

In a study by Richard Florida and Gary Gates, published in 2001 by the Brookings Institute and entitled *Technology and Tolerance: the Importance of Diversity to High Tech Growth*, the authors concluded that diversity and



Eva Egron-Polak

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inclusiveness nurtured innovation and creativity. The study stated: 'Diverse, inclusive communities that welcome unconventional people – gays, immigrants, artists, and free-thinking "bohemians" – are ideal for nurturing the creativity and innovation that characterize the knowledge economy'. The study was about cities, but it is highly applicable to higher education too. Institutional diversity and differentiation are increasingly examined and analyzed by higher education experts and researchers. Most often whether differentiation is vertical as in Germany, China, Japan or horizontal, based on mission specialization and profile as is the case in Australia and to some extent in Canada, it is seen as a response to some external conditions or constraints. These can include, for example, the inability of one type of higher education institution to respond to the ever-growing multiplicity of societal needs and expectations. Differentiation also provides an answer to the inability of the public sector to finance all institutions at the same level or in the same manner so institutional differentiation allows for a concentration of resources especially to meet costs of research and remain in that global race. More positively, institutional diversity is viewed as a path towards inclusion in terms of access and participation and a way to harness all talents in society.

However, despite this strong rhetorical commitment to diversity, at the international level (with impact at the national level too) there are very strong

countervailing forces towards homogeneity, or the term used more often these days, convergence. A recent EUA study entitled *Institutional Diversity in European Higher Education: Tensions and challenges for policy makers and institutional leaders*, Sybille Reichert cites the following as influencing factors that affect institutional diversity: institutional definitions in laws and regulations, funding streams, criteria for institutional or external funding, accreditation criteria, human resource policies, staff recruitment and promotion policies, student selection and national and institutional reward structures. (EUA, 2009)

Two or three additional and highly pervasive factors could be added to this list, since they have much potential to undermine and challenge diversity and differentiation by driving higher educational change in a rather narrow track towards more uniformity in terms of institutional models, structures, languages of instruction, pedagogical approaches and even scientific, disciplinary specializations. How many institutions do you know that have chosen nanotechnology, biomedical sciences, etc. as their 'unique' niche?

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Eva Egron-Polak is engaged with several pressing policy issues in higher education – internationalization of higher education and intercultural learning, quality of cross-border higher education, equitable access to and success in higher education, and the contribution of higher education to sustainable development or the UN Education for All program, etc. Since her arrival at IAU, she has focused on expanding the Association's convening role, consolidating the Association's capacity as a clearing house of information and launched a number of projects, including regular and systematic global survey on internationalization and the LEADHER grants program for professional development and North-South collaboration. She is a member of a large number of committees at UNESCO, the OECD, the EU.

The first of these forces is the internationalization of higher education itself. Generally considered a highly positive and much needed process, internationalization strategies adopted by some institutions in recent years are bringing about some unexpected and unwanted consequences as well. The internationalization of higher education can be interpreted and defined in a variety of ways. One of the most frequently used definitions, and one adopted by IAU in its research sees the process as a 'multidimensional and comprehensive effort to introduce an international and intercultural dimension into learning, research, services and delivery of higher education. (Knight, Jane, 2004) Thus defined, internationalization is a positive, enriching process designed to protect and celebrate diverse points of view and recognize and integrate the contributions of all cultures, approaches and perspectives into higher education and research. Moreover, it is a top priority for most higher education leaders today. Based on the response of more than 700 institutions in a recent IAU survey, the top three reasons for internationalization are: to improve student preparedness for a globalized world; to internationalize curriculum; and to enhance reputation and profile of the institution. Yet, when, in the same survey respondents are asked to identify the risks of internationalization, they cite the following: commercialization of higher education; contributing to the brain drain; and the loss of cultural identity. (IAU 3rd Global Survey, 2009, to be published)

The pursuit of reputation and profile, in a context of increased global competition among higher education institutions, is the fuel for the global rankings industry.

This perception of risks cannot be derived from the stated rationales nor from the two most important activities undertaken to further internationalization, as identified by the respondents. These were sending

or receiving students on the one hand and the development of research cooperation on the other. In fact these perceived risks stem from the fact that increasingly, the internationalization strategies being implemented fall well outside the scope of the traditional definition cited above. These strategies are also not in line with the top stated rationales. They have more to do with the globalization of the higher education industry – setting up campuses overseas to offer Australian, Canadian, American or French curriculum or style of education in Malaysia, South Africa, Egypt or Vietnam; franchising brand name programs in partnership with private firms, recruiting large numbers of international students both to generate revenue and to bridge gaps between demand and supply for places, especially in certain disciplines. Increasingly such recruitment is simply to secure the talent, especially at graduate levels, to remain in the competitiveness race.

The fact that increasingly, most industrialized nations are helping their higher education sector move in the same direction – towards branding, marketing their systems and establishing market presence for their higher education institutions and offering programs in English – is unlikely to reduce these risks. It is also not promoting diversity particularly since the current geographic concentration (5 nations host 50% of all international students) remains relatively stable, as does the narrow spectrum of key disciplines (engineering, computer science, basic sciences and business). So internationalization, which should and could be a strong countervailing force against uniformity in higher education, is actually not as effective as it could be.

Internationalization is also a path towards prestige and reputation, a fact that is closely linked to the second homogenizing driver influencing higher education reforms at various levels. The pursuit of reputation and profile, in a context of increased global competition among higher education institutions, is the fuel for the global rankings industry. The debate about the merits or demerits of various international and national rankings is heated and will continue to be so as long as those who place well use the results for their benefit and those who position poorly decry the results because they believe the methodology is biased. The only way to dilute the influence of rankings and simultaneously make them more useful is to develop as many kinds as possible. After all, if we believe that diversity among higher education institutions is positive, we cannot find that one or two global ranking schemes can do justice to the variety of mandates

and missions higher education institutions fulfil? In fact, as Ellen Hazelkorn recently underlined in a presentation to the Irish Government's Higher Education Review Group, such rankings also neglect to recognize the reality of differentiation within institutions, thus potentially undermining particularly those strong and innovative centers or groups that need to be nurtured. So the work of the German CHE and the current European Commission project for a multidimensional ranking are both positive contributions to the menu of instruments that are needed to sustain and value diversity among universities and other higher education institutions. Furthermore, alternative models for university assessment are being developed, such as one designed by universities in Malaysia, Japan, Taiwan, and Thailand, which place greater value on sustainability, inclusiveness, and community outreach, alongside more traditional indicators covering research publications and patents.

Rankings influence higher educational policies both internally and externally with the value placed on certain key performance indicators, such as research and publications in certain journals, steering developments. Thus they do not promote differentiation but rather stimulate convergence around those institutional models that emphasize the strengthening of those particular dimensions and indicators that can be easily measured. It is rather unfortunate that, for example in developing nations, the results in rankings are diverting attention and even funding from more relevant needs and priorities.

Yet creativity and innovation are not the exclusive domain of any one institutional type, one discipline, etc. They are not easily measured nor always well-organized or prepared, they often stem from clashes or exchanges and sometimes strange encounters between different perspectives, between science and art for example. Furthermore creativity and innovation cannot be developed and brought to fruition in terms of socially, technologically or even economically productive outcomes without an absorptive capacity in society. Without the capacity to recognize the potential of a new idea or an innovation and turn it into a new service, a new approach or a new product, it can be lost or wasted. This capacity rests with a well-educated population that is open-minded and tolerant, appreciative rather than fearful of 'otherness' or difference.

Thus the search for ways to promote creativity and innovation within the higher education and research sector requires the creation of multiple

spaces that promote and nurture diversity and cross-fertilization of ideas at many levels – between disciplines, between researchers and NGOs, artists, industry and certainly in an international context through mobility and research cooperation. And, in addition to proactive policies, incentives and programs to promote diversity, policy-makers, students and their families, researchers and employers need to become aware of the less obvious forces that need to be resisted if diversity is to thrive. In other words, as Martin Trow stated as early as in 1979, even 'the survival of an elite higher education depends on a comprehensive system of non-elite institutions'. More recently, but with equal conviction, Gerhard Schroeder, former Chancellor of Germany, argued at the World Innovation Summit for Education, organized by the Qatar Foundation in Doha that 'no industrialized nation can afford the failure to seek out and nurture the talents of every member of its society'.

Only a strongly diversified system of higher education that offers access based on potential as well as on merit and ensures that learners from diverse backgrounds have an equal chance to succeed, is a system that will not waste talents.

Only a strongly diversified system of higher education that offers access based on potential as well as on merit and ensures that learners from diverse backgrounds have an equal chance to succeed, is a system that will not waste talents. This ought to be the goal at institutional, systemic and international levels, recognizing of course that such a goal is very difficult to achieve. But if difficult goals are not set, there is no hope of finding creative and innovative solutions to achieve them. ■

Creativity Needs Diversity

The Royal Society is a particularly appropriate place to be holding a discussion on the internationalization of sciences and humanities, given its long history in recognizing and celebrating some of the finest minds in research. However, in the context of exploring creativity and diversity policies and perspectives, it is worth noting that although it was founded in 1660, the first woman Fellow was not elected until 1945. Women remain a small, if rising, proportion of Fellows today. Academic societies, universities and research institutes are in many senses rightly regarded as liberal, meritocratic institu-

tions. However, if new ideas emerge from the crucible where minds meet, then the lack of diversity in the academy sits uneasily with the desire to foster creativity.

It is curious that meritocratic institutions still use ascriptive characteristics, such as gender, to allocate positions and afford opportunities. While the 20th century was noted for the ending of the exclusion of women from academic life in Europe ¹, the 21st century still bears the hallmarks of gender segregation – vertical, horizontal and contractual – within the academy. If we believe that diversity promotes creativity, which is the thinking behind interdisciplinarity and the internationalization of research, then we need to pay serious attention to ensuring institutions do not, however unintentionally, discriminate either directly or indirectly. Ascriptive characteristics, such as gender, race and disability should not be impeding careers in the academy. So, promoting creativity and academic excellence necessitates promoting equality.

The European Commission's Research and Innovation Directorate-General has long been concerned about the international competitiveness of research and development (R&D) in the European Union, as a global region in the world economy. This has prompted over ten years of research and activities on women and science. As a result, gender disaggregated statis-

Promoting creativity and academic excellence necessitates promoting equality.



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tics are now published for each member state and the EU as a whole on a regular basis. The figures demonstrate the extraordinary persistence with which gender remains a powerful organizing principle of the Academy, governing how the scientific infrastructure is populated, both over time and across the member states.

If new ideas emerge from the crucible where minds meet, then the lack of diversity in the academy sits uneasily with the desire to foster creativity.

The European Commission's report on women and science over a decade ago showed that women 'leak' disproportionate to their numbers from scientific careers in every country, in every discipline, at every stage of the academic hierarchy (Osborn *et al.* 1999). The current 'glass ceiling index' for academic institutions in Europe is 1.7 (it would be 1.0 if gender did not make a difference). Fewer than 20% of professors in the European Union are women. They make up less than a third of board members of science and funding organizations. In 16 member states, women comprise

fewer than 10% of University Rectors. This is despite the fact that women are the majority of undergraduates in all but a few of the European Union member states, and now constitute 45% of all new Ph.D. students.²

In industrial research, many of the more successful companies are motivated to develop effective policies to promote diversity precisely because, as Astra Zeneca say, 'cloned people produce cloned ideas' (Rübsamen-Wagmann *et al.* 2003). Their experience shows that where there is a critical mass of women, the culture changes to make the workplace more amenable to them; this aids the recruitment and retention of women. Moreover, there is a positive correlation between the proportion of senior women employed in senior positions in such companies and their profits.

However, while big pharmaceutical companies may have good equality policies, they tend to operate the 'chemist guru with acolytes' model of working. Women are more likely to flourish in the less hierarchical, interdisciplinary research teams in the new, small and medium-

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size enterprises of the bio-science industry, where all individuals are respected for the particular disciplinary expertise that they bring to the table. In this context, the evidence suggests, women are more likely to flourish (Smith-Doerr 2004).

Creativity and diversity in research is not just about who does the research, or who is regarded as excellent, but also about being wise to the significance of gender as a variable in research itself.

Could it be the case that our research institutes, universities and laboratories are starved of senior women scientists because they are not 'as good'? It is important to recognize that 'scientific excellence' is a socially constructed concept. Moreover there is a gender dimension to that construction. Who decides what is scientifically excellent? A political arithmetic of members of scientific prize committees, panels of research councils, editorial boards of academic journals and promotion panels, demonstrates that it is overwhelmingly men who de-

termine what is deemed to be excellent (Osborn 1999). But gender differences in establishing scientific 'excellence' are related to social capital, networks and to the 'attribution of competence in a scientific culture in which the "similar to me" process unwittingly seems to favour men scientists' (European Commission 2004). In exploring the underbelly of sexism in the academy, Foschi records how gender bias modifies both how a given performance is evaluated and how much competence is inferred from performances by men and women already evaluated as successful or unsuccessful (2004). Weneras and Wold (1999) famously revealed in *Nature* how nepotism and patronage can operate even within the context of the peer review system of the Swedish Medical Research Council.

Excellent researchers need to take account, where relevant, of the gender dimension of research itself. The European Commission funded a post hoc evaluation of the gender dimension in the research projects in the Fifth Framework Programme which demonstrated that it was frequently omitted as a key variable in research projects, jeopardizing their validity. For example, a project based on large clinical trials showed that an aspirin a day can be beneficial to avoid heart disease. While the patients used in the trials were all male, the results were applied to men and women. However, women prescribed aspirins frequently reported contraindications. This is not surprising as heart disease is different in women and men. Creativity and diversity in research is not just about who does the research, or who is regarded as excellent, but also about being wise to the significance of gender as a variable in research itself.

A key issue in the development of a scientific career is the challenge of work-life balance. Working long hours is the cultural norm, not least because researchers love their work! The academy and science itself benefits from this dedication. However, such long hours can be both detrimental to a scientist's family life and to engaging in other activities that help to develop a rounded, experienced and mature person. It also restricts who can participate. The European Commission, in its Marie Curie scheme, recognizes the need to make resources available for child care for young researchers going abroad, but such accommodation is relatively rare among research-funding bodies in Europe. Equally, while member states such as Germany and the UK have some schemes designed to facilitate those who have taken a career break for family reasons to return to a scientific career, they are modest in scale.



There are many 'chill factors' that operate within the Academy for women. When I was offered a three-year post as a junior researcher, I was asked to agree to the inclusion of an additional clause in the contract that for its duration, I would not 'get myself pregnant'. Many senior academic women can narrate similar experiences. Valian (1997), in a series of studies, describes the 'male bonus' in the academy. It is not so much that women are disadvantaged but that men are advantaged. The evidence is quite clear that the more transparent and evidence-based recruitment and resource allocation systems are, the more likely that women will succeed.

Cardiff University is one of the research-intensive Russell Group UK universities. We have sought to promote excellence and creativity in research through interdisciplinarity, internationalism and growing capacity. In order to do this, we have a commitment to mainstreaming equality in our strategic plan. There is more transparency and evidence in the promotion system, and the success rates of women are now higher than men (although there are far smaller numbers of female candidates). We have used various devices to encourage creativity through 'speed dating', collision spaces, 'grand challenge' meetings, funding interdisciplinary research institutes and networks, and applying for funding for translational research, from bench science, through to medical applications to recuperation. These initiatives bring together people from different parts of the university who have never met before. By taking people out of their comfort zones and mixing them, we are encouraging them to listen and engage with others, take risks, and see new ways of tackling research questions. It means engaging with people who are 'not like us' – from other disciplines. These experiences can be helpful in learning to accept difference in the academy.

How can research-funding bodies mainstream gender equality in their ways of doing business? By publishing gender audits of committees, gender-disaggregated statistics of who gets funding, by accommodating work-life balance in funding arrangements through policies for parental leave, supporting child care for international work and providing opportunities for those returning to academic life after a period of family leave. But also by applying rigorous peer review, transparency in recruitment to panels and convincing themselves that institutions that they fund have robust equality policies.

Notes

1 In 1999, Cambridge University had a special degree award ceremony for those women who had studied at that university, taken their exams and had them marked before 1949. Up until that year, women had not been allowed to take a Cambridge degree because they were women. The ceremony awarded degrees to over a thousand women in their eighties, nineties and over.

2 All figures from European Commission (2009) *She Figures 2009 Women and Science Statistics and Indicators* Brussels: European Commission Directorate-General for Research <http://ec.europa.eu/research/science-society/index.cfm?fuseaction=public.topic&1d=27>

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Creative Capabilities and the Impact of the ERC Starting Grant Calls

Introduction

The ERC was established in 2007 with the objective 'to reinforce excellence, dynamism and creativity in European research and improve the attractiveness of Europe for the best researchers from both European and third countries, as well as for industrial research investment'. It consists of an independent Scientific Council, responsible for scientific strategy and an administrative arm, the European Research Council Executive Agency (ERCEA).

In the process of formulating the scientific strategy of the ERC, the Scientific Council was careful to consider those conditions which could best foster highly creative research performance. Of particular interest was the

Commission-funded CREA study – Creative Capabilities and the Promotion of Highly Innovative Research in Europe and the United States. Two aspects of this study were of particular relevance for the European Research Council (ERC). The first is that the nature and organization of research funding play a crucial role for the emergence of creative research, especially the need for flexibility in the use of funding, and second, that support for junior scientists early in their careers is vital for promoting creativity.

Young post-doc researchers at an early stage of their careers are therefore a key target group of the ERC. Europe educates a high number of doctoral graduates but offers insufficient opportunities for young investigators to develop independent careers and make the transition from working under a supervisor to being independent research leaders in their own right. This structural problem leads to a dramatic waste of research talent in Europe. It limits or delays the emergence of the next generation of researchers, who bring new ideas and energy, and encourages highly talented researchers



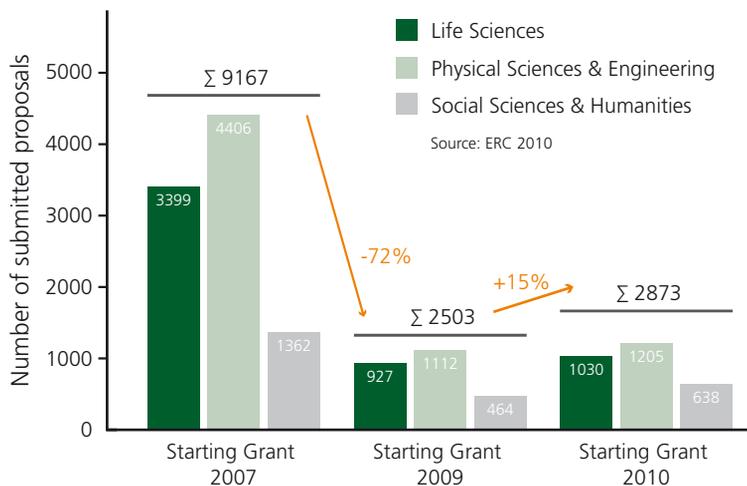
Andreu Mas-Colell

Secretary General, European Research Council, Brussels

Jens Hemmelskamp and Benjamin Turner
ERCEA, Support to the Scientific Council



Figure 1: ERC Starting Grant submissions



at an early stage of their career to seek advancement elsewhere, either in other professions or as researchers outside Europe, particularly in the USA.

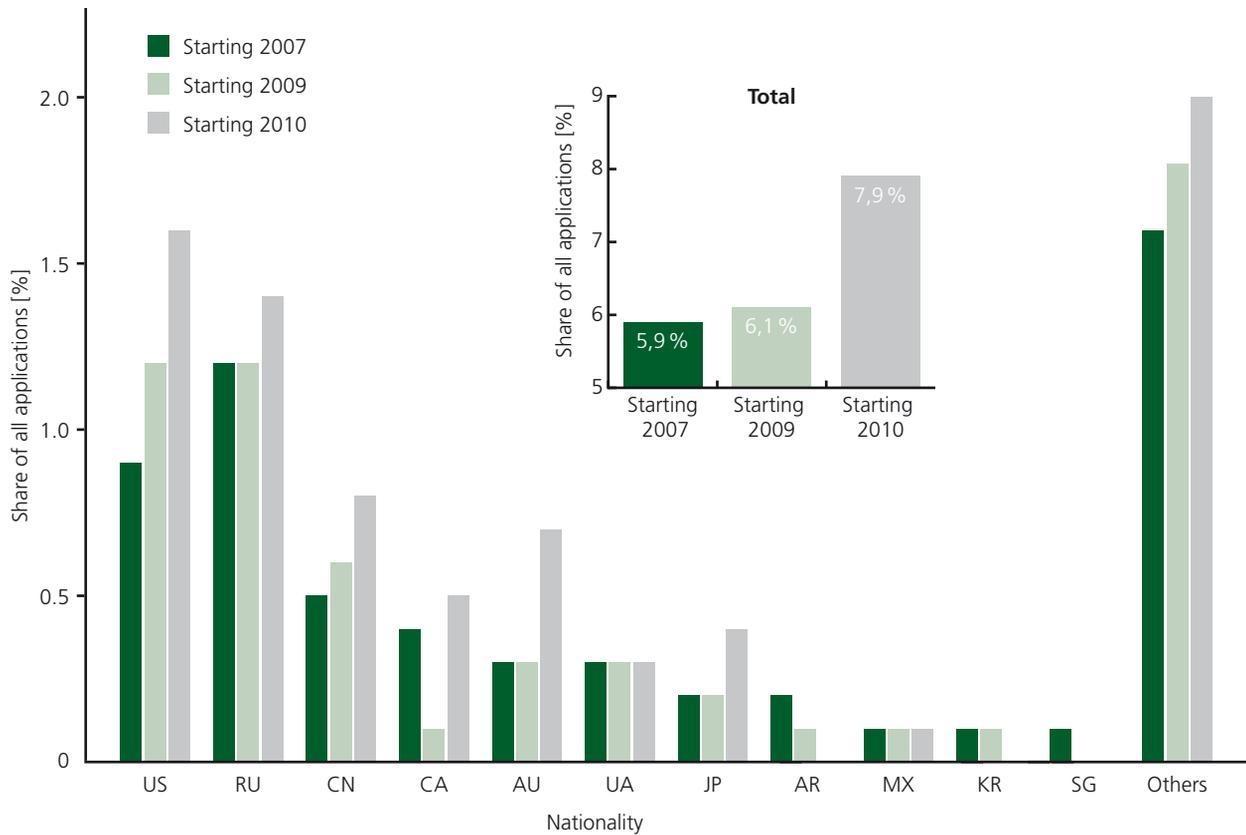
The ERC is well-placed to go beyond previous efforts to address this issue and is committed to making a sustained investment on the scale necessary to have a real impact on European science and scholarship.

Opportunities for young researchers

The ERC provides competitive research funding at the frontier of knowledge without predefined thematic priorities. For the moment two “core” schemes, Starting Grants and Advanced Grants, have been designed. Both are characterized by the scientific independence of the grantholder and the flexibility of the grant. The grants allow researchers to rebudget during the project and portability between institutions. Individual high-quality researchers can propose “bottom-up” research projects in any field of research with the emphasis on high risk, interdisciplinary projects, and these are evaluated on the sole criterion of excellence. Thus, the ERC allows researchers from all over the world to compete for generous, long-term funding and it forces institutions in Europe to compete for hosting the successful researchers.

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Figure 2: ERC Starting Grant submissions of applicants with a nationality of a third country



The ERC Starting Grant scheme targets young research talents with a Ph.D. The aim is to support the transition to an independent career of excellent researchers who are at the stage of starting or consolidating their own independent research team or independent research program.

A competitive Starting Grant PI must have already shown the potential for research independence and evidence of maturity. For example, the PI should have a promising track record of achievements appropriate to their research field and career stage, including significant publications in major peer-reviewed scientific journals.

The evaluation procedure for the Starting Grants takes the specificities of young researchers into account. The ERC attempts to get further information on the applicant’s potential or the quality of his research idea beyond the written proposal, the CV or the publication list through personal interviews in the premises of the ERC Agency in Brussels. These interviews take place in step 2 in addition to the peer review procedures evaluating the written proposal. The experience of the panel members confirms that in particular the interviews provide a deep understanding of the proposals but also provide an opportunity for the applicants to convince the evaluation experts with a focused and well-prepared presentation.

Three ERC Starting Grant calls have been published since the start of the ERC in 2007. Around 14,543 proposals for funding were received of which 543 projects have been selected for funding up to now.¹

This shows that the ERC Starting Grant scheme is addressing a real demand from the European research community. However this demand has also led to very low success rates. In the first four completed calls (including the Advanced Grant), the success rates were below 10% and there is a high number of proposals which pass the quality threshold but cannot be funded due to budget constraints. This was particularly true for the first Starting Grant call published in December 2006 with a budget of €338 million. An unexpectedly high number of 9167 proposals were received of which only 299 applicants were ultimately funded.

Fortunately, success rates are improving with the ERC's increasing budget and a new understanding on the part of the European research community of the level required to compete successfully in the ERC competitions. For the second Starting Grant call in 2009, 2503 proposals were submitted of which 244 projects were invited up to now for funding, which corresponds to a 10% success rate. The third call in 2010 has resulted in 2873 applications (see Figures 1 and 2).

Also a number of countries have development schemes to support their nationals who successfully pass the ERC competition but are not funded due to the limited budget of the ERC. There are also funding schemes which help early stage researchers to prepare for ERC competitions or which complement ERC funding. As can be seen in Figure 3, the distribution of ERC grants is not even across the Member States and Associated countries.

The share of the total number of grants to institutions in Germany is relatively low in comparison to Germany's very significant share of Europe's total research expenditure.

Figure 3: Success rate by country of the host institution of the Starting Grant 2009 call

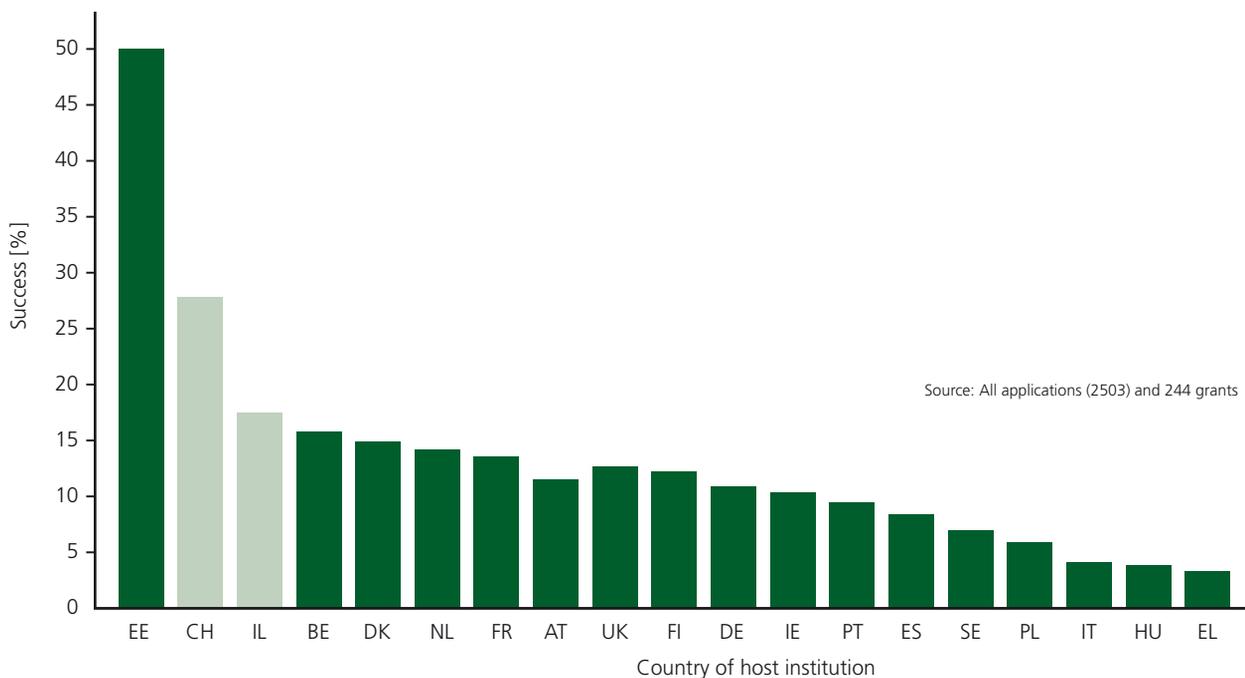
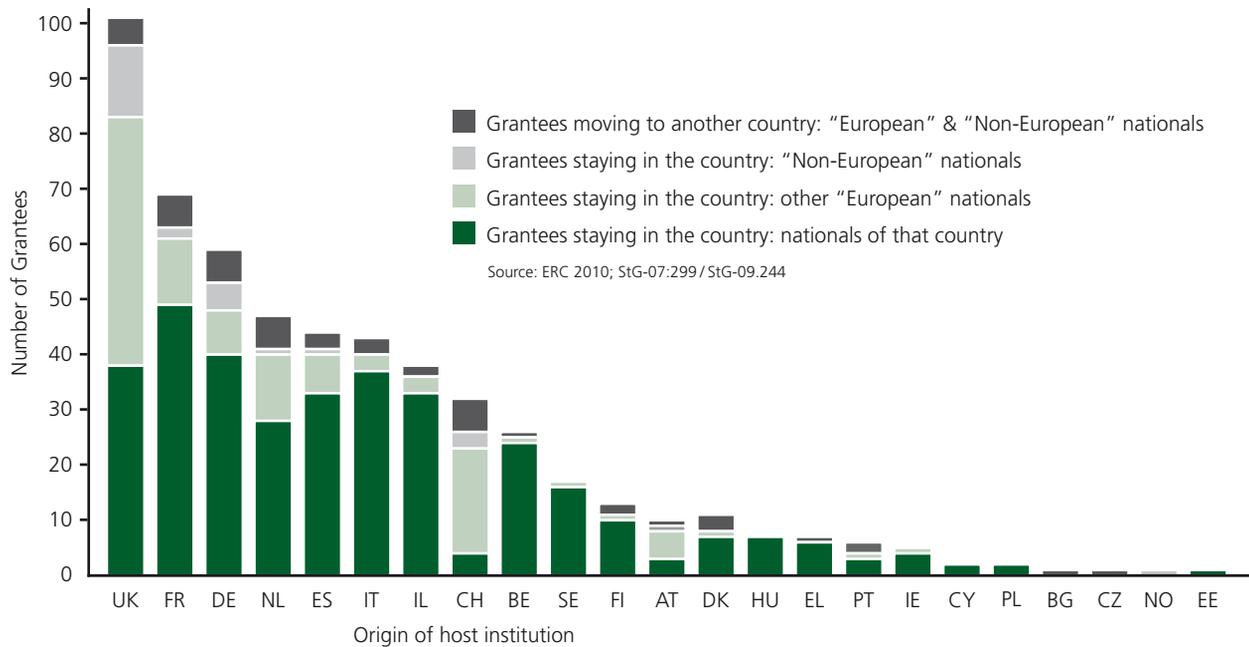


Figure 4: Origin of Starting Grant holders



Relevance of the research environment and the framework in which creativity can occur

In general ‘the grant distribution reflects the reality of unevenly distributed national R&D investments across Europe’. The number of ERC grants to institutions in a country scales with the absolute size of that country’s gross domestic expenditure on R&D (GERD). The correlation is even stronger between the absolute number of researchers in a country and the ERC grants to nationals of that country.

However there are significant deviations from this trend. Analyzing the reasons for these deviations should start ‘to illuminate the performance of individual countries, regions, and institutions’.² For example, the share of the total number of grants to institutions in UK, Switzerland, Netherlands, Israel and Spain is relatively high in comparison to those countries’ share of Europe’s

total research expenditure. The share of the total number of grants to institutions in Germany is relatively low in comparison to Germany’s very significant share of Europe’s total research expenditure.

The number of grants to nationals of Italy, Netherlands and Belgium is relatively high in comparison to the share of Europe’s total population of researchers of those countries. The number of grants to nationals of Germany, Poland, France, Spain and the Czech Republic is relatively low in comparison to the share of Europe’s total population of researchers of those countries (see Figure 4).

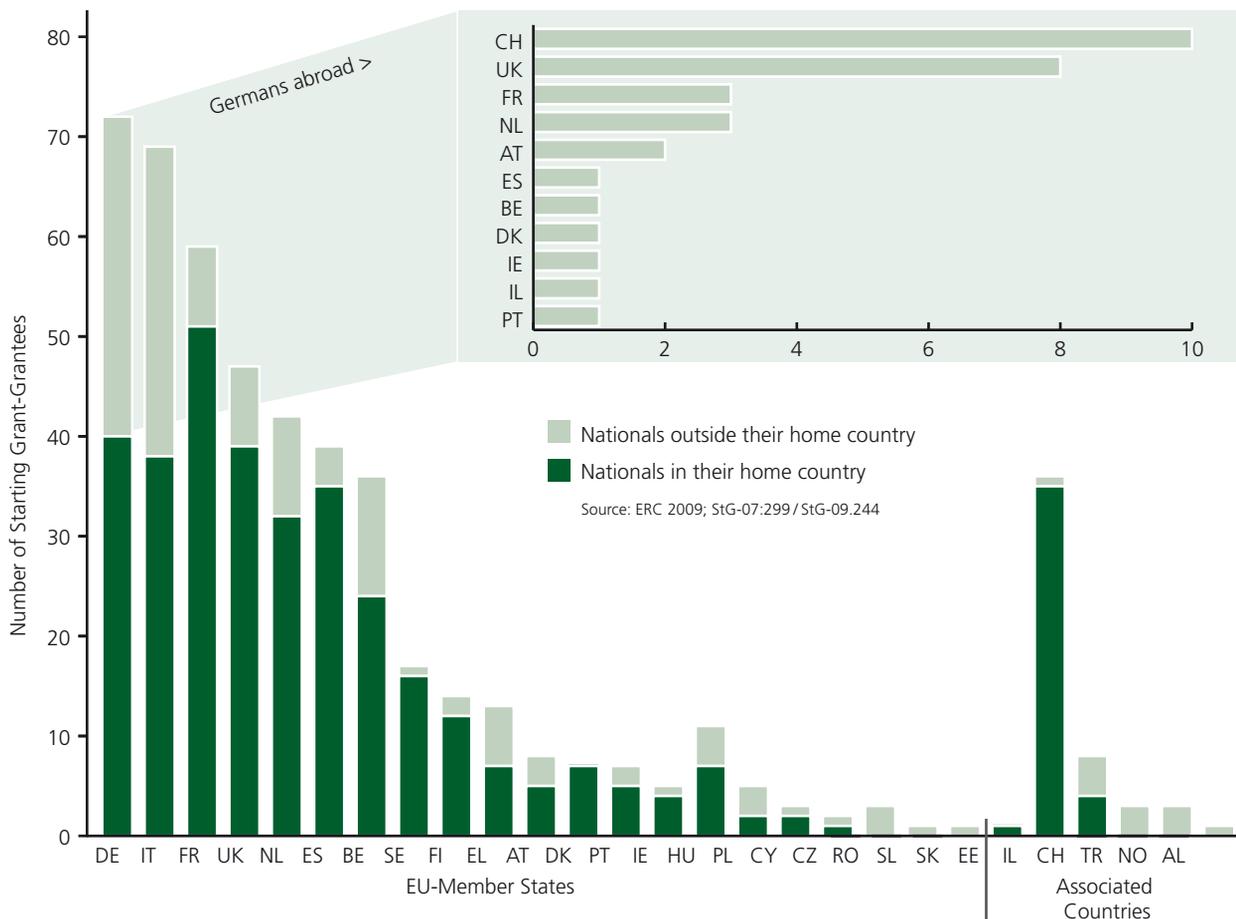
However, we can already see that grants are concentrated on a relatively small number of research institutions. While in the first four calls ERC grantees are hosted by more than 300 institutions, about 60% of them are hosted at just 60 institutions. The national level may therefore only be important in terms of the distribution of ERC grants in so far as national policies facilitate the existence of certain specific world-class research institutions. The majority of these host institutions are universities underlining that universities constitutes a main locus for research activities, in particular for more path-breaking, basic research.

The majority of the selected European nationals chose a host institution in their home country but 29% of the Starting Grant holders work outside their home country (see Figure 5). However, these patterns differ considerably between the host countries. One striking observation is that Switzerland is able to attract a high number of researchers from European countries and from overseas for a job in Swiss universities or research labs. In fact, the high R&D budget per researcher in Switzerland is a symptom of a strong science orientation of this country. The majority of the 32 successful Starting Grant grantees in Switzerland are non-nationals who were already in Switzerland and remained there after receiving the ERC grant; 19 PIs are European nationals, in particular from Germany, 3 are non-Europeans and there are 6 researchers who relocated to Switzerland from European countries or the U.S.

The UK also attracts young researchers from all over the world. More than 65% of all Starting Grant PIs are non-UK nationals from other European countries or Third countries who remained in the country and 6 PIs moved to the UK from Argentina, Germany, or the Netherlands as well as one UK national who moved back to his home country from the U.S.

It is noticeable that countries and institutions have started to react by implementing incentive systems for ERC grants. The city-state of Berlin recently announced that ERC host institutions in Berlin will get a financial reward for each successful ERC applicant. The University of Ghent offers tenure track for successful applicants.

Figure 5: Nationality of the grantholders and country of host institution



Competition was always intended to be an element of the ERC. And one of the most powerful potential impacts of the ERC will therefore be to stimulate structural change in the European research system by demonstrating where the system is or is not currently excellent. There is already evidence that the benchmark provided by the ERC has played an important role in national policy developments and that it had helped the idea of competitive research funding gain momentum in countries in which traditionally block-funding to institutions were the preferred funding mode.

As a pan-European research funding based on competition, the ERC provides a benchmark of national research systems and institutional practices.

The ERC was an important factor in the on-going overhaul of the Polish public research-funding structure: in the beginning of April 2010, the Polish Parliament passed a set of laws, including among others the creation of the National Research Center (NCN) whose mission is to support frontier research by competitive, responsive, and peer-review-based funding mode modelled on the ERC ones. It is hoped that this move would enable Poland, the 6th largest country in EU and its 7th largest economy, to realize its potential in R&D performance.

Outlook

The results of the ERC's Starting Grant calls so far show that some top institutions in some countries are able to attract talented and competitive young researchers. These institutions configure their overall performance by offering attractive "milieus" for work and living. An excellent researcher that may successfully compete in an ERC call has normally a reputation that makes it possible for him or her to choose and to take an appointment at an institution that provides adequate framework conditions in a local or regional innovation system, e.g. efficient governance structures, sufficient time to do research, adequate wages or portable grants with social security provisions, good social atmosphere, career perspectives or family support programs like double career programs or more child care facilities and not at least a lively cultural surrounding.

The ERC Starting Grant competition must be seen in the context of a world-wide competition between research institutions for talents and excellent researchers. The ERC can support and foster the competitiveness of European institutions by offering generous, flexible and portable grants but what must be taken into account is that efforts of the potential host institutions constitute the primary factor necessary for the attraction and retention of excellent researchers in Europe.

This highlights another important aspect of the impact the ERC is expected to have on the European research policy scene. As a pan-European research funding based on competition, the ERC provides a benchmark of national research systems and institutional practices. This should be instrumental in setting in motion or giving support to important reforms in the way research is funded in the EU member states.

Table 1: ERC facts

	Received proposals	of which		
		ineligible/withdrawn	evaluated	selected
Starting Grant 2007	9,167	373	8,794	299
Starting Grant 2009	2,503	111	2,392	244
Starting Grant 2010	2,873	(104)	(2,769)	
Total Starting Grant	14,543			
Advanced Grant 2008	1,583	57	1,526	244
Advanced Grant 2009	2,167	133	2,034	282
Advanced Grant 2010	2,009			
Total Advanced Grant	5,759			
Grant Total	20,302			(1,069)

Notes

- 1 The reference date for all data is end of March 2010.
- 2 See Antonoyiannakis, Hemmelskamp and Kafatos (2009): 'The European Research Council Takes Flight', in: *Cell* 136:805809.

OBSERVATIONS AND
RECOMMENDATIONS

The Challenge of Scientific Innovation in Transnational Perspective

Scientific innovation can only prosper in an atmosphere that allows for cutting-edge research at the frontiers of knowledge. It requires a climate that fosters curiosity, originality and the generation of new ideas, promotes institutional and methodological diversity as well as international and interdisciplinary cooperation, and that encourages risk-taking and early independence – in short: it needs a culture of creativity. The call for such a culture of creativity has become ubiquitous in German academia and politics in the past few years: recent German government initiatives aim at enhancing scientific creativity and inventive talent for sustained development, German universities call upon the idea of creativity to succeed in the “Initiative of Excellence” and a range of recent conferences have tried to explore what role creativity can play in both basic research and high-end R&D. Yet what does a culture of creativity actually entail? What promotes and what impedes such a culture of creativity? What institutional structures are needed to do integrative, innovative, and transformative research, and how must research be organized to meet the challenging complexity of scientific problems in the 21st century?

The following theses summarize rather general observations and recommendations, drawn from the papers and discussions of the third Forum on the Internationalization of Sciences and Humanities by the Strategy Department of the Alexander von Humboldt Foundation on behalf of the International Advisory Board.

Creativity needs freedom and flexibility

- *Scientific innovation is driven by people. Therefore, freedom is one of its prerequisites of creativity. Young researchers in particular should be able to work independently at an early stage of their careers and at the same time should receive better mentoring.*
- *Moreover, international competitive research is only possible in suitable research environments offering excellent infrastructure with top-level experimental equipment and at least professional assistance by technicians and support from permanent staff. This helps scientists to concentrate on science and research.*
- *As creativity often is an “outcome of unplanned, chaotic action” (J. Plamper) and scientific research is an open-ended process in which results are not known in advance (R. Väyrynen), researchers and scientists need an utmost degree of flexibility – in their daily work, their daily lives, but also with regard to their financial remuneration. Financial incentives on top of the regular salary could provide for open-ended research projects not subject to evaluation and would also allow for a fast and flexible reaction to new scientific challenges.*
- *Research careers must be made attractive and predictable. This means adequate social security and health insurance schemes, adequate working conditions uninhibited by bureaucracy, attractive salaries and promotion schemes, as well as a whole range of support instruments for researchers and their families, not least in order to make dual careers possible. Therefore, research institutions and universities, funding organizations and governments must also jointly strive to convince young people to remain curious about science and engage in research as a profession.*

Creativity needs smaller social structures and international research networks

- *Smaller research groups are more adequate to develop new ideas that depart from the established ways of thinking. While larger units may fit the needs of natural, life and some social sciences, in the humanities smaller units may give rise to new paradigms more easily. While innovation is increasingly steered by organizations, technology, and money, and scientific research has increasingly been converted into institutional, even industry-like processes (R. Väyrynen), scientific innovation is the product of people, and scientific ideas are social in nature. Scientific creativity, therefore, also depends on the individual scientist's and researcher's social environment.*
- *A research system should allow researchers to be creative and concentrate on science and research rather than 'honor' success by 'promoting' researchers to managers. The growing load of administrative work resulting from the increasing complexity of the self-organization of research institutions and universities, but also from the growing pressure for harmonization, output evaluation, and coordination, is one of the main impediments for scientists. When research units become too large, young scientists in particular have to wait for too long until they get the chance to conduct their own independent research (D. Imboden).*
- *The internationalization of research environments is an important condition for scientific creativity and innovation. Internationalization stimulates life in any community, not least since "personal encounters can be more creative and productive than the transmission of data between computers" (R. Väyrynen). It facilitates the sharing of new ideas and helps to overcome boundaries between disciplines and cultures.*
- *Research-funding organizations should primarily provide support of basic research without any thematic restrictions and without subjecting the researcher to output evaluation with regard to a previously defined product. As "the ultimate basis for innovation is the 'primary production' of knowledge" and "discoveries occur primarily by bottom-up driven basic research" (D. Imboden), a central task of research-funding organizations, is to identify and support high-quality and creative research. Peer review of external experts combined with the assessment*

of the reviews by 'internal' specialists – active researchers themselves – should therefore be the standard.

Scientific innovation needs institutional diversification, competition and cooperation

- *Introducing new structures can be immensely stimulating and can lead to an increase of creative ideas. The German "Initiative of Excellence" has encouraged universities and research institutions to question established ideas of research organization. The establishment of new research-beneficial structures, in particular for young researchers, seems particularly valuable.*
- *Scientists and researchers need to be encouraged to listen and engage with other units, take risks, and discover new ways of tackling research questions. As unique places of knowledge creation, universities are more than the sum of their individual parts. Greater institutional diversification as well as an increase in competition and differentiation between and within universities stimulates the sharing of resources and leads to collaborations between otherwise unconnected centers. Therefore, research cooperation often becomes an important pre-condition to accomplish challenging goals.*
- *A more robust cooperation and new strategic alliances between university and non-university research institutions does not only help to bridge the two-pillar system in Germany, but also stimulates creativity by accelerating the process of differentiation with regard to the functions of universities and research institutions, as well as with regard to the quality of research.*

- *Steering and directing academic work to respond to the needs and demands of civil society is a matter of academic responsibility. In order to exploit basic research results for civil society and make them economically productive, universities and research institutions must therefore also provide for knowledge-transfer offices at the interface between the supply and demand sides of the knowledge economy (C. Brink), unless potentially important knowledge gets lost. "Knowledge transfer is the domain of the specialist who should be located close to the place of knowledge production, i.e. in the universities and research institutions" (D. Imboden).*
- *On a systemic level, internationalization can be a strong countervailing force against uniformity in higher education and research by increasing global competition among institutions of higher education and research, but also among national science and research systems.*
- *Gender balance needs to be enhanced in order to achieve a higher degree of diversity. Women in particular profit from less hierarchical, interdisciplinary research teams and smaller to medium-size research institutions. The pursuit of creativity and diversity necessitates an awareness of the significance of gender as a variable in research itself and of 'scientific excellence' as a socially constructed concept. The more transparent and evidence-based recruitment and resource allocation systems are, the more likely that women will succeed.*

Creativity needs diversity and equality

- *The internationalization of the German higher education and research system leads to a higher degree of diversity. When international mobility is seen as a conscious decision to broaden one's own mind by exposing researchers and scientists to an unknown research (and living) environment, and making him or her explore new shores of science, creativity can flourish.*
- *Rigorous peer review, transparency in recruitment, and robust equality policies must be in place to guarantee equality and promote diversity and creativity. Funding organizations and research institutions should consider publishing gender audits of committees, gender-disaggregated funding statistics, accommodating work-life balance in funding schemes by providing for parental leave, supporting child care for international work and assisting those returning to academic life after a period of family leave (T. Rees).*
- *Resources for child care must be made available to a larger extent for young researchers going abroad. National and European funding schemes providing help for those who have taken a career break for family reasons to return to a scientific career, should be extended.*
- *Fostering creativity and diversity in science and research necessitates promoting equality and ensuring equal opportunities. Creativity and innovation are nurtured by clashes, exchanges and sometimes strange encounters of different perspectives. Only a diversified higher education and research system, providing opportunities based on potential and merit and ensuring that people of diverse backgrounds have an equal chance to succeed, is a system that does not waste talent (T. Rees). A diverse academic community must welcome unconventional people, as well.*



APPENDIX

Forum Participants 2009

A

Albrecht, Ulrike

Director Strategy Department, Alexander von Humboldt Foundation, Bonn

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Baumanns, Markus

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Bayvel, Polina

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Boomgaarden, Georg

Ambassador, German Embassy, London

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Distinguished University Professor, University of Maryland at College Park,

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American Friends of the Alexander von Humboldt Foundation, Washington

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Krull, Wilhelm

Secretary General, Volkswagen Foundation, Hannover

Kuo, Peggy

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Professor of Chemistry, Texas A & M University

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Director, Fritz Thyssen Stiftung, Cologne

Rohe, Wolfgang

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Walport, Mark

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Warner, Mark

Professor of Physics, University of Cambridge

Wulf, William A.

AT & T Professor of Computer Science, University of Virginia

Zacharias, Margit

Professor for Nanotechnology, University of Freiburg

Zoll, Amélie

Program Assistant, International Advisory Board, Alexander von Humboldt Foundation, Bonn

Z

Positions refer to the date of the Forum in November 2009.

The International Advisory Board of the Alexander von Humboldt Foundation

The Alexander von Humboldt Foundation is a non-profit foundation established by the Federal Republic of Germany for the promotion of international research cooperation. It enables highly qualified scholars not resident in Germany to spend extended periods of research in Germany and promotes the ensuing academic contacts. The Humboldt Foundation promotes an active world-wide network of scholars. Individual sponsorship during periods spent in Germany and longstanding follow-up contacts have been hallmarks of the foundation's work since 1953.

Chairs



Helmut Schwarz is Professor of Organic Chemistry at the Technische Universität Berlin and President of the Humboldt Foundation. He has worked as visiting professor at a number of research institutions abroad and has served as Vice-President of the Berlin-Brandenburg

Academy of Sciences and Humanities, Vice-President of the German Research Foundation (DFG), Chairman of the Scientific Advisory Board of the German-Israeli Research Programme and Vice-Chairman of the Board of Directors of the Fonds der Chemischen Industrie.



Kenneth Prewitt is Carnegie Professor of Public Affairs at Columbia University and Vice-President for Global Initiatives. He has held appointments as Dean of the New School University's Graduate Faculty of Political and Social Science, as Director of the U.S. Census Bureau, President

of the Social Science Research Council and Senior Vice-President of the Rockefeller Foundation. He has served on Advisory Boards to the World Bank, the World Health Organization, UNESCO and numerous other U.S. and international organizations.

The International Advisory Board of the Alexander von Humboldt Foundation is an independent, international expert group which meets once a year to discuss strategic issues relating to the global mobility of researchers and the internationalization of research. The Board provides a forum for debate on global developments in science and academia, science policy, and science administration.

Members



Lisa Anderson is the Provost of the American University in Cairo (AUC). Her responsibilities include shaping and implementing AUC's academic vision and building the size

and quality of the faculty. She is an expert on politics in the Middle East and North Africa. Her research focuses on state formation in the Middle East and North Africa; on regime change and democratization in developing countries; and on the link between social science, academic research, and public policy both in the United States and around the world. Dr. Anderson serves on the Board of the Carnegie Council on Ethics in International Affairs, and is a member of the Council on Foreign Relations. She holds a B.A. from Sarah Lawrence College and an MA in law and diplomacy from the Fletcher School at Tufts University. She earned a Ph.D. in political science from Columbia University, where she was Dean of the School of International and Public Affairs.



Gerhard Casper is President Emeritus of Stanford University. He is also the Peter and Helen Bing Professor and a Senior Fellow at the Freeman Spogli Institute for International Studies at Stanford. Mr. Casper studied law at the universities of Freiburg (Ph.D. 1964), Hamburg, and Yale University. After an initial teaching position at the University of California at Berkeley, Mr. Casper spent twenty-six years at the University of Chicago, where he served as dean of the law school, and, in 1989, became provost, a post he held until he accepted the presidency of Stanford University in 1992. He has written and taught primarily in the fields of constitutional law, constitutional history, comparative law, and jurisprudence. He is a member of the Council of the American Law Institute, a Fellow of the American Academy of Arts and Sciences, a Fellow of the American Philosophical Society, and a member of the Order Pour le mérite for the Sciences and Arts.



Angelos Chaniotis is Senior Research Fellow at the All Souls College of the University of Oxford. He has held positions as Professor of Classics at New York University and as Professor of Ancient History and Vice-Rector for International Affairs at the University of Heidelberg. He served as representative of the University of Heidelberg in the League of European Research Universities and is a member of the Advisory Board of the Helsinki Collegium for Advanced Study.



Rita Colwell is Distinguished University Professor of Environmental Health Sciences both at the University of Maryland at College Park and Johns Hopkins University Bloomberg School of Public Health and Senior Advisor, Canon U.S. Life Sciences, Inc. She served as the 11th Director of the National Science Foundation, is a member of the National Academy of Sciences and recipient of the National Medal of Science. Dr. Colwell has held many advisory positions in the U.S. Government, non-profit science policy organizations, private foundations, and international scientific research community.



Ute Frevert is Director at the Max Planck Institute for Human Development and Scientific Member of the Max Planck Society. Between 2003 and 2007 she was a professor of German history at Yale University and prior to that she taught History at the Universities of Konstanz, Bielefeld and the Free University in Berlin. Her research interests include social and cultural history of modern times, gender history and political history. Ute Frevert is an honorary professor at the Free University in Berlin and member of several scientific boards; she was awarded the prestigious Leibniz Prize in 1998.



Katharina Kohse-Höinghaus is Professor of Chemistry at Bielefeld University, President of the German Bunsen Society, member of the Senate of the German Research Foundation (DFG) and of the Board of Trustees of the Volkswagen Foundation. She has held positions as Senior Researcher and Group Leader with the German Aerospace Research Center (DLR) in Stuttgart and was awarded a Heisenberg fellowship. Her international experience includes periods in the USA and France. She is also a Fellow of the International Union of Pure and Applied Chemistry and a member of the Board of Directors of the International Combustion Institute.



Wilhelm Krull is Secretary General of the Volkswagen Foundation, one of the largest private science-funding organizations in Germany. He has held leading positions with the Wissenschaftsrat and Max Planck Society and serves on numerous national, foreign, and international committees

and boards, including the Governing Boards of the Universities of Göttingen and Budapest, the Scientific Advisory Commission of the State of Lower Saxony, and of the Board of Regents of several Max Planck Institutes.



Yuan Tseh Lee is Distinguished Research Fellow at the Institute of Atomic and Molecular Sciences of Academia Sinica in Taiwan, and President-Elect of International Council for Science (ICSU). He was awarded the 1986 Nobel Prize in Chemistry with Dudley Herschbach and John

Polanyi. He has held positions as Professor of Chemistry at University of Chicago and UC Berkeley, University Professor at the UC Berkeley, Principal Investigator in the Lawrence Berkeley National Laboratory, President of Academia Sinica as well as the Chief Scientific Advisor to Prime Minister. He has served on numerous national and international organizations, including U.S. Department of Energy, Welch Foundation (USA), International Scientific Council of the Israeli-Palestinian Science Organization, Science and Technology in Society Forum (Kyoto), RIKEN (Japan), and Okinawa Institute of Science and Technology.



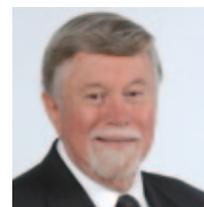
Ekhard K.H. Salje has held positions as Professor of Physics, Mineral Physics and Crystallography at the Universities of Hannover, Paris, and Cambridge and was Head of the Department of Earth Sciences and President of Clare Hall, a Cambridge College. He has served as advisor to

the Wissenschaftsrat (German Council of Science and Humanities) and to the Deutsche Forschungsgemeinschaft (German Research Foundation) on university reform. As President of the Alexander von Humboldt Association of the U.K. he built strong links with Germany and fostered the academic exchange between the two countries. He has held visiting professorships in Japan, Spain, Germany and France and is currently Ulam scholar in the U.S. (Los Alamos).



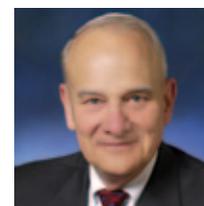
Konrad Samwer is Professor of Physics at the University of Göttingen and Vice-President of the German Research Foundation (DFG). He has held positions as Professor of Physics

and Dean of the Faculty of Mathematics and Natural Sciences at the University of Augsburg and has served on numerous selection and steering committees.



George E. Walker is Professor of Physics and Senior Vice-President for Research Development and Graduate Education, and Dean of the University Graduate School at

Florida International University. He has held appointments as Professor of Physics, Vice-President for Research and Dean of the Graduate School at Indiana University, and has served as Chair of the Council of Graduate Schools, President of the Association of Graduate Schools of the Association of American Universities (AAU), and Chair of the Council on Research, Policy and Graduate Education of the National Association of State Universities and Land-Grant Colleges (NASULGC). He directed "The Carnegie Initiative on the Doctorate" while a Senior Scholar at the Carnegie Foundation for the Advancement of Teaching.



William A. Wulf is a University Professor and AT&T Professor of Engineering at the University of Virginia. He was formerly the President of the National Academy of Engineering, an Assistant Director of the National Science Foundation, Founder and CEO of Tartan Laboratories Inc., and a Professor of Computer Science at Carnegie Mellon University.

History and Mission

The International Advisory Board was established in 2007 in response to an increasing demand for expertise in questions concerning the internationalization of science and scholarship. It is successor to the Advisory Board of the Foundation's Transatlantic Science and Humanities Program (TSHP), which was established in 2001 with the aim of creating a binational network of experienced leaders from German and North American academia, science administration, and science policy. The International Advisory Board supports the Foundation's strategic planning. As an independent expert group, it addresses current developments in global academic markets and identifies topics of special strategic concern for the Foundation and its partners in Germany, the United States, and beyond.

The Forum on the Internationalization of Sciences and Humanities

The International Advisory Board hosts an annual Forum on the Internationalization of Sciences and Humanities, opening its discussions to a select group of leading international experts and top management officials representing the Foundation's partner organizations. Each forum provides an opportunity for eminent international experts to hold an open exchange of views in a private setting. Important minutes of the proceedings and recommendations are published for the benefit of a wider audience.

The Board's first Forum convened in 2007 in Washington, D.C. It was dedicated to the topic "Postdoctoral Career Paths: International Perspectives" and featured expert reports from the OECD and European Union, from the United States, Portugal, Germany, Great Britain, China, and India. The second Forum took place in 2008 in Berlin, and focussed on "Strategies to Win the Best: German Approaches in International Perspective."



Forum Participants 2009



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