

Creativity and Innovation as a Challenge for European Universities and Foundations

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I. Changes and challenges

Change and talking about change and the challenges that go with it are as old as European thinking. The Greek philosopher Heraklitos once said: "Change is the only thing in the world which is unchanging." And yet, when we look back at the developments of the past ten to fifteen years, we cannot help but recognize that the speed of change has increased quite dramatically. This not only applies to the European political landscape but also to the public private infrastructures that impact upon our daily lives. Gradually, we have come to realize that we live in an increasingly interdependent, basically science and technology driven world which requires a thorough rethinking and subsequent re-alignment of our hitherto quite stable concepts and approaches.

During the next 20 years, Europe's economic paradigm will change fundamentally. While the manufacturing base will continuously shrink, future growth and social welfare will rely increasingly on knowledge-intensive products and services. And we can also observe that, particularly with our demographic development in Germany and more or less in the whole of Europe, we are faced with a completely new challenge of how an ageing society can actually innovate. In this respect – as well as with respect to the overall financial situation – priority-setting will become even more important in the future.

As far as the research and higher education sector is concerned, I foresee six major developments. The first one is the increasing impact of electronics and information technology on the creation, distribution, and absorption of new knowledge. The second one is an increased emphasis on inter-, or transdisciplinary approaches; and the third one is the move from bi- or trilateral

internationalisation towards network approaches and strategic alliances, setting up for example joint graduate schools or virtual research centres across the globe, and thus linking up with elite institutions in other countries. The fourth major development is the changing public/private interface and its consequences for the division of labour, particularly in the research and technology sector as well as the need to mobilise more private resources for public purposes like basic and strategic research. The fifth major development is on the research side itself which has to come to terms with integrating evaluation, foresight approaches, and priority-setting processes, thereby trying to find new ways of assessing performance while at the same time avoiding solutions that are too technocratic. And finally, of course, the growing public concern about recent scientific and technological developments, particularly in areas like stem cell research or nanotechnology, but also in other areas, is also an issue that the research community has to consider discussing which kind of programmes and which kind of approaches we develop.

II. Strengths and weaknesses

When we try to position Europe's performance on a global scale, it is interesting to see that the picture is not as bleak as it is often reported in the press. As you know, the EU countries have agreed to a goal for 2010 of spending 3 % of GDP for research and development. It is an ambitious goal and, thus far only the Nordic countries have reached the 3 % threshold or are even beyond it. With respect to the total number of graduates the figure for the EU is larger than for the United States. Also the number of PhD graduates is almost twice as large as the number in the US. When we look at the numbers of scientific papers published in the different parts of the world, we also see that Europe has overtaken the United States in the mid-1990s and is currently the largest producer of scientific publications. But in the meantime we have to recognize that the Asia-Pacific region is catching up quite fast. This rapid growth of scientific output in Asia-Pacific nations is in stark contrast to slow growth in Europe and stagnation in the United States. If this trend continues, the Asia-Pacific nations will be the biggest research community in about ten years time from now. In a number of other relative indicators – such as publications per inhabitant, per scientist or per million Euros spent in our universities – the EU is also ahead of the United States and Japan; and in triad patents per millions spent in business R & D, some European countries – Germany, Sweden, and the Netherlands – clearly outperform Japan and the US.

With respect to elite institutions, Europe is not in such a good position. For example in a ranking of the best universities published by Shanghai Xiaotong University 2005, only two of the top twenty universities were European, while 17 were American. On the other hand, in the top five hundred of the same ranking, Germany comes second with the 46 universities compared with 38 British and 168 American universities. Of course, we could discuss the basis for these rankings and the explanations for these results at length, and it seems to me that we have tried to develop good universities in the various parts of Germany, but over the last three decades we have not really focused on creating high-class internationally competitive universities, and the result is shown in these rankings as well as in many other benchmarking studies. Europe has also been loosing ground in the field of basic breakthroughs. Fifty years ago, European scientists dominated the lists of the Nobel Prize. Today, Nobel Prizes and similar prestigious awards are mainly won by scientists working in the US. And the gap in R&D investments between the EU and the US is steadily increasing. Apart from a few research areas such as astrophysics, 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.

The message for European research in an environment of global competition seems pretty clear: We really have to make an effort if we want to develop competitive research structures as well as support competent researchers in future. However, as the relative indicators show, we are not doing as badly as is publicly perceived, we are doing quite well in some respects, and we still have a very strong research base – I believe it is important to keep this in mind when analyzing the overall situation. But we really have to do something to establish new cultures of creativity in order to achieve major breakthroughs.

III. The role of foundations

European foundations are a very heterogenous pool of institutions whose defining characteristics often depend on local factors and the regulatory environment. In comparison to the US, foundations in Europe have played a less prominent role until now, but in recent years the importance of foundations has grown significantly. According to the latest comparative statistics for Italy and Germany, around 50 % of registered foundations have emerged since

1990, while other countries such as Belgium, Finland, France, and Sweden report between 19 and 29 % increases in the number of foundations.

Unlike publicly financed funding agencies which have to provide equal opportunities for all institutions, private foundations can act much more freely, flexibly and quickly. They can put objectives on top of rules and regulations, and they do not have to wait for political consensus. They can really encourage different ways of thinking and enable new lines of research very early on by supporting the first experiments, taking risks, and being frontrunners in institutional reform. Furthermore, due to the perpetuity of their funds, foundations have the capacity to be reliable partners who are willing to foster risky projects, and who have the capacity to help researchers in groundbreaking activities. They do not have to consider election periods or shareholders views. Therefore, they can strive to gain new insights, develop fresh ideas, find solutions for endeavours that their politicians cannot or do not want to embark upon.

Their independence contributes to the inspiring effect that private funding has on the development of higher education and research, but it also increases the willingness of citizens and enterprises to spend their money on these purposes. However, there are also limitations to the contributions of foundations. Given the billions of Euros spent by public authorities and enterprises, the impact of comparatively small-scale foundations is dependent on spill-over effects. Foundations have to rely heavily on partnerships. If we can develop the right kind of partnerships, we can have a liberating effect, and this is – in my opinion – the way forward, particularly with respect to risky projects and researchers who are prepared to follow new pathways. Despite this limitation, foundations have the flexibility to respond quickly to the needs of the research community, to pilot projects, and trigger spending on research by other funders by fostering risky projects, encouraging change, and helping the most creative researchers to break new grounds, foundations can at least create a few islands of success. They can encourage and support institutions and their leaders to engage in change processes towards achieving research-, and innovation friendly structures.

IV. The way forward: Towards a culture of creativity

When it comes to establishing a culture of creativity, there are at least seven aspects which have to be considered (but I am sure that one could come up with many more): competence, courage, communication, diversity, persistence and perseverance, innovativeness, and serendipity.

IV.1. Competence

The first precondition is to train the future generation of researchers. It is essential that you create a stimulating environment, but it also takes time, trust, and considerable investments. It starts with rethinking and subsequently reconfiguring our curricula at the undergraduate level.

Elite institutions such as Harvard University as well as experts in curriculum development from other institutions are deeply concerned with the challenges ahead of us. One quotation from a recently published interim report may suffice to demonstrate the scope and complexity of the issues at stake: "Harvard faces the challenge of preparing its students to lead flourishing and productive lives in a world that is dramatically different from the world in which most of its faculty grew up. The world today is interconnected in ways inconceivable thirty to forty years ago (...), it is a highly unstable and uncertain world. By virtue of their gifts, their hard work, and their good fortune, Harvard's students will enjoy exceptional opportunities. But they will need to make their way in an environment complex in new and incompletely understood ways; and they will also be responsible for more than themselves. They will lead lives that affect the lives of others. It is our mission to help them find their way and to meet their responsibilities by providing a curriculum that is responsive to the conditions of the twenty-first century." (Preliminary Report of the Task Force on General Education, October 2006). Subsequently, the Task Force recommends to implement a curriculum with five broad areas of inquiry: Cultural Traditions and Cultural Change; The Ethical Life; The United States and the World; Reason and Faith; Science and Technology. These are to be complemented by developing critical skills in written and oral communication, at least one foreign language, and in analytical reasoning as well as in "activity-based learning".

Very much in line with these observations and recommendations on undergraduate education, the Carnegie Foundation for the Advancement of Teaching has published a series of essays on doctoral education which clearly emphasize the need to reconfigure the balance between an indispensable

degree of specialisation and a just as urgently needed ability to make informed judgements about complex societal issues. But also in their respective field of expertise doctoral students should obtain a good overview of its general scope and development. In short, they should become "Stewards of the Discipline": As George Walker puts it: "The Ph.D. holder should be capable of generating new knowledge and defending knowledge claims against challenges and criticism; of conserving the most important ideas and findings that are a legacy of past and current work; and of transforming knowledge that has been generated and conserved into powerful pedagogies of engagement, understanding and application." (Golde, Criss, Walker, George eds.: *Envisioning the future of doctoral education: Preparing Stewards of the Discipline*. Carnegie Essays on the Doctorate. Jossey Bass, San Francisco 2006.)

After having been trained as a doctoral student and completed two or three years of postdoctoral studies, it is important that for the next phase the young researcher can work independently and set up his own group. Young researchers should pursue their own ideas much earlier and more independently than is currently the case. In Germany, the average age at the completion of a Ph.D. is now around 33 years, which is – compared to other parts of the world, very late, and this makes the case for independence even stronger: Their need to gain scientific independence quickly is even greater and more difficult to achieve than for their counterparts in countries where the graduation age is much lower. The flow of highly qualified researchers between countries and between private and public sectors requires flexibility and permeability. And, of course, universities and research institutions also have to offer tenure track options or similarly reliable career structures if you want to make sure that the best people do not stay in mainstream areas, or even move out of research.

IV.2. Courage

The second precondition for establishing a culture of creativity is courage – not only on the side of the researchers, but also on the side of funding agencies. Researchers and funders must both be courageous and adventurous. Only if you are prepared to share the risks, you can encourage people to enter new fields and leave the beaten track; you cannot expect people to take high risks in their research if you do not make attractive offers to reward them for taking such risks.

I want to present two examples that the Volkswagen Foundation has pursued recently in order to illustrate this point. To set the scene, it is worth mentioning that we try to identify topics usually early on – but we do this in a way that tries not to impose them on the research community. The first example is our support for neuroscience. We wanted to link researchers from different disciplinary backgrounds to investigate the issues of "Dynamics and Adaptivity of Neuronal Systems. Developing Integrated Approaches to Analyzing Cognitive Functions." In the late 1990s we had a preparatory workshop and a number of international experts commenting on the usefulness of pursuing this topic. Before that we had already supported pilot projects to develop a promising field in close contact with the research community at a time when this field was not (yet) supported by public funders. More than 80 % of the projects funded were international co-operations, and all partners were selected based on scientific merit; and the ex-post evaluation by an international expert group to assess success or failure, and also the impact is still going on. But we can already see that in particular to put an emphasis on the future generation of researchers and on international collaborations has led to an enormous number of very impressive findings and publications.

The second example is "Physics, Chemistry, and Biology with Single Molecules". In this case one of the Max Planck directors, Professor Dr. Gerhard Wegner, was instrumental: When I moved from the Max Planck Society to the Volkswagen Foundation, he said to me: "Well, as far as I know, the Volkswagen Foundation and you will be looking for emerging topics, so perhaps you get interested in single molecules?" At this time, in 1996/97, he had just found first hints on single molecules, and Professor Dr. Christian von Borczyskowski and his co-workers from the Technical University Chemnitz had started to write papers on physics and chemistry with single molecules for the Foundation. We followed basically the same procedure as in the case of neuroscience, invited a number of experts from various places, and established the funding initiative in 1997. The first breakthroughs were made early in 1998, and in 1999 the well-known journal *science* had the headline on its cover page saying: "Frontiers in Chemistry – Single Molecules" (*science*, 283 (54089, 12 March 1999, S. 1667-1695.) Of course, at this point the whole topic took off and very quickly turned into a hot topic for all the other funding agencies, too, so this is the reason why the Volkswagen Foundation's initiative was running not all that long. Compared

to seven to ten years for the typical initiatives in the 1990s, we funded this topic for only 5 ½ years and closed the initiative in 2003, because by the end of 2002 there were already several research units ("Sonderforschungsbereiche") supported by the Deutsche Forschungsgemeinschaft (DFG) and similar activities supported by other agencies. Of course, you may ask why we did not continue anyway, as it was so successful. At the time already 16 of the young researchers were promoted to full professorships, and there was a generational turnover and a lot of opportunities for our researchers, so the end was in a way the consequence of enlarged public funding and career opportunities.

IV.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. It is an important task of group leaders, professors, and funding institutions to foster interdisciplinary and intercultural exchanges, to strengthen the interaction between research centres and universities as well as to configure adequate research structures which help to establish the right kind of networks and exchange opportunities. But it is also necessary to address the scientists' role in society, and it is essential to make them capable to deal with these issues. If you compare the traditional role of researchers with their new role in society, the main differences will quickly come to mind. I just want to highlight two points in that respect: the traditional role of providing facts, figures, and results will have to be complemented by the ability to communicate about processes, objectives, and, last but not least to offer compelling stories. And the second one relates to the different modes of communication. It is no longer sufficient to simply use the transmitter-receiver mode of communication and just establish a one-way flow of communication. It is much more important to develop an interactive and dialogical way of communicating with the public (which may also speak back to the scientist!), and this again calls for additional skills to be developed in order to communicate successfully with the wider public.

IV.4. Diversity

Also in academia, monocultures do not provide an adequate breeding ground for exceptional thoughts. Meanwhile, it even seems to have become more or less common wisdom that new knowledge is usually formed at the boundaries of established fields, so the interfaces between these areas of expertise must

be activated. Apart from the usual difficulties in securing career prospects for researchers embarking upon new areas, interactively productive diversity is also limited by another factor: the size of an institution. It is essential to strike a balance between a sufficient degree of diversity and 'critical mass' on the one hand, and ample opportunities for all the researchers involved to get to know each other and have intensive interactions so that new pathways can be developed and breakthroughs achieved on the other hand.

There is clearly a need for a re-alignment between scientific values and society's needs. The basically subject-oriented organization of European universities and corresponding career patterns do not work in favour of problem-oriented research approaches. The marked emphasis of our universities on discipline-based specialisation often prevents researchers from committing themselves to inter-, and transdisciplinary research which otherwise could be fostered, in particular in medium-sized institutional structures. As the American researcher J. Rogers Hollingsworth has shown, there is clearly a close connection between the degree of communication and the degree of scientific diversity within an institution, and there is also the danger that an increase in size and diversity may create a decrease in the integration, productivity and flexibility of an institution (cf. J. Rogers Hollingsworth: *The Role of Organisations and Institutions in the Innovation Process*, 2003.)

IV.5. Innovativeness

The fifth precondition of success in achieving breakthroughs is to foster innovativeness. We have to make sure that we initiate unconventional ways of thinking if we want to develop research that really sets a new agenda with radically new approaches: "transformative research" as it has recently been called. For a funding agency as well as a private foundation it is important that we can identify those researchers who are prepared to really think in new ways, who are prepared to take a risk with unconventional approaches and go off the beaten track. The prime aim of private funding of transformative research must be to overcome the disciplinary boundaries and put new research topics, fields, structures, and approaches on the agenda. Transformative research scarcely originates on its own. The readiness to engage in ground-breaking research has to be encouraged and facilitated. The need for transformative approaches and for new funding opportunities for young researchers has to be tackled as two sides of the same coin. Furthermore, it is also a recurrent issue for any funder

to separate the wheat from the chaff without frightening off the most original thinkers and the most creative researchers. This requires different modes of communication, selection, and support, e.g. through successive grants and long standing commitments.

IV.6. Persistence and perseverance

To take new pathways in a barely known territory requires much longer timescales than the usual pattern of two to three years of project funding. It is also important to allow that mistakes can be made, and pursuing other directions than originally planned is possible. Patience, persistence and perseverance are important factors for successfully establishing a culture of creativity. Critical in this respect is the establishment of mutual trust. Only if the relationship between the funder and the researcher is based on trust and long-term commitment, instead of brand-making and short-term financing, can we hope to be successful in the end.

IV.7. Serendipity

Definitely, the decisive moment when a radically new idea emerges, or a major scientific discovery is made cannot be planned for. But there are numerous examples in the history of university-based research which prove that it is possible to establish a particularly stimulating environment which is clearly more conducive to achieving scientific breakthroughs than others. And although there is no one-size-fits-all kind of recipe we can apply, it is certainly worthwhile to try and try again. In research as well as in research funding it sometimes helps to remind ourselves of what the French writer Albert Camus once said: "We must conceive of Sisyphos as a lucky man." So there is nothing left but start rolling the heavy stone of creative research once more up the hill.

V. Conclusion

Many challenges can only be met if we take a long view. We must be prepared to exercise judgement, and to make long-term commitments whilst maintaining the flexibility to respond to new challenges. The most important prerequisites for a successfully performing research institution clearly are a research-friendly governance and decision-making structure. A move towards a more professionally organized and autonomous university is badly needed. Therefore, research institutions have to constantly tap their resources and realize their potential, ensure efficiency in their spending, accelerate and

simplify their processes, and intensify communication within the organization and beyond it.

Foundations can encourage and support institutions and their leaders to engage in change processes towards achieving research-, and innovation-friendly structures. Two basic concepts are institutional conditions sine qua non for ground breaking research:

- an organizational structure which facilitates cross-disciplinary interaction,
- strong leadership connected with very high quality standards.

Research institutions have reacted to the increasing complexity of knowledge creation and research with an increase in size and diversity. This often creates an increase in bureaucracy and hierarchic structures, but does not help to foster creativity. With respect to creativity the seven preconditions outlined are essential. Furthermore, it is important to focus on small research groups of five to seven researchers, allow for more creative spaces within large grants, e.g. collaborative research units, centres, clusters, as well as to develop new modes of funding which support medium-, to long-term research projects and fellowships of between seven and ten years. Time and space for some thorough rethinking of common wisdom is urgently needed, e.g. research professorships and extra grants for the most creative senior researchers should be expanded. It is also important to reconfigure the review process, and actively encourage risk-taking by applicants, reviewers, and decision-makers, e.g. based on a two-stage process including personal presentations and interviews.

Foundations can help higher education and research to tackle the challenges of change by encouraging risk-taking, stimulating new developments, redressing imbalances, creating role models for an effective change of research strategies, helping to improve organizational structures, and contributing to the creation of a more research-friendly environment. Ultimately, we should not feel overwhelmed by the complex and quite complicated issues involved. Rather we should take an optimistic view just like Albert Einstein once said: "Amidst all the difficulties, there is also room for opportunities."