CHAPTER

European Research Policy: Towards Knowledge and Innovation or Trivial Pursuit

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EUROPE NEEDS SCIENCE

Today 25 European countries from both sides of the former Iron Curtain belong to the European Union with an increased political, economic and cultural integration, where research and innovation are seen as strategic tools to promote European competitiveness in a more globalized world. This is reflected in the ambitious political declarations of the European Council of the E.U. Heads of Government in Lisbon (2000) and Barcelona (2002), which state that, by the year 2010, Europe should have become the most competitive knowledge-based economy in the world and have reached spending of 3% of its GDP as a goal for investment into research. These declarations also reflect the political awareness that European research has lost strength to the United States and that is also being challenged by the fast-growing economies of Asia. It will remain to be seen to what extent Europe can live up to these high goals which will very much depend on the level of economic growth and the political ability to re-orient current priorities, especially as two-thirds of the 3% target should come from the private sector. Another uncertainty is how the recommended increase in public research funding will be divided between the national and European levels.

THE NATIONAL APPROACH TO EUROPEAN RESEARCH

Historically, research has been a national responsibility and regarded as a means to increase a country's competitiveness. For example, Swedish tax

money should pay for a Swedish researcher's innovation carried out at one of the national universities which should then be exploited to create new job opportunities and economic growth in Sweden. This "virtuous circle" is a deeply rooted tradition that can be traced back to 1896 when Alfred Nobel died, and the openings of his famous will that provided the foundation for the Nobel Prizes. The implementation of the will was not an easy task, with many potential obstacles, including one imposed by the Swedish King Oscar II. Nobel, who had a true international perspective from his industrial activities in many countries, wrote: "It is my wish that in awarding the prizes no consideration whatsoever should be given to the nationality of the candidate, but that the most worthy shall receive the prize, whether he be a Scandinavian or not." The king despised this statement and considered that Nobel had acted in an unpatriotic manner by not reserving the prize for a countryman, and even boycotted the first Nobel Prize award ceremony.

The national predominance on science policy and research funding has prevailed from the early days of Nobel throughout the last century. Around 95% of public research funding in Europe is national, with the remaining 5% coming from the E.U. Framework Programmes (FP) (see below). There are many indicators that this overwhelmingly national approach is no longer optimal to develop European research, innovation and technological development across the European Union.

Certainly, Europe contributes to global research with high-level science and, in quantitative terms, produces approximately the same number of scientific publications as the U.S. However, in qualitative terms, the U.S.-based publications are clearly ahead when one uses parameters such as the average number of citations per paper, in particular when counting the papers with the highest impact factor (the top 1% cited papers). This high impact research in the U.S.A. is particularly evident in rapidly emerging fields such as ICT, nano-science and technology and biotechnology, while Europe performs relatively better in the more mature ("traditional") scientific areas, such as inorganic chemistry and the humanities.

It is also very important to note that the top 20 institutions in the world contain about 30% of the most quoted scientists and yet only 2 of these top institutions are European (Academic Ranking of World Universities, 2003). The dominance of U.S. institutions, when it comes to high level research, is also apparent from the distribution of Nobel prizes in physics, chemistry and medicine. However, the use of Nobel prizes for tracing excellence also shows that the dominance of U.S.-based scientists (today up to 80%) is a fairly recent phenomenon. For example, as late as 1980 the number of prizes in chemistry awarded to European scientists was equal to American prizes. However, it does illustrate a rapidly increasing trend which is bearing the fruit of an earlier and consistently high investment in research over several decades.

The benchmarking with research in the U.S.A. receives much attention in the current debate, somewhat overshadowing the fact that Europe today is also beginning to be challenged by fast-developing Asian countries.

There is also the so-called European paradox. The large amounts of resources that Europe is investing in science do not, to any significant extent, materialize into innovations of commercial potential. The reasons are complex and also relate to cultural attitudes not only in the research world but also in the risk finance industry in Europe. It is an often used argument that investment into basic research is not a limiting factor for European growth. This is the major reason why the common E.U. budget has almost entirely focused on applied research. As will be discussed below, this analysis is being challenged at the same time as the traditional classification of basic and applied research is no longer so obvious as it once was.

THE PLAYERS IN THE ERA

Which are the major organisations that today have an influence on European research funding and science policy? As indicated above, the major part of research in Europe is funded via national research funding organisations. The pan-European impact of these resources has, however, been limited by the strong national emphasis, variations in funding procedures and big differences in economic resources between countries. However, currently, there is a combination of political and economic, as well as scientific pressure, for the national funding organizations to increase their collaborative efforts at the European level and work towards a better coordination of their funding institutions and procedures and so maximize the potential of this investment.

CERN, EMBO, ESO and ESA are all examples of European intergovernmental cooperation with a specific disciplinary focus. Their impact on European (and world) science and science policy within their areas of expertise has been profound, and their position vis-à-vis their scientific communities is very strong.

Since the mid-1980s the single largest actor on the European science scene has been the E.U. Framework Programmes (FP) which represent a considerable financial strength and political influence. Indeed, because national resources also have to cover infrastructure of all types, as well as salaries and running costs, the influence of the FP is far higher than the 5% proportion of European research investment would suggest. The mission of the FPs is, primarily, to promote European competitiveness and to support the policy goals of the Union. Hence, as indicated above, the major emphasis has been placed on top-down initiated and applied research.

Thus, tackling the European paradox has been a mission for E.U. research while so-called basic research has remained a national responsibility. This

division of responsibilities is now being challenged. There are arguments to suggest that it would actually have been a better approach to exchange the responsibilities. Basic research does not normally see any borders and is by nature truly international. Applied research, on the other hand, is strongly connected to the national (or even regional) economy.

At the same time, one must recognize that the concepts of basic and applied research are becoming more and more obsolete. In many emerging areas of science and technology, it is difficult to define what is basic or what is applied. Is research in functional genomics basic or applied? In nano-sciences, the production of various forms of nano-tubes, which have many potential applications, is based upon the entirely unexpected result of "blue sky" research, namely the discovery of the fullerenes as a third crystallographic form of carbon. A study for the U.K. Treasury showed that the so-called "linear model" of basic research leading directly to applied research and then on to innovation and economic development rarely holds true and the process is actually a complex diffusion process with many stages and feedback loops. This is also the conclusion of the European Commission's High Level Expert Group in its recent report, which points out that the division, or rather frontier research, and innovation are becoming increasingly hard to define and that the relationship is becoming increasingly strong. When analysing the scientific publications from frontier research quoted in registered patents, one can see a clear and growing trend which is most obvious within the field of biotechnology. Furthermore, a considerable portion of "frontier" research is today taking place in industrial laboratories.

THE EUROPEAN RESEARCH COUNCIL

There are currently new winds of change in European research policy, in particular, the proposal for the establishment of a European Research Council (ERC) (2003). The idea of such a pan-European research council has been debated on and off during the last 30 years, but has always been dismissed as a political impossibility because of the missions of existing national and European research funding structures and their concern to defend their "fiefdoms" as discussed above. Some five years ago, many organizations representing European research, including the European Science Foundation (ESF), which includes most of Europe's research funding agencies in its membership, gave a new and strong push for the establishment of an ERC. Two financial options could be foreseen: the national research councils top slicing themselves to create a common European fund, or that the resources should be provided centrally by the European Commission. The former alternative was hampered by a general unwillingness to export national research money combined with restrictive legislation in many countries. The concern with the second option

was to ensure a bottom-up approach for frontier sciences under the commission. In 2002, the Danish Presidency of the European Union brought the ERC concept to the political level. In a relatively short time, a consensus was reached and the ERC is now one of the major pillars of the FP7 proposal from the commission. However, the task has been limited to a competition for the best individual research teams in Europe. In the recent budget proposal for the FP7, €1.5 billion have been allocated for the ERC. There are many potential benefits of such a "European Championship" in research. It will give additional significant economic support to Europe's best scientists — it will move the frontiers of European science forward. It will also undoubtedly have dynamic effects on the European research system. Potential "national heroes" will get a European benchmark, the priorities of national research councils will be tested and, most likely, it will lead to a clear ranking of the European universities and research institutions. The ERC will also, by promoting frontier research in emerging areas, stimulate innovation and European competitiveness. There are risks with the ERC project. One could be the discrediting of the system through a very heavy over-subscription application rate. The second is that the ERC may only have limited independence under the umbrella of the commission. This issue will be dealt with by a high-level senate of highly reputed scientists who can defend scientific independence and who will set the frame for operation of the ERC.

COORDINATION OF NATIONAL EFFORTS

European research has constantly suffered from fragmentation and unnecessary duplication of efforts and resources. Within Europe, we seem very adept at the creation of new and frequently overlapping and duplicating structures. What is clear is that there is an urgent need for a science-driven scale and scope in research. Even though research progress will continue to be driven by individually excellent principal investigators (the best being supported by ERC) it is also becoming increasingly clear that many future research problems are so complex that they cannot be solved in one institute or even in one single country. Progress to solve research questions and pave the way for new innovations will require a critical mass of competences and resources. Such critical masses will require the combination of multi- and interdisciplinary skills. Such interdisciplinary constellations are, for example, required to contribute to major global challenges such as the human genome project, as well as problems related to global environmental change, especially driven by climate change. A recent trend in Europe is that the national research councils are starting to create such critical mass through an increased coordination of their efforts in certain research areas. However, once one passes beyond bilateral, or, at most, trilateral cooperation, the complexities and difficulties of

arranging such cooperation increase exponentially. Now the research founders are working through their joint organization, the European Science Foundation. For example, the so-called EUROCORES programmes (2005), which are a new kind of networking of national research councils and funding, are an important step in developing European "frontier" research. The EUROCORES programmes bring together substantial research money in contrast to previous collaborative schemes which have only provided networking costs. Nevertheless, the process still remains complex and rather lengthy.

We have all recognized the need to maximize the human potential of Europe, especially at the critical stage of transition to a fully independent researcher. The European Young Investigators Award Programme (EURYI) (2005) brings together national research founders, through ESF and the Euro-HORCS, in order to promote 25 young researchers to establish themselves as independent scientists. This is another example where national money is being converted into pan-European resources.

There has been a common view among researchers that the European science policy has been a kind of trivial pursuit with a political rather than a scientific mission. Now, many of the current developments exemplified in this brief account may herald a change in this attitude. It is not a trivial pursuit. There is a growing awareness that Europe needs science, but also that science needs Europe.

REFERENCES

Academic Ranking of World Universities. (2003). Shanghai Jiao Tong University, Institute of Higher Education. http://ed.sjtu.edu.cn/rank/2003/2003main.htm

ESF EUROCORES. (2005) *European Collaborative Research Programmes*. http://www.esf.org/esf_activity_home.php?language=0&domain=0&activity=7

ESF EURYI. (2005). *European Young Investigator Awards Programme*. http://www.esf.org/esf_genericpage.php?section=8&domain=0&genericpage=1879

E.U. European Council, Lisbon. (2000). *Presidency Conclusions, 23-24 March*. http://ue.eu.int/ueDocs/cms_Data/docs/pressData/en/ec/00100-r1.en0.htm

E.U. European Council, Barcelona. (2002). *Presidency Conclusions, 15-16 March*. http://ue.eu.int/ueDocs/cms_Data/docs/pressData/en/ec/71025.pdf

The European Research Council: a cornerstone on the ERA (2003). "Report from an Expert group", *ERCEG — the "Mayor" report*, Ministry of Science, Technology and Innovation, Denmark. http://www.ercexpertgroup.org

Frontier Research: The European Challenge. (2005a). "High-Level Expert Group Report", European Commission (EUR21619), Feb. 2005. http://www.insme.info/documenti/hleg_fullreport_frontier_research_april2005.pdf

Frontier Research: the European Challenge. (2005b). "Report of the High Level Expert Group". Chair, William Harris, European Commission. http://europa.eu.int/comm/research/future/pdf/hleg_fullreport_frontier_research_april2005.pdf

Jank, W., Golden, B. L. & Zantek, P. F. (2005). "Old World vs New World: Evolution of Nobel Prize Shares". *INFOR, Canadian Journal of Information and Operational Research*, Feb. 2005.

New Structures for the support of high quality research in Europe. (2003). "A report from a High Level Working Group constituted by the European Science Foundation to review the option of creating a European Research Council". Chair, Richard Sykes. http://www.esf.org/newsrelease/63/ERC.pdf

Proposal concerning the seventh framework programme of the European Community for research, technological development and demonstration activities, 2007 to 2013. (2005). European Commission, COM (2005) 119 final. http://europa.eu.int/eur-lex/lex/LexUriServ/site/en/com/2005/com2005_0119en01.pdf

Scott, A., Steyn, G., Geuna, A., Brusoni, S. & Steinmueller, E. (2001). *The Economic Returns to Basic Research and the Benefits of University-Industry Relationships: A literature review and update of findings. Report for the Office of Science and Technology*, SPRU. www.sussex.ac.uk/spru/documents/review_for_ost_final.pdf