

Reworking Greek research

Costas Fotakis, the Greek Alternate Minister for Research and Innovation, explains to *Nature Materials* how he plans to improve the country's research and innovation landscape under the constraints of austerity.

■ Please tell us about your scientific background.

My scientific interests are in the fields of laser spectroscopy and photonics. In particular, I am interested in laser interactions with materials and biomaterials, and related biomedical diagnostics and fine material processing applications. I have served as president of the Foundation for Research and Technology Hellas (FORTH) and as director of the Institute of Electronic Structure and Laser, and have been professor of physics at the University of Crete. I am a fellow and life member of the Optical Society of America and recipient of the Leadership Award of the Optical Society of America (2004). I have also been Springer professor at the University of California, Berkeley, and have been awarded an honorary doctorate by the Mediterranean University of Marseille.



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■ How badly did the financial crisis affect research in Greece?

All the European countries have been hit by the crisis, on a different level of course. The big challenge is overcoming the crisis (given its socio-economic character), without compromising on scientific excellence and quality.

It should be noted that, despite the political and financial situation in our country, Greek academics and researchers are in a competitive position internationally. For example, it was shown that 1.13% of publications from Greek institutions were in the top 1% of the most cited papers worldwide in 2012 (*Nature* **492**, 324–327; 2012). The Greek research community — albeit small in real numbers compared with other countries — has managed to attract more than €1 billion from competitive funds in the European Commission Seventh Framework Programme for Research and Technological Development (FP7), which corresponds to more than 2% of the available budget. Based on several indices of scientific output, Greece ranks 18th out of 186 countries. FORTH and the Centre for Research and Technology Hellas are among the top 20 European centres regarding competitiveness through participation in FP7, while the National Centre for Scientific Research, Demokritos, is in the top 50. I will

not deny that the financial shortcomings are possibly mobilizing the Greek research community even more, but from my perspective this performance is exceptional, keeping also in mind that only 0.7% of the gross domestic product is allocated to research and innovation.

Of course, there are weaknesses and serious challenges. A serious obstacle in my opinion is the legal framework, which is as big a problem as the funding issues. There is clearly room for improvements and new reforms, taking into account the special conditions triggered by the crisis, such as the so-called brain drain that is now a significant part of the equation. It should be noted that, during the past five years of counterproductive austerity policies, more than 20,000 young scholars and qualified professionals have left the country, a tenfold increase over the previous five-year periods. You can imagine the negative impact of this situation on the future of this country.

■ How can research benefit the Greek society?

Research, besides being a pillar for education and culture, can certainly become an engine for growth through innovation. The upgrade of the General Secretariat for Research and Technology at ministerial level in January 2015

underlines the significance of research and innovation for the new government, and the intention to create a new axis of 'smart' and 'inclusive' socio-economic growth for the country, based on knowledge, culture and innovation. We aim to establish a mix of appropriate policies that will create a conducive environment for the whole innovation chain, from basic and applied research to the exploitation of research outcomes for wealth creation for the benefit of the society.

■ In what research areas is Greece most active?

There is a wide spectrum of active research areas in Greece. We have a strong presence in several areas such as photonics, materials, nanoscience and of course the life sciences; the number of publications, invitations to conferences and citations confirm this. There is also strong activity in the humanities and social sciences; in fact, our general secretary for research and technology was intentionally brought from that research area, in an effort to highlight the importance we place on these disciplines. Especially nowadays, owing to the social conditions spurred by the crisis, we need to embrace them more than ever both as a resource for culture and education, and as a medium for non-technological and social innovation.

■ What are the funding schemes available to Greek researchers?

Greek researchers seek funding in the Horizon 2020 framework of the European Union (EU), which is based on merit (like the funds from the European Research Council), and through the EU Structural Funds, which are distributed based on geographical considerations. The rules relevant to the use of Structural Funds for research and innovation actions are highly inefficient at the moment. The role of the European Commission is also critical in this respect. Furthermore, boosting the funding opportunities for research besides the public funding through national resources and the EU framework programmes is necessary. Emphasis will be placed on the exploitation of emerging risk-financing instruments for research and innovation at the European level. Our goal is to have the appropriate private/public funding mix, with the ratio depending on the end goal, on the type of innovation. For example, demand- or market-driven innovation should rely most on private funding; it has short-term goals and the results are visible quickly, because they are effectively addressing the market needs of today. Along these lines, initiatives for supporting start-ups and the research and innovation sector are planned, such as the reduction of the cost of money; currently, funding for Greek innovative companies is very expensive, subjected to 8–9% interest rate, which is a serious obstacle for their competitiveness.

■ Is there a way to reduce the brain drain?

The brain drain is, unfortunately, a reality and it varies among the areas of research and technology. There is indeed danger for further enhancement, but we are making efforts to stop and even reverse it through the realization of specific research programmes addressed to young scientists. In this direction, through the EU Structural Funds, we have planned targeted calls for supporting researchers at the pre- and postdoctoral levels, as well as reinforcing poles of excellence, which could be attractive to talented young scientists and also well-established researchers. In my opinion, although the wage level for scientists is a serious consideration, what is most important is the presence of the right environment to allow scientific interactions and ideas to flourish and be realized; we need to reverse the brain drain, but we also say 'yes' to the brain circulation and research mobility.

■ What is the innovation landscape in Greece like?

Greece is an acute example of the famous European paradox: although the quality of

research is high, the deployment is much weaker. The so-called scientific innovation index (how innovation, as a result of research, can be used for development) is quite low for Greece, lower than other European countries, despite its correlation with the high research output from the Greek community, that is, journal publications, conference talks and invited seminars. Therefore, it is clear that there are gaps along the chain that links basic and applied research with the end product and wealth creation. The big challenge for us is to establish policies to help cross successfully through the famous 'valley of death' — where most start-up companies die off. It is essential that public investment in research and development is converted through innovation into socio-economic benefits for the society. Our aim is for the ministry to act as an enabler for various actions towards this direction.

■ What are your plans in this direction?

First of all, we need to support the people involved — especially keeping in mind the brain drain — and second, we need to support various aspects of the route to innovation. The essential asset in this direction is the very active and competitive scientific community that we have in Greece.

At the same time, it is crucial that we pursue not only scientific but also entrepreneurial quality; towards this latter point we need to improve the legal and financial frame for research and innovation, which is most likely the weakest part of the chain. Our priorities include the establishment of rules adapted to the specific needs of research work.

An important first step is to create a relevant legal system for research that will simplify the process; overall, a drastic decrease in bureaucracy is needed. Although the complicated mechanisms of bureaucracy in Greece and most European countries are put in place to eradicate issues of corruption, in my experience they tend to have the opposite effect: corruption flourishes when the bureaucracy is complicated. The solution is simple and long-term stable rules, with the political commitment being a key factor.

Also, a new framework law for research is planned for the near future. In the meantime, it is necessary to undertake serious interim legal interventions, which will ensure the smooth operation of the research organizations in the country. These emergency measures have already been announced, to tackle serious weaknesses of the existing law, which was voted in December 2014.

■ Which kinds of innovation are mostly encouraged in Greece?

The demand-driven innovation is more appealing to politicians, because the end product is visible in the near future. From our side, we are planning several flagship-type initiatives for mission-led innovation, which are relevant to various interests of the Greek society. For example, the cultural material in our country is abundant. The initiative for cultural heritage and modern technology builds on the link between ancient and modern Greece, bringing together museums and excavation projects related to cultural heritage with innovative technologies developed in Greek research centres and companies active in those fields. Within this framework, the Caryatids in the Acropolis Museum were cleaned, exploiting the laser know-how developed in FORTH for cleaning applications in art and archaeology. Laser technologies are also used for diagnostics and characterization purposes. Through other similar initiatives that we are preparing, we wish to bring the key enabling technologies into everyday life, contributing to agriculture, culture and the environment.

■ Does this mean that blue sky research cannot be profitable?

On the contrary! For me, the type of innovation that is boosting the economy is the curiosity-driven. Normally, this is neglected or confused with basic research. Most of the innovations worldwide that have seriously affected the real economy and changed the world fall into this category. This type of innovation is long term and has an accumulative character. Mobile phones, for example, include a combination of laser, thin-film, semiconductor and fibre optic technologies; nobody could imagine our current state of the art almost a century ago, when relevant research in these areas was only beginning.

Examples such as wireless communication and biomedical diagnostics technologies underline the potential of blue sky research for wealth production. However, similar to mission-led innovation, blue sky research requires long-term planning and, most importantly, consistent public investment. Although the end product may have significant impact, it is certain that it will arrive much later. It is very important, therefore, to encourage blue sky research, with long-term political commitment being vital. Blue sky research is associated with high risk of failure and people tend to work in more ordinary areas, pursuing less ambitious goals that are more likely to succeed; eventually, they end up working in highly saturated areas. On the

contrary, breakthroughs in unsaturated research areas usually require smaller investment and therefore may have more substantial scientific and economic added value and impact, especially at a regional level. In this direction, it would also be helpful if we stopped penalizing failure in research, and instead gave more space to young researchers to try out their ideas.

■ **Does politics affect innovation?**

Of course it does, whether we realize it or not. For example, the dominant model worldwide nowadays has a strong neo-liberal approach, and follows a sort of mechanistic, market-driven, utilitarian way

of thinking. This is deadly in my opinion, even for the actual long-term needs of the market that it is supposed to serve. I do not believe that human potential should be locked in market-driven channels. History has shown that the future is not predictable; serendipity is the driving force of major innovations.

Thus, we do not support schemes based on this model, such as the so-called entrepreneurial university, which orientates the research portfolios of universities in terms of the occasional needs of the market, and translates scientific knowledge into a commodity for sale; a rather short-sighted approach. As a government, we

try to activate and follow another model that is evolving around stimulating talent and enabling creativity. From this perspective, the pursuit of quality and scientific excellence, and the establishment of vibrant environments that encourage the exchange and blossoming of scientific and entrepreneurial ideas, are of the utmost importance. Of course, many of these ideas will fail, but some will be successful; and they will make a difference. Establishing such scientific environments is a response to the current crisis and a prospect for the day after.

INTERVIEW BY MARIA MARAGKOU