THE FOUNDATION FOR SCIENCE AND TECHNOLOGY

DEBATE SUMMARY

Our plan for growth: science and innovation
HM Treasury and Department of Business, Innovation & Skills Command Paper 8980

Held at The Royal Society on 4th February, 2015.

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The hash tag for this debate is #fstscienceandinnovation .

Chair: **The Earl of Selborne GBE FRS**
Chairman, The Foundation for Science and Technology

Speakers: **Rt Hon Greg Clark MP**
Minister of State for Universities, Science and Cities, Department for Business, Innovation & Skills and Cabinet Office
Professor Dame Ann Dowling DBE FRS FREng
President, Royal Academy of Engineering
Dr Mike Lynch OBE FRS FREng
Founder, Invoke Capital

Panellist: **Professor Alex Halliday FRS**
Physical Secretary and Vice-President, The Royal Society

DR CLARK said that it had been the aim of successive science ministers to make clear that science policy was at the heart of government and required long term policies to sustain and develop it. This plan[1], as did the Sainsbury plan[2], looks ahead for ten years. This strategy set out in Command Paper 8980 is a government plan formed after consultation with all departments and supported by them. Departments see science and innovation as a crucial contributor to society at the centre of national life. The plan is framed around five themes; excellence, agility, collaboration, place and openness.

Excellence depends on maintaining and strengthening existing successful institutional arrangements, and investment. Our research is world class, and, while Ministers must decide the overall science budget, it was for scientists in the Research Councils to decide on projects. The REF (Research Excellence Framework) process was a success and he had written to HEFCE to urge that excellence should be funded wherever possible. Agility, responding rapidly to opportunities, to make decisions quickly on vital issues (such as responding to the ebola outbreak), and ensuring research delivers impact, is essential as the pace of innovation and competition increases.

The plan identifies a special agility fund to enable unforeseen research opportunities to be funded. We know the importance of collaboration as so many exciting results stem from bringing together people from different disciplines (again, ebola demonstrated the importance of linking social anthropology and health). Training is necessary to get researchers to lift their eyes from their limited field and understand the linkage between academia, industry and public policy. Place is important because we know that there is a close linkage between academic research and innovation and the economic health and culture of the areas in which research institutions are situated. City and regional managers recognise this. All 39 LEPs (Local Enterprise Partnerships) have academics on their boards. Businesses are more likely to partner in research with their local universities. Openness is important because of the wide public interest in science. The public want to know how taxpayers' funds are spent. So researchers

1 www.gov.uk/government/publications/our-plan-for-growth-science-and-innovation

2 The race to the top: a review of government's science and innovation policies, Foundation debate 14th November, 2007 - www.foundation.org.uk

have a duty to share research findings. He supported strongly open access.

The plan recognised the shortage of STEM skills. It set out proposals to nurture talent, through employing more teachers in STEM subjects, particularly physics and maths, in schools and monitoring their progress, setting up national colleges and establishing a loan scheme for post-graduates.

On infrastructure, the plan sets out new capital spending programmes which were mindful of the consultation submissions. The plan also recognises the need to support research not only in new but also in existing areas. Both research and innovation should be funded.

The plan also recognizes the importance of R&D funded by government departments. The plan seeks to ensure that there is greater collaboration between departments and research groups. R&D should be focussed towards the long term, not just to short term issues. The plan will catalyse innovation by supporting the existing Catapult Centres and establishing two new Catapults for precision medicine and energy systems. On international partnership, the plan recognizes the importance of the relationship of the UK research base to international research institutions. The Newton Fund[3] is supporting strengthening international scientific partnerships.

PROFESSOR DAME ANN DOWLING welcomed the plan. Inevitably there will be a Comprehensive Spending Review (CSR) after the election. All spending will be scrutinised. It was good that firm guidelines, and, as far as possible, commitments had been made in the Command Paper. She also welcomed the review by Sir Paul Nurse of the Research Councils and indicated the process, timetable and purpose of her own review of collaboration between universities and industry and how to enhance delivery of broad-based benefits to the UK[4]. The closing date for submission of evidence to her review is 6th March.

She outlined the problems she foresaw, and commented on issues in the Government's plan. She was particularly concerned that funding for new capital projects should have the corresponding funding for running costs. She was also greatly concerned about the shortage of well-trained UK engineers. The engineering skills pipeline was very leaky. Around 600,000 pupils take GCSE physics, but only 300,000 achieve grade C or above. 28,000 go on to do A Level physics and mathematics, but only 14,000 UK students graduate each year in Engineering (plus 2,000 EU and 5,000 non EU students).

Reviewing the STEM subjects taken at A Level, there is a welcome increase in pupils taking mathematics from 50,000 to 90,000 over ten years, but physics has remained static at between 30,000 and 40,000. On apprenticeships, those taking engineering and information technology, and engineering and manufacturing technology, were fast outnumbered by those doing business, administration, health, public services and care. In Higher Education there has been a 15,000 increase over ten years in students taking biological sciences, but the other disciplines had remained flat. Over 5,000 of the 20,000 engineers who graduate each year in the UK are foreign nationals.

What is the way forward? The challenge is cultural. We must seek to change attitudes and perceptions about STEM careers; increase the supply of specialist STEM teachers, give much better career guidance in schools and increase employer engagement with schools and teachers. We must also increase the opportunities for apprenticeship schemes in manufacturing and information technology and continue the investment in higher education.

There were major political issues, such as policies on immigration, which must be faced. The economy cannot do without the skills of foreign nationals and the university business model relies on the significant income from foreign nationals paying fees. Finally, science is science; it would be unfortunate if decisions on quality research investment were biased by the need to accommodate regional priorities.

DR LYNCH said that the research community must recognize that it had done very well from taxpayer support. The science budget had been protected while other budgets had suffered severe cuts. If growth is now back on the agenda the science community must demonstrate why scientific research is essential for growth. In the UK, growth cannot come from natural resources, it has to come from know-how; research, innovation and its exploitation. The debate between blue skies and applied research was now a thing of the past. Both were essential. What was important was the areas where research

[3] Newton Fund www.rcuk.ac.uk/international/newton/
[4] www.raeng.org.uk/policy/engineering-policy/dowling-review

happened; the themes that captured researcher's interest and which were capable of being exploited. The lesson of Silicon Valley was to go for an idea, develop it, work on it, exploit it and then move on. The UK does not do this process well. We fail to exploit research and we fail to seize opportunities.

A major problem is institutional inertia. There is a tendency in any institution to stay with existing paths and use existing structures to continue to support established research groups. The experts who decided on projects are those who are already doing work in that area. They will be reluctant to see new opportunities or balance arguments for considering new methods or subjects against existing ones. For example funding for super computers is well supported but funding research into algorithms is not.

He supported the strategy laid out in the plan, and he understood the Minister's view about maintaining existing institutional structures, but this must not be at the cost of continuing a culture of inertia, of reluctance to fund new projects which may be resisted by existing practitioners.

Whether a research project is labelled blue skies or applied is irrelevant, as long as the opportunity to exploit it is seized. And if the area or theme is well chosen, there will always be possibilities of exploitation now or in the future. We must market research to persuade the public of its value. A major rethink of how technology transfer from university to businesses was needed. IP and VAT rules needed to be thoroughly reviewed.

He supported Dame Ann's analysis that more must be done to persuade pupils and teachers of the value of STEM subjects; but we need also to recognize that past efforts to get more students to do engineering have failed; we must seek new ideas.

PROFESSOR HALLIDAY opened the discussion. The Royal Society welcomed the plan, but vision had to be turned into delivery. He had four comments. First, the Research Excellence Framework process had been a success. The results and analysis represent a valuable resource for searching for where the best science is done and how to use this information for future prioritisation. Secondly, the Nurse Review of the Research Councils would be valuable. He would like the US example of special funding for very exciting and innovative projects to be considered by the UK. Thirdly, we must give more emphasis to the importance of major strategic science and the national research infrastructure built to deliver the strategy. Finally place is important. The connections between research communities and their local communities could be strengthened. Both would prosper from a closer working relationship.

Several participants were concerned that arguments about the value of intellectual property (IP) hindered collaboration between universities and industry, particularly with middle sized companies. Short-term growth through innovation was most likely to succeed in mid-sized companies. Big businesses, with expert legal advice could afford to negotiate IP agreements with universities, and start-ups, with a graduate or so from the university would not need to worry, but for mid-sized businesses who could afford neither the time nor expense of negotiating agreements with universities who have access to expensive legal advice, the position was challenging. Sometimes they would simply walk away, and the research would not be exploited. Much of the problem was that every university had a different perspective on IP; ranging from those who thought the institution should have all the benefit, to those who thought the researcher should be the principal beneficiary, to those who saw that the company must have the benefit if the research was to be exploited. A way out would be for a selection of model pro forma IP Agreements to be agreed. In Scotland there is a scheme of enterprise fellowships to transform selected researchers into successful business people. To reduce difficulties over sharing IP with their host University, the agreement to fund the fellow includes a formal dispute resolution process involving an authoritative independent person. It very rarely requires to be used, because the parties soon recognise it is better to agree matters amongst themselves.

Technology transfer depends on trust, and trust cannot exist if the parties are wrangling about IP.

Participants also questioned whether the commitment to openness had gone far enough. The selection of themes seemed to be top down. The public themselves might well have views on priorities, for example, they might put sustainability more highly than profit. There was an emphasis on growth, which seemed to mean economic growth, but growth in other areas might be of higher priority to the public.

Scientists tended to look at the areas of their own discipline, whereas the public looked at the problem - environmental pollution or social care as a whole; they may see innovative opportunities that scientists miss. The impact of research and innovation was crucial, and it needed to be measured in other ways than the traditional economic growth measures. The public needs to be aware of the impact, it needs to be marketed, as a speaker said, and it needs to be seen alongside policies which might alleviate its social impact such as unemployment.

The REF showed which universities had achieved most impact from their research; indeed, perhaps there should be a national target for research and impact; but there are challenging problems in measurement. But, it could be a goal as universities do more to connect strongly with local communities as well as local businesses.

Participants also raised the following points:

1. Was it a problem that many engineers went into the City and left the profession? Probably not, the numbers were small and financial institutions (and thus the economy) benefited from engineers working in the sector.

2. The tax credit system for R&D was flawed. The broad definition of R&D by HMRC gave credits for spending that was not R&D. Adjustment of the rules could direct benefit to where the added value from exploitation was the greatest.

3. There needed to be a clear strategy for the contribution from public sector research establishments (PRSEs), which were downplayed in the plan. PRSEs make an important contribution and with Departmental R&D budges are an essential part of the research landscape. The contribution of research institutes funded by charities or companies should also be recognised.

4. The emphasis in the plan for the importance of biological sciences seemed small in comparison with other sciences. But this had been carefully considered, taking into account the funding for biological sciences from other sources, such as charities. But voters are passionate about research on cancer and health issues, and would not accept that public expenditure should fall because there were other sources of income from charities.

5. It was families, not just schools, who guided children to STEM; so you needed to persuade Mums and Dads about the excitement of careers in science and the possible better rewards.

6. Post docs are not going to be able to set up companies or commercialize their research on their own. They need help from business, and serial entrepreneurs who can guide and help fund start-up companies. Universities need to do more to ensure that business people understand what they are doing and can themselves see opportunities for exploitation.

Participants generally welcomed the strategy outlined in the Plan, and looked forward to the publication of the Dowling and Nurse Reviews.

In summary more needed to be done to break down the barriers that wrangles over IP placed in the way of technology transfer; the public(s) needed to be more involved in a conversation about the importance and impact of research; growth should be measured by social as well as economic measures; and the cultural aversion to promoting STEM education needs to change.

Sir Geoffrey Chipperfield KCB

Open the summary with Adobe Reader outside the browser and click on the URL to go to the sites below.

Our plan for growth: science and innovation (Command Paper 8980)
www.gov.uk/government/publications/our-plan-for-growth-science-and-innovation

Association for Independent Research and Technology Organisations
www.airto.co.uk

The Academy of Medical Sciences
www.acmedsi.ac.uk

BAE Systems
www.baesystems.com

British Academy
www.britac.ac.uk

Caparo Group Limited
www.caparo.com

Department for Business, Innovation and Skills
www.gov.uk/government/organisations/department-for-business-innovation-skills

ERA Foundation
www.erafoundation.org

Government Office for Science
www.gov.uk/government/organisations/government-office-for-science

Higher Education Funding Council for England
www.hefce.ac.uk

Innovate UK (formerly the Technology Strategy Board)
www.gov.uk/government/organisations/innovate-uk

Invoke Capital
www.invokecapital.com

Learned Society of Wales
www.learnedsocietywales.ac.uk

Research Councils UK
www.rcuk.ac.uk

Royal Academy of Engineering
www.raeng.org.uk

Russell Group
www.russellgroup.ac.uk

The Royal Society
www.royalsociety.org

The Royal Society of Edinburgh
www.royalsoced.org.uk

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