UK DEANS OF SCIENCE

RESPONSE TO LIBERAL DEMOCRATS POLICY GROUP CALL FOR EVIDENCE

– Sustainable sources of prosperity and jobs

UK Deans of Science (UKDS, www.deansofscience.ac.uk) is a national, non-political body that seeks to represent the individuals, usually formally designated as Deans, who are responsible for science in HEIs across the UK and who generally hold the budgets for science including any research budgets. Its primary aim is to ensure the health of the science base through the promotion of science and scientists and of scientific research and science teaching in the UK.

Our comments are deliberately focussed on the opportunities that exist for Government if it takes *an appropriate long term view and accepts the need to drive through substantial change in the balance of the UK economy*. We first attempt to briefly respond to the specific questions that are posed by the Policy Working Group. Following these responses we present some pointers to policies that are needed to ensure that science and technology generates the future sustainable prosperity that the party wishes to achieve. Without these, economic institutions alone, no matter how designed and how successful they may be, will not deliver what is required.

1) What is the single most important thing that the Government could do to support prosperity and jobs in the future?

The Government must make a major change to the balance of the UK economy. Following the last election UKDS communicated its views to the Government and major political parties in a document entitled 'The UK economy and the New Parliament'. This was sent to a number of people including the Secretary of State for Business, Innovation and Skills and is available on our website. Its main thrust was to call on the new Parliament to support all aspects of the UK's science and manufacturing base by actions including:

- creating a major economic stimulus package by increasing public funding of the science base through the Research Councils, the Technology Strategy Board, targetted use of government departmental expenditure and new initiatives
- committing to policies that will ensure that research and development expenditure will be at least 3% of the UK's GDP before the end of the current Parliament and 5% by 2020
- creating world-leading tax schemes and other incentives for science-based industries to invest in the UK
- ensuring that science policy is at the heart of government by locating the Government Office for Science in the Cabinet Office
- maintaining the post of Chief Scientific Adviser in every Government department including the Treasury
- making the study of science in schools and colleges more attractive to UK pupils through improved science facilities and better training and continuing professional development for science teachers
- increasing the number of science places in universities at undergraduate and postgraduate level
- appropriate funding of science facilities in universities

2) What are the current barriers or threats to sustainable prosperity and jobs?

There has been much rhetoric about the importance to the UK of high level science, technology and manufacturing. The barriers are the failure of UK Governments to invest sufficiently in science and technology, to encourage scientific and technological innovation and to encourage companies, in particular UK companies, to invest in R&D in the UK. Just as examples, too many of the successes (eg Jaguar Land Rover, Mini, Toyota, Nissan) are either British companies that were failing until bought up and invested in by overseas companies or are examples of overseas companies that have located to the UK. When international companies are deciding where to invest, the UK is only one of many potential destinations. When UK companies that have a global reach rationalise their R&D and manufacturing facilities they often reduce their investment in the UK. Much more has to be done to convince UK and international investors that the UK is truly serious about high level science, technology and high value manufacturing.

3) What policies have proven to work well, why and where? (Locally, internationally or in specific countries.)

We are very sceptical about the idea that something that has worked in one country will necessarily work in the UK without revolutionary changes in attitude and approach by Government, industry, banks/investors and most of the general public. For example, the last Government backed its talk about the importance of science and technology with a significant investment in funding. The assumption was that this would act as a statement of serious intent and that relevant industries and investors would increase their financial commitment to R&D. During the period from 2000-01 to 2009-10 public spending on R&D rose in real terms by 18.9% while private investment increased by only 3.5%. This meant that during the period commercial investment in R&D expressed as a percentage of GDP actually fell from 1.18% to 1.12%. This trend must be rapidly reversed. We can suggest no magic bullet but Government has to create a fiscal environment in which industry and other investors want to invest and to take a long term view of the value of R&D.

The UK needs to ensure that all regions share in a new science- and manufacturing-led prosperity. While we seriously doubt the assumption that models that work in other countries will necessarily succeed in the UK, we would suggest that the party investigates how Australia has developed support for its industries through separate national and state funding streams. This dual mechanism appears to manage to support the national research, development and production agenda while at the same time separate state governments direct funding to support local state-based industries.

4) What challenges are there in implementing such policies? (Current policy, proposed policy or a suggested policy that you are putting forward.)

If it were decided to give a major boost to region-specific funding new money would need to be found and a suitable process agreed to ensure that it was awarded to those most likely to use it successfully. It is worth noting that some groups of universities (for example, the N8 Research Partnership, White Rose University Consortium, Scottish Universities Physics Alliance) have developed regional networks, though not necessarily centred on the local industrial agenda.

5) Are there any suggestions of specific other people, teams, or organisations from whom we should be seeking views in this work?

We hope that the party will have been able to engage directly, and at the right level, with industrial FTSE companies, the CBI, banks and other investors, and SMEs.

FURTHER COMMENT - ACTIONS TO LEAD TO A REBALANCED UK ECONOMY

We limit our response here to policy issues that would affect the science and technology agenda so as to position the UK in the medium term as a global leader in the applications of science and technology to create economic growth, personal well being, sustainability and, ultimately, a zero-carbon Britain. These goals will not be achieved overnight or in the lifetime of a single Parliament. It will require patience and a longer term commitment then most Governments have ever been willing to give. In this response *we will limit ourselves as far as possible to issues which we consider to be of particular importance for the sciences*.

The nature of the sciences from age 5 to 19 and beyond

The learning of the sciences and mathematics is based on a hierarchy of knowledge, building, from primary education upwards. Thus the appreciation and use of mathematical principles which are developed at different educational stages lead, to a lesser or greater extent, to the mathematical competencies required for scientific (and engineering) disciplines (and the higher skills in mathematics that are required for study of mathematics in its own right at graduate and postgraduate level). Such a hierarchy of understanding pervades all science disciplines. It is simply not possible to take up a Bachelors or Masters degree in science or mathematics *ab initio*. Science subjects are also in a state of continuous development and change and increasingly require a multidisciplinary approach.

The practical nature of most of the sciences requires excellent facilities, supervision, technical support and management of health and safety in schools and universities.

Policies are therefore needed for school science to:

- develop and deliver a science and mathematics curriculum that teaches and assesses the subjects in a way that acknowledges their special hierarchical nature and rate of change
- take account of the resourcing requirements, including laboratory and other facilities and guaranteed CPD for teachers and technical staff

- ensure that teachers who teach the separate sciences are properly trained in the disciplines. Because of the shortages of teachers in certain science subjects this issue in often conveniently ignored. However, we would simply ask the question: Would a school expect to have history taught by someone without a degree in history or in which history was at least a major part?
- investigate the need for several Awarding Bodies; UKDS believes that having several Awarding Bodies, whether run as for-profit or not-for-profit organisations, has driven down standards and will continue to do so
- review critically any current curriculum approaches and make changes based on evidence not dogma; there has been some disquiet expressed, for example, that the Curriculum for Excellence in secondary schools in Scotland may result in a reduction in the number of STEM subjects taken at school level.

The nature of a university

The future sources of sustainable prosperity and jobs will rely most heavily on the outputs of higher education – the highly trained graduates and postgraduates and the research that they produce. We are concerned that the successive governments have allowed the concept of what constitutes a university to be gradually eroded.

Following a thorough and open debate on the future nature of the UK university, which takes into account the Bologna Process of which the UK Government is a signatory, we recommend that policies for UK universities, should:

- recognise that higher education has a fundamental value in itself
- recognise that universities are autonomous and must not be over-regulated by the Government
- accept the Robbins principle that courses of higher education should be available for all those who are qualified by ability and attainment to pursue them and wish to do so
- accept the Haldane Principle, which is also essentially enshrined in the Bologna Process
- ensure that all universities, whether private or public have a proper range of disciplines, are of an appropriate size and that the degrees offered are supported by the active research of the those who teach them.

The sciences and scientific research in universities

The sciences, by their very nature and practice, know no national boundaries. Except where national security or commercial sensitivity demand a different approach, the outcomes of all scientific research must be shared through readily accessible, peer-reviewed publication.

Undergraduate science can only be taught where there is an opportunity for students to engage with staff whose research is at the frontiers of knowledge staff and students are able to work together in a *community of scholars* within an appropriate teaching environment that includes laboratory and technical facilities allowing undergraduates, postgraduates and staff to experience and learn using the latest scientific methods. Government spending up to 2010 ensured that such infrastructure was mostly being maintained at a reasonable level but reductions in capital funding have now begun to bite.

The effect of the change in fees cannot yet be predicted. We are concerned that the positive, relative trend of applications for entry in 2012 towards science and engineering shown by early UCAS figures (in as much as the applications are down less that in most other subjects) do not act as predictors for what will happen over the next few years. Firstly, we expect fees for classroom-based subjects, which are currently showing a significant drop in applications, will be reduced to a level closer to their real cost of delivery (though note that this will unfortunately probably not significantly reverse the trend away from the study of languages). This will act as an attraction to those who wish to obtain a degree purely as a passport to a graduate job.

The debt which an undergraduate student in science will carry on graduation (especially if s/he has studied for a four year MSci qualification) will act as a serious disincentive to further postgraduate study. However, taught one year Masters and/or the four year integrated MSci programmes are necessary for the UK to achieve world competitive standards, both in terms of the research 'pipeline' that is preparing people for PhD study, and in delivering high level skills at exit from undergraduate education. The four year integrated Masters programmes are necessary to maintain high quality competitive science and engineering education and as the academic requirement for professional levels of accreditation for scientific and engineering professional bodies.

In the context of the above we believe that policies for UK university science and science research should:

- recognise the world-leading quality of much of the research carried out in UK universities which has made them increasingly attractive to students from across the world
- ensure that for its funded research Government does not dictate the direction of research in universities (though it may define, using independent advice from the scientific community, the main societal challenges that will benefit from the application of science and technology)
- provide funding for challenges that are yet to be recognised and to generate science whose application is as yet unknown
- support the transfer of scientific knowledge to business, industry and the wider community
- create initiatives to encourage secondments from industry to university departments and to create even better partnerships between industry and universities
- analyse the very small funding differential now made available through Hefce for STEM subjects compared with classroom-based disciplines. We would expect this to result in a reduction of the relative differential between science and medicine
- commit to a serious and thorough review of the funding of postgraduate taught provision, particularly given the gradual withdrawal of funding by the Research Councils. Any solution must take account of part-time study and fully incorporate the postgraduate lifelong learning agenda
- following the recent reforms of funding of higher education, commit to a detailed and continuous analysis of changes in numbers of applications, acceptances and students on courses, both part-time and full-time, in each year of each type of undergraduate, postgraduate taught and postgraduate research programme, detailed separately for each subject area, and take action to correct any unforeseen consequences should this be necessary
- strive to ensure that high level objectives of the EU's Horizon 2020 mirror as far as possible those of the UK's economic and innovation strategy - supporting the best research in science and technology wherever it is to be found, with limited restrictions on who may be part of a bid.

Universities, industry and the wider economy

Scientific disciplines in UK universities are aligned to knowledge and skills training that directly feed the needs of industry. This ensures that the UK can emerge for the current economic downturn and can lead to sustainable solutions to economic and social challenges. In recent years science Faculties have increasingly been concerned with the impact of their research through a range of technology transfer mechanisms. They attract some excellent home grown talent and have become even more attractive to some of the best international scientists. It is quite possible that an over-emphasis on commercial impact could discourage the best students, many of whom are initially attracted to science for its intellectual challenge rather than the economic or social benefits it may offer, from entering doctoral and postdoctoral education. Universities must be distinct from business and industry but at the same time there is an urgent need for even better partnerships to be created. These could be achieved by business and industry understanding better the operational imperatives faced by universities (for example, the implications of the teaching provision) so that they might be able to identify with the strategies of the universities they wish to partner. This will ensure the creation of sustainable agreements and collaborations of long-standing mutual benefit.

There is a need for a strategic approach to regional development. Attention needs to be given as to whether in the coordination of research priorities sufficient consideration is given to strategies for distribution of research funds to the regions and the effect that this may have on some of our regional universities. However, merely giving money to any form of regional development agency is insufficient. Proper and appropriate strategies are needed for regional development in science R&D. This would appear to be a role for the Technology Strategy Board. However, regional issues also need to be in the brief of Departmental Science Advisory Councils, Chief Scientific Advisors and the Council for Science and Technology. In this way we can ensure that the UK uses fully the talents of all its scientists.

There has been a welcome increase investment in R&D by the Government over the past decade. However, the percentage of GDP that the UK spends on R&D at only *ca.* 1.8% lags seriously behind most of our competitors. The previous administration had a target for it to reach 2.5% by 2014. The Coalition Government has no target at all, so has no robust method of measuring success or failure. If 2.5% were achieved by 2014 the UK would be well behind our main international competitors with the BRIICS countries (Brazil, Russia, India, Indonesia, China and South Africa) also rapidly increasing their R&D spend. Unfortunately it would seem that the more government money is made available, the more potential equity investors withdraw and demand that even more risk be eliminated before they invest their money in the UK.

Policies to support the increasing positive interaction between industry and universities should include:

- funding of joint university/industry research programmes, with the companies funding a fixed percentage of the full research and development costs in return for the right to exploit the results of the programme

- new local, national and international initiatives to enable universities to identify and engage with end-users, commercial mentors and non-executive directors who can advise and work with senior academics to bring IP to commercialisation
- a proof-of-concept fund to bridge the gap between concept and commercialisation. Government could co-invest in such schemes alongside established investors. There should be clear recognition that this is high risk funding
- enabling SMEs that have the potential to deliver high technology, high value added scientific manufacturing and R&D to operate in science parks, preferably near universities, or where this is not possible, within networked clusters that may also include connections with large companies
- consideration as to whether aspects of the Australian Commonwealth Scientific and Industrial Research Organisation (CSIRO) might be introduced into the UK
- focussing on increasing the intake of high quality graduates into the SME sector
- more short-term posts based in industry, including support for university-industry collaborations on a regional basis
- investment schemes for SMEs that is directed away from low tech, low added value organisations and towards high technology, high value-added companies
- setting a target for the percentage of GDP to be spent on R&D of 5% by 2020 and creating the means to monitor its achievement.

Other issues

There are a range of further issues that are worthy of consideration and inclusion in policies intended to rebalance the UK economy, including:

- recognition of the contribution that the scientific process, 'way of thinking' and method of approach, can make to society and Government decision making
- creating a **Department for Science within the Government** with the Minister having a place in Cabinet
- retaining the requirement that every government Department shall be required to have a Departmental Chief Scientific Adviser
- requiring all Departments to have a Departmental Science Advisory Council
- rationalising the very many Science Advisory Councils so that common challenges are more likely to be recognised and dealt with
- recruitment policies to increase the numbers of scientists and engineers in the civil service in every Government Department
- retaining the TSB
- attention to the cost of the Common Agricultural Payment Subsidy. Transferring 10% of the CAP into the FP8/Vision 2020 budget would almost double the funding available for R&D.

Further details of our views can be found in a number of documents on our website (www.deansofscience.ac.uk). We would be happy to supply further information if requested.

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