



**Creating the future: a 2020 vision for science and research
Department for Business, Innovation and Skills – June 2014
Joint submission by the Science Council and the Campaign for Science &
Engineering**

In preparing this joint response the Science Council and the Campaign for Science & Engineering (CaSE) have consulted member bodies across their respective organisations to identify areas of common interest. The issues they raised form the content of this submission. In addition a number of member bodies across both organisations will be responding individually to the inquiry.

1. Proposals for principles for investment in science infrastructure

The Science Council and CaSE believe that decisions about capital spending should be guided by the following principles:

- **Long-term, stable and balanced strategy:** a capital funding roadmap should sit within an overarching, long-term vision for UK science that supports high-quality multi-disciplinary basic and applied research, the development of a skilled workforce, sustains our world-leading universities and research institutions, attracts industries from all over the world and builds a diverse and sustainable innovation ecosystem.
- **Decisions must not be based on political expediency:** capital infrastructure decisions must be determined by robust cost-benefit analysis outlined in a comprehensive business plan, not determined by electoral timetables or political agendas
- **Robust and transparent decision-making:** a robust mechanism for making capital funding decisions should be outlined within a long-term research strategy. A long-term strategy must set out capital investment priorities *and* provide flexibility for investment in new technologies.
- **Science community-led decisions:** within the robust mechanism, funding priorities and decisions at an operational level must be aligned with an overall strategy and made primarily on the basis of scientific excellence and potential impact.
- **Resources to match capital investment:** funding of human and material resources to ensure efficient operation and maintenance of facilities and equipment should be matched to capital investment to ensure that resources are used efficiently and achieve the greatest impact.
- **Nurturing a highly skilled workforce:** a highly skilled workforce is essential to maximise capital investment. There needs to be an aligned, long term and adequately resourced skills and training strategy to nurture the next generation of talent to match the long term capital investment strategy.

- 2. A long-term vision for UK science must be aspirational, achievable and sustainable.**
 - 2.1. It is critical to the future success of the UK economy that Government continues to see science as a priority and invests in our national science and research capacity at the same level as our international competitors. Research and innovation underpins a strong economy, creates jobs and will be vital for preparing the nation for future challenges, such as climate change and food security. Funding levels must therefore reflect the considerable strategic need to address these challenges. Long term, sustainable investment in science infrastructure has a major role to play in enhancing capabilities that underpin research and innovation, driving advances in sectors critical to economic growth and tackling future challenges.
 - 2.2. The erratic nature of capital investment announcements since the 2010 Comprehensive Spending Review, while being welcomed by the science community, have created concern that decisions are often strongly influenced by short-term political agendas rather than long term strategic considerations. Consequently there has been concern for the stability of many scientific programmes and uncertainty as to the Government's strategy for science and infrastructure. In this ad-hoc decision-making environment planning becomes more difficult and there is a real danger that the UK's research capabilities in important areas will be lost as researchers in the UK turn to other areas that appear more stable. Such uncertainty also affects the development and sustainability of international collaborations and the UK's ability to attract leading international researchers who will look for opportunities in other countries. We believe that **long term, stable investment in science and research promotes confidence within the science community at home and to potential overseas investors, establishing global leadership in selected areas.**
- 3. Investment decisions should be informed by continuous dialogue across the science community, including employers, researchers, and professional bodies and learned societies in order to determine capital, resource and skills needs, and ensure a balanced science and research portfolio.**
 - 3.1. Priorities for investment in large and small-scale facilities must be set on the basis of evidence of scientific outputs and societal impact.
 - 3.2. The consultation seeks views on a series of options for the UK's priorities for long term large-scale capital investments. The proposed list of projects does not outline the method by which the list was determined or indicate the individuals or organisations that were consulted in drawing up the options. Neither is there clarity on how the potential capital costs for each project were estimated or a published risk analysis or criteria for measuring success, impact or opportunity costs of any particular set of decisions. Such supporting information is necessary if projects are to be prioritised.
 - 3.3. **Funding decisions at the operational level must be led by the research community through arms-length public bodies and made primarily on the basis of scientific excellence and potential impact.** A long term strategy for UK science must be achieved through ongoing, transparent and wide ranging consultation with the science community and other user groups. The strategy must be continually reviewed, evaluated and adjusted to meet new challenges arising from within the UK and internationally. Arms-length public bodies are best placed to deliver this approach. The failure to take a broad, cross-science and UK-wide approach overall has serious risks and is likely to lead to partisan interests making the case for the projects within their own area, pitching one area of science against another. This is not in the long term interest of UK science, which is becoming increasingly multi-and cross-disciplinary.
 - 3.4. The consultation proposes three potential scenarios for the science and research

budget for 2016-21. However there are no details about how the annual budgets in each scenario have been arrived at or on the individuals or organisations that were consulted to produce them. In addition the scenarios offer an incomplete picture of where Government spending could be distributed. Research Councils are key funders of capital investment, and are well-placed to inform the process of capital investment. Their funding allocation should to reflect this. It is crucial that funding streams, through the Research Councils and higher education institutions (HEIs) work in conjunction to provide adequate resources and capital spending to a range of different institutions and disciplines, and increasing multi-disciplinarity requires these institutions to develop a more coherent and strategically-led UK-wide strategy.

- 3.5. **The Science Council and CaSE recommend that a cross-government National Science Capital Infrastructure advisory group is established to provide leadership, guidance and direction to develop the Science Capital Roadmap, and to outline a long-term timetable of continuous replacement and improvement of capital research facilities. The advisory group should be comprised of representatives from the Research Councils, higher education, government, professional bodies, employers and other user communities at the national, regional and local level. A similar proposal has been made by the LSE Growth Commission with regard to UK infrastructure projects¹.**

4. Capital investment in UK science must be balanced, stable and strategic across all areas of science and research. Investment must also include sufficient long-term resources for operational and maintenance purposes to maximise the use of assets

- 4.1. Excellent scientific research takes place on a large and small-scale, and in both instances can take many years to deliver commercial impact. Large-scale projects in particular will have long lead times, and in many cases the period from development and planning to construction and completion will take a number of years before any scientific research is conducted. **To give stability to UK science and in order for the UK to reap the benefits of investment in its science base, a long-term capital investment strategy must be planned to last a minimum of 10 years.**
- 4.2. Without a long term investment plan Government-funded projects are more vulnerable to unforeseen global events, which threaten the capacity to complete projects in development, continue to maintain and upgrade existing projects or provide flexibility to rapidly exploit new scientific discoveries. Future demand is also an important consideration in investment policy. The Central Laser Facility is an example of a project which is running significantly below capacity due to lack funding for support staff. **The Government should commit adequate resources to horizon scanning programmes that can identify short and long term strategic infrastructure and support needs.**
- 4.3. The UK must have a balanced portfolio of investment in science and research based on excellence. Investment in scientific infrastructure should not therefore be determined primarily by the size of the existing user community but should be influenced by a number of factors including opportunity, the increasing multi-disciplinarity of complex issues and the need for breadth across the UK science base, both scientifically and geographically.
- 4.4. Adequate resourcing of mid-level facilities and infrastructure with matched maintenance and replacement costs is vital for long-term support for skills, training, jobs and excellence across all science activities. **These requirements and the associated costs should be provided in a comprehensive business plan for each proposed capital project.**

¹ <http://www.lse.ac.uk/researchAndExpertise/units/growthCommission/documents/pdf/LSEGC-Report.pdf>

- 4.5. Higher education institutions play a key role in forging links with other stakeholders and public investment in scientific infrastructure through universities can leverage further investment from private investors. The Technology Strategy Board and Research Councils should also have key roles as brokers between public and private sector interests.
- 4.6. The history and track record of stand-alone projects initiated by Ministerial decision, especially for large-scale publicly-funded projects is not impressive. Of course, this is not only a factor for science infrastructure but there are many examples of such decisions where the investment has failed to provide the public with value for money². One common error for such projects has been a tendency for Ministers to hugely underestimate project costs leaving a legacy issue for successors and biting into the budgets of arms-length agencies at a later stage. A recent example includes the Science and Technology Facilities Council's net expenditure in 2009-10 increasing by £24 million because it did not anticipate exchange rate fluctuations³ but there are many others across Government departments⁴.

5. A highly skilled workforce is essential for maximising capital investment. A long-term education, skills and training strategy that includes schools, and further and higher education must be aligned with a long term capital investment strategy.

- 5.1. To maximise the benefits of investment in capital infrastructure there must be the right skills and expertise to operate and maintain research infrastructure. Large facilities in particular will require large numbers of skilled technicians and other support staff to maximise their outputs. With growing economic demand for a workforce with higher level technical and practical science skills, the ability to conduct experiments with high-quality apparatus in real laboratory conditions provides scientists with opportunities to develop the necessary skills to meet this demand.
- 5.2. There must be in place skills and training frameworks to develop and maintain cutting edge technical skills and knowledge. Investment in the skills pipeline will increase the attractiveness to UK and overseas businesses of investing its R&D activities in the UK. The pace of advancement in science knowledge and the demands of the innovation economy for high-skilled individuals outside the R&D sectors means that increasing numbers of students and postgraduates need exposure and access to leading-edge facilities.
- 5.3. Joined-up policies and investment across Government will maximise the potential benefit to society from the opportunities provided by investment in the science base. For example, consultation and alignment with policy development in education, skills and training, workforce development and regional investment should be informed by science investment decisions. Such an approach would achieve greater coherence, collaboration and productivity.

6. A long term investment strategy must seek to support and provide opportunities for all sectors and regions of the UK

- 6.1. The Government has consistently expressed a desire to rebalance the UK economy⁵, both geographically and sectorally. Higher education institutions play an important role in growing regional economies through research and development and the development of high level skills, particularly in STEM sectors. Investment by Russell Group universities, for example in medical research and

² <http://www.iea.org.uk/sites/default/files/publications/files/upldbook419pdf.pdf>

³ https://www.gov.uk/Government/uploads/system/uploads/attachment_data/file/247170/1643.pdf

⁴ <http://www.instituteforGovernment.org.uk/sites/default/files/publications/System%20Error.pdf>

⁵ <https://www.gov.uk/Government/policies/reducing-the-deficit-and-rebalancing-the-economy>

other STEM facilities will support nearly 19,000 jobs and generate an economic value of more than £9 billion between 2012 and 2037⁶.

- 6.2. Joint regional scientific infrastructure investment ventures between multiple UK universities provide this resource, enabling undergraduates and postgraduates to gain regular access to the best equipment to help them to develop the necessary skills for the UK to be internationally competitive. There is greater potential for these types of facilities to be exploited and to include closer links with local schools and further education colleges. Many SMEs will also depend on access to facilities, capacity and the associated expertise that is available in higher education establishments to test their own research, mature ideas and up-skill their workforce. Such facilities need continual high quality equipment and highly skilled scientists, engineers and technicians and cannot be sacrificed in favour of a limited number of larger scale international level investments.
- 6.3. However financial restrictions will often limit large-scale capital spending to a single project in one location, for example the Diamond Light Source. The location of these projects must therefore be carefully considered. Decisions on the location of large-scale projects should be made on the basis of proximity to a highly skilled workforce, transport links – as these projects must also be available for use by other user communities across the UK – and the infrastructure of the surrounding environment which will include, for example schools, centres of culture, and leisure facilities.
- 6.4. The Government must not overlook the fact that excellent scientific research and innovation also occurs outside of higher education settings. This necessitates the development of a national science and innovation strategy that supports and encourages innovation in science parks, businesses and SMEs at the local and regional level as well as the national level and considers the connectedness of these across the system as a whole.
- 6.5. As well as being informed by national and international opportunities, other national and local infrastructure investment priorities can also inhibit local and regional opportunities. For example, while some regions of the UK already have ready access to a highly skilled, highly educated workforce and significant inward investment, some regions have fewer resources of this kind and science and innovation communities in these areas can be inhibited from participation. A number of coastal and seaside towns do not have the capacity to nurture and sustain their own science and innovation ecosystem because of poor transport links, low performing schools and colleges, and the lack of local university or large research or innovation-driven employers. In some parts of Wales, Scotland, and England, access to reliable broadband internet ranges from low to non-existent and is inhibiting the growth of smaller high-tech businesses. This lack of connectivity affects the demand from businesses to inwardly invest and operate, and the ability to attract a skilled workforce.
- 6.6. Local Enterprise Partnerships have the potential to play a key role in developing visionary and appropriate science, innovation and skills strategies at the regional and local level. These will need to be in partnership with local employers, schools, colleges, and where possible regional universities and employers. A national level strategy must focus on innovation, skills, support for businesses, and address local and regional infrastructure and skills needs⁷. **Without ensuring opportunities at the local and regional as well as the national and international level, there is a significant risk that a two-tier innovation, education, training and skills environment will develop.**
- 6.7. There is uncertainty and concern regarding the impact Scottish independence might have on science and related infrastructure facilities in Scotland and on the

⁶ http://www.russellgroup.ac.uk/uploads/Economic-impact-of-the-Russell-Group_1.pdf

⁷ <http://www.policy-network.net/publications/4695/Mending-the-Fractured-Economy>

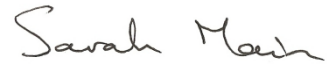
rest of the UK. In the event of Scottish independence there will be a clear need for careful management of any transition of research funding and activity between relevant funding agencies, industry and charities in the short term to cover existing projects. Scotland possesses a number of centres of scientific excellence that are used by research teams from across the UK as well as from overseas.

Negotiations between Westminster, Holyrood and other devolved administrations may be required to ensure that the four nations' access to facilities across each other's borders remain readily accessible.

- 6.8. The Science Council and CaSE acknowledge that budgets will be very tight over the next few years. However investment in science and research can provide a spur to growth. For the UK economy to grow in the long term, stable investment in science and research is essential. The key requirement is for a coherent, well-argued and properly adhered to long-term vision for UK science and complementary strategy.



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The Science Council

The Science Council was established in 2004. It is an umbrella organisation of learned societies and professional bodies, and currently has 41 member organisations drawn from across science and its applications: a list of current member bodies is attached. In addition to providing a mechanism for the sector to work collectively, the Science Council develops and leads collaborative projects working with member bodies and the wider scientific community: examples include the Future Morph website⁸ designed to provide young people with information about careers opportunities, and LMI analysis of the UK Science Workforce⁹.

The Science Council works to advance the professional practice of science and since 2004 has awarded the professional qualification of Chartered Scientist (CSci) with 15,000 individuals registered. A current key project is the development of new professional registers (Registered Scientist and Registered Science Technician), which aims to raise the profile, aspirations and retention of scientists at graduate and technician level. Collectively our member bodies represent almost 500,000 individual members, including scientists, teachers and senior executives in industry, academia and the public sector.

The Campaign for Science & Engineering

The Campaign for Science & Engineering (CaSE) is a membership organisation aiming to improve the scientific and engineering health of the UK. CaSE works to ensure that science and engineering are high on the political and media agenda, and that the UK has world-leading research and education, skilled scientists and engineers, and successful innovative business. It is funded by around 800 individual scientists and engineers, and 100 organisations including industries, universities, learned and professional organisations, and research charities.

⁸ www.futuremorph.org

⁹ *The current and future UK science workforce* TBR, Sept. 2011 <http://www.sciencecouncil.org/content/science-workforce>

Member Bodies of the Science Council

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Association for Clinical Biochemistry and Laboratory Medicine
Association of Neurophysiological Scientists
Association for Science Education
British Academy of Audiology
British Association of Sport and Exercise Science
British Computer Society
British Psychological Society
British Society of Soil Scientists
Chartered Institution of Water and Environmental Management
College of Podiatry
Energy Institute
Geological Society of London
Institute of Biomedical Science
Institute of Brewing and Distilling
Institute of Corrosion
Institute of Food Science and Technology
Institute of Marine Engineering, Science and Technology
Institute of Materials, Minerals and Mining
Institute of Mathematics and its Applications
Institute of Measurement and Control
Institute of Physics and Engineering in Medicine
Institute of Physics
Institute of Science and Technology
Institute of Water
Institution of Chemical Engineers
Institution of Environmental Sciences
London Mathematical Society
Mineralogical Society
Nuclear Institute
Oil and Colour Chemists' Association
Operational Research Society
Physiological Society
Royal Astronomical Society
Royal Meteorological Society
Royal Society of Chemistry
Royal Statistical Society
Society for Cardiological Science and Technology
Society for General Microbiology
Society of Biology
Society of Dyers & Colourists
The Organisation for Professionals in Regulatory Affairs

CaSE Member Organisations

Industry

Airbus
Astra Zeneca
BASF
Bayer
BMJ
Crocotta R&D
Electroimpact
GlaxoSmithKline
Google
Johnson Matthey
Norwich Research Park
Optimise Oil and Gas
Oxford Instruments
Rolls-Royce
Sharp Laboratories
Wiley-Blackwell

Charities & Other

Association of Medical Research Charities
Breast Cancer Campaign
Cancer Research UK
Prospect
Wellcome Trust

Learned & Professional

Royal Astronomical Society
The Biochemical Society
Society for Experimental Biology
Society of Biology
BCS – The Chartered Institute of IT
Society of Chemical Industry
Heads of Chemistry UK
The Institution of Chemical Engineers
The Royal Society of Chemistry
The UK Deans of Science
The British Ecological Society
Engineering Professors' Council
The Institution of Engineering & Technology
The Genetics Society
The Geological Society
British Society for Immunology
London Mathematical Society
The Institution of Mathematics and its Applications
Institution of Mechanical Engineers
Society for Applied Microbiology
Society for General Microbiology
National Farmers' Union
The Royal Pharmaceutical Society
The British Pharmacological Society

Institute of Physics
The Institute of Physics and Engineering in Medicine
The Physiological Society
The British Psychological Society
Experimental Psychology Society
Royal Statistical Society
Zoological Society of London

Academia

University of Aberdeen
University of Wales, Aberystwyth
University of Birmingham
University of Bradford
University of Brighton
University of Bristol
Brunel University
University of Cambridge
Cardiff University
University of Dundee
University of Durham
University of Edinburgh
University of Exeter
University of Glasgow
Heriot-Watt University
Royal Holloway
University of Kent
King's College London
Kingston University
Lancaster University
University of Leeds
University of Leicester
University of Liverpool
London Metropolitan University
London School of Hygiene and Tropical Medicine
Loughborough University
University of Manchester
University of Newcastle upon Tyne
University of Northampton
University of Nottingham
The Open University
University of Oxford
London School of Pharmacy
University of Plymouth
Queen Mary, University of London
Queen's University, Belfast
University of Sheffield
Sheffield Hallam University
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