A vision for Science and Society

A consultation on developing a new strategy for the UK

July 2008

Department for **Innovation, Universities** & **Skills**

Contents

What do we mean by ‘science’?

By science we mean all-encompassing knowledge based on scholarship and research undertaken in the physical, biological, engineering, medical, natural and social disciplines, including the arts and humanities, which is underpinned by methodologies that build up and test increased understanding about our world and beyond.

What do we mean by Science and Society?

We include engagement with society in its broadest sense, from science centres and festivals, through information provision by consultation, active dialogue and other media, to enabling citizen empowerment and decision-making. We include the use of science by society and the provision of scientific advice to policy makers for the benefit of society. We include the range of science skills opportunities, through the education system and beyond, and the importance of diversity in enabling a workforce truly representative of the society which it serves.

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Foreword

I am pleased to present this consultation document on developing a new Science and Society Strategy for the UK.

Despite a great deal of excellent work to date, I believe we can, and must, do more and keep striving to do it better. We need to refresh our science and society vision for the new environment we find ourselves in and look at how we can work more efficiently together.

I believe that the importance of scientific engagement across society has never been greater. And it should be startlingly obvious that we need to continue efforts to ensure we have a strong future supply of scientists, engineers and technologists. We need to unlock the talents of all people in the country – and that includes being able to use science and technology to help them live their lives more richly.

I believe we need a society that is excited by science; values its importance to our social and economic wellbeing; feels confident in its use; and supports a representative well-qualified scientific workforce.

The creation of the Department for Innovation, Universities and Skills (DIUS) provides a new opportunity to address these important issues and we want your advice and support. I hope we can develop a shared strategy that all of us working in the Science and Society policy community can commit to for the future.

I believe we now need a more mature relationship between science, policy and society, with each group working to better understand the needs, concerns, aspirations and ways of working of the others.

'Science and society' used to be an area which was seen solely as a niche part of science communication. Today, we have no choice but to see it as a necessary condition for British – and global – success.

So I want to encourage everyone to be a part of this: the science community, third sector organisations, business, the education community, individuals, families and the media, national and local policy makers. I look forward to hearing your views.

Ian Pearson MP
Minister of State for Science and Innovation.

1.0

Our challenge

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1.1. Science improves the quality of daily life, underpins prosperity and increases our readiness to face the challenges of the future – both in the UK and globally. There has never been a time when the UK population has been a bigger consumer of the products and benefits of science and technology. Our future economic prosperity and our ability to become an Innovation Nation depends on the successful exploitation of science and technology.

1.2. We also doubt if there has ever been a time when the potential for science to contribute to good policy making and sound government has been greater. Science will help us to address the main challenges we face as a nation and as a planet:

- tackling and adapting to climate change
- global security and international terrorism
- rising populations and the consequent pressure on food, water and other natural resources
- the impact of human diseases such as pandemic influenza and animal diseases such as foot and mouth and blue tongue.

1.3. To ensure we make the right decisions, now and in the future, we believe there is a pressing need to:

- strengthen the level of high quality engagement with the public on all major science issues; and
- increase the number of people who choose to study scientific subjects and work in research and scientific careers.

What does this mean for us?

1.4. To meet these challenges we need to see significant improvements in key relationships across science and society. We believe this means there are three broad themes that have immediate relevance for every member of society, that represent direct challenges for every one of us:

We must all learn to make better, more informed choices.

- Our ability to meet these challenges depends on our ability to handle the science involved. Policy makers without access to sound scientific advice, or to dialogue with communities, will be unable to make the best decisions on tough challenges facing the country.

- A public without improved scientific literacy, including an understanding of scientific evidence and risk, will be unable to make informed decisions for themselves, their families, and as part of the democratic process. They will be unable to contribute effectively to political and ethical debates surrounding such complex issues as GM foods, biometric data, or nuclear energy.
- If scientists and industry lack the capacity, or the incentive, to understand society's needs, we will all be less able to use science to help improve our lives.

With the liberalisation of information, both knowledge and innovation are increasingly driven by individuals and a wide range of organisations. Engaging and empowering people will help us ask better questions and increase the supply of good quality science.

- Research shows there is a continuing demand for more information directly from scientists at an early stage in the research process (coupled with a lack of understanding of the regulatory system), indicating there is considerable room to improve public confidence in the use and governance of science.
- Having an engaged public means recognising that science is not just a body of facts, but a discipline with established methods of inquiry, peer-review, and governance. It means understanding that science is often about measuring uncertainty. It allows ordinary people to better challenge what they read about, and understand different forms of scientific evidence.

We must unlock the talents of all people in the country – including being able to use science and technology to help them live their lives more richly.

- Society is increasingly user-driven. We depend on technology and other science to support our daily lives. Those who have the confidence to use devices and engage with new developments are able to drive consumer innovation. Those who are unable to utilise technological advances for their own needs will be left behind. Therefore, it is essential that businesses and technologists understand people's needs and wants better, so they can be more successful in designing and producing products and services that people find easy to use.
- As the pace of scientific development accelerates, so too does the pace of change in our society. Our challenge is to ensure that we make the most of the talents of all our people so that Britain can compete in this globalised world of the future. Such a fast pace has the potential to have the harshest impact on those least well-equipped to respond. We want to ensure that everyone is able to share in the increasing prosperity and the opportunities that scientific progress brings and that nobody gets left behind.

- Having more people with high level science skills benefits the economy by meeting potential skills shortages and increasing the productivity and capacity of businesses to innovate, and the prosperity of the country as a whole.
- Our strategy must look for innovative ways to provide people of any age with access to scientific resources and information, in the ways they want to access it. We must also continue to look for new ways of supporting the development of science skills, from basic technician level through to world-class scientific research, right across our society. We have made good progress, especially in improving the number and quality of science teachers in our schools. Surveys have revealed over three-quarters of people have a positive experience of science education. But involvement in science is not limited to formal education: cultural institutions such as the Science Museum and science centres can play an important role in making science exciting and accessible to the general public.

1.5. A final challenge concerns how this all fits together. The scale and complexity of science and society activities has grown dramatically over the years. As we work with our renewed vision, and develop a longer-term strategy, we must seek improved processes and frameworks for delivering outcomes on which there may be a fairly high degree of agreement but where effort is not well focused or co-ordinated.

2.0

Science and society up to now

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2.1. The Bodmer Report, 'Public Understanding of Science' (Royal Society, 1985), marked the birth of the 'public understanding of science' movement in the UK. In the two decades since, a great deal has changed, including some major successes:

- A massive increase in science communication – science books regularly top the bestseller lists.
- There are now over 100 science centres in the UK, Café Scientifiques have mushroomed, and there is a vibrant science festival scene.
- National Science and Engineering Week in 2008 attracted over 1,400,000 participants at around 3,500 events across the UK.
- Science is now a compulsory subject for all schoolchildren, and the nature and processes of science are increasingly being taught.
- The Science Museum and Natural History Museum are two of London's top visitor attractions.

2.2. The UK leads the way in promoting the Science and Society agenda. The UK population places more confidence in science and technology solving major global challenges than many other EU countries. We should rightly celebrate what we have achieved including the huge amount of work that has been done to build the supply base of scientists, technologists, engineers and mathematicians (STEM) in the UK. But we cannot rest on our laurels, and it is important to continue to work to build trust and confidence in UK science, and to improve the nation's skills at every level.

The scientific workforce

2.3. The need for a skilled scientific workforce has long been acknowledged. Sir Gareth Roberts' review (SET for Success, 2002) found significant barriers to ensuring a good supply of researchers for the research base. The ten-year Science and Innovation Investment Framework (2004) highlighted the importance of a strong supply of scientists, engineers and technologists to the long-term health of the science base and the wider UK economy.

2.4. In terms of STEM education there is a positive story to tell. Bringing greater coherence to the STEM education landscape through the STEM Programme, we have already achieved:

- more science graduates teaching science in schools than ever before – thanks to more bursaries, 'Golden Hellos' and better teacher training
- increased overall attainment in GCSE, A level, first degree and postgraduate results

- increased numbers of pupils taking science AS and A-level which has fed through to greater success in Further Education and Higher Education
- increasing the proportion of better qualified students pursuing R&D careers
- increasing the proportion of minority ethnic and women participants in higher education in STEM.

2.5. Beyond science education, we are currently working to bring greater coherence to the science skills agenda by focusing on other aspects of the wider workforce including:

- strengthening the employer voice on skills, refreshing the Sector Skills Councils and raising attainment in higher level qualifications, apprenticeships and degrees, as we implement our response to the issues identified in the Leitch Review of Skills (2006)
- developing STEM careers, diplomas, apprenticeships, and further measures to improve the recruitment and retention of STEM teachers, as we discussed in the 2007 Annual Report on the ten-year framework.

2.6. These activities will deliver a coherent approach to increasing STEM skills, with a focus on improved understanding of the link between labour market needs and business demands for STEM skills and the ability of the education system to deliver flexibly into the 21st century.

Engagement and public attitudes

2.7. Early attempts to bridge the gap between science and the public were simplistic – "If only the public had the science that they lacked explained to them, they would surely support its use". This approach was rarely successful, and since 2000 the emphasis for public engagement has been on two-way communication, or dialogue. The benefit of dialogue is that it allows the scientific community to be open to a continuous discussion of values and purposes, and is sensitive to these when developing avenues of investigation. There is now a strong consensus in support of this approach as an important beneficial style of public engagement.

2.8. From 2000, government has also tracked general public attitudes to science, including levels of confidence in scientists across government, business and a perceived independent sector. This has provided important information for the Science and Society policy commitment. Confidence in science should come from a shared understanding of the nature of the scientific process and depend less on the perceived affiliation of the scientist.

2.9. The DIUS/Research Councils UK (RCUK) Public Attitudes to Science Survey 2008 shows there is a demand from the public for more consultation on scientific issues. Only 21% of the public agree that "the public is sufficiently involved in decisions about science and technology". It also found that 78% of the public agree that "we ought to hear about potential new areas of science and technology before they happen, not afterwards". And this wish to hear about science and technology is not limited to government: 73% want more scientists to discuss research and its social and ethical implications.

2.10. As a government we want the public to be confident that when we make policy decisions we take into account the best scientific knowledge available. All government departments now draw on the science base to inform policy development with most having Chief Scientific Advisers (CSAs), usually drawn from academia. The Government Office for Science, led by the Government Chief Scientific Adviser (GCSA), aims to ensure that:

- government policy and decision-making is underpinned by robust scientific evidence and long-term thinking; and
- UK science is widely promoted and its contribution to society recognised at home and abroad.

The Government Office for Science will publish its forward programme later this year.

2.11. We also want every business which depends on science to better recognise and embrace their responsibilities in all the areas where they interact with society and policy makers. We see no difference in the use of science by the private or public sector. In particular, we would look for more visible responses to the continuing challenge from the public about how they demonstrate a commitment to societal benefit alongside their principal need for commercial success. Such an approach may go a long way to restoring trust in the wider exploitation of science and technology, and its impact on the public.

2.12. In the past Science and Society has sometimes been seen as a niche part of science communication. We welcome the fact it is now recognised as a necessary condition for British and global success. We have made some extraordinary progress and those responsible deserve our appreciation and congratulations. However, there remains a clear sense that more and higher quality engagement by all parties, and greater co-ordination and collaboration between those involved, is now needed. The new vision we offer and the shared strategy we want to develop will address these issues.

3.0

A new vision

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3.1. This chapter introduces a new vision that encapsulates our long-term ambitions and we believe directly addresses the science and society challenges facing us today. The vision has been discussed with a broad range of stakeholders, and is the basis for our consultation on the future landscape for science and society in the UK. It also addresses the issue of how we measure progress.

A society that is excited about science, values its importance to our social and economic wellbeing, feels confident in its use, and supports a representative well-qualified scientific workforce.

3.2. The vision itself can be broken down into three broad strands, which are dealt with in turn in the following chapters:

- A society excited by and valuing science
- A society that is confident in the use of science
- A society with a representative, well-qualified, scientific workforce

3.3. Each chapter sets out a clear goal, summarises where we stand now and then seeks answers to a number of questions that relate to what we need to do to achieve our vision.

A new relationship

3.4. As we elaborate this vision, we must also be clearer about what we, as a community with wide-ranging interests and capabilities, might do to realise the aspirations it contains. Our ambition should be to go further than scientific literacy. A major part of the challenge is to build a more mature relationship between the public, policy makers, the media and scientists, where everyone understands each other better. In particular, this means the public and the media maintaining the same healthy scepticism that they have towards other information they consume, whilst understanding the nature of science better and questioning what the real implications of the evidence should be. Analytically, we have found it helpful to distinguish three groups to focus our thinking.

Science, Society, Policy

Science: includes areas where science is undertaken (universities, science-based industry such as engineering or pharmaceutical companies, government agencies such as the Health Protection Agency), business, learned societies, Research Councils, national academies and research-based charities.

Society: includes schools, media, cultural institutions, citizens, communities.

Policy: includes politicians and policy makers in central, devolved and local government – Regional Development Authorities, local authorities and regulatory bodies.

3.5. Of course, Science, Society and Policy are neither isolated nor homogeneous sectors, but represent a huge variety of different kinds of public, policy makers and scientists; indeed, policy makers and scientists are themselves part of society. But we believe that thinking about each area separately and exploring the mechanisms in place to help each understand the others, is a valuable way of ultimately improving the relationships between them.

3.6. Our objective for these three groups is simple:

A greater level and quality of engagement, thinking and collaboration between sectors. We want to achieve a noticeable improvement in the Science and Society landscape: putting greater emphasis on why people are doing what they are doing; creating one or more effective 'bridges' or 'brokers' between each of the sectors; focusing more on celebrating and rewarding success.

Q. What steps can we take to co-ordinate better or streamline science and society activity to make it more effective?

Measuring progress

3.7. In developing our strategy, we think it is important to measure success and to consider setting some high-level targets to measure our collective effort. We already have a number of indicators gathered through the three-yearly Public Attitudes to Science Survey, the STEM Programme Report and DCSF strategies. There are lists in Annex B along with some additional suggestions.

Q. How should we measure progress? What indicators do we need to measure success?

4.0

A society excited by and valuing science

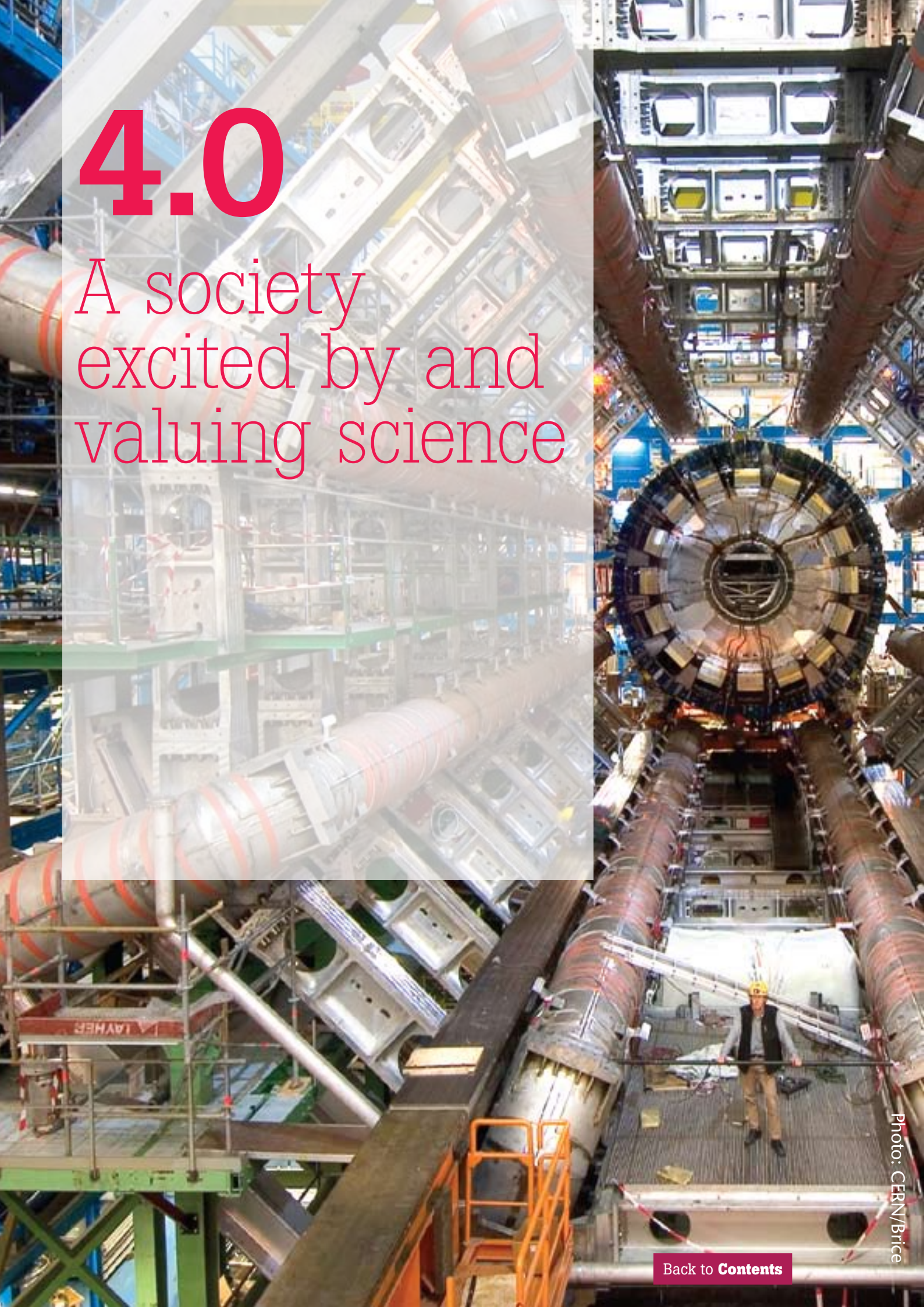

Photo: CERN/Brice

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The Goal:

A society that is excited about science and values its importance to our social and economic wellbeing.

4.1. This chapter sets out our aspirations for establishing science as an integral part of our culture, reflecting the important role that science has in our everyday lives, and to our future economic and social wellbeing. We identify three areas for action: strengthening communication, improving inclusion and participation, and demonstrating the relevance and benefits of science to our lives. A great deal of activity is already underway but we have identified some immediate challenges and ask some key questions around how we might address them.

4.2. We depend on science, technology and innovation to support our daily lives. The potential rewards that society can reap from science and technology have never been more important. The 'endless frontier' of research opens up new opportunities and ways of addressing societal challenges. Science is a tremendously important part of our cultural heritage and a vital part of our shared future.

4.3. The UK's National Museums, such as the National History Museum and Science Museum and galleries are world-leading cultural institutions which make an important contribution as centres of learning and expertise, to culture and education. Research is also fundamental to many of their activities. The media, local communities, education and business all play a role in developing the culture of this country. And all cultural organisations have the power, the potential and the responsibility to help engage, inspire and educate a generation of young people and an occasionally sceptical wider public in science.

Pictured: The ATLAS detector, part of the Large Hadron Collider, under construction at CERN, Switzerland. The UK's Science and Technology Facilities Council has invested £511 million in this project to explore conditions in the universe in the first moments after the Big Bang.

Where does the UK stand now?

4.4. The DIUS/RCUK Public Attitudes to Science Survey 2008 showed that there has been a notable rise in people who say they are very, or fairly, well-informed about science and scientific developments, up to 56% from 39% in 2005 and an encouraging 10 percentage point fall in the proportion of the public agreeing that science and technology is too specialised for most people to understand. Within the spectrum of science communication, public engagement and dialogue have emerged as the pre-eminent tools.

Public engagement and dialogue

4.5. The landscape in public engagement in the UK has changed significantly. As mentioned in Chapter 2, activity is increasingly more two-way, using techniques such as public dialogue.

What do we mean by Public Engagement and Dialogue?

We are using 'public engagement' to be an umbrella term – that encompasses many kinds of activity including science festivals, centres, museums, cafes, media, consultations, feedback techniques, and public dialogue. Any good engagement activity should involve aspects of listening and interaction.

Public Dialogue, a form of deliberative participatory engagement where the outcomes are used to inform decision making, is just one important kind of public engagement activity.

- Public engagement in science and its appraisal is now something that all funders of science are committed to, increasingly making it a core part of their activity, showing a clear shift in organisational culture.
- The launch in January 2008 of the Beacons for Public Engagement Initiative is a major step forward – aimed at helping to shift the organisational culture in Universities – to reward and value staff and students who engage with the public.
- Public dialogue is now a core activity for government in its role as policy maker. DIUS continues to support public dialogue through the Sciencewise programme and has now built on this success by developing the Sciencewise Expert Resource Centre, providing a corporate memory of dialogue activities and a range of support services to help policy makers make best use of dialogue, and the science community and public to engage better with the policy system.

What we need to do

4.6. We believe there is a need for all citizens to be fully engaged with science and to understand the nature of science better. Everyone should have the opportunity to play a relevant part in making the best possible decisions for public policy through engagement with science.

4.7. Policy makers and scientists are now using new communication tools, such as internet phones, blogs, Second Life and deliberative events alongside the traditional mainstays of printed media, museums and hands-on centres, consultations, surveys and dialogues. These tools are already used by a broad cross-section of society and it is almost certain that further novel tools will emerge. Scientists and policy makers need to utilise all these tools effectively.

Professionalising public engagement

There is real scope for sharing and building on good practice and for joining up activity. There is scope too for making public engagement less reliant on voluntary activity and for it to be perceived as more professional in its approach and a valued part of the work of scientists. There is more need for strategic thinking about what is being done well, what gaps there are and what needs to be done better, and for the best in public engagement to be incentivised and rewarded. All this can be achieved, but not without better understanding of the need to collaborate and co-ordinate activity, as is now happening with the Beacons initiative, and to become more involved in two-way dialogue.

4.8. We believe increasing excitement in science, improving inclusion and strengthening the relevance of science in our culture will be best achieved by professionalising public engagement and identifying ways to incentivise the practice. We have identified three key areas for action with a number of questions and challenges for the science, society and policy communities.

A. Strengthening communication

4.9. Some aspects of science are thought of as inherently exciting, such as space travel or dinosaurs. But when properly presented, almost all science has the power to stimulate wonder and the imagination – from how cells function to the Big Bang. Communicating this, creating curiosity, helping people to ask questions and generating enthusiasm are the building blocks needed to stimulate interest in science. The DIUS/RCUK survey shows that we start from a relatively good position. But we recognise that we can do more and do it better.

4.10. Engagement is becoming more professional, based on good practice, and often involves specific support, such as high quality media training. It is also becoming a two-way process, enabling scientists to understand the public's ideas, concerns, needs and interests better, thereby helping scientists' skills, research and careers, motivated by seeing the societal value of their work reflected back to them.

Beacons for Public Engagement

Launched in January 2008 and funded with £9.2m over four years by the UK Higher Education Funding Councils and Research Councils UK (RCUK), and with support from the Wellcome Trust, Beacons for Public Engagement is one of the biggest initiatives ever launched to support public engagement throughout the UK. It brings together a number of different funders with the common goal of achieving a more joined up and strategic approach to public engagement.

Six beacons have been set up in Manchester, Newcastle, Norwich, London, Cardiff and Edinburgh. There is also a UK-wide co-ordinating centre based in Bristol, which will work across the initiative to promote best practice and provide a single point of contact for the whole higher education sector. Their role also extends to the fundamental aim of this initiative, challenging all universities to embed public engagement in their mission but achieving this through listening to and learning from the sector.

The six Beacons – collaborative centres made up of a number of higher education institutions (HEIs) and their partners – will be at the forefront of efforts to change the culture in universities, assisting staff and students to engage with the public. Their partners include further education colleges, museums, galleries, businesses, third sector organisations, TV and press, and public bodies. The National Co-ordinating Centre for Public Engagement will provide leadership and will work with the Beacons, funders, policy makers, and the whole HE sector to make engaging with the public a key part of what it is to be an academic. **www.publicengagement.ac.uk**

Q. How can scientists further improve and professionalise engagement with the public?

4.11. There is a perception that scientists who engage with the public are not always rewarded or valued as much as they should be by universities, industry, funders or government. The Royal Society Report *Barriers to scientists communicating with the public* identified that science communication was not valued as a high priority activity or a central part of academic life and that the attitude of peers was that engagement was principally for those 'not good enough' for an academic career.

Q. How should high quality engagement be recognised and rewarded?

4.12. Despite the DIUS/RCUK survey showing that four fifths of those polled think that science is amazing, it also reveals that about a fifth are likely to be indifferent. Around 12% also said that they were not particularly interested in or even distrustful about, science and science issues.

Q. How can the scientific and policy communities make science more interesting for the public and particularly for those difficult to reach groups?

4.13. There are currently over 100 organisations in the UK which can be classed as a science or discovery centre. These include museums, zoos, aquaria, and specialist subject centres. Fifty-three of these organisations are represented by Ecsite-uk, which was set up to give the expanding sector a strong national voice and to be the point of reference for the work of science and discovery centres.

Q. What contribution can science centres make to the science and society agenda?

4.14. The appetite for science, health and environmental stories in the national media is voracious with a huge number of stories appearing most days. There are many signs that editors value their specialist reporters, arguably science's biggest allies, and we should nurture this relationship. The DIUS/RCUK survey showed that a majority of people still obtain their science information from TV, leading to a concern over the decrease in quality documentaries and the use of credible science in other programming.

Q. How can the media better support society's need for balanced information that accurately portrays the nature of science and improves scientific literacy?

Q. How can the lack of quantity and breadth of science television on terrestrial and other channels be addressed?

B. Improving inclusion and participation

4.15. For people to show an interest in and potentially be excited about science, we need to address the concerns of those who feel excluded. This might involve improved access to scientific expertise that the public can understand, in ways they choose, increasing the public's feeling that their opinions count and can influence decisions, research being seen to be more focused on addressing society's needs. The DIUS/RCUK survey showed that the less interested groups include a disproportionate number of women. Newer technologies such as social networks, e-voting and wikis could all contribute to improving participation through ways that suit different people's lifestyles.

Q. How can new technologies help empower all people, especially minorities and those currently excluded, to contribute ideas and opinions to scientists and decision-makers?

Sciencewise Expert Resource Centre

The Sciencewise Expert Resource Centre for Public Dialogue in Science and Innovation (ERC) is funded by DIUS and was launched on 29 May 2008 as a tool for helping Ministers and officials understand public views and concerns on complex and potentially controversial scientific issues. It aims to help policy makers commission and use public dialogue to inform policy decisions in emerging areas of science and technology.

The Sciencewise-ERC consists of a comprehensive online resource of information, advice and guidance together with a wide range of support services aimed at policy makers and all the different stakeholders involved in science and technology policy making, including the public. It also provides co-funding to government departments and agencies to develop and commission public dialogue activities. **www.sciencewise-erc.org.uk**

C. Demonstrating relevance

4.16. The science sector, including those working in industry, needs to demonstrate the relevance of its work to both society and policy specialists, explaining the science, the benefits, the complexities and the processes by which decisions about future development are taken. Business has a very particular role to play here, as society's direct interface with science is more often through the products and services they use.

Q. How can business better engage with society and policy makers about the development and use of science in everyday life?

4.17. The policy sector needs to understand the role that they can play in demonstrating the relevance of science to the public. Government funds much of the research in the UK and oversees, and in some cases regulates, its use.

Q. How can policy makers better engage with society about the development of science?

4.18. Most people engage with issues related to the personal impact of new science or technology. We have identified a wide range of current issues but these are always changing as the pace of science development increases:

- synthetic biology
- food security/sustainability
- artificial intelligence
- reproductive technologies
- data issues
- genetic modification technologies
- nanotechnology
- energy (personal responsibility)
- certain medical advances, for instance those related to ageing
- animal research.

Q. How can we capture emerging issues effectively and feed into the communication and engagement process?

5.0

A society that is confident in the use of science

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The Goal:

A society that feels confident in the use of science.

5.1. This chapter sets out our aspirations for building public confidence in using science and in the governance, regulation and use of science by scientists, business and government. It identifies three key areas for action, focusing on building a shared understanding of how science is done, how science is used in national and local policy making and what role the public and public thinking can play in developing science. We provide information on some of the existing work, identify current challenges, and pose questions on how to address them.

Where does the UK stand now?

5.2. We believe everyone should be a confident consumer of science and technology. Consumers of technology – such as computers, mobile phones, trains, cars, TV, electronic games, medicines – drive innovation. But those who are unable to utilise technological advances for their own needs may be left behind.

5.3. Public trust in the governance of science and technology, in regulation, product development and the policy making process through consultation and dialogue is critical for science's ultimate licence to operate. The DIUS/RCUK survey shows that 25% of those polled agreed that "the more I know about science, the more worried I am". Encouragingly, this is down from 35% in 2005.

What we need to do

5.4. The DIUS/RCUK survey shows that public trust in scientists continues to be strongly influenced by the scientists' experience, academic credentials and, crucially, their perceived independence from government and big business. It also indicates a demand for more consultation on scientific issues with 75% of those surveyed wanting to hear about potential new areas of science and technology before decisions are made. We have here identified four key areas for action.

A. Better understanding of the nature of science

5.5. Confidence and trust in science should arise from a realistic and informed understanding of the processes of science and the practices of scientists. It is not about promoting blind faith in science or an unquestioning acceptance of its authority; it is about providing everyone with the understanding and the opportunity to contribute to debates when science is discussed.

Rigour, respect and responsibility: A universal ethical code for scientists

Rigour, honesty and integrity: Act with skill and care in all scientific work. Maintain up to date skills and assist their development in others. Take steps to prevent corrupt practices and professional misconduct. Declare conflicts of interest. Be alert to the ways in which research derives from and affects the work of other people, and respect the rights and reputations of others.

Respect for life, the law and the public good: Ensure that your work is lawful and justified. Minimise and justify any adverse effect your work may have on people, animals and the natural environment.

Responsible communication: listening and informing: Seek to discuss the issues that science raises for society. Listen to the aspirations and concerns of others. Do not knowingly mislead, or allow others to be misled, about scientific matters. Present and review scientific evidence, theory or interpretation honestly and accurately.
www.dius.gov.uk/policy/science-society.html

5.6. There is a key role for scientists in academia and business to explain how science is developed and used. Demonstrating and exploring their own values and motivations is also an important way for scientists to understand their responsibilities towards society and to refresh their perspective on the value of their work. This provides the public with enough understanding of science and the opportunity to contribute to debates when science is discussed, ultimately empowering society more.

Q. How can we embed and communicate the principles of responsible scientific practice and ethics?

5.7. Scientists would prefer scientific stories presented by the media to demonstrate its uncertain nature and risks, whilst the tendency of the non-specialist media is to present a much more black and white picture. There is a middle ground. The Science Media Centre has been very helpful in this regard but there is a continuing need for a more sophisticated portrayal of the nature of science, and in particular what science can and cannot do.

The Science Media Centre (SMC) maintains a large database of scientists in a wide range of disciplines prepared to speak to the media. It acts as a bridge between the two sectors, fostering a greater understanding of the media by scientists and providing access to high quality scientific sources for the media. **www.sciencemediacentre.org**

The Head of Vision at the BBC, Jana Bennett, ran a workshop for news staff and others at the BBC on Climate Change in 2007, inviting many scientists to speak, resulting in a marked change in news reporting. **www.bbc.co.uk**

Q. What more can the science community and the media do to foster a shared understanding of the nature of science?

5.8. The Government Chief Scientific Adviser also has a role to play as a public figurehead, explaining how science has informed decision-making in government, whilst fully acknowledging areas of uncertainty. The public and scientific community's trust in the government's use of science should derive from transparent explanations which include discussions of risk.

5.9. Scientific literacy allows people to evaluate scientific sources of information, giving them confidence to scrutinise science and a greater understanding of potential solutions to problems. The foundations for all young people to engage with science and policy are laid in schools and colleges, and DIUS and DCSF are working closely together on actions to improve the potential of young people to gain knowledge, develop skills and the motivation required as researchers, policy makers, entrepreneurs, business leaders and citizens of the future.

Q. What more can the education community do to develop scientific literacy in young people?

5.10. Involvement in science is not limited to formal education. We are looking for innovative ways to provide access to scientific resources, in ways people want to access them. Earlier this year, DIUS launched an ambitious consultation on the future of informal adult learning and integration of this with other opportunities will be crucial to ensuring we achieve a broader approach to scientific literacy.

Q. How can we develop the scientific literacy of the science, policy and public communities?

B. Confidence in science funded by the private sector

5.11. The DIUS/RCUK survey showed that a clear majority of people (70%) trust scientists to tell the truth, and that this has increased from the last survey in 2005. However, they were more likely to trust scientists if they were seen as independent. Around one in five respondents agreed that they would be more likely to trust a scientist if they were independent of government (20%) and if they were independent of business/industry (20%). For others, the most important factors in determining whether scientists and engineers could be trusted were related to competence, e.g. experience (49%) and academic credentials (37%).

5.12. The government has doubled investment in science over the last ten years, but researchers also leverage funding from the private sector. Given the close links which exist between business, government and scientists there is an increased risk of a lack of perceived independence in science. Improved public reassurance means a responsibility to work to improve public perception of the independence of scientists across the community, particularly in government and industry. There is no reason why the way science is conducted, governed or communicated by the private sector should be or be perceived to be any different from the public sector.

5.13. Business has as great a responsibility as government to demonstrate competence, making clear that their scientists' experience and academic credentials are comparable with other scientists traditionally perceived to be more independent. Secondly, business has as great a need to build more confidence in their activities, engaging with the public on their motives, being honest about the constraints of their sector, showing equal concern for the safety, health, environmental, ethical, regulatory and social impacts of their work as their perceived motivations for control or commercial gain. Thus, the Universal Ethical Code for Scientists has an equally important role to play in business as in other spheres.

5.14. There is no doubt business faces different constraints when explaining its use of science. Ultimately, business is accountable to shareholders (and regulators at times) and keeps one eye firmly on the bottom line. It balances the risks and benefits that accrue for doing science and sharing the results, and using these as the basis for explaining its actions. However, in seeking to improve its relationship with shareholders and wider society, business has not always used science to best effect, and has missed opportunities to win the trust of customers and society. Even where there are concerns over commercial sensitivity and exploitation of Intellectual Property, business must explain how it uses science and how it uses good practice in scientific process. To secure public trust, the private sector must show that the way it governs science does not differ from any other sector.

5.15. Similarly, the private sector needs to engage with the public in the same ways that other scientists do. Section C below discusses good practice in scientists engaging with the public. Consumers are increasingly able to make choices about what they buy based upon how the product is developed, by whom, and why. Therefore, the private sector would be naive to disregard the public's desire for scientific methodology to be transparent and companies' motives to be clear.

Public appreciation of the harmful effects of smoking was in the past seriously damaged by the tobacco industry's attempt to discredit the findings of independent research which showed causal links between smoking and cancer and other illnesses. Lack of transparency surrounding the industry's motives in producing their own 'independent' research, is perceived to have allowed uncertainty to develop, which may have affected both public health and public attitudes towards industry-based scientists.

The industry's alternative approach could have been to allow a more open peer-review of its sponsored research. Business engagement with the wider science community may have led to earlier and increased understanding of the impact of smoking on health, promoted public trust in the messages from the industry and enabled development of alternative products and services.

5.16. There are signs that business is learning from past experiences and appreciating the consequences of trying to engage in the same way as those scientists perceived to be more independent. Business can easily lose the trust of many sections of society, often simply through poor communication, and there is a cost to recovering such trust, which may well impact on profit. This suggests there could be clearer incentives on business to make the effort to explain their scientific procedures, and to win public support for their activities. Our aim should be for the public to consider the allegiances of scientists to be irrelevant to the level of professionalism they bring in carrying out and communicating their work, and for business to be transparent in its presentation of scientific evidence.

Q. What more can the business community do to foster public confidence in science in industry?

C. Listening to what people say

5.17. The science, business and policy communities need to understand the value that the public can add to decision-making; when to engage with them and how to engage them appropriately, based on good practice and using all the tools within the spectrum of engagement.

5.18. Helping more people to engage with science and contribute to science, technology development or policy needs to be done in a manner that reflects their own engagement preferences. The rise of web-based and other technologies should not exclude those people unable to participate in this way. Innovative methods to support these people in acquiring new skills are needed to provide confidence to both engage and to continue learning.

Q. How can we use technology better to empower more people to contribute ideas, opinions and data to science?

Q. What can we do to reach those not able to use technology?

Train to Gain and other skills initiatives provide employers with tools to play a key role in this area. **www.traintogain.gov.uk**

5.19. Confidence in the governance of science develops from knowing that decisions concerning the regulation and implementation of technology are:

- made in as transparent a manner as possible;
- informed by an understanding of the public's aspirations and concerns around science; and
- in line with the ethical values held by scientists.

There have been substantial positive moves towards greater transparency, with increasing numbers of open meetings of Research Councils and regulatory bodies, with minutes being published on the web. **www.rcuk.ac.uk**

5.20. Policy making at all levels and business decisions can be significantly improved by knowledge of public concerns, ideas and aspirations. A range of methods can be used to understand these, including surveys, focus groups, consultations, new technologies, blogs or dialogue but all should be based on good practice. Significant national policy consultations can be opportunities for mass public education about science and the associated issues.

Q. How can we ensure policy makers understand the benefits of engagement with society on science in bringing a wider dimension to policy making?

5.21. In 2005, the Council for Science and Technology (CST) identified that a corporate memory of public dialogue activity should be established in government. Sciencewise is building an expert resource centre for public dialogue in science and innovation. We need to ensure this is used throughout government to ensure best practice for all future dialogue in the government policy system.

Q. How can good practice in public dialogue be embedded across government?

D. Better understanding of the role of science in policy making

5.22. Policy makers should have access to good, timely, scientific evidence and advice and be more transparent about the process. Scientists need support to understand policy makers' needs better if more are to become involved in policy work.

Q. What additional mechanisms should be put in place to enable scientists to better interact with policy makers?

5.23. Engaging with policy makers ought to be a valued part of what it is to be a scientist. Those researchers who have worked with policy makers report that it enriches their research and teaching. It is important that universities, industry, funders and government recognise the value of this interaction and reward those scientists who engage with policy makers. DIUS has asked the CST to investigate ways in which the interaction between academia and public policy makers in government could be improved.

Q. How is good practice by scientists engaging with policy makers celebrated and rewarded?

Newton's Apple aims to act as a neutral bridge between the science and policy communities. The ESRC has a people transfer scheme in place which has enabled academics to work on projects such as the Stern Review. There has been a pilot pairing scheme for scientists and civil servants and MPs, run with the Royal Society. Interaction with policy makers is part of National Endowment for Science, Technology and the Arts Crucible course organised for young post-doctoral scientists.
www.newtons-apple.org.uk
http://royalsociety.org/page.asp?id=6998
www.esrc.ac.uk
www.nesta.org.uk/crucible

5.24. Equally, engaging with the scientific evidence base ought to be a valued part of policy development for civil servants. The Government Office for Science, led by the Government Chief Scientific Adviser, has responsibility for championing and improving scientific advice to support better policy making across government.

5.25. In the summer of 2008, the Government Office for Science will be publishing its forward programme along with a consolidated set of policies and guidance. This will bring together government's science policy and guidance into one place, ensuring transparency and making it simpler for government departments to access science guidance and support.

Q. What additional mechanisms should be put in place to enable policy makers to better interact with scientists?

The Government Office for Science has sponsored the 2008 Whitehall and Westminster World Civil Service Science and Technology Award, which recognises best practice in the innovative use of science and technology as part of the policy making or business planning process.
www.civilservice.gov.uk

Q. How is good practice by policy makers engaging with scientists celebrated and rewarded?

6.0

A society with a representative, well-qualified scientific workforce

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The Goal:

A society that supports a representative well-qualified scientific workforce.

6.1. This chapter sets out our aspirations for achieving a representative well-qualified scientific workforce of the future. It identifies three areas requiring action and highlights some of the activities already underway, some of the challenges that remain, and makes suggestions for how we might address them and poses key questions.

Where does the UK stand now?

6.2. Government is committed to ensuring there is an appropriate supply pipeline of science skills to the workforce. The trends of the last twenty years are well known and in recent years government has announced a wide range of commitments to address Science, Technology, Engineering and Maths (STEM) supply issues in particular. These are outlined in the Science and Innovation Investment Framework 2004-2014, the Science and Innovation Investment Framework 2004-2014: Next Steps published in March 2006, and the STEM programme report published in October 2006.

- The 2006 Programme for International Student Assessment (PISA) study showed that England's students achieved above the Organisation for Economic Cooperation and Development (OECD) mean in science, placing us among the high achievers, although not yet in the topmost group of countries such as Finland, Hong Kong and Canada. For mathematics, we are not statistically different from the OECD mean. These results are good but there is no room for complacency.
- There has been an encouraging recent upturn in achievements in science within the secondary education system. The Higher Education Funding Council for England (HEFCE) continues to monitor the position of STEM subjects and others of 'strategic importance' and has made funding available to increase and widen participation, in particular in engineering, chemistry, physics and mathematics.
- There continues to be a strong demand for those with science skills and training from employers in all sectors, not just in traditional science-based industry. Initiatives to improve diversity in the scientific workforce have been set up, such as the UK Resource Centre for Women in SET (UKRC) and government support for programmes to engage the most under-represented Black and Ethnic Minority (BME) secondary school students in STEM.

What we need to do

6.3. For the UK to remain at the forefront of scientific discovery and to secure its future in a highly competitive global economy, we need to ensure the next generation of scientists and engineers are properly equipped through opportunities in education, research, commerce and government. Unlocking the talent of Britain's citizens through increasing their ability to acquire and develop their own skills is critical both individually and at a societal level. As the Leitch Review of Skills outlined, the only way to compete on the world stage is to increase the coverage of higher levels of skills in our workforce.

6.4. The science workforce is not yet truly representative, with a significant gender imbalance in many areas, as well as poor representation of some ethnic minorities. The SET Fair report published by Baroness Greenfield in November 2002 highlighted the barriers which result in girls and women playing an unrepresentative role in SET (STEM), both in its workforce and its governance. The government's Strategy for Women in SET published in 2003 responded with commitments such as setting up and funding a National Resource Centre for Women (UKRC) in 2004 to deliver its Women in SET strategy.

6.5. We want to ensure that the needs of employers are met, that the science curriculum is sufficiently challenging for the top 25% of pupils, that it increases scientific literacy of the population at large, and that there are good enrichment and enhancement activities as part of science education. On the latter, DIUS has made major investments in STEMNET and the Science and Engineering Ambassadors programme with 19,000 ambassadors now acting as role models, while DCSF sponsors the science and engineering after school clubs run by STEMNET. We believe that there are three objectives essential to building on this and realising the goal.

A. Exciting people about science

6.6. This objective is integral to the vision and has already been discussed. However, it is particularly relevant to recruitment and retention in the science workforce. Children are excited by science and maintaining this excitement and curiosity during and beyond their primary school years increases the likelihood that this will continue into adulthood. Promoting science as a vibrant and rewarding subject to teach will help increase the quality and number of teachers in science subjects. Links between schools, research and industry allows those working in science careers to convey their enthusiasm and excitement to children at a point when they may be making decisions about their future.

6.7. Inspirational teachers are frequently cited as the reason that young people take up science. Maintained schools, in particular, struggle with serious shortages of teachers qualified to teach physics and chemistry. Improved skills are already being tackled through a wide range of initiatives including golden hellos for STEM graduates and pre-initial teacher training for those who need to top up subject knowledge.

Q. What further support do teachers need to help young people understand how science works, how government works and how the media works?

High quality Continuing Professional Development (CPD) is being provided through the DCSF/Wellcome Trust supported Science Learning Centres (SLC), and the DCSF funded National Centre for Excellence in the Teaching of Mathematics. In the 2008 Budget, government is providing £10m over 5 years on a new initiative, Enthuse, building on SLCs to address teacher skills and retention, with up to £20m investment from business and the Wellcome Trust.
www.sciencelearningcentres.org.uk
www.wellcome.ac.uk

6.8. There are a number of factors that inhibit pupils taking up science post 16. The secondary science curriculum has already been overhauled to make it more relevant and engaging. The challenges identified in Chapter 4 on raising interest in science and its relevance are applicable here too.

Q. What more do schools need to enhance the science curriculum to make it more exciting and relevant?

A comprehensive STEM careers awareness programme is currently being developed by the Centre for Science Education at Sheffield Hallam. The FutureMorph website, developed by the Science Council with funding of £500,000 from DCSF, is one of the strands of the Careers for Science programme. The STEMNET Science and Engineering Ambassadors scheme currently has over 19,000 ambassadors, professionals with science based careers who act as role models and mentors to pupils, currently reaching over 1 million children.
www.stemnet.org.uk
ww.sciencecouncil.org

B. Increased clarity

6.9. Careers in science subjects are valued by society and those with training in science subjects are very attractive to a wide range of employers including the finance, business and policy sectors and third sector organisations in addition to those traditionally associated with science. Greater information about the wide range of opportunities to which science study can lead and improved awareness and clarity of the nature of scientist's jobs would be helpful in encouraging more people into science.

Q. What can the science and business communities do to tell young people about the career opportunities that a science education opens up in all work areas?

6.10. Most universities have schools outreach programmes and all schools and teachers should now be able to engage with real researchers and with research in industry and universities. Universities are also beginning to partner academies, allowing direct engagement with researchers, in addition to access to university facilities and enrichment of the curriculum. However, we do not yet have a critical mass in this area with all organisations embracing this as part of their everyday culture. The Secretary of State has asked Vice-Chancellors to look at what more they can do to support science in colleges and schools.

Q. How can we measure future demand for science skills in the UK?

6.11. There is a considerable role for business and industry here on a number of different fronts, including encouraging members of their workforce to take part in enrichment activities. These efforts need to be plugged in to what already exists both locally and nationally and undertaken with best practice constantly in mind. Identifying members of the workforce who would benefit from training, particularly those who may not have had an opportunity to have science training previously in their lives, can also unlock unidentified talents.

Q. What can business do to make sure that its efforts in enrichment activities are co-ordinated and effective?

6.12. Within government, the Government's Chief Scientific Adviser (GCSA) is leading work to strengthen the skills and raise the profile of the science and engineering community within the Civil Service, a major employer of scientifically skilled workers. Key to achieving this is the revitalisation of the HoSEP (Head of Science and Engineering Profession) network with particular focus on delivering in four key areas. The network plans to:

- create a cross-government science and engineering community
- create a Professional Skills for Government (PSG) framework for scientists & engineers below Grade 7
- hold the first annual conference for the science and engineering community in government this year
- produce a range of case studies demonstrating where science and engineering has had a positive impact, and where policy has suffered due to lack of science and engineering input.

6.13. The GCSA is also an active member of the HoA (Heads of Analysis) group, which also comprises the Heads of Service for Economics, Operational Delivery, Social Research and Statistics. This group works together to achieve more effective joined-up analysis across government through various means, such as co-ordinating the professions' contribution to the Analysis and Use of Evidence PSG core skill.

C. Increased diversity

6.14. Science should be seen as something that everyone is able to do, regardless of their gender, age or origin. The under-representation of some groups remains an issue. Since the UKRC was set up there are signs of progress but changing workplace culture requires time and there is still a great deal to be done in this area to develop the level of skills and size of workforce that will be required for the future.

6.15. Teaching that is not sensitive to gender may contribute to the gender gap in take-up beyond 16 of the physical sciences and mathematics, lessening the chances of the workforce being truly representative. There is also scope to improve take-up of science subjects in maintained schools in disadvantaged areas which can lead to further exclusion.

Q. Is there a different way to teach science subjects which could help overcome the issue of under-representation of some groups?

6.16. Whilst the gender gap begins to appear in schools, its effects are most noticeable in the later stages of career development. There is perhaps more that the science and business communities can do to show young people that they welcome and embrace diversity and provide opportunities for advancement.

Q. How can the science community and employers show society that they welcome and embrace diversity, including women, ethnic minorities and older people?

6.17. One of the consequences of demographic change is that increasing the number who enter post-16 study in science subjects may still not fill the demand from business for employees with these skills. As the Leitch Review made clear, older people will increasingly be needed to fill this gap. They may either have science training that needs refreshing, or may want to retrain in science subjects.

Q. What can policy groups and business do to address issues of under-representation and retention?

7.0

Roles, responsibilities and actions

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7.1. This chapter considers the role of government and those involved in the Science and Society agenda in response to the questions posed in the preceding chapters. We also seek views on what major areas should be the focus for significant policy initiatives, which could subsequently form the basis of our strategic delivery plan.

Government's role

7.2. We believe there is a strong leadership role to be played by government, in addressing the challenges set out above. We cannot achieve the vision alone and want to develop a shared strategy we can all commit to for the future.

Government's unique role, as a driver of policy, is to enable the conditions for a society in which the public is truly engaged with science in the modern world and to provide appropriate support.

This requires the scientific community, policy makers and the public to share a common and open culture of discussion about science and its applications, as science ultimately takes its licence to operate from society.

A role for the Department for Innovation, Universities and Skills

7.3. DIUS champions science and innovation, working with partners across and outside government. Some key elements include:

- Government's knowledge economy programme
- The 2004 Science and Innovation Investment Framework
- Lord Sainsbury's review "The Race to the Top"
- The innovation White Paper "Innovation Nation"

7.4. In addition, DIUS has taken up the challenge to improve the high-level oversight of science and society both within and outside government:

- The Science and Society Champions Network brings together science and society policy representatives from many government departments and Agencies
- The Council for Science and Technology advises the Prime Minister on cross-departmental issues, including science and society
- DIUS engages with new governance arrangements in STEM policy – including a national STEM Director, a Ministerial Steering Group, and a High Level Strategy Group
- DIUS supports cross-government initiatives such as the Cabinet Committee on Public Engagement and Service Delivery and Ministry of Justice citizen empowerment
- Rationalise related strategies and provide common goals where appropriate.

7.5. DIUS will continue to play a key role in maintaining and improving its oversight activities, and in bringing greater coherence to the science and society agenda.

The role of the wider Science and Society Community

7.6. There are many organisations working within the science and society arena, and a great deal of activity. Solutions to the challenges are not therefore a question of simply creating more organisations or increasing levels of activity. The fruits of better, more mature relationships ought to be better quality outcomes achieved through greater collaboration, coupled with careful decisions on the expansion or rationalisation of different work areas.

7.7. We are keen to see evidence of an increased willingness to work together on the part of all members of the science and society community, and see workable, cost-effective offerings that can form part of our longer-term strategic vision.

7.8. We are especially keen to see business become a more integrated part of the science and society community, with the entire community learning from and building on the different approaches of the business and science sectors.

7.9. We would like all members of society to be more open about their views and aspirations with respect to science in research and business, education, communication and policy making, especially on issues which impact on their lives.

A key role for Business

7.10. We see no difference in principle between the use of science by the private and public sector. We believe business has a key responsibility to do more to communicate its understanding of society's needs and demonstrate commitment to societal benefit alongside commercial success.

7.11. Research has shown that there is public demand for more information directly from scientists at an early stage in the research process. This applies to scientists involved in research and development in business as much as to those in the public sector. We would like business to consider how it could better explain its use of science and technology in the development of products and services.

7.12. We would like to see business articulate its skills needs more effectively and take action with others within the community to communicate the demand for scientific skills and the associated career opportunities that a science education opens up to all. We would also like business to consider how effectively it is involved in enrichment activities, and how it addresses issues of diversity and under-representation and retention.

7.13. Overall, trust in scientists has gone up since 2000, but scepticism about the influence of funders has increased. In particular, the DIUS/RCUK survey showed that 60% of people believe that scientists are too dependent on business for funding, which affects perception of independence.

7.14. We would like business to consider each of these areas, and its role as an integral part of the wider science and society community. In particular, evidence that business is addressing each of these challenges will help to restore trust in the wider exploitation of science and technology.

Our shared responsibilities

7.15. DIUS will explore setting up a multi-agency oversight group for the whole of the science and society agenda, maximising the effectiveness of existing groups, to ensure delivery agents and partners are able to share objectives, best practice and budgets (where appropriate), to collaborate more effectively and evaluate effectiveness on a more coherent scale than previously.

7.16. The DIUS Science and Society and GO-Science in Government teams are taking a common approach to the development of the Sciencewise programme to include an Expert Resource Centre for Public Dialogue which will tackle several of the challenges around empowerment and the quality of decision-making.

Areas for policy intervention

7.17. Our dialogue with a range of partners to date has identified a number of areas where we believe policy initiatives and actions could be taken. These are reflected in the discussion and questions we have asked in the preceding chapters.

7.18. We offer the following summary of these areas and would welcome your views on what are the priorities between the different areas and where there is scope for initiatives and actions which will make us more effective in working together to achieve our vision.

7.19. A final question:

Q. Do these areas and questions provide a suitable framework for addressing the challenges we have identified?

Summary of goals, areas for action and questions

Goal: A new vision

What steps can we take to co-ordinate better or streamline science and society activity to make it more effective?

How should we measure progress? What indicators do we need to measure success?

Goal: A society that is excited about science and values its importance to our social and economic wellbeing

Areas for action	Science	Policy	Society	All
Strengthening communication	How can **scientists** further improve and professionalise engagement with the public?		How can the **media** better support society's need for balanced information that accurately portrays the nature of science and improves scientific literacy?	How should high quality engagement be recognised and rewarded?
	How can the **scientific** and policy communities make science more interesting for the public and particularly for those difficult to reach?	How can the scientific and **policy** communities make science more interesting for the public and particularly for those difficult to reach?	How can the lack of quantity and breadth of science television on terrestrial and other channels be addressed?	What contribution can science centres make to the science and society agenda?
Improving inclusion and participation				How can new technologies help empower all people, especially minorities and those currently excluded, to contribute ideas and opinions to scientists and decision-makers?
Increasing relevance	How can **business** better engage with society and policy makers about the development and use of science in everyday life?	How can **policy makers** better engage with society about the development of science?		How can we capture emerging issues effectively and feed into the communication and engagement

Goal: A society that feels confident in the use of science

Areas for action	Science	Policy	Society	All
Better understanding of the nature of science	How can we embed and communicate the principles of responsible **scientific** practice and ethics?		What more can the **education** community do to develop scientific literacy in young people?	How can we develop the scientific literacy of the science, policy and public communities?
	What more can the **science** community and the media do to improve understanding of the nature of science?			
Confidence in science funded by the private sector	What more can the **business** community do to foster public confidence in science in industry?			
Listening to what people say		How can we ensure **policy makers** understand the benefits of engagement with society on science in bringing a wider dimension to policy making?		How can we use technology better to empower more people to contribute ideas, opinions and data to science?
		How can good practice in public dialogue be embedded across government?		What can we do to reach those not able to use technology?
Better understanding of the role of science in policy making	What additional mechanisms should be put in place to enable **scientists** to better interact with policy makers?	What additional mechanisms should be put in place to enable **policy makers** to better interact with scientists?		
	How is good practice by **scientists** engaging with policy makers celebrated and rewarded?	How is good practice by **policy makers** engaging with scientists celebrated and rewarded?		

Goal: A society that supports a representative well-qualified scientific workforce

Areas for action	Science	Policy	Society	All
Exciting people about science			What further support do **teachers** need to help young people understand how science works, how government works and how the media works?	
			What further support do **schools** need to enhance the science curriculum to make it more exciting and relevant?	
Increased clarity	What can the **science** and **business** communities do to tell young people about the career opportunities that a science education opens up in all work areas?			How can we measure future demand for science skills in the UK?
	What can **business** do to make sure that its efforts in enrichment activities are co-ordinated and effective?			
Increased diversity	How can the **science** community and **employers** show society that they welcome and embrace diversity, including women, ethnic minorities and older people?	What can **policy** groups and business do to address issues of under representation and retention?	Is there a different way to **teach** science subjects which could help overcome the issue of under-representation of some groups?	

Roles, responsibilities and actions

Do these areas and questions provide a suitable framework for addressing challenges we have identified?

8.0

Next steps: how to respond

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8.1. This consultation document has set out a proposed vision for Science and Society and outlined some key questions and challenges facing the science and policy community as the government looks to develop its future strategy. We want this vision to be widely shared and hope that others will want to align their strategies and actions with it.

8.2. Over the next few months we invite all sectors of society, science and policy to answer the questions posed in this strategy, tell us how they are already addressing some of the challenges and propose ways of achieving the vision in the future. We intend to draw all of this together in a strategy and action plan in the new year. We need to agree outcomes and how success should be measured. We need to agree and prioritise benefits.

How to respond

8.3. This consultation will close on Friday 17 October 2008. We will be seeking input and responses to this draft strategy through a range of methods, including an online consultation space (**http://interactive.dius.gov.uk/scienceandsociety**).

8.4. We will be holding a number of meetings and workshops. A list of key events is in preparation and will be posted on the website as they are set up throughout the consultation period.

8.5. We encourage all organisations within the broad science community to play an active part in this consultation and host events or other opportunities to provide input.

8.6. We would also support more informal activities, which may be able to be supported nationally or regionally by DIUS or one of our key stakeholders. If you would like to discuss such an activity, please email **scienceandsociety@dius.gsi.gov.uk**

8.7. Finally, we welcome other written responses and input by email to: **scienceandsociety@dius.gsi.gov.uk**

ANNEX A

Development of this consultation document

Structured discussions with a broad range of stakeholders have been undertaken to scope the development of this consultation document and discuss key issues concerning science and society in the UK. These began with a small scoping workshop in October 2007, after which the vision was proposed by the Minister at the inaugural Gareth Roberts' Memorial Lecture in November 2007. A web consultation on the proposed new vision followed the speech and ran until the end of December. Other written input was also received at this time from stakeholders. A mapping exercise of activities within science and society was undertaken. This is available at www.dius.gov.uk/policy/science_society_mapping.html

Stakeholders were also invited to attend a series of workshops between December 2007 and February 2008 to explore the elements of the vision and how they should be addressed, with the aim of co-developing a science and society strategy for the UK. Two workshops in December focused on establishing the strengths and weaknesses of current public engagement, public dialogue, science workforce issues and communication activities. Three workshops in early 2008 explored themes emerging from the strategy: exciting people about science, enriching their lives, engaging and empowering. In addition, the workshops addressed the challenge of collaboration within the science and society community and the relationships between the various groups.

Each workshop involved between 15 and 30 stakeholders from research, business, media, think tanks, education, government and public services. Ian Pearson, Minister of State for Science and Innovation, chaired the first workshop with the remainder managed by the Science and Society team at DIUS.

This document will be available for wide consultation for three months with the aim of publishing an agreed strategy in the autumn, along with an agreed implementation and delivery plan.

Written responses

A small number of written responses were also received. The majority of people responded positively to the proposed vision and this has therefore remained constant throughout the process. The quality of responses was high and many of the policy themes and ideas put forward have been reflected in this document and will be further taken into account during the consultation phase and in drawing up the implementation plan.

ANNEX B

Measuring progress

In developing our strategy we think it is important to measure success and to consider setting some high-level targets to measure our collective effort. By 2014, we would like to see significant improvement in the current trajectory. This date marks the end of the 10-year Science and Innovation Investment Framework timeframe. We already have a number of indicators gathered through the three-yearly public attitudes to science survey and a number of targets and indicators in the STEM Programme Report and DCSF Strategies. We want to build on these measures by developing the most appropriate targets, indicators and measures to support achievement of our vision. We give some suggestions below, but this is by no means intended as a proscriptive or exhaustive list. We welcome views on:

- How should we measure progress?
- What indicators do we need to measure success?

Goal: A society that is excited about science and values its importance to our social and economic wellbeing

Areas for action	Current measures	Proposed future measures
Strengthening communication	The proportion of people who say they are well informed about science and scientific developments.	An increase in and widening of the diversity and coverage of science on TV, as this is acknowledged to be the main source of information.
Improving inclusion and participation	Greater recognition that engaging the public is a valued part of what it is to be a scientist. Only 20% of scientists say "scientists who engage with the public are less well regarded by other scientists" (Ref 2006 RS survey)	
Increasing relevance	The proportion of people who consider science to be such a big part of our lives that we should all take an interest.	

Goal: A society that feels confident in the use of science

Areas for action	Current measures	Proposed future measures
Better understanding of the nature of science	An increase in the number of people who have confidence in the regulation of science and engineering. This has remained static since 2005 at 53%. Increase in people's confidence to use science and technology across all demographic groups e.g. digital inclusion programme.	
Confidence in science funded by the private sector		Increased quantity and quality of engagement with the public by business.
Listening to what people say		Increased use amongst policy makers of the range of engagement techniques, including dialogue, based on good practice.
Better understanding of the role of science in policy making		Evidence of an increased capability and capacity of government to carry out high quality dialogue.

Goal: A society that supports a representative well-qualified scientific workforce

Areas for action	Current measures	Proposed future measures
Exciting people about science	Year-on-year increases in the number of young people taking A levels in physics, chemistry and mathematics so that by 2014 entries to A level physics are 35,000; chemistry A level entries are 37,000; and mathematics A level entries are 56,000. Science clubs doubled from 250 to 500 by September 2008.	
Increased clarity	By 2014 25% of science teachers to have a physics specialism, 31% of science teachers to have a chemistry specialism and 95% of mathematics lessons in schools to be delivered by a mathematics specialist.	
Increased diversity	More women attracted into STEM-related 16–19 and post-19 training, degree and postgraduate courses, particularly in physical and mathematical sciences and engineering. 27,000 Science and Engineering Ambassadors, from the current level of 18,000, by March 2011 acting as effective role models representing the diversity of society. Network of BME SEAs.	An environment in UK STEM education, employment, research and policy making in which women continue to participate in and share the benefit equally with their male counterparts. More people from BME groups attracted into STEM-related higher and further education and employment.

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