

# SCIENCE POLICY AGENDA 2005 TO 2010

## SUMMARY

Science and engineering have become important political issues because science is everywhere in modern life.

No modern economy can thrive without mechanisms that attempt to optimise the nation's effectiveness at using science to stimulate wealth creation. Science is equally important to the formulation of public policies on a huge range of issues. This document analyses the current science policies in the UK, and sets out some specific recommendations for Parliament during the period from 2005 to 2010.

In Chapter 1, we set out policies to ensure that the maximum economic benefits are generated from science and engineering. The science and engineering research base needs to be vibrant, with a reciprocal transfer of knowledge between the science base and wealth-creating industries. Industry needs to carry out its own development and research, to generate new products and processes. Colleges and universities need to train scientists and engineers to the range of levels, as a skilled workforce for economically-active industry.

Chapter 2 explores the high cultural value that the country places on science. Science should be treated equally with other areas in the areas of national life such as the distribution of National Lottery funding. New and better mechanisms need to be put in place to support scientists in communicating with a wider audience.

We deal with the use of science in formulating public policy and some of the other benefits of science in Chapters 3 and 4. Departments of State need more scientific expertise, and the Government as a whole would function more effectively if a cabinet minister had primary responsibility for science and engineering. The budget for policy-based research should be increased by 20% by 2010.

Research in the science and engineering base is the subject of Chapter 5. To maintain a competitive science base, the government should aim to continue increasing the budget at the same rate that has occurred in recent years. Risk-taking research should be promoted, and much more must be done to ensure that some of the world's best minds are recruited and retained in the UK's science base.

Finally, in Chapter 6, we discuss the crucial area of science education. The transition between primary school and secondary school requires better handling, as does the interface between secondary education and university. Reversing the crisis in recruiting science teachers is an urgent priority. Further education policy needs a complete overhaul by a Royal Commission. In higher education, barriers to studying science must be removed.

This set of policies is a realistic programme for the coming five years, and if enacted would enable the UK to retain the position as a leading scientific and technological nation that it has held for more than two centuries.

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# SCIENCE POLICY AGENDA

## 2005 TO 2010

### INTRODUCTION

Science is everywhere. Its achievements dominate our daily lives, from satellites that beam communications around the world in seconds, to the modern medicines that act on individual molecules in our bodies, making our lives longer and healthier than our ancestors could have imagined.

The majority of people say they are amazed by science, and believe that it should form a major part of the educational curriculum<sup>1</sup>. Research in the fields of science and engineering is the bedrock of the nation's economy, and it informs public policies in areas as diverse as international development, military defence, public health, crime detection, and the horseracing industry.

Because of its all-pervading influence on our society, science is now an important political issue. In order to optimise the way in which the nation handles its science policies, we need a vigorous and informed debate about the ways in which the private and public sectors organise, fund and handle research and its results.

This document is a contribution to such a debate from the Campaign for Science & Engineering, formerly known as Save British Science. It analyses the current situation and sets out a series of science policies for the next Parliament, together with the thinking that justifies those policies. It is addressed primarily to those people who will be elected Members of Parliament at the next General Election and those who will sit in the House of Lords. It is particularly directed to those who will form the next Government, and also to the civil servants and others who will advise them.

But the document is also designed to be of interest to anyone who is interested in seeing the UK thrive scientifically, including the devolved areas that are no longer wholly governed from Westminster.

The document updates the last major set of policies that Save British Science published before the last General Election in 2001<sup>2</sup>. The policies and suggestions are the considered collective opinion of the members of the Executive Committee of the Campaign for Science & Engineering, but are also the product of an ongoing consultation with the organisation's members and Advisory Council, and with scientific societies, school teachers, university staff

and students, industrialists, financiers and many others.

#### The importance of science and engineering to society

The main reason that societies undertake scientific and engineering research is to improve the quality of human lives. Science achieves this in four broad ways:

⇒ First, science and engineering form a crucial part of the **economy**; researchers discover and invent the products and processes that drive economic activity, and engineers turn them into reality. The main reason the scientific community expects billions of pounds of public money each year is that taxpayers receive very substantial returns on their investment.

⇒ Second, science and engineering are important **cultural activities**; they enrich people's lives because we find scientific results fascinating and because science reveals untold beauty in the structure of the universe. Although this is the personal motivation of many individual researchers, it is also important to the huge number of non-scientists who enjoy science programmes on television or who are inspired by museum exhibits or books about science.

⇒ Third, science and engineering are essential to the formation of **public policy**; governments and other public bodies attempt to make our lives more comfortable or fulfilling by implementing policies that are informed by the best and most up-to-date knowledge.

⇒ Fourth, scientific and engineering results feed into a wide variety of fields that may not pay economic dividends, but which nevertheless bring **other benefits**. Expensive medical treatments or environmental conservation practices may not pay immediate or measurable economic dividends, but they enhance the lives of many people.

The first four Chapters of this document deal in turn with each of these four reasons for pursuing science. They give examples of how and why science and engineering are important, and set out a series of specific policies in each area.

The research that makes these benefits possible is achieved by having a strong **science and engineering**

## Box 1

## Historical investment in science in the UK

Although learning has been “cherished” in Britain since the time of Alfred the Great, Francis Bacon is generally regarded as the earliest strong proponent for research in something like its modern form, because he championed state support for science in the sixteenth and seventeenth centuries.

By the eighteenth century, the Board of Longitude was like a modern Research Council, dispersing public money both for work that succeeded in its aims and for work that failed but which was worth trying. Taxes were being used for technological advancement in other ways, such as the local rates levied to cover the costs of surveying land for enclosure during the agricultural revolution. This amounted to the equivalent of an extra penny in the pound of income tax in today's money.

The Victorian age saw public support for engineering in the form of Parliamentary grants. John Loudon McAdam, who invented ‘macadmized’ road surfaces was granted £2,000 in 1825 ‘for the service which he has rendered by the introduction of a valuable improvement in the method of constructing the public roads’. Royal patronage grew in the nineteenth century, with William IV granting a lifetime’s pension to William Smith, the ‘father of geology’. Prince Albert acted as the driving force being the Great Exhibition, which brought together much of the world’s finest engineering and science; its proceeds are still funding research today. Queen Victoria gave a house to the palaeontologist Richard Owen specifically because she thought ‘that there is no method in which she can better give a tribute of her respect and regard for science’.

In the early twentieth century, the Royal Commission on Awards to Inventors dealt with more than 700 inventions, including microphones, telegraphic devices and process to prevent iron and steel from rusting. At about the same time, the precursor of the Medical Research Council (MRC) was founded, and its reconstitution as a Council was one of the most memorable acts of the premiership of Arthur Balfour.

This occurred at much the same time as the setting out of some of the principles on which science is funded today. The Haldane Principle, for example, by which arm’s length bodies like the MRC distribute public funds, is named after Richard Haldane, who died less than a decade after the MRC began its work.

The modern age of science funding had begun.

**research base**, which in turn depends on a healthy system of **science education**. Science education is also important in enabling citizens to take an active part in a modern democracy, dominated by science and technology. Chapters 6 and 7 therefore examines the science base and the education system, and sets out relevant policies in these areas.

**“Few countries which have contributed so much to science, and benefited so much from it, cherish it so little, and support it so grudgingly.”**

*Professor Bob Michell,  
former President of the Royal College of Veterinary Surgeons*

## Investment in science and engineering

The UK has a long tradition of investing in its scientific and engineering potential. It was no accident that the Industrial Revolution was centred in what is now the UK. Box 1 gives a few examples of the historically huge diversity of investment that this country has made in science and engineering.

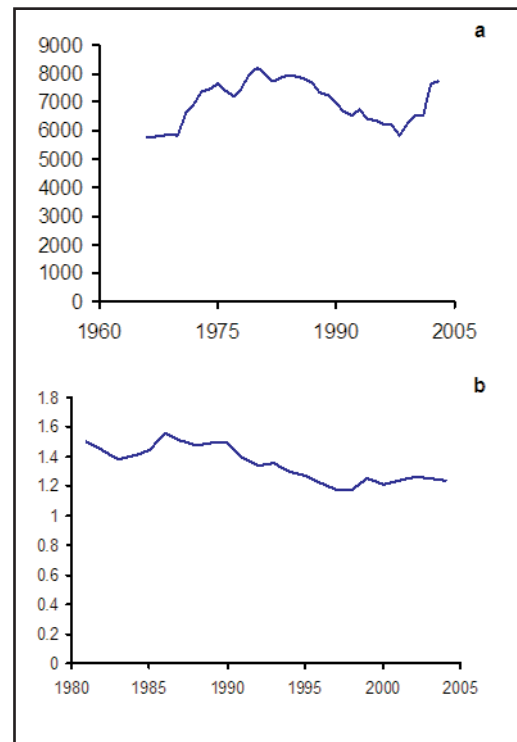


Figure 1. Investment in research and development in the UK in recent years. (a) Public investment since the mid 1960s (£ million in real terms at 2001 prices) (b) Private sector investment as a percentage of the Gross Domestic Product since the early 1980s. [Sources: *Main Science & Technology Indicators*, OECD, Version 2004/1; *Research and Development Spending in 2002*, ONS, 2004; *Forward Look 2003: Government Funded Science, Engineering and Technology*, DTI, 2003; *Science & Innovation Investment Framework 2004-2014*, HM Treasury/DTI/DfES, 2004].

Figure 1 shows the recent trends in overall public investment in research and development, compared

with private sector investment. Overall, some 1.9% of the national economy is invested in scientific and engineering research and development<sup>3</sup>.

Box 2 examines how British investment in research and development compares with the performance of other countries, and shows that the UK is about average among the group of 30 industrialised countries but lags behind its main competitors such as the USA, Japan, Germany and France.

This document examines this investment, assesses some of the ways in which the investment is used for the benefit of the British people, and makes suggestions for how the scientific health of the nation might be enhanced in the coming years.

### An inclusive use of the word 'science'

To most non-specialists, the word 'science' encompasses a range of activities, including medicine, engineering, mathematics and technological development. This is the sense in which the word 'science' should be interpreted in this document. Although it is used primarily to mean the natural sciences, many of the policies may be equally relevant to the social sciences.

Some of the many fields encompassed by an inclusive sense of the word 'science' have unique features that set them apart from the rest of scientific endeavour, but they all share a single set of aims: to understand the world and the universe more fully, and to use that understanding to create novel artefacts, to invent new ways of doing things, and to generate entirely new experiences.

On occasion, the document emphasises the importance of the diversity of rational inquiry by repeating the words 'engineering', 'mathematics' or 'medicine', but every use of the word 'science' is intended to encapsulate the huge array of different activities that are defined by these aims.

## Box 2 International levels of investment in research and development

Figure 2 shows the total level of investment in research and development in the countries of the OECD, combining all public and private sources of funding.

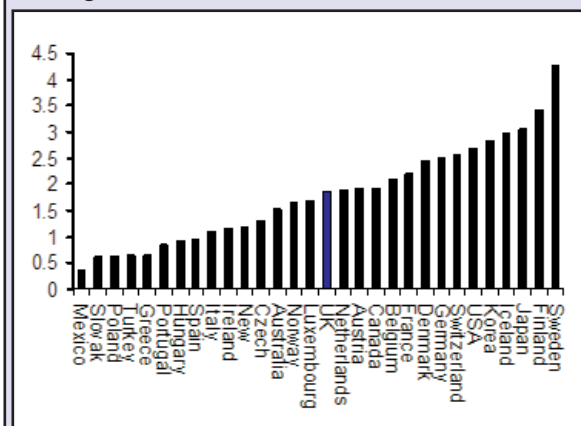


Figure 2. Gross investment in research and development in all the countries of the OECD, as a percentage of the Gross National Product (average of all available figures from the year 2000 onwards) [Source: *Main Science & Technology Indicators*, OECD, Version 2004/1].

While overall investment in research and development in the UK has fallen by 21% since 1981, it has risen in the USA by 12% over the same period. The data allow the same comparison to be made in 13 nations that are now members of the European Union; the UK is the only one in which this measure has fallen over the past two decades.