



Government  
Office for Science

# Government Office for Science

Annual Report 2015-16

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## Foreword



The Government Office for Science, supported by the Departmental Chief Scientific Advisers, has ensured that high-quality science advice is available to support government decision making and policy. More than ever, it is clear that science has a fundamental role to play in strengthening the economy, resilience and policies of the UK.

We have ready access to external expertise on everything from emergencies to long term strategic issues. We try to anticipate issues using horizon scanning and foresight techniques. We deliver expert advice in a variety of ways ranging from face-to-face rapid reactions, to convening seminars and roundtables, rapid technology assessments, or in-depth authoritative reports focused on complex policy issues

Our work this year has been varied and included delivering the evidence and analysis for the National Flood Resilience Review; providing advice on how distributed ledger technology could reduce fraud, corruption, error and the cost of paper-intensive processes; providing the Prime Minister with advice from the Council for Science and Technology on how the UK can gain the greatest value from autonomous and connected vehicles; and developing an evidence base on the future challenges of an aging population.

In doing so the Government Office for Science provides a unique service which works closely with Ministers and policy officials across government. We act as a transmission mechanism bringing expertise to bear on policy issues of the day and getting ahead of those of the future.

**Professor Sir Mark Walport**  
**Government Chief Scientific Adviser**

## What we do

The Government Office for Science ensures that government policies and decisions are informed by the best scientific evidence and strategic long-term thinking. The Government Chief Scientific Adviser (GCSA) is head of the Government Office for Science and head of the government's science and engineering profession. He is responsible for:

Providing scientific advice to the Prime Minister and members of Cabinet;

- Advising the government on aspects of policy on science and technology; and
- Ensuring and improving the quality and use of scientific evidence and advice in government.

## How we operate

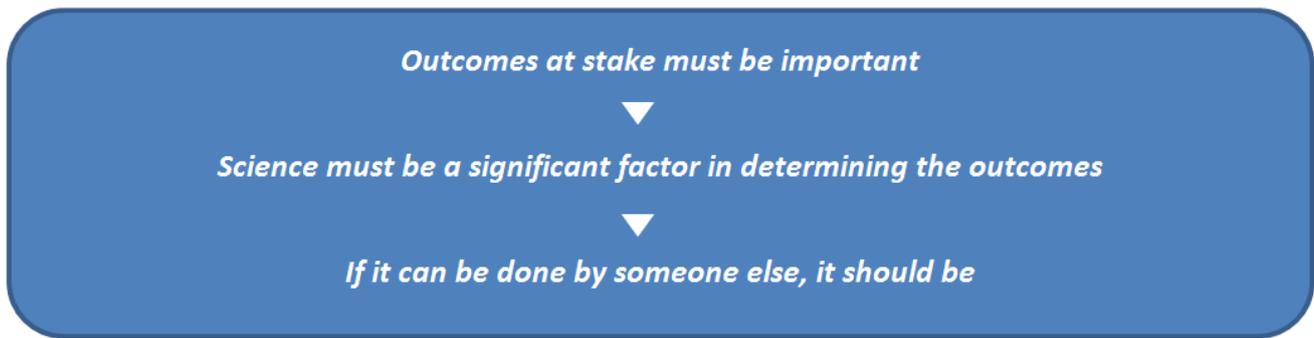
The Government Office for Science has three areas of focus:

- Science for resilience
- Science, engineering and technology for the economy
- Evidence and analysis for policy

### Key Functions:

- Acting as a transmission mechanism between leading scientists, engineers, technologists and social scientists from academia, industry, and government and Whitehall policy-makers;
- Working across Whitehall departments on complex issues that go beyond the domain of individual departments;
- Providing high quality futures capability through a rolling programme of [Foresight](#) projects to understand long term issues and trends, and the [Horizon Scanning Programme](#), jointly with the Cabinet Office;
- Proactively identifying gaps and opportunities for the UK, particularly in emerging technologies, to drive economic growth;
- Providing the best scientific advice in the case of emergencies, through the [Scientific Advisory Group for Emergencies \(SAGE\)](#); and
- Helping the independent [Council for Science and Technology](#) provide high level advice to the Prime Minister.

## How we prioritise



In practice this means we prioritise issues that are novel and important, present urgent policy challenges, and have long-term implications.

## Building capacity for science in government

In order that science is efficiently embedded in all policy making, the Government Office for Science is committed to ensuring that:

- Science and Engineering professionals in government work shoulder-to-shoulder with policy officials and analysts, supporting and complementing a strong network of Chief Scientific Advisers (CSAs), extending across government and outwards;
- The best scientists are engaged in informing policy, drawing on expertise from academia, industry and government;
- Rich strategic conversations about R&D priorities are held across government departments, Research Councils and universities; and
- Government has the scientific infrastructure it needs to support robust policy and governance.

## Facilitating science advisory networks

Sir Mark Walport and the Government Office for Science continue to work across government to maintain a highly effective network of [Chief Scientific Advisers](#) (CSAs) located in most government departments. These advisers offer expert advice and intelligence across the full range of science, technology, engineering and social science disciplines to support policy as needed.

This cross-disciplinary network of CSAs meets weekly. Members contribute individually, and also work together where needed. Many departments also have deputy CSAs, who meet regularly to discuss current issues and share expertise.

The Government Office for Science coordinate the work of the cross-Whitehall network of Chief Scientific Advisers, who this year have delivered a number of responses to calls for evidence such as the Nurse and Stern Reviews. We have supported departments in the appointment of a number of new CSAs and continue to improve the way the network operates.

The network of over 70 Science Advisory Councils and Committees (SACs) continue to provide their expert independent advice to policy makers. The GCSA met SAC Chairs, together with

CSAs, in February 2015, helping to build relationships between senior science advisers across government and ensure the system for scientific advice is fit for the future.

## Science and Engineering Fast Stream

The Science and Engineering Fast Stream is the flagship development scheme for postgraduate scientists and engineers across government. The scheme was re-launched in 2015. The second cohort of scheme entrants began their placements in October 2016. Science and Engineering fast streamers play an essential role in ensuring the best science underpins the development and application of government policies.

## Government Science and Engineering (GSE) Profession

The Government Science and Engineering (GSE) profession is managed by the GSE team in GO-Science, on behalf of the Head of Profession, Sir Mark Walport. With around 10,000 civil servants working in a range of specialist, deep specialist, policy, analytical and operational roles, working in locations across the UK. Their work has an enduring national and global impact, tackling problems such as poverty, disease, climate change, crime and terrorism for the public good.

In October, we launched the new [GSE Strategy](#), which sets out what the GSE profession wants to achieve in the next 5 years. It included an ambitious action plan to bring about transformational change in 10 key areas or workstreams such as diversity and inclusion, mentoring, talent management and leadership, reward and recognition.

We have created "[The GSE Story](#)" – a series of cartoon illustrations and a supporting narrative, which charts the successes and achievements of government scientists and engineers across history. The story featured in Issue 12 of Civil Service Quarterly. We want to use this story to secure the GSE profession's place at the heart of government decision making; building pride, raising the profile, and encouraging fresh talent into the GSE profession.



# Key work streams of 2015-16

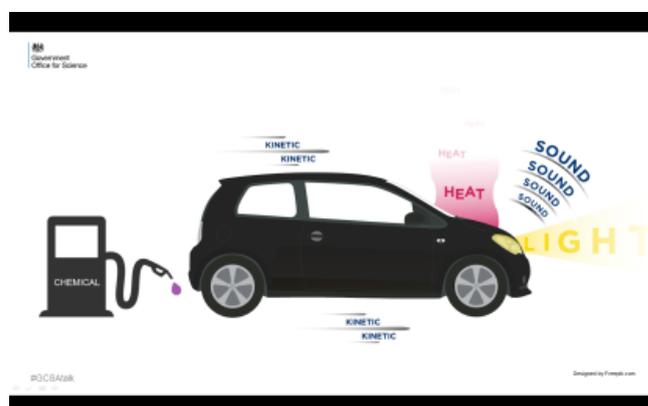
## Horizon Scanning – Emerging technologies

The Horizon Scanning Programme team is responsible for bringing emerging issues to a senior-level audience, as well as commissioning work on areas of interest; coordinating work between departments and input from experts outside the Civil Service; improving cross-government horizon scanning work; and developing networks to gather and share information and to gain new insights.

The Government Office for Science undertook a rapid technology assessment of virtual reality. It identified opportunities for the UK Government including public sector delivery applications in healthcare, education and defence and more broadly in training, testing, design and working in dangerous environments.

## Energy and Climate Change

Sir Mark Walport completed a six-month public lecture series talking about how we [supply and use energy](#) and the options we have for the future. Presentations took place in London (at the Natural History Museum), Belfast, Bristol, Leicester, Glasgow and Birmingham. Sir Mark also gave the prestigious annual Clerk-Maxwell lecture on energy at Institution of Engineering and Technology in March 2016.



## Forensic Science and Beyond: authenticity, provenance and assurance

The Government Chief Scientific Adviser's [second annual report](#) is about the power of analytical science and its many applications. It starts with forensics – the use of analytical science to assist the courts with issues such as identity and identification. But the power of forensic analysis has the ability to deliver benefits to society that go far beyond the Criminal Justice System. The report explores the many ways in which we can use analytical scientific tools, combined with the approaches and skills of the forensic scientist, to reap the rewards of these benefits.



The UK has the opportunity to become a world leader in the development and use of technology for prevention, deterrence and detection of fraudulent products and services. The key message for innovators is that they need to go beyond the traditional boundaries of forensic science, and think more broadly about applications in new markets and new forms of public service delivery.

The report has provided the catalyst for bringing together the judiciary (under the leadership of the Lord Chief Justice), academia (including the Royal Society) and policy makers to form a Forensic Forum which. The Forum will discuss challenges identified in the report associated with communication, collaboration, consistency, clarity and common standards.

## Distributed Ledger Technology: beyond block chain

Algorithms that enable the creation of distributed ledgers are powerful, disruptive innovations that could transform the delivery of public and private services and enhance productivity through a wide range of applications. The technology provides the framework for government to reduce fraud, corruption, error and the cost of paper-intensive processes. It has the potential to redefine the relationship between government and the citizen in terms of data sharing, transparency and trust. It has similar possibilities for the private sectors, particularly the financial industries.



The Government Office for Science [Blackett review on distributed ledgers](#) makes eight recommendations which focus on ministerial leadership, research, standards and the need for proof of concept trials.

Leading on from the recommendation for proof on concept trials the Department for Work and Pensions has supported a small scale trial to test whether this technology has potential to contribute to better outcomes in the distribution of welfare payments.

# Responding to emergencies

## Flooding

Following severe flooding in the North West last winter, the Government decided to review national resilience to severe flooding. To support the review, the Met Office looked at the maximum quantity and duration of rain possible in England – based on new meteorological research. These rainfall totals were then run through the Environment Agency's flood models to ascertain the flooding that would result from the hypothetical extreme conditions. Given the novel approach, the Government Chief Scientific Adviser established a Scientific Advisory Group to provide expert oversight and assurance to the process

The Advisory Group commissioned additional work from the European Centre for Medium-Range Weather Forecasts which supported the approach taken. The group also identified important limitations and uncertainties in the science and communication challenges around risk and uncertainty, as well as identifying important research and development gaps in risk modelling.

Sir Mark Walport was asked to join the National Flood Resilience Review team. They review assessed how the country can be better protected from future flooding and extreme weather events such as during December 2015. The review tested our understanding of the fluvial and coastal flood risk in England, assessed the resilience of key local infrastructure to that risk, and identified actions to strengthen our resilience.

## Zika virus

The cluster of microcephaly cases (babies born with small heads) reported in Brazil was declared as a Public Health Emergency of International Concern (PHEIC) in February 2016 by the World Health Organization. This health threat was associated with the continuing spread of Zika virus disease in Latin America and the Caribbean.

A Precautionary Scientific Advisory Group for Emergencies (Pre-SAGE) was convened soon after the PHEIC was declared and has met regularly since to review the latest science and evidence to inform the UK Government response. The expert group was co-chaired by the Government Chief Scientific Adviser and the Chief Scientific Adviser from the Department of Health, with membership including epidemiologists, entomologists and risk communication specialists from both government and academia. Pre-SAGE has provided advice to Government on evidence of the link between Zika and microcephaly, modes of transmission, potential control measures, priority areas for research, the risk to the UK, and modelling of the potential global spread.

# Foresight Projects

## Future of an Ageing Population

The average age of the UK population is expected to increase significantly over the coming decades. This change will bring both challenges and opportunities for central and local government, with impacts on a wide range of public services.

The [Foresight Future of an Ageing Population](#) project worked with Ministers, experts and policy-makers to assemble a comprehensive, state of the art scientific evidence base to underpin the policy response to the UK's aging population. The Cabinet Secretary commissioned the project team to lead analysis across Whitehall to help departments understand the implications of ageing. The project also worked with the Reimagine Challenge on independence in later life.



The project analysis and findings have been widely discussed and significantly raised the profile of the implications of the ageing population within central government, and with devolved and local authorities. The evidence formed the basis of ministerial discussion on the potential opportunities and challenges related to the workforce and to housing supply and informed new policy formation in several departments. The evidence also fed into the continuing debate on responsibilities for later life care and levels of support required in future. GO-Science presented and discussed the report's findings with Welsh and Scottish devolved administrations, and worked with local authorities to examine the implications at a local level in a range of areas across the country.

## Future of Cities

The main objective of the [Foresight Future of Cities](#) project is to understand what has caused variance in performance between UK cities over the last 30 years to promote more equitable growth in the future.

The project has identified opportunities and challenges facing UK cities over the next 50 years, including social and economic trends. The project team worked with UK cities to develop a vision for their long-term future as a result of this work Milton Keynes Council agreed a plan for the city for the next 30 years; Newcastle ran an exhibition on the future of the city and established a City Futures Development Group, and Lancaster initiated a Youth Chamber to link 16-18 year olds to local businesses to develop their skills for the workplace.



The project has generated [new ideas with six UK cities](#) to help them to attract graduate labour to boost local productivity and there are now six pilot projects up and now running. The project worked with Birmingham, Bristol, Cardiff, Leeds, Liverpool and Manchester.

# Council for Science and Technology

The Council for Science and Technology (CST) operates at the very highest level in government, reporting directly to the Prime Minister. Jointly chaired by Professor Sir Mark Walport and Professor Dame Nancy Rothwell, its members come from business, the National Academies and academia.

The Council provides advice to the government on a wide range of science and technology topics. CST has provided advice to the PM on the following areas:

- How the UK can gain the greatest value from [autonomous and connected vehicles \(CAVs\)](#), published in July 2015. The PM agreed that its recommendations should help inform Government policy in this area. The Government has taken forward a number of recommendations, including launching a call for evidence to consider the Council's recommendation to establish a real-world test bed for CAVs.
- What the future evolution of the [UK's energy system](#) may look like in the short to medium term, published in October 2015.

It has developed work on the following areas:

- How the UK can strengthen its [entrepreneurship education](#) for undergraduates to boost growth, jobs and productivity.
- How the UK could build upon its existing strengths in [robotics, automation and artificial intelligence](#) to be at the forefront of developments, and harness its economic and social benefits.

CST discussed science and technology issues with a range of senior officials, as well as experts from business and academia. Key guests included:

- Sir Martin Donnelly, *Permanent Secretary at the Department for Business, Innovation and Skills*
- Jonathan Slater, *Cabinet Office*
- Dr Ruth McKernan, *CEO at Innovate UK*
- John Pullinger, *National Statistician*
- Professor Tim Dafforn, *Chief Scientific Adviser at the Department for Business, Innovation and Skills*
- Professor John Loughhead, *Chief Scientific Adviser at the Department for Energy and Climate Change*
- Professor Jonathan Haskel, *Professor of Economics at Imperial College Business School, Imperial College London and Director of the Doctoral Programme at the School*
- Professor Rachel Griffiths, *Professor of Economics at the University of Manchester and a Research Director of the Institute for Fiscal Studies (IFS)*
- Professor John Kay, *Kay Review of Equity Markets*
- Matthew Bell, *Chief Executive of the Climate Change Committee*
- Steve Yianni, *Chief Executive, Transport Systems Catapult*
- Tim Armitage, *Director, Arup*

In December 2015, CST co-hosted a dinner with the Bank of England, to consider issues around capital markets and how well technology companies in the UK are able to grow and remain domiciled here. The Council also held a workshop on technology for an ageing population. It held a second meeting with its US equivalent, the President's Council of Advisors on Science and Technology to discuss issues around biosecurity.

## CST members as of 30 March 2016

### Co-chairs

- Professor Sir Mark Walport, FRS, FMedSci, Government Chief Scientific Adviser
- Professor Dame Nancy Rothwell, FRS, FMedSci, President and Vice-Chancellor of Manchester University

### Other members

- Professor Sir Robert Lechler, FMedSci, President of the Academy of Medical Sciences\*
- Professor Sir Venki Ramakrishnan, FRS, President of the Royal Society\*
- Lord Stern of Brentford, FRS, President of the British Academy\*
- Professor Dame Ann Dowling, OM, FRS, FREng, President of the Royal Academy of Engineering\*
- Professor Fiona Murray, CBE, Professor of Entrepreneurship at MIT Sloan School of Management
- Rowan Douglas, CBE, CEO of Willis Re Global Analytics and Chairman of Willis Research Network
- Colin Smith, CBE, FRS, FREng, Group President at Rolls-Royce
- Anne Glover, CBE, Chief Executive of Amadeus Capital Partners
- Professor Sir Keith Burnett, CBE, FRS, Vice-Chancellor of Sheffield University
- Dervilla Mitchell, CBE, FREng, Director at Arup
- Professor Sarah Harper, Professor of Gerontology at the University of Oxford
- Dr Paul Golby, CBE, FREng, Chair of EPSRC
- Dr Michael Lynch, OBE, FREng, Founder of Invoke Capital
- Professor Philip Bond, Visiting Professor at the Oxford Centre for Industrial and Applied Mathematics
- Professor Steven Cowley, FRS, FREng, CEO of UKAEA and President Elect at Christ College, Oxford
- Professor Sir Christopher Snowden, FRS, FREng, Southampton University, Vice-Chancellor
- Dr Graham Spittle, CBE, VP and Chief Technology Officer, Europe at IBM
- Professor Dame Julia Goodfellow, FMedSci, Vice-Chancellor at the University of Kent

\*Ex officio member

CST letters and meeting summaries can be found at [www.gov.uk/cst](http://www.gov.uk/cst).

# Communications

The Government Office for Science supports transparency by ensuring the public also has access to the scientific facts that inform key issues. Communication forms a key part of the work the GCSA does.

## Social media

Twitter is an important channel for the GCSA to communicate with the public about our work. Our @uksciencechief twitter feed continues to grow in popularity with new followers joining all the time. From 1 April 2015 to 31 March 2016 the GCSA account gained over 2,000 new followers to reach over 18,500.

The Foresight twitter feed @foresightgovuk also continues to grow at a steady pace. From 1 April 2014 to 31 March 2015 the Foresight account gained over 500 new followers to reach over 2,700.

## Website

Between March 2015 and April 2016 the combined web pages received over 337,932 page views.

A video to accompany the [distributed ledger](#) report has received over 45,000 views.

The charts below detail the most popular reports.

**Figure 1: Top 5 reports - GO-Science (excl. Foresight) 2015-16**

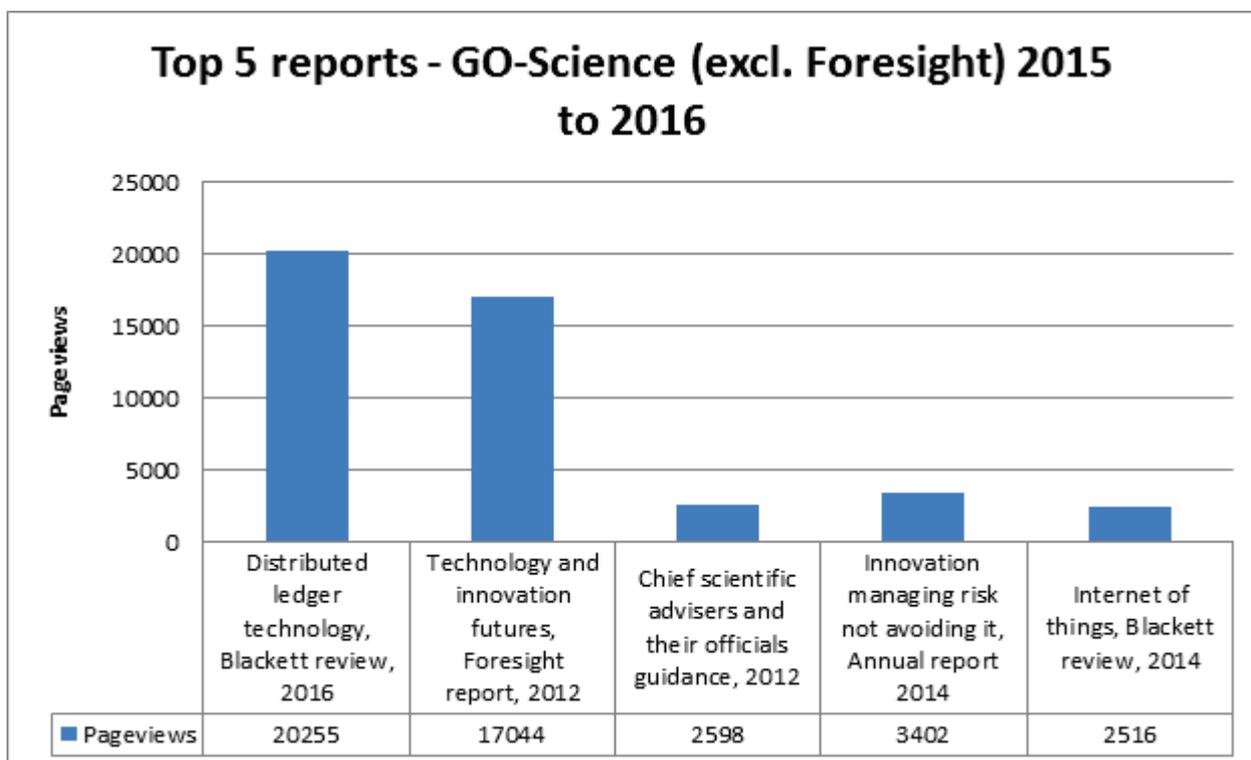
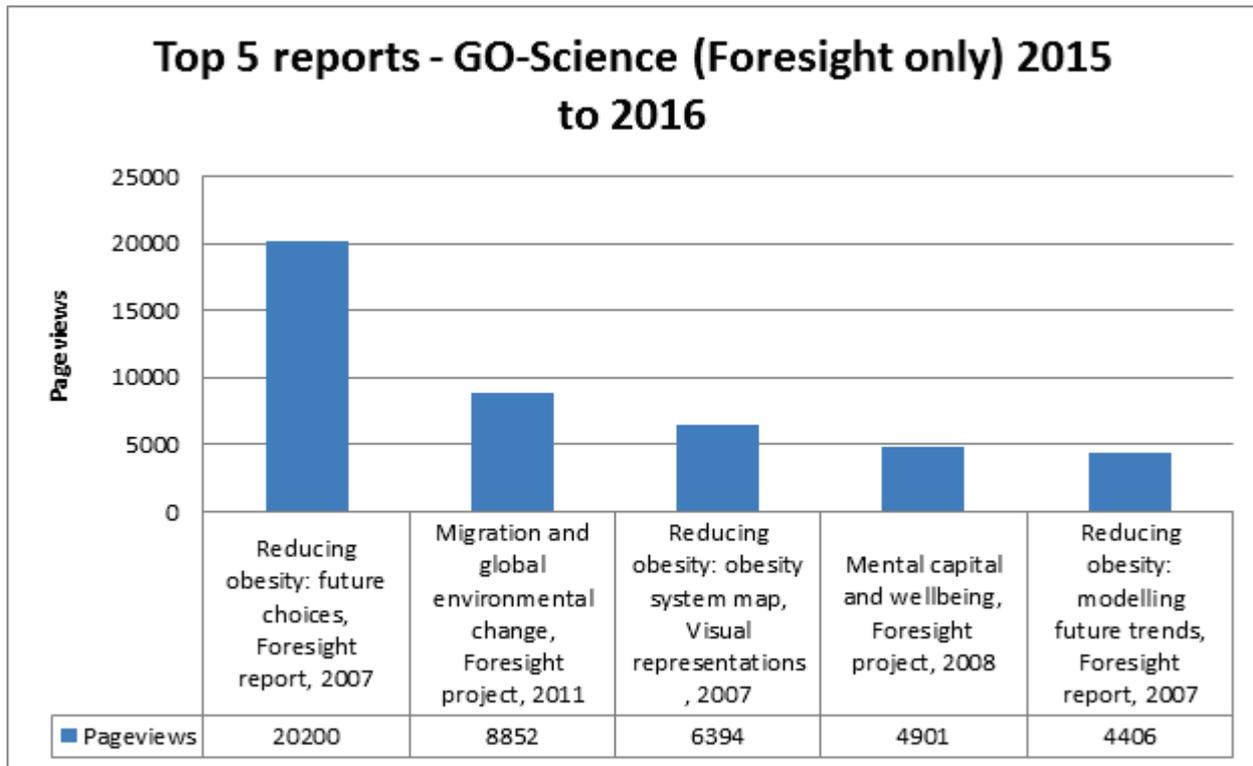


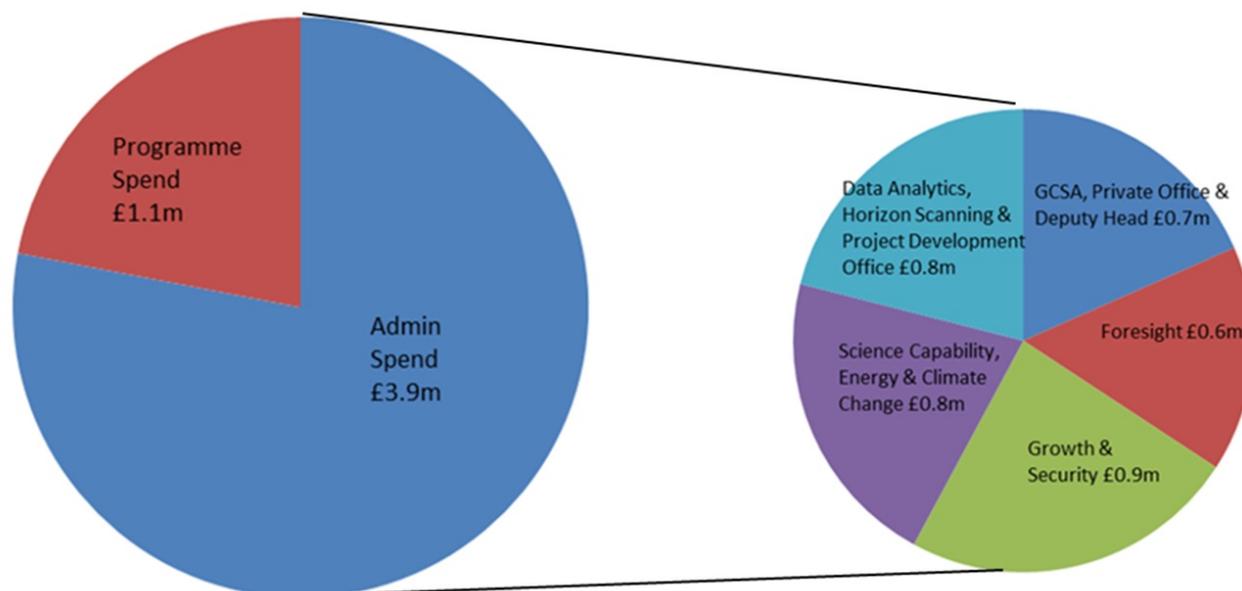
Figure 2: Top 5 reports – Go-Science: Foresight 2015-16



## Finance

GO-Science total spend in 2015-16 was £5.0 million. Of this £3.9m is administration and £1.1m is programme spend.

**Figure 4: GO-Science spend 2015-16**



The table below shows outturns for 2011-12, 2012-13, 2013-14 and 2014-15, 2015-16. Figures are quoted in £m.

**Table 1: GO-Science spend 2011-12 to 2015-16**

	2011-12	2012-13	2013-14	2014-15	2015-16
<b>Programme</b>	<b>2.3</b>	<b>2.6</b>	<b>1.7</b>	<b>1.4</b>	<b>1.1</b>
<i>GCSA/Private Office/Deputy Head</i>	0.7	0.8	0.7	0.9	0.7
<i>Foresight</i>	1.3	1.4	1.4	0.7	0.6
<i>Science in Government<sup>1</sup></i>	2.0	2.0	1.9	-	-
<i>Growth and Security</i>	-	-	-	0.9	0.9
<i>Science Capability and Climate Change</i>	-	-	-	0.7	0.8
<i>Data Analytics, Horizon Scanning and Project Development</i>	-	-	-	0.8	0.8
<b>Total Admin</b>	<b>4.0</b>	<b>4.2</b>	<b>4.0</b>	<b>4.0</b>	<b>3.9</b>
<b>Overall Total</b>	<b>6.3</b>	<b>6.8</b>	<b>5.7</b>	<b>5.4</b>	<b>5.0</b>

The administration budget covers all activities related to staff in GO-Science.

The programme budget relates to activities that GO-Science has commissioned to meet the GCSA's objectives.

<sup>1</sup> What was previously called Science in Government was split into *Science Capability and Networks*, and *Global Issues Science Team* between 2012 and 2013. The Government Office for Science was restructured in 2014 as set out in the table.

The continuing reduction in programme spend results from more efficient procurement of expert science advice. The restructuring of the Office in 2013 also means that figures are not necessarily directly comparable across the years, for instance Horizon Scanning moved out of Foresight into one of the new teams.

# Work streams for 2016-17

## Artificial intelligence: opportunities and implications for the future of decision-making

This [report](#) will give an overview of the technology and will set out some of the benefits AI is capable of bringing to the UK. It will also discuss some potential ethical and legal issues that need to be anticipated in order to maximise the positive impact of artificial intelligence in society

## The quantum age: technological opportunities

This [report](#) will argue that the UK could enhance its international position as a global leader in quantum technologies and capitalise on this comparative advantage. This will be done through government, industry and academic action and collaboration to support the development and commercialisation of these technologies.

## Foresight Future of Skills and Lifelong Learning

This [project](#) will draw on academic evidence reviews and essays to assess the current and future skills mix in the UK and the challenges of the coming decades. The project will consider the importance of digital skills, learning throughout the life course and the value of formal, informal and non-formal learning.

## Foresight Future of the Sea

This [project](#) will consider the role that science and technology can play in understanding and providing solutions to the long-term issues affecting the sea. It will focus broadly on resources and economic potential, environmental issues, and governance of the sea.

## Technology and Innovation Futures (TIF)

The [report](#) will update previous analysis of the emerging technologies of significance to the UK.



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