Government Office for Science

Annual Report 2016-17

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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

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.

Over the past year, we have: provided insight and advice to the Government's Industrial Strategy through the Council for Science and Technology and through an evaluation of the UK's capability in battery research; developed an evidence base on the future of skills and lifelong learning; and mobilised rapid science advice in response to the Zika virus.

Looking back on my time as Government Chief Scientific Adviser, I am proud of the breadth and importance of the work conducted by the Government Office for Science. Science has a vital role to play in government, and it is right that it is embedded into the policy making process.

As I leave the role of Government Chief Scientific Adviser, I am confident that GO-Science and the networks that exist across departments are well-placed to help my successor in continuing to support government policy and decisions with high quality science advice.

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
- Helping to assure and improve the quality and use of scientific evidence and advice in government.
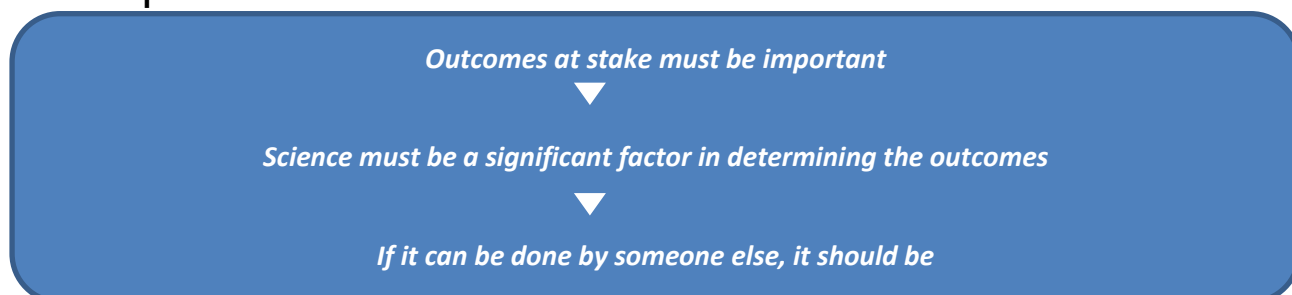
How we operate

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 though 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

> *Outcomes at stake must be important*
> ▼
> *Science must be a significant factor in determining the outcomes*
> ▼
> *If it can be done by someone else, it should be*

In practice this means we prioritise issues that are novel and important, present urgent policy challenges, and those that 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 Stern Review. 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.

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 third cohort of scheme entrants will begin their placements in October 2017. 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 2016, 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, capability and skills.

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 from the birth of the Royal Society to the present day, and highlights the successes of people from a range of backgrounds. 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 from all backgrounds into the GSE profession.

Key work streams of 2016-17

The Faraday Challenge

As part of our work on the Industrial Strategy green paper, the Government Office for Science evaluated the case for a new research institution to act as a focal point for work on [battery technology, energy storage and grid technology](#). This work culminated in March 2017 in a letter written from the Government Chief Scientific Adviser, Sir Mark Walport to the BEIS Secretary of State, who subsequently announced significant funding for the 'Faraday Challenge'.

The Quantum Age: Technological opportunities

Following an increasing interest in understanding the impact of quantum research on the UK academic, business and policy worlds the Government Office for Science convened a panel of industry, academia and government experts to produce a [report on Quantum Technologies](#) which was published on 3rd Nov 2016.

The UK is among the world leaders in quantum research. The report highlights: areas where the UK could maintain and even increase its lead; the implications of quantum technologies for the UK economy; and the ways in which these technologies could improve peoples' lives over the next 15 years.

The report argues that the UK could enhance its international position and capitalise on this comparative advantage through government, industry and academic action and collaboration to support the development and commercialisation of these technologies.

Horizon Scanning

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.

Technology and Innovation Futures (TIF)

GO-Science has conducted two previous exercises to analyse emerging technologies of significance to the UK. This iteration of [TIF](#) concludes that the greatest disruption and biggest benefits will come from technologies converging and interacting to yield fresh data insights and new applications. This trend could drive productivity and improve public services in domains like health, energy, transport and cities.

TIF concludes that Government should focus attention on platforms where technologies interact, not just on specific technologies, coordinating its policy levers to support technological innovation and market growth.

Artificial Intelligence: Opportunities and implications for the future of decision-making

Artificial Intelligence (AI) offers huge potential to enable more efficient and effective business and government but the use of AI brings with it important questions about governance, accountability and ethics.

[GO-Science's report on AI](#) followed on from a seminar held at the British Academy in February 2016, chaired by Mark Walport, Government Chief Scientific Adviser and Mark Sedwill, Permanent Secretary at the Home Office, which discussed some of the legal and ethical issues around the use of artificial intelligence. The issues discussed there provide the core of this report, with additional material drawn from the views of a wide range of scientific and legal experts in the field. The report concentrates on the practical aspects of the debate, rather than detailed technical aspects, and considers 3 questions:

- What is artificial intelligence and how is it being used?

- What benefits is it likely to bring for society and for government?

- How do we manage any ethical and legal risks?

Responding to emergencies

Zika virus

The cluster of microcephaly cases 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 met on five occasions over the following seven months 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 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 Skills and Lifelong Learning

The Foresight Future of Skills and Lifelong Learning project is focused on providing evidence to inform policy tackling the issue of the UK's changing skill requirements with an aging population in a time of rapid technological advancement.

This project has drawn on academic evidence reviews and essays assessing the current and future skills mix in the UK and the challenges of the coming decades. The project has considered the importance of digital skills, learning throughout the life course and the value of formal, informal and non-formal learning. Evidence has been gathered on the potential challenges to creating a high skills economy, including poor literacy and numeracy in young adults, high levels of skill underutilisation and the emergence of regional and sectoral low skills equilibria.
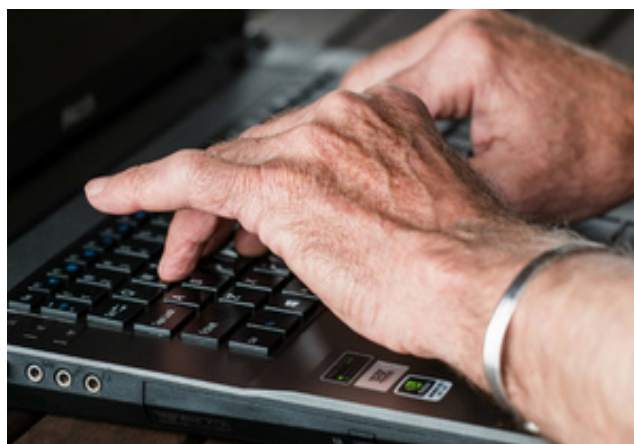
Future of the Sea

The sea covers 70% of the world's surface and is essential to regulating global temperature, water, and oxygen and carbon dioxide levels. Including its overseas territories, the UK has jurisdiction over one of the largest area of ocean of any country in the world. The Future of the Sea project considers the role that science and technology can play in understanding and providing solutions to the long-term issues affecting the sea, focussing broadly on resources and economic potential, environmental issues, and governance of the sea.

The project is working in partnership with academics and industry professionals to develop a large evidence base in the form of evidence reviews, expert workshops and interviews. The project will use this analysis to inform a cross-departmental response to address the future challenges and opportunities facing the sea and develop the UK's diverse marine and maritime interests.

Council for Science and Technology

The Council for Science and Technology (CST) is the government's advisory body on science, technology, engineering, social sciences and disruptive innovation. It 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 and has provided advice to the PM on the following areas:

- How the UK can strengthen its entrepreneurship education for undergraduates to boost growth, jobs and productivity, published in October 2016
- 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. This was published in October 2016.
- What the Government's Industrial Strategy might consider and include, published in October 2016

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

- Greg Clark, *Secretary of State, Department for Business, Energy and Industrial Strategy*
- Jo Johnson, *Minister for Universities, Science and Research and Innovation*, *Department for Business, Energy and Industrial Strategy*
- Robin Walker, *Parliamentary Under Secretary of State, Department for Exiting the European Union*
- Sir Jeremy Heywood, *Cabinet Secretary, Cabinet Office*
- Alex Chisholm, *Permanent Secretary, Department for Business, Energy and Industrial Strategy*
- Wanda Austin, *President, The Aerospace Corporation (USA)*
- Professor Ian Boyd, *Chief Scientific Advisor for the Department for Environment, Food and Rural Affairs*
- Sir Colin Dollery, *Senior Consultant for Research & Development, GlaxoSmithKline*
- Professor Jane Elliott, *Chief Executive, ESRC*
- Dr Felicity Harvey, *Director General, Public and International Health, Department of Health*
- Professor Ruth McKernan, *Chief Executive, Innovate UK*
- Neil O'Brien, *Special Advisor on the Economy and Industrial Strategy, Prime Minister's Office*
- Ashley Predith, *Executive Director, President's Council of Advisors on Science and Technology (USA)*
- Professor Bernard Silverman, *Chief Scientific Advisor for the Home Office*
- Ceri Smith, *Director, UK Government Investments*

CST members as of 30 March 2017

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**
- Sir John Kingman, KCB, *Chair of UK Research and Innovation**
- Professor Fiona Murray, CBE, *Professor of Entrepreneurship at MIT Sloan School of Management*
- 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*
- 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 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.

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 2016 to 31 March 2017 the GCSA account gained over 2,000 new followers to reach over 20,600 followers. We put out 114 tweets and received 14,503 engagements.

The Foresight twitter feed @foresightgovuk also continues to grow at a steady pace. From 1 April 2016 to 31 March 2017 the Foresight feed gained around 1,000 new followers to reach over 3,400 followers.

Blogs

In 2016 the Government Office for Science launched two new blogs on the GOV.UK Wordpress platform. The Government Science and Engineering blog launched in July 2016 and has had a total of 18,913 page views. The Foresight Projects blog launched in October 2016 and has received a total of 3,912 page views. A Government Digital Service audit in early November 2016 ranked the Government Science and Engineering blog 1st out of 90 blogs in government and the Foresight Projects blog 10th.

Website

Between 1 April 2016 and 31 March 2017 the GO-Science, Government Science and Engineering and Council for Science and Technology web pages received 365,787, 24,073 and 34,689 page views respectively. The charts below detail the most popular reports:

Top 6 reports - GO-Science excl. Foresight, 2016 to 2017

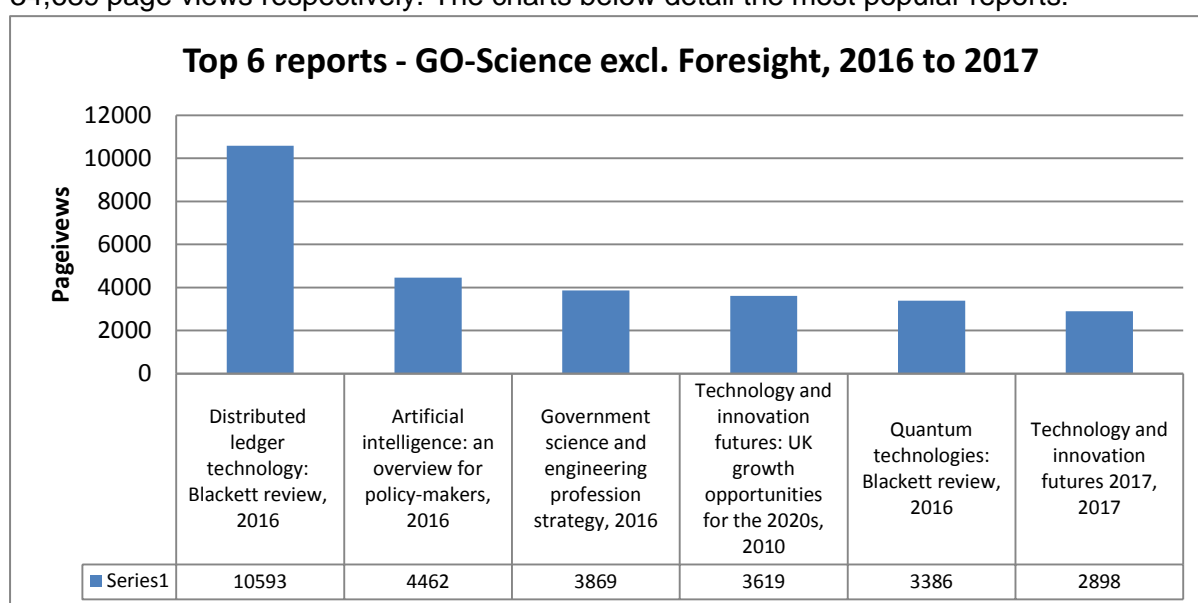|	Distributed ledger technology: Blackett review, 2016	Artificial intelligence: an overview for policy-makers, 2016	Government science and engineering profession strategy, 2016	Technology and innovation futures: UK growth opportunities for the 2020s, 2010	Quantum technologies: Blackett review, 2016	Technology and innovation futures 2017, 2017
Series1	10593	4462	3869	3619	3386	2898

Figure 1: Top 6 reports - GO-Science excluding Foresight, 2016 to 2017.

Top 6 reports - GO-Science Foresight only, 2016 to 2017

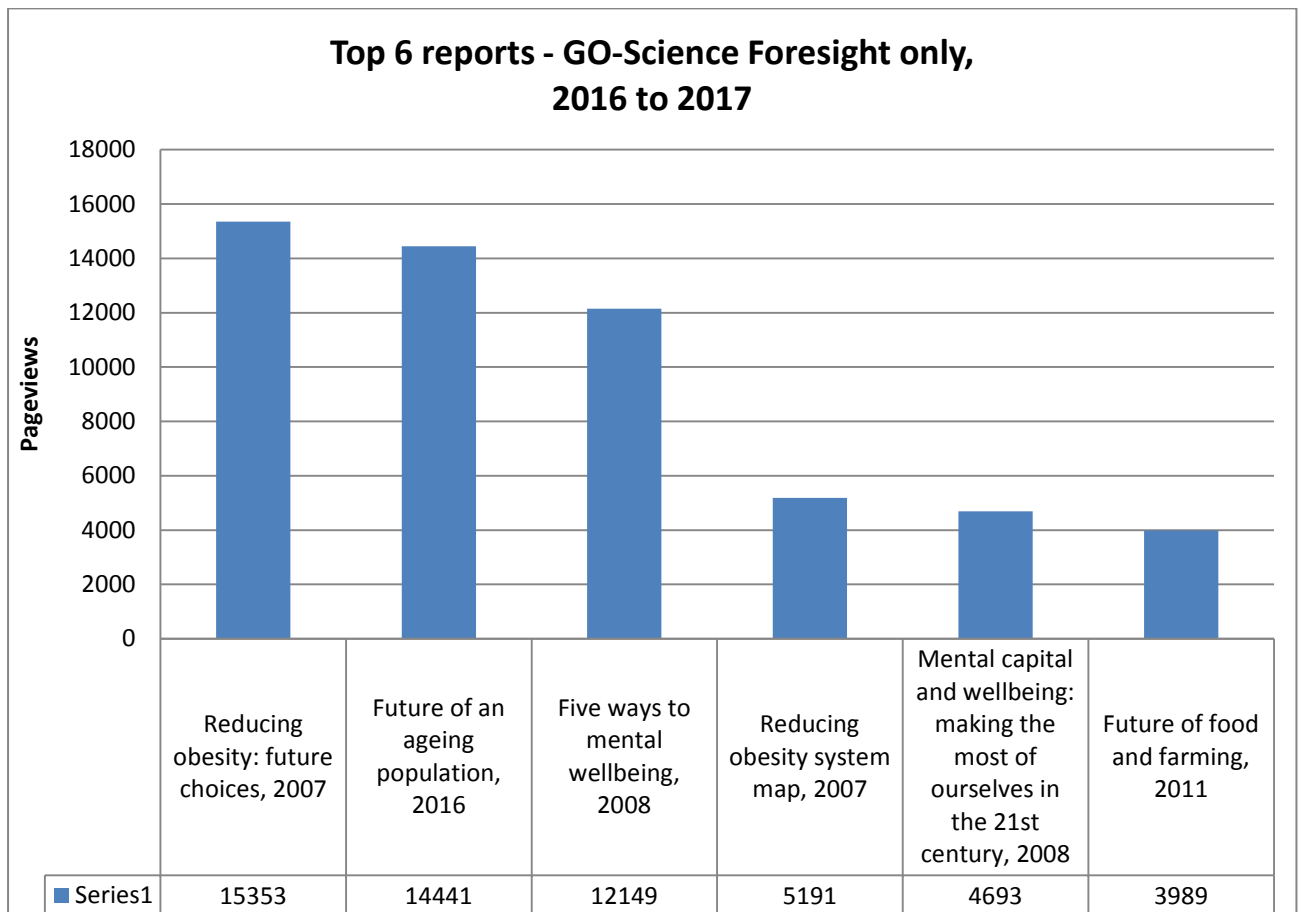|	Reducing obesity: future choices, 2007	Future of an ageing population, 2016	Five ways to mental wellbeing, 2008	Reducing obesity system map, 2007	Mental capital and wellbeing: making the most of ourselves in the 21st century, 2008	Future of food and farming, 2011
Series1	15353	14441	12149	5191	4693	3989

Figure 2: Top 6 reports – Go-Science Foresight only, 2016 to 2017.

Top 6 publications - Council for Science and Technology, 2016 to 2017

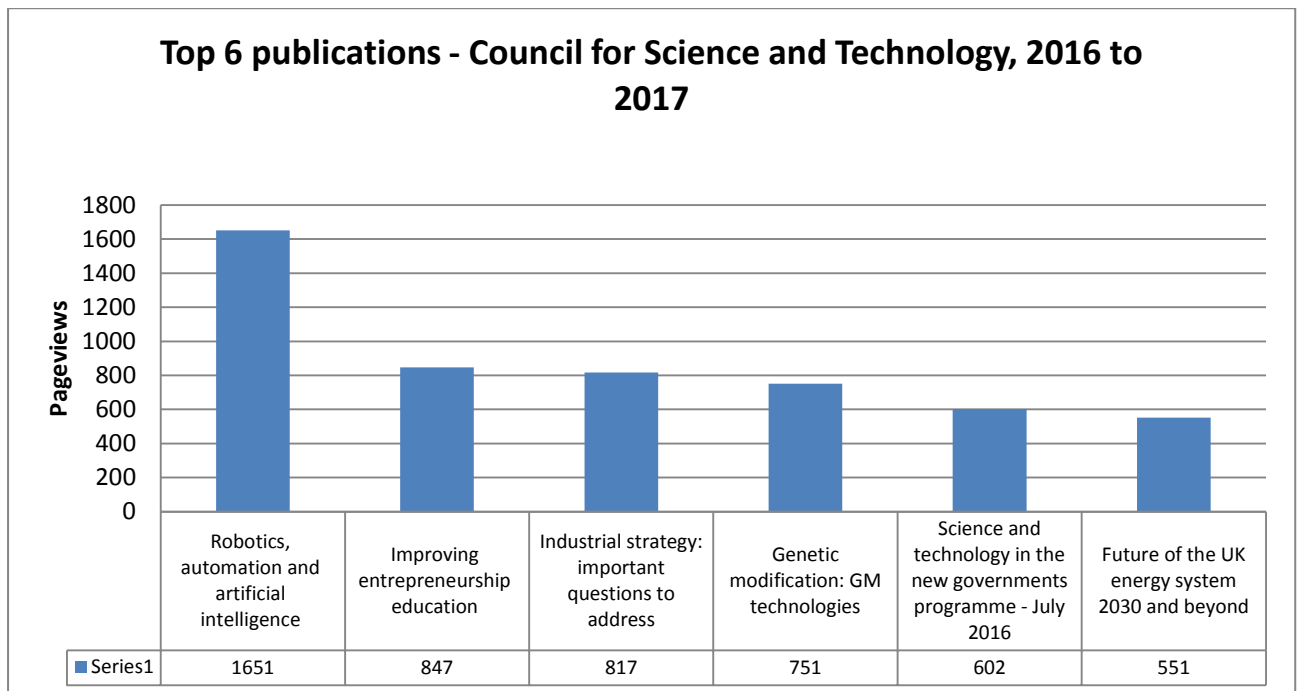|	Robotics, automation and artificial intelligence	Improving entrepreneurship education	Industrial strategy: important questions to address	Genetic modification: GM technologies	Science and technology in the new governments programme - July 2016	Future of the UK energy system 2030 and beyond
Series1	1651	847	817	751	602	551

Figure 3: Top 6 publications – Council for Science and Technology, 2016 to 2017.

Finance

GO-Science total spend in 2016-17 was £4.6m. Of this £3.5m is administration and £1.1m is programme spend.
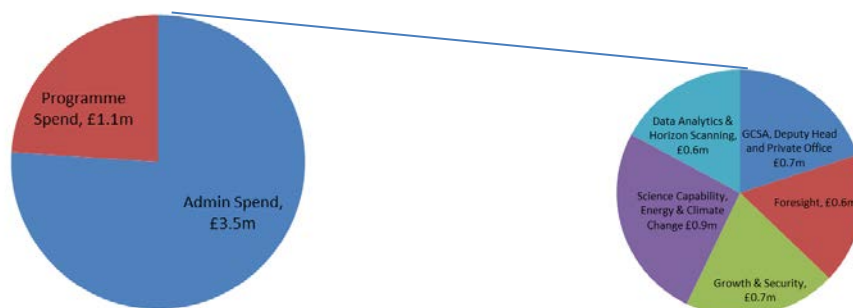

 Figure 4: GO-Science spend 2016-17

The table below shows outturns for 2012-13, 2013-14, 2014-15, 2015-16 and 2016-17. Figures are quoted in £m.

Table 1: GO-Science spend 2012-13 to 2016-17

	2012-13	2013-14	2014-15	2015-16	2016-17
Programme	**2.6**	**1.7**	**1.4**	**1.1**	**1.1**
GCSA/Private Office/Deputy Head	0.8	0.7	0.9	0.7	0.7
Foreight	1.4	1.4	0.7	0.6	0.6
Science in Government[1]	2.0	1.9	-	-	-
Growth and Security	-	-	0.9	0.9	0.7
Science Capability and Climate Change	-	-	0.7	0.8	0.9
Data Analytics, Horizon Scanning and Project Development	-	-	0.8	0.8	0.6
Total Admin	**4.2**	**4.0**	**4.0**	**3.9**	**3.5**
Overall Total	**6.8**	**5.7**	**5.4**	**5.0**	**4.6**

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.

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.

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[1] 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.

Work streams for 2016/17

From Waste to Resource Productivity

'From Waste to Resource Productivity' looks to transform the dialogue around waste to unlock productivity by moving from creating waste to valuing resources, identifying practical solutions for policy makers to reduce material wastage, and maximise UK competitive advantage. It will do so by exploring how science, technology and engineering solutions can decouple growth from overexploitation of resources and build resilience to shocks from volatility in raw material prices and environmental change.

Modelling: Opportunities for growth, productivity & resilience

The Government Office for Science's review on modelling will provide information for policy makers on the potential for modelling to help respond to policy challenges, and identify key areas in which to advance the UK's skills and capabilities. It will look at how existing modelling capability could be better harnessed in the near term, as well as looking at how future modelling potential could be best captured over the next decade.

Future of Mobility

The Future of Mobility project aims to investigate the changes that could significantly alter the landscape of UK transport in the near future, highlighting key decision points for policy makers and ensure the UK is able to benefit from a sustainable, resilient and effective transport network.

Services

The Services project aims to understand the use of existing and emerging science and technology within the services sector in order to retain UK competitiveness. It is doing so through technology and process/business model innovation drawing on case studies such as the use of blockchain, advanced data science (Uber and AirBnB), advanced machine learning (DeepMind), supply chain innovation and data analytics (Amazon). It will review the nature of innovation in the services sector and identify options for improving research & development and the uptake of new technology and process/business model innovation to boost growth and productivity.