ANNUAL REVIEW 12

Foresight

Foresight

Advises government about how to ensure today's decisions are robust to future uncertainties

About Foresight

This annual review summarises Foresight's programme of work for 2012/13

Foresight is the part of the Government Office for Science, which is tasked with advising government about how to ensure that current policies are robust in the light of future uncertainties. Foresight is led by the Government Chief Scientific Adviser, who reports directly to the Prime Minister and the Cabinet Secretary.

By working with a wide range of leading experts, Foresight combines the latest science and evidence with futures analysis to aid policy makers tackling complex issues by giving them a better understanding of the potential opportunities and challenges that lie ahead. Our work is used to stimulate and inform the development of more effective strategies, policies and priorities at both national and international levels.

Our main activities are:

- Two-year Foresight studies: in-depth projects which build a comprehensive evidence base on major issues looking 10–80 years into the future
- Policy Futures Projects: shorter projects which provide futures and analysis of evidence to fill a specific gap in current policy
- The Foresight Horizon Scanning Centre: which provides training, toolkits and networks to strengthen the capacity for futures thinking and shares best practice within and across government

Highlights of 2012/13

January – June 2012

Foresight fostered closer interaction with the global scientific community by participating in the Science and Innovation Network biennial conference held by the Department for Business, Innovation and Skills and the Foreign and Commonwealth Office

Foresight organised a high-level workshop in Accra in partnership with the Government of Ghana and the Global Forum for Migration and Development on migration and environmental/climate change

UK and international high-level stakeholders met to review the impact of the Foresight report *Global Food and Farming Futures*

Publication of the One-Year Review of the Foresight report *Global Food and Farming Futures*

Foresight presented at the high-level UK/India Science and Innovation Council

Westminster Forum Food Security 2012 – a major seminar taking forward the Foresight project on *Global Food and Farming Futures*

June 2012 – January 2013

International summit on *Improving Future Disaster Anticipation and Resilience* hosted by Foresight and the Government Office for Science and attended by government representatives and non-governmental international development organisations

Publication of a working paper on MiFID II policy measures by the project on *Future of Computer Trading in Financial Markets*

Foresight promoted a UK/Australia collaboration at a symposium in Brisbane to raise awareness of international and Australian approaches to flood risk management in strategic flood risk planning and policy development

Publication of the Foresight report *The Future of Computer Trading in Financial Markets – An International Perspective*

Foresight presentation on *The Future of Computer Trading in Financial Markets* to the Committee on Economic and Monetary Affairs (ECON), European Parliament

Publication of the One-Year Review of the Foresight report *Migration and Global Environmental Change – Future Challenges and Opportunities* highlighted the breadth of international impact of this work

David Willetts, Science Minister, published a refresh of the Foresight report *Technology and Innovation Futures* reviewing the range of developments with the potential to support sustained economic growth in the next 20 years

Foresight presentation on *The Future of Computer Trading in Financial Markets* to the European Commission Joint Research Council

Publication of a Foresight Policy Futures report on *Reducing Risks of Future Disasters*

Foresight presentation on *The Future of Computer Trading in Financial Markets* to the European Securities and Markets Authority

Foresight Policy Futures report on *Future Identities: Changing identities in the UK: the next 10 years* is published

Government Chief Scientific Adviser's Foreword

Professor Sir John Beddington CMG, FRS
Chief Scientific Adviser to HM Government and
Head of the Government Office for Science

As we prepare for the challenges ahead, we must understand what those challenges are. 2012 was a dynamic year for Foresight futures work, which seeks to achieve just that – a better understanding of complex major issues and actions need to respond to them, informed through the analysis of the best science available.

In the last five years, I have published a number of reports that provide a strong scientific foundation for "some of" the most urgent of those challenges. As the world's population grows, urbanisation continues and we face major demographic trends against a backdrop of climate change, I am pleased that in 2012 this vital work continued to be used by governments and agencies nationally and internationally to formulate effective policy designed to help local populations.

Foresight has also formed high-level collaborations across a range of projects. This year alone it has worked with the African Union to address the spread of infectious disease; the UN High Commission for Refugees on global migration and disaster risk reduction; the Bank of England and the EU Commission on computer-based financial trading and the UK Government's agri-tech strategy, in the context of global food security issues.

It has also worked with governments in China and India, and at home with the Government's Science Minister to review the technologies and innovations that will provide opportunities for UK growth in the next two decades.

2012 has also been the year of three new Foresight reports: *The Future of Computer Trading in Financial Markets, Reducing Risks of Future Disasters,* and recently, *Future Identities*. Each provides analysis of the implications of a wide range of robust scientific evidence to help us meet some of the major challenges of the next decade and beyond.

The report on the *Future of Computer Trading in Financial Markets* was commissioned to address two critical challenges: the pace of technological changes coupled with the ever-increasing complexity of financial trading and markets; and the relative lack of evidence and analysis to inform new regulation currently being considered within the European Union. The European Securities and Markets Authority (ESMA), and the Task Force on Microstructural Issues (encompassing a number of European securities regulators) have already engaged substantially with the findings.

In November, I published the report *Reducing Risks of Future Disasters*. Today there are more people at risk than ever from natural hazards, and this important work asked whether more can be done to anticipate infrequent, high-impact events, and to limit the destruction they cause. Already since publication, the World Bank, European Commission and Cabinet Office have been reviewing the findings, while Research Council UK and other UK funders of development research are now looking at the research priorities highlighted.

As I come to the end of my five-year term in office, I have great pleasure in handing over to my successor, Sir Mark Walport. In the year ahead, Sir Mark will lead a new Foresight study on the future of cities, whilst also overseeing the completion of a major project on the future of manufacturing.

I want to extend my thanks to the innumerable colleagues nationally and internationally who, through the Foresight programme, have turned their considerable skills to some of the key challenges faced by this and future generations. Mental health and wellbeing, migration, food security, flooding and computer-based financial trading are just some of the diverse topics which have come under the Foresight spotlight. The undoubted success and impact of such projects could not have been possible without their support.

Professor Sir John Beddington CMG, FRS
Chief Scientific Adviser to HM Government and
Head of the Government Office for Science

Head of Foresight's Report

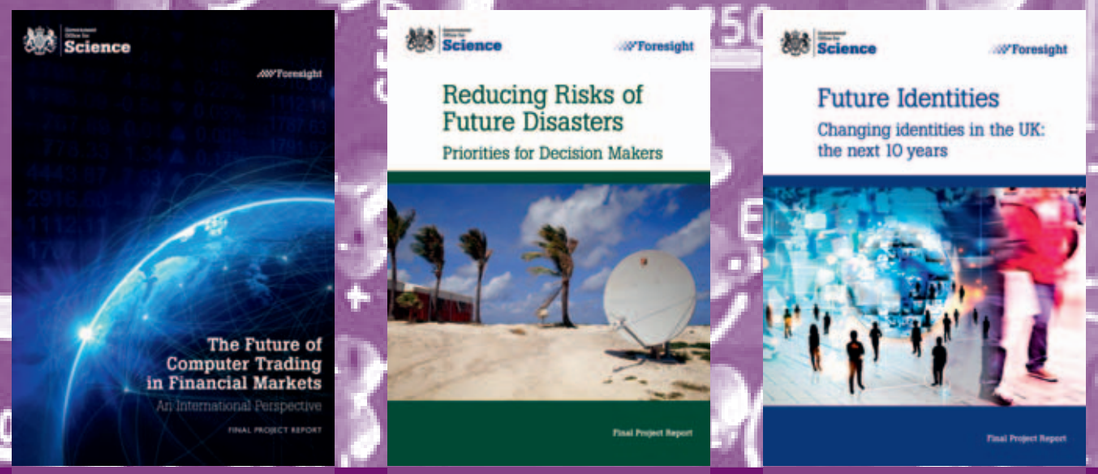
Professor Sandy Thomas
Head of Foresight

This has been an exceptional year. The Foresight team has delivered three Foresight reports, all published in the last quarter of 2012, each of which has a robust evidence base and looks forward between 10 and 30 years. These reports will inform thinking at the highest levels in government, in other organisations and, in some cases, internationally. The topics are diverse, ranging from the highly technical *The Future of Computer Trading in Financial Markets* to the *Future of Identity*, where a wide range of evidence from the social sciences made a particular contribution.

Much of the year has been invested in the two-year project on the Future of Manufacturing, sponsored by the Secretary of State for Business, Innovation and Skills, Vince Cable, MP. We have built on our previous experiences of bringing in some of the best academic and industry expertise into policy making, consulting with more than 350 individuals to date. This exemplifies open policy making principles and provides a strong foundation on which to develop policy. Three workshops, in Berlin, Singapore and Washington, DC, will bring international perspectives to the analysis, which will report in the autumn of 2013.

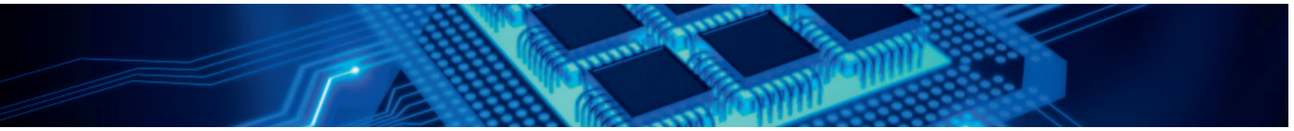
In making our reports freely available Foresight aims to make our work highly accessible. The Foresight follow-up team ensures that even after report publication, our findings are not only disseminated widely, but also lead to tangible impacts. Working closely with governments, industry, international organisations and academia, a wide range of impacts has been achieved this past year, particularly in the topic of the future of migration and global environmental change.

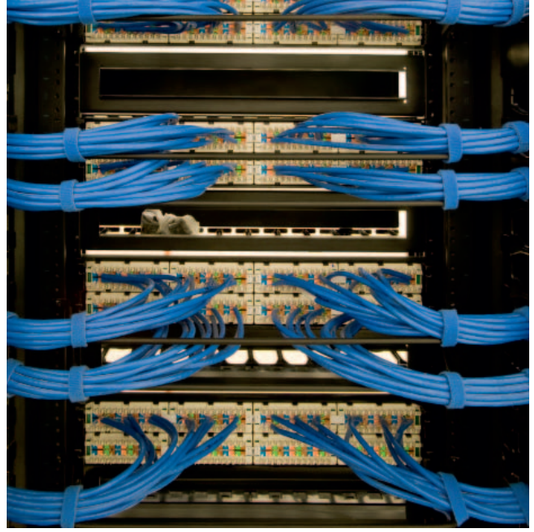
Foresight will continue to work across government over the next year, providing evidence to help tackle some of the greatest challenges we face in preparing for the future. We will strengthen our relationships with the Cabinet Office and support the cross-government horizon scanning function, and continue to expand our networks in government and beyond. I look forward to the challenges of 2013.



Completed projects

Computer Trading





The Future of Computer Trading in Financial Markets – An International Perspective **was published by Sir John Beddington on 23 October 2012 and presented to the UK and European Parliament.**

The main findings of the report were also presented to legislative Directors and Chiefs of Staff at the US Senate Banking Committee and the US House Financial Services Committee.

The report aimed to shed new light on technological advances which enable computer algorithms, rather than humans, to drive high-speed stock trades, and which have transformed market structures in recent years.

How we did the project

This two-year project drew upon scientific evidence from across the world to consider how computer-based trading will affect financial markets globally over the next 10 years. It was guided by a group of leading experts, including Professor Charles Goodhart and Andy Haldane, Executive Director of Financial Stability at the Bank of England. The group was chaired by Dame Clara Furse.

The project published a working paper in August 2012 which considered the costs, risks and benefits of six legislative proposals in the European Union's Markets in Financial Instruments Directive MiFID under consideration by the EU Parliament, EU council and EU Commission.

The work benefited in particular from the strategic advice of the 29-strong High Level Stakeholder Group, composed of end users, leading practitioners and regulators including Paul Tucker, Deputy Governor of the Bank of England and Xavier Rolet, CEO of the London Stock Exchange. Overall, over 150 independent academics and over 350 industry experts from over 20 countries were involved, producing over 50 studies in the most comprehensive research on the subject to date.

Project conclusions

The study found no direct evidence that computer-based high frequency trading (HFT) has increased volatility in financial markets, nor any evidence to suggest it has led to an increase in market abuse.

However, it found that in specific circumstances computer-based trading can lead to market instability and periodic illiquidity, and that policy makers are right to consider measures to address this risk.

The report suggests immediate priorities for action to limit future market disturbances. These include:

- **Immediate evidence-based regulatory action:** European authorities working together with practitioners and academics should assess and introduce ways to manage the adverse side effects of computer-based trading and incentivise accident-avoiding practices and behaviour
- **A larger role for standards:** Implementation of accurate, high-resolution, synchronised timestamps should be considered as a key means for helping analysis of financial markets
- **Better surveillance of financial markets:** Software should be developed for automated forensic analysis of adverse/extreme market events
- **Improved understanding of the technology:** In the longer term, more needs to be done to improve understanding of the effects of computer-based trading. The report suggests unlocking the power of the scientific community to play its role in addressing the considerable challenge of developing better evidence-based regulation

Early impact

The topic and international scope of the report have resonated with the European policy and legislative community where computer trading, and HFT in particular, are at the top of the regulatory agenda. Foresight lead experts briefed the European Commission Joint Research Council in a workshop focusing on the role of science in financial stability.

The project lead experts were also invited to present at the European Securities and Markets Authority (the European Financial Regulator) Task Force on Microstructural Issues. The Task Force encompasses a number of European securities regulators and delivers regulatory advice to the Commission on topics related to algorithmic trading and HFT.

Foresight fostered close relationships with EU Commission officials and as well as national regulators across the major EU countries and regulatory communities in Asia and the USA to promote the report's findings.

> "Well-functioning financial markets are vital for everyone. They support business and growth across the world and provide important services for investors. This research provides evidence to policy makers concerning the effect of HFT on financial markets, looking out to 2022."
>
> Professor Sir John Beddington

> "The most comprehensive effort to date to understand the computerized trading…the committee's findings are likely to become a touchstone in global debates about how to deal with the fast rise of high-speed trading firms."
>
> New York Times

> "We should follow the example and model of the UK Foresight project on computer trading."
>
> European Union Commissioner Michel Barnier

http://www.bis.gov.uk/assets/foresight/docs/computer-trading/12-1086-future-of-computer-trading-in-financial-markets-report.pdf

Reducing Risks of Future Disasters

The Foresight Policy Futures project *Reducing Risks of Future Disasters* makes the case that the rising risk of disasters in developing countries can be tackled with the effective use of science.

If effective action is not taken, millions more people in developing countries will be at serious risk from disasters resulting from natural hazards. These disasters have impacts across the world through the global connections of trade, family, commodity prices and security.

How we did the project

Policy Futures projects aim to synthesise and supplement existing evidence on specific policy questions, and to put it into a form that highlights the main issues for policy makers and other decision makers in the public, private and third sectors.

The catalyst for this project was the call in the Humanitarian and Emergency Response Review led by Lord Ashdown to make better use of science and technology in addressing disaster risk. The project was overseen by a lead expert group of 11 senior representatives from academia, NGOs and the private sector, chaired by Professor Angela Mclean from the University of Oxford. It drew on more than 400 existing reports from around the world, commissioned 20 synthesis papers, and was guided by a high-level summit of senior practitioners of disaster risk reduction.

Project conclusions

The project found that disaster and death are not the inevitable consequence of greater exposure to hazards. It is possible to stabilise disaster impacts, save lives and protect livelihoods if science is used more effectively. However, achieving this will require a change in culture and a new approach. Everyone with a stake in developing countries needs to play their part in reducing risk.

Achieving this new culture will require action in three priority areas:

- **Improved forecasting of natural hazards:** Hazard forecasting depends on expensive and complex infrastructure to gather and analyse enormous amounts of data. Satellites and sensor networks observe the planet, feeding data to supercomputers that run complex forecasting models. The report argues that if the next generation of these facilities are to be affordable, careful consideration should be given to where infrastructure can be shared or co-ordinated between countries
- **Improved information about vulnerability to hazards:** The same hazard will have very different impacts depending on the local context. To make an accurate forecast of disaster risk, detailed information is needed about the vulnerability of people and assets at a local level. The significant improvements needed can only come from engaging those at risk from the hazards. Emerging technology and traditional knowledge must both be harnessed to build up a detailed picture from the ground up of where risk is highest, so that decision makers can target their efforts effectively
- **Improved evidence on what actions are effective in reducing disaster risk:** Even if disaster risk is well understood, there remains the question of what should be done to manage it. The report highlights some actions that are clearly effective, but emphasises that there is often no robust evidence on whether an action is likely to reduce disaster impacts, or whether its benefits outweigh the costs. Because large disasters are rare, one city or country cannot learn simply from its own experience. The report argues for systematic and routine evaluation of initiatives to reduce disaster impacts, and for the sharing of this evidence worldwide

> “The UK Research Councils welcome this report and look forward to working with the UK Collaborative on Development Sciences to explore how we can help deliver its recommendations. As a first step NERC is funding a Hazard and Risk Science coordinator, with a view to expanding this role across RCUK. He will work with UK and international stakeholders to ensure science and engineering contributes to key information requirements such as forecasting, risk assessments and best practices.”
>
> Professor Duncan Wingham, CEO NERC and Chair UK Collaborative on Development Sciences

Early impact

The report was well received, and findings from the report are due to be presented to the World Bank, European Commission, UK Research Councils and the Government of India.

The UK Government Chief Scientific Adviser chaired the United Nations Office for Disaster Risk Reduction Scientific and Technical Advisory Group.

http://www.bis.gov.uk/assets/foresight/docs/reducing-risk-management/12-1289-reducing-risks-of-future-disasters-report.pdf

Changing Identities in the UK: The Next 10 Years

This report makes the case that people have many different, co-existing identities. Hyper-connectivity, will have a transforming effect on how we see ourselves and others in the next decade. The report highlights that to create effective policy, government has to keep up with how people's identities are changing.

How we did the project

The Foresight study *Future Identities – Changing Identities in the UK: the next 10 years* was commissioned to provide policy makers with a better understanding of how identities in the UK are changing. The project, carried out over a year and overseen by 10 leading academic experts, considered a range of areas affected by identity, including social inclusion and mobility, education and skills, crime and mental health. It published 20 driver reviews.

The study has shown that traditional ideas of identity will become less meaningful as boundaries between people's public and private identities disappear, with potentially wide ramifications for policy makers.

Project conclusions

Hyper-connectivity will have a transforming effect on how we see ourselves and others in the next decade. The benefits for identity offered by advances in communications technology are highlighted. Being part of a hyper-connected society can increase the pace and turbulence of social change. Increasing social plurality, where society is more diverse, and the blurring of public and private identities are also important emerging trends for the next decade.

> "Perhaps the most convincing example of multidisciplinary work that I have ever come across."
>
> Professor Anthony Heath, Emeritus Professor of Sociology, University of Oxford

While religion, ethnicity and nationality continue to be influential aspects of identity, rapid developments in technology and social media are likely to overtake these established notions and enable people to create more complex personas.

Violations of identity and privacy online will continue to be an area of public concern. But changing identities can also be a positive resource, building social capital and promoting wellbeing.

The report makes the case that the government needs to be agile in responding to the challenges raised by changing definitions of identity, particularly in the following areas:

- **Equality:** To avoid new forms of inequality, universal levels of access to the internet and development of computer skills are essential
- **Social integration:** The government needs to acknowledge and adapt to new forms of communities, such as virtual communities, as they emerge
- **Police and law enforcement:** The police and other organisations will need to take account of changing identities: for example, the legal system will need to keep pace with developments and continue to ensure that people's identities online and offline are protected. Public data will become more important for detecting patterns of criminal behaviour, but the large volume of data will make location and analysis challenging
- **Government responsiveness:** The speed of modern communications is increasing public expectations that government will respond quickly to change. Policy making across many different areas will need to be more agile, taking into consideration how policies might affect different groups, or individuals, at different times and places

http://www.bis.gov.uk/assets/foresight/docs/identity/13-523-future-identities-changing-identities-report.pdf

Current projects

Future of Manufacturing

The manufacturing sector has a key role to play in driving economic growth, particularly in driving exports and productivity, and in rebalancing the economy. This makes it increasingly important to understand the long-term picture, including the potential impacts of changes in such areas as the nature of manufacturing and the role of manufacturing in the national and global economy.

The Foresight Future of Manufacturing Project is examining how the UK can gain long-term future value from manufacturing activities by investigating areas of future uncertainty, up to 2050 where possible.

The work is sponsored by the Secretary of State for Business, Innovation and Skills, Vince Cable, MP. A final project report will put forward a range of options for UK policy makers to consider.

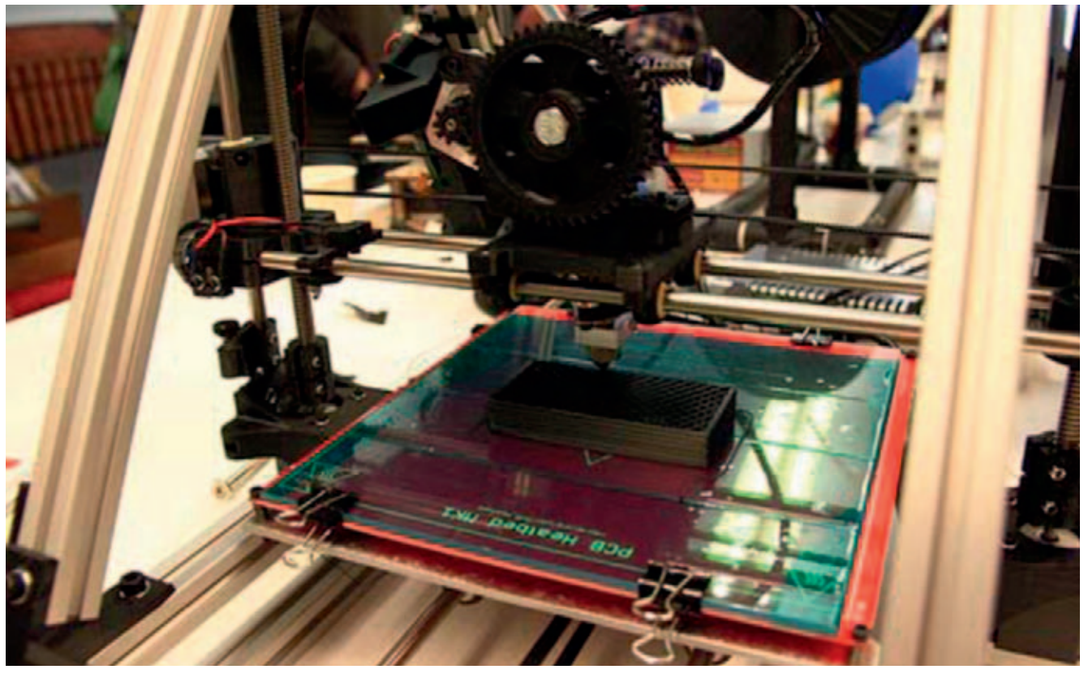
The project is building a robust evidence base, using research commissioned specifically for the project from leading UK and international experts on a range of sociological, technological, economic, environmental and political uncertainties. Additional valuable input from non-UK experts is being sought via a small number of international workshops in Berlin, Singapore and Washington, DC. So far, the project has engaged with over 350 academic and industry experts from 20 countries.

Work is being guided by a multidisciplinary lead expert group chaired by Sir Richard Lapthorne, Chairman of Cable & Wireless plc, with an industry High Level Stakeholder group chaired by Vince Cable providing strategic input.

The innovative evidence base and futures analysis provided by the project will inform policy makers throughout the course of the project and beyond, helping the UK to maximise opportunities in manufacturing, mitigate risks and deal effectively with future uncertainties.

The project is due to publish its final report in autumn 2013.

> “The UK is an important manufacturing economy, but if we think about what manufacturing is going to look like in a few decades, it will be different from what we see today.
>
> Consider the technological advances, changing business models and increased competition from emerging economies we have seen in the last 10 years. This project will help ensure that policies affecting UK manufacturing activities are resilient to future uncertainties.”
>
> Professor Sir John Beddington



Horizon Scanning

Horizon Scanning

The Horizon Scanning Centre (HSC) in Foresight helps deliver long-term, futures analysis and capability in government. Our work with government departments and agencies of government improves the resilience of policy and decision making.

This year, Jon Day, Chair of the Joint Intelligence Committee, reviewed strategic thinking and horizon scanning functions across government for the Cabinet Office. The Civil Service Reform Plan (2012) commits to 'improving the ability to scan the horizon better for threats and opportunities ahead'. HSC networks (Fusion and Heads of Horizon Scanning) were integral to meeting that commitment.

In government

The HSC worked with a variety of departments and agencies in 2012 to carry out internal horizon scanning projects on social mobility, identities, aviation, technology and innovation, and the Government Science and Engineering professional community. These ranged from delivering workshops and facilitating events held by other government departments, to undertaking more in-depth work to identify drivers of change and develop futures scenarios. In November 2012, the Minister for Universities and Science, David Willetts MP, published a report updating the HSC's 2011 review Technology and Innovation Futures to identify new opportunities for UK growth.

Capability

The HSC trained more than 100 officials in futures analysis in 2012, providing advice and coaching, running networks for analysts and aiding strategy or policy development. Training delivered by HSC for 2013 is being updated and integrated into the Civil Service Learning syllabus, with new materials that reflect the latest developments in tools and techniques.

Professional networks

HSC networks have thrived over the past year, sharing work and experience among analysts in government, and exploring some of the key issues facing the UK. The HSC is continuing to expand into areas external to government, enabling external organisations, academics and private sector contacts to share information, consult widely and gain access to the networks.

http://www.bis.gov.uk/assets/foresight/docs/horizon-scanning-centre/12-1157-technology-innovation-futures-uk-growth-opportunities-2012-refresh.pdf

Foresight's Impact

Migration and Global Environmental Change

The One-Year Review of this report was published in 2012. It highlighted the breadth of the international impact of this research, through collaborative work with a range of major development partners, including UN High Commission for Refugees, Global Forum on Migration and Development, International Organisation for Migration, Organisation for Economic Co-operation and Development, UNICEF and the Department for International Development

The final report, published in 2011, highlighted how profound changes in environmental conditions, such as flooding, drought and rising sea levels, will influence and interact with patterns of global human migration over the next 50 years. The report revealed that the major challenges associated with migration in the context of environmental change have been underestimated. By focusing solely on those who might leave vulnerable areas, we risk neglecting those who will be 'trapped' and those who will move towards areas that are also at risk. But it also showed that migration can have a transformative role in helping communities adapt to environmental pressures. This was a critical finding for policy makers working to avert costly humanitarian disasters in the future.

Building on the foundations laid in the months following publication, Foresight has continued to work with major international stakeholders to ensure that the findings inform initiatives at the country and regional levels.

The follow-up programme of work has included the following:

Work with the UK government (DFID)

A workshop took place in Accra with senior Ghanaian stakeholders from government, NGOs and civil society organisations, which stimulated the development of policy briefings on migration, climate change and social protection to support senior Ghanaian policy makers. Foresight and DFID are now developing a similar event with the Indian government and other Indian stakeholders

Work with the European Commission

Following a major launch at the European Commission involving the Government Chief Scientific Adviser, Commissioners and other senior officials, Foresight worked with DG DEVCO and others to develop three papers to inform the Commission's Staff Working Paper on Adaption scheduled for publication in early 2013. Foresight experts will develop papers on migration, the impact on urban destination areas, and the South Mediterranean region.

Work with United Nations organisations

Foresight provided a briefing for the UNHCR and attended the inaugural meeting of the Nansen initiative's consultative committee focusing on an inter-governmental exchange of experiences on the assistance and protection of people displaced due to natural disasters.

In the coming months Foresight will be working with the International Organisation for Migration (IOM) to develop training materials for use by policy makers in the Asia-Pacific region. Foresight will continue its work with DFID to explore opportunities to support country-level initiatives; in particular, in India in the fields of climate-resilient development and urbanisation. We also look forward to contributing to a UNICEF report to deepen our understanding of the links between youth, adolescents and children and migration in the context of environmental change.

Global Food and Farming Futures

Nearly one billion people go to bed hungry every night. *The Future of Food and Farming: Challenges and choices for global sustainability* is a study addressing the consumption of the world's natural resources at an unsustainable rate and the failure to meet the needs of the world's poorest. The report set out the case for urgent action on several fronts and showed that policies on the major global challenges of food security, climate change, economic growth and the eradication of poverty are all inextricably linked.

A review of the report's impact, published in March 2012, highlighted that the study continues to have significant UK and international impact.

The findings from the Global Food and Farming Futures project are being used to inform the development of the government's Agri-Tech Strategy, as part of its UK industrial strategy. This aims to harness and exploit the UK's world-leading agricultural science base to help deliver solutions to the worldwide challenges of economic recovery, global food security, climate change and sustainable development.

In addition, the report has generated:

- High-level debate with policy makers, researchers and other stakeholders, at the Westminster Forum and Foundation for Science and Technology in May 2012

- A high-level Foresight workshop on fertilisers, to explore innovation in product development and use, the move towards sustainable consumption of resources, and the reduction of agriculture's environmental impacts
- A collaboration with China, via the UK:China Sustainable Agriculture Innovation Network, to identify where in particular the report aligns with China's priorities and to identify where it might usefully inform and aid development of policy and research agendas and action

Further Impact of Past Projects – Flood and Coastal Defence

This project looked at future flood risks and flood risk management. The report, *Future Flooding*, continues to inform debate and action eight years after its publication, a testament to the robustness and relevance of the original analysis

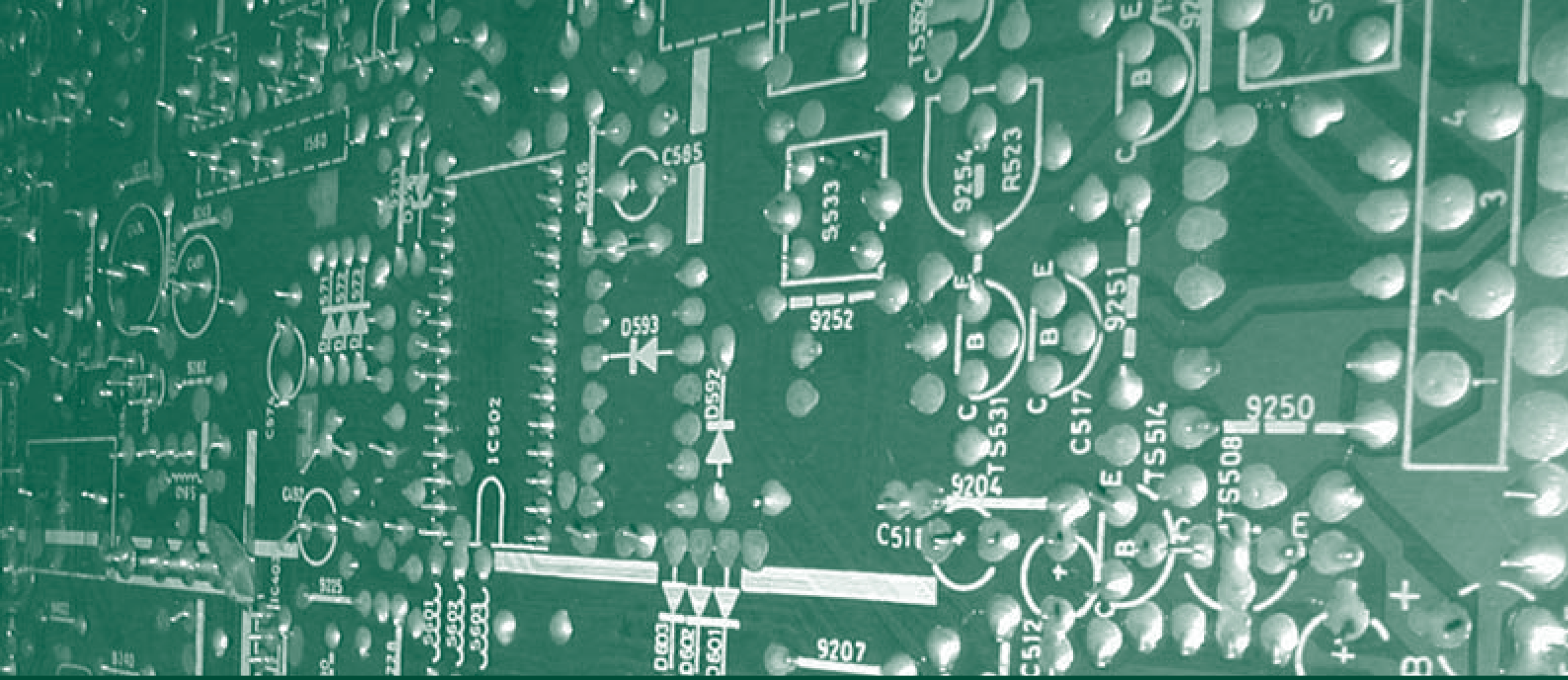
There has been considerable international interest in the report in recent years, highlighting the potential benefits for supporting the transfer of lessons and techniques from the report. For example, Foresight supported an international symposium in Brisbane in September 2012 to increase awareness of international and Australian approaches to flood risk management. In particular, the event explored how the report could inform Queensland's approaches on flood risk management and its strategic flood risk planning and policy development.

International impact is also reflected through the publication of a special issue of the *Journal of Flood Risk Management* which comprises a suite of papers developed through the Foresight-inspired China/UK scientific cooperation project: Scenario Analysis Technology for River Basin Flood Risk Management in the Taihu Basin.

Detection and Identification of Infectious Diseases

In the future, the UK and other countries cannot effectively manage the risks of infectious disease at their borders: they must be addressed at their source.

The report *Infectious Diseases: Preparing for the Future* analysed the science and social context of the future long-term risks for plant, animal and human health in the UK and Africa and set out how we might develop integrated and innovative policies and technologies in response. The African Union (AU) commissioned Foresight's lead African experts to develop the **African Union Science and Technology Framework for the Detection, Identification and Monitoring of Infectious Diseases in Africa**, which is founded on Foresight's pan-African 'vision' and calls for the creation regional networks of disease surveillance. The Framework was endorsed by the AU Executive Council at the January 2013 summit, an important step towards its implementation by member states, regional economic communities and other stakeholders.



Key Expert Collaborators

Key Expert Collaborators

Many academics, experts and policy makers contribute to Foresight's work. Our lead expert groups bring together specialist from a wide range of scientific and other disciplines to ensure that our work is of the highest technical standard and relevant to policy. A High-Level Stakeholder Group (HLSG) of relevant organisations in the public sector, research community and business advise Foresight on the strategic direction of projects and the actions that should result from the the work. Membership of the lead expert groups and HLSG are published in this section.

High Level Stakeholder Group for the Future of Computer Trading in Financial Markets

- Paul Tucker, Deputy Governor, Bank of England
- Martin Wheatley, Financial Services Authority, Managing Director (Designate), Consumer and Markets Business Unit
- Dr Kay Swinburne MEP, European Parliament
- Dr Adrian Blundell-Wignall, Deputy Director (Financial and Enterprise Affairs), OECD
- John Bates, Senior Vice President and Chief Technology Officer, Progress Software
- Laurent Useldinger, Chief Executive Officer, ULLink
- Thomas Secunda, Founding Partner, Bloomberg
- Jon Robson, Thomson Reuters
- John McCarthy, General Counsel, Erco
- Richard Gorelick, Chief Executive Officer, RGM Advisors LLC
- Nicholas Nielsen, Global Head of Trading, Marshall Wace
- Rob McGrath, Global Head of Trading, Schroders
- Scott Cowling, Global Head of Scientific Equity Trading, BlackRock
- Xavier Rolet, Chief Executive Officer, London Stock Exchange
- Dominique Cerutti, President, Deputy Chief Executive Officer and Head of Global Technology, NYSE Euronext
- The Honourable Ronald Arculli, Chairman, Hong Kong Stock Exchange
- Kerim Derhalli, Managing Director and Global Head of Equity Trading and Head of Equities EMEA, Deutsche Bank
- Olivier Osty, Deputy Head of Global Equities and Commodity Derivatives, BNP Paribas
- Andrew Bowley, Managing Director, Head of Electronic Trading Product Management, Nomura
- Mark Northwood, Global Head of Trading, Fidelity
- David Harding, Chief Executive Officer, Winton Capital
- Dr Ali Toutounchi, Managing Director (Index Funds), Legal & General Investment Management
- Stephen O'Connor, Chairman, International Swaps and Derivatives Association
- Danny Truell, Chief Investment Officer, Wellcome Trust
- Chris Marsh, Managing Director (Advanced Execution Services), Credit Suisse
- Stijn Claessens, Deputy Director (Research), International Monetary Fund

Lead Expert Group for the Future of Computer Trading in Financial Markets

- Chair – Dame Clara Furse DBE, former Chief Executive Officer of London Stock Exchange and a non-executive director of Legal & General plc, Amadeus IT Holding SA, Nomura Holdings Inc.
- Professor Philip Bond, Oxford Centre for Industrial and Applied Mathematics
- Professor Dave Cliff, Professor of Computer Science, University of Bristol
- Professor Charles Goodhart, Professor of Finance, London School of Economics
- Andy Haldane, Executive Director for Financial Stability, Bank of England
- Kevin Houstoun, Chairman, Rapid Addition; co-Chair, Global Technical Committee, FIX Protocol Limited
- Professor Oliver Linton, Professor of Econometrics, London School of Economics
- Dr Jean-Pierre Zigrand, Reader in Finance, London School of Economics

Lead Expert Group for the Reducing the Risk of Future Disasters

- Chair – Professor Angela McLean, Professor of Mathematical Biology, University of Oxford
- Rowan Douglas, Chief Executive Officer, Global Analytics, Willis Group; Chairman, Willis Research Network
- Professor Jan Willem Gunning, Professor of Development Economics, Amsterdam Institute for International Development
- Professor Peter Guthrie, Professor of Engineering for Sustainable Development, University of Cambridge
- Carolyn Miller, Chief Executive, Merlin
- Professor Tim Palmer, Royal Society Anniversary Research Professor, University of Oxford
- Professor Mark Pelling, Professor in Geography, King's College London

- Professor John Rees, Professor of Medical Education, British Geological Survey
- Dr Emma Tompkins, Geography and Environment, University of Southampton
- Brendan Gormley, Chief Executive Officer, Disasters Emergency Committee
- Robert Muir-Wood, Chief Research Officer, Risk Management Solutions

Lead Expert Group for the Future of Identity

- Chair – Professor Chris Hankin, Professor of Computing Science and Director of the Institute for Security Science and Technology, Imperial College London
- Professor Michael Hulme, Director, Social Futures Observatory, an independent futures 'think tank' (formerly Director of Applied Research, Henley Management College and Fellow of the Institute for Advanced Studies, Lancaster University)
- Dr Adam Joinson, Reader in Information Systems, School of Management, University of Bath
- Professor Nigel Rapport, Professor of Social Anthropology, St Andrews University
- Professor Anthony Heath, Professor of Sociology, Institute for Social Change, Manchester University
- Professor Mark Levine, Professor of Social Psychology, University of Exeter
- Dr Maureen Fordham, Principal Lecturer in Disaster Management, School of the Built and Natural Environment, Northumbria University
- Professor Ann Phoenix, Professor and Co-Director of the Thomas Coram Research Unit, Institute of Education, University of London

Lead Expert Group for the Future of Manufacturing

- Chair – Sir Richard Lapthorne CBE, Chairman, Cable & Wireless plc.
- Professir Nicholas Crafts, Professor of Economics and Economic History and Director of the Competitive Advantage in the Global Economy Research Centre, University of Warwick
- Professor Steve Evans, Professor of Life Cycle Engineering and Director of Research in Industrial Sustainability, Institute for Manufacturing, University of Cambridge
- Professor Anne Green, Professorial Fellow, Institute for Employment Research, University of Warwick and UK Commission for Employment and Skills Expert Panel
- Professor Richard Harris, Professor of Applied Economics and Director of the Centre for Public Policy for Regions, University of Glasgow
- Professor Alan Hughes, Margaret Thatcher Professor of Enterprise Studies at the Judge Business School and Director of the Centre for Business Research, University of Cambridge
- Professor Chris Lowe, Professor of Biotechnology and Director of the Institute of Biotechnology, University of Cambridge
- Dr Hamid Mughal, Executive Vice President, Manufacturing Engineering and Technology, Rolls Royce plc.

High Level Stakeholder Group for the Future of Manufacturing

- Will Barton, Head of Manufacturing, Technology Strategy Board
- Jeremy Bentham, Vice President, Global Business Environment, Royal Dutch Shell plc.
- Lucy Thornycroft, Head of Industrial Policy, Enterprise and Innovation, CBI
- Roger Connor, President, Global Manufacturing and Supply, GlaxoSmithKline plc.
- Professor David Delpy, Chief Executive, Engineering and Physical Sciences Research Council
- Ron Dennis, Executive Chairman, McLaren Group Ltd.
- Warren East, Chief Executive Officer, ARM Holdings plc.
- Mark Elborne, President and Chief Executive Officer, GE UK & Ireland, General Electric Company
- Ronnie Fisher, Director, Specialties General Manager, Pentagon Chemical Specialties Ltd.
- Mark Florman, Chief Executive Officer, British Private Equity & Venture Capital Association
- Fiona Kendrick, Chief Executive Officer, Nestlé UK Ltd.
- Tim Luke, Senior Adviser on Business, Trade and Innovation, No 10 Policy Unit
- Dr Siavash Mahdavi, Chief Executive, Within Technologies Ltd.
- Juergen Maier, Managing Director, UK Industry Sector, Siemens plc.
- John Martin, Senior Vice President, Manufacturing, Purchasing and Supply Chain, Nissan Motor Co.
- Geoff Mulgan, Chief Executive, Nesta
- Frances O'Grady, General Secretary, TUC
- Dick Olver, Chairman, BAE Systems plc.
- Sir John Parker, President, The Royal Academy of Engineering
- Professor John Perkins, Chief Scientific Adviser, Department for Business, Innovation and Skills
- Jeremy Pocklington, Director, Enterprise and Growth, HM Treasury
- Angus Robertson, Chief Executive Officer, PowerPerfector Ltd.
- Rachel Sandby-Thomas, Director General, Business and Skills Group, Department for Business, Innovation and Skills
- Ian Scott, Group Supply Director, Mulberry Group plc.
- Terry Scuoler, Chief Executive Officer, EEF
- Nigel Stein, Chief Executive, GKN plc.
- Trevor Williams, Chief Economist, Lloyds Banking Group plc.

High Level Stakeholder Group for Global Food and Farming Futures

- Chair – Jim Paice MP, Minister of State for Agriculture and Food, Department for Environment, Food and Rural Affairs
- Chair – Stephen O'Brien MP, Parliamentary Under-Secretary of State for International Development, Department for International Development
- Professor Sir John Beddington, Government Chief Scientific Adviser, Government Office for Science
- Dr Pedro Arcuri, Coordinator, EMBRAPA Labex Europe Empresa Brasileira de Pesquisa Agropecuária
- Dr Tariq Banuri, Director, Division for Sustainable Development, UN
- Dr John Barrett, Deputy Director Policy and Research Division, DFID
- John Bensted-Smith, Director, Directorate-General for Agriculture, European Commission
- Sam Bickersteth, Head of Programme Policy Team, Oxfam
- Professor Joachim von Braun, Director General, International Food Policy Research Institute (IFPRI)
- Eckhard Deutscher, represented by Stephen Groff, Deputy-Director, Development Co-operation Directorate, OECD
- Dr Nina Fedoroff, Special Advisor on Science and Technology to the US Department of State
- Iain Ferguson CBE, Chief Executive, Tate & Lyle plc.
- Anne Guttridge, Supply Chain Manager, Grain and Oilseeds, Europe, Cargill

- Brian Harding, Director, Food and Farming Group, Department for Environment, Food and Rural Affairs
- Patrick Holden, Director, Soil Association
- Michael Jacobs, Senior Policy Adviser to the Prime Minister
- Professor Doug Kell, Chief Executive, Biotechnology and Biological Sciences Research Council and Research Councils UK
- Peter Kendall, President, NFU
- Laurie Lee, Director, Agricultural Development, Global Development Program, Bill and Melinda Gates Foundation
- Dr Will Martin, Acting Research Manager, Development Research Group, Trade, World Bank
- Dr Jeff McNeely, Chief Scientist, International Union for Conservation of Nature (IUCN)
- Professor Richard Mkandawire, Head of the Comprehensive African Agriculture Development Programme, New Partnership for Africa's Development (NEPAD)
- Alexander Mueller, Assistant Director, General Sustainable Development Department, Food and Agricultural Organisation (FAO)
- Dr Namanga Ngongi, Director, Committee on Agriculture and Rural Development (AGRA)
- Nancy Roman, Head of Public Policy and Communications, World Food Programme (WFP)
- Professor Andrew Rosenberg, Director, Ocean Process Analysis Laboratory, University of New Hampshire
- Dr Harsha Vardhana Singh, Deputy Director-General, World Trade Organization (WTO)
- Achim Steiner, Executive Director, United Nations Environment Programme (UNEP)
- Ajay Vashee, President, International Federation of Agricultural Producers
- Jan Kees Vis, Director Sustainable Agriculture, Unilever
- Ross Warburton, President, Food and Drink Federation

Lead Expert Group for Global Food and Farming Futures

- Chair – Professor Charles Godfray FRS, Hope Professor, Oxford University
- Professor Lawrence Haddad, Director, Institute of Development Studies, University of Sussex
- Professor Ian Crute, Director, Rothamsted Research
- Professor Jules Pretty, Environment and Society, University of Essex
- Dr David Lawrence, Head of Research and Development, Syngenta
- Dr Camilla Toulmin, Director, International Institute for Environment and Development
- Professor Sherman Robinson, University of Sussex

High Level Stakeholder Group for Migration and Global Environmental Change

- Mehari Maru, African Conflict Prevention Programme (ACPP)
- Richard Edwards, Asian Development Bank (ADB)
- Andy Bearpark, CARE International UK
- Professor Robert Watson, Chief Scientific Adviser, Department for Environment, Food and Rural Affairs
- David Warrilow, Department for Energy and Climate Change
- Alan Winters, Chief Scientific Advisor, Department for International Development
- Paul Boyle, Economic and Social Research Council UK (ESRC)
- Heike Buss, European Commission
- Frank Laczko, International Organization for Migration (IOM)
- Kris Ebi, Intergovernmental Panel on Climate Change (IPCC)
- Chris Field, Intergovernmental Panel on Climate Change (IPCC)
- Andrew Watkinson, Living with Environmental Change (LWEC)
- Alan Thorpe, Natural Environment Research Council (NERC)
- Steven Wilson, Natural Environment Research Council (NERC)
- Barrie Stevens, OECD
- Goran Svilanovic, Organisation for Security and Co-operation in Europe (OSCE)
- Madeleen Helmer, Red Cross/Red Crescent Climate Centre
- Robin Mearns, The World Bank
- Jeni Klugman, United Nations Development Programme (UNDP)
- Veerle Vandeweerd, United Nations Development Programme (UNDP)
- Diarmid Campbell-Lendrum, World Health Organization (WHO)

Lead Expert Group for Migration and Global Environmental Change

- Chair – Professor Richard Black, Head of the School of Global Studies, University of Sussex
- Professor Neil Adger, Environmental Economics, School of Environmental Sciences, University of East Anglia and Programme leader, Tyndall Centre for Climate Change Research
- Professor Nigel Arnell, Director, Walker Institute for Climate System Research, University of Reading
- Professor Stefan Dercon, Developmental Economics, Oxford University
- Professor David Thomas, Head of School of Geography and the Environment, Oxford University and Deputy Leader, Tyndall Centre for Climate Change Research
- Professor Andrew Geddes, Department of Politics, Sheffield University