Foreign & Commonwealth Office

BIS
Department for Business Innovation and Skills

Science & Innovation Network Report

April 2008 to March 2010

Part II: Country and Regional Profiles

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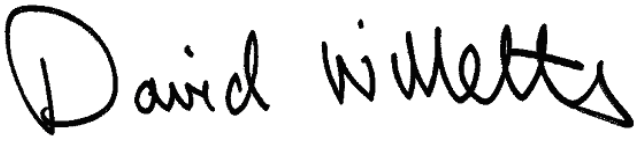
Foreword

Science and technology are major drivers of productivity and economic growth. They are essential to understanding and tackling the most serious challenges of our time, whether healthcare, food security or climate change.

The UK punches above its weight in many areas of science. We produce eight per cent of the world's scientific publications and attract a higher share of research and development from overseas than any other country in the G8.

The UK Government recognises, however, the importance of contributing to – and drawing upon – the best global scientific thinking: for our researchers, business leaders and policy makers. The Science and Innovation Network, based in our Embassies, High Commissions and Consulates across the world, leads this agenda. Together with UK Trade & Investment, the British Council and the Research Councils, it works with international partners in sectors ranging from education to finance.

This report highlights the varied activities of the Network – its value in both keeping the UK at the cutting edge of science and in stimulating strong, sustainable growth.



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Introduction

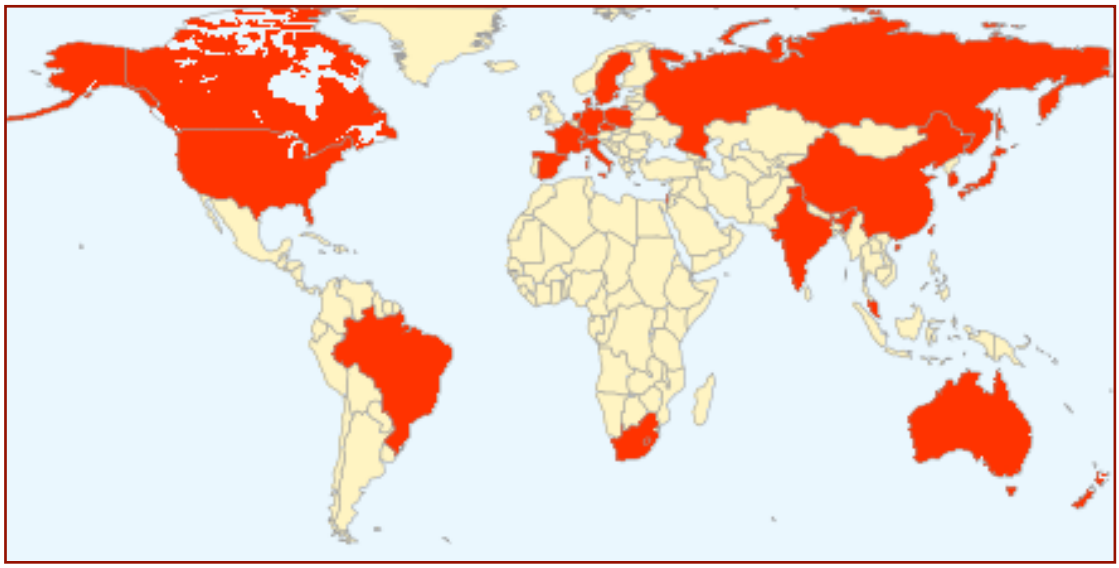


Figure 1: The Science & Innovation Network of around 90 staff in 25 countries and territories is based in 40 British Embassies, High Commissions and Consulates.

About this Report

This report highlights some of the achievements of the UK's global Science and Innovation Network (SIN) over a two-year period. Part I gives an overview with examples from around the network. Part II has country and regional profiles from places where the network is active, with many examples of successful outcomes.

Brazil

For a profile of Brazil, with headline facts and figures including economic trends and commercial and political relations with the UK, click here.

Science and Technology are a priority for the Brazilian Government, with a doubling of public and commercial funding in real terms[1] between 2003-2008, representing a an increase from 1.26% to 1.43% of Brazil's growing Gross Domestic Product (GDP). Brazil plans to further increase science spending to 2% of GDP by 2020. Generous and co-ordinated public support for research is widely credited to have played a key role in the dramatic expansion in the quantity and quality of Brazilian science in recent years.

Publications by Brazilians in peer-reviewed science journals also doubled from 14,237 to 30,415 between 2003 and 2008, the most dramatic increase in the history of Brazilian science. Brazil now produces 2.63% of world publications, and has overtaken Russia and the Netherlands in terms of research production. It is now the world's 13th largest producer of publications [2]. In addition, Brazil produces more than 500,000 new graduates and about 10,000 new PhD researchers each year. This represents a ten-fold increase in 20 years.

Brazil is increasingly recognised by the UK as an important BRIC[3] country and potential partner for business, research and innovation, whilst Brazil regards the UK as a partner of choice, especially in the areas of innovation and scientific standards.

The benefits of UK collaboration with Brazil have been demonstrated in a recent Thomson Reuters report[4] which showed that the UK now co-authors more than 900 papers with Brazil, up from 400 in 1999. The UK overtook France in 2008 to become Brazil's largest partner in science after the US.

In terms of impact, the UK impact gain when working with Brazil is 1.3 times the UK average[5], which compares very favourably with that obtained from co-authorship with India (1.01) and China (1.07). Evidence for the State of São Paulo suggests that Brazilian impact gain when working with the UK increases by a factor of nearly 3, significantly higher than the impact gain obtained

[1] Expenditure increased from 21.4 billion to 43.1 billion Real, equivalent to 7.1 billion to 14.3 billion GBP.

[2] Thomson Reuters. (2008). *National Science Indicators*

[3] Brazil, Russia, India China – countries characterised by rapidly growing economies

[4] Thomson Reuters. (2009). *Global Research Report – Brazil – Research and collaboration in the new geography of science*

[5] Evidence Ltd. (2009). *International Comparative Performance of the UK research base*

when working with any other country.

S&I Network in Brazil: Making a Difference

The team of three Science & Innovation staff in Brazil is based in São Paulo.

UK-Brazil Partnership in Science and Innovation

There has been a step change in UK-Brazil science relations in recent years. The *UK-Brazil Year of Science* in 2007-08, and the extension of the programme under the *UK-Brazil Partnership in Science and Innovation* into 2008-09 have been a success.

Figure 2: Opening of the UK-Brazil Partnership in Science and Innovation by Chief Scientific Advisor, Prof. Sir John Beddington, and Brazil's Minister of Science and Technology, Dr. Sérgio Machado Rezende

Over 28,000 Brazilian scientists and students have met more than 250 UK researchers, with numerous agreements between Universities and research labs being signed.

Support for UK spin-out companies

The International Innovation Programme (IIP) was created in partnership with UK Trade and Investment to promote collaboration between UK and Brazilian spin-out companies. The programme supports UK spin-outs and high-tech Small and Medium Enterprises (SMEs) in the commercialisation of technologies in Brazil. This is achieved through mechanisms including joint ventures on the basis of shared IP rights or joint-research with Brazilian universities, or the formation of new companies. The programme has already identified 735 UK and 300 Brazilian spin-outs and is currently working with UK companies that possess technologies on vector control (dengue fever), bio-polymers (sugarcane-based), and second generation biofuels.

Attracting Brazilian investment to the UK innovation market

SIN has supported activities that encourage Brazilian investment in UK spin-out companies. A mission of 7 Brazilian Venture Capital companies to the UK focused on technologies that are particularly suited to the Brazilian market, such as agro-biotechnology, biodiversity-based drug discovery, and bioenergy. It also created opportunities to establish joint ventures or technology transfer agreements between UK and Brazilian spin-outs that have already received investment.

Second generation biofuels research

A joint funded project was approved between Embrapa, the Brazilian Agricultural Research Corporation and the British Government's Department for Environment, Food and Rural Affairs (DEFRA) to send 15 Brazilian researchers to the UK to work on research within main UK universities on second generation biofuels.

Innovation/technology transfer

SIN Brazil has played a major role in enabling UK stakeholders such as Plant Biosciences Limited and the University of Oxford to licence Brazilian technology worldwide through technology transfer and supply agreements. An agreement facilitated by the S&I team between university-based technology transfer office associations (UNICO in the UK and FORTEC in Brazil) enables exchange of best practice, training of human resources and collaboration between incubators.

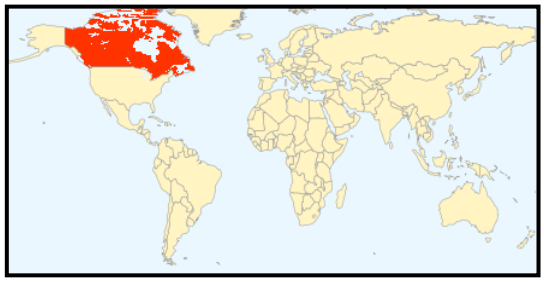
Brazilian University-based Technology Transfer Offices and their UK counterparts have built a strong relationship that has enabled Brazil to market and commercialise technologies in sectors including tropical agriculture and bioenergy in the UK and has also created opportunities for UK technologies in Brazil.

Enhanced collaboration in research

A ground-breaking agreement between RCUK and FAPESP (the State of São Paulo Research Funding Agency), finalised following the Prime Ministerial visit to Brazil in March 2009, will enable Brazilian and UK researchers to apply for funding through a single application and peer review process. The agreement will maximise the effectiveness of UK public funding as Brazilian research funding agencies will now be able to co-fund joint projects proposed by the joint community of more than 75,000 academics. The UK Research Councils currently spend about £14M in UK-based research projects that involve Brazilian stakeholders.

Further examples of how SIN Brazil has made a difference can be found in Part I of this report.

Canada



For a profile of Canada, with headline facts and figures including economic trends and commercial and political relations with the UK, click here.

Canada has a strong science and innovation environment. With world-class universities, areas of strength include medical research, Polar science and alternative energy sources such as marine, fuel cells and biomass.

Other key areas of focus for Canadian science and innovation include nuclear and particle physics, photonics and high tech ("Silicon Valley North").

The federal government is the primary funding source for scientific research in Canada. The Federal Budget in March 2010 included several science-specific items despite the uncertain economic climate. These included C$32M to national granting councils to sustain research at universities, hospitals, and colleges, C$600M Canada Foundation for Innovation competition to be launched December 2010, C$397M over five years to the Canadian Space Agency, C$126M over five years to TRIUMF, the national laboratory for nuclear and particle physics research, and C$75M to Genome Canada.

Both the federal and provincial governments have funding schemes for research and innovation. One example of a federal funding programme would be the Canada Excellence Research Chairs (CERCs) that recently attracted four top UK researchers to Canada.

Similar demographics, a shared history and culture, and many scientific and systematic parallels mean there is great scope for UK impact. The Science & Innovation Network in Canada has capitalised on key areas of Canadian expertise and worked on strategic projects to strengthen the scientific base in the UK where Canada offers the best science, innovation, and facilities. Significant projects include:

- Polar research - access to Canadian facilities and expertise, and climate modelling
- Health, including nutrition, neuroscience, computational medicine, cardiac research and pandemic preparedness
- Environmental Science - alternative energy such as wave and tidal, where Canada has niche expertise which overlaps with the UK – and also wind energy and nuclear
- Clean-Tech, looking at innovative vehicles, alternative fuels and systems
- International development aimed at technology partnerships, building on a history of joint work
- High Tech, especially photonics, and some initial work in space research

S&I Network in Canada: Making a Difference

The team of five Science & Innovation staff in Canada is based in Ottawa, Toronto, Montreal and Vancouver.

Celebrating Darwin and biodiversity

In 2009, SIN Canada organised a public forum on Biodiversity, Climate and Evolution, carried out in collaboration with McGill University, the UN Council on Biological Diversity and the British Council. The purpose of the event was to celebrate Darwin's scientific legacy, celebrate UK science and highlight how climate change affects biodiversity. In addition, the S&I team organised meetings with various high level Canadian government officials for the Chairman of the UK's Joint Nature Conservation Committee, to discuss conservation and biodiversity initiatives and access to scientific expertise. The event was possible due to joint funding by SIN, the FCO and British Council.

Collaboration in Medical Research

The SIN Canada Team negotiated and worked with high-level representatives from University College London and the University of Toronto to achieve signing of an agreement between the universities for collaboration and exchanges in the areas of Neuroscience and Imaging, with SIN programme funding leveraging equal contributions from both universities.

Nuclear skills symposium

A meeting organised by the S&I team in Canada in partnership with UKTI established a UK-Canada exchange scheme for graduate students in various areas of nuclear engineering and applied research.

The meeting involved representatives of Manchester University, University of Sheffield and the Nuclear Technology Education Consortium from the UK and McMaster University and the University Network for Excellence in Nuclear Engineering from Canada and was possible due to joint funding by SIN, FCO and the British Council. Exchanges began in September 2009.

Further examples of how SIN Canada has made a difference can be found in Part I of this report.

China

For a profile of China, with headline facts and figures including economic trends and commercial and political relations with the UK, click here.

China is on track to become the world's second largest economy, and the approach it takes to tackling the challenges that come with growth will have global impact. In 2009, China's greenhouse gas emissions rose by well over the UK's total. Engaging with China on these issues will be essential to global sustainability as well as bringing wider benefits to research in both countries.

In research, China is world number two in publications and across broad research areas now has more top-three places by citation than France or Japan. By 2007, China had equalled the USA as home to the world's largest pool of researchers, and 18% annual investment increases over a decade have established world-leading facilities. China's innovation capacity is also rising fast. In 2006-08, it produced more alternative energy innovations than any other country, becoming the world's third largest innovator in non-fossil fuels.

Collaboration is growing strongly and SIN China works with Chinese partners across a wide range of areas. The UK is China's third-largest science partner, and collaboration can produce significant impact gains to both countries - 12% of UK-China papers are cited four times above the world average, compared with 8% for UK-only and 7% for China-only papers.

However, the research landscape in China is complex, with research quality unevenly distributed. Intellectual property management and market access remain an issue for UK investors and innovators. The World Bank ranks China 89th in the world for the ease of doing business.

A central part of SIN China's role is therefore to help identify the best research using experts to identify potential partnerships, influence policies towards more open collaboration and innovation and identify funding opportunities across China. The Innovation Dialogue helps to build understanding of our innovation systems and improve them. SIN China also works closely with UKTI to promote UK science and innovation, share intelligence and develop economic opportunities.

SIN also engages with China on global challenges. The UK collaborates with China on developing and applying research on climate change, the environment, infectious diseases and food security. The UK Foresight programme and joint Sustainable Agriculture Innovation Network are also influential in engaging policy- and decision- makers.

S&I Network in China: Making a Difference

The team of twelve Science & Innovation staff in China is based in Beijing, Chongqing, Guangzhou and Shanghai.

Linking research systems

UK institutions, Chinese Ministries and Tsinghua University have worked together on a project looking at the full economic costing of research. The project represents a major step forward in connecting UK and Chinese research systems. The project should assist China's research system reform, enhance the UK's reputation and increase transparency. This will benefit funding of future joint research collaborations. We are now developing an institute pilot study. An earlier project shed light on China's research evaluation processes and won the Foreign Secretary's Award for Innovation in Project Design and Delivery.

Promoting the UK

SIN China is delivering a suite of events to raise the profile of UK Science in China at the 2010 Shanghai Expo, with videos on the web of Chinese scientists in the UK and leading UK scientists talking about the UK's strengths. 10 million visitors will visit the UK pavilion and 100 million Chinese have already engaged with its social and digital media presence. 81% of these came away with a positively changed attitude to the UK.

Reducing climate emissions – and saving cost

China's greenhouse gas emissions could be reduced by 3-5% after a £0.44M UK-China joint research project focusing on improved nitrogen fertiliser use. Led by Rothamsted International with China Agricultural University in Beijing and co-ordinated from SIN Shanghai, the project engages ministry officials, advisory agencies, farmers associations and industry. Farmers will also be able to save money and reduce water pollution through technologies that will help reduce by 25% emissions from nitrogen fertiliser use without lowering crop yields. Chinese emissions from nitrogen fertiliser account for 20% of total CO_2 equivalent emissions.

Traditional Chinese Medicines (TCM)

SIN China worked with Imperial College, Jiao Tong University and the Chinese Academy of Science, funding a project using top-down systems biology to develop a new strategy to evaluate and exploit TCM and related natural product mixtures in promoting human health. A position paper on Functional Metagenomic analysis of TCMs was submitted to Nature Drug Discovery and a toxicity study completed. The project yielded the design of a study to analyse two TCMs on Chinese patients. The methodology opens the way to enhance evidence on the impact of Traditional Chinese Medicines and achieve conformance with internationally accepted research protocols.

Green manufacturing

SIN China worked with The University of Nottingham Ningbo, China, to fund two successful green manufacturing workshops. These resulted in the formation of the "Sino-UK Low Carbon Manufacturing Consortium" involving Tsinghua, the

National Key Lab for Remanufacturing, Chongqing, Jiao Tong and Zhejiang Universities in China and Cambridge, Bath, Cranfield, Hull and Nottingham in the UK. The project also produced a university spin-out contract, joint paper and a website for sharing knowledge.

Identifying new plant species and protecting consumers

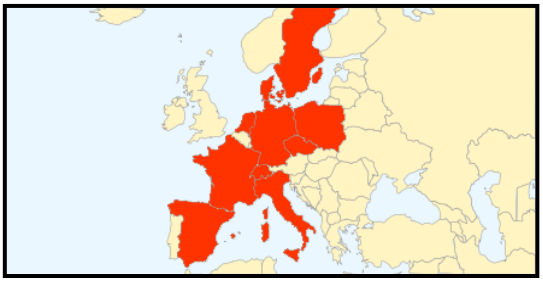
SIN China has helped Kew Botanical Gardens and the Natural History Museum identify new partners and extend collaborations in China, building on long associations in identifying and cataloguing Chinese plant species. During one field trip with Gualin Botanical garden museum, staff helped identify five new flora species. Kew is working with several Chinese institutions to identify and classify Chinese herbs used in foods, pharmaceuticals, cosmetics and Chinese herbal medicines ahead of EU legislation effective from 2011. The work supports safe use of these products by UK consumers. Kew's work has led to intellectual property that they are now seeking to exploit.

China Tomorrow

Over the last year and a half, together with the China-Britain Business Council, SIN China organised inward missions providing participants an opportunity to forge innovative collaborations with UK organisations. Subsequently a UK-China Innovation centre was established in Chongqing. Collaborations were also established between King's College London and Guangxi University, and between Guangdong Academy of Agricultural Sciences and the China-UK Sustainable Agriculture Innovation Network. The programme also led to the Medicare KTN mission to China promoting R&D collaborations. It will next focus on food-security, low-carbon energy production and hi-tech industries.

Further examples of how SIN China has made a difference can be found in Part I of this report.

Europe



For a profile of European countries, with headline facts and figures including economic trends and commercial and political relations with the UK, click here.

Europe is a significant player in terms of world R&D. 25% of global R&D takes place in Europe, 33% of all publications are produced there and Europe receives 33% of world citations. The EU27 spent a total of €212 billion on R&D in 2006.

The S&I Network has a presence in 10 of the 27 European member states, although we seek to access opportunities in a further 6. These 16 countries present a highly diverse R&D landscape. In terms of thematic strengths, OECD reports that health, environment, food and ICT attract most international partnering with Europe. This indicates that life sciences, environmental science and underpinning enabling technologies are world class. The UK also undertakes a high proportion of its energy, materials and IT research in partnership with Europe.

The diversity of science capabilities and differing perspectives and approaches European countries bring to research and innovation challenges provide wide opportunities for the UK. The SIN Europe network contributes to UK policy-making on European issues such as developing a competitive and innovative knowledge based economy in Europe. It benchmarks and shares information on science and innovation policies from European capitals and provides access to key contacts. SIN creates new networks of excellence for collaboration amongst researchers in Europe to develop mutually beneficial solutions to global challenges. SIN Europe horizon scans and responds flexibly on emerging issues, identifying opportunities to share good practice or contacts that benefit the UK

The S&I Network in Europe: Making a Difference

The team of twenty one Science & Innovation staff in Europe is based in the following countries:

Czech Republic; Denmark; France; Germany; Italy; Netherlands; Poland; Spain; Sweden; Switzerland.

Postdoctoral positions in cancer research

Spain's top cancer research institute Fundación CNIO[6], working with SIN Madrid, has agreed to offer 5 postdoctoral positions to UK scientists to undertake research at CNIO in Madrid. The project will launch in 2011 and will be fully funded by Fundación Banco Santander. The two year investment will be worth some €400K.

[6] Spanish National Cancer Research Centre

Collaboration on chemicals from biomass

This workshop and a follow-up event jointly organised with the French Embassy in London led to many opportunities for training and R&D collaborations as well as joint funding calls. The University of York has been asked to join a €150M bid to build a world class green chemistry cluster in France and a consortium of British and French universities have recently applied for funding (around £125K) from the Leverhulme Trust to set-up a research network.

Technology, innovation and intellectual property

A Czech-British Technology & Innovation event was co-organized with CzechInvest[7] in 2009. Held in London and opened by Czech Ambassador Michael Žantovský, the event was attended by over 40 UK participants. It was followed by an international conference in January 2010 which focused on innovation policy and intellectual property rights, with over 150 participants. As a result of many years of SIN activity in this area, the UK is seen as the partner of choice in Science and Innovation, the UK innovation model is well established in the Czech Republic and the UK's Best Practice is one of the role models for Czech Policy-making in science and innovation. Commercial successes include Technopolis, who received in March 2010 a contract of £1.2M for the audit of Czech science.

[7] The investment and business development agency of the Czech Republic

Venture Capital for Cleantech Seminar

A seminar to help broker relationships between the venture capital (VC) community and hi tech R&D companies was organised in collaboration with UKTI, Think London and the London Stock Exchange, who said the event was the best attended since the start of the global recession. Four Global Entrepreneur Programme leads were generated for UKTI, two of which are now confirmed successes. Two Swedish companies have set up in the UK, bringing their highly innovative technologies concerned with environmentally friendly chemicals and efficient lighting for homes. Based on SIN Sweden's creative approach to the innovation agenda, other parts of the S&I Network have now implemented projects of a similar nature.

Biobanking

Italy: Professor Leonardo Santi, Chairman of the Italian National Committee for Biosafety and Biotechnology (CNBB) of the Presidency of the Council of Ministers, participated in a mission to the UK of selected Italian experts to investigate biobank regulations and operations. A dissemination workshop was held in Rome to inform a wider Italian audience about the findings. Following the workshop, a 5 year research project on tumour biomarkers was launched. Samples will be collected from healthy volunteers over 4 years and used to develop diagnostics tests for ovarian and prostate cancer. The project, worth €25M, will lead to the creation of a biobank containing 1.2 million samples.

Poland: Together with the Ministries of Health and Science, SIN Poland organised a Polish-British Biobanking workshop in June 2009. As a result, Poland is on track to join the BBMRI[8] and works on adjusting its legal framework to make it OECD-compatible.

International expert forum on food waste

The S&I team in Switzerland worked with the UK Government Office for Science Foresight Programme to organise a forum on food waste, focusing on food waste reduction along the food chain. The forum, opened by Professor Sir John Beddington, Government Chief Scientific Adviser, involved thirty five experts from around the world from organisations including Sainsbury's, Nestlé, Sodexo, Swiss Federal Institute of Technology, Wilton Park, DEFRA and the International Food Policy Research Institute (IFPRI). The UK took a leading role in addressing this neglected problem and the Foresight workshop report will contribute towards advising the UK government on implementing sustainable food chain models. The outcomes from the workshop will be integrated into the 'Addressing Waste' chapter of the upcoming Foresight Global Food and Farming Futures report.

Cultural heritage conservation

During the meeting between the Italian National Research Council (CNR) and the British delegates participating in the mission on cultural heritage conservation in Italy, CNR and the Arts and Humanities Research Council (AHRC) signed a 3 year Memorandum of Understanding aimed at fostering mutual understanding and promoting cooperation between scholars from both countries.

Informing UK plans on hydrogen fuelling infrastructure

Missions organised by SIN Denmark helped the UK to reformulate and further the plans for a continuous hydrogen fuelling infrastructure covering mid-England and London. The UK Hydrogen Network Project (UK-HyNet) has now been established to bring together clusters into a UK national effort.

Life Sciences and IT Partnerships Conference

110 people attended a conference organised by SIN Poland with the British-Polish Chamber of Commerce and Krakow Life Science Cluster. The conference was a platform for Polish and British scientists and entrepreneurs to forge contacts and transfer technology. As a result of the conference, UK scientists from London, Oxford, Cambridge and Edinburgh applied to participate in a Polish-led EU-funded project on Life Science Networking worth £120K, with application results due to be announced by the end of 2010. Krakow Life Science Cluster will now participate in BioTrinity 2011, the largest gathering of the UK bioindustry aimed at partnering and investment.

[8] Biobanking and Biomolecular Resources Research Infrastructure, a pan-European resource for biomedical and biological research in Europe and worldwide.

"Made in Future" workshop

Organised by SIN Italy in collaboration with the Materials Knowledge Transfer Network, the 'Made in Future ' workshop was a showcase for UK excellence in the field of innovative technologies applied to fashion, sportswear and textiles. The event, attended by more than 70 guests from Italian fashion industry and academia and followed by an exhibition of over 30 high-performing products and prototypes, attracted excellent media coverage and has led to on-going interactions with major Italian companies.

Bio & medical sciences with new light sources

A two-day workshop organised by SIN Italy explored the possible biological and biomedical use of the new light sources that are under construction in Italy and Europe and has resulted in enhanced collaboration between participants. It has also led to engagement with key US partners, such as Oak Ridge National Laboratory, and a project bid to the European Seventh Framework Programme involving the ISIS facility at Rutherford Appleton Laboratory was recently approved.

Collaboration in carbon capture and storage

Thanks to the Rotterdam Climate Initiative, SIN Benelux and FCO colleagues working on climate change issues organised a seminar to discuss taking Carbon Capture and Storage (CCS) from demonstration to full scale deployment. Policy makers and leading scientific experts from the UK, Netherlands, Germany, Belgium, France and Norway identified key research and policy challenges, including liability, ensuring technological progress and public acceptance. Consensus emerged that scientists and policymakers should endeavour to ensure that scientific evidence on the safety of CCS is available and used to inform policy-making.

Informing UK thinking on innovation infrastructure

The SIN team in Germany worked with the organisers of a conference on Germany's High-Tech Strategy to engage a senior UK speaker. The conference focused on the role of science and innovation to accelerate economic recovery. Former UK Science Minister Lord Drayson addressed an audience of more than 450 high-level contacts from industry, research and policy-making. A dinner hosted by the British Ambassador gave an opportunity for Lord Drayson and the German Federal Research Minister, Prof. Dr. Annette Schavan and her most influential innovation policy advisers to discuss approaches to innovation. The conference was a resounding success and helped to inform UK thinking on innovation infrastructure. It also generated excellent media coverage.

Promotion of EU R&D Structural Funds opportunities in Central Europe

Experts from the Czech Republic and Poland, together with Czech and Polish SIN Officers, promoted S&I opportunities arising from EU R&D Structural Funds.

For 2007-15, these amount to £5.8 billion available in the Czech Republic and £7.8 billion in Poland. Two events were organised for UK R&D businesses in collaboration with UK Trade and Investment, Scottish Development International, Scottish Enterprise and the Council of British Chambers of Commerce in Europe, with more than 120 participants. Collaborations between UK businesses and partners in the Czech Republic and Poland have resulted.

Further examples of how SIN Europe has made a difference can be found in Part I of this report.

India

For a profile of India, with headline facts and figures including economic trends and commercial and political relations with the UK, click here.

India is an emerging scientific superpower. It has the largest and most sophisticated research capacity in South Asia, together with firm policy commitments and implementation measures to increase the level of excellence. Public funding on research and development is expected to triple between 2006 and 2012.

India's traditional strengths have been in maths and basic sciences but past decades have seen a substantive shift towards applied science and engineering. Investment in research is already bringing real benefits and 2009 saw the launch of India's first lunar probe and nuclear submarine, both indigenously developed.

The number of highly educated and qualified researchers in India is growing rapidly, with the number of elite Indian Institutes of Technology doubling since 2008. India is well set to achieve its research targets, with GDP growth predicted to be about 8% in 2010 (equivalent to 2008 levels). It has also emerged as an important destination for several multinational companies' R&D centres, including Microsoft, Intel, IBM and Du Pont. Most international pharmaceutical companies, including AstraZeneca, GSK and Pfizer, have R&D labs in India.

India's 2010-11 budget allocated almost £400M for agriculture research, helping India to exploit its wide agro-climatic diversity. India's six ecosystems, seven agro-climatic zones, and 20 major river systems, provides the perfect opportunity to test globally relevant research.

Against this backdrop, the S&I Network in India focuses on developing opportunities for collaboration and policy influence related to the challenges shared by both the UK and India. These include areas such as climate change; water, energy and food security; poverty alleviation; and fighting disease. This greatly strengthens UK stakeholders' ability to partner with India's growing research base.

Figure 3: Health check at a clinic in India (courtesy of DFID)

Recent activities undertaken by the S&I Network in India helped to shape India's innovation policy following a visit to the UK by senior Indian innovation policymakers. They have also resulted in India's first ever representation at the International Stem Cell Network, re-invigoration of the UK-India

relationship in civil nuclear research and the £9M funding to bring online education, healthcare and early warning disaster systems to remote areas in both countries. The outcomes of the S&I Network-led 2010 Indo-UK Science and Innovation Council will have a significant impact in tackling our shared challenges and have placed India firmly on-track to become the UK's largest bilateral research funding partner.

The S&I Network in India: Making a Difference

The team of ten Science & Innovation staff in India is based in New Delhi, Bangalore and Mumbai.

Stem cells

The SIN team organised the visit of a key Indian stem cell scientist from the Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) to the UK and her participation in the inaugural UK National Stem Cell Network conference. This meeting secured India's representation, for the very first time, in the International Stem Cell Initiative (ISCI) phase 2 project and helped to overcome a major hurdle by identifying a way forward for accessioning of cells from India by the UK Stem Cell bank. This led to the listing of human embryonic stem cell lines derived by JNCASR on the European Human Embryonic Stem Cell Registry, making this data available to all stem cell researchers in Europe.

Re-invigoration of the India-UK relationship in civil nuclear research

At a time when global attention is turning to energy in terms of both security and the low-carbon agenda, a SIN India initiative worked to increase the levels of understanding between the UK and Indian civilian nuclear researchers. This was initiated by the funding of a team of senior academic experts from the UK to visit Indian Department of Atomic Energy (DAE) research facilities. They were impressed with what they saw and the report that they wrote highlighted areas where the UK and India could mutually benefit from collaborative research. Similarly, a SIN sponsored visit by senior DAE officials to the UK led to Indian scientists reassessing their opinion of UK academic civilian nuclear research.

The result has been concrete steps forward for the UK-India nuclear research community. The Engineering and Physical Sciences Research Council and DAE have agreed to jointly fund £2.4M for five research projects. These projects will focus on areas of collective interest in the civilian nuclear research field and will utilise the best scientific facilities in both countries.

Figure 4: British High Commissioner His Excellency Sir Richard Stagg and Dr Srikumar Banerjee, Chairman of the Atomic Energy Commission of India and Secretary of the Department of Atomic Energy, sign the Civil Nuclear Cooperation Declaration

Research collaboration in security

In 2009, SIN India organised UK visits for a delegation of Indian academics and policy makers, and

India visits for a delegation of UK cyber-security experts. The visits were used to explore research collaborations and have resulted in a series of Indo-UK workshops, the appointment of a British academic as a Centenary Professor at India's top research institute faculty and student exchange, the launch of an Indo-UK working Group on Cyber Security that feeds into the development of India's security policies, and joint research proposals on emerging topics (security in cloud computing and Critical National Infrastructure Protection).

Set up and launch of the RCUK Office in India

In 2008-09, SIN India was instrumental in developing plans for, establishing and launching the Research Councils UK Office in India. The team's involvement included organising and facilitating interactions with key Indian and UK stakeholders in India and advising on RCUK policies for operations in India. SIN also played a central role in developing and delivering the high profile launch of the RCUK Office, including arranging three days of tailored visits for UK attendees of the launch event and gaining an invitation for part of the delegation to the launch of India's first moon mission. The integrated working between SIN and the RCUK Office in India demonstrates a commitment to ensuring the best value for our stakeholders of the increased strength of UK representation in India.

Lecture series

A joint venture between SIN India, RCUK and the Indian Institute of Science (IISc) is delivering a year-long programme of high profile lectures across India. The series showcases cutting edge research undertaken by academics and links this to the challenges facing the world today. SIN leads on the delivery of the programme.

Outcomes already include:

- IIM Bangalore and IISc (brought together on one platform for the first time during one of the lectures) have developed a joint entrepreneurship programme for students, and are working on joint PhD programmes

- The development of a proposal by Infosys to provide an additional year of funding for LSE PhD students.

Fuel Cells

Over the past two years SIN India has led a number of activities to build linkages between UK and Indian research communities in the area of fuel cells, including publication of the report "Fuel Cells in India: Opportunities for UK-India Collaboration" which highlighted the potential for much more joint collaboration in areas of mutual interest. SIN conducted webinars to disseminate these findings and brought Indian researchers to the UK to engage with UK research in this area. The culmination of this is an agreement by the Society of Indian Automobile Manufacturers to collaborate with the UK and a government agreement on jointly funded Indo-UK collaborations in this clean energy area.

India Research Network

SIN India is leading on the coordination of the India Research Network, a network of UK public sector stakeholders with an interest in research. This allows better co-ordination of activities for the various in-country UK groups and more coordinated, strategic engagement with Indian partners. SIN developed the Network and provides dedicated secretariat support. The Network has identified a number of crosscutting priority areas where joint working allows the experience and expertise from one member organisation to be harnessed by others. The Network is known for its interactive and informative meetings and is recognised as an example of international good practice, with an analogous network being developed for use in China.

Science Bridges

In mid 2008, the S&I team in India facilitated initial discussions between RCUK in the UK and the Department of Science and Technology (DST) in India and the establishment of the RCUK- DST joint funded Science Bridges scheme, resulting in three awards totalling over £3M in value. RCUK runs similar schemes with the US and China, but the Indian scheme is the only one operating on a joint funding agreement.

The team's work prior to the scheme brought together the partners of a Bridge that will exploit and develop advances in biotechnology applicable in an agricultural context. Further S&I engagement has enabled the BioPharm 2020 Bridge to develop a strategy for industrial engagement in India, that includes a joint business plan competition with the Indian Association of Biotech Led Enterprises, and agreement between AstraZeneca, Bangalore and Nottingham University for a student exchange programme to begin in 2010.

Further examples of how SIN India has made a difference can be found in Part I of this report.

Israel

For a profile of Israel, with headline facts and figures including economic trends and commercial and political relations with the UK, click here.

Israel continues to lead in the national spend on R&D relative to its GDP - 4.9% (2009). It has the largest number of start-ups outside the US, has more companies traded on NASDAQ than any European country and accounts for over 1% of all scientific articles in the world. In absolute terms, Israel also has the second highest number of publications in stem cell research.

In its 2008 yearly report, the IMD[9] World Competitiveness Yearbook ranked Israel first for availability of scientists and engineers, third for quality of scientific Research organisations, third for technological readiness and sixth for overall innovation. Five Israelis have won Nobel Prizes within the last eight years in the fields of chemistry and economics.

Israel is one of the world's technology power houses, leading in areas such as software and ICT industries, satellite capabilities, renewable energy, agriculture and agrotechnology, water technologies, electro-optics and medical equipment, as well as research in areas such as life sciences, nanotechnology and stem cells.

The Israeli government has given preferential funding to projects in biotechnology and nanotechnology. It has also introduced a programme for the development and commercialisation of water and renewable energy. It invests in mechanisms for innovation and technology transfer, including a programme of technological incubators and consortia bringing together industry and academia. Technologies such as network firewalls, disk-on-key technology, zip compression, the ingestible pill-sized camera, modern drip-irrigation technology, ICQ instant messenger and many more were all Israeli innovations.

Israel's innovative capabilities received international acknowledgment in the past year following the country's acceptance as a full member of the OECD and Israel's selection for EUREKA[10] chairmanship.

The S&I team in Tel Aviv is taking full advantage of the wide range of Israeli innovation and research as well as of its entrepreneurial spirit. In recent years it has promoted, for example, collaboration in life sciences in the field of stem cells through the UK-Israel Stem Cell Collaboration Development Awards.

[9] International Institute for Management Development

[10] A Europe-wide network for market-oriented industrial R&D

The S&I Network in Israel: Making a Difference

The team of two Science & Innovation staff in Israel is based in Tel Aviv.

UK-Israel research collaboration programme

The Britain-Israel Research and Academic Exchange (BIRAX), announced in 2008, was designed to enhance research and academic co-operation between the two countries, strengthening existing links and creating new ones. In 2009, 15 joint Israeli and British projects were awarded grants, out of 200 requests. The total value of the grants was estimated at £365K. In 2010, the proposals are focused on energy and the environment, with special attention to nanoscience and nanotechnology. The Embassy's S&I Attaché, Dr Adee Matan, is an active member of the BIRAX steering committee.

UK-Israel collaboration in environment

In November 2009, a mission of 12 delegates from the UK water sector visited Israel for WATEC Israel 2009, an international conference and exhibition on water technologies. Organised by the S&I team and UKTI in Tel Aviv and led by British Water, the mission included site visits and meetings with government, researchers and companies. The delegation included representatives from research institutes such as the University of Leeds and companies such as Ove Arup and Biwater Treatment. Many new contacts were made and potential contracts with an estimated worth of £700K were identified. Work on a EUREKA water cluster was highly advanced as a result. British Water made Israel one of 6 priority destinations in 2010 and as a result is planning a follow up visit by an Israeli water mission to the UK.

Figure 5: The British delegates of the UK Water Mission to Israel, visiting the Eshkol Water Filtration Plant (Sedimentation Reservoir), accompanied by Dr Adee Matan, S&I Officer

In addition, S&I Tel Aviv is collaborating with the Eilat-Eilot 2011 International Renewable Energy Conference that will include a UK keynote speaker and a large UK delegation.

UK-Israel Stem Cell Forum

Following a seminar on stem cell research organised in 2008 by the S&I team in Tel Aviv in conjunction with a local partner, the UK National Stem Cell Network and the Israel Stem Cell Society announced the creation of a UK-Israel Stem Cell Forum, with the assistance of Lord Patel, the keynote speaker at the seminar.

UK-Israel collaboration in nanotechnology

A visit by the S&I officer in Tel Aviv in 2009 resulted in an Israeli professor and his British counterpart pursuing joint research in nanotechnology. The Tel Aviv University and Newcastle professors

have collaborated (Nano2Life), are currently working together (RenaChip - €3.3M euro project) and are planning further mutual cooperation through the European Framework programme.

Large facilities

The S&I team in Tel Aviv oversees the UK funding of SESAME[11] for which the UK is a prominent observer.

[11] The International Centre for Synchrotron-Light for Experimental Science Applications in the Middle East

Japan

For a profile of Japan, with headline facts and figures including economic trends and commercial and political relations with the UK, click here.

Substantial, long-term investment in science and technology is the foundation of Japan's economic success and prosperity. Despite having few natural resources, Japan has grown to become the world's second largest economy. While contributing 7% of world GDP, Japan accounts for around 13% (PPP[12]) of total global R&D spending and has 20% of the top global industry R&D spenders, making it easily the largest single R&D spender after the USA. It is estimated that Japan accounts for up to one fifth of total global R&D effort.

Japan's massive research expenditure is estimated at 3.78% of GDP – the highest of any large economy. The government target is to increase this to 4% by 2020. Nearly 80% comes from the private sector, with particular strengths in advanced manufacturing, ICT, electronics and, increasingly, life sciences.

Japanese companies have maintained high levels of investment in basic R&D, even during periods of slow growth. Many have research facilities overseas, with more than 148 Japanese R&D facilities in Britain.

Government S&T expenditure, including university support, amounts to roughly 3.6 trillion Yen per year, or around £25 billion. Planning is based around a 5-year plan, which currently defines eight priority areas: life sciences, information and telecommunications, the environment, and nanotechnology/materials, energy, monozukuri[13] (manufacturing), infrastructure, and frontiers (space/ oceans). The government target for public sector spend on S&T is 1% of GDP.

Universities and research institutes in Japan are the strongest in Asia and in many cases world-leading. Japan hosts the top four research institutions in the region[14] and Japanese universities claim half of the top 20 spots in the Times and Shanghai Asian University indexes. Over the last ten years the number of articles published in Nature has more than doubled, demonstrating the depth and breadth of the science base.

Japan is a major investor in large science facilities and a committed partner in global research programmes, including the Human Frontiers of Science Programme initiated by Japan in the 1980s, the

[12] Purchasing Power Parity

[13] "Monozukuri" embraces the idea of producing excellent products, with the ability to constantly improve a production system and process

[14] NPG Nature Asia-Pacific. (2009). *Nature Asia-Pacific Publishing Rankings 2009*.

International Space Station and the International Thermonuclear Experimental Reactor (ITER).

Japan's S&T effort is increasingly targeted at meeting the social and economic challenges of the future, with a strong focus on developing technology-based solutions. The new growth strategy being developed by the government identifies "green innovation" and "health (life) innovation" as top priorities. Continued investment in S&T is an integral part of the growth strategy, coupled with efforts to raise the global profile and impact of Japan's research base. These include a commitment to internationalisation of universities and research institutes, stronger industry-academia links and an S&T diplomacy initiative to boost global co-operation.

All this makes Japan an essential partner for the UK. The UK-Japan Joint Committee on S&T, chaired on the UK side by the Government Chief Scientific Adviser, meets every two years to review the strategic priorities for science collaboration with Japan and to maximise the benefits of the relationship. The last meeting in 2009 reinforced the strong desire of both sides to develop existing S&T co-operation and expand collaboration into new areas in the life sciences, energy, environment, climate change, ICT, nanotechnology and large facilities.

The S&I Network in Japan: Making a Difference

The team of twelve Science & Innovation staff in Japan is based in Tokyo and Osaka.

Securing value from large science facilities

In 2008 the Diamond-Membrane Protein Laboratory and the RIKEN Systems and Structural Biology Centre in Japan signed an agreement to increase co-operation on high throughput protein crystallography, bringing together world leading expertise in the UK on membrane protein structural biology and in Japan on structural genomics and proteomics. In 2009 a workshop on the industrial use of synchrotrons brought together the heads of the Diamond and SPring-8[15] synchrotrons and some of their industrial partners from the pharmaceutical, materials and manufacturing industries in both the UK and Japan, to forge closer links and exchanges between the research facilities and between industrial scientists.

Figure 6: Diamond Synchrotron, South Oxfordshire. Courtesy of Diamond Light Source.

A delegation from SPring-8 will visit Diamond in 2010 to renew the Memorandum of Understanding (MoU) for a further five years. In other areas, the Science and Technology Facilities Council has supported the establishment of

[15] **S**uper **P**hoton **ring 8** GeV large scale synchrotron in Hyogo Prefecture, Japan

strong links with large science facilities in Japan, including long term Japanese investment into the Rutherford Appleton Laboratory in the Muon facility at ISIS.

Neuroscience and the brain-machine interface

Newcastle University, Japan's Advanced Telecommunications Research Institute (ATR) and National Institute of Physiological Sciences (NIPS) signed an MoU to strengthen existing links and promote research exchanges for further collaborations. Following the success of the first workshop in Japan, the British Embassy, Newcastle University and the Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT) co-organised the return workshop in Newcastle a year later to showcase UK and Japanese neurotechnology and further reinforce the links between the two countries.

Complementary strengths in medical engineering

A workshop on bio-optics and brain imaging, derived from a UK biophotonics mission in 2008, demonstrated synergy between UK strengths in medical physics and Japan's advances in medical devices.

Figure 7: "Multimodal Measurements for Brain Function" - a UK-Japan workshop held in Tokyo in January 2010

As a result, the Institute of Psychiatry in Japan is now planning to hold a follow-up future satellite meeting in 2012 as part of the Japan Human Brain Mapping Project. The UCL Biomedical Optics Group and GSK Clinical Imaging Centre agreed to provide more opportunities for Japanese research clinicians to train in the UK translational environment and UCL Group is acting as a contact point to establish mechanisms to strengthen the links between Japanese industry and UK research groups.

Climate change science

The success of the three-year UK-Japan climate modelling collaboration (2005-2008) was enhanced by two summer schools in Cambridge designed to help develop future Asian leaders in climate research. A climate impacts workshop brought together Japanese business and climate modellers for the first time, enabling climate modellers to contribute to the creation of corporate adaptation strategies by climate sensitive businesses. As a result, the National Institute of Environmental Science and the Nomura Research Institute launched a Japanese academia-industry consortium for climate modellers and climate sensitive businesses. Other activities laid the foundations for future collaborations between climate modellers and those assessing the impact of climate change on agriculture, forests, the urban environment, flooding and the oceans.

Promoting carbon capture and storage (CCS)

A UK mission to Japan enabled UK experts to access Japan's world-

leading R&D in Autumn 2008. CCS policies presented by UK government officials also drew the attention of over 1,000 Japanese stakeholders to the importance the UK attaches to this area. A bilateral workshop focused on environment impact assessment was arranged to contribute to accelerating the deployment of CCS. The event delivered multiple collaborations and continuing discussions that will feed into an EU-Japan CCS research programme to be launched in 2011.

Reporting for UK departments and agencies

The S&I Japan team contributed to policy-making and strategy development in many UK departments and agencies, including No.10, DECC, DIUS, DfT, DOH, DCLG, the Human Genetics Commission, the Technology Strategy Board and the Energy Technologies Institute. Reported topics included energy sector; international energy strategy; public bodies for energy R&D; low-carbon vehicles; climate change research; climate change mitigation and adaptation for existing buildings; public spending on physical sciences; biofuel research; electronic, photonics, electrical systems; genetic testing policies; food security; genetically-modified food; and bio-tech sector.

Further examples of how SIN Japan has made a difference can be found in Part I of this report.

New Zealand

For a profile of New Zealand, with headline facts and figures including economic trends and commercial and political relations with the UK, click here.

The New Zealand Government invests about 0.5% of GDP in research, science and technology, a figure that has remained steady for several years. The private sector invests just under 0.6%. Both these figures are lower than OECD[16] norms.

New Zealand's strengths lie in biology, agriculture, horticulture, environmental science, earth science, materials science, health research, ICT and indigenous knowledge. Firms such as Fonterra dairy and FP Health Care maintain sizeable research capacities.

New Zealand's firms offer fertile ground for collaboration when combined with the UK's scientific expertise, manufacturing capacity, and access to capital and markets.

Over the past 50 years, New Zealand has fallen from 3rd to around 25th in the OECD ranking of GDP per capita. Growth has been driven mainly by increased labour utilisation. A challenge for New Zealand is how to combine excellent basic academic research with an entrepreneurial culture for practical application.

Recent budget announcements have sought to develop more effective industry-science linkages to ensure that end-users see the relevance of, and therefore absorb, research.

Support for universities is largely through Vote Education. The Tertiary Education Commission has created seven Centres of Research Excellence that network university researchers together in mostly basic research, with increasing collaboration with Crown Research Institutes[17] (CRIs).

About half of CRI income is derived from government contestable funds, the remainder coming from the private sector.

The New Zealand Venture Investment Fund invests NZ$100M alongside private sector co-investors in a series of privately managed venture capital investment funds.

New Zealand Trade and Enterprise (NZTE), set up in 2000, develops business capabilities within New Zealand and export 'beachheads' in selected overseas markets.

The S&I Network in New Zealand: Making a Difference

The Science & Innovation Officer in New Zealand is based in Wellington.

[16] Organisation for Economic Co-operation and Development

[17] Established through the Crown Research Institute Act 1992 and charged with carrying out research to the benefit of New Zealand

Collaborations in textiles and biofilms

Following an R&D mission to New Zealand in 2009, Durham University has ongoing links with New Zealand research and high-tech firms, including Victoria University of Wellington, to analyse textile samples for nano-deposition of metallic particles that impart distinctive colour and antibiotic properties to wool fibres.

Collaborative projects are also underway with Auckland University of Technology, Woolyarns NZ, and New Zealand's Cawthron Institute on textiles and biofilms.

Agricultural research

Aberystwyth's Institute of Biological, Environmental and Rural Sciences (IBERS) has a £1.6M collaboration with part-funding from Vialactia in New Zealand to develop a physical map of Lolium grass. The resulting Intellectual Property (IP) will be important to the world's grass breeders.

Safe storage of hydrogen for transport fuel

Oxford University has signed an agreement for joint research with New Zealand's Industrial Research Ltd. on ammonium compounds for hydrogen storage – and the associated challenge of releasing the hydrogen when needed. Ammonium compounds safely hold large amounts of hydrogen, and are thus suitable for hydrogen storage as a transport fuel.

Innovation

The UK Centre for Process Innovation (CPI) in Redcar reports engaging in several entities in New Zealand, including a contract with Abel Engineering with delivery expected in 2010. Abel specialises in engineering, and steel fabrication. CPI is also exploring agreement on a specific project and a corporate relationship with Scion, New Zealand's forest research institute.

Russia

For a profile of Russia, with headline facts and figures including economic trends and commercial and political relations with the UK, click here.

Russia has announced ambitious plans to modernise the economy through a new Commission for Modernisation and Technological Development. The key focus is on technological breakthroughs with 10 billion roubles for five key areas in 2010: nuclear technology, space and communications technology, energy efficiency, medical technology and information technology (including supercomputers).

Russia has about 375,000 researchers compared to 1.2 million in 1990 and higher education now plays a small role - just 4% of R&D spend. R&D expenditure overall was 1.03% of GDP in 2008. Russia's share of the world's papers over a recent 5-year period was 2.6%[18].

Science and Innovation policy, implementation and funding happens via three routes: The Ministry of Education and Science (MES), a new department for "Science, High Technology and Education" in Prime Minister Putin's office and President Medvedev's Modernisation Commission.

The UK is Russia's 4th most frequent partner after the US, Germany, and France.

Russia's key Science & Innovation strengths

Although Russia's output in research has weakened considerably in recent years, Russia is notable in nuclear physics, particle and fields and multidisciplinary physics representing 10.3%, 9.9% and 8.0% of world output. Unsurprisingly, Russia also maintains strength in petroleum engineering (8.9%) and geochemistry and geophysics (7.9%)[15].

Key growth areas between 2004-2008 include neuroscience and behaviour, environment/ecology, clinical, medical and geosciences[15].

Figure 8: Courtesy of NASA

Russia is keen to engage internationally and is a major contributor to the International Thermonuclear Experimental Reactor (ITER). Russia has requested to become an Associate Member of EU Seventh Framework Programme.

Opportunities for the UK

[18] Thomson Reuters. (2010). *Global Research Report – Russia – Research and collaboration in the new geography of science*

There is strong scope for UK innovation experts to provide advice on setting up a national innovation infrastructure in line with President Medvedev's desire to acquire "Institutions, Infrastructure, Innovation and Investment".

Opportunities exist for UK design/architect companies in designing Russia's new US$2 billion energy efficient innovation city called "Skolkovo", nicknamed Russia's Silicon Valley. In 2010, £90M is designated for design concepts and infrastructure planning of homes for 30,000 people in 380 hectares of greenfield just outside Moscow.

Between 2010-2015, the state plans to spend 62 billion roubles (£1.41 billion) on nanotechnology and a "National Nanotechnology Network" (NNN) encompassing leading Russian universities and research centres, according to the Nano-industry Development Programme. This money will come directly from the Federal budget as well as from Rusnano[19], Vnesheconombank (VEB) and the Russian Venture Company (RVC). The Kurchatov Institute will co-ordinate scientific research in the NNN and Rusnano will analyse the nano products market and monitor state-funded R&D projects.

There are also opportunities for basic and applied research collaborations with key institutes within Moscow and other regions where science is strong, including St Petersburg, Tomsk, Novosibirsk, Yekaterinburg and Dubna – particularly in the Modernisation Commission's five key areas as these are receiving strong funding.

[19] Russian Corporation of Nanotechnologies

The S&I Network in Russia: Making a Difference

The team of two Science & Innovation staff in Russia is based in Moscow. In February 2010, a new First Secretary for Science and Innovation set up a dedicated Science and Innovation section within the British Embassy.

First tasks are to map world-class science excellence across Russia and identify key opportunities for UK researchers, whilst promoting the UK in Russia as a world-class base to carry out R&D.

The S&I team has alerted potential UK participants to a 12 billion rouble fund set up by Russia's Ministry of Education and Science to enable international researchers to work in Russian Universities for up to 4 months each year for 3 years.

Reaching policy makers in Russia

In November 2009, the Government Chief Scientific Adviser, Professor Sir John Beddington, delivered a major presentation on the future effects of climate change to a high level audience at the Embassy in Moscow. Representatives from the steel, coal and gas sectors and senior Russian businessmen were present.

In December 2009, SIN Moscow brought a high level Russian delegation to the UK for a workshop on innovation funding at the London Stock Exchange. This workshop attracted over 80 Russian participants including the CEO of the Russian Nanotechnologies Corporation, Russian venture capital

companies and senior academic representatives from Moscow and Tomsk Universities.

Further examples of how SIN Russia has made a difference can be found in Part I of this report.

Southeast Asia

For profiles of countries in Southeast Asia, with headline facts and figures including economic trends and commercial and political relations with the UK, click here.

Southeast Asia is an economically and scientifically diverse region, ranging from affluent city-state Singapore through to emerging economies rich in biodiversity. SIN focuses efforts on Singapore, and manages proactive relationships with Malaysia, Thailand and Vietnam in partnership with respective British Embassies and High Commissions.

Over the last decade, **Singapore** has rapidly built up an impressive science cluster, boasting world-class research facilities, top international talent, strong government support, and targeted incentives for R&D-intensive companies. Gross expenditure on R&D hit 2.8% of GDP in 2008, and the government this year raised its target to 3.5% by 2015. Singapore was recently ranked the world's most innovative country[20].

Singapore is an applied research hub and gateway to Asia, with strengths in electronics, chemicals, precision engineering and biomedical sciences. Capability is expanding in environmental/water technologies, and interactive/digital media, with attention turning to nuclear science and physical/cybersecurity. State-of-the-art infrastructure includes Biopolis, which co-locates public and private biomedical R&D, and nearby Fusionopolis, which houses physical science, engineering and ICT research.

Figure 9: Sam Myers (left), First Secretary Science and Innovation, at Fusionopolis with a UKTI colleague

Singapore's Agency for Science, Technology and Research (A*STAR) and the local universities are keen to develop international partnerships with leading overseas institutes. To capitalise on this opportunity, the SIN team have organised 50 workshops attracting over 8,000 participants since 2004, which have stimulated new UK-Singapore collaborations across a broad range of themes including infectious diseases, drug discovery and aerospace research.

Malaysia was identified by the UN Environment Programme as one of

[20] Boston Consulting Group, 2009

the world's top 12 'mega-biodiverse' countries with over 2,000 unique higher species of flora and fauna. Following SIN engagement on medicinal chemistry, the government is developing plans for a biobank of natural products to support the development of novel compounds. The S&I Network also links UK scientists with Malaysian experts across agricultural science, biotechnology, infectious disease, biomass and biofuels research.

Thailand ranks second in Southeast Asia in its volume of published research articles, and houses centres for the Wellcome Trust and London School of Hygiene & Tropical Medicine. SIN engagement is channelled through a partnership programme with the National Science and Technology Development Agency (NSTDA) and leading universities, across the fields of infectious diseases, healthcare, agricultural and aquaculture technology, biofuels and nanotechnology.

Vietnam is a rapidly developing country whose economy is largely agriculture-based. Its GDP grew by 6% in the first half of 2010, and the country houses a renowned Wellcome Trust-Oxford University Tropical Disease research institute. SIN is implementing a joint action plan with the Ministry of Science and Technology following up collaborative opportunities identified by the Government Chief Scientific Adviser, Professor John Beddington, in 2009. These include healthcare and infectious diseases, climate change, food and agricultural science and low-cost R&D/manufacturing solutions.

The S&I Network in Southeast Asia: Making a Difference

The team of five Science & Innovation staff in Southeast Asia is based in Singapore and Malaysia.

UK-Singapore-Malaysia project receives £2.7M from EU to fight incurable mosquito-borne disease

A UK-led consortium formed at the SIN-organised "EU-Southeast Asia Vector Borne Diseases" workshop in 2009, was successful in securing £2.7M funding under the European Commission's FP7 programme. The four-year project, "Integration of Chikungunya Research", will be led by the University of Edinburgh, with collaboration from A*STAR's Singapore Immunology Network and the University of Malaya.

Researchers will focus on developing treatments for Chikungunya, a mosquito-borne virus that is currently incurable and causes fever and severe joint pain. Previously confined to Asia and Africa, the first outbreak of the disease hit Europe in 2007, and scientists will work to prevent its spread.

SIN harnesses Malaysia's biodiversity for UK science, including £3.2M joint biotech venture

SIN Malaysia organised a series of workshops and seminars to generate opportunities for UK science from the country's extraordinary biodiversity. As a result, biotech company AvantiCell have entered into a £3.2M joint venture with Malaysian research organisation CARIF, to develop anti-cancer therapeutics from natural products. The Malaysian government is also developing proposals to set up a biobank of natural resources. SIN has helped establish a Malaysian chapter of the Royal Society of Chemistry, which locally secured a £14K endowment to increase engagement between UK and Malaysian scientists, educators and policymakers.

"UK-Thailand Partners in Science Programme" yields early successes

Professor Sir John Beddington, Government Chief Scientific Adviser, secured support from the Thai Prime Minister for a UK-Thailand S&I partnership in 2009. Since then, academic and research exchange programmes have been agreed between a number of Thai institutes and the Universities of Manchester, Liverpool, Newcastle, St Andrews, East Anglia and Imperial College. Thailand's National Science and Technology Development Agency will also open a 'Technology Management Centre' at Norwich Research Park, representing its first entry into Europe. Alongside this, SIN has initiated a range of new collaborations, including work by a team of UK and Thai researchers who have jointly identified two new species of malaria parasites, which were both previously thought to be a single species, paving the way for improved diagnosis and treatment[21].

SIN opens up new Vietnam opportunities for UK science base

During his visit in October 2009, Professor John Beddington, Government Chief Scientific Adviser, identified new collaborative opportunities in Vietnam. SIN then worked through the British Embassy in Hanoi to develop a joint Action Plan with Vietnam's Ministry of Science and Technology. A BBSRC visit to Vietnam in February 2010 agreed areas for collaboration and drove forward a new project involving the John Innes Centre and local researchers to sequence Vietnam's rice genome. Policy exchanges and a series of targeted bioenergy researcher missions are just some of the future actions under the plan.

SIN leverages £200K from EU to increase UK influence across Southeast Asia

SIN Singapore leveraged further value from the £3.5M EU-funded "SEA-EU-NET" project, set up to stimulate an EU-Southeast Asia S&I partnership. Over £200K has been secured to expand the successful 'UK-Singapore Partners in Science' Programme across Southeast Asia in UK priority areas of climate change, agricultural science and infectious diseases. Through the project, SIN is working with OECD experts to map innovation strengths in the region, which will highlight emerging

[21] The Journal of Infectious Diseases 2010; **201**:1544-1550

opportunities for the UK. Additionally, a network of National Contact Points has been set up to support UK scientists in identifying local partners and bidding into European FP7 funding.

Further examples of how SIN in Southeast Asia has made a difference can be found in Part I of this report.

South Korea

For a profile of South Korea, with headline facts and figures including economic trends and commercial and political relations with the UK, click here.

South Korea's research and development (R&D) budget accounted for 3.37% of the country's GDP in 2009, one of the highest rates in the world. The Korean Government's 577 Initiative was launched in 2008 and so far remains on target. This programme plans to raise R&D investment to 5% of GDP by 2012. To support this, the government is planning an annual 15% increase in R&D spending over the period. Government funding (US$9 billion) accounts for about a quarter of the R&D budget, with the rest coming from industry.

The 577 programme will focus on 7 areas: world-class human resources, basic and fundamental research, SME innovation, S&T globalisation programmes, regional innovation, S&T infrastructure and S&T culture. With this investment Korea hopes to rise to 7th in the ranking of world S&T powers.

Korea's R&D expenditure remains heavily focused on close-to-market development: mobile handsets; plasma and LCD displays; MP3 players; DRAM (direct random access memory) and flash memory chips, but Korea is investing more in basic research as a percentage of R&D investment. Korea is involved in fusion research. It is a partner in the international ITER consortium and operates one of the worlds more advanced Tokamak experimental fusion devices: K-Star.

Future Plans

The government has identified 22 industries as the new drivers of its future economic growth. Most investment (92%) is expected to come from industry with the government providing 8% for more high-risk projects. Korea's new growth engines include:

- Energy/Environment: clean coal technology, biofuels from marine sources, renewable energy sources, solar cells, carbon dioxide capture and storage, fuel cells, nuclear power plants
- Transportation: green cars, ships and offshore systems
- New IT: semiconductor, display, mobile telecommunications, LED lighting, RFID/USN
- Convergence Technology: robots, new materials/nano-convergence, IT based convergence, new media for telecommunication-broadcasting convergence
- Biotechnology: new medicines & medical equipment
- Knowledge-based services: software, design, healthcare, cultural content

The S&I Network in South Korea: Making a Difference

The team of four Science & Innovation staff in South Korea is based in Seoul.

Securing scientific collaboration funds from the Korean government

BIS and the Korean Ministry of Education, Science and Technology (MEST) held a UK-Korea Science and Technology Joint Committee Meeting in November 2008 in London to plan bilateral research activities. MEST annually invests £1.4K in bilateral co-operation programmes with UK partners including the UK-Korea Focal Point Programme, MEST Chevening Scheme, Cavendish/KAIST physics collaboration and the Rolls Royce-Pusan National University technology collaboration. The Focal Point Programme currently supports networking in the areas of: polar research, food safety, life sciences, global navigation and satellite systems, e-science, and women in science and engineering (WISE).

BIS and the Korean Ministry of Knowledge Economy (MKE) held a UK-Korea Science, Technology and Innovation Partnership (STIP) Committee Meeting in November 2009 in London. The meeting agreed proposals for future bilateral science collaboration in the areas of: nanotechnology, biotechnology, ICT, energy and environment, space and aerospace. MKE had subsequently awarded £300K to the Korea Institution for Advancement of Technology (KIAT) to deliver research networking activities with UK partners in 2010. The UK is matching Korean funding from various sources.

Secure communications

In 2009, the CSIT (Centre for Secure Information Technologies) at Queen's University Belfast agreed a programme of collaboration on secure computer networks and intelligent CCTV with the Software Research Lab of ETRI (Korean Electronics and Telecommunications Research Institute). A pilot research programme was launched in 2009 and a full programme involving £4M of research funding is due to start in October 2010.

Figure 10: CSIT/ETRI collaboration signing ceremony, 24 June 2009. L to R: Professor Peter Gregson, President of Queen's University, Belfast, Professor John McCanny, Dean of Electrical Engineering and Dr. Myungjune Lee, Head of the Software Contents Laboratory, ETRI

Life sciences

Networking under the bilateral Life sciences Focal Point Programme has led to a successful research bid by Imperial College London and Chungbuk National University to MEST's "Global Research Lab" programme. The bilateral project was awarded £2.25M Korean funding over nine years for research into micro-fluidic biochips. Joint research labs have been set up in both Imperial College and Chungbuk

National University. Dr Dongku Kang was awarded a Royal Society Newton Fellowship to undertake research under this programme

Railways

In November 2009, the University of Sheffield and the Korea Railroad Research Institute (KRRI) signed a Memorandum of Understanding and opened joint research labs in both locations. Research on wear/rolling contact fatigue started in March 2010. SIN Korea supported the visit of Lord Adonis, former Secretary of State for Transport, to the KRRI in August 2009. The Secretary of State called on Mr Sung-kyou Choi, President of KRRI, to discuss Korean participation in the development of the UK high-speed rail network.

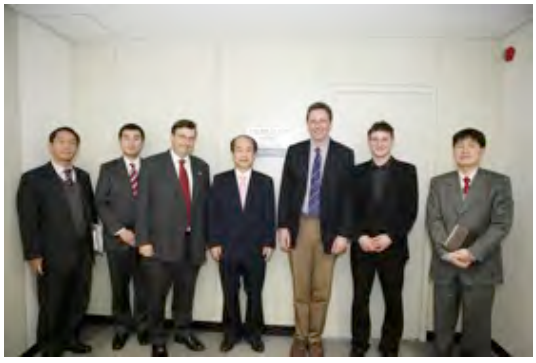


Figure 11: Opening of Sheffield University's R&D Liaison office at KRRI, 25 February 2010, with Sung-Kyou Choi, President of KRRI and Professor Rob Dwyer-Joyce, Head of Mechanical Engineering, Sheffield University.

Intellectual Property (IPO/KIPO)

In 2009, the UK's Intellectual Property Office (IPO) and the Korean Intellectual Property Office (KIPO) launched a trial PPH (Patent Prosecution Highway) service. The PPH allows patent applicants who have received a favourable examination report by either the IPO or KIPO to request a faster examination of the corresponding patent application filed in the other country. The MKE-BIS Science, Technology and Innovation Partnership programme supports the collaboration.

Global Navigation and Satellite Systems (GNSS)

From 2008-10, four networking events took place in Nottingham, Daejeon, and Jeju under the GNSS Focal Point Programme. These meetings were led by the UK Location and Timing Knowledge Transfer Network and Chungnam University and covered the Galileo R&D programme under the EU Seventh Framework Programme, GPS/Galileo chipsets, and the R&D status of Korean civilian and military satellite applications. As a result of the programme, EJTech, a structural behaviour monitoring company in Korea, will pay £25K in royalties to Nottingham University under a new research partnership to monitor deformations of the Seohae Grand Bridge, the longest bridge in Korea, using Nottingham's GNSS technology.

Food safety and sustainability

A report for UK researchers on the organisational infrastructure of Korean food research has been compiled under the Food Safety Focal Point Programme. The report's author has been selected as an international adviser to the National Food Cluster in Jeonju. A joint symposium between LGC and the Korean Research Institute of Standards and Science (KRISS) entitled "Global Food Quality and Safety: Delivering High Standards" was held in Seoul in October 2009. Participation by the Korean Food and Drug Administration (KFDA)

emphasised import/export and regulatory interest. There was also input from the food industry including Tesco Samsung. Three scientists from the Imported Food Analysis Division, KFDA received Korean government sponsorship to visit LGC for analytical and quality training (Jan-March 2010).

Plastic electronics

Supported by the BIS Global Partnerships Fund, Imperial College's Centre for Plastic Electronics (CPE) has developed a strong collaboration with the group of Professor Soonil Lee at Ajou University on flexible transparent electrodes for plastic electronic devices. This has resulted in world-leading electrode performance. Through the collaboration with Ajou University, Imperial College London has developed strong links with the Samsung Advanced Institute of Technology (SAIT).

Green chemistry

In October 2009, the Royal Society of Chemistry and the Korean Chemical Society (KCS) signed an international cooperation agreement in Daejeon. With the support of a Global Partnerships Fund grant, a UK/Korea symposium on green chemistry was held at the KCS biannual meeting in April 2010. Future industry/academic exchanges are planned.

Polar research

British Antarctic Survey (BAS) and Korea Polar Research Institute (KOPRI) held a joint workshop in 2009 under the Focal Point Polar Research programme to discuss cooperation in research, logistics and operations. The two institutes signed an agreement for the sharing of UK's icebreaker "James Clark Ross" in 2009.

Figure 12: Korean scientists visit the UK's Rotherham Research Station in Antarctica in 2009

World conference of science journalists

In July 2009, SIN Korea led a Korean delegation to the World Conference of Science Journalists in London to highlight UK science and innovation excellence, particularly in the area of climate change and low carbon technologies. Subsequent coverage in leading Korean newspapers, science journals and on-line publications was worth more than £20K.

Taiwan

For a profile of Taiwan, with headline facts and figures including economic trends and commercial and political relations with the UK, click here.

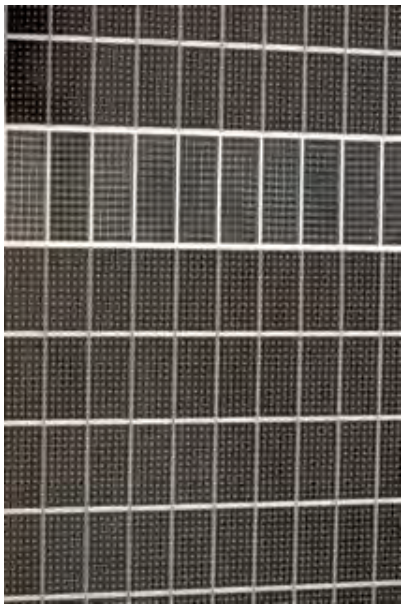
According to the 2010 Global Competitiveness Rankings compiled by IMD[22], Taiwan is now ranked 8th in the world, whereas in 2009 it was ranked 23rd. This is a remarkable achievement and the largest gain of all 58 economies covered by the IMD report. Taiwan owes its outstanding showing to major improvements in business competitiveness and government efficiency, scoring 3rd and 6th, respectively, in the two indicators.

Taiwan is still keen to build on the collaborative working opportunities in science, technology and innovation presented by the European Union, with the UK ideally placed as a gateway into Europe.

In terms of key themes for Science and Innovation development, Taiwan's core strength still lies in its high-tech industries, where it is a world leader in the development and production of electronic, information technology (IT), computer and semiconductor products.

Taiwan's aim is to achieve the same kind of successes and global standing in the industries of the future — biotechnology, nanotechnology and renewable energy and the environment. These are also industries where complementary UK strengths and expertise can be leveraged and many opportunities for collaboration exist.

Taiwan is now showing a strong interest in climate change/renewable energy/green technologies in the transition to a low carbon economy. The S&I Network continues to work with partners from both the UK and Korea to ensure mutually beneficial outcomes are achieved.



Improved regional working will be particularly important given current economic constraints, and the recently completed Outward Photonics Mission to South Korea, Taiwan and Hong Kong set a good example for this way of working.

[22] International Institute for Management Development

The S&I Network in Taiwan: Making a Difference

The team of two Science & Innovation staff in Taiwan is based in Taipei.

Investment in bio-inspired technologies

The S&I team were the first point of contact when leading Taiwan industrialist Winston Wong announced his £2M donation to Imperial College London, funding a Research Centre for Bio-Inspired Technology. The team worked with UKTI colleagues to help communicate, facilitate and work towards the completion of the deal, a UK inward investment success. The Centre will be used for both laboratory infrastructure and short-term research opportunities. It aims to bring together different science and engineering disciplines to explore how disposable silicone can be used for medical monitoring devices. Work includes devices to monitor patients with heart conditions and diabetes.

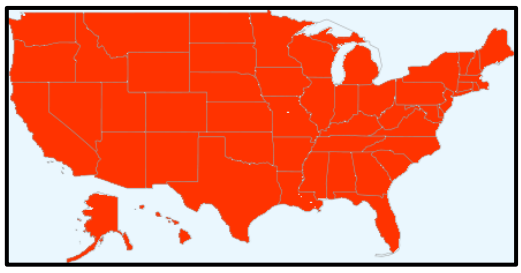
New agreement facilitates PhD exchanges

Building on the close relationship Imperial College London has with Taiwan and also related to the Winston Wong Centre for Bio-Inspired Technology, Imperial College has signed a Memorandum of Understanding with Taiwan's Minister Ovid Tseng to facilitate PhD exchanges. The programme will initially start at a modest level of six PhDs a year but may increase in scale later. The S&I team supported and facilitated the process throughout.

UK companies gain access to funding and technical knowhow

Through S&I organised outward missions plus follow on visits and meetings, UK sister companies Ilika and Altrika Technologies were matched up with Taiwan's Industrial Technology Research Institute (ITRI), a semi government funded organisation tasked with upgrading the country's R&D competitiveness. Ilika, an innovative chemistry and new materials company and Altrika, its sister company focusing on biomedical applications, were attracted to ITRI by its access to funding and technical knowhow. ITRI's focus on accelerating the development process and bringing products to market as soon as possible were also complementary to the entrepreneurial mindset of Directors at Ilika and Altrika and proved to be a perfect match for collaborations.

USA



For a profile of the United States, with headline facts and figures including economic trends and commercial and political relations with the UK, click here.

The US is the UK's most important scientific partner. 30% of the UK's international co-authored papers are with the US, producing an impact that is 50% higher than the UK research base average.

The US is the world's scientific powerhouse. Total US spending on research and development was around US$389 billion in 2009 - around 33% of the world's total R&D. Federal expenditure in 2010 is around US$147.5 billion. In addition, the US:

- is responsible for 31% of the world's high value patents
- employs 25% (1.44 million) of the world's researchers (more than the whole of the EU)
- produces one third of the world's papers and citations
- is the home to more than half of the world's top 100 universities

The new US administration has put science at the heart of its agenda. President Obama has appointed a number of high-profile scientists to key posts, revitalised the President's Council of Advisors on Science and Technology, and has set a target of investing 3% of GDP in R&D. Changes have also been made to US stem cell and climate change policies and a new space policy has been launched which emphasises international collaboration. A Strategy for American Innovation has been produced focussing on investing in the building blocks of innovation, including fundamental research and education, promoting competitive markets, and catalysing breakthroughs that spur productive entrepreneurship, for example, in clean energy.

The White House has set out four key challenges for R&D investment in 2011:

- driving economic recovery, job creation and economic growth
- promoting innovative energy technologies to reduce dependence on energy imports and mitigate climate change
- applying biomedical science and information technologies to help Americans live longer
- technologies needed for a safe and secure America

There are significant opportunities for UK researchers to link with their US counterparts. The Science & Innovation Network uses its local knowledge and contacts to help UK researchers to link with universities and other research establishments. It has forged numerous collaborations in key UK priority areas, facilitated access to unique US facilities and provided analysis of US

science and innovation policies and practice.

By linking the best of UK science and research with by far the largest and highest quality science community in the world, the S&I team across the US makes a significant contribution to the UK.

The S&I Network in the US: Making a Difference

The team of fifteen Science & Innovation staff in the US, based in Washington, San Francisco, Boston, Houston, Los Angeles and Atlanta, works closely with the RCUK Office in the US, UKTI and the British Council.

Innovation

Innovation implicitly underlies the US S&I team's work. For example, the team used local knowledge of US innovation to inform the UK's Hauser review of technology and innovation centres in the UK, and arranged Cabinet Office engagement in a Harvard workshop on innovation in public service.

Nanotechnology and environmental policy

The US S&I team facilitated the Royal Commission for Environmental Pollution's visit to the US as part of their study on the impact of novel materials on the environment and human health, organising visits to Washington and Houston to meet with key Federal agencies and scientists, and also follow-up visits to disseminate the report's findings. The team also made a significant contribution to the House of Lords S&T Committee Nanotechnologies and Food inquiry, by organising a visit to meet federal agencies, and input from scientists and industry.

Figure 13: Professors Daniel Robert (Director Centre for Nanoscience and Quantum Information at the University of Bristol) and Paul Weiss (Director of the California NanoSystems Institute at UCLA) sign an MoU agreeing to pursue a broad range of collaborative activities in the nanosciences as the result of several years of engagement with the SIN team in Los Angeles

Climate policy

The S&I Network in the US has influenced the climate policies of a number of US states and cities. For example, the team negotiated UK Memoranda of understanding (MoUs) with Wisconsin and Michigan and facilitated an MoU between the Carbon Trust and California Air Resources Board. A project in Texas led by the team resulted in a shift in state policy and legislation to reduce Texas greenhouse gas emissions. In addition, S&I teams around the US were key in influencing and supporting the US state cap and trade programmes in the North East, California and New Mexico and also influenced US city climate policies in Los Angeles, San Francisco and Houston.

Climate science collaborations

The US S&I team facilitated an MoU between NERC's National Centre for Atmospheric Science and the US National Center for Atmospheric Research on atmospheric science and modeling and also established links between the Met Office and Florida University on Climate Impacts. Other work involved forming an expert group of leading US and UK IPCC[23] scientists on Operational Attribution to inform policy makers and work towards the next IPCC report. Resulting from an S&I Network facilitated workshop, the British Antarctic Survey is leading a €10M EU study on the contribution of ice sheets to sea level rise. The S&I Network also organised a climate communication seminar in Texas to debate and influence the climate change agenda.

Research collaborations

The S&I Network in the US has facilitated collaborations involving more than US$11M in joint or foreign research funding, with another US$1.7M currently under review. Examples include US$4.4M for a UK-US Nano-Enviro Consortium and US$2.6M for a UK-Texas Collaboration on Oral Cancer. One collaboration led to the establishment of a £21.6M EU funded Centre for NanoHealth in Wales creating 450 jobs. 11 major institutional links or Memoranda of understanding, for example, between Liverpool University and the University of Georgia, have also been facilitated, as well as 17 follow-on senior researcher visits or new collaborations, and 5 graduate student exchanges, with at least 6 more agreed over the coming two years.

Access to large facilities

UK researchers have been able to access some of the US's large and unique facilities with the help of the S&I Network. Examples include collaboration between University College London and US Department of Energy's Oak Ridge National Lab, resulting in an estimated £3M worth of access to the world's fastest supercomputer. A Memorandum of Understanding between the Science and Technology Facilities Council and the Stanford University Linear Accelerator Center (SLAC) led to UK input into the design of the Linac Coherent Light Source (LCLS), enabling UK researchers to gain first-hand experience in using free electron lasers and placing the UK in a strong position to get future research time on the LCLS machine at Stanford.

Figure 14: SLAC Director Persis Drell and Government Chief Scientific Adviser John Beddington sign the MoU which will enable UK scientists to access the novel Linac Coherent Light Source (LCLS)

Further examples of how SIN USA has made a difference can be found in Part I of this report.

[23] Intergovernmental Panel on Climate Change

Find more details about the Science and Innovation Network on the BIS and FCO websites:

http://www.bis.gov.uk/policies/science/sin

http://www.fco.gov.uk/en/about-us/what-we-do/working-in-partnership/working-with-stakeholder-groups/science-innovation/science-innovation-network/

Department for Business, Innovation and Skills www.bis.gov.uk

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