Inspiring Change
Impact Highlights of the UK-India Research Partnership
“Research and innovation are increasingly developed and transferred through international co-operation. India is the most populous liberal democracy and the second fastest growing economy in the world. RCUK India is here to develop the research and innovation partnership between the UK and India by fostering opportunities for research excellence.”

Dr. Nafees Meah, Director RCUK India

RESEARCH AND INNOVATION WILL PLAY A BIG ROLE IN DELIVERING PROSPERITY FOR ALL IN INDIA AND THE UK

Research Councils UK (RCUK) India, based at the British High Commission in New Delhi, represents all the seven UK Research Councils. Our aim is to facilitate research collaboration between the UK and India in order to develop sustainable, strategic partnerships that:

- Promote high impact research that improves lives
- Demonstrate long term commitment
- Focus on agreed priorities
- Forge strong links between academia and business in both India and the UK
- Deliver innovation and prosperity

Since 2008, RCUK, Government of India and other partners have together invested over £150 million in joint research programmes. Understanding the impact of this publicly funded research is of crucial importance for both the UK and India. Indeed, RCUK has had a long standing commitment to ensuring that publicly funded research delivers impact. By impact we mean the demonstrable contribution that excellent research makes to society and the economy.

Both the UK and India are investing to enhance and sustain their respective research and innovation ecosystems. In the UK, the Government published its science and innovation strategy Our Plan for Growth in December 2014. The report stated, “if we are to become a flourishing knowledge economy, we have to build on our long-standing scientific advantages and innovate. But innovation requires investment. Countries around the world recognise that science and innovation is the right path for sustainable growth."

In India, likewise, high-profile initiatives with research and innovation at their core have been recently launched, including:

- Make in India
- 100 Smart Cities Mission
- Atal Mission for Rejuvenation and Urban Transformation (AMRUT)
- Ganga Rejuvenation
- Atal Innovation Mission
- Clean and Green India
- Digital India

In these areas, the burgeoning UK-India research and innovation partnership has the potential to make a significant contribution in the future.

1 Our Plan for Growth: Science and Innovation, Cm 8980, (2014)
The UK-India research and innovation portfolio

Co-funded research and innovation partnerships investing over £150 million.

- Covering several themes in energy, environment and society that are of mutual long-term interest to both countries.
- Supporting 290 principal and co-investigators in India and the UK with many more postdoctoral researchers and PhD students.
- Involving 43 top UK universities and institutes in partnership with 31 Indian universities and institutes and 17 laboratories.
- Engaging with more than 90 business and industry groups at small and medium to large-scale level in both countries.

% spend by research theme

Food Security and Agritech: 9%
Bioenergy, Renewable Energy and Rural Enterprise: 8%
Advanced Manufacturing: 7%
Water and Climate: 6%
Civil Nuclear Energy: 6%
Smart Energy, Energy Storage and Digital Economy: 27%
Health, Well-Being and Social Change: 37%

Impact Highlights

Smarter, Cheaper Solar Cells
Project Title: Advancing the efficiency and production potential of excitonic solar cells (AREX)
Funding Partners: RCUK Energy programme and DST

‘Excitonic’ solar cells offer important advantages over conventional PV technology. Indeed, judged against key criteria – cost and portability, for example – the benefits are widely recognised. But major barriers nevertheless need to be overcome, namely long-term stability and the efficiency which had been stagnant for almost two decades. Overcoming these hurdles is absolutely essential if this promising technology is to break into markets in India, the UK and across the globe.

This project, between Brunel University London and the National Physical Laboratory, Delhi, has developed cells that could meet all the major requirements, from efficiency and stability through to eco-friendliness and cost-effectiveness. Importantly, these nano-structured cells offer low up-front manufacturing costs – and this could ensure that they are particularly well-positioned to seize a healthy share of the Indian PV market.

An important by-product of this technical milestone has been the building of strong relationships between researchers in India and the UK, as well as between big commercial players in both countries. Unquestionably, a vibrant Indo-UK R&D community in excitonic solar cells now spans academia, industry and government, creating the conditions to achieve further successes in areas such as technology scale-up and PV module testing under UK and Indian conditions.

Joining Hands for Better Public Health
Project Title: Advances in research on globally accessible medicine (ARDGYM)
Funding Partners: ESRC, KSSR, DFG, ANR, NWO

The battle to boost public health involves a continuous quest to find better ways of detecting, preventing and treating disease. But it also demands a deeper understanding of the attitudes, behaviours and lifestyles that help to determine diseases’ prevalence, their ability to spread and people’s capacity to cope with them. That applies just as much to diabetes, obesity, mental health issues and other non-communicable conditions as to diseases such as HIV/AIDS, malaria and tuberculosis.

Involving partners – Jawaharlal Nehru University, Delhi, The Edinburgh University, UK and Heidelberg University, Germany, this project is exploring the social science aspects of public health from both a global and a national perspective. Moreover, it is taking an unequivocally cross-disciplinary approach to an issue critical to economic success, social cohesion and quality of life. Linking expertise in medical sociology, medical anthropology, health economics and the law, for example, its focus includes the potential impact of innovations in biomedical technology and healthcare delivery, as well as transcultural health issues (e.g. how people’s mobility between countries affects the spread of disease). This is a project that can confidently be expected to sharpen and enhance thinking on public health well beyond the boundaries of the three partner countries.
Cool Reactors

Project Title: Thermal hydraulics for boiling and passive systems
Funding Partners: RCUK Energy programme and DAE

Nuclear reactors give off heat; lots of heat. That is what they are designed to do, in order to generate lots of carbon-free electricity. It is obviously important to be able to extract that heat from them safely, reliably take it away and make steam with it. Designing and constructing reactors so that this happens safely, is the role of nuclear thermal-hydraulics.

The work at Imperial College London and Bhabha Atomic Research Centre (BARC) in Mumbai is addressing various aspects of being able to predict nuclear heat removal with confidence.

Even if electricity to power pumps is lost, we can still count on the fact that natural buoyancy-driven flows will take place (“hot air rises”). If the plant is designed to be able to rely upon these flows for its cooling we can be sure of very robust and effective cooling of the plant even if engineered systems like electrically-driven pumps have failed.

One part of the work is attempting to develop reliable methods to predict these rather delicate and subtle flows, by building experimental facilities at the BARC laboratory in Mumbai in which buoyancy-driven flows are caused to occur.

The Imperial team then tries to predict these experimentally-observed flows using computational models, and thereby generate a refined, validated capability to predict flows in the real reactor.

By contributing to the ability to build such plants with confidence in their safety, this research is helping both India and the UK reduce their reliance on fossil fuels, and their emissions of carbon dioxide.

Energising Villages

Project Title: Rural hybrid energy enterprise systems (RHEES)
Funding Partners: RCUK Energy programme, RCUK Digital Economy programme and DST

India and the UK have many rural energy challenges in common. Arguably, one of the most important is how to unleash the economic potential of rural communities by equipping them with a quality of energy supply comparable to that often taken for granted in urban areas. Renewable sources can meet many of the key criteria, directly tackling fuel poverty and generating local revenues, as well as stimulating new opportunities for rural industries to create jobs and cut their transport costs. Society, economy, and environment – all three stand to profit from the exploitation of energy solutions that are clean, sustainable, stable and above all, affordable.

Squaringly addressing the specific needs of rural communities, this project which is led by Nottingham University in the UK and the Indian Institute of Science, Bangalore, is developing small-scale systems that combine biomass gasification, solar thermal and anaerobic digestion technologies. Nutrients in the biomass wastes produced by the systems could even be re-processed and used as crop fertilisers, while an inclusive, participatory philosophy goes right to the hub of the initiative. Test sites in the two countries are playing a big role in training, up-skilling and empowering people to work with renewable energy sources and to develop the business judgement vital to maximising precious benefits that could boost rural communities wherever they may be.

Understanding Mother Ganges

Project Title: Hydro meteorological feedbacks and changes in storage and fluxes in northern India
Funding Partners: NERC and MIES

Over the past half-century, the north Indian plains have experienced land-use changes and associated increases in groundwater exploitation on a scale never previously seen. These dramatic developments have added to the difficulty of accurately measuring water resources there and predicting future availability – an issue vital to economic health and social well-being in the region. Only improvements in computer modelling capability can deliver the required reductions in the uncertainty surrounding such projections.

The multi-disciplinary team led by Imperial College, London and the Indian Institute of Science, Bangalore is building a sophisticated new model for the Ganges basin – highly urbanised, intensively farmed and the most densely populated large river basin in the world. This is the first project to assess the effect of climate on water regimes as well as the effect of water availability and usage on the climate. This demands a detailed evaluation of the manmade and natural changes that have had an extensive impact on groundwater resources across the basin.

Harnessing data on groundwater levels, irrigation practices, crops under cultivation, river flow, soil types and rainfall, for example, the UK-India team is producing findings that are feeding into the Indian Government’s Ganges River Basin Management Plan. This will underpin sound decision-making designed to ensure water availability while protecting vital ecosystems in this delicately balanced, economically crucial region.

Climate-Change Resistant Rice

Project Title: Using wild ancestor plants to make rice more resistant to increasingly unpredictable water availability
Funding Partners: BBRC, DBT, ICRISAT, DFID and Gates Foundation

Rice is the staple food for over two billion people, but more rice is needed to feed a growing global population. A quarter of global rice production, rising to 45 per cent in India, is in rain-fed environments, so the challenge of producing more rice is further complicated by climate change, which is predicted to cause more drought and flooding in the future.

Researchers from the University of York, UK, Central Rice Research Institute, India and Cornell University, USA are working together to access valuable genetic information about variation in ancestral wild species of rice to identify beneficial segments of the genome that help plants survive drought. These small segments from ancestral rice genomes can then be transferred into commercial rice varieties by breeding. In parallel, researchers in India are conducting field trials using hundreds of lines of rice carrying chromosome segments of DNA from wild varieties to see how different varieties grow. Using this field information, scientists in the lab are studying the different varieties to build up a detailed genetic picture of what causes increased resistance to drought in specific lines of rice.

At the end of the project, the international team plans to produce improved drought-tolerant rice varieties that are accepted and adopted by local communities in rain-fed areas of India, as well as new breeding tools to enable rapid further development of new rice varieties.
Aligning our research and innovation priorities for greater impact

RCUK India held a series of events to celebrate its 5th Anniversary in November 2013. These events included a number of roundtable discussions on:

- Sustainable Cities and Rapid Urbanisation
- Applying Energy-Water-Food Nexus Thinking
- Big Data
- Rapid Economic, Cultural and Social Change in India

At the same time, the UK-India Science and Innovation Policy Dialogue meeting agreed that the UK-India research partnership had achieved much over the previous 5 years and that the next level of collaboration called for demonstration of even greater impact. Therefore, they agreed that a UK-India Task Force should be established to identify potential Grand Challenge areas for future UK-India joint research and innovation. The Task Force met twice in 2014. Key research and innovation funders, and senior decision makers from both countries, attended the meetings and represented a wide spectrum of interests from knowledge to delivery on diverse themes. The Task Force identified three interdisciplinairy, Grand Societal Challenges on:

- Sustainable Cities and Urbanisation
- Public Health and Well-Being
- Energy-Water-Food Nexus

It also identified two underpinning capabilities on:

- High Value Manufacturing
- Big Data

The areas identified by the UK-India Task Force align closely with the ambitions of the Government of India.

In 2014, the UK also announced the creation of the Newton Fund: a new Research and Innovation Fund of £375 million over 5 years to promote science and innovation partnership with key international partners in emerging economies, including India. Subsequently, Science Ministers from both the UK and India met at the fourth UK-India Science and Innovation Council (SIC) in November 2014 and signed a Memorandum of Understanding (MoU) establishing the Newton-Bhabha Programme. This is a new UK-India programme of research and innovation cooperation addressing global development challenges and augmenting the existing research collaboration between the two countries.

Ministers agreed that the Newton-Bhabha Programme (£50 million over 5 years from the UK and matched efforts from India) would address, amongst other things, the interdisciplinary Grand Societal Challenges identified by the UK-India Task Force. It was also agreed that the Newton-Bhabha programme should be built on three pillars:

- People (capacity building)
- Programmes (joint research)
- Translation (innovation)

The Newton-Bhabha Programme will be delivered by a partnership of UK and Indian agencies — including Research Councils UK. RCUK have, already, made significant progress on a number of major new research and innovation partnerships. These include:

- The UK’s Medical Research Council (MRC) and Indian Council of Medical Research (ICMR) joint initiative on Mental Health and Substance Abuse
- Joint Global Research Programme in Women’s and Children’s Health supported by MRC, Department for International Development (DFID, UK) and India’s Department of Biotechnology (DBT)
- Joint Centre partnerships in Cancer Biology and Antimicrobial Resistance, funded by MRC and DBT
- Joint UK-India Centre for Research in Clean Energy co-funded by the RCUK Energy programme and India’s Department of Science and Technology (DST)
Launched in 2008, Research Councils UK (RCUK) India brings together the best researchers in the UK and India through high-quality, high-impact research partnerships. RCUK India, based at the British High Commission in New Delhi, has facilitated co-funded initiatives between the UK, India and third parties that have grown to over £150 million. These initiatives are often closely linked with UK and Indian industry partners, with more than 90 partners involved in the research.

RCUK India is actively involved in co-funded research activities with major Indian research funders across a wide array of research themes addressing global challenges such as energy, climate change, social sciences, healthcare and life sciences. These are:

- Department of Atomic Energy (DAE)
- Department of Biotechnology (DBT)
- Department of Science and Technology (DST)
- Indian Council of Agricultural Research (ICAR)
- Indian Council of Historical Research (ICHR)
- Indian Council of Medical Research (ICMR)
- Indian Council of Social Science Research (ICSSR)
- Ministry of Earth Sciences (MoES)

Research Councils UK (RCUK) is the strategic partnership of the UK's Research Councils. We invest annually around £3 billion in research. Our focus is on excellence with impact. We nurture the highest quality research, as judged by international peer review, providing the UK with a competitive advantage. Global research requires that we sustain a diversity of funding approaches, fostering international collaborations, providing access to the best facilities and infrastructure, and locating skilled researchers in stimulating environments. Our research achieves impact – the demonstrable contribution to society and the economy made by knowledge and skilled people. To deliver impact, researchers and funders need to engage and collaborate with the public, business, government and charitable organisations.

The seven UK Research Councils are:

- Arts and Humanities Research Council (AHRC)
- Biotechnology & Biological Sciences Research Council (BBSRC)
- Economic & Social Research Council (ESRC)
- Engineering & Physical Sciences Research Council (EPSRC)
- Medical Research Council (MRC)
- Natural Environment Research Council (NERC)
- Science & Technology Facilities Council (STFC)