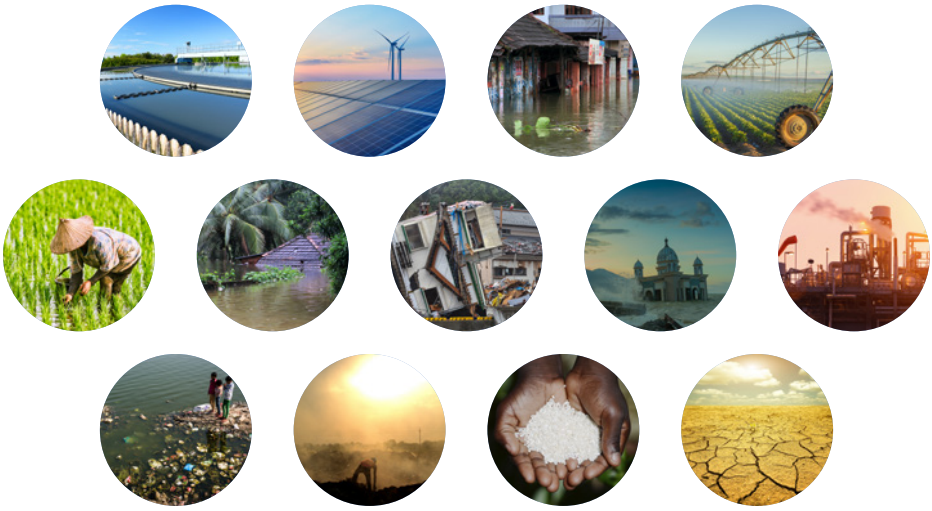
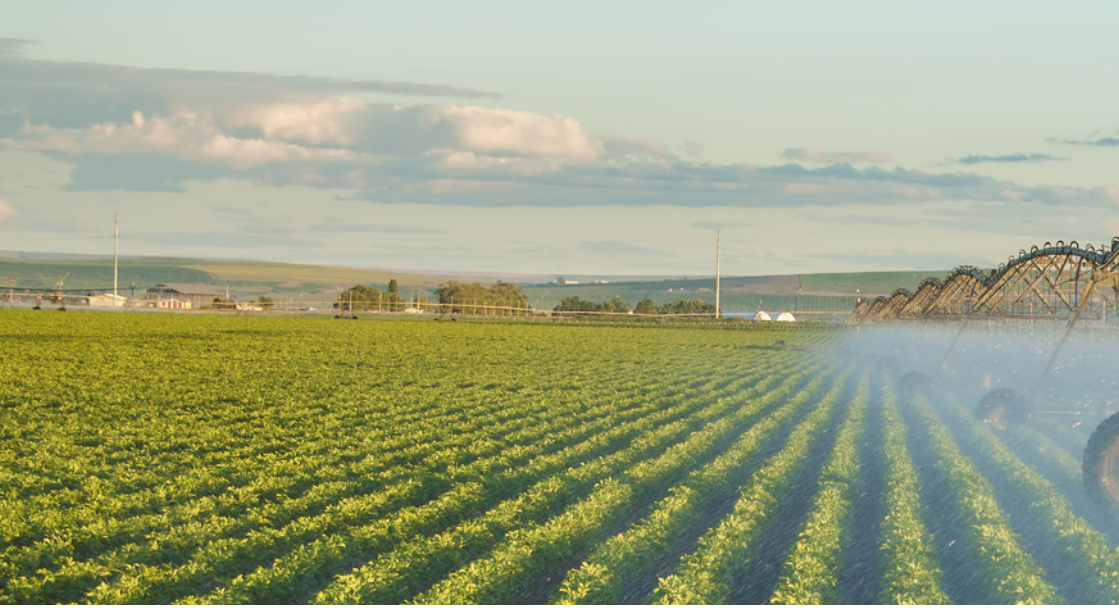
Brunel University London

Developing Solutions for Global Challenges





Global Challenges: Developing Local Solutions at Brunel University London

Addressing Global Challenges with locally owned solutions is a key priority for Brunel University London.

Research informed by the needs of society, delivered through research programmes co-created with the intended beneficiaries and stakeholders, is at the heart of our approach.

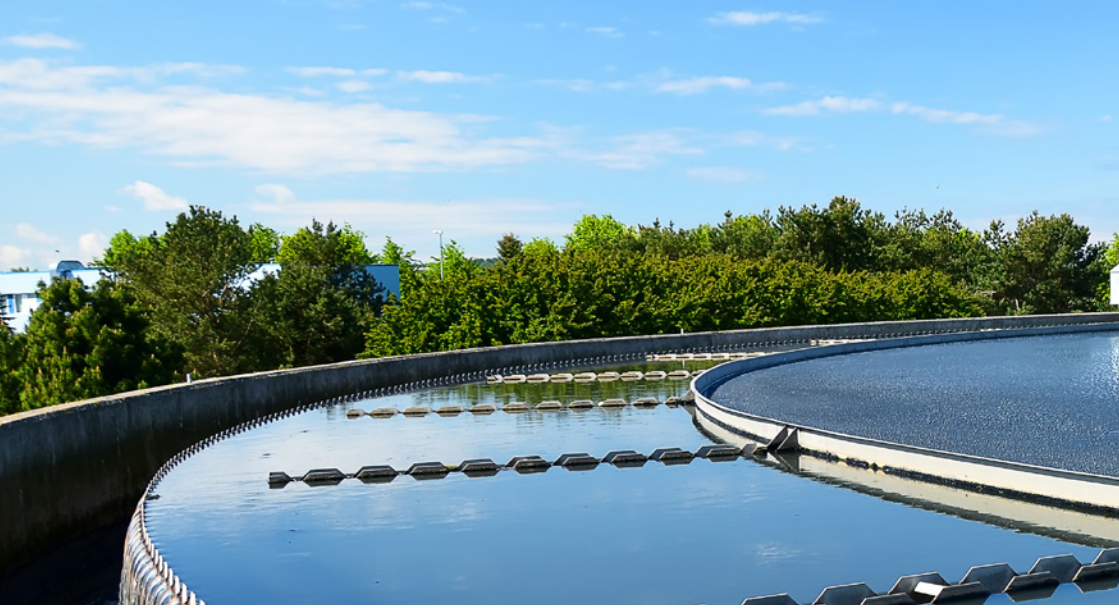
Our Global Challenges research objective is to create new knowledge and drive innovation to develop more equitable access to sustainable development. Brunel's research has four key clusters of activity:

Brunel was the UK lead for the Newton-Bhabha APEX II project that won the first ever UK Newton Prize in 2017. The project developed advanced, excitonic solar cells that increase energy efficiency from the sun to supply cheaper and more sustainable electricity to rural homes in India. The Prize 'recognises excellent research and innovation in support of economic development and social welfare in partner countries'.

1. Secure and resilient food systems: an interdisciplinary approach involving industries, Government and civil society actors to respond to global pressures on existing food systems. We apply circular economy principles across the "food chain" with the mission to improve

Strengthened humanitarian supply chain systems for refugee population in Turkey: The British Council - Newton Fund supported project (£38,000) developed an innovative humanitarian supply chain and logistics system to ensure resilient and efficient food distribution for Syrian refugees. Brunel researchers led the project in collaboration with Ankara Yıldırım Beyazıt University, Turkey.

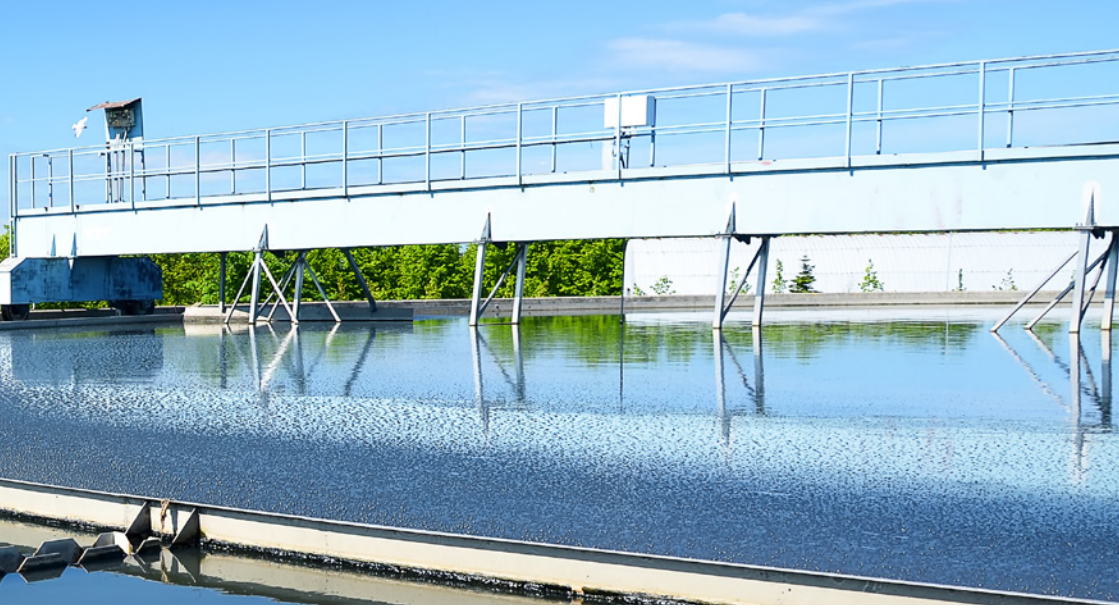
The project adopted "lean" principles in the food supply chain and identified approaches for identifying bottlenecks to improve operational resilience, enhance logistical support and to improve effective delivery of food supplies during a humanitarian crisis across refugee camps.



2. Sustainable health and well-being: Brunel develops knowledge and solutions that address diverse challenges to health and wellbeing throughout the human life course, including cultures, societies, social groups and global regions.

Health and Well Being and Inclusive Education (Pakistan): With funding support from the British Council and the Higher Education Commission of Pakistan (£57,853), occupational therapists and teachers worked together in three schools to develop strategies that enable children with special needs to study, play and socialise with their classmates.

The project applied Occupational Therapy methods with special needs students in Pakistani classes. The results showed significant teaching and learning improvements, resulting in the method being supported by the World Federation of Occupational Therapists.



3. Clean air, water and sanitation: Brunel has advanced knowledge and expertise on the causes and the health and environmental impacts of pollution.

This includes toxic chemicals that disrupt natural resources (e.g. freshwater or nutrients), material or economic cycles (e.g. plastic waste) along with extensive experience of translating knowledge into effective policies that protect the planet and humanity.

The Queen's Anniversary Prizes
For Higher and Further Education

Everyday chemical threat finds global audience: World class research at Brunel led to the global regulation of chemicals that cause irreversible damage to unborn babies. Brunel's research team pioneered an identification method to recognise endocrine disrupting chemicals (EDC) – hazardous chemicals that interfere with the production or activity of hormones in the endocrine system.

This research has underpinned decision-making in the European Union, USA and United Nations, specifically the UN Environmental Programme. Brunel received the **Queen's Anniversary Award in 2012** at Buckingham Palace honouring the University's ground breaking research into the effects of hormone disrupting chemicals.

4. Affordable, reliable and sustainable energy: This cluster focuses on holistic approaches to the energy costs of food distribution, bringing together researchers from a range of disciplines, as well as mainstream engineering research.

Innovative solar technologies for global buildings, waste management and food preservation: Brunel researchers have developed solar energy generators to solve challenges such as: treatment of municipal solid waste, provision of space cooling energy, food preservation and storage, and industrial heat demand. Brunel team developed cost effective and least complex in operation (none or minimal sun tracking) systems achieve highest solar-energy conversion efficiency.

These projects are funded by the Newton Fund (UK-Egypt) and UK India Education and Research Initiative and the Department of Science and Technology (UKIERI-DST) and the Engineering and Physical Sciences Research Council (EPSRC) through Global Challenges Research Fund (UK-India).

Multi-Disciplinary Research: Multi-disciplinary research is a fundamental priority and strength at Brunel. This is driven by – and embedded in – three specialist **Research Institutes** with main themes focussed on: **Energy Futures; Environment Health & Societies; Materials and Manufacturing.**

These Institutes tackle Global Challenges through world leading inter-disciplinary research and international partnerships.

Over the last three years 55% of our research outputs have had an international collaborator or co-author. To further develop and focus our expertise in these fields, Brunel has developed two Global Challenge networks:

Brunel University London is ranked 40th most impactful university in the world (Times Higher Education, 2019) and 24th 'most international university' (Times Higher Education, 2018).

The Plastics in Society Research and Innovation Hub works with collaborators in India, Indonesia, Malaysia, South Africa and Thailand to create methodologies, technologies and sustainable solutions to address the growing plastic pollution catastrophe in the Indian Ocean region – now a global crisis.

The mission is to engineer a sustainable solution through a fully circular plastics economy.The Sustainable Protected Horticulture network works with collaborators in India, Kenya, Tanzania and Uganda to develop sustainable technologies through the various links across all parts of the food chain to improve agricultural productivity and food waste.

Our Funding: Brunel holds one of the largest portfolios of Newton Fund grants in the UK which underpins our research in Global Challenges. In addition, we also work in collaboration on many other international projects with funding from bodies such as: UK Research Councils, Innovate UK, UKAID (DFID), British Council, the EU, the UN Systems and many others.

Case Study

Strengthened Farming Production Systems Reap Better Harvests in Uganda

Lean Farming was founded with the vision and mission to increase productivity and improve the livelihoods of farmers in Uganda who suffer from low agricultural productivity and the ever increasing costs of farming. In response, Brunel's Food Supply Chain experts adapted Toyota Automotive's 'lean thinking' model, that reduces material wastes in car manufacturing, to develop sustainable global food supply chains to integrate farming with food supply.

Through consultation with networks of farmers, co-operatives, food processors, and suppliers, a new Food Supply Management System was applied in the Rwenzori region in Uganda. The project is achieved in partnership with Brunel, the University of Ghent, Belgium (consortium lead), and the Mountains of the Moon University (MMU) in Uganda (funded by VLIRUOS Institutional University Cooperation - €3.2 Million (£2.7 Million). The 12-year long project (2013 – 2025) focuses on capacity building and institutional strengthening in areas of relevance to Ugandan farming communities, providing a pilot for future farming solutions.

Analysis of the challenges facing farmers revealed both scepticism to engage with unfamiliar processes, and costly and poor performing farming methods. Coordinating with policy makers and others, Brunel's team supported farmers to streamline their farming processes, eliminate waste and improve productivity.

Evidence proved that Lean Farming increased farmers' capabilities to produce:

- better food quality
- reduce quantities of defective foods
- reduce food waste
- improve production time
- increase income

"Due to new farm management practices and support from the university we could increase our yield and better manage our resources. Lean helps us to see the whole process clearly and act efficiently" Kajoogo Yoweri, Farmer, Uganda

“Traditional farming methods caused a lot of waste and led to considerable losses of money. But now, by applying lean, you use fewer resources, so you use less energy, less water. This is more sustainable farming.” says, Dr Manoj Dora, Director, Large Collaborative Projects and Principal Investigator, Brunel University London.

The Food Supply Management System is now successfully integrated with traditional farming in Uganda and has been replicated by farming communities in South Africa and has generated progressive economic, social, and ecological results across rural communities.

For more information about the project, please contact:

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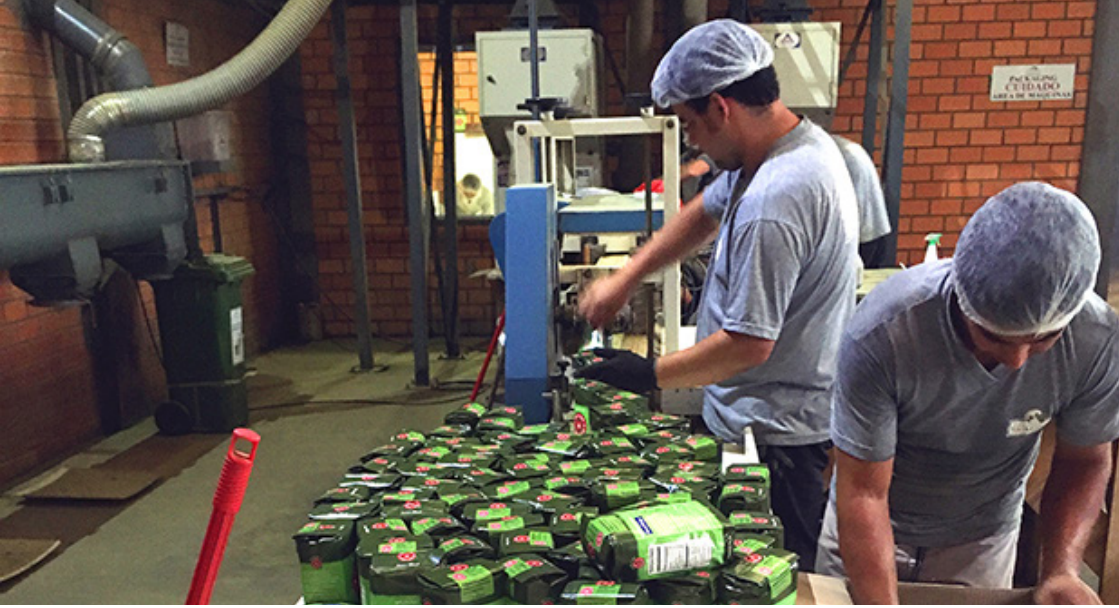
Case Study

Novel Heat Pipe Based Drying Solution: The Health and Economic Benefits to Brazil's Traditional Mate Tea Industry

Mate tea is a popular traditional South American caffeine-rich infused drink and said to have the "kick" effect of coffee, the health perks of tea and the delight of chocolate. Its popularity is rapidly growing throughout countries. Mate tea is made from the dried, chopped, ground leaves of rainforest holly tree. Like other natural drinks, Mate contains polycyclic aromatic hydrocarbons (PAHs) that are linked to mouth, throat, kidney and bladder cancers. The traditional wood smoke drying process has also been found to contaminate the tea leaves with high levels of PAH.

The Brunel University London team, led by Professor Hussam Jouhara, along with British company Econotherm, Brazilian company Ervateira São Mateus and the Instituto SENAI de Inovação em Biomassa, worked in a consortium for the Innovate UK Newton Funded project (£472,383) – Erva Mate Drying – that focused on developing the implementation of a novel heat pipe based drying solution that eliminates the high level of PAH. Brunel's research expertise in heat exchangers and thermal systems was key to the design of the new system.



"We had a fruitful partnership with Brunel University London that led the designing and implementation of the novel type of Mate Tea drying system which has increased the export potential of Mate Tea from Brazil. The new system has also minimised the negative health effect that was present with the old traditional drying system". Dr Carolina Andrade, Director, Instituto SENAI de Inovação em Biomassa, Brazil

The traditional way of heating tea leaves had created a variety of issues for companies like Ervateira São Mateus, a major Mate tea producer in Brazil. They faced losing their market due to national and international regulation aimed at preventing tea with high levels of PAH. The Brunel research team consulted with the factory staff and markets to analyse the challenges of production, develop practical, feasible and innovative technological solutions for an age old tradition which has both a significant economic and public health impact. The Brunel team also strengthened the capacity of Brazilian staff to use the newly developed technology.

The solution involved using clean hot air and a heat-pipe based heat exchanger that stopped PAHs, making the tea safe to drink. A further benefit is that the biofuel can be used, meaning the unused parts of the

rainforest holly is still utilised. Thus, further reducing waste during production and also the disposal costs for the manufacturer

Ervateira São Mateus (www.ervateirasm.com.br) has been using the newly developed heat-pipe-based system for over a year, with immediate, positive impact. After the new heating system had been introduced, the production and economic output of the company has increased significantly.

The Brazilian government report highlights that with the eliminated PAH content, the export potential of the product to the South American and the international market will also be maximised.

"The project is in response to a need highlighted by a major mate tea beverage producer in Brazil with a vision of obtaining a safer, cleaner, efficient and cost-effective tea leaves drying system," says Brunel's Professor Hussam Jouhara who developed the new system.

"The utilisation of the new heat pipe based drying system has led to the elimination of PAHs in the final Mate Tea products and consequently has led to new markets for our products such as the European Union, United States, Russia, China, South Korea and Turkey. The implementation of this with the superior thermal efficiency of the heat pipe system". Mr Ignacio M. Carrau, Director & CEO of Ervateria Sao Mateus

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