

RE:ACTION



Enduring links, inspiring future

Celebrating a fifty-year partnership with India and looking to the future, as the University of Southampton Delhi opens

ACROSS THE UNIVERSE

Collaborating to unlock the secrets of black holes

SUN POWERED

Empowering rural communities through solar energy

HEALTH FOR LIFE

A better start for the next generation

FROM WASTE TO WONDER

Hearing the voices of Mumbai's recycling workers

WELCOME TO RE:ACTION



The University of Southampton has a long and proud history of undertaking research, knowledge exchange and enterprise, and education activities with partners in India. With the imminent launch of our new campus in India, based in Gurugram, near Delhi, there are great opportunities to further enhance these relationships. This issue of Re:action explores some of our existing collaborations with India and celebrates our rich shared history.

As with every issue of Re:action, the subject matter is wonderfully diverse. Features range from Stratis Batzelis' work empowering poor rural communities in India through solar-powered electricity, to Achala Gupta's research on 'shadow education', and Ian Dawson's residency in Mumbai's Dharavi district exploring disposability through 3D printing and portrait workshops with the settlement's young people. These, and the other articles, highlight the importance and impact of high-quality international collaborations in research and knowledge exchange. Above all, the stories are fascinating.

We previously produced an India-focused issue of Re:action in 2019. Much has changed since then; India has become an even more significant country on the world stage and an even more important partner to the University of Southampton. I am sure that 2025 will mark a further milestone in our relationship with India, and that everyone reading this issue can look forward to even stronger and more meaningful engagement in the future.

I very much hope that you enjoy this edition. As always, comments and feedback are very welcome.

Best wishes

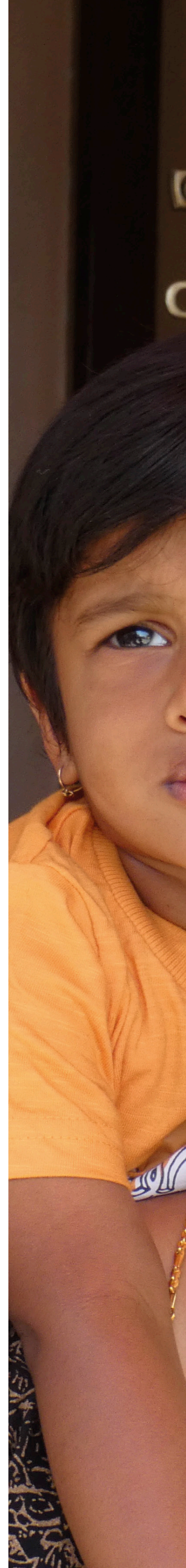
Professor Mark Spearing
Vice-President (Research and Enterprise)

PLEASE SEND US YOUR FEEDBACK



We are keen to receive your feedback about Re:action. If you have any ideas, comments or suggestions, please send them to riscomms@soton.ac.uk

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Cover and left: families participating in the HeLTI Study (pages 18 – 21)

ENDURING LINKS, INSPIRING FUTURE

The University of Southampton's links with India stretch back more than half a century. Re:action spoke to Professor Jane Falkingham CBE (Vice-President Engagement and International) and Professor Andrew Atherton (Vice-President International and Engagement) about the history and future of the University's relationship with India.



Professor Jane Falkingham

“

Pioneering Southampton researchers such as Professor Sir David Payne CBE and Professor Dame Wendy Hall DBE have developed close partnerships with the IITs (Indian Institutes of Technology) over many years.”

“We have welcomed Indian scholars and students for decades, and Southampton researchers have worked productively with Indian institutions since the early 1970s,” explained Jane.

“Pioneering Southampton researchers such as Professor Sir David Payne CBE (Optoelectronics) and Professor Dame Wendy Hall DBE (Electronics and Computer Science) have developed close partnerships with the IITs (Indian Institutes of Technology) over many years.”

David's collaborations, which span 50 years, have been recognised with prestigious fellowships from the Indian Academy of Engineering and the Indian National Science Academy (INSA). Wendy has strong research links with IIT-Bangalore and IIT-Madras and is currently involved in the development of a joint UK-India research centre in AI, to be funded by the UK and Indian governments.

“Today these links extend across the University,” continued Jane. “For example, Professor Craig Hutton (Sustainability and Resilience Institute) has been researching the impacts of climate change on vulnerable communities around India's river systems for the past two decades.

“In Social Sciences we have long-standing partnerships with institutions including the Tata Institute of Social Sciences, the Indian Institute of Management in Bangalore, and the University of Kerala. Together with Southampton, these three universities received Indian Council for Social Sciences Research, and Economic and Social Research Council funding to study ‘Ageing and

wellbeing in a globalizing world’. For the past decade, Arts and Humanities researchers have been working with O.P. Jindal Global University.”

The University maintains valued links with the UK's South Asian community too. Lord Patel of Bradford OBE was appointed joint Chancellor of the University in May 2024 and is a founding patron of the University's India Centre. One of Southampton's two Members of Parliament is University alumna Satvir Kaur, who previously served as the first female Sikh leader of a local authority in Britain.

“Hampshire and Southampton have strong historical ties with India,” commented Jane. It was in Southampton that Mahatma Gandhi first set foot in the UK on 27 October 1888 as an 18-year-old law student. The University also holds The Mountbatten Archive – a remarkable collection of materials covering Lord Mountbatten's life, including his time as Viceroy of India.

The India Centre

In March 2019 the University, recognising the need to harness the breadth of engagement with India across the institution, established The India Centre for Inclusive Growth and Sustainable Development (see page 10). “The India Centre provides a framework for people to come together and make connections and plays a vital role in nurturing relationships with India and Southampton's South Asian community,” explained Jane, who is a co-founding director.

India's National Education Policy

In 2020, the Indian Government announced plans for major changes to its National



Professor Andrew Atherton



The level of engagement and support we've had across the Indian Government has been outstanding."

Education Policy (NEP), including the internationalisation of higher education, which would allow foreign universities to establish branch campuses in India for the first time (under regulations announced in 2023).

Jane, who was both Dean of the Faculty of Social Sciences and Vice President International at the time, drafted the University's international strategy in 2021. "As part of Vice-Chancellor Professor Mark E. Smith's vision, the strategy identified an ambition to expand the University's international footprint by opening three new campuses by 2030," explained Jane. Professor Andrew Atherton was appointed in 2022 to lead on realising this ambition.

A warm welcome

For Southampton, India was the first choice of location for a new campus. The country's "growing demographic, increasing participation in higher education, and propensity for families to invest in their children's university education" were key, commented Andrew. As was its vast untapped potential: "There is a large proportion of students in India leaving the secondary education system with very high

scores, compared with the number of places available at top-ranked higher education institutions," he explained.

India is also becoming "more enterprising and entrepreneurial," said Andrew. The Indian Government's 'Startup India' programme, designed to build a strong innovation ecosystem, aligns with Southampton's knowledge exchange and enterprise goals.

Building on the foundation of the University's historic ties with India, Southampton's application to establish a campus in Delhi was warmly welcomed, said Andrew. "The level of engagement and support we've had across the Indian Government has been outstanding. They are excited to have a top 100 Russell Group university establishing a presence in the country."

University of Southampton Delhi

For Indian students, University of Southampton Delhi offers access to a global top 100 university (currently the only one in India), and the advantages of an international education, at a considerably lower cost than studying overseas.

The students expected to benefit most are those whose families want to invest significantly in their future but are not in a position to fund overseas study. This is something Andrew is proud of. "We are offering them something they wouldn't have been able to experience otherwise. And these are the people who will change India as it grows. That long-term impact is really important."

For UK researchers and students, the India campus offers outstanding opportunities. "Addressing challenges such as sustainability, water and energy are priorities both for us and for the Indian Government," said Jane. "This is hugely exciting in terms of research potential."

With the same curriculum and quality of education being offered in both Southampton and Delhi, and in other locations in the near future, students will be able to spend a semester at an overseas campus. "For global citizens of the 21st century, having an understanding of India will be important. This is an incredibly valuable opportunity," concluded Jane.

“A GENUINELY GLOBAL UNIVERSITY”

Southampton meets Delhi



“A genuinely global university”

With a foundation of trusted relationships, and a vision to bring a Southampton presence to this strategic location, the team behind the Delhi campus were ready on the starting blocks when the Indian government published new regulations in 2023 allowing international universities to open campuses in the country.



Associate Professor Dr Sagaya Amalathas



At Southampton, we're well-known for the strong engagement we create with students, through our academic teaching practice and by nurturing students to grow.”



The Food Court within the Delhi campus

Relationships were a key component in Southampton being the first international university to be granted a licence by the Indian government, explained Professor Andrew Atherton. “We were in conversation with the University Grants Commission before the regulations came out, so we knew what to expect – and were able to move quickly to submit our proposal.”

“There were certainly challenges that came with being the first university to go through this process!” said Zoë Marlow, Director of Transnational Education. “But we had some important lessons from Southampton’s previous experiences of offshore delivery – including the need for a partner [Oxford International] to lead the operation of the campus, and the importance of bringing the whole University community on board through a broad engagement strategy.”

With an initial offer of six programmes (BScs in Accounting and Finance, Business Management, Computer Science and Economics, and MScs in Finance and International Management), and a planned first intake of 140 students to start in September 2025, the Delhi campus is set to quickly expand. “We’ll be growing numbers to around 5,400 students by year ten, with new courses launched each year,” said Andrew.

Associate Professor Dr Sagaya Amalathas, formerly Head of Electronics and Computer Science at Southampton’s Malaysia campus and now Director of Learning and Teaching for the Delhi campus, is focused on “ensuring that Southampton’s best educational practises are being carried out in all the programmes at the Delhi campus.

“At Southampton, we’re well-known for the strong engagement we create with students, through our academic teaching practice and by nurturing students to grow in an environment where that happens alongside research and enterprise. Our students will get the same world-class experience whether they’re studying in Southampton or Delhi.”



Professor Andrew Atherton

When it comes to employability, Academic Provost Professor Eloise Phillips commented, “The location of our Delhi campus, in the Gurgaon Tech Park where there are over 20 companies at the last count, puts us in a strong position to build partnerships for our students’ future careers.”

The Delhi campus promises to translate the University’s core offer to a new cultural context. “We want to deliver a recognisably ‘Southampton’ experience, whilst also ensuring it’s culturally resonant for Indian students,” said Kieron Broadhead, Deputy Vice-President (Operations). “We can bring the best of Southampton, put it with the best of India, and come up with something that’s a genuine third way.”

“I know from experience how important it is to localise the curriculum,” said Eloise, who has come from a key role establishing the University of Birmingham’s flagship campus in Dubai. “We will be working collaboratively with our locally appointed staff to ensure the course material has maximum relevance.”

David Winstanley, Executive Director of Student Life, has been seconded to the Delhi campus for six months as Executive Director India Implementation. “A key part of my role is to ensure that what we deliver in India is truly ‘the University of Southampton’.



The new Delhi campus building

Find out more:
www.delhi.southampton.ac.uk



Professor Eloise Phillips

That's about everything from brand identity to student experience to the quality of education, which of course includes our Triple Helix approach – intertwining education, research and knowledge exchange and enterprise activities.

“This first cohort of students are real pioneers! It's so exciting that they'll be able to say they were in the first year of the first foreign University in India,” he commented. David is excited to see the campus grow from this bespoke cohort to a “big, broad, comprehensive institution with its own research environment and culture, and its own entrepreneurial context.”

Ultimately, he continued, having an international presence is about the University fulfilling its mission to make an impact in the world. “This is how, as thought-leaders, we want to approach the global challenges we're trying to tackle: not just in a UK-focused way, but with a much broader spectrum of insights.”

“We are becoming a genuinely global university, which from an academic and institutional perspective is fantastic,” concurred Andrew. “We are changing the paradigm for international higher education – instead of mainly expecting students to come to us, we're also going to them.”



The location of our Delhi campus, in the Gurgaon Tech Park where there are over 20 companies at the last count, puts us in a strong position to build partnerships for our students' future careers.”



Zoë Marlow



David Winstanley



Kieron Broadhead

A LIVING BRIDGE

India Centre for Inclusive Growth and Sustainable Development

The University's India Centre for Inclusive Growth and Sustainable Development was established in 2019 to promote evidence-based development and policy innovations in India through research, education, knowledge exchange and enterprise.



Professor Sabu Padmadas

“Our main goal was to create a vibrant platform that connects researchers with policymakers and industry partners to advance equitable, sustainable development, while accelerating real-world impact,” explained the Centre’s Founding Executive Director, Professor Sabu Padmadas.

Sabu, along with Co-Founding Directors Amarjit Singh (Law School alumnus and CEO of the India Business Group), and Professor Jane Falkingham CBE, started by mapping existing collaborations and working with academic schools to identify key priorities. Together, they developed a strategic roadmap for future engagement with India.

Six years on, the India Centre has become a focal point for multidisciplinary collaboration between the two countries. Through research initiatives, knowledge exchange and curriculum innovation, the Centre has expanded the University’s reach across India and within the UK’s South Asian community.

“Our first phase has been dedicated to establishing reputation, fostering strategic relationships, and building trust as a foundation for sustainable and impactful collaboration,” said Sabu. Key figures from India, the UK, and the Indian diaspora were enlisted as founding patrons, including Lord Patel of Bradford, India’s first woman police officer and former Lieutenant Governor of Puducherry Dr. Kiran Bedi, former Indian High Commissioner Ruchi Ghanashyam, Bollywood actress and activist Shabana Azmi, and former Chief Justice of India, Deepak Misra. They joined Vice-Chancellor Professor Mark E Smith, and Professors Dame Wendy Hall DBE and Sir David Payne CBE, who both brought a wealth of expertise and strategic leadership in collaborating with India.

This relationship-building has been crucial to the Centre’s success, moving the University’s partnership with India to the next level. The India Centre’s engagement with senior academic and Government figures in India,



India Centre Launch



Professor Mark E. Smith, and Indian High Commissioner, HE Mr Vikram Doraiswami, sign the ICCR Memorandum of Understanding

including policy think tank NITI Aayog, the Prime Minister's Principal Scientific Adviser, and the Ministry of Education, was instrumental in facilitating a meeting between the Minister and Southampton's Vice-Chancellor to explore opportunities under India's new National Education Policy.

The Centre's campaign with the British Asian Trust to support India during the Covid-19 pandemic led to a pivotal connection with the Vice-Chancellor of Jawaharlal Nehru University, who subsequently became Chairman of India's University Grants Commission. This relationship laid the foundations for discussions on establishing a campus in India.

Since the Centre's inception, improving recognition of the University in India has been a priority. During the pandemic, the Centre helped coordinate online research events with Indian partners to showcase existing collaborations. In 2022, India Week, which coincided with Azadi Ka Amrit Mahotsav,

the official celebration of India's 75 years of independence, provided a high-profile platform which gained Indian and UK press attention. Organised with Southampton City Council, Southampton City of Culture 2025, the India Business Group, and supporting partners, this week-long programme showcased the University's collaborations with India and celebrated cultural and sporting links. Events across seven locations were attended by guests from India and the public.

"Six years ago, Southampton was not widely known in India, but we have since built our brand reputation and a credible presence across the country," said Sabu.

One of the most significant outcomes of the deepening relationship is the establishment of an Indian Council for Cultural Relations (ICCR) Chair of India Studies at the University, funded by the Indian Ministry of External Affairs and facilitated by the Indian High Commission in London.



Javed Akhtar and Shabana Azmi during India Week



Our main goal was to create a vibrant platform that connects researchers with policymakers and industry partners to advance equitable, sustainable development, while accelerating real-world impact.”

Professor Sabu Padmadas

COLLABORATIVE RESEARCH



Sir Sajid Javid and Poppy Jaman featured in the Pioneers Project

The India Centre brings together researchers from across the University interested in India-focused research. It supports and showcases ongoing multidisciplinary research and initiates new projects.

One such project is the *Ramniklal Solanki Pioneers Project*, which documents the life stories of ten influential South Asians who have helped shape modern Britain. Led by the India Centre in partnership with the Asian Media Group, Eastern Eye and the India Business Group, and part funded by UKRI India, the project explores the South Asian diaspora's sociocultural, economic, political, and intellectual impact on Britain over the past century. The first phase, completed in 2024, showcased the diverse contributions of leading figures including Sir Sajid Javid, Meera Syal, Azeem Rafiq, Neil Basu, Lord Dholakia, and the Southall Black Sisters. “The project has strengthened ties with the UK’s South Asian community,” said Sabu. A second phase documenting the stories of 90 more pioneers is expected to begin in 2026.

Through the Centre, University researchers are supporting a major water sustainability programme in Southern India led by Dr Kiran Bedi. Supported by a public-private partnership, the *Water Rich Puducherry* initiative is restoring lakes, improving water conservation and quality, and engaging young people. “We are preparing an impact evaluation report assessing the sustainability of the initiative, with a focus on ecosystem resilience and the wellbeing of local communities,” explained Sabu.

As Professor of Demography and Global Health, Sabu is also leading policy-relevant research with IIT Roorkee under a SPARC (Scheme for Promotion of Academic and Research Collaboration) project funded by the Government of India, examining the social determinants of disease burden among women of reproductive age in northern India.

EDUCATIONAL INNOVATION

In partnership with Mijwan Welfare Society (an Indian NGO championing rural women and girls), the India Centre offered students in the UK, India and Australia the opportunity to collaborate. Run together with the GRD College of Science, India, and the University of Western Australia, the *Kaifi Azmi Global India Virtual Internship programme* paired students to work on social enterprise projects in India, such as creating an e-commerce platform for rural women entrepreneurs, improving English proficiency for schoolgirls, and developing the Rozgar Dhaba employment database for rural communities in northern India. “This has been one of our most successful programmes, delivering meaningful outcomes for students and communities,” said Sabu.

In response to India’s growing global importance, the University now offers a new undergraduate module, *Emerging and Resilient India*. Taught by an interdisciplinary team, this module is open to students from all disciplines. It explores India’s political, social, economic, environmental, and cultural landscape, while examining the opportunities and challenges facing India. “We started with 40 students; now we have 75. Next year we’re aiming for 150,” said Sabu. “98 per cent are home students. They gain a whole new understanding of India.”



Lucia Hall,
Y2 BSc Business Management



The module has enlightened me to the huge importance of India as a powerhouse nation and given me a passion to explore this fascinating nation further.”

KNOWLEDGE EXCHANGE



Meera Syal

One of the Centre’s aims is to drive thought leadership in policy development, bringing together researchers, policymakers and business leaders.

The Centre’s *Global India Vision 2030* round-table series engages scientists, businesses and decision-makers in developing sustainable solutions to improve quality of life and wellbeing globally.

With the support of the Centre, Southampton Business School brought its *Global Leadership Conference* to Bangalore in 2023, and to Patna in 2019. The conferences assembled experts and key figures from industry to discuss ethical and organisational challenges facing business leaders.

The Centre leads the *Changing the World for the Better* lecture series, an interactive platform where experts share their research across diverse disciplines, fostering dialogue and collaboration. Its *Pioneers Fireside Chats* series during COVID-19 engaged the diaspora community, with guests including Meera Syal, Neil Basu, and Poppy Jaman. The Centre hosts three distinguished lecture series focused on key themes: sustainable development; arts and culture; and science, technology and innovation. Notable speakers have included the then Chief Justices of India’s Supreme Court, Dr. Dipak Misra and Dr. D.Y. Chandrachud, as well as former Scientific Secretary to the Government of India, Dr. Arabinda Mitra.



Find out more:

www.southampton.ac.uk/research/institutes-centres/india-centre-for-inclusive-growth-sustainable-development

LIGHTING UP FUTURES THROUGH SOLAR ENERGY

“In developed countries, the conversation around renewables can often seem like a matter of numbers, or of politics,” said Dr Stratis Batzelis, Lecturer in Electrical and Electronic Engineering at the University of Southampton. “But in developing parts of the world, renewables can transform people’s day-to-day lives.”





Stratis in Nanpara, Uttar Pradesh, with a local pump operator from Oorja Development Solutions during the trial of the Solar Pump Scheduler app

Stratis was struck by this realisation early in his career, whilst working on solutions for integrating solar energy into the grid. Since then, the transformative potential of renewable energy has shaped the direction of his research, leading him to a Royal Academy of Engineering Research Fellowship in Engineering for Development (2019-2024), and a focus on empowering poor rural communities in India through solar-powered electricity.

“When it comes to developing countries, solar energy in particular is not just a force for decarbonisation, it’s an enabler,” said Stratis. “Unlike other renewables, it’s very modular; you can have anything from a single cell to a system that supplies a whole city. It’s easy to install and repair – and nowadays it’s the cheapest source of electricity worldwide.”

Over the course of his Fellowship (started at Imperial College London and continued at Southampton since joining in 2021), Stratis has focused on two research strands: how to ensure that the grid can host more solar energy; and how to enable solar energy in isolated communities where there is no grid.

More solar into the grid

Stratis and his team looked in detail at the challenge of integrating solar energy into the grid in the UK and India, drawing parallels and looking at differences between the developed and developing world. Some challenges with the technology are universal, Stratis said: “The popular idea is that we can’t be solely reliant on solar because the sun doesn’t shine during the night – but it’s actually much more complex than that! There are many other factors around the stability and reliability of the system, especially related to the power electronics that mediate between the solar panels and the grid.”

Other challenges were specific to the Indian context. “We found that the Indian grid in rural areas is what we term a ‘weak grid’. That not only means frequent power cuts and intermittent electricity supply, but lots of technical challenges in deploying solar energy locally when it’s most needed,” explained Stratis.

“The network infrastructure, such as power lines and transformers, and generation mixture, such as from coal or hydro, make it hard to host too much solar power into the grid. India

derives a lot of energy from coal, which – quite apart from environmental concerns – is what’s known as an ‘inflexible’ source, meaning that it can’t quickly ramp its output up or down to complement intermittent generation from solar or wind farms.”

As a result of this analysis, the team proposed a pathway towards a high-solar grid, and began developing the innovations necessary to make this possible. These include the concept of solar systems operating below capacity to keep some power in reserve for grid support; and in collaboration with IIT Kharagpur, a solar power converter with supercapacitors and power-burst capabilities. The former is now used by operators worldwide, in both developed and developing countries, as a cost-effective alternative for more “grid-friendly” solar systems.

Solar-powered energy access

Stratis partnered with Oorja Development Solutions, an India-based solar energy company, to look at enabling energy access in remote communities. He explained that even

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Lighting up futures through solar energy



Dr Stratis Batzelis



When it comes to developing countries, solar energy in particular is not just a force for decarbonisation, it's an enabler ... It's easy to install and repair – and nowadays it's the cheapest source of electricity worldwide."

in villages connected to power lines, farmers were unlikely to have electricity access in their fields. "Oorja is leading the emerging sector of solar irrigation in India, with solar-powered pumps that draw water from underground to irrigate crops. This is very significant for marginalised farmers in particular."

Financially, it isn't viable to install batteries or water tanks for these systems in rural locations – but without storage, fluctuating energy supply might not meet the demand. Along with Oorja and partners at Imperial College London, Stratis developed a digital solution: a mobile app which forecasts the next day's solar energy and expected water output, capturing the water requirements of each farmer and using an optimisation algorithm to match farmers with timeslots. "Essentially, it's a sophisticated scheduling app with forecasting capabilities," he explained.

Stratis has recently received an EPSRC Impact Acceleration Account grant to test and deploy a tool to monitor the performance of these pumps. "We will implement digital twins of the pumps so that the system operator will know in real time how each pump is performing and raise flags if there are problems. This will make fault detection and resolution much faster."

Empowering communities

As part of his Fellowship, Stratis has also been involved in the RE-EMPOWERED (Renewable Energy EMPOWERing European and INdian communities) EU-India Horizon project. This multi-partner project is developing efficient, decarbonised and renewable-intensive local energy systems for isolated communities. At two pilot sites in India, Ghoramara and Keonjhar, microgrids have been introduced, along with tools to support communities in

achieving maximum benefit from their energy access.

Even in poor communities most families will have a simple, affordable smartphone. Taking advantage of this, Stratis led the development of a mobile app called ecoCommunity, designed to facilitate customers' interaction with the energy system and boost their energy access.

"ecoCommunity matches volatile solar generation with demand by incentivising people to use electricity at particular times. This is particularly important when you have a very small system, and customers are incentivised not only by savings but by having electricity for longer."

The app uses a traffic light system to indicate when it's a good time for small-scale tasks such as charging a phone, or large-scale consumption such as using agricultural

machinery. "ecoCommunity differs from other apps in that it's tailored for energy-disadvantaged contexts. So, for example, it also has a functionality around communal energy uses." RE-EMPOWERED introduced three-wheeler electric vehicles for essential transport in these small communities, with the app identifying optimal timeslots for charging at a communal point.

Changing lives

It is hard to overstate the benefits that electricity can bring to formerly cut-off communities, said Stratis. "Instrumental' is the word. Look at how an energy-disadvantaged community could miss out in terms of income, for example. Without electricity, an agricultural community can't effectively irrigate their crops; they can't refrigerate produce to access the right markets; markets themselves can't be held at night if there's no lighting." Electrical access changes all this, as well as opening up advantages. "Electricity is an enabler for better health, and for proper education for the next generation."

With the apps he is developing now midway along the path to full commercial readiness, Stratis is hoping to one day see them in use in people's daily lives. His mission is "to create a network of stakeholders, from the research partners to industries to the communities themselves, to develop solutions which really make a difference; to test those ideas on the ground; and then to put them out there on the market in a way which is financially sustainable.

"The path to impact is a long one! But I'm passionate about this research direction because it can have a tangible impact on people's lives."



Stratis at a rural village close to Kanpur, Uttar Pradesh, with a local family (left) and technicians from Boond solar (right)

NEWS IN BRIEF

PAVING THE WAY FOR UK-INDIA AI COLLABORATION



Responsible and Trustworthy AI Workshop, New Delhi, India

Gopal Ramchurn, Professor of Artificial Intelligence at the University of Southampton and CEO, Responsible AI UK (RAi UK), hosted a week of four key events in India in September 2024.

RAi UK is a flagship UK government initiative which is led by the University of Southampton. RAi UK's first international 'sandpit' event in India took place at the historic Neemrana Fort Palace near Delhi, bringing together 23 researchers from the UK and India for four days of collaboration to drive responsible Artificial Intelligence (AI) research. The sandpit sparked new ideas and fostered lasting connections, representing a step toward a more inclusive and ethical AI future across diverse cultures.

The 2024 Builders of Better AI: Responsible AI Hackathon at Indraprastha Institute of Information Technology Delhi (IIIT-Delhi) brought together 60 schoolgirls from across India, offering hands-on experience in AI and responsible innovation. Hosted by Gopal, the event marked a new strategic collaboration between RAi UK and Technovation's AI Forward Alliance (TAIFA), a global alliance working at the intersection of AI and gender.

A Responsible and Trustworthy AI workshop, hosted as part of the UK-India Technology Security Initiative, brought together leading researchers and innovators from the two countries. Delegates explored the ethical, social, and technical challenges in AI, including perspectives from Regius Professor of Computer Science and co-Chair of the UK government's AI Review, Dame Wendy Hall (pictured, centre, with Gopal, above).

The week was rounded off with an exclusive reception hosted by the British High Commissioner to celebrate the RAi UK – Centre for Responsible AI IIT Madras joint initiatives in India and the unique 'living bridge' between the two countries under the UK-India Technology and Security Initiative.



Professor Gopal Ramchurn

SPARKING GLOBAL ENTREPRENEURS

Spark India began as a small-scale cultural and social impact experience within the University's Social Impact Lab (SIL), taking around ten Southampton students to India each year between 2017-2022 (the programme ran online during COVID-19). Despite hundreds of applicants, spaces were limited. Now, with responsibility shifted to the Careers, Employability and Student Enterprise (CESE) team, Spark India is poised for significant expansion, welcoming participants from Southampton's UK, India, and Malaysia campuses and, eventually, universities worldwide.

Rooted in the United Nations Sustainable Development Goals, Spark India will aspire to offer three flexible pathways. The first is a one-week immersion, where students engage with innovative social projects and the real-world challenges they address. The second is a two-week intensive 'bootcamp,' guiding participants through the fundamentals of building impactful social ventures. Students can undertake either element separately or take the third pathway, which combines both for a comprehensive three-week experience.

Preparations are underway to secure funding and develop key partnerships, ensuring a successful re-launch by Summer 2026 in tandem with the Delhi campus. The guiding principle of Spark India remains the same: to empower the next generation of social changemakers, instilling them with deep cultural insights, practical skills, and a passion for sustainable change.



Thomas Simmonds from the Careers, Employability and Student Enterprise (CESE) team, who now leads Spark India

A family participating
in the HeLTI study



BREAKING THE CYCLE

Addressing the developmental origins of disease

Non-communicable diseases (NCDs), including cardiovascular disease, type 2 diabetes and depression, are rapidly increasing in low- and middle-income countries. In India, for example, an estimated 74 million people were living with diabetes in 2021; unchecked, diabetes could affect 124 million by 2040 (*IDF Atlas 2021*).

The Developmental Origins of Health and Disease (DOHaD) hypothesis, first proposed by Southampton's pioneering epidemiologist, the late Professor David Barker CBE, suggests that exposure to adversity (such as poor maternal nutrition, stress, or pollution) during early life can lower the metabolic capacity of tissues and increase adult NCD risk when combined with factors such as adult obesity and inactivity. Low birth weight, poor infant nutrition, rapid childhood weight gain and overweight/obesity are known risk factors for poor long-term health.

Against the backdrop of rapid economic development, India is experiencing what is known as the 'double burden of malnutrition' – high levels of undernutrition and overweight/obesity co-existing in the same population. 35 per cent of children under five, and 19 per cent of women of reproductive age, are underweight. This is reflected in the 18 per cent of babies born each year with low birth weight. At the same time, 24 per cent of women of reproductive age are overweight or obese (*NFHS 5*).

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Breaking the cycle

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DOHaD in India

For the last 30 years, Southampton's DOHaD specialists, including Professors Caroline Fall and K. Kumaran, have developed collaborations in India through a network of birth cohorts called SNEHA-India (Society for the Natal Effects of Health in Adults).

Kumaran, a professor of public health who began his career in India with Caroline, rejoined Southampton in the MRC Lifecourse Epidemiology Unit in 2012. Now based mainly in India, he researches early life factors affecting long-term health.

Findings from the SNEHA collaboration have shown that maternal undernutrition and low birth weight have a detrimental impact on foetal development, increasing vulnerability to diabetes and cardiovascular disease in later life. This is due, in part, to changes in foetal body composition.

Kumaran explained: "Indian newborns are typically light and thin but have relatively high body fat – a pattern known as the 'thin-fat Indian' phenotype. This body composition often persists into adulthood and is linked to a higher risk of diabetes and cardiovascular disease, even at lower BMI [Body Mass Index] levels compared to Caucasian populations. The impact of undernutrition in early life is worsened by poor weight gain during infancy, followed by rapid weight gain in childhood, increasing health risks even when overall obesity is not present."

Women who experienced foetal undernutrition have an increased risk of developing gestational diabetes during pregnancy, another risk factor

for diabetes in the next generation. Rates of gestational diabetes are rising rapidly.

HeLTI India

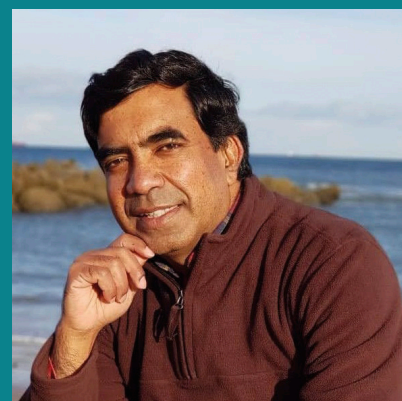
The Healthy Life Trajectories Initiative (HeLTI) is a 10-year international collaboration exploring whether women's health and nutrition before and during pregnancy influence their children's risk of becoming overweight or obese and developing NCDs, and whether this risk can be reduced.

HeLTI was developed by the Canadian Institutes of Health Research, the Department of Biotechnology of India, the South African Medical Research Council, the National Science Foundation of China, and the World Health Organization (WHO).

Previous research shows that good nutrition, health, and stimulation are crucial for foetal and child development. Building on this and the DOHaD approach, HeLTI studies in India (led by Kumaran), South Africa (led by Southampton's Professor Shane Norris), China, and Canada are testing evidence-based interventions from pre-conception through early childhood, to reduce childhood adiposity (body fat), improve child development, support maternal health, and lower long-term NCD risk. Unlike previous trials, HeLTI interventions begin before pregnancy is confirmed.

"During preconception we cover general health, diet, physical activity, mental health, screen time, sleep hygiene, pollution, and preparing for pregnancy," explained Kumaran. "In India we also provide micronutrient supplements to the women from pre-conception to six months postnatal.

Continued on page 21 →



Professor K Kumaran

OPTIMISE

A major new study will use data and biosamples collected by the HeLTI studies in India, South Africa, and China to investigate a possible link between inflammation and an inter-generational cycle of non-communicable disease (NCD) risk in low- and middle-income countries (LMICs). The £2million Medical Research Council-funded OPTIMISE project is led by Professor K. Kumaran and colleagues at Southampton.

"We think that recent dietary changes in LMICs may be associated with chronic inflammation which increases the risk of cardiometabolic diseases," explained Kumaran. "We're aiming to understand the nutritional factors causing inflammation and whether it is related to pregnancy complications affecting foetal growth and development. We will also assess whether improving women's diets before and during pregnancy mitigates these effects."

The researchers hope to see results within two years.



Delivering HeLTI interventions



From late pregnancy until the child is three, our Learning Through Play Plus programme includes cognitive behaviour therapy aimed at reducing maternal depression, and parenting interventions to promote child development.”

HeLTI team training local healthcare workers

“From late pregnancy until the child is three, our Learning Through Play Plus programme includes cognitive behaviour therapy aimed at reducing maternal depression, and parenting interventions to promote child development.”

HeLTI India differs slightly from the other studies. “We added a third arm where the interventions commence only once pregnancy is established to allow us to compare the benefits and costs of initiating an intervention preconceptionally versus in pregnancy only,” commented Kumaran.

Community support

The main study, based in the Mysore district of Southern India, began in 2021 and runs until 2030.

“We chose a rural population where undernutrition is common, but obesity currently is not,” commented Kumaran. The population is typical of much of India where the effects of economic transition are in the early stages. “If the interventions work, this group will likely benefit most,” he said.

With the help of Swami Vivekananda Youth Movement, a local health and social care NGO, the researchers engaged with local government, community leaders and women’s groups. “It would be impossible to do this kind of study without the support of the community,” said Kumaran. “Their perspectives contributed to the study design, helping us to finalise our interventions and delivery methods.”

Researchers selected 105 villages, randomly allocating 35 to each arm of the study (preconception, pregnancy and control). They aimed to recruit 6,000 women aged

18 and over, married, and planning to have children in the next two years. To date, they have knocked on 37,000 doors to find study participants, recruiting 4,600 women with 85% retention.

Biorepository

As well as delivering the interventions, researchers collect data and bio-specimens from participating families until the child is five. Samples are stored in a biorepository and sent for biochemical and molecular biology analysis. “We feed back test results and arrange referrals if there are any issues,” said Kumaran

The HeLTI team also shares health information with the wider community. From leaflets in the local language or pictorial formats, to community radio programmes, and stands at village fairs, topics include nutrition, sanitation, and disease.

They hold regular events with community leaders, study participants, local government and health professionals, to provide study updates and seek feedback.

Triple burden

“Preliminary findings suggest that our population is experiencing a triple health burden of malnutrition; with underweight, overweight/obesity, and anaemia (micronutrient deficiencies) co-existing, along with high rates of gestational diabetes,” said Kumaran.

Over 1,250 babies have been born in the India study so far, whose progress will be followed until they are five. Success, for Kumaran, will be “if the intervention reduces adiposity and obesity, and improves neurocognitive development at five years of age.

“This will hopefully track into adulthood, reducing their NCD risk.”

The team is seeing immediate impacts too. “Since we began, communities’ health literacy has improved and more women are engaging with healthcare, including coming to hospital for deliveries.”

Researchers are interacting with policymakers and feeding into international forums, such as UNICEF’s Advancing Preconception Nutrition in South Asia, the WHO’s Guideline Development Groups on Management of Wasting and Nutritional Oedema in Children under 5, and Management of Childhood Obesity.

Long-term, the longitudinal data and biorepository of specimens “will allow researchers to develop new DOHaD-related questions to investigate,” said Kumaran. Funding has so far been secured for studies on inflammation (see OPTIMISE, left), body composition, and gestational diabetes.

HeLTI data can be analysed by country and pooled across countries, generating evidence to guide policy in India and worldwide. “Our findings also open the way to integrating maternal and child health policies with NCD policy.

“Most importantly, the interventions have the potential to reduce undernutrition, obesity and gestational diabetes in women and promote healthy trajectories in their children,” concluded Kumaran.

 **Find out more:**
<https://helti.org/>

GAINING ADVANTAGE IN THE SHADOW EDUCATION ECONOMY

In a country with a burgeoning middle class and fierce competition for higher education places, it may seem natural that parents want to help their children get ahead. ‘Shadow education’, the informal coaching and tuition that exists alongside formal schooling, is sought by nearly 71 million students in India across educational levels.

Dr Achala Gupta, Co-Director of the Centre for Research in Inclusion in the University of Southampton Education School, is asking what advantages shadow education offers – and whether the system is fair.

Achala grew up within the Indian education system, and although she received parental support with her own learning, she saw most of her peers engage with shadow education. “I was an outsider to it, which made me more curious,” she said. Later, working on her PhD at the National University of Singapore, she discovered that there was a significant knowledge gap in this area.

Her early work focused on three dimensions of shadow education – why there is a need; how it gains social validity; and what it means for society. Her findings included a significant insight into why parents – many of whom are already paying for private schooling – are willing to also pay for tuition. “Whilst many parents in this situation had the economic capital to qualify themselves as middle class, they did not necessarily see themselves as having the cultural capital,” explained Achala. “This was perceived as being connected with things like educational background and social connections.”

Achala also gained insights into the importance of the student-tutor relationship, “often more familial than hierarchical in nature,” and into the shifting identities of teachers between the formal

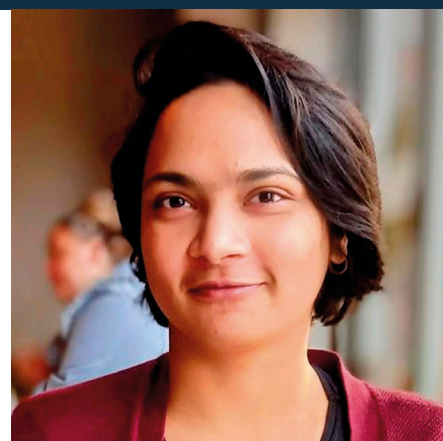
and shadow education systems. “Speaking with teachers, I found that they view themselves as entrepreneurs. They perceive a systemic shift in the buying and selling of education, and think, why shouldn’t they gain from it? They were reformulating their identity when they were traversing between the formal and shadow education landscapes.”

Coached habitus

The sociological concept of ‘habitus’ has formed the basis of Achala’s research in this area since joining the University of Southampton in 2021. The term refers to “dispositions reflected in how individuals perceive, conceptualise and perform in the social world,” said Achala.

She coined the term ‘coached habitus’ to describe a previously underexamined phenomenon: the part of a person’s social formation which happens through non-formal education.

Achala and her team conducted interviews with 30 postgraduate students from India studying at Russell Group universities in the UK in 2023. The interviews drew out individuals’ experiences of non-formal education in their educational lives: despite participants being selected only on the basis that they were Indian citizens who were studying for a postgraduate degree, all 30 were found to have engaged with shadow education at some point.



Dr Achala Gupta



Speaking with teachers, I found that they view themselves as entrepreneurs. They perceive a systemic shift in the buying and selling of education, and think, why shouldn’t they gain from it?”



Four transitions

“The core finding, published in the British Educational Research Journal, was that coaching influences educational transitions in precise, significant and meaningful ways throughout one’s educational trajectory,” said Achala.

Analysing the data from the interviews, she found four key transitions where coached habitus played a significant role. “The first transition is in the early schooling years, below the age of 16. At this stage parents would choose to engage academic help geared towards improving engagement with socially valued subjects such as English, maths and science.” As well as knowledge, participants gained “a positive relationship to learning. Coaching gave them meritocratic principles and nurtured their identity as a learner.”

During the second transition, the later schooling period and entering university, the focus of coaching shifted. “Here, it was all about learning to thrive in competition – how to do better than the person sitting next to you.” With exams on the horizon and university places at stake, students developed an intense awareness of where they stood in relation to their peers. Coaching ‘corrected’ and ‘enhanced’ their academic habits, preparing them to succeed in state-level or national exams for college admissions.

During the third transition – university and the period immediately after – coaching was more self-motivated and took place in diverse

formats, with participants engaging in peer tutoring and finding their own resources via social media such as YouTube. “By this stage, participants were clarifying and broadening their horizons, and acquiring the advanced skills they would need to have better opportunities after university. The identity developed at this stage was an enterprising self.”

The final transition for the participants had been moving abroad to study, and similarly at this stage coaching often took the form of influencers on social media platforms, including YouTube and LinkedIn. Participants felt they gained authentic insights into both the practical and cultural aspects of studying abroad – “the identity formed here was a transnational self, somebody who has transnational mobility on top of being academic, competitive and enterprising.”

Systemic problem

Achala is now developing further research on the use of the coached habitus concept. “I want to know, does it hold true in other countries? Will the transitions be different from those we found in India? How can we link coached habitus to related concepts like familial and institutional habitus?”

Her research has already shown that the role of shadow education is not limited to preparing students to secure good grades in the formal system. It shapes the whole of academic socialisation, forming fundamental aspects of students’ self-identity and

preparing them to successfully navigate through their academic life and beyond. As such, said Achala, “shadow education can strongly reinforce social inequalities.

“Whilst coaching and tutoring can provide support to students who are struggling, they can also be a means by which those with economic power gain an even more advantageous position,” she reflected. “Governments everywhere need to think about regulating the industry, which is a challenge because shadow education can take so many forms and is evolving as an industry with advanced technology (such as Artificial Intelligence).”

The conceptual work she is now developing will help policymakers to navigate this complex area – and has already been cited in a recent UNESCO report about the regulation of private tutoring. “The Indian Government’s 2020 National Education Policy identifies coaching as an issue, but they view it in narrow terms, as a school-level problem,” she said. “I’m keen to emphasise that there’s a deeper, systemic problem when parents feel they need to do this for their children, and when coached habitus is profoundly shaping the educational trajectory for some young people in a way that’s not available for others.”

Achala’s research on coached habitus is funded by Research Funding for the Southampton Education School, the Centre for Research in Inclusion (CRI), and by Leadership Effectiveness Education and Policy (LEEP).

NEWS IN BRIEF



Professor Katherine Newman-Taylor



A child supported by Dream a Dream

MAKING DREAMS A REALITY FOR DISADVANTAGED CHILDREN

Indian non-governmental organisation Dream a Dream (DaD) works with children and young people to develop the social, emotional and cognitive ‘life skills’ that have been compromised by growing up in poverty. The World Health Organization defines life skills as the abilities we all need to manage the demands and challenges of everyday life (WHO, 1997).

As part of a research and knowledge exchange collaboration, University of Southampton researchers from the School of Psychology have been sharing psychological, clinical and statistical expertise to support DaD in its mission, alongside training and supervision providers GreenWood Mentors Ltd. Dr Fiona Kennedy and Dr David Pearson have been involved with DaD since 2006, joined more recently by Professor Katherine Newman-Taylor.

“We are supporting DaD to optimise their programmes by drawing on psychological theory and practice – including cognitive behavioural therapies and attachment principles,” said Katherine. “We are also helping DaD measure the impact of their work on the social, emotional and cognitive development of children and young people.”

The partnership has resulted in several collaborative papers, and initial trials have helped DaD to demonstrate that their educationally framed programmes have a considerable impact on children’s development – putting these young people in a much stronger position to live well and find work in ongoing challenging circumstances.

DO WOMEN ON CORPORATE BOARDS IN INDIA MAKE A DIFFERENCE?

Associate Professor Anita Krishnan (Southampton Business School) has examined the impact of women on corporate boards of listed companies in India on their financial performance. Using a mix of market-based and accounting-based performance measures, she analysed data from 612 companies listed on the BSE (formerly Bombay Stock Exchange) between 2018 and 2023, focusing on the roles of women executive directors, non-executive directors, and women in leadership positions such as committee chair or CEO.

“Overall, having more women on boards was linked to stronger company performance in market measures,” said Anita. “However, when broken down by specific roles, the impact was often negligible or slightly negative.”

Anita’s research highlights a persistent lack of women in top leadership roles. Only 3.3 per cent of CEO positions were held by women across the study period. “There is a better chance of women being appointed as board members, although still not a critical mass,” said Anita. 13 per cent of firms had no women board members and women made up just 17 per cent of the corporate boards sampled.

“This is despite India’s Companies Act 2013 requiring these firms to have at least one woman on their board,” commented Anita. Many western countries have set 30 per cent quotas and report a positive relationship between more women board members and corporate performance.

“Firms in India have historically been reluctant to appoint women as committee chairs or CEOs,” said Anita. “Studies suggest that this reflects broader societal factors, including resistance to women in leadership positions.”

Anita’s research underlines ongoing challenges: “With 13 per cent of firms still non-compliant, my findings suggest that enforcement of existing laws must be improved. To achieve a critical mass and meaningful influence, I recommend setting a mandatory 30 per cent target for women’s representation on corporate boards.”



Associate Professor Anita Krishnan



3.3%

Only 3.3 per cent of CEO positions were held by women across the study period



Professor Lajos Hanzo

BUILDING THE NETWORKS OF THE FUTURE THROUGH UKI-FNI

Southampton academic Professor Lajos Hanzo from the School of Electronics and Computer Science has been appointed to the management board of the UK-India Future Networks Initiative (UKI-FNI), a landmark £1.1 million project to revolutionise the future of telecoms.

Led by Professor Gerard Parr from the University of East Anglia, with partners in multiple UK and Indian universities, this strategic collaboration will explore supply chain innovations for the hardware and software systems that support telecoms networks. The project will also develop a joint research strategy for the integration of terrestrial and non-terrestrial networks.

“Professor Parr (UEA), Professor Steve Hailes (UCL), Professor Toktam Mahmoodi (KCL) and myself have enjoyed a long and fruitful collaboration with the Indian research community, including the Indian Institutes of Technology in Delhi, Chennai, Hyderabad and Mandi, as well as with the Indian Institute of Science in Bangalore,” said Lajos. “This new project allows us to deepen and broaden our outreach to the wider telecommunications community in India and in the UK.”

As part of a related UK-India initiative with the University of Surrey, Lajos and the team were also successful in attracting additional research funding for innovating in the emerging field of integrated sensing and communications. “This project will look at new solutions for how wireless systems detect human activity, perceive and interpret their surroundings, and locate objects,” said Lajos.

ELECTRICITY FROM HUMAN WASTE WITH MICROBIAL CELL TECHNOLOGY

Microbial Fuel Cell (MFC) technology developed by Professor Yannis Ieropoulos, Head of the Civil, Maritime and Environmental Engineering Department at the University of Southampton, is making it possible to generate electricity from the sanitation of human waste. Microbes in the fuel cell break down organic matter, a process which both suppresses the pathogens involved in disease outbreaks, and converts chemical energy into electricity.

Now thanks to funding from the Engineering and Physical Sciences Research Council (EPSRC), the European Commission and the Gates Foundation, and partnerships with Birla Institute of Technology and Science (BITS) Pilani and Indian Institute of Technology (IIT) Palakkad in India, the technology is ready for commercialisation.

“The Gates Foundation has supported us to the point where the technology can be bought off-the-shelf, and made accessible to Low- and Middle-Income Countries (LMICs) like India,” said Yannis. BITS Pilani has integrated Yannis’s technology with their own systems and are trialling in Goa; IIT Palakkad is using it to train their sanitation engineers.

“We’re envisaging the technology going into communal toilets in rural communities, or being built into households, where it could supply electricity for lighting or phone charging,” said Yannis. “We are hoping to see it deployed in as many environments as possible.”

On top of energy generation and sanitation, the microbial cells have environmental benefits too. “It is a natural process – we’re enhancing the natural environment’s ability to deal with the organic pollutants that we have been mismanaging for decades.”



Professor Yannis Ieropoulos



A prototype of the microbial fuel cell

ALUMNI SPOTLIGHT: FINDING SUSTAINABLE SOLUTIONS

TACKLING THE MATERIALS CRUNCH

Dr Reshma Rao is a materials scientist whose research addresses the pressing global problems of diminishing resources and climate change. Reshma graduated from the University of Southampton with an MEng in Mechanical Engineering in 2014. Via a PhD at Massachusetts Institute of Technology, she is now Royal Academy of Engineering Research Fellow at Imperial College London, exploring the creation of green fuels and chemicals using renewable energy.

After completing her schooling in Mumbai, Reshma chose Southampton because of the world-class course. She credits her time at Southampton with setting her on her career trajectory.

“Southampton was the first place I had studied where the emphasis was on project-based learning and applying the knowledge. It helped me think that you can have a dream, and you can achieve it. It’s not just about transmitting the knowledge, it’s about giving someone the confidence and the network, and everything intangible that you get from a degree.”

During her PhD Reshma investigated technologies for clean air and clean energy applications. She returned to the UK in 2020, joining Imperial to pursue her post-doctoral studies. In 2022 she was awarded a Royal Academy of Engineering Research Fellowship. The five-year fellowship has allowed her to steer her own research direction.

Reshma’s current research aims to discover new active, stable and low-cost catalysts for green energy conversion. Catalysts are materials that speed up or enable specific, desirable, chemical reactions.

“I look at how these catalytic materials operate at the molecular level, why some catalysts fail to work as we intend them to, and how we can best optimise them to make clean energy.”



Dr Reshma Rao

Her group is investigating how seawater can be split to create green hydrogen fuel. Reshma explained: “Current technologies for hydrogen production require highly purified water. To make green hydrogen from seawater at scale would need water purification plants which would be extremely expensive to build. So, we’re thinking about how we can make catalysts that are resilient enough to directly split seawater [without the need for purification].”

“We work with industrial partners to see how the operating conditions of electrolyzers [devices that use electricity to split water into hydrogen and oxygen gas] affect the lifetime and efficiency of materials.”

The team is also looking at decarbonising the supply chain for the platform chemicals that go into pharmaceuticals, the beauty sector, and the chemical industry. “If we want to get rid of oil and gas, then we don’t just need to find another way of making energy, but another way of making all these other chemicals.”

“We’re working on green chemical synthesis, including how we can take biomass waste

“

Southampton was the first place I had studied where the emphasis was on project-based learning and applying the knowledge. It helped me think that you can have a dream, and you can achieve it.”

and upgrade it into something useful, to make these platform chemicals. And how we can make them using renewable energy.

“It’s an exciting time because we have so many different industries to decarbonise, and at the same time, there’s a huge materials crunch. So we’re thinking about how we can make these chemicals using as little material as possible.”

In 2023 Reshma won an India UK Achievers Honours award. The Honours marked 75 years of India’s independence and recognised 75 young Indian alumni who have made substantial contributions to their fields.

The award prompted her to reflect on her journey, after coming to the UK to study fifteen years ago. “I didn’t have family here; it was just me with two little suitcases at Heathrow.

“It makes you think about how far you’ve gone, and about having a dream, and an ambition. And how the UK’s society is very giving and nurturing in helping young people succeed.”

TURNING AGRICULTURAL WASTE INTO GREEN PACKAGING

Kaushal Shah came up with his award-winning business idea while studying for a Masters in Global Entrepreneurship at Southampton in 2015. He is now founder and CEO of Envopap which turns agricultural waste into environmentally friendly paper and packaging.

Before coming to Southampton, Kaushal worked in his family's paper and packaging business in India. During his Masters, he used his downtime to travel to packaging expos across Europe. "I always planned to return to the family business," he said. "I had no ambition to become an entrepreneur."

Through his engagement with the industry, Kaushal saw the urgent need for sustainable packaging solutions. He also recognised that the industry's shift from plastics to wood fibre-based materials could hasten deforestation. "The world does not have enough trees to sustain this transition," he explained.

Back in India, Kaushal was appalled by the burning of millions of tonnes of agricultural waste, primarily from sugarcane production, which was choking cities with acrid smoke and accelerating climate change. Kaushal believed that cellulose could be extracted from this waste to create environmentally friendly packaging materials. Agricultural stubble-burning is widespread not just in India, but in Australia, Africa and South America.

"We began aiming to address these two things and be part of the solution: by upcycling this waste but also by empowering farmers through collecting it and paying them a fair price."

Nearing the end of his Masters, Kaushal developed his ideas with support from his Southampton Business School supervisor Professor Laura Costanzo, basing his dissertation on his business plans. In April

2015, he incorporated the company before heading home and pitching the concept to his family.

"My grandfather, a second-generation entrepreneur running the business started by his father in 1965, said "If you manage to make enough money to sustain your expenses in England, you stay. If you don't, come back and rejoin the family business"," said Kaushal. "I guess entrepreneurship runs in our family."

Following graduation Kaushal began intensive research and development. The company's first product was printing paper – which, ten years on, is used around the world. "We have packaging materials too, from boxes to ecommerce materials and food packaging, all made from agriculture waste. We can add biopolymers derived from fruit and vegetables to provide oil- and water-resistant coatings on our fibrous food packaging."

The company continues to innovate, developing frozen food packaging and looking for replacements for common plastic and aluminium packaging.

33 thousand tonnes of Envopap's products have been sold in 62 countries. By transforming a waste product into a valuable resource, Envopap has reduced air pollution, provided farmers with additional income, and prevented 2.5 million trees from being felled for paper production. Their manufacturing creates 30% less carbon emissions than traditional production and their products are recyclable and biodegradable. In 2019, the company attained B-Corp certification for its commitment to social and environmental performance.

Having recently been awarded a patent for their innovative technology, Envopap is scaling up, building a facility in Mumbai to enable a ten-fold increase in manufacturing.



Kaushal Shah

"We're also looking for partners in different markets, where we can licence our technology to take local waste and sell to local customers."

Kaushal's vision is having a global impact. In 2021 he was named as one of Forbes magazine's '30 Under 30 Europe' outstanding young entrepreneurs. In 2023 he received both an India UK Achievers Honour, and a University of Southampton Outstanding Alumni Award. "It was a deep honour for me to get this recognition among such outstanding individuals," he said.

Reflecting on his time at Southampton, Kaushal said: "We had some excellent guest lecturers, including the founder of What Three Words. You read studies and articles but when people talk from experience, for me that was more meaningful."

As a student Kaushal made the most of the University's student enterprise opportunities. Now he supports the next generation of entrepreneurs. "I am proud to be on the Southampton Business School Advisory Board and to work with the Social Impact Lab, supporting social enterprises."

MAKING THE INVISIBLE VISIBLE

Empowering Dharavi's recycling workers

Dharavi, in central Mumbai, is among the world's oldest and largest informal settlements. At just over 2.39 square kilometres, it is home to an estimated one million people. Its informal economy, powered by thousands of micro-enterprises, has an annual turnover exceeding US\$1 billion (£750 million).



Sculptor and Winchester School of Art lecturer and researcher Ian Dawson undertook two residencies in Dharavi as part of the Rethinking Waste project at Compound 13 (C13) Lab.



Ian Dawson in Dharavi

Up to 80 per cent of Mumbai's hard domestic waste is recycled in Dharavi. Each week, thousands of tons of plastic arrive by rickshaw and are carried into the settlement's narrow alleys to be sorted, cleaned, and processed by up to 250,000 workers – mostly women – who earn as little as 10 rupees a day (eight pence). Despite their critical role in reducing landfill, incineration, and the city's carbon footprint, their work is largely invisible.

As Mumbai expands, Dharavi's central location makes it a prime target for redevelopment, putting its residents at risk of displacement.

Rethinking Waste

Sculptor and Winchester School of Art lecturer and researcher Ian Dawson undertook two residencies in Dharavi as part of the Rethinking Waste project at Compound 13 (C13) Lab, funded by the UK's Global Challenges Research Fund and the Arts and Humanities Research Council. The Lab, located within Dharavi's recycling district, is an experimental maker space established by Mumbai charity Acorn India, with Shiv Nadar University, Bath Spa University, and the University of the West of Scotland.

C13 Lab explores livelihoods and alternative futures, sharing knowledge and technologies with Dharavi's citizens through workshops and residencies in art, design, music, media, and science. Its programme is co-designed with local young people, using the materials and resources of Mumbai's recycling industry as the starting point for learning about ecological design and living solutions.

During his first visit in January 2020, Ian worked with 20 Lab members aged 11 to 15, introducing them to 3D scanning and printing. With equipment funded by the project, the group experimented with creating 3D-printed plastic portraits.

"They immediately turned the scanners on themselves," said Ian. Watching their images take shape in plastic—material they handle daily—sparked questions of identity and visibility. Ian encouraged them to "think about how their identity and the plastic are intertwined," and how they could use it to "make something that reflects themselves, rather than remain invisible." Alongside portraiture, the group scanned the *godowns* – warehouses where plastic is manually sorted



80%

Up to 80 per cent of Mumbai's hard domestic waste is recycled in Dharavi

and graded – creating digital maps of these unmapped, unacknowledged workspaces.

Creating visibility and building a future became a "rich vein" running through the residency. "We built towers with the 3D portraits," Ian explained. "Dharavi is constantly being torn down and rebuilt. These towers became symbolic of reclaiming that process and recognising that making can be collaborative and productive. In sculptural terms, when you make something improvisationally, you're projecting a future onto it, saying: 'This is what I can do.'"

Left: 3D printed portraits of young Lab members

Continued on page 30 →

Making the invisible visible

Migration and repatriation

Ian returned in January 2023 for a collaboration between C13 Lab and London's Horniman Museum, as part of a project connecting UK museum collections with their communities of origin. Most Dharavi residents are migrants from rural India and many are Muslim. The project explored parallels between human migration and the displacement of artefacts.

In early online sessions, young Lab members were introduced to the Horniman's Asian collection and invited to select five objects. "Interestingly, they chose ordinary, everyday items like a ghatam [a waterpot], a scythe, and a spice grinder," commented Ian.

Digital scans of these objects were sent to the Lab and 3D printed in recycled plastic. Some were quickly repurposed: a spice grinder became a visiting artist's palette; water pots were taken home by Lab members. "They were reabsorbed into Dharavi," said Ian. "Every now and then Lab members send me pictures of the objects still in circulation – it's a project with a long tail."

The augmented reality (AR)-enabled digital scans were also shared with Lab members, allowing them to use AR apps on their smartphones to place the objects, virtually, in their own homes. "It became a playful way to liberate these objects to become part of communities again."

Plastik ka Mela

The project culminated in Plastik ka Mela: Waste Work and the Art of Survival, a symposium in Mumbai in April 2023 which brought together environmentalists, Dharavi residents, academics, and artists – and saw the launch of *Waste Work: The Art of Survival* in Dharavi, a book co-authored by Ian.

An accompanying exhibition, Compound Terra Plastik ka Mela, took place in Maharashtra Nature Park, near Dharavi. The park is a remarkable story of ecological recovery, built on what was once a waste dump. Featuring works by artists and designers working with the Lab, the exhibition included 3D-printed portraits and objects from the residencies.

At its heart was a life-size mangrove tree digitally scanned and recreated using waste gathered from nearby swamps. The mangroves, said Ian, are "like non-human citizen activists. The branches collect the plastic caught in the tidal flow, while the roots clean the water." Like the homes and livelihoods of Dharavi's residents, the mangroves are under threat from development.

Since then, some of the work has featured in UK exhibitions curated by Ian: *The Waste Makers* on Cornucopia Street, (at Newhaven ArtSpace, and the Lethaby Gallery, Central Saint Martins), and *WASTEWORX* (The Winchester Gallery)—rethinking how we perceive and interact with waste.



A local resident with some of the 3D printed objects

Part of the conversation

By sharing emerging circular economy technologies, the Rethinking Waste project and C13 Lab are enabling the marginalised communities of Dharavi to explore safe, creative plastic recycling practices. The goal is to develop an ecological design curriculum, addressing the lack of art and design education in India, and acknowledging the critical role that artists, designers and skilled makers will play in India's sustainable future.

When Ian returned to the Lab in 2023, he found several young members pursuing creative careers in art, music-making and production. "They were successfully navigating the creative sphere," he said.

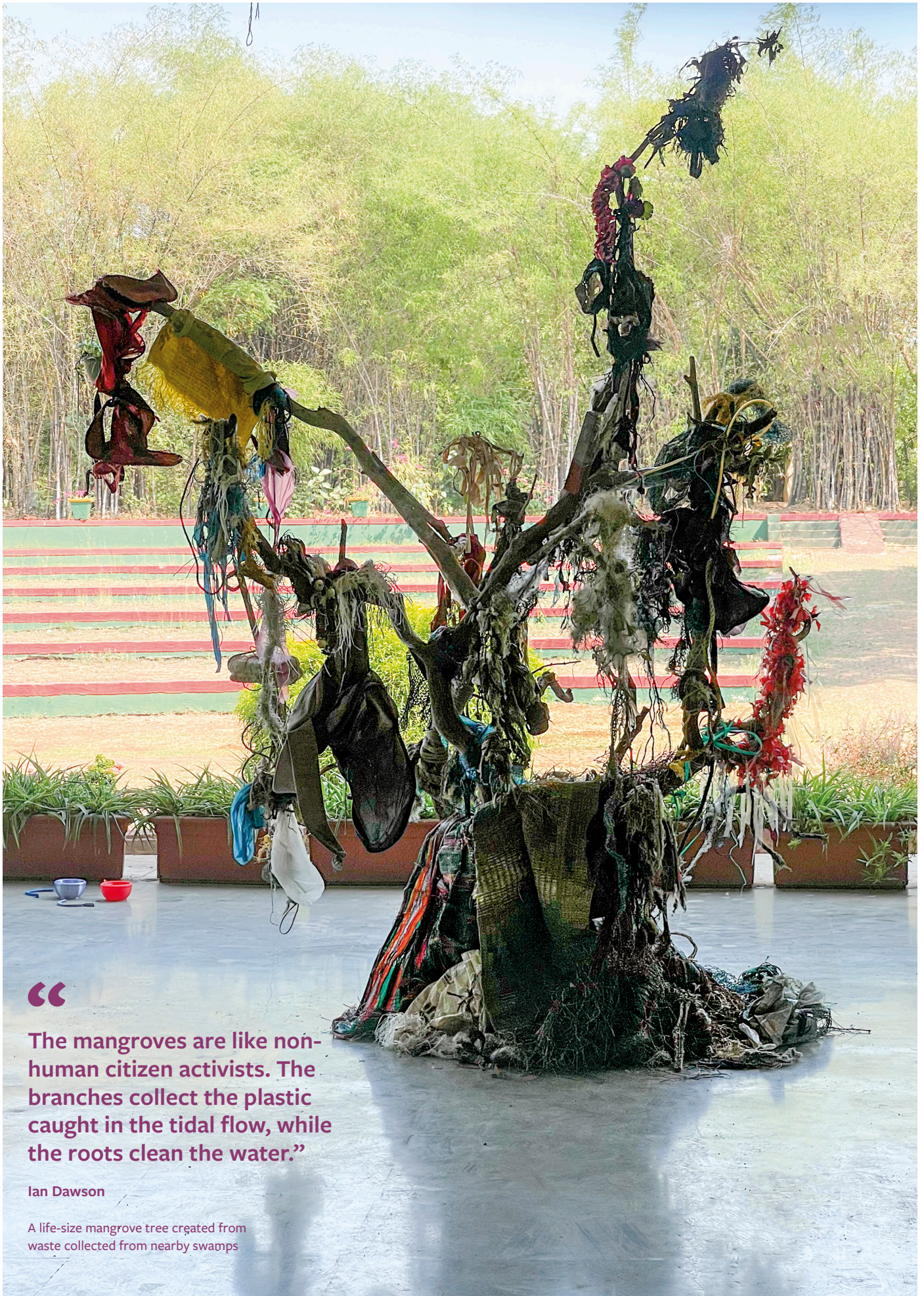
Ian emphasised the need to recognise the contributions of Dharavi's recycling workers—and to harness their innovation, resilience, and "remarkable materials knowledge" to help shape the technologically advanced city of the future "from below."

As the project concluded, the United Nations named Dharavi one of eight global sites for environmental study. "We worked to ensure Dharavi's voices were part of the conversation," Ian said.



C13 Lab members during the residency

 **Find out more:**
www.iandawsonstudio.com/waste.html



“

The mangroves are like non-human citizen activists. The branches collect the plastic caught in the tidal flow, while the roots clean the water.”

Ian Dawson

A life-size mangrove tree created from waste collected from nearby swamps

“

There were some people we spoke to who were really mourning the loss of the original sacred geography of Varanasi, and its connection to the multiple forms of Hinduism being practiced in the city.”

Dr Jen Dickinson



THE EVERYDAY SACRED

Spiritual sites and urban redevelopment

In the last decade, many Indian pilgrim cities considered as sacred sites have undergone redevelopment. These urban transformations have not only impacted the lives of local people from diverse religious communities but also influenced Indian diaspora communities in the UK (the largest ethnic minority in the country).

Dr Rishika Mukhopadhyay and Dr Jen Dickinson from the University of Southampton's School of Geography and Environmental Science – along with co-investigator Dr Saeed Ahmad at O. P. Jindal Global University in Haryana – have set out to investigate the role of the Indian state and diaspora in conceptualising, conserving and redeveloping sacred heritage. Their research project, running 2024 to 2026, spans cities across India and the UK.

The everyday sacred

“The urban redevelopment projects have come from both the former and current Indian governments,” said Rishika. “Our research looks particularly at the National Heritage City Development and Augmentation Yojana (HRIDAY) scheme, instigated by the previous government in 2015.”

Rishika, Jen and Saeed looked at archival material to understand the history of sacred sites; interviewed architectural and design firms who had led on redevelopment projects; and conducted field work in the three key cities of Varanasi, Puri and Amritsar.

Their findings suggest that the HRIDAY scheme, which centred on providing amenities and infrastructure such as water, sanitation and security in 12 cities identified as heritage hotspots, enhanced the tourism ecosystem. However, the current government’s redevelopment work, said Rishika, is often focused on developing corridors around temple sites leading to demolition and the overhaul of spatial design – as evidenced in the city of Varanasi.

Sacred geometry

“Varanasi made for an interesting case study because it has an important ‘sacred geometry’ which attracts many pilgrims, and

because it has seen interventions from both governments,” said Jen. The most sacred city of Hinduism, Varanasi is laid out in a network of pilgrimage routes, the shape of which holds spiritual significance.

“We used spatial ethnography to find out how the geometry is being changed. This observational technique documents changes to the layout of physical space, and to boundaries and movement patterns. This enables us to look at how these changes influence social interactions, experiences and perceptions, shaping the community’s everyday life and cultural use – as well as the symbolic meaning of the space.”

They found that changes to the city had affected local people in varied ways, including practical disruption, such as the influx of tourists which benefited the hospitality industry but negatively impacted other businesses in the old core of the city. Then there was spiritual disruption: “there were some people we spoke to who were really mourning the loss of the original sacred geography of Varanasi, and its connection to the multiple forms of Hinduism being practiced in the city,” said Jen. “Others were less bothered by changes such as the loss of smaller temples, for example, and were happy simply to go to the main temple.”

Varanasi also has a Muslim community with long-established social and economic networks in the city. The newly developed corridor is situated between a temple and a mosque that has been in the space for centuries.

“These are contested heritage sites,” said Jen. “What we’re trying to do in our research is go beyond simple narratives about conflict between religious communities.”

Claiming back heritage

As well as top-down government redevelopment, another strand of the project investigates initiatives driven from the bottom up by UK-based diaspora communities, who support the restoration of temples around India, as well as constructing new temples in the UK modelled after Indian sacred sites. “We wanted to explore everyday sacred impulses and practices and how these shape diaspora communities’ philanthropic motivations,” said Jen.

The researchers are currently speaking with a range of heritage advocacy groups in the UK who identify as being of Indian origin. “The diaspora is not homogenous, and we are consciously targeting groups which are diverse in terms of faith and gender, as well as linguistically and regionally diverse,” said Rishika.

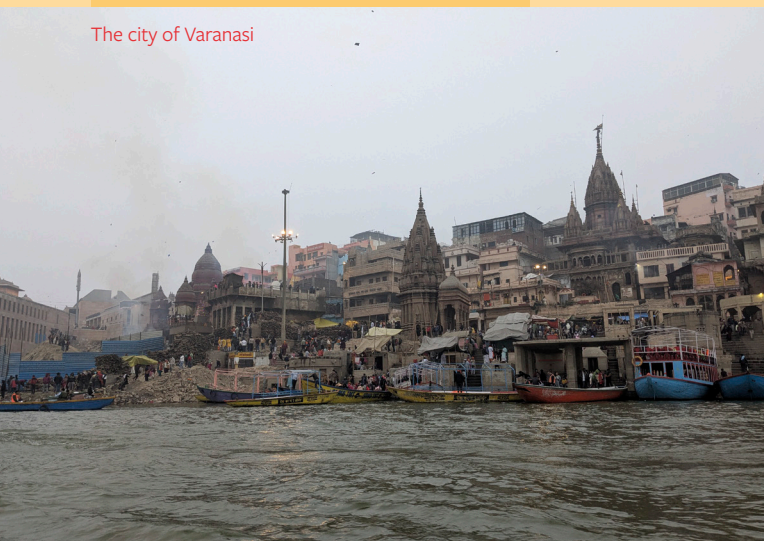


Jen and Rishika in Delhi with project Co-I Dr Saeed Ahmed

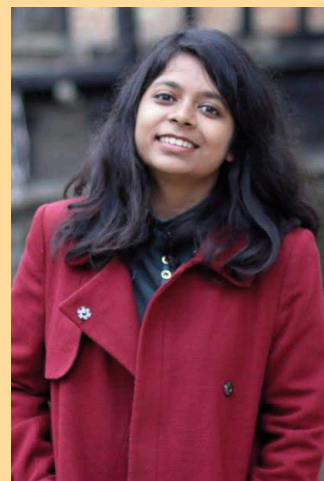


A HRIDAY site in Puri, now in disrepair

The city of Varanasi



Dr Jen Dickinson



Dr Rishika Mukhopadhyay

“

There is rising tension and conflict between communities all over the world around claims over sacred spaces, and we think this work has potential to restore nuance to that conversation, showing how people are connecting back to sacredness in constructive ways.”

Dr Rishika Mukhopadhyay

These interviews are revealing complex differences between and within groups – such as views in Sikh communities on the value of physical sites. “We found one community in Birmingham who have a particular connection to the Golden Temple in Amritsar, one of the holiest sites in Sikhism,” said Jen. “They haven’t only mobilised funds but have been instrumental in the diplomacy work needed to make the restoration possible, and intimately involved in having the Gurdwara restored to a specific historical period.

“Then there’s another group centred around the Southall Gurdwara in London who are interested in restoring non-material aspects of Sikhism such as poetry and sacred texts.”

Other diaspora groups, said Rishika, are focused on keeping traditions alive, such as devotional singing or painting. “This is very much a personal approach – a grounded, intimate connection with the sacred.”

The passing of religious practice between generations is emerging as a key motive for these communities, said Rishika, along with claiming back sacred heritage that has been lost to displacement, migration and inter-generational loss.

Restoring nuance

With the research project due to finish in March 2026, Jen and Rishika are beginning to share their findings with the public. A multi-sensory art exhibition at Southampton’s John Hansard Gallery in June 2025 focused on diaspora engagement, opening up questions around people’s relationship to their heritage.

“The Indian diaspora in the UK is one audience for this research, but I think the other is much wider,” said Rishika. Another

exhibition is planned in India in January 2026, and co-investigator Dr Saeed Ahmad will engage students at O. P. Jindal Global University to develop this output. In future the findings will have a pedagogical impact for students.

“We believe research has the power to shape positive public discourse,” said Rishika. “Through strong links with HRIDAY stakeholders (such as design firms) integrated in the policy networks, and through working closely with community heritage organisations in the UK, we hope to fulfil that purpose.”

“We would like to see a shift in policy narratives moving beyond polarised debates – but there’s a delicate balance to strike as these are sensitive issues,” added Jen.

“Longer-term, we would like to see the idea of sacred heritage itself being expanded,” reflected Rishika. “There is rising tension and conflict between communities all over the world around claims over sacred spaces, and we think this work has potential to restore nuance to that conversation, showing how people are connecting back to sacredness in constructive ways.”

‘Heritage revival through diaspora engagement: India-UK diasporic worlding practice’ is funded by the British Academy.



Contact:

r.mukhopadhyay@soton.ac.uk or
j.dickinson@southampton.ac.uk
if you are part of a UK Indian diaspora community and are interested in taking part in this research.

NEWS IN BRIEF

UKRI RESEARCH ENGAGEMENT EVENT STRENGTHENS SOUTHAMPTON-INDIA PARTNERSHIPS

UKRI India colleagues, led by Gaurav Gurung, Senior Portfolio Manager Technology and Innovation, provided an overview of research priorities identified by the UK and Indian governments at an engagement event in Southampton this spring.

Professor Jane Falkingham, Vice President Engagement and International, spoke about the University's vision for deepening engagement with India. "We already have a long track record of conducting world class research on, and with colleagues in, India. The opening of our new campus in Delhi presents an opportunity to extend this research into new areas and with a range of partners across India from Higher Education, Government and Business. I am truly excited to embark on the next phase of our journey, changing the world for the better."

Prof Sabu Padmadas, Director India Centre, explained, "Equitable research partnerships with India are the way forward for co-developing solutions that generate transformative impact at national and global levels. We co-create rigorous, evidence-based research that informs policy and accelerates inclusive social and economic transformation."

Launching the Global Partnership Award 2025 – exclusively focused on research collaborations with Indian partners – Maria Norton, International Partnerships Lead, highlighted: "The GPA is a mechanism to foster thought leadership and innovation which we are now channelling towards the co-creation of new India-UK research initiatives, thereby providing an opportunity to raise our profile with Indian partners, drawing on the diversity of our research community." The four winning collaborations will be invited to report on outcomes in 2026.



Attendees at the engagement event



iStock.com / Emilio Navarino

HELPING KERALAN FISHERS OPTIMISE DWINDLING FISH STOCKS

Researchers in the UK and India are supporting small-scale fishing communities in Kerala, India, as fish stocks are depleted by climate change, habitat degradation and marine pollution.

The research team, led by Southampton's Dr Bindi Shah, Associate Professor in Sociology, has developed an Android mobile phone app to help optimise fishing days.

The app enables fishers, organised into small groups, to communicate easily. When a boat goes out, they can share the GPS location of fish shoals, saving other fishers in the group time and fuel and helping stabilise incomes for the community.

Data collected through the app will be used by the researchers to better understand the state of the ocean in that region, supporting the development of sustainable fishing policies.

"Along with our Indian partners, we have researched the impact that climate change and biodiversity loss are having on the ocean and on traditional fishing communities in Kerala," said Bindi.

"Climate change and the anthropogenic factors are not going away, so we need to give marginalised communities accessible tools to mitigate some of those challenges."

The app will be trialled in Kerala, before being rolled out for wider use in the region. Public Policy Southampton's 'New Things Fund' enabled the app development.

Find out more:
www.youtube.com/watch?v=mxgl6lcfou

This work is part of a Royal Academy of Engineering interdisciplinary project between the Universities of Southampton, Exeter and Newcastle, and the Central Institute of Fisheries Technology, Kerala. Read more in [Re:action Spring 2023](#).



“

In our study, we combined a new measurement technique with deep data analysis to identify six new markers of TB. This could lead to a simple test that detects proteins in the bloodstream whose levels differ between people with TB, healthy individuals, and those suffering from other respiratory illnesses.”

Dr Hannah Schiff

NEW TEST TO STOP THE SPREAD OF TB

Tuberculosis (TB) is the world’s deadliest infectious disease, affecting 10 million people each year, and killing more than one million (World Health Organization (WHO)). India has more cases than any other country, with 2.8 million annually. 26 per cent of all cases in 2024 were in India (Global TB Report 2023, WHO). The Indian government has committed to eradicating TB.

Southampton researchers, in collaboration with experts from around the world, have taken a major step towards identifying millions of ‘silent spreaders’ of the disease. TB is spread when infectious people cough, sneeze or spit.

A study led by Dr Hannah Schiff from the NIHR Southampton Biomedical Research Centre (BRC) has identified a group of biological markers that occur in high levels among infectious patients. Hannah explained:

“TB remains a global catastrophe. Our efforts to control the spread are hindered by inadequate diagnostic testing, which is slow and reliant on specialist equipment and labs.

“In our study, we combined a new measurement technique with deep data analysis to identify six new markers of TB. This could lead to a simple test that detects proteins in the bloodstream whose levels differ between people with TB, healthy individuals, and those suffering from other respiratory illnesses.”

The team now hopes to identify collaborators in India to help implement these techniques to identify and treat individuals who are driving the country’s TB epidemic. Their research is part of a major interdisciplinary tuberculosis research programme at the University.

 **Find out more:**
<https://insight.jci.org/articles/view/173273>



Dr Hannah Schiff



“

Understanding black holes can allow us not just to better test our physical theories, but also give us clues as to what lies beyond our current theories.”

Professor Poshak Gandhi

UNLOCKING COSMIC MYSTERIES

“Astronomy research at Southampton is focused on some of the biggest questions in the field,” said Professor Poshak Gandhi from the School of Physics and Astronomy. “What are the fundamental components that shape our universe? What is the nature of extreme objects like black holes, how can they help us understand how galaxies grow?”

Thanks to Poshak’s partnership-building work, Southampton researchers are collaborating with IUCAA (the Inter-University Centre for Astronomy and Astrophysics) in Pune, India, to help unravel these cosmic mysteries.

IUCAA is a focal point for astrophysics in India. A dedicated research institute which brings together researchers and visiting students from across the country and beyond, IUCAA is involved in every large international astrophysics project that India has a stake in. The institute has 20 permanent astronomy faculty members, with a visitor programme welcoming more than 600 academic visitors every year to its lush green campus in Pune University.

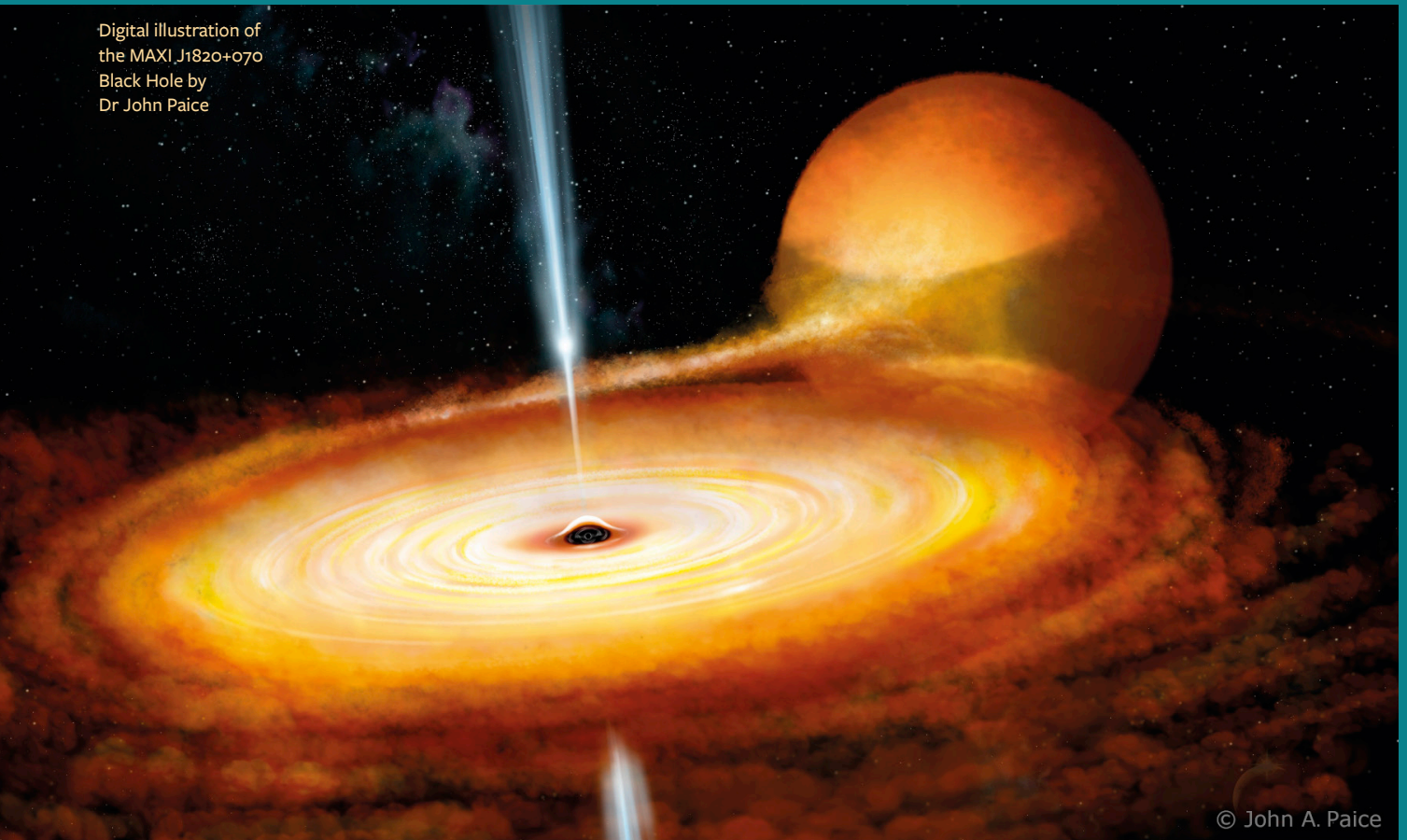
In total, the Southampton-IUCAA partnership has to date resulted in 315 publications in international peer-reviewed

journals; an Adjunct Professorship for Poshak at IUCAA; and two joint PhD studentships, with another being recruited for September 2025. Among many grant awards, the partnership has received two from UK-India Education and Research Initiative (UKIERI), which funds research collaborations between the two countries.

“A high point in the partnership so far was receiving a joint grant from the Global Challenge Research Fund in 2018,” said Poshak. “This allowed us to go into underserved communities in India and Nepal, inspiring students with scientific workshops, camps and study groups.” The best students were invited to travel to Southampton for a research project. “It was a privilege to be able to visit remote communities and help nurture the spark of curiosity in these research stars of the future.”

Unlocking cosmic mysteries

Digital illustration of
the MAXI J1820+070
Black Hole by
Dr John Paice



© John A. Paice

Another major highlight, Poshak said, was seeing a Southampton-IUCAA project on the cover of the journal *Nature Astronomy* in 2017. This research looked at the powerful jets of energy – known as relativistic jets – that shoot out from the vicinity of black holes. The research team led by Poshak measured the ‘blink of an eye’ delay between X-ray flares emitted from near the black hole and the appearance of visible light flashes, capturing new insights into how the jets behave.

The universe in multicolour

The Southampton-IUCAA partnership gained significant momentum in 2015 with the launch of the *AstroSat* mission, operated by the Indian Space Research Organisation (ISRO), with scientific support provided by IUCAA through its *AstroSat* Science Support Cell (ASSC). *AstroSat* is a multi-wavelength space telescope, able to detect light invisible to the human eye, on a mission to “study the universe in multicolour,” said Poshak. *AstroSat*’s multiple cameras can detect a range of wavelengths – including ultraviolet and X-ray – simultaneously.

“It’s really good for studying growing black holes, because they emit energy across most of the electromagnetic spectrum – you have to build up a multi-wavelength picture.”

Southampton, he said, was a natural partner to help make the most of *AstroSat*’s unique detection capabilities. “Our research on black holes is considered world-leading, so it was a confluence of respective strengths. I organised the first joint meetings in the UK, and we were then in a great position to leverage major grant opportunities.”

Southampton-IUCAA joint PhD student Shrabani Kumar led research published in 2024 looking at the behaviour of a supermassive black hole in NGC 4151, a galaxy in our cosmic neighbourhood, and the subject of much ongoing research. “This work tries to disentangle the central power-source in NGC 4151,” explained Poshak. “We know it’s a monster growing black hole, but there remain many uncertainties because it’s a system obscured by interstellar gas and dust. Shrabani used *AstroSat* data to pin down the amount of ‘stuff’ in the way, and to correct for it. She then proposed a new model for the environment around this black hole.”

Another joint PhD student, alumnus John Paice, led research (published 2019) which visualised the flickering of light around a stellar black hole called MAXI J1820+070. “We think this violent flickering holds clues to how the black hole is growing; to the chaotic conditions around the black hole;



Professor Poshak Gandhi



Our research on black holes is considered world-leading, so it was a confluence of respective strengths.”



Professor Ian Jones



Associate Professor (IUCAA)
Dr Debarati Chatterjee

and to how the matter's getting sucked in, with some of it spewed out before it can fall down the hole," said Poshak.

"This work was a real cross-fertilisation of ideas between Southampton and IUCAA."

Beyond current theories

All of this research puts Southampton and IUCAA at the vanguard of an increasingly significant field, said Poshak. "Black holes are of enormous interest right now, especially since the Nobel-prize winning detection of gravitational waves by the LIGO (Laser Interferometer Gravitational-Wave Observatory) project in 2015." Both Southampton and IUCAA are involved in LIGO, with international attention focused on India as it constructs its own gravitational wave observatory in the coming years (see right).

"Black holes are arguably the most mysterious objects in the universe," reflected Poshak. Their behaviour might seem a vastly remote subject, he said – but it can unlock crucial information about the workings of the universe.

"Understanding black holes can allow us not just to better test our physical theories, but also give us clues as to what lies beyond our current theories."

LIGO: "A NEW WAY OF DOING ASTRONOMY"

"When LIGO (Laser Interferometer Gravitational Wave Observatory) detected gravitational wave signals for the first time in 2015, it basically represented a whole new way of doing astronomy," said Ian Jones, Professor of Mathematical Physics at the University of Southampton.

These waves, ripples in the gravitational field caused by the movement of objects like stars and black holes, were originally theorised by Einstein in 1915. LIGO consists of two observatories located 3000 kilometres apart in Washington and Louisiana, USA, each an underground L-shape formed by four-kilometre-long vacuum tubes. "We bounce laser beams up and down the arms of the L and the beams get reflected off mirrors at the ends," explained Ian. "They bounce back and recombine, and it's by looking at that recombination that we can detect a passing gravitational wave."

The LIGO project is funded by the U.S. National Science Foundation, along with contributions from other countries, including a significant UK contribution via the Science and Technologies Facilities Council. The project draws in collaborators from over 80 scientific institutions around the world – including Southampton and IUCAA – as well as working with the similar Virgo observatory in Italy and KAGRA (KAmioka GRAvitational wave detector) in Japan.

Ian works alongside an international group of researchers to mathematically model the sorts of signals that LIGO is looking for, helping to make and interpret detections. His colleagues include Debarati Chatterjee, who is an Associate Professor at IUCAA, and now Chair of Education and Public Outreach for a huge new initiative.

There are plans to build a third LIGO detector in India, with funding from the Indian government and IUCAA as the leading scientific stakeholder. "When the new observatory is complete in 2030 it will play a crucial role in the global gravitational wave network by drastically improving our ability to pinpoint where gravitational waves are coming from," said Debarati. "This improves our chances of also detecting electromagnetic emissions from the waves' sources, which is a game-changer for the emerging field of multi-messenger astronomy [the study of cosmic events using multiple types of signals]."

"Building this detector on Indian soil will put India at the forefront of research in this emerging field."



The Laser Interferometer Gravitational-Wave Observatory (LIGO), Livingston, Louisiana, USA.
iStock.com / Roberto Michel

THE AI HELPING REVEAL THE SECRETS OF INDIA'S MANGROVE FORESTS

Tangled roots, shifting tides and thick mud make mangroves some of the most challenging environments to study—but the need to understand them better is critical. These unique coastal forests absorb carbon two to four times faster than other tropical forests, and play a vital role in climate regulation, biodiversity, and coastal protection. Yet in India they remain severely understudied, particularly when it comes to understanding how they capture and store carbon.



Now, a research collaboration between the University of Southampton, the Indian Institute of Technology (IIT) Kharagpur, and India's Space Applications Centre (ISRO-SAC), Ahmedabad, is offering an innovative new way to measure vital ecological indicators in Indian mangroves.

Led by Southampton postdoctoral researcher Dr Somnath Paramanik (Geography and Environmental Science), the collaboration has resulted in the first allometric model for estimating Leaf Area Index (LAI) in mangroves. An allometric model is a set of equations used to show how one part of a living organism relates in size to another part or the whole. For example, instead of measuring every leaf, an allometric model estimates leaf area based on a biological variable such as the tree density, or its trunk diameter or height.

Why LAI matters

Leaf Area Index (LAI) is a measure of how much leaf surface area exists in a forest canopy. It is a key proxy for understanding sunlight absorption, carbon intake, water retention – and overall forest health. “LAI is central to ecological, physiological, and climatological studies,” said Somnath.

Traditionally, establishing LAI has meant cutting down trees and painstakingly measuring leaves – destructive, time-consuming and impractical in hard-to-reach ecosystems like mangroves. “Our goal was to find a simpler, cheaper, and scalable way to estimate LAI without harming the forest,” said Somnath.

Fish-eye lenses and satellites

The study focused on the biodiverse coastal wetland of Bhitarkanika Wildlife Sanctuary in Odisha, India's second-largest mangrove

forest and a Ramsar site (a designated wetland of international importance).

To estimate the forest's LAI the researchers used a technique called digital hemispherical photography (DHP). This involves taking upward-facing fisheye photographs from beneath the canopy and analysing how much of the sky is visible through gaps in the foliage. By measuring these gaps, scientists can infer how much leaf area is present above.

Using their allometric model, the team then linked the DHP-derived LAI to three forest inventory variables collected during fieldwork: tree height (Ht), diameter at breast height (DBH), and tree density (TD). These data, widely available for many forest types including mangroves, are often used to understand the carbon dynamics of an ecosystem.

“Most allometric models use only one variable, like DBH or tree height,” said Somnath. “Our model uses several variables together, which potentially makes the results more accurate and reflective of real-world variability.”

What made the model especially innovative was its use of symbolic regression, a type of AI that discovers the best-fitting equation without relying on pre-defined formulas being fed into it. “Allometric models usually use simple linear equations,” Somnath explained. “Instead, we used a ‘genetic algorithm’ that learns directly from the data by testing many possible mathematical expressions to find the best fit.

“Mangroves are critical to climate crisis mitigation and coastal resilience,” he added. “But they’re under pressure from sea level rise, pollution, and deforestation. By using commonly collected forest inventory data, our model has potential to be applied across the country, helping to build a detailed dataset for Indian mangroves, filling a major knowledge gap, and allowing for large-scale monitoring.”

In addition to establishing LAI, the project focused on identifying the mangrove species present in the forest and assessing their health by estimating chlorophyll concentration. The team used AI and hyperspectral data collected by a joint Indian Space Research Organisation (ISRO) and NASA mission (AVIRIS-NG) in 2015/16.

Hyperspectral imaging is a technique that uses airborne sensors to capture images of the light reflected from the Earth’s surface

across a wide range of wavelengths. This data is then processed to extract a detailed light spectrum for each pixel in the image. The resulting information allows scientists to study vegetation, soil, water, and other materials using spectroscopic analysis—a method that reveals the composition and properties of materials based on how they interact with light.

The researchers assessed leaf-level chlorophyll concentrations using a spectrophotometer – an instrument that measures how much light a substance absorbs at different colours or wavelengths, and a handheld device called a SPAD (Soil Plant Analysis Development) meter which can estimate how much chlorophyll is in a plant’s leaf.

A global collaboration

The project began during Somnath’s PhD at IIT Kharagpur, where he worked in partnership with ISRO-SAC. It continued at Southampton’s School of Geography and Environmental Science when he joined as Newton-Bhabha PhD Fellow (funded by the British Council and the Indian Department of Biotechnology), supervised by Professor Jadunandan Dash. The international collaboration blended fieldwork, remote sensing, and AI modelling techniques.

“One of my PhD goals was working with leading experts across institutions,” said Somnath. “The project has built a bridge between IIT Kharagpur, ISRO, and Southampton.”

After his PhD, Somnath stayed on as a postdoctoral researcher in Professor Dash’s



Dr Somnath Paramanik

lab, working on a European Space Agency-funded project expanding his mangrove research using next-generation Earth observation data.

Next-gen remote sensing

With the upcoming launch of *NISAR* – a joint Indian Space Research Organisation (ISRO)-NASA satellite mission – and the European Space Agency’s *Biomass* and *CHIME* missions, researchers should soon have access to high-resolution radar and hyperspectral data.

“We’re planning a new phase of the study and field campaign,” said Somnath. “These new datasets could allow us to improve our model, and how we estimate key characteristics of vegetation and ecosystems, and species-level mangrove classification.”

Left:
Digital hemispheric photograph of mangrove forest

Right:
Field sampling in mangrove forests is very challenging

Far right:
Taking SPAD measurements for chlorophyll



RESEARCH AWARD HIGHLIGHTS

This list encompasses a selection of awards logged with University of Southampton Finance from January to March 2025 that are not considered commercially sensitive.

FACULTY OF ARTS AND HUMANITIES

Dr Charlotte Unruh; School of Humanities

Meaningfulness and Automation

British Academy; £9,004 over 24 months

Prof Nazmul Karim; Winchester School of Art

Sustainable Electronic Textiles for Wearable Point-of-Care (PoC) Systems

EPSRC; £48,292 over 15 months

FACULTY OF ENGINEERING AND PHYSICAL SCIENCES

Prof Peter Kazansky; Optoelectronics Research Centre

Ultrashort pulsed laser nanostructuring of packaging material surfaces for food safety applications

British Council; £79,561 over 36 months

Prof Phillip Joseph; School of Engineering

Horizon Europe – WATER-LDL

European Commission; £212,452 over 24 months

Prof Simon Cox; School of Engineering

RETRO-Priority Forest Wilding Pump Priming Need: Detecting Pine Marten with UAVs

Forestry Commission England; £26,320 over 6 months

Prof Periklis Petropoulos; Optoelectronics Research Centre

Renewal of National Dark Fibre Infrastructure

EPSRC; £317,493 over 36 months

Prof Simon Hettrick; School of Electronics and Computer Science

Evidence-led curation skills for sensitive data

EPSRC; £86,893 over 27 months

Prof Christian Knigge; School of Physics and Astronomy

Line-Driven Disk Winds in Active Galactic Nuclei

Science And Technology Facilities Council;

£456,765 over 36 months

Dr Collin Sones; Optoelectronics Research Centre

Understanding the clinical pathway for early-stage point-of-care testing of Sepsis

EPSRC; £291,625 over 30 months

Prof Anna Peacock; Optoelectronics Research Centre

3D Polysilicon Photonics – A New Platform for Integrated Optoelectronics

EPSRC; £1,054,715 over 36 months

Dr Richard Boardman; School of Engineering

NXCT Core equipment 2024

EPSRC; £36,000 over 18 months

Dr Saeed Hosseinzadeh; School of Engineering

HORIZON EUROPE MSCA Postdoctoral Fellowship – Development of a Numerical Model for Wind-Assisted Ships – FSI Modelling and Fatigue Analysis for Sustainable Ship Propulsion

European Commission; £212,452 over 24 months

Dr Martynas Beresna; Optoelectronics Research Centre

Innovative scattering-based optical interrogation for high sensitivity detection of arsenic contamination in groundwater

British Council; £49,924 over 18 months

Prof Mark Sullivan; School of Physics and Astronomy

Horizon Europe MSCA Postdoctoral Fellowship – DAWNS – Dark energy Analysis for W and Next-generation Surveys (Brodie Popovic)

European Commission; £200,268 over 24 months

Dr Minkwan Kim; School of Engineering

Impact of Space Activities on the Earth Atmosphere

Global satellite Operators Association; £53,552 over 6 months

Dr Marcus Newton; School of Physics and Astronomy

Multifunctional Materials Imaging of Nanoscale Devices in Three Dimensions (MIND-3D)

UK Research and Innovation; £708,074.73 over 36 months

Dr Mehdi Kashani; School of Engineering

Horizon Europe – AIESHM – MSCA-PF-2024- Masood Mohandes – MEHDI KASHANI

European Commission; £212,452 over 24 months

Dr Katherine Kwa; School of Engineering

NextGen Anchor Design: Harnessing the potential of probabilistic surrogates and seabed evolution modelling

EPSRC; £92,461 over 12 months

Dr Patrick Ledingham; Optoelectronics Research Centre

ESA Quantum Memory ITT

European Space Agency; £66,633 over 9 months

Prof Yannis Ieropoulos; School of Engineering

A mathematical modelling and computationally-assisted approach based on gene regulation to predict bioelectrochemical systems performance for water resilience

Cyprus Research & Innovation Foundation; £3,704 over 24 months

Dr Daniil Yurchenko; School of Engineering

Horizon Europe-SURE IDEAs-Structural Uncertainty-oriented REgularization Framework for Inverse Design of Engineering Applications

European Commission; £200,268 over 27 months

Dr Shoaib Ehsan; School of Electronics and Computer Science

PRIV-LOC: Assessing and Mitigating Privacy Risks of Vision-Language Models in Image-based Geolocation Systems

EPSRC; £204,957 over 12 months

Dr Dikai Guan; School of Engineering

HORIZON EUROPE – DREAM – Intelligent Degradation Control of Biomedical Rare-Earth Magnesium Alloys

European Commission; £212,452 over 24 months

Dr Dikai Guan; School of Engineering

HORIZON EUROPE – E-AH-MMEAC – Engineering Architecturally Heterogeneous Multi-Material Multi-Principal Element Alloy Composites

European Commission; £212,452 over 24 months

Dr Gregory Perry; School of Chemistry

Dual Function Reagents

EPSRC; £516,627 over 36 months

Dr Gregory Perry; School of Chemistry

Decarboxylative Metal-Halogen Exchange: Generating Metalating Agents and CO₂ In Situ for Carboxylation and Carbon Isotope Labelling

Royal Society of Chemistry; £5,000

Dr Kang Ren; School of Engineering

Energy harvesting from liquid sloshing using dielectric elastomers

Royal Society; £30,000 over 12 months

Prof Eileen Yu; School of Chemistry and Chemical Engineering

C-Circ: Accelerating the translation of CO₂ Electrolysers

EPSRC; £252,490 over 24 months

Dr Daniel Zabek; School of Engineering

Manufacturing New Class of Ferrofluids for Thermomagnetic Convection Enhanced Heat Transfer, Energy Generation and Storage

Royal Academy of Engineering; £61,311 over 6 months

FACULTY OF ENVIRONMENTAL AND LIFE SCIENCES

Prof C. Patrick Doncaster; School of Biological Sciences

Developing novel methods to understand and mitigate grey squirrel bark-stripping behaviour

Department for Environment, Food and Rural Affairs; £231,190 over 36 months.

Prof Lisa Roberts; School of Health Sciences

Apni Jung (our fight) against rheumatoid arthritis; fEasibility of an online Learning patient Education programme for improVing outcomes in pAtients from a minority eThnic background in England (ELEVATE)

National Institute for Health and Care Research; £30,979 over 24 months

Prof Lisa McNeill; School of Ocean and Earth Science

Testing Models of Active Extension (TMAX)

Natural Environment Research Council (NERC); £673,113 over 36 months

Prof Lyn Ellett; School of Psychology

Evaluating the Effectiveness of Mindfulness-Based Therapy for SMI Implemented in a Community Mental Health Setting

National Institutes of Health – USA; £58,740 over 60 months

Prof Lynn Calman; School of Health Sciences

Understanding psychological distress and support needs of people diagnosed with non-smoking lung cancer.

The Ruth Strauss Foundation; £47,432 over 12 months

Prof Sybren Drijfhout; School of Ocean and Earth Science

Subpolar gyre Observations, models and AI to Resolve Tipping points and provide Early warning Detection (SORTED)

Advanced Research and Invention Agency (ARIA); £71,204 over 36 months

Dr Natalia Tejedor Garavito; School of Geography and Environmental Science

Enhancing Resilience of critical subsea telecommunications connections for South Pacific Small Island Developing States (SIDS)

United Nations; £95,591 over 24 months

Prof Dianna Smith; School of Geography and Environmental Science

Food Aid Inequality Rectified (FAIR-food)

BBSRC; £1,489,022 over 36 months

Prof Justin Sheffield; School of Geography and Environmental Science

Understanding the spatio-temporal variability of soil moisture and its feedbacks across scales

Natural Environment Research Council (NERC); £759,708 over 36 months

Research award highlights

Dr Euan Sadler; School of Health Sciences

Co-production of an evidence based, patient-centred communication guide delivered by physiotherapists to improve self-management support for older people with complex multiple long-term conditions and their carers in the home setting

National Institute for Health and Care Research;
£173,031 over 15 months (as part of a larger award with University College London and Dorset Healthcare University NHS Foundation Trust)

Dr Bieito Fernandez Castro; School of Ocean and Earth Science

Autonomous Profiling observations to unravel the role of mixing in North Atlantic climate tipping points (POLEMIX)

Advanced Research and Invention Agency (ARIA);
£4,999,337 over 60 months

Dr Fatima Pereira; School of Biological Sciences

In situ single-cell metabolic profiling of the microbiota and its control by the immune system

BBSRC; £651,712 over 36 months

Dr David Evans; School of Ocean and Earth Science

The correlative cryo-analytical centre: a globally unique facility for combined cryo-electron microscopy and cryo-elemental imaging

Natural Environment Research Council (NERC);
£750,000 over 30 months

Dr Alessio Bellato; School of Psychology

Establishing the 'South-East Asia Mental Health Consortium' (SEAMHC)

The Academy of Medical Sciences; £24,990 over 12 months

Dr Veronica Zamora Gutierrez; School of Biological Sciences

Implementation of bespoke Uncrewed Aerial Vehicles (UAV) conservation technologies in subterranean habitats for bats as keystone species

Royal Society; £28,038 over 12 months

Dr Kif Liakath-Ali; School of Biological Sciences

Decoding RNA-Binding Proteins at Isoform-Level: Unraveling Their Role in Neurodegeneration

Royal Society; £29,992 over 12 months

Dr Triana Amen; School of Biological Sciences

ABCD1-specific probes to distinguish between benign and pathogenic variants of ABCD1 for improved accuracy in newborn screening programs for ALD

European Leukodystrophy Association (ELA);
£131,696 over 24 months

Dr Jeff Thompson; School of Biological Sciences

How does a single cell type build diverse shapes and structures during skeletal development?

BBSRC; £717,015 over 36 months

FACULTY OF MEDICINE

Prof Philip Calder; Human Development and Health

Analysis of samples from University of Liverpool study

The Academy of Medical Sciences; £5,629 over 6 months

Prof Mark Cragg; Cancer Sciences

Evaluating efficacy and toxicity of the agonistic antibody clamp technology

Cancer Research UK; £160,142 over 12 months

Prof Chris Byrne; Human Development and Health

Cost effectiveness evaluation within REFLEX Study

Echosens; £151,549 over 12 months

Dr Lydia Newman (supervisor Prof Ying Cheong); Human Development and Health

Improving knowledge and education of fertility and pregnancy in primary ciliary dyskinesia

National Institute for Health and Care Research;
£512,641 over 36 months

Prof Ingrid Muller; Primary Care, Population Sciences and Medical Education

"It takes a village": Mapping healthcare support in the perinatal period using a participatory approach (MaPP)

National Institute for Health and Care Research;
£21,924 over 12 months

Prof Miriam Santer; Primary Care, Population Sciences and Medical Education

A pragmatic randomised trial comparing Oral Corticosteroids and Colchicine for the treatment of goUt flaRes in people with relative contraindications to non-steroidal anti-inflammatory drugs (the OCCUR trial)

National Institute for Health and Care Research;
£46,214 over 42 months

Dr Adam Geraghty; Primary Care, Population Sciences and Medical Education; in collaboration with the University of Bristol

Psychoeducational support for patients with prosthetic joint infection

National Institute for Health and Care Research;
total award £217,386.00 over 21 months

Dr Liku Tezera; Clinical and Experimental Sciences

Investigation of Mechanotransduction in Tuberculosis in Search of Therapeutic Targets

The Academy of Medical Sciences; £92,485 over 24 months

Dr Rosie Essery; Primary Care, Population Sciences and Medical Education

Optimising Acne Care Online for ethnically diverse skin tones

National Institute for Health and Care Research;
£218,375 over 15 months

Dr Matthew Blunt; Clinical and Experimental Sciences

Development of Natural Killer cell immunotherapy for Gastrointestinal Stromal Tumours (GIST)

Sarcoma UK; £58,923 over 12 months

Dr Taeko Becque; Primary Care, Population Sciences and Medical Education

Placebo blinding in randomised trials of respiratory infections in primary care: a meta-epidemiological study

National Institute for Health and Care Research; £39,783 over 12 months

Dr Hilda Hounkpatin; Primary Care, Population Sciences and Medical Education

Enhancing fairness and accuracy in AI models by tackling bias in primary care electronic health records (EHR): a rapid scoping review

National Institute for Health and Care Research; £18,310 over 3 months

Dr Hilda Hounkpatin; Primary Care, Population Sciences and Medical Education

NIHR Development and Skills Enhancement award

National Institute for Health and Care Research; £74,412 over 12 months

Dr Mark Burton, Senior Research Fellow; Human Development and Health

The skeletal muscle sncRNA/metabolite interactome as a biomolecular marker and mediator of sarcopenia

The Dunhill Medical Trust; £346,436 over 48 months

Prof Tim Fenton; Cancer Sciences

APOBEC3B: essential gene for some and optional extra for others?

Leverhulme Trust; £219,155 over 36 months

Dr Hollie Birkinshaw; Primary Care, Population Sciences and Medical Education

ELEVATE: Exploring Lived Experiences and Views on Antidepressant Treatment in Chronic Pain: A Qualitative Study

National Institute for Health and Care Research; £34,906 over 12 months

FACULTY OF SOCIAL SCIENCES

Prof Leor Barack; School of Mathematical Sciences

LISA Ground Segment: Support For 04/2025 – 09/2025

Science And Technology Facilities Council; £24,621 over 6 months

Prof Leor Barack; School of Mathematical Sciences

Self-force in black hole scattering as a precision probe of inspiral-merger dynamics

Science And Technology Facilities Council; £449,997 over 36 months

Dr Benjamin Leather (supervisor Prof Adam Pound); School of Mathematical Sciences

Marie Skłodowska-Curie Fellowship – NEXTGW – Next-Generation Gravitational Waveforms

European Commission; £200,268 over 24 months

Dr Tae-Hee Choi; Southampton Education School

Promoting Women Leadership in Cambodian Higher Education: Challenges and Future Direction

Southeast Asian Ministers of Education Organization Regional Centre for Higher Education and Development (SEAMEO RIHAD); £1,808 over 9 months

Dr Wahyu Jatmiko; Southampton Business School

Financing Disability Inclusion in Higher Education: The Case of Indonesia

British Council; £24,997 over 18 months

Prof Pete Fussey; School of Economic, Social and Political Sciences

CRIMKNOW: Private knowledge, public issues: Digitalization and private economies of knowledge in criminal justice

The Research Council of Norway; £25,778 over 18 months

Dr Adrien Allorant; School of Economic, Social and Political Sciences

Optimizing HIV Self-Testing Delivery and Data Integration to Enhance HIV Care in Mozambique

British Academy; £7,350 over 18 months

Prof Sorin Krammer; Southampton Business School

HSDR Project: NIHR157268 – Increasing retention of healthcare staff from ethnic minority groups (I-CARE)

National Institute for Health and Care Research; £11,020 over 27 months, as part of a collaboration with the University of Surrey, Leicester Biomedical Research Centre (BRC) and University College London (UCL).

Dr Peng Xu; Southampton Business School


Resilient Healthcare Supply Chain Management through Risk-Seeking Decision Making: A Multi-Method Research Project

British Academy; £7,004 over 3 months

Dr Olga Maslovskaya; School of Economic, Social and Political Sciences

Under-represented population subgroups in social surveys: Methods for respondent-driven sampling with probability-based seeds

ESRC; £199,251 over 12 months

 **Find out more:**
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