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THE INSTITUTE FOR
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STUDIES



Our Mission

At The Institute for Global Innovation and Institute of Advanced Studies (IGI-IAS), our aim is to inspire, support and deliver world-leading, interdisciplinary research that addresses the world's most pressing challenges.

We believe that research works best when walls are broken down. Our role is to make that happen, combining expertise of academics from across the University of Birmingham with forward-thinking individuals and organisations who share the same goals.



A message from the Director

We established the Institute for Global Innovation (IGI) to help find solutions to the world's most pressing challenges – those that affect humanity at a global level.

As we saw throughout 2020 with the COVID-19 pandemic, these challenges are vast and complex in nature, and can only be addressed by working collaboratively across and within disciplines. These knotty, global issues can only be countered with truly global solutions.

More recently, the IGI joined forces with the Institute of Advanced Studies (IAS), to ensure that our efforts in facilitating and supporting multidisciplinary research across the University of Birmingham are even stronger and more coordinated.

The University has amazing depth and breadth of research across diverse topics. What the IGI-IAS brings to our research teams is focus, facilitation and acceleration, helping them develop those initial ideas, bringing together the teams with the necessary expertise, and supporting them in their delivery of solutions that will have long-lasting sustainable benefits for the people who need them most. To do that, we also support our academic community in forging relationships with partners who share our vision; be that an international NGO, a leading global business or a branch of local government.

I'm deeply proud of the depth and breadth of the fantastic interdisciplinary research taking place at the IGI-IAS. Even with COVID-19 restricting our capacity to meet face-to-face, work continued apace and we funded a number of additional projects to specifically address that challenge. You can read about some of those successes, and the impact that they have on the most vulnerable people around the world, in this brochure.



You can also read about the Forum for Global Challenges, a new venture that will culminate in May 2022 with an ambitious international conference in our home city of Birmingham. Work is already underway to generate and share solutions to some of the challenges faced by our planet and its people, from climate change and destruction of the natural world, to poverty and rising inequalities. We welcome contributions from anyone and everyone, and would love to have you on board too.

It remains a great honour to lead the fantastic and dedicated academics and professional services staff of the IGI-IAS, and I look forward to building on our early accomplishments in the years to come.

Professor Hisham Mehanna

A message from the Deputy Director

Achieving our ambition, to address some of the world's most pressing questions, will hinge on new ways of thinking. The solutions to such complex questions will stem from conversations and interactions that differ from what came before, and that go beyond the norm.

You can see this ethos echoed in our ongoing commitment to funding novel pilot projects or scoping activity that explores directions that others may not have considered.

Since our inception, the IGI-IAS has become a meeting place where researchers from all disciplines can come together and fan the flames of those bold ideas.

With that role we have a growing responsibility to keep breaking down the barriers to fruitful interdisciplinary working. We must support our existing research community and challenge obstacles that might prevent them from achieving their goals, while supporting new colleagues and partners to navigate their early forays into interdisciplinary projects.

We know, for example, that interdisciplinary research requires partners from different disciplines to start 'speaking the same language', and that achieving this is often tricky and can take considerable time.

With that in mind, we have been working hard to develop a new type of culture at the IGI-IAS, underpinned by a suite of activities that can provide more direct guidance to colleagues.



Building on existing academic expertise, these workshops, networking sessions and roundtables are designed to support those who are planning future interdisciplinary projects or facing difficulties in undertaking specific interdisciplinary research activity.

We also provide an environment to promote unfiltered discussion between passionate experts who want to take on these global challenges. Some of the most exciting ideas to come through the IGI-IAS have come about through serendipitous interaction that was facilitated by simply having the right platform in which to meet.

It is with immense pride that we can witness those conversations catch fire and flourish into ideas that might just change the world.

Professor Dominique Moran



Gender Equality and Women's Health

Gender inequality is one of the most pressing global issues of our time. In many countries, discriminatory laws and social norms remain pervasive. Women continue to be underrepresented at all levels of political leadership. We still fail to provide access to appropriate healthcare for many women and girls - approximately 808 women die every day from preventable causes related to pregnancy and childbirth.

According to the UN, an estimated 736 million women across the globe - almost one in three - have been subjected to intimate partner violence, non-partner sexual violence, or both, at least once in their life. These challenges are why we look to be at the forefront of impactful research that promotes gender equality and women's health.

The role of human rights is central to much of our work at the IGI-IAS. To truly have a world in which 'no one is left behind', per the UN Sustainable Development Goals, women's right to health must be upheld, which in turn intersects with and contributes to the realisation of other human rights, including participation, equality under the law, employment, sexual and reproductive rights, as well as freedom from violence, abuse, discrimination, and displacement.

Our vision is to achieve sustainable improvement in women's health and human rights through a network of global researchers, policy makers, governmental and non-governmental partnerships. With that in mind, we conduct interdisciplinary, policy-relevant research in collaboration with our partners, and influence and advocate for evidence-based change at the local, national, and international level.

We are fortunate to work with partners who share our ambition for greater gender equality, and a more peaceful, prosperous, and sustainable world, including the World Health Organisation, Oxfam, the Wangu Kanja Foundation, Ammalife, Concept Foundation, the Bill & Melinda Gates Foundation, Jhpiego, and Tommy's.

Maternal Health

Our researchers have a track record for reducing miscarriage and maternal morbidity and mortality using high quality clinical trials, and innovative implementation approaches.

We are leading a global effort to tackle bleeding after childbirth by implementing early detection strategies and a 'first response' bundle of care which could save the lives of millions of mothers. One such project, the E-MOTIVE trial, sees us work with international partners and co-ordinating centres in Kenya, Tanzania, Nigeria, South Africa, and Sri Lanka to test the E-MOTIVE intervention in a large, randomised trial involving over 300,000 women.

Closer to home, we address the issues most important to women and partners who suffer miscarriages, alongside partners including Tommy's. This builds on our research that provided the evidence to increase the use of progesterone in hospitals in the UK, dramatically reducing the risk of miscarriage, and aligns with our goal to push for more equitable access to both miscarriage care and safe and effective drugs in pregnancy.

Tackling sexual and gender-based violence through digital innovation and technology

We are enhancing the medico-legal response to sexual and gender-based violence (SGBV) globally through survivor-centred approaches and advanced data technology.

We deliver high quality data collection and analysis to capture critical information about the nature of SGBV. This evidence is combined with the co-production of new approaches for organisations, including the government and the third sector, to document and analyse SGBV violations, and inform effective security, crime prevention, protection, and response strategies.

For example, in one of our projects in Kenya we are working alongside the Wangu Kanja Foundation and the Survivors of Sexual Violence Network, as virtually no cases make it through the criminal justice system. Our GCRF-supported work there hopes to significantly increase access to justice and reduce incidents using an innovative technological solution, called MobApp, to support people and criminal justice agencies through documenting, reporting, and tracking new SGBV cases.

Gender barriers within and into work

We are investigating issues relating to gender differences in human capital development, and how these are influenced by family background and other environmental factors. Research in the stream also examines labour market outcomes including access to decent jobs, earnings, career progression, and representation.

Our researchers pursue an overarching goal of improving access to education and meaningful employment for all, but particularly marginalised workers including women and girls. Some of the issues examined include trade-offs between paid and unpaid work and unpaid caregiving; barriers to employment faced by women and older workers; disability and work; work and wellbeing. Other aspects of our research include understanding mechanisms of school-to-work transition as part of a British Academy/Leverhulme funded project. Members of the stream have built an extensive network of researchers in the UK, USA, Ghana, among others.

We have a laser focus on driving change and influencing policy and on informing new approaches to removing barriers to work.

Sexual, reproductive and marital rights

We are examining the legal, political, cultural, social, and economic barriers to access sexual and reproductive health services, as well as the inequalities that lead to, and result from, such barriers. This includes studying the conditions necessary to achieve reproductive justice in different historical, socio-political, and geographic contexts.

Our research enhances understanding of the role that healthcare professionals play in developing sexual and reproductive rights in transitional and/or post-conflict societies. We also assess the processes shaping the resilience of institutional structures and individuals in the context of sexual violence. Furthermore, we examine processes relating to transnational reproductive travel and migration.

By establishing collaborations in different countries across the world, including Mozambique, Kenya, Malawi, Argentina, Colombia, Mexico, Peru, Canada, Ireland, Norway, and Poland we are building a lasting network of partners with a shared commitment to promoting and protecting human rights.

Political rights and participation

The great majority of countries in the world have signed the Convention for the Elimination of All Forms of Discrimination Against Women (CEDAW), but action on implementing the Convention is often shown to be slow or inadequate. This is linked to the low proportion of women in elective and appointive political positions in many countries of the world. Globally, just under one quarter of parliamentarians are women - although there have been some striking increases achieved through the use of quotas, especially in proportional representation systems.

We are exploring the challenges to women's political participation and rights under different kinds of political systems in the 20th and 21st centuries. Recent projects have focused particularly on Malawi (in partnership with the Westminster Foundation for Democracy and Ministry of Gender) and Ghana (in collaboration with leading Ghanaian academics and civil society activists). Our research has investigated the most effective mechanisms to improve the proportion of women in national legislatures, and how women can influence policy and legal reforms even when they are in the minority in parliament or in situations where parliaments are weak or non-existent. We will propose solutions to enhance women's political participation in formal and informal contexts, at a local and national level.



Building Resilient Cities

Global urbanisation is predicted to continue, with estimates that by 2030, 60 per cent of the world's population will be living in cities. While cities can bring many benefits, as drivers of economic growth and by providing critical mass that enables services to be delivered efficiently, there are also challenges. Diverse and interlocking forces acting on cities provide opportunity, but may also subject the population, or sections of it, to distress. The causes may be environmental, technological, economic, social or political, and act over timescales of days to decades.

A more resilient city should enable responses to these forces that can improve the lives of its inhabitants and limit the negative impacts. Its networks and systems should work to support its people in adapting and recovering.

At the IGI-IAS, our researchers are focusing on how communities and individuals experience change or 'shocks'. We are exploring the responses at different levels of analysis: individual, community, city and national, across multiple sub-systems and timescales.

The Resilient Cities theme draws on research expertise that covers infrastructure, decarbonisation, air quality, physical and mental health, governance, public services and economics.

“Resilience has become a concept used frequently across many disciplines as well as becoming a ‘buzzword’ used by government, non-governmental and international agencies. A novel contribution to how it is conceptualised, and demonstration of its in-country application, has the potential to generate international impact in policy-making and academia.”

Dr Jonathan Radcliffe

This interdisciplinary approach is enabling us to reassess the concept of resilience and its measurement as it is applied to cities undergoing transition. Using a conventional framing of resilience may not always be appropriate, especially in the context of LMICs. We are drawing on our existing research and partnerships to co-develop context-appropriate responses with local stakeholders in city regions including Nairobi, Sao Paulo, Kathmandu, and Beirut, as well as our home, Birmingham.

The transformative adaptation of infrastructure

In Kenya, we are studying the impacts that the development of a new bypass road for High Volume Transport infrastructures will have on the informal settlement of Kibera, Nairobi. Our study employs a systems approach to investigate how changes in connectivity will affect the resilience and wellbeing of a community, determine how these communities react and/or adapt to such changes during the development of the projects, and assess the wider environmental and socio-economic impacts of such infrastructure development. We are also examining how transport infrastructures and services, health and access to health, built environment, household characteristics and individual coping strategies affect the fulfilment of mobility needs during later life in informal settlements.

A Systems Approach to Energy Resilience

Nepal has undergone significant institutional changes since the 2015 earthquake, including the decentralisation of governance with a new constitution, and the first elections in over a decade. Our study in the Kathmandu Valley has involved stakeholders across different sectors and scales, including energy suppliers at national and community levels, departments for infrastructure, central and local governments, and community organisations. We scrutinised the extent to which long-term resilience could be enhanced by institutional changes that have been made in relation to energy supply and improving energy access following the earthquake, covering both infrastructure changes and governance processes.

Institutional Barriers and Enablers to City Resilience

Through research with four municipalities in Brazil, we have identified factors that promote or undermine financial resilience at the municipal level and developed an index of municipal resilience. Although this information was gathered in case study research in three major cities and complex urban areas in Brazil, we expect that the findings and methodology will be relevant to a broader range of cities in LMICs.

We found evidence that institutional pressures (formal and informal) affect the municipal resilience.

- Local governments are still dependent on grants by the Central/Federal government – a type of informal budgetary institution.
- Formal regulation (i.e., ring-fence grants, minimum expenditure required by constitution) usually undermines financial resilience because of its impacts on buffer capacity.
- Lack of planning is a major concern mitigating anticipatory capacity.
- Decision making is short-term oriented, because of political capital (mayors' goal is to achieve more votes).
- Lack of coordination between municipal departments impede swift responses towards resilience.
- Leadership matters. We found evidence that the background (i.e., formal education, experience on public sector management, technical skills) of individuals in positions of leadership affect positively the success of resilient responses.





Water Challenges in a Changing World

Water is essential for human health, prosperity, and security. Yet billions of people worldwide are confronted by serious water-related challenges, from water scarcity and uneven access, poor quality and lack of sanitation to disasters such as flood and drought.

The rise in frequency, magnitude and impacts of hydrological extremes, including associated water contamination and environmental pollution, is now recognised as a severe threat to environmental and public health globally. UNESCO calculates that 80 per cent of the world's population, across all societies, now live in areas that are under high water security threats. Meanwhile, changes in the availability and management of the world's water resources are having a direct impact on aquatic and water-dependent eco-systems.

The IGI-IAS Water Challenges theme is addressing globally relevant water resource and quality challenges relating to the serious threats to water systems around the world, one of the United Nation's Sustainable Development goals. IGI-IAS researchers are pioneering a multidisciplinary approach that builds on the success of the University's virtual Birmingham Water Council, created in 2017 to integrate water-related research across the institution in a joined-up approach of investigating water quantity and quality challenges together.

Our theme is addressing relationships between people, society and the environment; focusing on improving understanding of the complex interactions between those elements to allow better resilience and preparation for potential crises in water supply and enables water resources to be managed more sustainably.

The IGI-IAS researchers are focusing on:

- How socio-economic, technological and nature-based solutions can improve preparedness and resilience to extreme events such as drought, flooding and water pollution
- How water affects public and environmental health
- How the sustainable and equitable governance of water can be achieved to increase security and reduce conflict

"It is our clear ambition to use our collective critical mass in water research across the theme to influence and shape national and international research programmes and solutions to global water crises. Our activities build on the joint initiatives created by the Birmingham Water Council with strategic partners such as UNESCO and our UNITWIN network on Ecohydrological Interfaces, UK and international regulators, public and private sector partners globally."

Professor Stefan Krause

Water Technologies

The highly dynamic and often non-linear behaviour of hydrological processes poses critical challenges to understanding, monitoring, and protecting water resources and freshwater environments. Technological innovation is needed. We are developing analytical and sensor technologies that support unprecedented high frequency and in-situ monitoring of hydrological and hydro-chemical processes in near natural, rural, and urban systems, including the built environment. This allows for smarter, real-time monitoring of water resources and pollution that will give communities better and more timely information to help deal with the threats posed by poor water quality on a day-to-day basis.

Water Resources under Change

Our work on sensors and monitoring enables us to evaluate how access to potable water as well as exposure to hydrological extremes will change in the future due to climate, land use and water management changes. Here, we are addressing three inter-connected grand challenges: quantifying the nature and extent of change in hydrology and water sources, explaining the causes of spatial and temporal patterns of change, and reducing uncertainty of predictions of change. The outcomes of this research are crucial to developing practical solutions that address water scarcity and security.

Water Pollution

To tackle global challenges in water contamination, we are building on our core strengths to focus on the fate, transport and environmental impact of emerging pollutants (e.g., engineered nanoparticles, microplastics, pharmaceuticals, flame retardants and their mixtures) and their interactions with legacy pollutants (e.g. excess nutrient concentrations, heavy metals such as arsenic, persistent organic compounds including PFAS). Pioneering such an integrative approach means we can challenge the current practice of single impact analysis and, for the first time, quantify the complex impacts of multi-stressor pollutants on public and ecosystem health. This has enabled us to develop highly innovative ways to combat and remove pollution from water.

Water and Health

Globally, for a wide range of diseases, water represents either a major disease vector or has substantial control on the environmental conditions of disease hosts, thereby having direct control of the spread of disease and, consequently, public health. We are investigating the health effects of microplastics in water and the environment, the effect of climate change and water dynamics on incidents of diarrhoea, and the fate and transport of antimicrobial resistance genes and how to reduce them. We are also examining the effect of water quality (and its in-situ detection) and the impact of WaSH (Water, Sanitation and Hygiene) interventions – with a particular eye on food safety, hygiene in maternal-child health, and WASH during the COVID-19 pandemic in Africa.

Water Justice and Socio-economic Consequences

We are investigating the economic and social implications of interrelated hydro-meteorological, water management and governance-related challenges in LMICs. We are considering the impact of land use and climate change on the socio-economic impacts of water extremes such as flooding, drought and contamination, and the relationship between water and technology (hydropower production and the impact on households, firms and farmers). We are developing adaptation and mitigation strategies, focused on water justice and resilience in LMICs, linking storm surge, wind field and hydrological modelling to socio-economic (agent based) models. For example, we have developed models of insurance to help cities deal with the effects of storms and flooding.





21st Century Transnational Crime

The changing nature of crime in the 21st century poses a global challenge, exposing a plethora of new threats and harms. While there has been a reduction in some traditional types of crime, violent crime in particular is a complex and burgeoning problem around the world. A step-change in thinking is required if we are going to successfully tackle emerging crime in the digital age.

Analysing and solving the challenges presented by ever-more sophisticated criminal systems transcend conventional means of measurement and disciplinary boundaries.

At the IGI-IAS, a multidisciplinary team of researchers is focusing on the challenges of transnational crime and proposing evidence-based approaches to solve it. We collaborate with police and other law-enforcement organisations within the criminal justice system to provide solutions to pressing problems faced by law enforcement both in the UK, and overseas.

This includes helping to develop new tools to protect vulnerable people, such as blending Artificial Intelligence and Big Data approaches with traditional criminology to safeguard children at risk of sexual exploitation.

“The dialogue that we have between disciplines and practitioners is what sets our approach apart. Translating academic research into policy and practice through continuous engagement means our work is helping the police and the criminal justice system to transform current practice to deal with evolving patterns of crime.”

Professor Sid Bandyopadhyay

Our goal is to provide an evidence base that aids the reduction of victimisation, the apprehension of more offenders, and a more efficient deployment of limited police and criminal justice resources. All in all, we strive to support the operation of more just criminal justice systems across the globe.

Combatting gender-based violence

In our work on gender-based violence, we work closely with our colleagues in the Gender Equality theme. We take a public health approach to understanding risk and protective factors to prevent violence and abuse against women and children.

One project explored the lives of people across Africa with genetic conditions that lead them to being the victims of violence. In Africa, stigmatisation, rejection and violence against people with albinism is common and many are mutilated and killed in witchcraft-related abuse. One of our early IGI-IAS projects saw us work with a Ugandan film-maker to document the lives of three people with albinism, with an emphasis on hope and success. The film, *See My Life* is available on YouTube.

In Uganda we are investigating the impact of Domestic Abuse Law on NGOs such as ADOVIC, and their capacity to address sexual violence, reproductive rights, and housing for women seeking safety for themselves and their children.

Borderless Crime, Modern Day Slavery, Violence Prevention and Humanitarian Protection

We are examining the most important factors that are linked with intergenerational cycles of violence in order to identify those vulnerable to victimisation and criminality. Working in collaboration with West Midlands Police, we are creating interventions to address child sexual exploitation, domestic violence and trafficking by observing patterns across generations.

We also focus on the most effective responses to the transnational exploitation of vulnerable people. The aim of the IGI-IAS's anti-slavery research is to identify mechanisms for regulating supply chains and to examine different forms of formal and informal regulation and intervention from source to destination country.

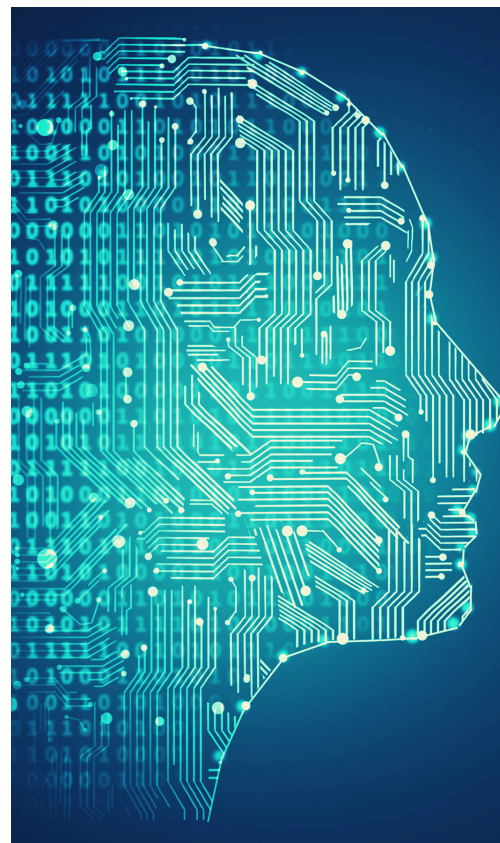
For example, alongside childhood charity Lumos and local non-profit organisations we are mapping the situation of unaccompanied minors in Greece. Closer to home, our work with the Salvation Army is looking at the establishment of Law Centres for survivors of modern slavery.

Data Science and AI

We are investigating the role of data science and artificial intelligence in prevention and law enforcement, including the potential for such tools to support crime linkage of sexual offences.

A key project (funded by the Home Office and in collaboration with the National Crime Agency) is looking at the design and development of tool-supported approaches to policing child sexual offences; specifically, we are concerned with the development of decision-support for the prioritisation of those suspected of engaging in child sexual abuse.

We also work on the large-scale analysis of online communication to support investigations and interventions in cybercrime, drawing on advanced methods from data science, natural language processing, and machine learning. For example, we are examining the language used by child sex offenders across the Dark Web. Working in partnership with the Alan Turing Institute we are creating a map of rhetorical strategies used by offenders in authentic dark web forum posts by using a combination of close reading and computational analysis. Our practical training interventions for officers help them to adopt the language and, by extension, the identities of online sexual offenders, so they can infiltrate these illegal cyber-communities.



Organised Crime and Corruption

As organised crime and corruption evolve, and new threats emerge, novel interventions are sought by policy makers and practitioners. Our work provides comprehensive evidence to support law enforcement agencies and others in developing more effective measures, using the breadth of our multidisciplinary expertise to co-design innovative new approaches.

Our diverse team, across the UK, Asia and Africa investigate some of the greatest challenges in the field. We look to understand the drivers of, and solutions to, cybercrime, covert networks, illegal fishing and other illegal wildlife trade, corruption and street crime. Our research delves into the role of urban politics and marginality, authoritarianism, impunity and human rights abuses, state crime and state surveillance, and youth unemployment.

We also examine organised crime, tax governance, offshore finance, illicit financial flows and informality, and the patrimonial state.

Protecting the Protectors

There is a growing concern for the mental 'ill-health' of law enforcement personnel and other staff employees working within the criminal justice system. First responders and front-line police officers can suffer from exposure to traumatic material and research has revealed that criminal justice personnel are at high risk of burnout, vicarious trauma, compassion fatigue, post-traumatic stress disorder and secondary traumatic stress.

Criminal justice system staff, such as those whose daily tasks involve exposure to traumatic material such as, descriptions and footage of sexual violence, abduction, torture and murder are at high risk of reporting mental 'ill-health'.

This work will provide an evidence base to improve mental health and wellbeing, and provide recommendations for workplace interventions and preventing the effects of exposure to traumatic material through work.



Forum for
**Global
Challenges**

ICC Birmingham, UK, 03-05 May 2022



Ageing, Frailty and Resilience

One of the greatest social changes in the 21st Century will be the ageing of all human populations on earth, with the number of people over 60 years old expected to rise to 3.1 billion by 2100.

Prolonging the human lifespan is a remarkable achievement, but it can also pose significant challenges. The disease chronicity, multimorbidity, and frailty that are seen with ageing conspire with changing economics and societies to place new demands on clinical practice and expedite the need for new care models, including greater provision of formal and family care support. Whilst much is known about ageing from high income countries, little is known about ageing and health, ageing in societies, or the economic effects of ageing in LMICs.

The United Nations has proclaimed 2021–2030 the Decade of Healthy Ageing, with WHO leading international action to improve the lives of older people, their families and communities.

The Ageing, Frailty and Resilience theme at the IGI-IAS aims to provide evidence to support the realisation of the UN aim of healthy ageing, especially in LMICs. The theme brings together a multidisciplinary combination of leading researchers in Birmingham with colleagues from other institutes all over the world to develop new insights and methodological innovation through collaborative work.

This means getting to grips with how we understand ageing, how we measure it and why we design the interventions we do.

Through our relationships in Brazil, Pakistan, Rwanda and Burkina Faso we are working to identify what priorities really are for older people in different contexts. This means taking a broad approach to the idea of ageing well, considering core social and economic elements alongside the more traditional healthcare-led methodology.

A key project is a longitudinal study in Burkina Faso, run alongside the Nouna Health and Demographic Surveillance Site. By blending this large dataset with in-depth focus groups we are looking to disentangle the idea of 'frailty' and the associated ideas that people have about older people. Each of our projects are designed with sustainability in mind, building in-country research capacity to continue vital research for generations to come.

Our goal is to guide policy and research thinking to better match the needs of older people across the world, both removing obstacles to healthy ageing and protecting what matters most to them.



Antimicrobial Resistance

Infections have been the major cause of mortality in human history. Only since the start of the 20th century have public health interventions, and the discovery and use of antibiotics and vaccines, drastically reduced the number of deaths due to infectious diseases in the developed world.

In LMICs, however, infections remain a major cause of mortality due to poor sanitation and lack of access to antibiotics and vaccines.

Over the last decade, treatment of infections has become increasingly difficult around the world, due to the emergence of pathogens that no longer respond to existing antimicrobial therapy. As a consequence, antimicrobial resistance (AMR) is now seen as a major threat to global health.

The COVID-19 pandemic brought infectious diseases and vaccines to the foreground of global policy making. Success in overcoming such complex issues can only be achieved through integrated approaches that draw on expertise across disciplines.

If no action is taken, by the year 2050 AMR may claim ten million lives per year globally. Only if we act now, and consider the factors driving infectious diseases and AMR, can we secure a future in which infections remain preventable and treatable.

At the IGI-IAS, we are working to build global collaborations that can address the growing problem of antimicrobial resistance and support emerging research that has the potential to lead to meaningful change.

We look to inform new interventions that consider the legal, ethical and economic aspects of antimicrobials and their use. Our team examines the evolution and transmission of antimicrobial resistance, from both a biological standpoint and through studying the historical and cultural contexts of infection and antimicrobials.

Within our research, we aim to reduce the reliance on antimicrobials and optimise their efficacy where they are used. This means developing new antimicrobials, diagnostic tools and delivery methods, while concurrently investigating the use of alternatives for use in medical and non-medical settings.



Clean Air

Air pollution leads to over 7-8 million premature deaths annually worldwide.

Poor air quality disproportionately impacts low- and middle-income nations, who face the dual challenge of achieving a sustainable development pathway and experiencing the greatest environmental, social and health inequalities across their populations.

Delivering clean air solutions is essential for the protection of public health and achievement of environmental justice. It will also help us to progress towards the UN Sustainable Development Goals and contribute to mitigating the challenges brought about by climate change.

The Clean Air theme spans countries including Rwanda and Mongolia to India and China, where we explore clean air interventions and policy solutions that can best benefit the population. Closer to home, we work in the UK and assist local, regional and national groups in adapting to new air pollution targets and mapping where interventions are most needed.

We create new, internationally leading and excellent interdisciplinary clean air research, publications and impact, drawing upon a track record of existing University of Birmingham academic, policy-focused and public engagement activities.

Our collaborations with in-country experts, policy makers and industry allow us to co-design our projects with implementation in mind, and we strive to support emerging research ideas, offering opportunities to examine new pathways to cleaner air for all.

Within the UK alone, ambient (outdoor) air pollution leads to around 34,000 early deaths per year and reduces average life expectancy by up to six months, with associated direct and indirect economic costs on productivity and livelihoods approaching £20 billion.

Within the theme, our four workstreams are:

Air Pollution & Human Health

This workstream investigates the interactions between exposure to air pollutants and human physical and mental health. Our holistic approach explores this relationship at a cellular or whole-body level, including projects on cognitive function and wellbeing. We also track the associated impact on health and social care service demand planning.

Clean Air Solutions

We are developing effective strategies for mitigation of poor air quality – including technical, engineering, planning and policy measures to reduce emissions and exposure.

Indoor Air Quality

Many of us spend up to 90% of our time indoors and yet understanding of indoor air quality, its interactions with outdoor pollution, exposure and health implications is in its infancy. As such, we are driving this emerging area of research, engaging with the public sector, academia and industry to develop the evidence base and deliver meaningful, sustainable responses to this public health issue.

Engagement and Involvement

We are looking at how best we can better communicate the importance of cleaner air across diverse national, cultural, ethnic and religious groups to underpin long-term behavioural change and more active involvement in developing clean air solutions.



Research in Action: Using crustaceans to treat wastewater

More than two billion people worldwide have no access to clean water, largely because over 80% of wastewater returns to the environment untreated. In LMICs, inadequately purified water exposes individuals, especially children, to preventable health risks and deaths.

Researchers from the IGI-IAS pioneered an innovative biological platform that uses an active filter feeder, a harmless crustacean, to remove both dissolved chemicals and suspended matter from water, reducing water-borne diseases and enabling water reuse. In lab conditions the treatment improves water quality significantly, removing up to 99% of chemical mixtures, including highly persistent compounds.

This prototype Daphnia-algae bioreactor has been tested in laboratory settings to develop a model that will help identify the optimal Daphnia intensity in different environmental conditions, allowing for a constant population.

Due to its low demands on energy and infrastructure, the platform is especially suitable for countries with poor infrastructure, so the team looked to deliver solutions for the application of the biological platform in LMICs with an initial focus on Vietnam and Nigeria, thanks to funding from the Global Challenges Research Fund and the Petroleum Technology Development Fund (Nigeria).

Through further awards from NERC and Innovate UK, the team are building on their early successes to expand the



research into Brazil, conduct additional feasibility studies, and undertake an initial market assessment with a view to commercialising the treatment system.

The aim is to implement the biotechnology and upskill the local work force, leading to sustainable benefits to communities and cleaner, safer water for all.

“We wanted our science to help with one of the most pressing issues in modern society: water reuse. We were pleased that our partners showed such a deep understanding of the problem and a forward looking attitude to solving it.”

Lead Researcher, Dr Luisa Orsini



Research in Action: Setting the standard for GBV research

Gender-based violence (GBV) takes place around the world, but survivors in LMICs often face specific problems, as a result of inadequate state responses to this violence, and because of cultural or religious norms that blame survivors for experiencing this violence, leading to their stigmatisation or even rejection. Therefore, GBV has severe physical, emotional, social, and economic effects.

Research is crucial to better understand the causes and consequences of GBV, as well as the experiences of those who have faced it. Such understanding is vital for designing appropriate actions and policies. But researching GBV is not without risks. Participating in research can cause the re-victimisation of survivors through the recall of painful events and it can put survivors at risk, if the perpetrators of violence are still close to them.

These problems are especially present when research is undertaken in LMICs by researchers from the Global North, as this creates power inequalities between researchers and participants and can lead to incomplete understandings of participants' local contexts and challenges.

The Ensure No 'Grab and Go' Extractive Research (ENGAGE) project sought to address some of these problems by providing a consistent and ethical framework for future research in this field. The project, a collaboration between a UK research team affiliated to the University of Birmingham and practitioners working on gender issues and supporting survivors of gender-based violence in Guatemala (Impunity Watch), Kenya (Wangu Kanja Foundation), and Uganda (ADOVIC), was funded through the IGI-IAS and the Global Challenges Research Fund.

Through the team's experience of undertaking such research including projects that used participatory and creative research approaches, and through in-depth workshops with global partners, they developed a set of guidelines that will contribute to the setting of a global standard for research engagement with survivors of GBV in LMICs.

The guidelines are divided into three different parts; the ENGAGE principles (which identify the core elements to adhere to in such research), a framework for a survivor-centred approach, and recommendations for core elements to include in a research plan.

These each put the core values of openness and transparency, truly collaborative and equal partnerships, and participant safety and wellbeing, at the heart of the research process.

Together, by understanding the context of each project (from local political, historical and social contexts to individual contexts) and promoting the ethical co-design of research goals, the guidelines will help to prevent GBV research from becoming an extractive or exploitative experience for those involved in it.



Research in Action: Understanding the coastal wetlands

Humans have significantly altered the global biogeochemical cycles of nitrogen and carbon through industrialisation, land use and climate change. These elements impact soil health, food security, greenhouse gas emissions and ecological resilience, and so understanding our ecosystems and how we can alleviate our impact upon them is crucial.

Coastal wetlands, including mangroves and melaleuca forests, are of particular significance due to their capacity in sequestering carbon and nitrogen, and intercepting pollution from vast, nutrient-rich tropical riverine networks. These wetlands are crucial in both mitigating the harmful effects of climate change and improving water quality. Despite this, the environmental drivers controlling soil biogeochemistry in these ecosystems remains poorly understood. This lack of understanding hampers our ability to assess the response of greenhouse gas fluxes and nitrogen reduction and to minimise emissions through effective management.

A team of IGI-IAS researchers, led by Professor Sami Ullah, are investigating these environments in Vietnam.

They first visited colleagues at Vietnam National University and Can Tho University to facilitate co-design of a project that would inform sustainable land use and ecosystem management strategies to help local communities benefit from the wetlands for aquaculture and agriculture without detracting from the beneficial role of the ecosystems in mitigating climate change.

This collaboration continued throughout the fieldwork in Xuan Thuy National Park and U Minh Thuong National Park, lab-based work, and into the dissemination of the findings - including to the directors and staff of the national parks to help inform their management priorities.

The study informed academic papers, which investigated the impact of restoration of mangroves and melaleucas. It found that disturbance, and subsequent recovery, of these forest wetlands did not have a significant detrimental effect on key aspects of soil biogeochemistry, speaking to the resilience of the ecosystems.

It also detailed how a mangrove system may remove excess nitrogen and improve water quality, whereas melaleucas process nutrients at a cost of nitrous oxide and carbon dioxide emissions. They do, however, have the capacity to act as a significant methane sink, at least partially balancing these emissions.

The outcomes of the research will improve management strategies in Vietnam regarding restoration practises and human activities, while mitigating climate change through decreasing greenhouse gas emissions. The team are now looking to expand this research into other countries with coastal wetlands.



Research in Action: Enhancing investigations with crime linkage

Crime linkage is the process of linking two or more crimes together, based on the underlying principles that perpetrators' behaviour will be both consistent and distinctive. Our team in the 21st Century Transnational Crime theme investigates the proper use of crime linkage, and evidence-based forensic psychology, by practitioners of law enforcement.

Researchers at the University of Birmingham have long been at the forefront of developing the scientific foundations for crime linkage and have established benchmarks to assess the reliability of the underlying principles which has led to significant advances in the field. Their studies have shown that across a range of crime types (e.g., rape, burglary, robbery), offenders are consistent and distinctive enough in their behaviour for crimes from the same series to be identified with a high degree of accuracy.

However, there are some crimes within a series that are characterised by inconsistent or indistinct behaviour. In these cases, erroneous links could be made that could have significant investigative and legal ramifications. Crucially, the team have shown that unapprehended offenders are less consistent in their crime scene behaviour than apprehended offenders (and crime linkage is normally applied to identify the former).

This nuanced insight into perpetrator behaviour is at the heart of the IGI-IAS work on crime linkage to support practitioners in both increasing and safeguarding its use.

One key project has assessed the role of Automatic Number Plate Recognition (ANPR) in linking crime series and detecting serial offenders. A collaboration between academics in the departments of Psychology and Economics, the Serious Crime Analysis Section of the National Crime Agency, the Metropolitan Police, and the Home Office, explored the distances in time and space between crimes from the same series. This ESRC IAA and National Police Chiefs Council funded project has led to new understandings on how ANPR can have use in practice for tackling and solving serial sexual offences and was included in national guidance sent out to all ANPR police units in England and Wales.

The team are now expanding their work into other countries (including a project commissioned by the Swiss Police into their practice of crime linkage), and delving deeper into the role of data science and artificial intelligence in supporting crime linkage. One such project will examine how Natural Language Processing can help in the semi-automated population of crime linkage databases.

“Used correctly, crime linkage can be transformative for police forces in tackling serious and prolific offenders. Our goal is to work with practitioner colleagues to embed proper evidence-based use for different types of crime across diverse global settings.”

Professor Jessica Woodhams



Research in Action: Investigating air flows around critical infrastructure

We depend on information communications networks more than ever before.

This is a truly global infrastructure, comprising of data centres and telecommunications technologies that host and provide access to the internet, cloud storage, and computing from anywhere in the world. These technologies produce a lot of heat and must be kept cool to prevent critical thermal failures. Cooling alone can account for up to half of the total energy use, and this is most often achieved by blowing air over the electronic devices.

As populations grow and countries develop, more data centres and technologies are required, sometimes in harsher operating environments blighted by poor quality air. Where air, both indoor and outdoor, contains higher levels of particle pollutants (PM2.5 and PM10) there is an accompanying risk. The risk of poor-quality air to human health is significant, but it can also lead to premature mechanical, thermal, and chemical corrosion failures when pollutants stick to the surfaces of electronics.

Researchers at the IGI-IAS are working to develop interdisciplinary solutions to reduce this risk. By employing advanced flow diagnostics and numerical modelling techniques, they are studying and predicting how these harmful microscale particles are transported in air flows. These allow us to reveal the pathways they take, and importantly, where they end up.

Working together with Nokia Bell Labs, the team have identified the physical mechanisms that accelerate the deposition of pollutants onto the surfaces of sensitive electronic devices installed in poor air quality environments. From there, they developed aerodynamic solutions that control the flow of these pollutants, reducing their interaction with sensitive electronic devices and doing so with a substantially lower energy penalty compared to contemporary filtering.

Now the team is looking to extend multiphase flow approaches to investigating complex source-exposure pathways into other areas, including urban road transport. This can inform solutions that reduce the impact of particle pollution on human and environmental health.

“The involvement with the Clean Air Theme has opened up many opportunities for cross-disciplinary discussions and ideas. This has strengthened existing research activities while also providing new avenues where my research can be applied to critical clean air problems.”

Dr Jason Stafford

Responding to COVID-19

The COVID-19 pandemic exemplifies the type of cross-cutting global challenge that the IGI-IAS was established to address. Our team moved swiftly to support groundbreaking research, bring experts together, and share the latest evidence-based knowledge.

The COVID Corpus

The generation, and synthesis, of knowledge about COVID-19 has been central to understanding and mitigating its negative effects. However, with research being undertaken at pace, and on a global scale, the risk of duplication was high. With this challenge in mind, we created 'The COVID Corpus', an online international data repository to capture all research related to COVID-19, regardless of academic discipline, funding or location.

COVID Corpus is open access and includes all research disciplines, including health, socioeconomic, behavioural, educational and cultural, as well as covering both funded and unfunded research. Researchers can add their own projects to the database, search for existing projects to minimise the risk of duplication and find international collaborators to increase the scope of their work.

The Corpus also extracts data from several other existing databases, such as the Academy of Medical Sciences and UK Collaborative on Development Research, to provide a comprehensive portal, and the largest database on COVID-19 research activity in the world.

Webinar series: Living with the Pandemic

As the UK entered lockdown, the IGI-IAS team reverted to working from home. It was during this initial period of uncertainty that we felt the need to connect with the public to share evidence-based knowledge about the effects of the pandemic unfolding around us. From this sentiment our headline series of webinars: "Living with the Pandemic" was born.

"Living with the Pandemic" webinars covered topics ranging from the economic effects of lockdown, the challenges faced by LMICs, and the pandemic's relationship with the Black Lives Matter movement. The webinars were broadcast via zoom and Facebook Live, and to date have reached over 200,000 people.

Antibody testing

Effective testing and tracing is at the heart of any public health response. However, one of the unique elements of COVID-19 is the mild or asymptomatic state of many of those with the virus, which makes the track and trace process all the more challenging. The IGI-IAS collaborated with Professor Adam Cunningham and Birmingham based medical diagnostics company 'The Binding Site' to develop a new antibody test for COVID-19.

The test detects antibodies specific to the SARS-CoV-2 trimeric spike protein, which is an important protein for virus infectivity. The test was designed to detect all three immunoglobulins to optimise sensitivity and increase detection at the earliest possible stage after exposure to the virus.

The test was deployed in many of the clinical studies conducted through the University of Birmingham, including those focused on health care workers and reached a peak of over 2 million tests per month.

Examining trends of sexual and gender-based violence

Members of the IGI-IAS and colleagues at the Wangu Kanja Foundation in Kenya reported on the trends of sexual and gender-based violence towards women and girls in Kenya. Based on primary research conducted across the country between March and June 2020, the report was one of the first to provide evidence about patterns during the pandemic, using first-hand accounts from survivors. Researchers in Kenya spoke with 80 victims of offences of violence to inform a report that outlined the main impacts of pandemic restrictions on sexual and gender-based violence.

They found that emergency measures exacerbated the vulnerability of women and children – both by increasing time spent at home due to school and other closures, and to attacks by strangers due to increased isolation. The socio-economic impact of the crisis also increased tensions within households, with reports of physical violence and increased homelessness for women.

Framing the ‘pandemic paradox’

An increased risk of domestic violence was an unintended and negative consequence of the measures imposed to control the COVID-19 pandemic. The UK’s Office of National Statistics estimated a 7% increase in recorded domestic violence offences compared to 2019, and other agencies suggest true prevalence to be even greater.

To that end, Professor Caroline Bradbury-Jones and Dr. Louise Isham authored an editorial for the Journal of Clinical Nursing to provide context for a worsening problem. They identified the ‘pandemic paradox’ caused by instructions to stay at home. For those experiencing domestic violence, home is not a safe place and having to remain there only increased opportunities of violence to occur and reduced chances to escape, seek help or have the behaviour noticed by others.

Though they did not challenge the need for such measures during the pandemic, their message highlighted the need for governments and others to ensure that services at-risk people require continued to be available during the pandemic.

Investigating sex offender behaviour and victim vulnerability

Professor Jessica Woodhams is working alongside the Serious Crime Analysis Section of the National Crime Agency to create much needed, new knowledge for criminal justice entities regarding how the COVID-19 pandemic and associated mandates – particularly those that have restricted and changed the public’s movements – affected stranger sexual offending in the UK.

By determining who is vulnerable to this type of offending, who the perpetrators are, and how and where these types of offences occur - and if this changed since the start of the pandemic – the research will provide agencies with the evidence base to inform practice and policy in this area in the UK and overseas.

Urban region COVID-19 responses

Our research to date, across multiple locations, has shown how the ‘connectivity’ of the population and urban sub-systems affects responses to shocks or disturbances, ultimately impacting on the wellbeing of the individuals. Working with West Midlands Combined Authority (WMCA) during the development of its COVID-19 recovery plan, we identified three key principles that can foster successful approaches:

- ambidexterity, balancing alignment of current processes and adaptability to future changes;
- social asset building, with more permissive and open methods of priority-setting; and
- whole-systems thinking, embedding networks across sub-systems and scales within normal policy processes.

We believe that a more sophisticated view of resilience as a shared property, not belonging to any individual system or party and that is not based upon ‘returning to normal’, needs to underpin recovery planning.

Forum for Global Challenges

Birmingham 2022: Creating an inclusive, healthier and sustainable future

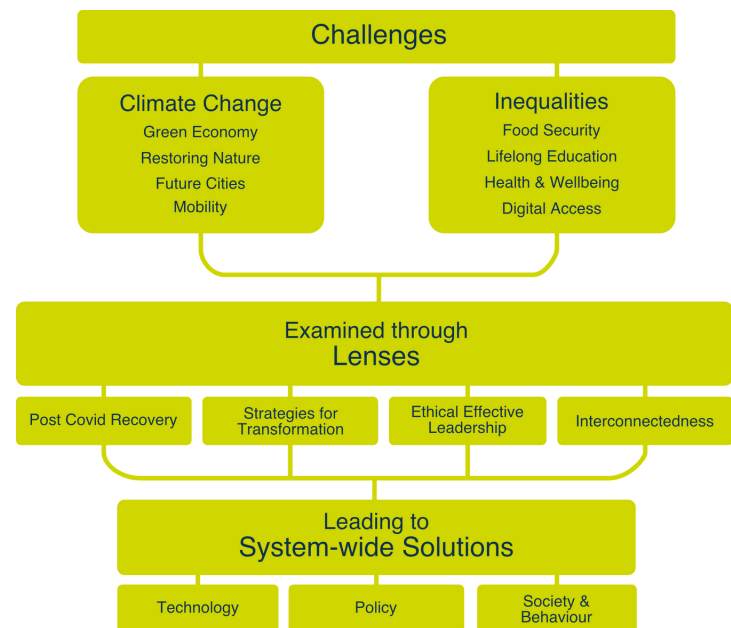
The need for action

The world faces significant challenges – from living with the devastating impacts of climate change, the destruction of the natural world to the effect of pandemics on jobs and livelihoods – making the need to create a better, fairer, and more inclusive future for all people and the planet all the more urgent. Yet the response to global challenges has long been slow and inadequate, with low- and middle-income countries bearing the cost.

The Forum for Global Challenges

The IGI-IAS, in collaboration with the Birmingham 2022 Commonwealth Games, West Midlands Combined Authority, United Nations Development Programme, the Thomson Reuters Foundation, and the Association of Commonwealth Universities, has established the Forum for Global Challenges, a solutions-focused international meeting, events series and dialogue.

This main event will be a hybrid meeting with a face-to-face forum at the ICC Birmingham in May 2022, marking the city as host of the Commonwealth Games, together with online interaction and parallel events in different parts of the world. We will bring together academics, policy-makers, practitioners, the private sector, civil society and the public, with a particular youth focus. The dialogue leading up to the main event will take place through debate within an online community and events around the world, such as panel discussions and workshops, virtually and in person.



The inaugural Forum will catalyse action that will make a real difference and help us all to work towards a fairer, healthier and more sustainable future. Participants will work together to address and find solutions for global challenges within the areas of climate change and inequalities. These will be examined through lenses of post-COVID recovery, transformation, leadership and interconnectedness.

Action and impact

The Forum will also provide a platform for showcasing the efforts and solutions developed by industry and academic research to tackle these seemingly intractable problems, and for obtaining feedback from a variety of disciplines and especially the public. It will facilitate the sharing of ideas and learning from different sectors on specific problems of the global challenges, and provide a conduit for developing collaborations between public and private sectors and between business with government, the third sector, academic and civic organisations.

In the post-pandemic period, the Forum 2022 comes at a crucial moment of global change and will build on and leverage the legacy of the Commonwealth Games 2022. We are actively seeking international partnerships in low- and middle-income countries to help achieve this.

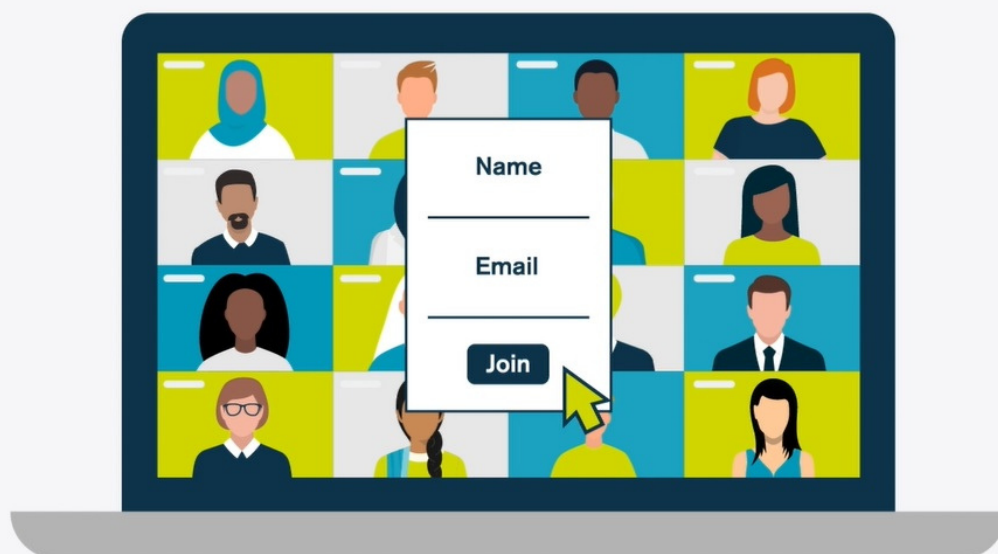
Alongside the direct benefits for LMICs, which are the primary focus of the Forum, this global dialogue and showcase of solutions will raise the profile of international development within the UK, and generate socioeconomic benefits for Birmingham and beyond, ensuring sustainability of the Forum in the long term.



The Programme

The Forum for Global Challenges will find, share and promote technological, policy, societal and behavioural solutions to climate change and inequalities. The Forum will focus on the key topics of the green economy, restoring nature, the future of cities, mobility, the future of education and employment, health and wellbeing, food security and access to the digital world. These will be examined through the lenses of post-COVID recovery, strategies for transformation, ethical and effective leadership and interconnectedness.

Visit forumforglobalchallenges.com to join our community





We believe that research works best when walls are broken down. Our role is to help that happen, combining expertise of academics from across the University of Birmingham with forward-thinking organisations who share the same goals.

Our door is always open to new ideas and collaborations, so please do get in touch.

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