Department for
Business, Energy
& Industrial Strategy

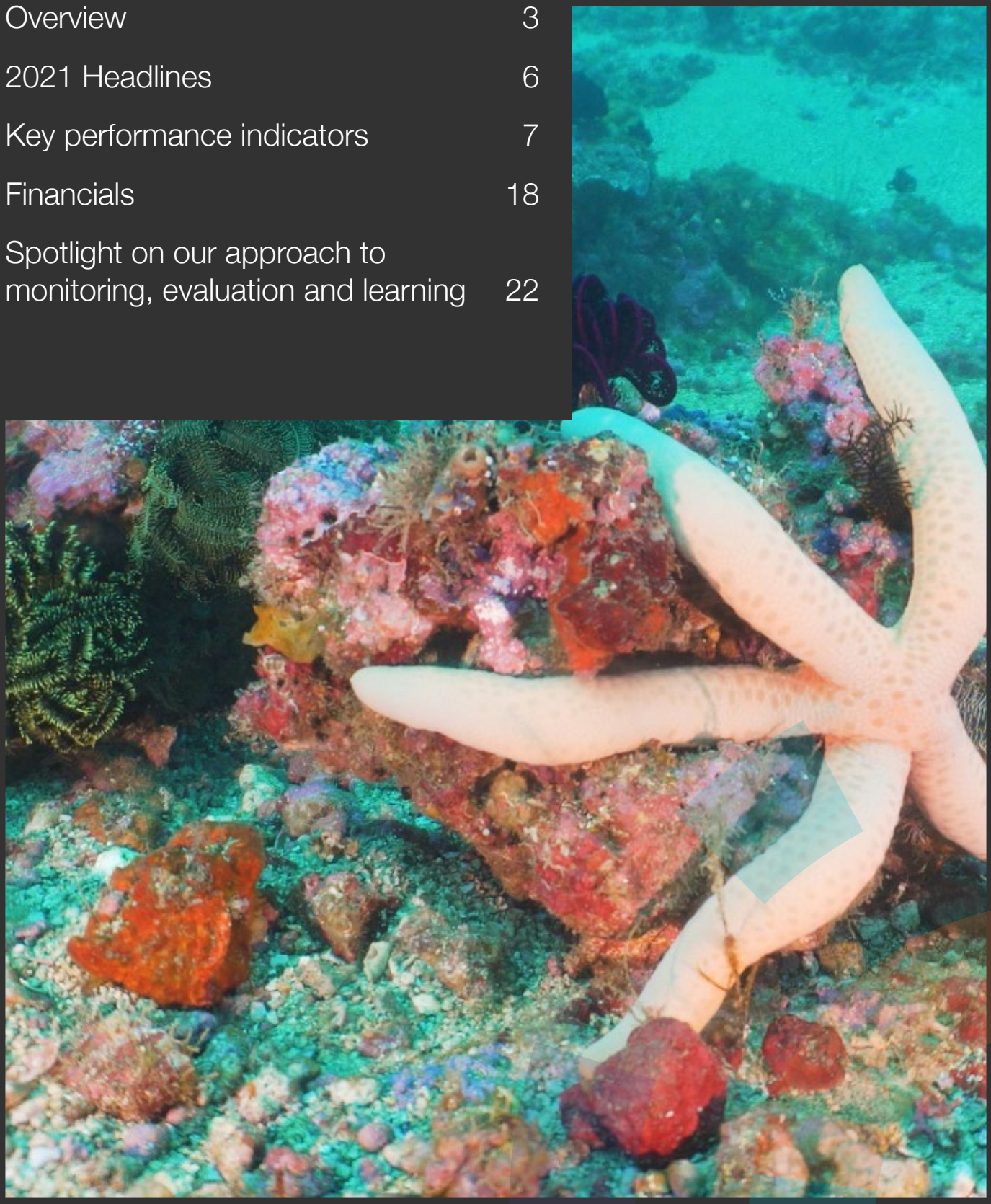
Research and Innovation for Development at BEIS

Annual Review 2021

GCRF

Newton Fund

Contents



Overview

This report details the Department for Business, Energy, Industrial Strategy (BEIS) 2021 annual review and financial statement for its research and innovation funds for development: the Newton Fund and Global Challenges Research Fund. The report covers the 2021 calendar year and is part of our commitment to manage the funds in an open and transparent way.

Global Challenges Research Fund

GCRF provides dedicated funding to research focused on addressing global challenges which most significantly impact upon developing countries. It achieves this by supporting challenge led disciplinary and interdisciplinary research, strengthening capability for research and innovation within low- and middle-income countries, and providing an agile response to emergencies, where there is an urgent research and on-the-ground need. In 2021 the GCRF total spend was £219m.

From 2016–2021 a UK investment of up to £1.5 billion.

Newton Fund

Newton Fund supports bilateral and regional research and innovation partnerships between the UK and selected middle income countries agreed at a national level. The aim of this is to address specific global development challenges and build research and innovation capacity. It operates on the basis of matched funding, with partner countries contributing similar resources to support the partnership. In 2021 the Newton Fund total spend was £72m.

From 2014–2021 a UK investment of up to £735 million with 'match' from partner Countries.

£219m
GCRF total spend in 2021

£72m
Newton Fund total spend in 2021

£76m
Other ODA total spend in 2021

What we set out to achieve

Our mission is to invest in new research and people and their careers, supporting researchers and innovators around the world to find lasting solutions to developmental challenges such as human health, food security and climate change.

GCRF and Newton Fund work in different ways. They each have a 'theory of change' setting out the rationale for our programmes and the expected results over time. A simple unified theory of change is also available from www.newton-gcrf.org.

The use of UK supported research and innovation, funds projects to support people in low and middle-income countries, helping to:

- Make progress towards United Nations' Sustainable Development Goals
- Improve capabilities for research and innovation around the world
- Create the networks and opportunities for groups of researchers to work together on specific challenges
- Enhance people's welfare and create opportunities for them
- Improve governance, policies and practices
- Reduce gender inequalities

These projects are delivered by our UK and international delivery partners, responsible for the operational design, disbursement and management of the funds.

They funded a wide range of activities, including:

- Research studies, from basic science through to applied research and innovation via small, medium and large-scale projects
- International partnerships, between institutions and the partners themselves, with other funders in low and middle-income countries
- Innovation and technology accelerators
- Research capacity building through fellowships and PhDs. And through technologies and information technology systems
- New networks of people working on specific themes or in certain regions of the world
- Commercialisation of research and innovations
- Engagement activities, including policy talks in low and middle-income countries.
- Block funding to UK universities and institutions to deliver costed GCRF strategies, including developing low and middle-income partnerships and developing capacities
- Large investments that combine many of these activities in multi-year interventions. For example, the GCRF interdisciplinary Hubs

In 2021 there were over 2,500 individual GCRF and Newton Fund projects active across at least 74 ODA eligible countries.

> In financial year 2021 we allocated a budget to eight UK delivery partners and the UK higher education funding councils for England, Scotland, Wales and Northern Ireland. Our partners distribute funding to research institutions in the UK and internationally based on a competitive process. In the case of Newton Fund, programmes are designed and delivered in collaboration with funding partners in middle income countries and each programme is match funded.

2021 Headlines

3.21% **Total UK Official Development Assistance allocated to BEIS**

74 **DAC-listed countries reached**

2860 **Individual projects funded**

72 **Fellowships funded***

394 **Intellectual Property created**

19 **Spinouts created**

16,185 **Journal publications***

31,334 **Creative, policy and technology outputs***

*Over the life of the funds

Key performance indicators

Research and innovation in the field of international development is long term, complex and challenging.

We are working closely with partners to deliver against a set of agreed key performance indicators, including:

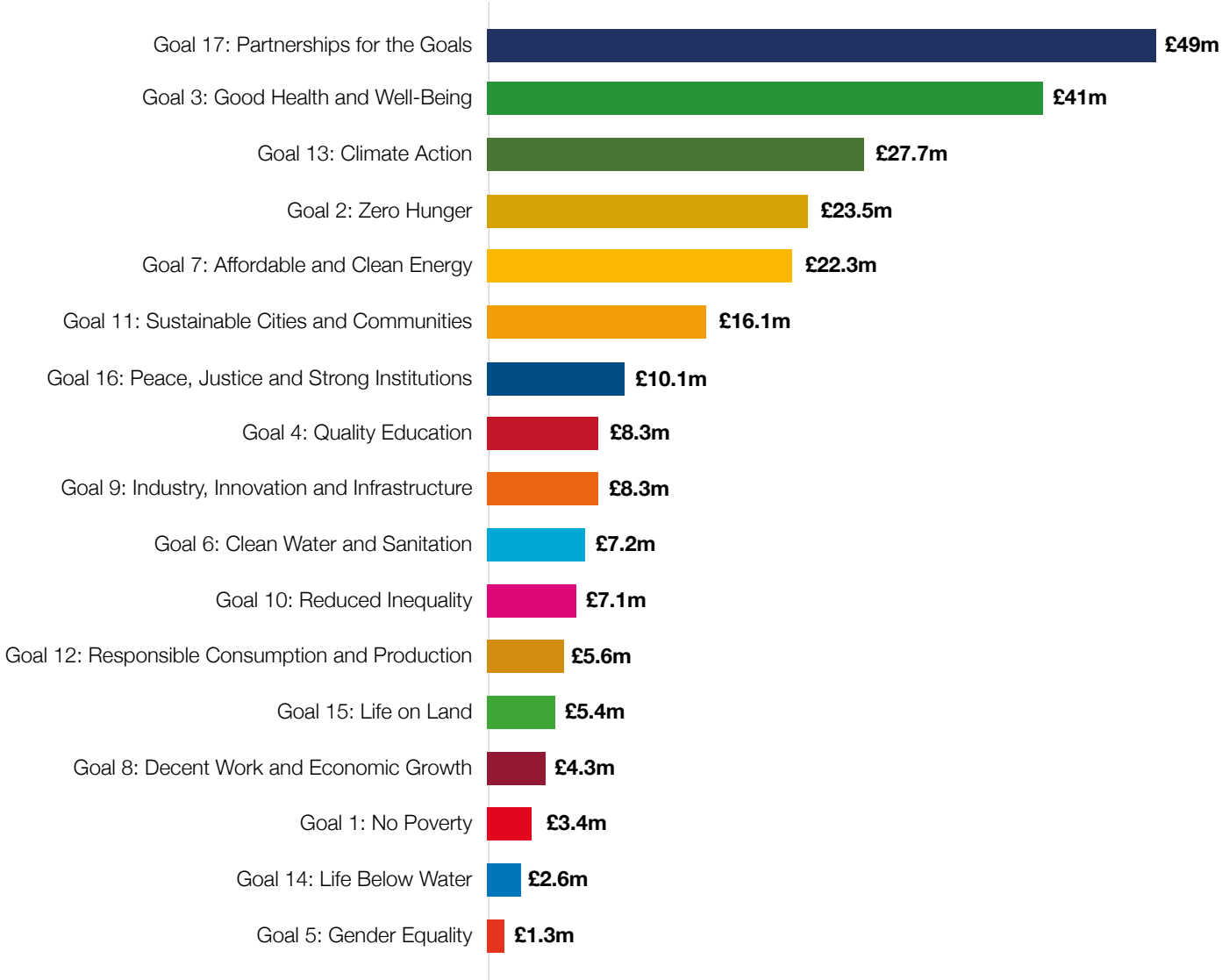
1. Activities addressing each Sustainable Development Goal and total value
2. Proportion of projects addressing each GCRF Challenge Area and total value
3. Number of fellowships and corresponding grants funded under both funds
4. Instances of intellectual property protection each year
5. Instances of spin-out companies each year

Sustainable Development goals

The 2030 Agenda for Sustainable Development was adopted by all United Nations Member States in 2015. It includes the 17 Sustainable Development Goals (SDGs), which recognize that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequalities, and improve economic growth.

Our top SDG themes in 2021 across both funds were Partnerships, Good Health and Wellbeing, Climate Action and Zero Hunger.

Spending breakdown by SDG in 2021 for GCRF and Newton Fund



Source: Statistics on International Development: Final UK Aid Spend 2021
Note: Some spend can not be allocated to a SDG, e.g. call administration, delivery costs etc. or because the activity is too wide in scope.

Global Challenges Research Fund challenge areas

The GCRF Strategy sets out 12 challenge areas which are linked to the UN Sustainable Development Goals (SDGs).

Challenge Areas 'translate' the 17 SDGs into research and innovation challenges. They guide how our delivery partners allocate funding.

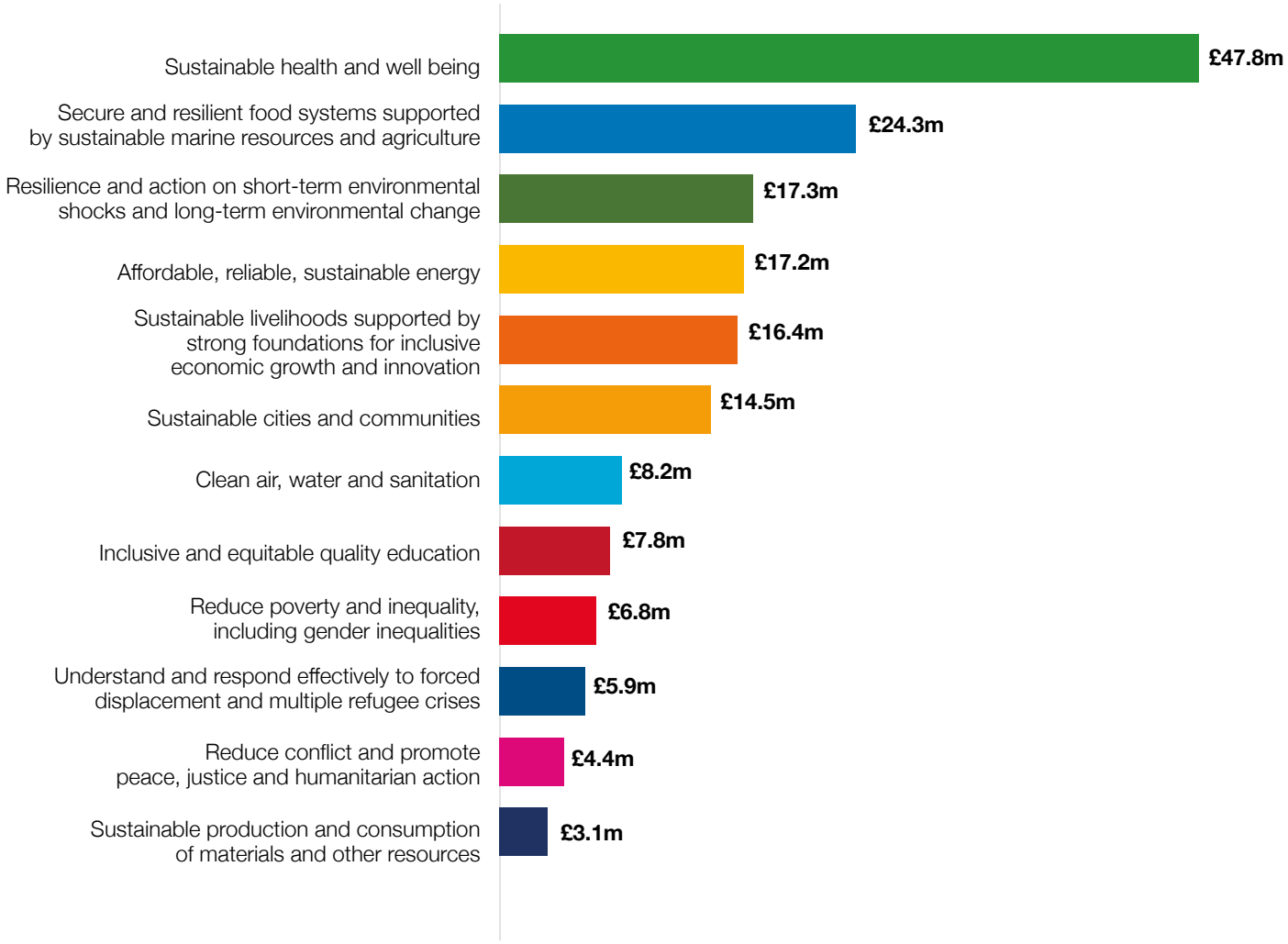
The top three challenge areas in 2020–2021 mirror the SDGs above. They were:

1 Sustainable health and wellbeing

2 Securing resilient food systems, marine resources and agriculture

3 Resilience and action on short-term environmental shocks and long-term environmental change

Spending breakdown by GCRF challenge areas in 2020



Source: Statistics on International Development: Final UK Aid Spend 2020
Note: Some spend cannot be allocated to a challenge area, e.g. capacity building, call administration, delivery costs etc.

Partnerships

Spoke universities

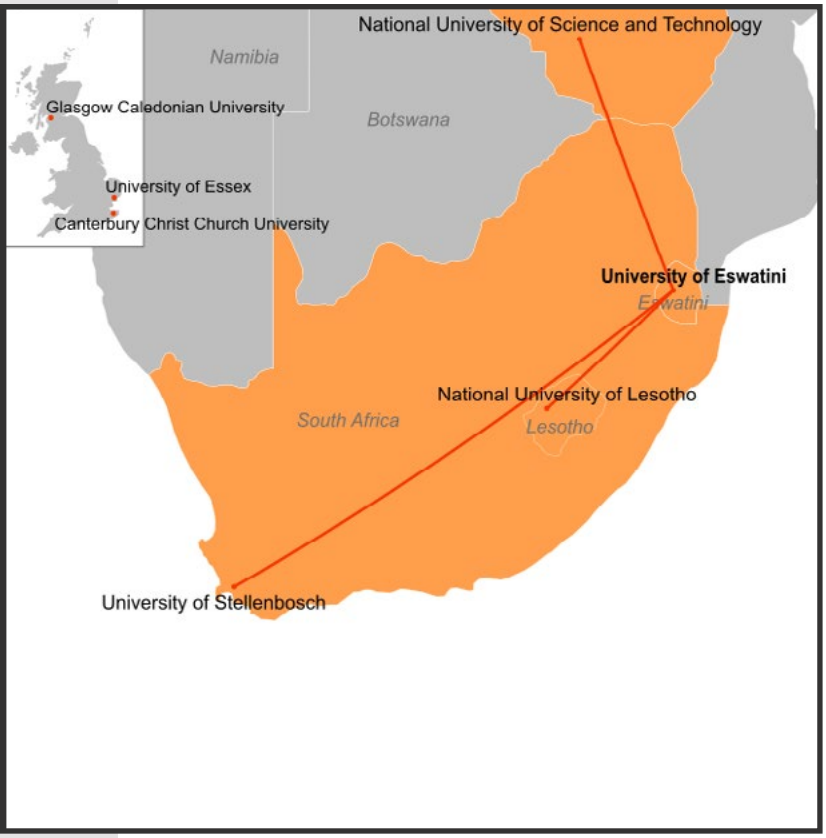
University of Stellenbosch (UoS)
National University of Lesotho (UoL)
National University of Science and Technology (NUST), Zimbabwe

Industry partners

The Eswatini Electricity Corporation (EEC)
Eswatini Postal and Telecommunications Corporation (EPTC)
Palfridge
Touch-IT
TECH-SD
Eswatini's Royal Science and Technology Park (RSTP)

UK Partners

University of Essex
Glasgow Caledonian University (GCU)
Canterbury Christ Church University (CCCU)



The Higher Education Partnerships in sub-Saharan Africa (HEP SSA) programme was set up to address the engineering skills shortage in the region, showcasing the role of engineering in driving inclusive economic development.

To maximise the impact of this collaborative programme it is implemented through a 'hub and spoke' model.

The hub universities led the project, collaborating with spoke universities, industry and UK partners, to design a curriculum to create outcome-based engineering research projects, facilitate work-based learning secondments and coordinate knowledge sharing.

Industry partners were keen to participate in the work-based learning element of the project, recognising the opportunities it provided for codesign concepts and shared learning. A participant, who completed a placement at Glasgow Caledonian University, said it was a 'real eye opener'.

Another key activity was the virtual innovation lab (i-Lab), established to design and deliver entrepreneurship and innovation training to all staff and students.

Participants were trained to write a research proposal, presenting their research idea to the 'Lion's Den', an initiative based on the TV show 'Dragon's Den'. The 'Lions' then worked with successful participants to deliver their research project.

The strategic fit of the project activities with institutional strategies helped ensure the long-term sustainability of results, these include an increase in the number of start-ups and IP creation, improved employability of graduates, improved quality and quantity of research, as well as commercialisation of patents.

Partners

Funded by the Royal Academy of Engineering UK, through the Global Challenges Research Fund.

> UNESWA has moved leaps and bounds towards the adoption of new learning concepts and outcome-based approaches.
>
> Chris Fowler, Project Manager

Waste management for improved health

Supplying clean, secure and sustainable supplies of water, food and energy, while managing waste and optimizing circular economies, is still an aspiration rather a policy-in-operation in Sub-Saharan Africa.

ACTUATE are co-delivering two community-based pilot bioenergy systems in Ghana and Nigeria to highlight the technology's benefits in management of waste, energy production from biogas, improving soil and food security, and improved health.

The UK –Africa team are working closely with universities, research institutes, NGOs and SMEs, to show how this example of a circular economy positively impacts on human health and the environment, as well as looking to develop safer practices with stakeholder groups.

ACTUATE is engaging with local SMEs and entrepreneurs to support the expansion and pre-commercialisation of the technologies. Offering training opportunities for local partners to manage and support the continued use of the systems.

Good health and wellbeing

Healthy hands

To highlight issues of hygiene around waste and how to reduce illness, the ACTUATE team designed 'Healthy Hands' a living lab approach for use in schools to show the importance of hand washing.

A set of experiments were used, enabling children to visualise the impact of hand-washing (unwashed, with water, water and soap) on the growing of bacteria on petri dishes.

These interactive experiments enabled children to see the 'invisible bacteria', and how hand-washing is the first line of defence against the spread of dirt and bacteria that may cause illness.

The children pledged to act as agents of change in educating their families, friends and community members, on the importance of washing hands often with soap and water.

Partners

Lancaster University, UK
University of Benin, Nigeria
Council for Scientific and Industrial Research, Ghana
Green Advocacy
HATOF Foundation
Umar Bun Hatab Islamic School
Sewerage Systems Ghana Ltd

Good health and wellbeing

D-MOSS: Dengue forecasting MOdel Satellite-based System

Half the world's population is now estimated to be at risk from the dengue fever, a mosquito-borne viral infection found in tropical and sub-tropical climates worldwide.

D-MOSS, a pioneering Earth Observation-based forecasting system, allows decision makers to identify areas of high risk for disease epidemics before an outbreak occurs, to target resources to reduce epidemic spreading and to increase disease control.

D-MOSS gives beneficiaries several months advance warning of likely outbreaks of dengue fever, allowing local communities to mobilise to eliminate mosquito breeding sites thus reducing incidents of dengue.

D-MOSS improves coordination and timely decision making at regional and provincial level. The system includes graphics that track the trends in specific areas and maps to understand the situation in neighbouring provinces.

The D-MOSS early warning system is already live in Vietnam and is being implemented in Cambodia, Laos, Malaysia, Thailand, The Philippines and Sri Lanka.

> "For the first time, an Earth Observation-based forecasting system allows decision makers to identify areas of high risk for disease epidemics before an outbreak occurs, in order to target resources so as to reduce an epidemic spreading and to increase disease control."
>
> Darren Lumbroso, Technical Director

Zero hunger

Developing affordable solutions to Kenya's saltwater problem

In parts of Kenya, people have long suffered from food insecurity caused by scarcity of water and frequent drought. They must turn to food aid when they would normally depend on their livestock for their livelihoods.

Farming, livestock, and new tree planting mostly depend on limited supplies of borehole water and other underground sources. Much of this water is brackish (salt water) and harmful to animals, humans, plants, and soils.

A UK-Kenya research team have come up with an affordable, easy to build and maintain solution. Not only does it meet basic drinking water and food needs, it also empowers the population to practice horticulture and agro-forestry.

The team use water bottles buried in the soil, their topsides left exposed to the sun. The bottles contain the brackish water, which is evaporated by heat from the sun and hot soil. This resulting vapour reaches the soil and plant roots through holes above the water surface, leaving harmful salts behind.

The team also built the 'Made-In-Kenya' solar-thermal desalinator. A device that concentrates the light from the sun to boil away brackish water, condensing the vapour into freshwater.

Recycled heat from the process evaporates more brackish water, producing additional freshwater.

The device can provide 10–20 litres of freshwater per day, enough to meet the drinking water needs of a typical household.

Further funding from the Scottish Funding Council/GCRF enabled more data to be obtained from test fields, confirming the effectiveness of the method and data for further improvement of the design.

Climate action

Seasonal forecasts tackle wildfires

Wildfires significantly impact people, ecosystems, and the climate. They affect regional air quality, destroy forests, and create hazards for the people and infrastructure surrounding them.

A United Nations Environment Programme report has predicted that even if greenhouse gases are reduced, there could be a global increase in extreme wildfires of up to 50% by the end of the century.

It is particularly important in South America's protected areas to understand how wildfires may change and predict fire risk. Protected areas have high biological, environmental and sociocultural value.

Led by Brazil's National Centre for Monitoring and Early Warning of Natural Disasters (CEMADEN) in collaboration with the Institute of Space Research (INPE) and the Met Office, scientists have used the Met Office seasonal forecast to calculate fire probability for South America several months ahead.

The seasonal forecast is used to produce reports for decision makers, identifying areas with increased fire probability and providing recommendations to mitigate that risk. As a result, the project is helping generate information to support wildfire strategic prevention and planning that will support conservation strategies across South America.

The report is already being shared across national borders, facilitating strategic planning and fire management in Brazil, Bolivia, and Peru, highlighting the value of this collaborative effort.

Fellowships

FLAIR Fellowships

Through his FLAIR Fellowship, Dr Gift Mehlana set up and led a research group focussing on capturing waste carbon dioxide from industrial exhausts. The first research group in the department of chemical sciences at the Midlands State University in Zimbabwe.

The active removal of carbon dioxide from the atmosphere is a major global challenge. Mehlana is not only working on technology to capture CO2, he is also using the process to create organic materials that have alternative uses, for example methanol which can be used as a biofuel.

Two students under Mehlana's supervision completed their PhDs, one of whom was awarded the Vice Chancellor's award for the best PhD thesis.

Future Leaders – African Independent Research (FLAIR) Fellowships are awarded to talented African early career researchers who have the potential to become leaders in their field. They provide the opportunity to build an independent research career in a sub-Saharan African institution, and to undertake cutting-edge scientific research that will address global challenges facing developing countries.

FLAIR Fellowships are funded through a partnership between the African Academy of Sciences (AAS) and the Royal Society, supported by the Global Challenges Research Fund (GCRF).

> "In Zimbabwe most of the universities don't have a solid research culture so you are looking in terms of capacity, assets or equipment that is needed to carry out cutting edge research, research that is high quality, and looking at FLAIR, the amount of the grant is so much that you can actually acquire the equipment that you can, that you actually need to carry out cutting edge research."
>
> Dr Gift Mehlana, Midlands State University in Zimbabwe

Innovation and IP

Innovation and intellectual property

Some delivery partners focus more on supporting innovation rather than traditional research studies. Their outputs develop technologies, products and services, as well as spin-out companies that are established to take these innovations to scale.

Our key performance indicators aim to track these outputs by counting the instances of intellectual property protection and spin-out companies arising from our awards.

Due to the type of activity and relevance of this KPI to a few delivery partners, most came from the Royal Academy of Engineering, Royal Society and UKRI.

In 2021 delivery partners reported 19 spin outs and 394 instances of IP

Saving lives of patients experiencing respiratory distress

The high price and shortage of mechanical ventilator systems has caused strain for health systems globally. In Africa this limited supply of ventilators contributed to the deaths of thousands of patients in respiratory distress.

Energy infrastructure engineer Yusuf Bilesanmi and his team set up Shifa Technologies Ltd., in response to the lack of affordable, easy to use ventilators during the Covid-19 pandemic.

Produced at a fraction of the price of the average mechanical ventilator, ShiVent is a non-invasive ventilator for patients with respiratory difficulties.

Using the principles of Bubble CPAP, (Continuous Positive Airway Pressure), the patient inhales oxygen to fill up the lungs and then exhales into a water column creating back-end pressure that keeps their airway open.

Spin outs

Designed for under-resourced clinics with unreliable electricity supply, ShiVent's simple, non-electric design, enables unspecialised healthcare workers to be trained in its use in 30 minutes.

Following trials in Lagos and Pune, the team rolled out the system in Sub Saharan Africa and Asia and are exploring opportunities in South America as well.

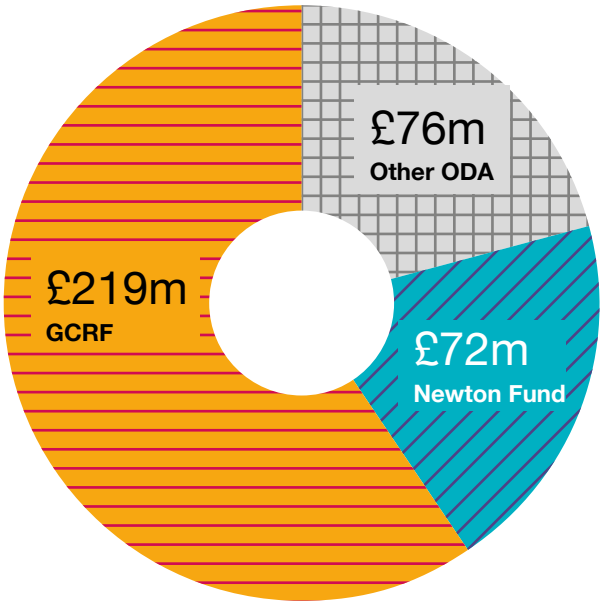
Bilesanmi was one of 5 winning innovators who pitched their ideas to a live online audience at the Africa Prize for Engineering Innovation run by the Royal Academy of Engineering.

> "In designing our solution, we noted the requirements and guidance of the NHS and MHRA (Medicines and Health Regulations Authority) in the UK on the standards required for a medically-compliant ventilator. After 10 weeks of development and testing, we are proud to introduce what we call the Shi Vent, a Bubble Continuous Positive Air Pressure device."

Financials

An overview of our financial data for this year and previous years, and breakdown of spend for each delivery partner.

2021 calendar year spend by fund: total spend £367m



Other ODA is a target set by HMT against which BEIS reports ODA eligible activity from core (non-ODA) BEIS R&D spend.

Calendar years spend by fund in previous years

	2018	2019	2020	2021
GCRF	£262m	£362m	£392m	£219m
Newton Fund	£120m	£119m	£101m	£72m
Total	**£382m**	**£481m**	**£493m**	**£291m**

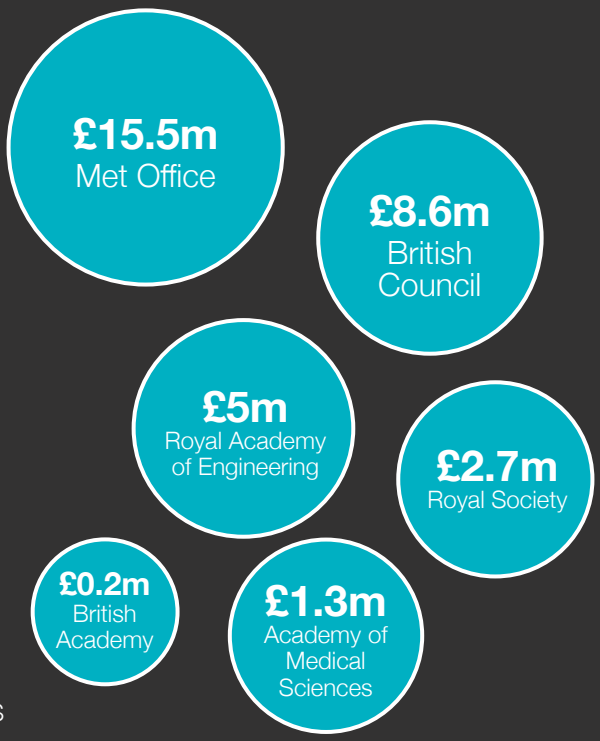
2021 calendar year spend by delivery partner and fund

Global Challenges Research Fund

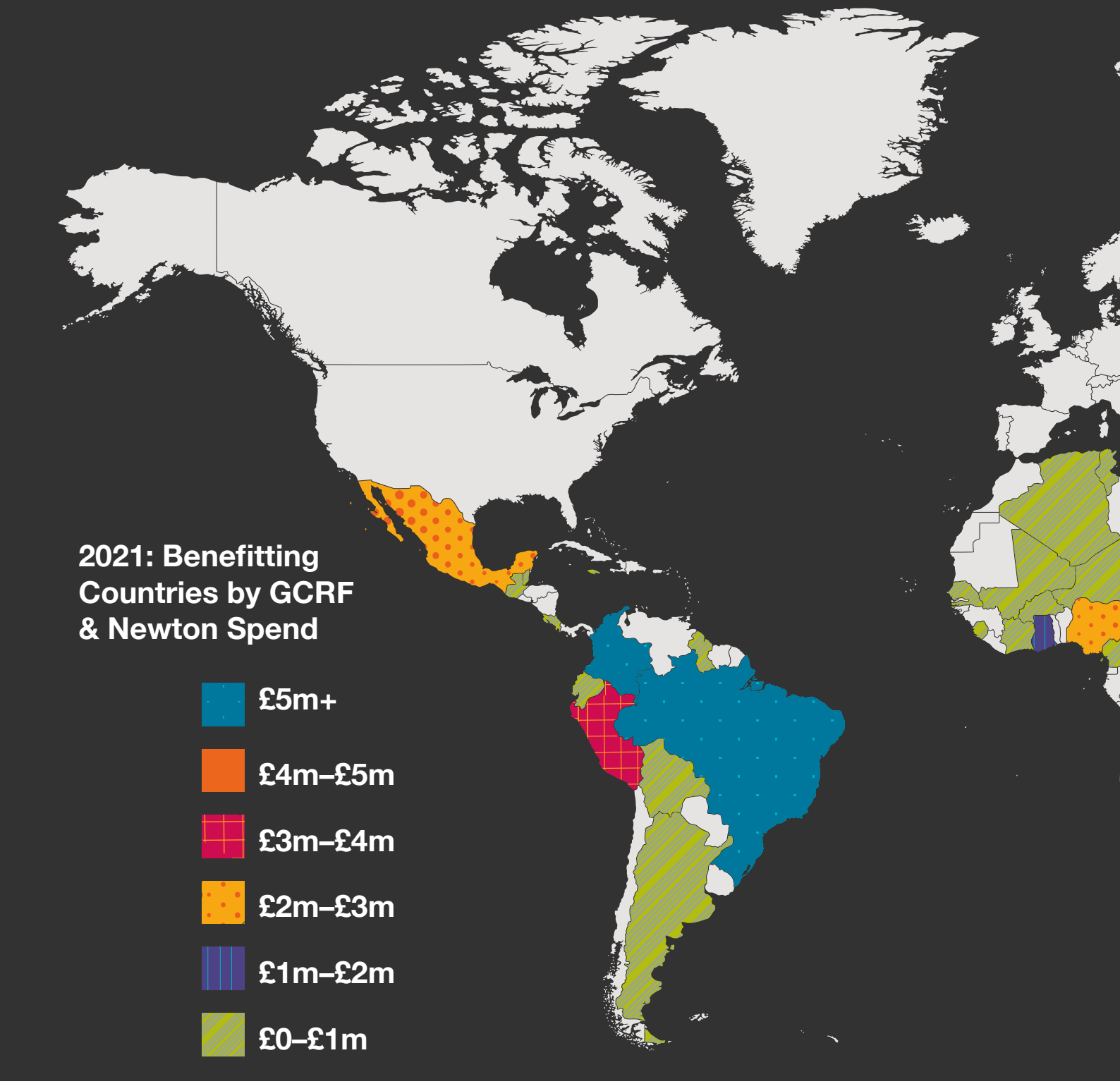
£151.4m
UK Research and Innovation

Newton Fund

£34.8m
UK Research and Innovation

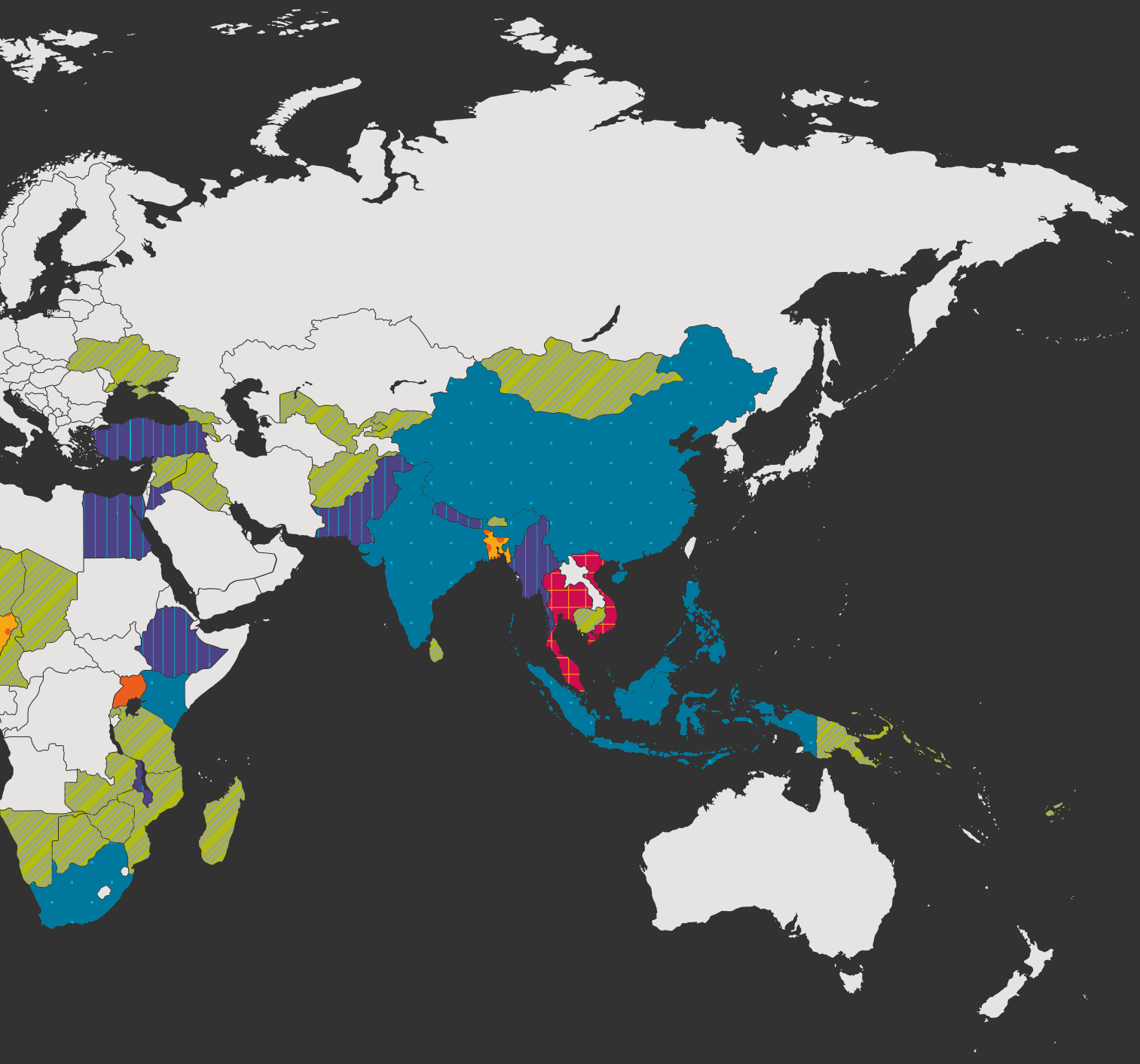


Note: In addition to the above a further £12.5m was spent by BEIS



Reach and outputs

Breakdown of combined spend for GCRF and Newton Fund in 2021



Source: Statistics on International Development: Final UK Aid Spend 2021

GCRF and Newton Fund target low- and middle-income countries (LMIC). Today's most pressing global development challenges such as inequality, pandemics and climate change – transcend national borders. We need to work with researchers and communities in LMICs if we are to achieve globally sustainable poverty reduction.

Countries associated with funding may reflect activities either taking place in that country, and/or activities that are deemed to be relevant to that country's development challenges but taking place elsewhere, such as the UK.

The UK works in partnership with China and India respectively to deliver global development impact; addressing challenges that are relevant to developing countries around the world.

Spotlight on our approach to Monitoring, Evaluation and Learning

Traditional monitoring and evaluation (M&E) tend to focus on producing data for accountability. BEIS takes a wider monitoring, evaluation and learning (MEL) approach. Alongside reporting requirements, we evaluate our funds to identify where we are on track, and where we need to incorporate feedback and learning to improve the effective delivery of our funding programs.

Newton Fund

The Department for Business, Energy and Industrial Strategy commissioned Tetra Tech International to undertake an independent evaluation to determine the success of the Newton Fund.

Achievements:

The Newton Fund was found to address the needs of partner countries. Activities and outputs meet the key objectives of the fund, targeting economic development, welfare, and poverty issues.

Equitable partnerships are a defining feature of the fund. The partnership model is highly valued and viewed as mutually beneficial. Award holders strongly agree that working in a partnership improved the quality of their work, developed their skills and enabled access to resources. The Newton Fund has built capacity to commercialise innovations. It has resulted in 164 patents and 77 spinouts.

The fund has contributed to establishing the UK as a partner of choice in partner countries. It has enabled the strengthening of links with government stakeholders and institutions, influencing policy and practice, providing a basis for joint science and research strategies, and facilitating new partnerships outside the framework of Newton activity, which will provide additional platforms for collaboration and translation in future.

Recommendations:

If Newton Fund was to continue a fund level strategy would articulate the fund's trajectory from research to impact, and how these activities influence policy or practice. It would further clarify how the fund mainstreams diversity, inclusion and gender equality and would provide an exit strategy, supporting new partnerships with a view to sustainability.

The partnership model is highly valued, mutually beneficial, and unique to each partner country and delivery partner. It facilitates the co-design of priorities, engages senior level buy-in and reflects partners' interests. Crucially, it enables critical success factors, such as the co-creation of research programmes, the exchange of knowledge and skills, and the creation of linkages for wider engagement in the research and innovation ecosystem to influence design and delivery.

Collaborative country-specific strategies should identify research capacity and thematic priorities for partner countries. The strategies would provide more direction for delivery partners and award holders when designing projects. They should include exit strategies and transitioning support.

- £735m ODA to the Newton Fund programme
- 18 Partner Countries – 2,000 overseas partners
- 164 Patents – 77 Spinouts
- 5,400 grant-assisted projects
- 5,700 research publications

Figures correct at time of evaluation publication.

Newton Fund case study

CRADLE

Obstetric haemorrhage, pre-eclampsia and sepsis account for more than 50 percent of maternal deaths worldwide.

A Newton-Bhabha funded collaboration, between researchers in India and the UK, introduced a new vital sign device into routine maternity care at community and hospital level in 10 sites in India, Ethiopia, Zimbabwe, Zambia, Uganda, Sierra Leone, Malawi and Haiti.

The CRADLE Vital Signs Alert (VSA) is a hand-held, semi-automated, early warning device which measures blood pressure and pulse, detecting hypertension and circulatory shock.

The project was awarded the Newton Prize 2017, enabling researchers to introduce the device in Ugandan refugee settlements to provide disease detection and further evaluate its abilities.

300+ devices delivered to hospitals and clinics

1,500+ healthcare workers trained to use the device

GCRF

Evaluation of findings from the first five years of the GCRF, produced by independent external evaluators ITAD.

Achievements:

GCRF has produced a high volume of diverse outputs and interdisciplinary collaborations. These go beyond academic publications, and include 20,373 creative, policy and technology outputs.

The evaluation found that investments are the strategic initiatives that represent the 'essence' of what GCRF was set up to achieve. These include Growing Research Capacity (GROW), Interdisciplinary Hubs, the UK Space Agency's International Partnerships Programme (IPP), the Future Leaders – African Independent Research (FLAIR) programme and the Collective Fund.

The greatest progress was found in the 'relevance' and 'equitable partnerships' measures in the signature investments and wider portfolio.

Recommendations:

Key structures and systems are needed to deliver a fund that has a sense of identity and ownership, which is structurally aligned around clear development-led missions. The signature investments offer useful models for cascading management structures and approaches that could be applied across the whole GCRF.

GCRF needs to balance the key priorities for research excellence and development impact, and quality standards for ODA excellence should be agreed.

Collaborative country-specific strategies should identify research capacity and thematic priorities for partner countries. The strategies would provide more direction for delivery partners and award holders when designing projects. They should include exit strategies and transitioning support.

Key figures

- £1.5 billion in Official Development Assistance
- 887 artistic and creative outputs
- 5,850 research publications
- 1,076 policy influences – 174 policy citations
- 46 innovation outputs – 701 technology outputs
- 6,114 grant-assisted projects

GCRF case study

Lab in a suitcase

Potentially hazardous bacteria in water can be screened rapidly to save lives anywhere in the world thanks to a testing laboratory that fits into a suitcase.

Developed by researchers at the Water Security and Sustainable Development Hub, the portable testing lab is believed to be the first of its kind.

The lab allows researchers to go to any location where waterborne disease is thought to be present and screen the water samples, enabling hazards to be identified quickly, easily, cheaply.

The data can be used on-site to measure the effectiveness of wastewater treatment, track faecal source pollution, and determine water safety.

The affordability of the equipment and the speed of sampling gives public health officials a better opportunity to identify and deal with local hazards, potentially saving countless lives.

Department for Business, Energy & Industrial Strategy

GCRF

Newton Fund

6817.0223