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Partner Country Case Study: South Africa

Final Evaluation of The Newton Fund

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TETRA TECH
International Development

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Disclaimer

The views expressed in this report are those of the evaluators. They do not represent those of the Department for Business, Energy and Industrial Strategy, the Newton Fund or of any of the individuals and organisations referred to in the report.

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Abbreviations

AH	Award Holder
AGN	Active Galactic Nuclei
ANC	African National Congress
AVN	African Very Long Baseline Interferometry Network
BC	British Council
BEIS	Department for Business, Energy and Industrial Strategy
BRIC	Brazil, Russia, India, and China
CCs	Competence Centres
CoCs	Centres of Competence
CPC	Compound Parabolic Collector
CSIR	Council for Scientific and Industrial Research
DAC	Development Assistance Committee
DARA	Development in Africa with Radio Astronomy
DEFF	Department of Environment, Forestry and Fisheries
DHET	Department of Higher Education and Training
DP	Delivery Partner
DTIC	Department for Trade, Industry and Competition
DSI	Department of Science and Innovation
DST	Department of Science and Technology
EPA	Economic Partnership Agreement
EU	European Union
EVN	European VLBI Network
FCDO	Foreign, Commonwealth and Development Office
GCRF	Global Challenges Research Fund
GCRO	Gauteng City-Region Observatory

GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on R&D
GSK	GlaxoSmithKline
GSSTI	Ghana Space Science and Technology Institute
HartRAO	Hartebeesthoek Radio Astronomy Observatory
HDIs	Historically Disadvantaged Institutions
HMG	Her Majesty's Government
HSSE	Health, Safety, Security and Environment
HySA	Hydrogen South Africa
IAP	International Astronomical Union
ICT	Information and Communications Technology
ICT	In-Country Team
IMF	International Monetary Fund
ISARP	Italy-South Africa Joint Research Programme
LOC	Lab-on-a-Chip
LRI	Laser Research Institute
M&E	Monitoring and Evaluation
MBI	Maternal Bacterial Infection
MRC	Medical Research Council
MTSF	Medium Term Strategic Framework
NACI	National Advisory Council on Innovation
NCD	Non-Communicable Diseases
NDP	National Development Plan
NF	Newton Fund
nGAP	New Generation of Academic Practitioners Programme
NIBEC	Nanotechnology and Integrated Bioengineering Centre
NRF	National Research Foundation

ODA	Official Development Assistance
OECD	Organisation for Co-operation and Development
PI	Principal Investigator
PPPs	Public-Private Partnerships
R&D	Research and Development
RED	Research and Evidence Division
SACUM	Southern African Customs Union Member States and Mozambique
SADC	Southern African Development Community
SAMRC	South African Medical Research Council
SANSA	South African National Space Agency
SARAO	South African Radio Astronomy Observatory
SARChI	South African Research Chairs Initiative
SAWS	South African Weather Service
SKA	Square Kilometre Array
STEM	Science, Technology, Engineering and Mathematics
STFC	Science and Technology Facilities Council
S&I	Science and Innovation
SUN	Stellenbosch University
TB	Tuberculosis
THRIP	Technology for Human Resources in Industry Programme
TIA	Technology Innovation Agency
UK	United Kingdom
UKRI	UK Research and Innovation
US	United States
UU	Ulster University
VfM	Value for Money

VLBI	Very Long Baseline Interferometry
WCSSP	Weather and Climate Science Partnership
WHO	World Health Organisation
WRC	Water Research Commission

Executive Summary

Newton Fund in South Africa at a glance

- Established in 2014, the UK-South Africa (UK-SA) Newton Fund for science and technology collaboration is based on the principles of co-ownership and co-responsibility.
- The primary purpose of the Fund is to develop scientific capacity in partner nations for their long-term sustainable economic growth.
- It does this through 1) research capacity building – assisting partners to undertake and disseminate scientific research; and 2) broader scientific capacity building – supporting the ability of developing countries to support and gain from science and innovation.
- The UK-SA Newton Fund's priority sectors include higher education and research capacity, health research, weather and climate change, oceans economy, food security, renewable energy, entrepreneurship, radio astronomy and data science. All areas of focus are underpinned by cross-cutting themes of human capital development, innovation, regionalisation, and big data.
- Under the 'people' pillar, the National Research Foundation (NRF) partners with UK academies and the British Council. Under the 'programme' pillar, the NRF partners with UK Research and Innovation (UKRI).
- The UK committed £40 million to the UK-SA programme between 2014 and 2021, which is match funded by South African partners.

The case study

Tetra Tech International Development produced this Partner Country Case Study in South Africa to inform the Final Evaluation Report of the Newton Fund. It is one of 11 country case studies that investigates the Fund's implementation and its results. It serves as a deep dive into the development, relevance, additionality, and results of (a) the programme activities; and (b) their success factors and barriers that affected their implementation.

The case study sampled three calls under the UK-SA Newton Fund, and from each a project was selected for in-depth analysis:

- **African VLBI (Very Long Baseline Interferometry)[1] Network Training Programme:** under the call **'**Development in Africa with Radio Astronomy' (DARA), the project aimed to upskill students in STEM subjects by partnering with eight other African countries as part of the Square Kilometre Array (SKA), a major next-generation radio telescope and the first big science project on the African continent.
- **Unseen infrastructures: post-colonial migration, unseen labour and maintenance and repair in British Cities**: under the call 'Newton International Fellowships Year 4', this two-

[1] Very-long-baseline interferometry (VLBI) is a form of astronomical interferometry that is used in radio astronomy.

year International Fellowship was hosted at the University of Sheffield in the UK where a South African Fellow examined issues relevant to international refugees within a UK urban environment.

- **Low-cost technologies and microbial assessment for safe drinking water in South Africa:** under the ‘‘Institutional Links’ call, this research project aimed to develop new low-cost reactors for solar disinfection based on compound parabolic collector (CPC) reflectors, photocatalytic materials, and novel engineered design for the optimisation of solar drinking water disinfection. It was a collaboration between the Council for Scientific and Industrial Research, CSIR, and the University of Hull.

The research was carried out by reviewing documents at project and fund-level and carrying out interviews in November and December 2020 with 39 people from the UK and South African institutions. Interviewees came from Delivery Partners in both countries, award holders (AHs) and UK High Commission and FCDO staff, and high-level stakeholders from Delivery Partners in South Africa.

The case study is a self-contained investigation and its findings are not intended to be generalised to the entire Newton Fund in country. Case studies were limited to three projects per case study, which were conducted remotely owing to the Covid pandemic. In some projects, the added logistical challenge of remote research limited the number and range of stakeholders consulted. The case study findings reflect the data provided by each project and available information online. The volume of documentation provided varied by project, thus limiting the possibility of triangulating findings. In terms of total Newton Fund expenditure, the projects selected represent a very small fraction of all expenditure across 5,400 projects. The case study is therefore not representative of all Newton Fund activities. Whereas it provides valuable depth and illustration of Newton Fund activities, the case study alone does not provide generalisable evidence.

Key Findings

Effectiveness

- **The UK-SA Newton Fund has contributed to strengthening UK-South Africa bilateral relations through scientific collaboration**. For example, the British Academy established a research collaboration with South Africa for the first time through the Newton Fund.

- **The role of the UK’s in-country team in South Africa has been valuable in generating results.** The team is regarded by partners as having unparalleled knowledge of the innovation sector in South Africa. Their personal networks and relationships throughout the sector have been a key contributing factor to the Fund’s success.

Emerging impacts

- **The Fund has achieved important results at the individual researcher level and beyond, although it is too soon to observe this in all cases**. There is evidence of improved research capacity in South Africa thanks to work carried out through the Newton Fund. This includes improving individual researchers’ capacities and technical expertise, allowing projects to progress and connecting international teams of researchers and institutions. International collaborations have included policymakers in South Africa and the UK.

- **The Newton Fund's activities have been instrumental in supporting South Africa's innovators through access to funding and networking opportunities**. These have helped generate innovative research and products. Newton has supported projects whose advancements have the potential to tackle pressing health challenges in South Africa.

Sustainability

- The Fund has led to **new relationships between South Africa and UK scientists at the government level,** supported by its strong brand. The Fund was valued by all stakeholders, who expressed eagerness to participate in a second phase of the Fund.
- It was reported that due to the Newton Fund, **many projects had built strong foundations for sustainability, potentially leading to even greater impact**. In addition, Newton Fund activities have supported the creation of an enabling environment in the field of astronomy in South Africa.
- While the UK-SA Newton Fund has shown signs of success, **the sustainability of research collaborations is mixed and varies by project.** Any potential collaborations in the future depend on securing follow-on funding through a next phase of Newton or from other sources.

Complementarity and coordination

- **There is potential for Newton-funded collaborations to lead to long-lasting future partnerships.** One notable example is the DARA VLBI training programme. The UK team developed strong partnerships and networks between institutions and researchers in the UK, South Africa, and the other partner countries, leading to the creation of a growing and promising research community. In the two other sampled projects, the more limited project timeframe or the limited funding scope meant that the projects were more self-contained in terms of their potential for further research collaborations.

Lessons Learned

- The UK-SA Newton Fund demonstrated that a **regional model across multiple countries can be successful for certain types of collaboration**. Respondents welcomed establishing stronger research ties with countries which are of strategic relevance to South Africa socio-political interests.
- Respondents felt that the programme's co-design and launch phases followed overly tight timeframes. **More time could have been invested in the organisation of fora and workshops** to identify research topics relevant to the country's priorities.
- Some award holders felt **research calls were not framed in the spirit of equal partnership** – for example by implying a collaboration is arranged between an experienced UK researcher who provides technical expertise and a South Africa-based researcher whose contribution is limited to providing empirical data.

Considerations and recommendations for the UK-SA Newton Fund

- **The Newton Fund could extend beyond a bilateral implementation model in certain cases.** Several South African DPs and AHs suggested running calls and research partnerships through trilateral or multilateral collaborations across Newton Fund countries. This would allow collaborations to take a greater regional focus. For example, one DP

pointed to their research collaborations with Egypt and Kenya, which are similar in intent and objectives to the UK-SA Newton Fund.

- **The Newton Fund could allow more project preparation time in collaboration with other in-country funders so that responsibilities could be better defined among all stakeholders.** Match funding was regarded as a positive implementation model, ensuring both parties' commitment and fostering equal partnership and mutual collaboration.
- **Research calls could do more to include principles of equity in selection processes and ensure representation of historically disadvantaged institutions and socio-economic groups**. More explicit efforts could be made to ensure their participation in international research collaborations and capacity building activities.
- **The Fund's role is clear in creating value against the People and Research pillars; however, more could be done to further support its Translation aims.** As such, a future phase of the Newton Fund could include greater alignment and collaboration with other diplomatic and international efforts carried out by the UK government in South Africa.

1 Introduction

1.1 Aim and purpose of the case study

This report presents our findings for our country case study of Newton Fund activities in South Africa under the UK–SA Newton Fund for Science and Technology Partnership. It focusses on three activities in the country. While these findings will inform the Newton Fund's final evaluation, they are specific to the country under investigation and are not to be generalised to the broader Fund. The strength of evidence (Section 1.5) for this case study should guide the reading of the results set out in Sections 3- 6. Remote research on the Newton Fund in South Africa was carried out in **November and December 2020**.

The purpose of the case study is to examine:

- the relevance of the country-level work to Newton Fund's theory of change, including the ways in which funded projects have supported the Newton Fund to achieve its stated outputs and outcomes.
- the effects of Newton funding in terms of the scale and type of results delivered by the sampled projects, and their potential impact on the socio-economic challenges identified in the country and more widely.
- the likely sustainability of the activities and results of the sampled projects and by the Newton Fund.

We also aim to better understand the overarching significance and impact of the UK-SA Newton Fund in South Africa, such as on the internationalisation of research institutions, the relationship between the partner country and the UK, and in the sharing of best practice between the two countries.

1.2 Research scope

This country case study focusses on the activities under the UK-SA Newton Fund. Specifically, it assesses the following:

- the **development of each activity** – examining its origins, how engagement with the Newton Fund occurred, and an overview of the process of securing Newton funding.
- the **relevance of each activity** to South Africa's development needs and to Newton Fund and Official Development Assistance (ODA) goals.
- the **additionality of each activity.**[2]
- the **results of each activity** in terms of the outputs, outcomes and impacts generated to strengthen the science and knowledge base, innovation capacity and policy influence in South Africa and beyond.

[2] In the context of the Newton Fund, additionality aims to assess whether a given call or project could have happened in the absence of the Newton Fund (for example, through funding for similar activities provided by other programmes).

- the **success factors (and barriers) which affected each activity**, as well as the potential benefits from each activity that might be expected to arise in the future.

The case study includes a mix of ongoing and completed activities. When assessing these activities' results, we considered their ambitions as well as early signs of achieving impacts recognising that impacts of research and innovation take time.

To understand how sustainable solutions to economic development and poverty reduction have emerged from Newton Fund activities, our enquiry focusses on the factors that facilitate specific research activities, increase the quality of research outputs, enhance international collaboration for higher-level education and translate research into innovative practices.

1.3 Case study selection

As part of our sampling methodology for the Newton Fund country case studies, we shortlisted case study calls for each country based on three measures: size, pillar, and sector (see Annex 2 for details). Project selection considered thematic areas of focus, aiming to include priority areas for the Newton Fund in each country. We also sought to achieve a spread of Delivery Partners (DPs) and activity types across the countries in our sample. Following consultations with in-country teams (ICTs), DPs and the Newton Fund Central Team, we selected **three calls per country**. This selection allowed us to include a call under each of the Newton Fund's core activity pillars: People, Research, and Translation.

One project was sampled from each of these three calls to ensure as broad geographical and partner coverage within the country case study's short timeframe. We also considered the relevance of their specific research areas to the Newton Fund's priorities in South Africa when the projects were selected.

In South Africa, the sampled calls and projects analysed in depth in this report are:

Calls	Projects
Development in Africa with Radio Astronomy (DARA)	African VLBI Network Training Programme - upskilling students in STEM subjects to develop a sustainable African economy (extension)
Newton International Fellowships Year 4	Unseen infrastructures: post-colonial migration, unseen labour and maintenance and repair in British Cities
Institutional Links	Low-cost technologies and microbial assessment for safe drinking water in South Africa

1.4 Methodology

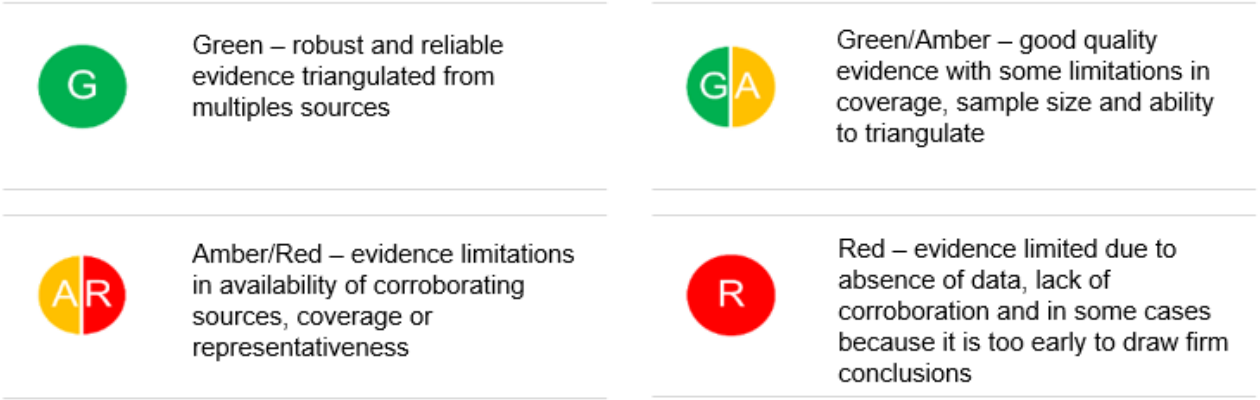
The research for the country case studies included desk-based review documentation and remote key informant interviews (see Annex 1). For the South Africa case study, we consulted 39 UK and South Africa stakeholders such as Delivery Partners in both countries, Award Holders (AHs), senior staff from partner organisations as well as the programme team and UK High Commission staff.

Due to COVID-19-related travel restrictions, we had to switch to a purely remote approach. We assured the quality of our interviews by building rapport with stakeholders by email prior to the interviews, reviewing documents thoroughly to identify the most important gaps to keep the sessions brief amongst other steps. Details of the limitations of this approach and our mitigation actions are set out further in Annex 1.

1.5 Strength of evidence assessment

Tetra Tech used a traffic light system to assess the case study's strength of evidence (see figure 1 below).[3] The rating assesses the evidence supporting the conclusions reached given the methodological limitations outlined in Annex 1. Table 1 details the main sources of evidence used for this case study and the rating assigned to it.

Figure 1: Strength of evidence ratings



[3] Our aim was to achieve a sufficient degree of confidence about the extent to which outcomes have occurred, Newton Fund's level of contribution to the outcomes and our theory about how the Newton Fund has contributed or failed to contribute. Confidence is affected by the extent of triangulation across sources and the position, knowledge, analytical capacity, and potential biases of primary informants. The ratings are not designed to be a rigid framework, but rather a way to ensure evaluative judgements were made systematically across the Evaluation Questions.

Table 1: Strength of Evidence for the Newton Fund in South Africa

Strength of Evidence	
Green/ Amber 	There are gaps in the evidence, which limited the assessment of relevance, effectiveness, emerging signs of impact and sustainability. This is due to the relatively small sample of interviews conducted which limits the extent to which it is possible to assess if the UK-SA Newton Fund has produced results and benefited its intended recipients. In addition, the extent, type and structure of monitoring data and documentation varied across DPs, limiting the extent to which outputs and outcomes can be reviewed and triangulated.

1.6 Report structure

The report is structured as follows:

- Section 2 introduces the context of South Africa, including political and economic developments and trends in the R&I landscape.
- Section 3 discusses high-level emerging results of the Newton Fund in South Africa based on findings from the three sampled projects and broader consultations undertaken with the programme team.
- Sections 4 to 6 analyse three specific projects in-depth, providing an assessment of the relevance, effectiveness, emerging impact, and sustainability of the sampled activities.

2 Context

2.1 Context and evolution of the Fund in South Africa

South Africa has seen slight growth in gross domestic product (GDP) since 2016, after an economic downturn between 2014 and 2016. The government's national development plan is seeking to address poverty, inequality, and unemployment challenges.

South Africa is a parliamentary republic in which the president serves both as head of state and government. The National Assembly elects the president. The current president of South Africa is Cyril Ramaphosa, who was elected in 2018 after former President Jacob Zuma was forced to step down because of corruption scandals and public protests.[4] President Cyril Ramaphosa is an anti-apartheid veteran with a strong business background and is one of South Africa's richest businessmen.[5] The most recent general election in South Africa took place in May 2019, with the president leading his ruling African National Congress (ANC) party to victory. The ANC party has won every election in post-apartheid South Africa since the end of the apartheid era in 1994.[6] South Africa is considered a relatively stable democracy[7], dominated by the ANC,[8] despite struggling with high levels of corruption,[9] poverty and violent crime.[10]

South Africa is classified in the Development Assistance Committee (DAC) list of Official Development Assistance (ODA) recipients as an upper-middle-income country. It advanced from the lower-middle-income category in 2004.[11] The majority of ODA for South Africa is provided by the United States (US). The UK is South Africa's fourth-largest bilateral donor after the US, Germany, and France.[12]

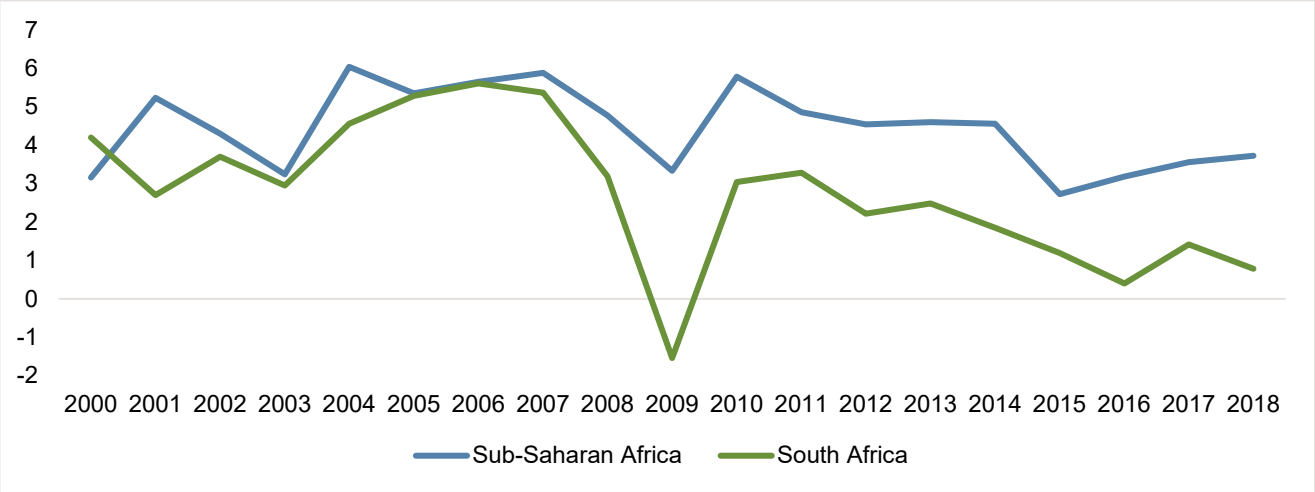
As shown in Figure 2, South Africa's gross domestic product growth has experienced serious volatility and a decreasing trend since 2010 after briefly recovering from the 2008 global crisis.[13] South Africa went through an economic downturn between 2014 and 2016, with a continuous fall in GDP per capita.[14] However, GDP growth increased slightly from 0.40% to 0.78% between

[4] BBC News (2018). 'South Africa's Jacob Zuma resigns after pressure from party' Available at: https://www.bbc.co.uk/news/world-africa-43066443
[5] BBC News (2019). 'Cyril Ramaphosa - South African union leader, mine boss, president' Available at: https://www.bbc.co.uk/news/world-africa-20767093
[6] World Bank (2021). 'The World Bank In South Africa' Available at: https://www.worldbank.org/en/country/southafrica/overview
[7] GOV.UK (2021). 'Overseas Business Risk - South Africa' Available at: https://www.gov.uk/government/publications/overseas-business-risk-south-africa/overseas-business-risk-south-africa#:~:text=risk%2Dsouth%2Dafrica-,1.,dominated%20by%20one%20political%20party.&text=This%20victory%20came%20with%20the,(COSATU)%20and%20the%20ANC.
[8] Ibid.
[9] Transparency International (2019). 'Corruption Perceptions Index' Available at: https://www.transparency.org/en/cpi/2019/results/
[10] Bloomberg (2019). 'South African Murders Increase to Highest Level in a Decade' Available at: https://www.bloomberg.com/news/articles/2019-09-12/south-african-murders-increase-to-highest-level-in-a-decade
[11] OECD (n.d.). 'DAC List of ODA Recipients (current and historic)' Available at: http://www.oecd.org/dac/stats/historyofdaclistsofaidrecipientcountries.htm
[12] Compare your country (n.d.). Available at: https://www1.compareyourcountry.org/en
[13] Mouhamadou M. LY (2019). South Africa's Economic Slowdown and Its Policy Options. Policy Center for the New South.
[14] Mouhamadou M. LY (2019). South Africa's Economic Slowdown and Its Policy Options. Policy Center for the New South.

2016 and 2018. According to the World Bank, political transition and economic reform initiatives contributed to a stronger performance in 2018.[15] More recently, COVID-19 triggered another severe economic downturn leading to low levels of growth and investment and declining commodity prices.[16] South Africa has the largest number of positive COVID-19 cases in the sub-Saharan Africa region, and strict lockdown measures weigh heavily on the economy.[17] In late December 2020, the country entered a new lockdown after discovering a new COVID-19 variant.[18] The economy grew 0.2% in 2019, against 0.8% in 2018. It is expected to fall to -5.8% in 2020 due to the outbreak of the COVID-19 and pick up to 4% in 2021, according to the updated International Monetary Fund (IMF) forecasts from 14th April 2020.

South Africa remains a dual economy with one of the highest inequality rates globally, which is perpetuated by a legacy of exclusion and the nature of the country's economic growth, which has not generated sufficient jobs. Inequality in wealth is even higher: the richest 10% of the population held around 71% of net wealth in 2015, while the bottom 60% held 7%. Furthermore, intergenerational mobility is low, meaning inequalities are passed down from generation to generation with little change in inequality over time. Not only does South Africa lag its peers on level of inequality and poverty, but it also lags on the inclusiveness of consumption growth[19].

Figure 2: GDP growth in South Africa and the Sub-Saharan Africa region, 2000-2018



Source: World Bank

South Africa presents an advanced economic infrastructure and hosts 75% of the largest African companies. Nigeria has recently surpassed South Africa as the largest sub-Saharan economy. To address the economic downturn, President Ramaphosa has been investing in policy improvements to restore macroeconomic stability. Before the outbreak of COVID-19, President Ramaphosa had been able to boost economic growth, avoid downgrading from credit-

[15] World Bank (2018). Global Economic Prospects.
[16] World Bank (2020). Africa's Pulse, No. 21, Spring 2020: An Analysis of Issues Shaping Africa's Economic Future.
[17] Ibid.
[18] The Telegraph (2020). 'South Africa plunged into lockdown as Covid-19 cases soar' Available at: https://www.telegraph.co.uk/global-health/science-and-disease/south-africa-plunged-lockdown-covid-19-cases-soar/
[19] The World Bank (2021). 'The World Bank In South Africa' Available at: https://www.worldbank.org/en/country/southafrica/overview

rating agencies, and cut unemployment. However, South Africa faces rising public debt, inefficient state-owned enterprises, and spending pressures, reducing its global competitiveness.

South Africa is rich in mineral resources. It is the world's largest producer and exporter of gold, platinum, chrome and manganese, the second-largest palladium producer and the fourth-largest producer of diamonds.[20] It also enjoys substantial reserves of coal, gas and oil. **South Africa has diverse manufacturing industries and is a world leader in several specialised sectors, including railway rolling stock, synthetic fuels, mining equipment and machinery.** The industrial sector employs nearly a quarter of the workforce (22.7%) and represents 26% of its GDP.

Agriculture represents a small part of the country's GDP (1.9%) and employs 5% of its workforce, which is relatively low compared to other African countries. South Africa's agricultural economy is highly diversified and market oriented. The country is the world's sixth-largest producer of wine and the continent's largest corn and sugar producer. Grains and cereals - such as maize, wheat, barley, and soya beans - are the county's most important crops.

The services sector is flourishing. It employs 72.3% of the workforce and represents 61.2% of the country's GDP. The economy's major sectors are finance, real estate, and business services, followed by general government services. South Africa has a sophisticated financial structure with an active stock exchange that ranks among the world's top 20 in market capitalisation. The tourism sector has struggled to capitalise on the boost it received from the FIFA World Cup in 2010, despite benefiting from the weakness of the rand and visa facilitation. According to South Africa's department of statistics, tourism contributed 2.7% to the country's GDP in 2018 and provided jobs for 4.5% of the country's total employed.

In August 2012, the South African government introduced the **National Development Plan (NDP),** which aims to eliminate poverty and reduce inequality by 2030.[21] To address the country's socio-economic imbalances, the NDP outlines the key constraints to faster growth and presents a roadmap to a more inclusive economy.[22] The plan sets out actions around nine primary challenges: 1) too few people work, 2) the quality of school education for black people is poor, 3) infrastructure is poorly located, inadequate, and under-maintained, 4) spatial divides hobble inclusive development, 5) the economy is unsustainably resource intensive, 6) the public health system cannot meet demand or sustain quality, 7) public services are uneven and often of poor quality, 8) corruption levels are high and 9) South Africa remains a divided society.

The plan focuses on uniting South Africans of all races and classes around a common programme to eliminate poverty and reduce inequality, encouraging citizens to be active in their own development, in strengthening democracy and in holding their government accountable, and raising economic growth, promoting exports and making the economy more labour-absorbing. It also targets key capabilities of both people and the country. These capabilities include skills, infrastructure, social security, strong institutions, and partnerships within the country and with key international partners. Ultimately, it hopes to build a capable and developmental state.

[20] Noread Trade (n.d.) 'South Africa: Economic and Political Overview' Available at: https://www.nordeatrade.com/fi/explore-new-market/south-africa/economical-context
[21] Planning, Monitoring and Evaluation Department (2012). National Development Plan 2030 Our future - Make it work.
[22] Ibid.

More recently, the government published the second **Medium Term Strategic Framework (MTSF)** for 2019 to 2024 for the NDP. The MTSF aims to address poverty, inequality and unemployment challenges in the country and is composed of seven priorities, 81 outcomes, 377 interventions and 561 indicators. Its targets are summarised in Table 2 below.[23]

Table 2: Medium Term Strategic Framework objectives

	Baseline[24]	Target 2024	Target NDP 2030
GDP growth	0.8%	2% - 3%	5.4%
Unemployment rate	27.6%	20% - 24%	6.0%
Number employed	16.3 million	18.3 – 19.3 million	23.8 million
Investment - % of GDP	18%	23%	30%
Gini Coefficient[25]	0.68	0.66	0.60
Food poverty	24.7%	20%	0%
Lower bound poverty line	39.8%	28%	0%

Source: Planning, Monitoring and Evaluation Department. (2020). Medium Term Strategic Framework 2019-2024.

The seven priorities are the following: i) a capable, ethical and developmental state, ii) economic transformation and job creation, iii) education, skills and health, iv) consolidating safety nets through reliable and quality basic services, v) spatial integration, human settlements and local government, vi) social cohesion and safe communities, and vii) ultimately a better Africa and world.[26]

2.2 South Africa – UK relations (bilateral relations)

Since the end of apartheid, the UK and South Africa have had relatively good relations, and the country re-joined the Commonwealth. Ties between the two countries include a shared language and cultural links and similar financial and legal systems. Since 1997, South Africa and the UK hold the biannual South Africa-UK Bilateral Forum to regulate and enhance political and economic relations between the two countries. Priorities addressed during the Forum include global and regional issues: counter-terrorism and counter-proliferation,

[23] Planning, Monitoring and Evaluation Department. (2020). Medium Term Strategic Framework 2019-2024.
[24] Baselines are as follows: unemployment Q1:2019; growth 2018; inequality and poverty 2015/16.
[25] The Gini co-efficient is a standard measure for distribution of income across a population. The co-efficient ranges from 0 to 1, which 0 representing perfect equality and 1 representing perfect inequality.
[26] Planning, Monitoring and Evaluation Department. (2020). Medium Term Strategic Framework 2019-2024.

conflict prevention, climate change, migration, and 'fostering strong, sustainable, open and inclusive economies.[27]

Economic links are also strong, and South Africa is the largest African trade partner of the UK. South Africa is one of the top 20 exporters to the UK. Exports include natural and precious stones, mineral products, vehicles, machinery and mechanical products, fruits, and vegetables, and base materials. In addition, the UK was one of the top two largest foreign investors in South Africa as of 2011. Between 1998 and 2003, the UK was also South Africa's third largest import source before decreasing to sixth largest in 2008. UK imports to South Africa include gas turbines, turbojets and propellers, machinery and mechanical appliances, electrical equipment, chemicals, and vehicles. In 2011, it was announced that bilateral trade between the two countries should be doubled by 2015. In 2018, former UK Prime Minister Theresa May similarly announced plans to boost Britain's investment in Africa after Brexit.[28] This included a commitment to focus on long-term economic and security challenges rather than short-term poverty reduction. In the past, the UK has been criticised for focusing more on aid than trade. Many sub-Saharan Africa partners are keen to see how these plans and ambitions, prompted by Brexit, demonstrate a broader shift towards seeing the African continent as an equal economic partner.[29]

Until the UK decided to leave the EU, it had a trade deal with South Africa under an economic partnership agreement (EPA) between the EU and some member states of the Southern African Development Community (SADC). The agreement was meant to tackle unfair trade practice and contains safeguarding measures. With the UK leaving the EU, the UK, and the Southern African Customs Union (SACU) – comprising South Africa, Botswana, Lesotho, Namibia and eSwatini – and Mozambique have agreed in 2019 to an Economic Partnership Agreement. The continuity agreement mirrors the terms of the EU-SADC EPA.[30]

2.3 Science and innovation landscape in South Africa

During the evaluation period, the South African Department of Science and Innovation (DSI – formerly the Department of Science and Technology, DST) published several science and innovation (S&I)-related publications. **This includes the 2019 White Paper on Science, Technology, and Innovation, which sets out the government's long-term policy approach to S&I.**

The 2013 NDP articulates a strong role for S&I and sees it as a key driver of equitable economic growth, economic advances and improvements in health systems, education, and infrastructure. The NDP is structured in three separate phases:

- **Phase 1:** The first phase (2012 to 2017) had a focus on intensifying research and development spending, emphasising opportunities linked to existing industries.

[27] Weimer, M. and Vines, A. (2011). Programme Paper, *UK–South Africa Relations and the Bilateral Forum* Available at: https://www.chathamhouse.org/sites/default/files/19481_sa-uk_links.pdf
[28] BBC News (2018). 'Theresa May pledges Africa investment boost after Brexit' Available at: https://www.bbc.com/news/uk-politics-45325701
[29] BBC News (2018). 'Theresa May pledges Africa investment boost after Brexit'. Available at: https://www.bbc.co.uk/news/uk-politics-45325701
[30] Reuters (2019). 'Britain agrees post-Brexit trade deal with southern Africa' Available at: https://www.reuters.com/article/uk-britain-africa-trade/britain-agrees-post-brexit-trade-deal-with-southern-africa-idUKKCN1VW1N5?edition-redirect=uk

- **Phase 2:** In the second phase (2018 to 2023), the emphasis is on South Africa laying the foundations for more intensive improvements in productivity, and innovation across state, business and social sectors should start to become pervasive.
- **Phase 3:** Approaching 2030, the emphasis will move more towards consolidating the gains of the second phase, with greater emphasis on innovation, improved productivity, more intensive pursuit of a knowledge economy, and better utilisation of comparative and competitive advantages in an integrated continent.

DSI also published a **ten-year Innovation Plan for South Africa (2008-2018)** in 2008. Its goals include: being one of the top three emerging economies in the global pharmaceutical industry, based on an expansive innovation system using the nation's indigenous knowledge and rich biodiversity, deploying satellites that provide a range of scientific, security and specialised services for the government, the public and the private sector, a diversified, supply-secured sustainable energy sector, achieving a 25% share of the global hydrogen and fuel cell catalysts market with novel platinum group metal catalysts, being a world leader in climate science and climate change response, and meeting the 2014 Millennium Development Goals to halve poverty.[31]

More recently, DSI published its 2019 **White Paper**, which sets out the government's long-term policy approach to the S&I sector.[32] The White Paper outlines three main goals: i) to take advantage of opportunities presented by megatrends and technological change, ii) to expand policy approaches that have worked and propose new ones where necessary, and iii) to promote a more inclusive economy at all levels.[33] A new ten-year plan on S&I priority areas is expected to be published by DSI later in 2021. This is expected to provide an implementation plan for these priorities covering the 2020 to 2030 period.

In 2019, DSI and National Advisory Council on Innovation (NACI) published the Synthesis Report: South African Foresight Exercise for Science, Technology and Innovation 2030 to investigate the future of S&I and the use of S&I to improve the quality of life of all South Africans.[34] The report identifies 30 thrusts, each associated with one of the nine S&I domains: circular economy, education for the future, sustainable energy, future of society, health innovation, high-tech industrialisation, information and communications technology (ICTs) and smart systems, nutrition security, and water security. The report analysed the current status of the S&I domain and suggested recommendations. It also emphasised that the availability of funding sources is essential to implement all initiatives.[35]

South Africa's rich tradition of academic excellence and sophisticated research system is an area of strength.[36] There are 26 public universities in South Africa. South Africa boasts well-recognised public universities such as the University of Cape Town (136th worldwide on the Times World University Rankings), the University of the Witwatersrand (194th), and the University of Stellenbosch (215-300th).[37] In 2017/18, the top five public universities in terms of

[31] Department of Science and Technology (2007). Innovation Towards a Knowledge-based Economy: Ten-year Plan for South Africa 2008-2018.
[32] Department of Science and Technology (2019). White Paper on Science, Technology and Innovation.
[33] Department of Science and Technology (2019). White Paper on Science, Technology and Innovation.
[34] Department of Science and Technology (2019). Synthesis Report: South African Foresight Exercise for Science, Technology and Innovation 2030.
[35] Department of Science and Technology (2019). Synthesis Report: South African Foresight Exercise for Science, Technology and Innovation 2030.
[36] Coffey International Development (2018) Thematic Impact Study Report – South Africa.
[37] Times World University Rankings (2020).

research and development (R&D) expenditure were the University of Stellenbosch, the University of Cape Town, the University of the Witwatersrand, the University of Pretoria and the University of KwaZulu Natal.[38] **The South African higher education system is the product of the historical legacy of apartheid. An existing gap in funding and research capacity exists among the formerly 'white' universities and the group of so-called 'historically disadvantaged institutions'** (HDIs) – referring to the cluster of universities that were created under apartheid to cater for black Africans and other non-white populations. Transformation of the higher education system to address the gap between the 'Top Five' and the HDIs represents one of the main challenges for education policies in the country.

In recent decades, South Africa's government has made efforts to open new universities in previously under-served regions of the country and promote more equitable access to higher education. This led to the establishment of institutions, including Nelson Mandela University[39] (formerly Nelson Mandela Metropolitan University) in 2005 and Sol Plaatje University and the University of Mpumalanga in 2014.[40]

Table 3: Top five public universities on R&D expenditure

Ranking	Name of university	R&D expenditure
1	University of Cape Town	£ 112 070.91
2	University of Stellenbosch	£ 1 01 824.75
3	University of Pretoria	£ 75 512.53
4	University of the Witwatersrand	£ 66 897.09
5	University of KwaZulu Natal	£ 57 539.11

Source: Centre for Science, Technology and Innovation Indicators. (2019). South African National Survey of Research and Experimental Development. Note: Author's calculation; 1 South African rand = 0.047 British pound sterling.[41]

As shown in **Error! Reference source not found.**4, South Africa's research output was highly specialised in agricultural sciences, astronomy, biology and biomed, natural resources and conservation, psychology, social sciences and geosciences, and atmospheric and ocean sciences as of 2018. South Africa's specialisation rate in social sciences was the highest among the 17 Newton countries. Meanwhile, South Africa's rate of specialisation in physics was significantly below the global average. Its specialisation score for biology and biomed, ICT,

[38] Centre for Science, Technology and Innovation Indicators (2019). South African National Survey of Research and Experimental Development.
[39] Nelson Mandela University (n.d.). 'About us' Available at: https://www.mandela.ac.za/About-us
[40] Brand South Africa (2013). 'South Africa's new universities named' Available at: https://www.brandsouthafrica.com/governance/education/universities-250713
[41] South African National Survey of Research and Experimental Development (2013). 'Statistical Report 2018/19' pg. 82.Historical currency exchange at 01.04.2018. Available at: http://www.hsrc.ac.za/en/research-data/view/8614

materials, physics, natural resources and conservation, and psychology increased during the evaluation period (2014 to 2018).

Table 4: Extent of specialisation of articles across selected research fields

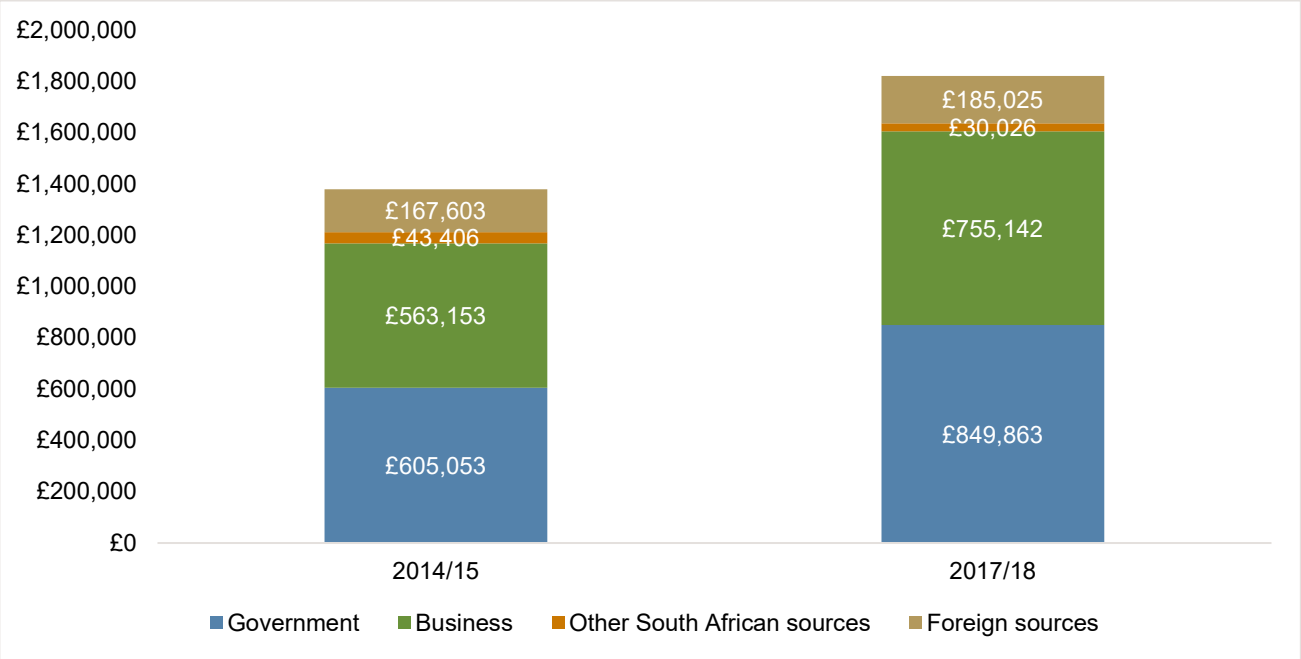
	2013	2014	2015	2016	2017	2018
Agricultural Science	1.50	1.46	1.36	1.33	1.48	1.41
Astronomy	1.04	1.23	1.27	1.16	1.11	1.19
Biology and Biomed	1.42	1.39	1.40	1.36	1.38	1.40
Chemistry	0.91	0.78	0.87	0.85	0.75	0.76
ICT	0.86	0.69	0.87	0.81	1.01	0.77
Engineering	0.76	0.79	0.69	0.86	0.73	0.73
Health Services	0.87	0.89	0.88	0.87	0.85	0.89
Materials	0.40	0.51	0.58	0.39	0.47	0.68
Maths	1.10	1.22	0.97	0.92	0.91	0.88
Physics	0.48	0.52	0.60	0.60	0.62	0.57
Natural Resources and Conservation	1.23	1.17	1.22	1.14	1.37	1.38
Psychology	1.21	1.04	1.11	1.03	1.29	1.17
Social Sciences	2.75	2.90	2.76	2.60	2.57	2.86
Geosciences, atmospheric, and ocean sciences	1.20	1.28	1.19	1.32	1.16	1.27

Source: Scopus (data sourced from U.S. National Science Foundation).
Note: the figure represents a measure of concentration of a country's publications in a field, by dividing the fraction of publications in a country that are in a certain field by the equivalent global fraction. A score higher than 1 shows that the country is more specialised than the global average, and a score lower than 1 shows that the country is less specialised.

Overview of South Africa's research funding structure

South Africa has one of the continent's largest and most developed economies,[42] which is reflected in its research funding availability. South Africa's funding for R&D was £1.7 billion (R36,784 billion) in 2018/19 falling 5% (R38,725billion) from the previous year.[43] The level of gross domestic expenditure on R&D (GERD) increased from 0.77% of GDP in 2014/15 to 0.83% of GDP in 2017/18 (the latest year for which the data is available). Of this, 46.7% came from government, 41.5% from business, 1.6% from other South African sources and 10.2% from foreign sources, as shown in Figure 3.[44]

Figure 3: Funding for R&D by source



Source: Centre for Science, Technology and Innovation Indicators. (2019). South African National Survey of Research and Experimental Development. Note: Author's calculation; 1 South African rand = 0.047 British pound sterling.

DSI is responsible for setting public research policy, owning policy for the innovation ecosystem and providing an enabling S&I environment.[45] DSI allocates funds for R&D through agencies including the Council for Scientific and Industrial Research, the National Research Foundation (NRF), the Human Sciences Research Council, the South African National Space Agency (SANSA), and the Technology Innovation Agency (TIA).[46] DSI also funds cross-departmental S&I programmes, such as the Strategic Health Innovation Partnerships, run jointly with the South African Medical Research Council (SAMRC).[47]

[42] BBC News (2019) 'South Africa Country Profile' Available at: https://www.bbc.co.uk/news/world-africa-14094760
[43] South African National Survey of Research and Experimental Development, 'Statistical Report 2018/19' pg. 15.
[44] Centre for Science, Technology and Innovation Indicators (2019). South African National Survey of Research and Experimental Development.
[45] Foreign and Commonwealth Office (2018). UK Science and Innovation Network Country Snapshot – South Africa.
[46] UKCDR. (2020). UK Research Funding for Development in South Africa - An analysis of funding and research (2014-2019).
[47] SAMRC (n.d.). 'Strategic Health Innovation Partnerships' Available at: https://www.samrc.ac.za/innovation/strategic-health-innovation-partnerships

Research funding for the private sector flows through the NRF. [48] The NRF operates six national research platforms[49] and manages competitive research funding programmes for businesses and researchers at national facilities and higher education institutions.[50]

The White Paper on Science, Technology, and Innovation (2019) recognised that increasing funding for S&I remains critical for the country's development. The White Paper recommits the government to increasing the level of R&D investment so that GERD can reach 1.5% of GDP in the next decade. It proposes encouraging provincial and local governments to contribute more to S&I funding and national government departments to set appropriate targets for S&I in their budgets.[51]

Since 2004, DSI has established various 'centres of competence' (CoCs), which are platforms for collaborative technology partnerships between key innovation actors, namely industry, universities, and research institutions.[52] CoCs support the commercialisation of R&D and have a budget of R5 million (approx. £230,000) per year for ten years, with funding of approx. £3.75 million per year for ten years from DSI. The CoCs are similar to the Competence Centres (CCs) found in the European Union.[53] Since 2010, 28 CoCs have been introduced, including seven in biotech and health.

Hydrogen South Africa (HySA) is a key CoC that contributes to value-added manufacturing and aims to supply 25% of the global demand for hydrogen and fuel cells by the end of 2020[54]. Strategic goals for DSI through this CoC include greater energy security and potentially zero-emission energy. There has been collaboration between organisations such as the University of Cape Town, Anglo American and Impala Platinum in developing the projects at HySA. The CoCs programme was reviewed in 2015, and departmental documents indicate that the programme is likely to be extended further.

The initiative with the longest history of developing collaborations between business and academia is the Technology for Human Resources in Industry Programme (THRIP), which was established in 1991. The programme is one of the main government innovation initiatives and aims to enable researchers to access industry networks and foster academics and managers' mobility. The initiative is funded by the Department for Trade and Industry and Competition (DTIC) and the NRF, with a budget of over £21 million per year. An average of 235 projects are supported by THRIP every year, with an additional £34 million estimated to be provided per year by industry actors. A research body proposes THRIP projects, and industry expertise is leveraged to carry out market research. THRIP has targeted engineering research as a major priority since the OECD identified it as an industry in crisis in its 2007 innovation review.[55]

[48] Foreign and Commonwealth Office (2018). UK Science and Innovation Network Country Snapshot – South Africa.
[49] A list of research platforms is available at NRF, 'Research Infrastructure Platforms' Available at: https://www.nrf.ac.za/research-platforms/national-facilities
[50] Foreign and Commonwealth Office (2018). UK Science and Innovation Network Country Snapshot – South Africa.
[51] Department of Science and Technology (2019). White Paper on Science, Technology, and Innovation.
[52] PMG (2015). 'Department of Science and Technology Centres of Competence: Departmental briefing' Available at: https://pmg.org.za/committee-meeting/20104/
[53] OECD (2014).
[54] Renewable Energy Focus (2013). 'HySA Infrastructure: producing and using hydrogen for energy in South Africa – Part 1' Available at: http://www.renewableenergyfocus.com/view/34110/hysa-infrastructure-producing-and-using-hydrogen-for-energy-in-south-africa-part-1/
[55] OECD (2007). pp. 122–123, 171–173.

2.4 International relations and research collaborations

South Africa has long-standing bilateral cooperation agreements with many countries, including the UK, some of which have launched calls for collaboration during the evaluation period.

Since 1995, the UK has had a formal bilateral Science and Technology Agreement with South Africa and strong partnerships with South African academics.[56] The UK has, for instance, partnered with South Africa's flagship scientific projects and has positioned S&I at the centre of the bilateral relationship. The UK is involved in flagship science projects such as the Square Kilometre Array (SKA)[57], the world's largest radio telescope, located in Australia and South Africa.[58] The programme is headquartered in the United Kingdom and comprises organisations from 13 countries.[59]

More recently, the Digital Access Programme launched in 2019 in Kenya, Nigeria, South Africa, Brazil and Indonesia (£45 million of funding) to increase connectivity and digital skills of marginalised communities, build cybersecurity capacity, and establish Tech Hubs to grow the local digital economy and empower start-ups with the skills needed to expand globally.[60] South Africa has the most developed science and research base in Africa and is keen to encourage regional development through international collaboration initiatives. South Africa participates actively in international R&D programmes, such as the African Union's STI Strategy for Africa 2024.[61] In 2018, South Africa held the BRICS Presidency and focused on disruptive technologies and big data initiatives.[62] BRICS is a bloc of emerging economies comprising Brazil, Russia, India, China and South Africa.[63] South Africa joined the bloc in December 2010 in accordance with the country's foreign policy on strengthening South-South relations.

Table 5: Summary of funding initiatives similar to the Newton Fund

Funding initiative	Description of activity
Global Challenges Research Fund (GCRF)	A £1.5 billion ODA research and innovation fund from the Department for Business, Energy and Industrial Strategy (BEIS) covering 2016-2021. The Fund's goal is to reduce poverty by *"generating and putting into use knowledge and*

[56] UKCDR. (2020). UK Research Funding for Development in South Africa - An analysis of funding and research (2014-2019).
[57] SKA UK (n.d.) 'SKA Project' Available at: https://unitedkingdom.skatelescope.org/ska-project/
[58] Costs estimates put the first phase of the telescope to €630 million.
[59] Department of Industry, Science, Energy and Resources (n.d.). 'Co-hosting the Square Kilometre Array' Available at: https://www.industry.gov.au/strategies-for-the-future/astronomy/co-hosting-the-square-kilometre-array
[60] GOV.UK (2020) 'UK-Africa Investment Summit 2020, UK Government Statement' Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/859314/2020_01_20_AIS_-_UK_Government_Statement_-_Final_Version.pdf
[61] G20 Innovation Report (2016). p. 62.
[62] Annual Report (2017/18). p. 63.
[63] Brand South Africa (2011). 'New era as South Africa joins BRICS' Available at: https://www.brandsouthafrica.com/investments-immigration/business/trends/global/brics-080411#:~:text=South%20Africa%20will%20attend%20its,of%20Hainan%2C%20on%2014%20April

	technology to address development challenges and advance development for the poorest people and countries".[64]
Horizon 2020	The biggest EU Research and Innovation programme, with nearly €80 billion of funding available over seven years (2014 to 2020). The main thematic areas of EU-African cooperation under Horizon 2020 are environment, food, ICT and health.[65]
Research and Evidence Division (RED)	Established in 2011, the RED FCDO division leads a portfolio of outcome-led ODA research and development in six locations: London, East Kilbride, Delhi, Nairobi, Lagos and Pretoria. The main aim is to develop and deliver high impact research, new technologies and innovations; test high potential interventions; and ensure that thematic work aligns with wider UK government priorities in climate, health and education.[66]
National Institute for Health Research (NIHR) Global Health Research Portfolio	NIHR was established in 2016 by the Department of Health and Social Care to support the UK Aid Strategy and the United Nations' Sustainable Development Goals. The NIHR is a major funder of global health research and training in LMICs that are eligible to receiving ODA from the UK government.

The Global Challenges Research Fund (GCRF) started in 2017 with £1.5 billion worth of ODA funding from the Department for Business, Energy and Industrial Strategy (BEIS). The funds are allocated through 17 Delivery Partners, some of which are also Newton Fund Delivery Partners. Unlike the Newton Fund, the GCRF does not have an explicit priority list of developing countries. Instead, GCRF funding supports universities, industry, and research organisations.[67] With this logic, UK research institutions typically select partners based on where and with whom research collaborations would be most effective, add the most value, or have the most impact.[68]

[64] GOV.UK (2017). 'Global Challenges Research Fund' Available at: https://www.gov.uk/government/publications/global-challenges-research-fund/global-challenges-research-fund-gcrf-how-the-fund-works)

[65] The Africa-EU Partnership (2019) 'Horizon 2020: Africa and the EU strengthen their cooperation in research and innovation' Available at: https://africa-eu-partnership.org/en/stay-informed/news/horizon-2020-africa-and-eu-strengthen-their-cooperation-research-and-innovation#:~:text=Horizon%202020%2C%20the%20EU's%20most,opportunities%20to%20strengthen%20this%20partnership.&text=With%20126%20projects%20funded%2C%20South,the%20most%20from%20Horizon%202020.

[66] FCDO (n.d.). 'Research at FCDO' Available at: https://www.gov.uk/government/organisations/foreign-commonwealth-development-office/about/research#research-and-evidence-division-red

[67] Department for Business, Energy and Industrial Strategy (2017). Research & Innovation: Official Development assistance (ODA).

[68] UK Strategy for the Global Challenges Research Fund (2017). Research Councils, Academies and UK Space Agency.

The GCRF's Southern partners include larger middle-income countries such as China, India, Kenya and South Africa.[69]

South Africa is one of the European Union's strategic partners.[70] The EU is by far South Africa's most important development partner, providing 70% of all external assistance funds.[71] **Horizon 2020** is the biggest EU research and innovation programme active in South Africa, with a total of €80 billion for the 2014 to 2020 period. As of 2019, with 126 projects funded with €27.56 million, South Africa is so far the African country that has benefited the most from Horizon 2020.[72] Some projects started during the evaluation period, including All Atlantic Cooperation for Ocean Research and innovation (2018-2022, €4 million) and Co-production of Climate Services for East Africa (2019-2014, €7 million).[73]

The FCDO's **Research and Evidence Division** delivers technical economic, science, social science and analytical functions across six locations: London, East Kilbride, Delhi, Nairobi, Lagos and Pretoria. Its regional research hubs provide country specific evidence and research in strengthening science, innovation and research systems.[74] Overall, the Research and Evidence Division aims to make FCDO more systematic in the use of evidence, and thereby have greater development impact, by commissioning research and improving policy and practice through using evidence and thus improving professional skills and impact of the FCDO.[75] The **NIHR Global Health Research Portfolio** has established a substantial portfolio of global health research programmes by investing in applied health research and health system priorities of the LMICs. Research funding is delivered through three main strands: research programmes to groups of researchers or research institutions; forming partnerships with other global health research organisations; investing in people by funding the career development.[76]

At the national level, the **South African Research Chairs Initiative (SARChI)** - introduced in 2006 - aims to attract and retain excellence in research and innovation at South African public universities by establishing Research Chairs for up to 15 years. The programme, funded by DSI, is creating new public-private partnerships (PPPs) to strengthen industry and academia links. Researchers receive funding for either 15 or ten years for Tiers 1 and 2, respectively. Tier 1 Chairs are designed for established researchers recognised internationally as leaders in their

[69] Independent Commission for Aid Impact. (2017). Global Challenges Research Fund: A rapid review.
[70] European Commission (2018). 'Roadmap for EU - South Africa S&T cooperation' Available at: https://ec.europa.eu/research/iscp/pdf/policy/za_roadmap_2018.pdf#view=fit&pagemode=none
[71] European Commission (n.d.) 'South Africa' Available at: https://ec.europa.eu/trade/policy/countries-and-regions/countries/south-africa/
[72] European Commission (2018). 'Africa and Horizon 2020' Available at: https://ec.europa.eu/research/iscp/pdf/policy/eu-af_infographic_2018.pdf#view=fit&pagemode=none
[73] European Commission (n.d.). 'CORDIS' Available at: https://cordis.europa.eu/search/en?q=contenttype%3D%27project%27%20AND%20contentUpdateDate%3C%3D2020-07-07%20AND%20(programme%2Fcode%3D%27H2020%27)%20AND%20relatedRegion%2Fregion%2FeuCode%3D%27ZA%27%20AND%20startDate%3D2018-01-01-2019-12-31&p=1&num=10&srt=%2Fproject%2Ftitle:increasing
[74] 'Research at FCDO' (n.d.). Available at: https://www.gov.uk/government/organisations/foreign-commonwealth-development-office/about/research#research-and-evidence-division-red
[75] Department for International Development (2014). 'Operational plan 2011-2016 Research and Evidence Division'. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/388889/Research-and-Evidence-department.pdf
[76]NIHR (n.d.) Global Health Research Portfolio' Available at: https://www.nihr.ac.uk/explore-nihr/funding-programmes/global-health.htm

field and/or have received international recognition for their research contributions. Tier 2 Chairs are for established researchers who have the potential to achieve international recognition for their research contributions in the next five to ten years.[77] The highest level of funding for Tier 1 researchers is R2.5 million (approximately £110,000) per year. Over 150 Research Chairs have been awarded since the start of the programme, which had a five-year review in 2012. SARChI will continue to be part of the country's innovation policy to achieve its 2030 vision.

[77] NRF, 'South African Research Chairs Initiative'

3 Emerging results of the Newton Fund in South Africa

This section sets out the emerging results of the UK-SA Newton Fund. The findings are based on the three calls included as part of the case study as well as the broader consultations undertaken with the programme team (see Section 1.4 for details of the methodology).

3.1 Key findings

There are strong indications that the UK-SA Newton Fund has further strengthened bilateral relations between South Africa and the UK. The UK's presence in South Africa and support to the country have been particularly strong following the 1994 democratic transition. Several local funders already had experience running research collaborations and partnerships with the UK. Respondents noted that Newton had strengthened these collaborations. The Newton Fund facilitated the first research partnership run by the British Academy in South Africa. South Africa was seen by the British Academy as one of the most successful partnerships in its Newton Fund portfolio.

Through mobility and capacity building programmes, the Fund has built research capacities at the individual level. This type of grant also allows existing projects to progress and move forward and for international teams to connect and build relationships with other researchers and institutions.

Examples of projects making socio-economic contributions to South Africa include:

- The PhD Partnering Programme and the South African Research Chairs Initiative contributed significantly to developing a centre of excellence in South Africa and a mechanism for PhD exchanges between the University of Southampton and Nelson Mandela Metropolitan University on marine and maritime studies.
- Health research collaborations such as innovative TB screening trials in the North West and Limpopo provinces. The project addresses South African priority areas in developing and testing optimal HIV-TB service delivery models to strengthen case detection and improve treatment.
- The Leaders in Innovation Fellowship programme supported the creation of a jet loop reactor as part of research on treatment methods for acid mine drainage.
- A design for an efficient mechanical cassava harvester, which does not currently exist in South Africa, was shortlisted for the Africa Prize for Engineering. Another was shortlisted for a UK Energy Innovation Centre Award for the creation of a powerline inspection robot.

The role of the in-country team has been valuable in generating results. The team is regarded as having unparalleled knowledge of the innovation sector in South Africa. Their personal networks and relationships throughout the sector have been a key contributing factor to the Fund's success.

The diversity of fields supported by the Fund sets the UK-SA Newton Fund apart from more traditional ODA programmes. The Newton Fund has created an enabling and

supportive environment for fields not traditionally associated with ODA funding or socio-economic development, for instance, through the support provided to the field of astronomy with the DARA programme. The programme upskills African students that train the next generation of radio astronomy researchers and astronomy students. It promotes the study and application of STEM subjects, contributing to the emergence of knowledge-based economies across several sub-Saharan African countries contributing directly to the attainment of several SDGs.

The Fund has led to new relationships between South Africa and UK scientists at the government level, supported by its strong brand. The strength of the Newton name and the high levels of support from South African partners have further reinforced Newton's performance and reputation of supporting research excellence in South Africa and beyond.

The UK-SA Fund was valued by all stakeholders, who expressed eagerness to participate in a second phase of the Fund.

3.2 Factors affecting the performance of the UK-SA Newton Fund

Despite its strong emerging results, respondents identified some lessons learned and potential adjustments to the Newton Fund's current structure, which could potentially hold benefits and increase its impact potential. It is important to note that the programme has already learned from and responded to initial difficulties in setting up the Fund and its partnerships.

Budget cuts of 16% announced in mid-2020 by South Africa's National Research Foundation presented challenges for match funding within UK-SA collaborations. Some DPs highlighted that the **Fund's design should guard against excluding less well-resourced institutions** which may struggle to meet match funding requirements. Later phases of the Fund could consider a match funding model which aims to address inequality and build quality, rather than prioritise research excellence.

The Newton Fund was established with a sense of urgency which did not always provide sufficient time to define calls and the scope of collaboration to the satisfaction of local funders. The UK-SA Newton Fund has been most successful in instances where it linked with existing programmes run by different local funders. Ongoing collaborations were already aligned with governmental and departmental strategies including the national plan for development.

Respondents suggested that the Newton Fund could allow more time in collaboration with other in-country funders so that responsibilities could be better defined among all stakeholders. Match funding was regarded as a positive implementation model, ensuring both parties' commitment and fostering equal partnership and mutual collaboration.

Some award holders felt research calls were not framed in the spirit of equal partnership – for example by implying a collaboration is between an experienced UK researcher who provides technical expertise and a South Africa-based researcher whose contribution is limited to the provision of empirical data. In a related point, some respondents queried the dual objective of the Newton Fund supporting the socio-economic development of the partner country as well as the secondary objective of establishing the UK as a preferred partner of choice[78].

[78] UK Benefits, also termed 'Secondary Benefits', are covered in a separate Tetra Tech report across the Newton Fund as a whole.

The Fund's role is clear in creating value against the People and Research pillars; however, more could be done to further support its Translation aims. As such, a future phase of the Newton Fund could include greater alignment and collaboration with other diplomatic and international efforts carried out by the UK government in South Africa.

4 Project: Development in Africa with Radio Astronomy (DARA)

Summary

Project title	Development in Africa with Radio Astronomy (DARA)
Call title	African VLBI Network Training Programme - upskilling students in STEM subjects to develop a sustainable African economy: extension
Short description	Basic radioastronomy training programme with a duration of five years. The programme falls under the human capacity building Development in Africa with Radio Astronomy (DARA) projects, which includes DARA and its sister project DARA Big DATA.
Objective(s)	To contribute to human capital development in the eight partner African partner countries taking part in the Square Kilometre Array collaboration. The projects aim to equip technical personnel and researchers with 21st century skills and astronomy knowledge to manage radioastronomy stations and technology across the African continent.
Pillar	People
Project value (total budget allocated in country, in GBP)	UK: GBP 3,787,322 SA: GBP 154,113 (R 3,236,064)
Start/end date (Status: on-going or complete)	2015 to 2021
DP UK and overseas	UK: STFC SA: National Research Foundation

Award holders/grantees	UK: University of Leeds (lead), University of Manchester, University of Oxford, University of Hertfordshire, University of Central Lancashire, University of Bristol, GES Ltd. (Goonhilly Earth Station). SA: SKA-SA, University of Cape Town, HARTRAO (now part of South African Radio Astronomy Observatory – SARAO), Rhodes University, North-West University, Office of Astronomy for Development, University of Western Cape, University of South Africa, SANSA (South African National Space Agency).

Description of the project

The Development in Africa with Radio Astronomy (DARA) programme provides technical personnel and researchers in targeted countries with training to use radio telescopes. The eight SKA partner countries included in the training programme are **Botswana, Ghana, Kenya, Madagascar, Mauritius, Mozambique, Namibia, and Zambia.**

DARA also runs an outreach programme to encourage young people to study the technological aspects of radio astronomy and pursue science, technology, engineering, and mathematics (STEM) subjects, which the Newton Fund also funds.

South Africa is hosting part of the Square Kilometre Array (SKA), the largest next-generation radio telescope in the world and the first scientific project of its kind on the African continent. A network of up to 2,000 satellite dishes will eventually spread out across southern Africa to provide the telescope with its powerful resolution capacities. South Africa is partnering with eight other countries in Africa to host these outstations. There is little astronomy activity in these countries at present and so SKA-SA is building the African Very Long Baseline Interferometry Network (AVN) as a precursor instrument and a valuable addition to the world's radio astronomy networks in its own right. The AVN will consist of 30-metre radio dishes in each partner country. The UK team has experience in converting old telecommunications dishes for radio astronomy purposes through its involvement in a similar project at the Goonhilly Earth Station in Cornwall.

Together with South African colleagues, the UK team will provide basic training in AVN countries to allow the local research community to use and help run the radio telescopes. These STEM skills can be applied to a range of other industries. An integral part of the training programme will be interacting with entrepreneurs who have experience in setting up businesses using related technologies.

The project aims to establish a virtual centre of excellence to pull the various strands of training, research, and industry together and to boost interest in STEM subjects.[79]

Pathway to impact

[79] UKRI (n.d.). 'Development in Africa with Radio Astronomy Phase 2' Available at: https://gtr.ukri.org/projects?ref=ST%2FR001103%2F1#/tabOverview

Figure 5 (in Annex 4) illustrates how this collaboration relates to the theory of change for Newton Fund People and Research Pillar activities. The partnership consists of the following:

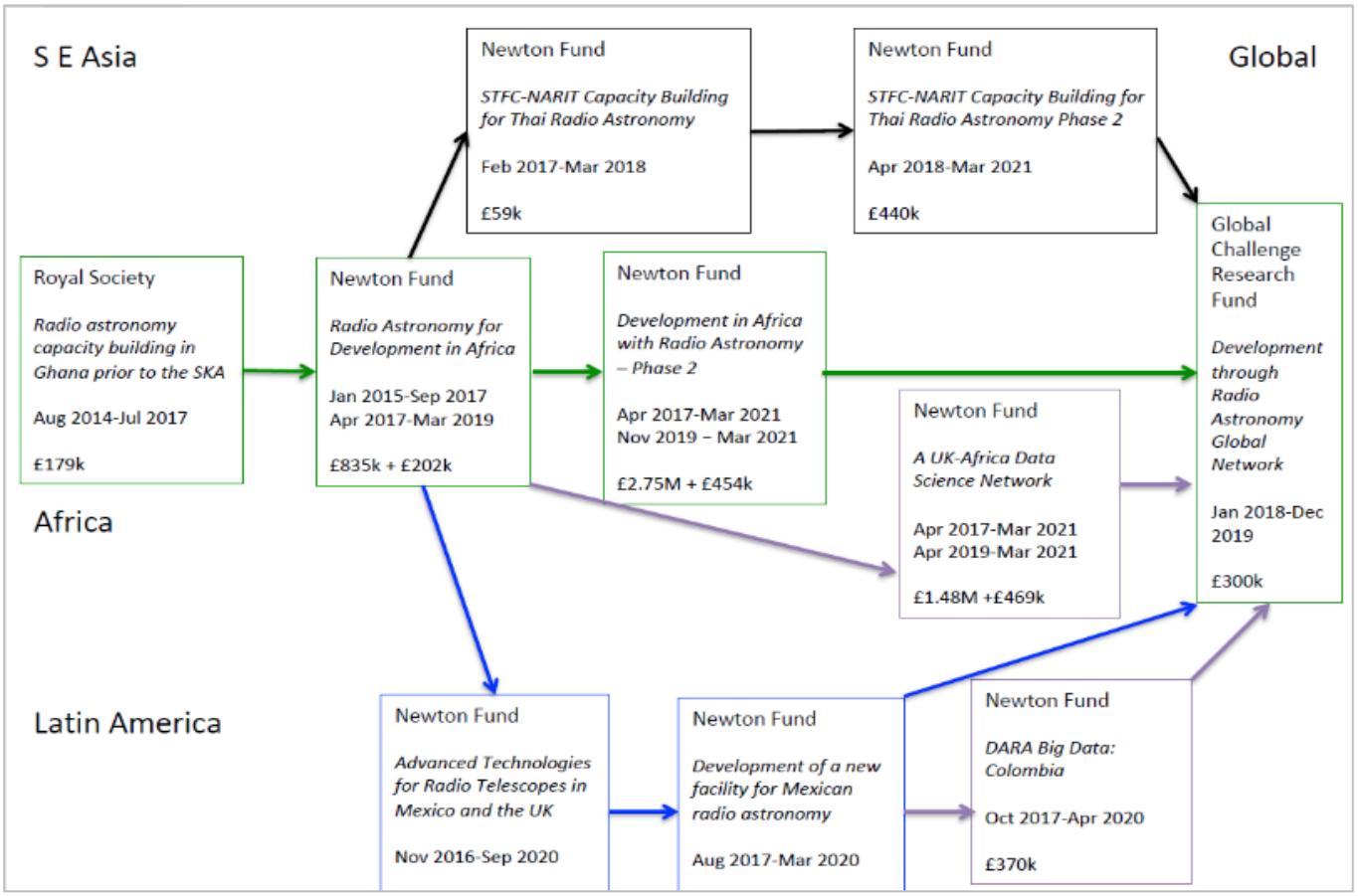
- **Activities:** Five cohorts of students from eight AVN countries participate in training split between their respective AVN countries and Hartebeesthoek Radio Astronomy Observatory (HartRAO) in South Africa. The programme recruits students with a first degree in physics or related subjects such as mathematics, engineering or computing. In AVN countries, there are many young researchers with a physics background but who rarely have the opportunity to study astrophysics at university. They complete four modules in astrophysics, technical training, radio astronomy observation and radio astronomy data reduction and analysis. Students are also provided with other support such as commercial aware and business skills, networking opportunities, computer training and English language training.
- **Expected Outputs** will be:
    - upskilling of trainees' research potential and capacity through knowledge acquisition and consolidation, and familiarisation with technical equipment.
    - stronger networks between trainees, as well as with other researchers and experts, enabling collaborations and research partnerships.
    - equipping trainees with basic skills to better market themselves and create entrepreneurial solutions through business modules, CV writing support and *ad-hoc* business consulting.
    - improved English language skills for students from Mauritius, Madagascar, and Mozambique, which will enable them to establish and deepen collaborations with the UK (and other English-speaking countries).
- **Expected Outcomes** by the end of the training – students will:
    - have a solid foundation in astrophysics and be able to elucidate the role of radio astronomy in understanding key issues and providing solutions across a range of different sectors.
    - be able to identify, test and maintain the main elements of the local telescope, receiver system and recording system in a safe manner.
    - be familiar with the use of the local antenna for astronomical observations in both single dish and VLBI mode, to select samples from large multi-wavelength online databases and to research individual objects and present their results.
    - have gained experience in the theory and practice of the reduction and analysis of VLBI and single-dish data. They will also be aware of good practice in applications for telescope time.
    - have gained valuable computing skills in the use of Linux and Python for scientific research – both highly transferable skills into industry and commerce.

After training completion, it is expected that trainees will be able to apply for advanced training that will set them on the path to a career either in astrophysics or in local industries using the advanced skills acquired through the training.

- **Expected Impact**: The AVN is a key part of the development strategy of SKA-SA to lead to economic benefits through an aspirational and upskilled research community throughout southern Africa. The training provides a significant boost to the limited human capacity development currently available in AVN partner countries. In the long run, the programme will foster astrophysics groups and research communities around the dishes in the AVN partner countries. Starting with the programme's pool of researchers, the programme hopes that trainees will become integrated into the wider SKA effort as leaders and representatives of SKA-SA partner countries. Economic activity as a whole is expected to be boosted, as some will start their own businesses inspired by entrepreneurs, they have met during the training programme.

Figure 4: shows all the existing initiatives under the DARA umbrella underway to globally advance knowledge and technical expertise in radio astronomy.

Figure 4: Projects Diagram



Source: The diagram has been produced by the DARA team to map all the existing initiatives underway to advance knowledge and technical expertise in radio astronomy globally.

4.1 Emerging project results

Relevance of Newton Fund activities

ODA Relevance

The training programme contributes to the upskilling African students who are expected to help build the research community in radio astronomy on the African continent and train the next generation of researchers and astronomy students. More broadly, it aims to promote the study

and application of STEM subjects, contributing to the emergence of knowledge-based economies across several sub-Saharan African countries. **The programme contributes directly to the attainment of several SDGs.**

Relevance to South African socio-economic priorities

DARA is relevant to South Africa's ambitions to expand its scientific infrastructure and become a regional leader in 'astronomy for development'. In winning the bid to host part of the SKA next-generation radio telescope, South Africa linked the opportunity to use radio astronomy as a vehicle for wider development across the emerging economies of the African continent. The concept of 'astronomy for development', coined by the International Astronomical Union (IAU), is seen by South African leadership as a catalyst for scientific development, technological innovation, the utilisation of human resources and the expansion of the scientific infrastructure.

Additionality

Respondents largely believed that the programme would not have been possible without the Newton Fund umbrella, particularly not in its current form and funding scale. Funding from other sources would have been much smaller – respondents estimated it at around GBP 100,000. The Newton Fund is therefore partially additional in providing funding in a niche area of work, particularly through a bilateral funding scheme, uncommon in the South African landscape.

4.2 Effectiveness of Newton Fund activities

Capacity building for individuals

The programme's objective was to build a cohort of academic researchers who would go on to train other students in their home countries and institutions. For this reason, there has been less of a direct impact in South Africa and the UK. The primary benefit was aimed at students in partner countries.

To date, the programme has trained over 250 students, of which about 40 have received *ad-hoc* business consulting, and six have developed business plans. A number of students have gone on to study MSc programmes, many of which have included programme funding to go to the UK to complete their studies.

Students pointed to how the programme was a catalyst for securing their current research positions and academic postings or progressing onto fully funded PhD programmes in the UK. Some students have been able to study under the supervision of the UK principal investigator (PI) or at the University of Bristol. They spoke of their interest to return to South Africa eventually. They also pointed out that the opportunities for learning and obtaining research funding in the UK were greater. As such, the UK has experienced a 'brain gain' as an unintended consequence of Newton, where the African partner countries struggle to offer research ecosystems capable of welcoming back skilled talent.

Partnerships

The UK-South Africa Newton Fund is a partnership administered by South Africa's Department for Science and Innovation and the UK's Department of Business, Energy and Industrial Strategy. Based on a match funding model, the UK-South Africa Newton Fund has seen a co-investment of £30 million since its launch in 2014.

The Fund's activities are managed by a core group of South African and UK Delivery Partners,[80] which develop and run calls and allocate and manage funding. Newton Delivery Partners involved are the Department of Higher Education and Training, South African Medical Research Council, National Research Foundation, South African Weather Service (SAWS), Technology Innovation Agency, Laser Research Institute (LRI), Square Kilometre Array Africa, South African Radio Astronomy Observatory (SARAO), Council for Scientific and Industrial Research (CSIR), and the Department of Environment, Forestry and Fisheries (DEFF).[81]

Quality of the research collaboration

There has been a good level of communication and sharing of responsibilities and duties between partner countries. The collaboration awarded the additional opportunity for supervision and guidance to students and junior researchers. Individual universities typically face challenges in how much they can supervise students, or provide tailored, one-ot-one support. It was reported that the collaboration also assisted African partner countries in ways that South Africa would not have been able to do on its own while also providing scholarships and financial support to students from those partner countries. The partnership was valued as an opportunity to open new areas of research within astronomy and collaborate internationally beyond sub-Saharan Africa. In the view of research respondents, South Africa will benefit in the long-term from collaborations with UK scientists and institutions, as well as by enhancing its reputation for research excellence and astronomy leader within the African continent.

Benefits to the UK

The research aims to address key research questions in radio astronomy, which will be explored by the talent pool emerging from the programme. From the UK perspective, these research goals include:

- characterisation of southern pulsars through timing and astrometry to improve knowledge of the galactic neutron star population.
- utilisation of southern methanol masers through monitoring and astrometry to increase understanding of massive star formation and its distribution in the Galaxy.
- high-resolution studies of protoplanetary discs to detect cm-wave emission from regions of grain growth as the first stage of planet formation.
- high-resolution studies of the jets from nearby AGN to understand the physics of jet propagation and collimation and their interactions with the surrounding media.
- development of new instrumentation and technology for radio astronomy and related industrial applications.

The programme is strengthening links with the UK. Several students are now pursuing PhD programmes at UK universities, where they are set to contribute to the country's overall research output in their respective fields. This is a tangible benefit to the UK. DARA also improves the perception of the UK as a partner of choice in the field of radio astronomy.

[80] For a full list of Newton Fund Delivery Partners, please see: Newton-GCRF, 'UK Delivery Partners (Newton Fund)' Available at: https://www.newton-gcrf.org/newton-fund/delivery-partners/

[81] Newton-GCRF (n.d.). 'South Africa' Available at: https://www.newton-gcrf.org/impact/where-we-work/south-africa/

The DARA site will continue to act as a valuable networking tool for the African radio astronomy community.

Challenges in the collaboration

The main challenge for the collaboration has been securing match funding, particularly in the current economic downturn context. A budget cut in June 2020 reduced South Africa's its science budget for the year by 16%. The country's major research funding agency, the National Research Foundation, also lost 10% of its government allocation, about $5.6 million (R96.6 million). The site construction was delayed to later in 2021 because of the pandemic.

The pandemic has exacerbated funding challenges. South Africa had some issues in providing match funding even before COVID-19, but STFC had senior ministerial level relationships because of SKA, which allowed the collaboration to leverage funding from the South African government to support the DARA programme. The VLBI network was paused during 2020, awaiting a no-cost extension to resume its training activities with its last cohort of students later in 2021.

There were also challenges in terms of ensuring ODA alignment. Astronomy for development is a novel field and not recognised by all as directly relevant to ODA. The novelty of the collaboration hindered engagement with the UK's research community, more used to developing technology rather than in providing this type of training. There were also smaller operational challenges – such as trying to accommodate and provide support to all students – which the programme had expected.

4.3 Emerging signs of impact

The training programmes ran smoothly until COVID-19. Due to the global pandemic, programme activities were put on hold and postponed by a year. A series of virtual seminars was organised from May 2020 onwards. A 12-month extension is required to complete planned activities.

The VLBI training programme is a unique UK-SA collaboration under the Newton Fund's umbrella due to its thematic area of focus and that its direct beneficiaries are students and researchers from AVN partner countries rather than South African researchers. Both countries are engaging in developing a talent pool of researchers across various parts of Africa to advance the still limited field of astrophysics in the continent. This will help ensure that in the medium- to long-term, the continent nurtures enough talent in the field of astrophysics.

The programme is expected to impact positively the management and use of the radio astronomy VLBI infrastructure developed in different AVN countries, ultimately supporting both UK and South African research in this field. As impacts, capacity building and fostering community of practice are expected to be felt more by partner countries in Africa and less so for South Africa and the UK. However, South Africa could benefit by being viewed as being at the forefront of a growing African community of astrophysics research.

Signs of sustainability

Respondents widely agreed that this programme has shown very tangible signs of impact and sustainability and holds the potential for long-lasting and deep impact. At the individual level and from a human capital development perspective, students that have taken part to the training have commended the knowledge and network they acquired through it and

have stated that the training represented a steppingstone for advancing onto further Masters, PhD or research programmes in the field of astronomy. In addition, it is hoped that in ten years, those trained and supported as part of this collaboration will have gone on to train others, improving STEM education more broadly in partner countries – many of which previously lacked astronomy courses and a research community focusing on this field.

The provision of radio telescopes and basic computing facilities, combined with practical training and highly technical skills, will allow participants to participate in applied, practical experience with large-scale engineering and computing projects. This is expected to have a positive knock-on effect on their career. These individuals will represent the experts who could manage the SKA infrastructure on the African continent.

There have been other incidental effects from the SKA initiative. For example, two former DARA students were able to secure funding to build a data management infrastructure at the observatory in Ghana, owing to the support received from the UK team in preparing their application and proposal.

The sustainability of the community created by the VLBI training programme is ensured through a continued alumni programme where former students stay connected through a Facebook group, a Slack channel, they meet at an annual conference and participate in several webinars and events online.

Complementarity and coordination

A catalytic effect is expected when students take their newly acquired knowledge and pass it on in their home countries to other students. **It is still too early to observe this type of result.** One of the concerns is whether the programme will help students find employment, an important challenge in many of their countries of origin. One suggestion was to introduce an industry partnership component to the DARA programme to add internship experiences to the training and thus increase prospects for employability.

The programme has been recognised as best practice in the field of capacity building for radio astronomy. STFC has been looking at **south-east Asia to see whether similar initiatives can be rolled out in these areas, and the programme has now been taken up in Latin America.** The GCRF-funded workshops, which form part of the overarching DARA programme offering, have also been extended to other countries, such as Algeria and Egypt.

4.4 Conclusions

- **The initiative fits well with South Africa's ongoing work and ambitions in the field of radio astronomy**. South Africa is hosting part of the SKA, a major next-generation radio telescope and the first science project of its kind on the African continent. A network of up to 2,000 dishes will eventually spread out across Southern Africa. To this aim, South Africa is partnering with eight other countries in Africa that will host these outstations. SKA-SA are building the African VLBI Network's capacities as a precursor instrument for this collaboration.

- **The STEM skills learnt as part of the DARA training programme can be applied to a range of industries such as telecommunications, space science, land management and computing.** Building capacity of the AVN is a key part of the development strategy of SKA-SA to enable not only the use of the SKA telescope itself but also to spread the potential economic benefits of a highly skilled population throughout sub-Saharan Africa.

- The training programme contributes to the training and upskilling in astronomy with the idea that these students will be the catalysers of **trickle-down effects** upon returning to their home countries. It is hoped they will contribute to establishing a research community in radio astronomy and train the next generation of researchers and astronomy students.
- **The programme has already had important capacity building effects**. Although it has been put on hold and postponed by a year due to COVID-19, there has been good progress made and valuable communication and sharing of responsibilities and duties.
- Challenges have included COVID-related budgetary cuts within South Africa and other minor operational challenges.
- The programme has a less direct impact in South Africa and the UK, and more so in partner countries. However, it holds the potential to improve South Africa's standing as a regional and global centre of excellence in the field of astrophysics.

Lessons learned and points to consider going forward

- The VLBI network attracts students through country representatives at institutions in partner countries. **Some partner countries have been more effective in advertising the opportunity and bringing students to the programme.** Countries where some radio astronomy infrastructure is already present or being developed tend to be more represented than others – possibly reflecting more general disparities in the depth of their respective research communities.
- English speaking countries are better represented since there are basic language entry requirements for the training. Proficiency in academic English also represents a barrier to increasing research outputs and knowledge dissemination activities. **Respondents have suggested the inclusion of an English language elective foundation course.**
- The business consulting element has been praised by students who have benefited from it. It has the potential to evolve into formal funding opportunities and streams to support students' entrepreneurial endeavours. **The programme organisers could consider taking part in initiatives carried out by Foreign, Commonwealth and Development Officer (FCDO) staff across the African continent through the Research and Innovation Hubs to develop contacts across the continent.**

5 Project: Unseen infrastructures

Summary

Project title	Unseen infrastructures: post-colonial migration, unseen labour and maintenance and repair in British Cities
Call title	Newton International Fellowships (Year 4)
Short description	This project seeks to provide detailed personal accounts of the everyday experiences of refugees living and working in the Yorkshire region through in-depth interviews, personal observations and ethnographic research.
Objective(s)	The research aims to highlight the unseen, taken-for-granted work that maintains British cities and is centred around the people behind it. It hopes to reveal the ongoing racial and geographic hierarchies and micro-acts of violence present in everyday life, especially among ethnic minorities and people of colour.
Pillar	People
Project value (total budget allocated in country, in GBP)	UK: GBP 99,000 SA: N/A
Start/end date (Status: on-going or complete)	February 2018 to February 2020
DP UK and overseas	UK: British Academy
Award holders/ grantees	University of Sheffiled

Description of the project

The project examined the relationships between post-colonial migration, unseen labour, maintenance, and repair of (public) infrastructure, and the reproduction of racialised identities and spaces in British cities. The research comprises detailed ethnographies with people from various migrant backgrounds, namely first-generation migrants from former British colonies,

working in industries that support and maintain daily life in the UK, for example, cleaning, care work and warehouse and packaging. The scope evolved to explore the everyday experiences of refugees living and working in the Yorkshire region of the UK. It analysed the difficulties refugees face and examined how these different forms of infrastructure contribute to their physical and social marginalisation.

Pathway to impact

As shown in Figure 6, Annex 4, this project corresponds to the People Pillar of activities, with some elements of Research. The partnership consists of the following:

- **Activities:**[82] The project consisted of a three-year fellowship project conducted by Dr Aidan Mosselson (formerly based at the University of Johannesburg and the Gauteng City-Region Observatory) under the guidance of Professor Paula Meth. Research was carried out through in-depth interviews, mobile methods, and ethnographic research. 12 in-depth interviews were carried out with refugees, and Dr Mosselson spent several hours in the field carrying out ethnography work and action research.
- **Outputs:** Findings have been presented at a workshop, hosted by the Bartlett School of Architecture at University College London, and in three papers at international conferences:
    - Cities of sanctuary in environments of hostility: refugees' experiences of urban space in contemporary Britain, at the IMISCOE Spring Conference: Transforming Mobility: Brexit and Beyond, the University of Sheffield
    - Belonging, displacement and hostile environments: refugees' everyday experiences in Sheffield and Barnsley, at the RGS-IBG Annual Conference
    - Urban infrastructures, migration, and the reproduction of colonial forms of difference, at the RC21 International Conference, Delhi
- **Outcomes:** The research will provide narratives of refugees' commuting experiences and work situations. It will highlight the unseen work that goes into maintaining cities. It hopes to reveal the ongoing racial and geographic hierarchies among ethnic minorities and people of colour. In addition, it seeks to illustrate and reveal refugees' histories, cultures, and systems of knowledge, ultimately showcasing the role migrants play in the unseen work that cities in the West rely upon. By undertaking the research, the award holder will have developed his research skills and theoretical expertise and broaden his ties with academics in the field by participating in conferences and initiatives hosted and organised by the hosting department at the University of Sheffield.
- **Expected Impact:** This research adds a critical perspective to the issues explored, highlighting race, prejudice and power. It can reveal refugees' hidden experiences in the UK while also building bridges and contributing to generating more real accounts of contemporary life in Britain. This research aims to impact academics studying migration, national and racial identities, urban infrastructures, and everyday urban life. It also aims to impact practitioners focused on working conditions, labour relations, and multicultural policies.

5.1 Emerging project results

[82] The British Academy (2019). Newton Fellowship Interim Report Form.

Relevance of Newton Fund activities

ODA relevance

The research explores the infrastructures that support and sustain migrant communities in British cities, as well as the infrastructures which regulate and order their experiences, working conditions and identities. A focus on migrant groups explored the intertwining of contemporary urban life with relations and networks of movement established during the period of British colonialism. It drew attention to the ways in which these legacies continue to shape and contribute to urban life in Britain today.[83]

The thematic focus of the research does not have a clear link to the Newton Fund's – or broader ODA – priorities for South Africa, as it is entirely based in and focused on the UK. **However, it does tackle issues of inequality, racism, and migration, all of which form part of the Sustainable Development Goals, which can ultimately contribute to and inform policy in South Africa and beyond**. Most notably, there is a clear link with Newton Fund People Pillar objectives through strengthened researcher skills and institutional capacity. The Fellowship, in fact, allowed the South African researcher to expand his horizons, build capacities in a specific field, and explore a new direction in his work. This will prepare him to do more research on similar topics in sub-Saharan Africa, which is his ambition in the long term. BEIS has indicated future fellowship activity will be more directly aligned to addressing development challenges.

Relevance to South African priorities

This project is not of direct relevance to South African government priorities or policies in the research space. However, it can generate impact in the South African research community through new and stronger links between South African and UK institutions. According to respondents, this research can link to some of the major themes explored by the University of Witwatersrand and the Gauteng City-Region Observatory's (GCRO) project: 'Living in the Urban Periphery: Investment, Infrastructure and Economic Change in African City-Regions'. This Fellowship's research can add a UK-based comparator to the results yielded from case studies carried out in Addis Ababa, Durban, and Johannesburg. This will ultimately provide access to innovative, cross-national reflections and debates. The Fellowship can also contribute towards ongoing work at the GCRO focusing on the economic and social conditions of peripheral urban areas in Gauteng and migration in Southern Africa. The results of the Fellow's research, and the production of papers co-authored with colleagues at the GCRO, can strengthen relations and the profiles of both organisations involved. Through new linkages between case studies in South Africa and the UK, the Fellowship can also make research undertaken in South Africa more relevant, visible, and appealing to a more extensive and international audience. In addition, it can help GCRO gain insights that go beyond the South African context and contribute to international debates.

[83] The University of Sheffield (n.d.). 'Unseen Infrastructures: post-colonial migration, unseen labour and maintenance and repair in British cities' Available at: https://www.sheffield.ac.uk/usp/research/projects/unseen-infrastructures

Additionality

The Newton Fund has been instrumental in providing the fund's needed to carry out research. The fellowship covered all accommodation and relocation costs for the AH to the UK, enabling him to further his international mobility and research in a UK university.

5.2 Effectiveness of Newton Fund activities

Emerging results

This Newton International Fellowship falls under the impact dimension of human capital development. The primary outcome of the project lies in capacity building and broadening of expertise for the South African AH, who was funded to conduct research within the Department of Urban Studies at the University of Sheffield. **This expanded his professional network and international mobility and gave him experience of conducting fieldwork with vulnerable individuals abroad.**

Between April 2018 and October 2019, by volunteering with a local charity that supports refugees and asylum seekers once a week and attending various events centred around refugee and migrant issues, he gained first-hand insights into this community. The Fellow plans to carry out more in over 2021. This project has now concluded its research phase, and the AH is now focusing his attention on producing publications aimed at peer-reviewed migration and urban studies journals.

Capacity building for individuals

Taking part in this International Fellowship has allowed the AH to learn from more senior academics who have helped establish solicited diaries as a research method and have expertise in different contexts, such as Southern and East Africa and the UK. It has also allowed the Fellow to expand his professional skills, experience, and international networks, ultimately putting him in a more established position to contribute to academia as a researcher and educator in South Africa. While in the UK, the AH was able to apply for larger grants and funding for further projects, which have resulted in securing a position at University College London. Overall, the Newton Fund provided essential research funding and allowed the Fellow to work with a budget and gain experience of how institutional requirements work first-hand.

Benefits to the UK

This Fellowship helped solidify the existing institutional relationship between GCRO and the UK host institution. The research aligns with the work already being undertaken for the 'Living in Urban Periphery' project. It will provide a UK-based case study to generate North-South comparisons and strengthen knowledge on sustainable urban development across international contexts. Engagement with migration, race and community issues is pertinent within the British political climate and can ultimately inform policymakers and practitioners interested in these subject areas.

Challenges in the collaboration

As a self-contained project, the collaboration went smoothly. The main challenge faced in the collaboration was the inability to carry out research internationally, particularly given the Newton Fund's objective of cross-country collaboration. Despite this, carrying out fieldwork outside of

the UK was not possible under this project, which limited the research scope and required extensive changes.

5.3 Emerging signs of impact

The Fellow presented research findings at a workshop hosted by the Bartlett School of Architecture at University College London and presented papers at three international conferences.[84][85] He is also co-organising a stream with the title *Infrastructures, identities and the materiality's of difference and belonging in the city* at the RC21 Conference (The Urban and Regional Development), which aligns with the research themes in this project. The Fellow also has collaboration plans with a local photographer to produce a series of photo essays illustrating the commuting practices and work experiences of refugees in the area of Sheffield.

Signs of sustainability

Sustainability from a human capital development component lies in expanding the AH's professional network and developing a cross-thematic and versatile skillset by branching into a new subject matter. The researcher secured a research role at University College London to continue his professional development. The nature of this project and its research content, based in the UK and not South Africa, can provide a foundation for future work in South Africa and contribute to existing knowledge on the subject matter. This project is ultimately strengthening the researcher's capacities to make contribute to both the international and South African research communities in the future.

Complementarity and coordination

The research holds the potential to inform policy, particularly given the current British political climate. It can aid policymakers and practitioners interested in integration, migration, and community relations in the UK's peripheral urban areas. The Fellow originally had plans to collaborate with the Runnymede Trust, which focuses on multi-ethnic Britain and social cohesion in Sheffield, tying well into the scope of this research. He is a member of the Urban Studies Foundation, a Scottish charity that advances academic research and education in urban studies,[86] and he is continuing his research at UCL in London. The Fellow also plans to contribute to public debates and the work of migration-focused think-tanks, such as the Migration Policy Institute, and produce information more accessible to a wider audience.

5.4 Conclusions

- Under the International Fellowship, a researcher from the University of Johannesburg spent two years at the University of Sheffield's Department of Urban Studies. The Research Fellow **broadened his academic network and gained practical experience** in ethnography and

[84] The British Academy (2019). Newton Fellowship Interim Report.
[85] These papers are the following: *Cities of sanctuary in environments of hostility: refugees' experiences of urban space in contemporary Britain*, to be presented at the IMISCOE Spring Conference: Transforming Mobility: Brexit and Beyond, University of Sheffield, 28-29 March; *Belonging, displacement and hostile environments: refugees' everyday experiences in Sheffield and Barnsley*, to be presented at the RGS-IBG Annual Conference, 27-30 August, London; *Urban infrastructures,* migration and the reproduction of colonial forms of difference, to be presented at the RC21 International Conference, Delhi, 18-21 September.
[86] Urban Studies Foundation (n.d.). 'Dr Aiden Mosselson' Available at: https://urbanstudiesfoundation.org/funding/grantees/dr-aiden-mosselson/

qualitative research methods, which were applied to his existing work in urban studies and sociology. The PI at Sheffield performed an oversight role.

- The research will provide detailed personal accounts and narratives of refugees' commuting experiences, work situations and movements across different parts of the city. It highlights issues of race, prejudice and power, and adds to scholarship on urban infrastructure. It focusses on refugees' hidden experiences in the UK while also building bridges and contributing to generating real accounts of contemporary life in Britain.
- **The main impact of this project has been the capacity building of the Fellow**. He was able to learn from scholars who have expertise in different country contexts and specific research techniques. It has also allowed him to expand his professional skills and experience, which can ultimately put him in a more established position to contribute to academia as a researcher and educator in South Africa. This research, along with making linkages between case studies in South Africa and the UK, can make research undertaken in South Africa more relevant and well-known across international audiences.
- Engagement with migration, race, and community issues is particularly crucial and relevant in the current British political climate. It may ultimately inform policymakers and practitioners interested in these subject areas. The methods used could be applied to investigate similar issues in the South African context.

Lessons Learned

- The researcher would have benefited from there being **greater clarity around the funding eligibility** of certain aspects of the project. Communication from DPs at the beginning and throughout project implementation should be clearer and more detailed.
- Research of this type could benefit from more **cross-country and international perspectives**. Due to the project requirements, which did not allow for fieldwork to be carried out internationally, the Fellow was required to adapt and re-design his project to fit these requirements. It was suggested that this requirement could be rethought, as it was seen as contradictory to the Newton Fund's aim to enhance international collaboration and cross-country learning.

6 Project: Low-cost technologies and microbial assessment for safe drinking water in South Africa

Summary

Project title	Low-cost technologies and microbial assessment for safe drinking water in South Africa
Call title	Institutional Links
Short description	The research seeks to provide a low-cost and instrument-free mechanism to evaluate water quality levels. The solution would significantly reduce the turnaround time for results, as traditional processes require incubating the material for 24 hours to be able to detect the presence of any bacteria.
Objective(s)	Development of a water quality testing mechanism that would reduce turnaround times for detecting bacteria, thus improving access to clean water.
Pillar	Research
Project value (total budget allocated in country, in GBP)	UK: GBP 49,995 SA: GBP 35,409 (in-kind contribution)
Start/end date (Status: on-going or complete)	April 2015 to September 2017
DP UK and overseas	UK: British Council SA: Technology Innovation Agency (TIA)
Award holders/grantees	UK: University of Hull SA: Council for Scientific and Industrial Research (CSIR)

Description of the project

Globally, diseases from microbial contamination in water are cause for major concern. A common consequence of this is diarrhoea, which mainly impacts those living in poverty in developing countries and can ultimately lead in many cases to death, especially among children.[87] This research collaboration aims to develop microbial detection techniques to provide low-cost diagnostic devices and technologies in resource-constrained environments in locations in South Africa**. The ultimate goal lies in developing low-cost diagnostic devices for use in resource-poor environments that are easy to dispose of and instrument-free so that the diagnostic device can be used as a standalone**.

At the time of the proposal, no such device existed for rapid water testing and quality control, with the result that water borne diseases, such as diarrhoea, result in millions of deaths every year. Current testing methods include the gold standard of membrane filtration and Colilert, which is expensive. Both these tests require over 24 hours to produce a result, so they are not satisfactory tools as a point of use test. The project aimed to develop a test capable of collecting a sample of 100ml water and deliver a readable and easy to interpret result on which an end-user can react. The principal research aims were:

- to investigate and implement methods for reducing water sample volumes while retaining microbial content.
- the vital exchange of knowledge and expertise between the two teams, and an in-depth understanding of the problem to be addressed.

Pathway to impact

As illustrated in Annex 4, Figure 7, this project fits closely with the Theory of Change for Newton Fund Research Pillar activities. The project's impact logic outlined in Figure 7 is further expanded upon below.

Activities:

- A two-day workshop in Pretoria at the Council for Scientific and Industrial Research (CSIR) in September 2015, attended by the UK and South African teams and representatives from the local funder, the Technology Innovation Agency (TIA). The workshop included a visit to a local water treatment plant. During this phase, discussions took place around possible methods and approaches to constructing a testing device, and a work plan was developed.
- In May 2016, a second workshop took place in the UK. In September 2016, the Hull-based post-doctoral researcher spent two weeks at CSIR in South Africa to conduct joint experiments with real samples.
- In October 2016, the team participated at the MicroTAS conference[88] in Dublin, where plans for the remaining phase of the projects were discussed. The project involved two other trips to South Africa from the UK team in February and March 2017 for knowledge transfer in lab-

[87] Pamme, N. (2018) Research Fish Award Download for 174351216 – Newton Fund, Institutional Links.
[88] The Micro Total Analysis Systems (MicroTAS) conference is the premiere conference on microfluidic and lab-on-a-chip technologies and their applications in the biological and chemical sciences. See CBMS (n.d.). 'MicroTAS' Available at: https://cbmsociety.org/microtas/

on-a-chip[89] (LOC) technology and for conducting a final set of experiments with real samples.

- Testing of devices developed throughout the investigation to choose the best methods and fine-tune the design.

Outputs:

- Publishing of a brief literature study and review articles outlining their findings.
- Participation in engagement activities, in the form of workshops and conferences.
- Development of physical low-cost diagnostic devices for use in environments struggling with resources. These devices should be low-cost, easy to use, easy to dispose of, and instrument-free.
- Testing of devices, prototype refinement and selection of best method.

Outcomes:

- To exchange knowledge and expertise between the two partners and foster an in-depth understanding of the problem the team is hoping to address.
- Investigate current microfluidic methods and other methods to reduce the sample volumes necessary when measuring lateral flow tests.
- Design and manufacture devices for water assessment. Some methods to explore include IFAST, phase guides, continuous flow systems, and particle beds.

Expected Impact:

- The main expected impact of the collaboration was the reduced incidence of waterborne diseases in developing regions, both in South Africa and beyond.
- Low-cost technologies for safe drinking water have potential to improve the health of communities who currently rely on unsafe water, thus improving their quality of life through reduced illnesses, reduced absence from employment, improved school attendance and improved family life. This would also reduce stress among women and girls (usually responsible for collecting and providing drinking water at home).

6.1 Emerging project results

Relevance of Newton Fund activities

ODA relevance

In 2015, the WHO estimated that 663 million people worldwide still lacked access to improved drinking water sources, with 156 million people in Africa using sub-standard water supplies.

[114] Lab-on-a-chip (LOC) technology integrates one or more laboratory processes onto a single miniaturized chip. This technology offers several advantages which include the opportunity of performing point-of-care clinical diagnostics in remote locations where access to laboratories or equipment is limited, cost efficiency and reduced environmental impact. For more details see: Bioanalysis Zone (2020) 'What is lab-on-a-chip technology?' Available at: https://www.bioanalysis-zone.com/lab-chip-technology_loc/

Contaminated drinking water causes an estimated 502,000 diarrheal deaths each year. Diseases such as cholera, dysentery, typhoid, and polio are also contracted through the consumption or exposure to a contaminated water source. Sub-Saharan Africa faces severe water shortages and drought conditions. There is a growing need for alternative water sources to alleviate pressure on existing resources.

This research directly aligns with SDG 6, which aims to ensure availability and sustainable management of water and sanitation for all, and SDG 3 on ensuring healthy lives and promoting well-being for all at all ages.[90] The research collaboration aims to address these issues by developing microbial detection techniques with the ultimate goal to develop low-cost diagnostic devices, making them accessible to low-income countries and populations.

Relevance of the collaboration to South Africa's socio-economic priorities

South Africa faces considerable challenges relating to the quantity and quality of its water supply. Between 37% and 42% of potable water is unaccounted for, most of which is lost through illegal connections, leakage and wastage. The Hazelmatere, Goedetrouw, Hluhluwe and Klipfontein dams are all facing critical water levels.[91] Livestock farmers face financial challenges, and numerous small towns in South Africa's Northern and Eastern Cape are threatened by total water supply failures. In addition, heatwave conditions and the late onset of rains are causing local supply failures in other parts of the country.[92]

Water pollution has become the country's biggest threat to water security and quality, due in large part to a lack of formalised waste management services.[93] This research responds to South Africa's challenge in ensuring safe access to water and the health of its population. The collaboration focuses on developing microbial detection techniques, with the ultimate goal of creating a low-cost diagnostic device for use in resource-poor.

Origins and quality of the collaboration

The idea for the project originated in response to the launch of the Newton Fund call. The two award holders had met previously during conferences, and the UK AH reached out to the South African AH, suggesting a proposal to carry out research in South Africa. At the time, the UK AH had developed a mechanism for testing food quality; this technical expertise could be re-engineered for the new purpose of testing water quality.

Additionality

The award holders scoped various funding opportunities and chose the Newton Fund as the best fit due to the possibility of securing funding to carry out work in developing countries, specifically in South Africa. Research on microfluidic engineering and chemistry tends to be mostly based in developed countries. As such, Newton was considered a good match for the

[90] United Nations (n.d.). 'Ensure availability and sustainable management of water and sanitation for all' Available at: https://sdgs.un.org/goals/goal6
[91] South African Government (2015). 'Government on water scarcity and drought' Available at: https://www.gov.za/speeches/government-water-scarcity-and-drought-13-nov-2015-0000?gclid=CjwKCAiAq8f-BRBtEiwAGr3DgRBKMcHUeL8tEZ6RJU433BPhvPfe5QS5xt0S_A_IXBC65sVQH2xivBoCVb4QAvD_BwE
[92] Muller, M. (2019). 'South Africa's real water crisis: not understanding what's needed'. *The Conversation.* [online] Available at: https://theconversation.com/south-africas-real-water-crisis-not-understanding-whats-needed-126361
[93] Averda (n.d.) 'Water pollution is a major threat to South Africa' Available at: https://averda.co.za/news/water-pollution-major-threat-south-africa/

project's aims and ambitions. **The project would not otherwise have gone ahead without the Newton Fund.**

6.2 Effectiveness of Newton Fund activities

Emerging Results

This Institutional Links project aimed to devise a solution that, by collecting as little as 100 ml of water, would be able to deliver an easily interpreted result for the user. **The project's duration of only two years did not allow for direct rural community benefit to be achieved, as the project wrapped up its activities at the end of its testing phase.**

The project had reached the testing phase by the time of its completion. The outcomes of the research regarding innovation in technology were then taken forward and applied through a further Newton Fund project in Kenya. The SA team would have applied for further funding, but an institutional restructuring prevented this from happening. **The team partially achieved its objectives, as more time would have been needed to look at potential commercialisation of the device.** It was estimated that this would have required two more years.

The collaboration provided multiple engagement opportunities such as the 2017 Hull Science Festival, where the team hosted workshops on lab-on-a-chip with schoolchildren and a stall for the general public. Practical demonstrations for children covered various scientific concepts. The team also took part in other events such as Pint of Science, Soapbox Science and the Beverley Cafe Scientifique[94]. The team also ran workshops and STEM clubs for school children and college students both on campus and in local schools. The dissemination activities linked to the research project are documented and accessible on the UK AH's research group website.[95]

This research collaboration undertook a literature review, the findings of which were shared at a workshop in Pretoria. The research also led to the publication of a peer-reviewed article[96]and successfully designed and manufactured devices to be tested. These include a technique for isolation of pathogens from water samples (IFAST). Fabrication protocols have also been exchanged and tested by both partners.

Quality of Research Collaboration

The project was successful in the exchange of knowledge and expertise between the two countries. The collaboration between the two teams was strong and led to robust research results. The choice of partnership between CSIR and the University of Hull was effective and complementary across disciplines. The UK AH is a chemist and microbiology expert, the South African AH comes from an engineering background.

The UK and South African research teams collaborated well. There was a natural split in terms of how the work could be carried out. The UK brought manufacturing capacities, while South Africa provided contacts in the water sector and could identify device testing locations.

[94] Pint of Science (n.d.) Available at: https://pintofscience.co.uk/ ; Soapbox Science (n.d.) Available at: http://soapboxscience.org/ ;'Café Scientifique (n.d.) Available at: http://cafescientifique.org/
[95] Nicole Pamme – Research Group (n.d.). 'Outreach' Available at: https://pammegroup.org/outreach/
[96] Ngamsom et al. (2017). A Microfluidic Device for Rapid Screening of E. Coli. 0157:H7 Based on IFAST and ATP Bioluminescence Assay for Water Analysis, Chemistry (Weinheim an der Bergstrasse, Germany), pp. 12754-12757. Doi: 10.1002/chem.201703487.

The collaboration supported the capacity building and career development of AHs and their research teams. During the duration of the project, a research assistant was hired for one year and went on to pursue a post-doc under the supervision of the UK AH. In addition, CSIR also appointed researchers to the project. For the South African AH and their institution, this was the first opportunity to collaborate in a research partnership with the UK, particularly with an institution and research counterpart who is an expert in their field.

Challenges in the collaboration

Some early logistical challenges were reported, mainly the long delivery timeframes for reagents to arrive in South Africa compared to the UK's short delivery times. Methods that generally worked better in the UK did not always work as effectively in the South African lab. However, these issues were overcome through close and continuous communication over Skype and mutual visits.

6.3 Emerging signs of impact

Potential impact on poverty reduction and economic development

The CSIR-University of Hull collaboration has partially achieved its objectives. The project's limited lifespan meant that limited its potential longer-term impact. It stopped its activities at the end of the testing phase. **However, the project has enabled another collaboration with a high potential for impact.** Research findings and testing outcomes provided the groundwork for a further Newton Fund project carried out by the UK AH in Kenya. This subsequent project provided an opportunity for additional testing and refinement of the technology.

The subsequent collaboration with Mount Kenya University has focused on improving diagnosis techniques of maternal bacterial infection (MBI). Maternal infection causes high rates of sepsis, stillbirths, premature delivery and new-born deaths among women in Kenya. As such, MBI represents a global public health issue. **In 2020, this project won the Newton Prize**. This project was developed a quick, low-cost device – known as IFAST - which analyses pathogens in urine at the point of care. The low-cost testing technology behind IFAST was an application of the technology used to test water quality levels in South Africa under the Newton Fund project.

Potential impact on the UK

The collaboration raised the international profile of the NIBEC research centre at the University of Hull. When a visit of South African researchers was organised to the University of Hull, this was extensively advertised by the university management. For members of the UK research team, this collaboration represented the first opportunity to carry out work in a developing country, and it laid the ground for further work in the African continent.

The UK AH went on to be awarded the 2020 Newton Prize,[97] which stands as a testimony for the ground-breaking work carried out as part of her research. As said by Pro-Vice-

[97] The Newton Prize is a £1 million fund which recognises the excellent research and innovation that the Newton Fund has invested in since its launch in 2014. It celebrates the best partnerships between the UK and Newton Fund countries and encourages new international collaborations to address some of the world's most pressing challenges.

Chancellor for Research and Enterprise at the University of Hull: *"At the University of Hull, we are incredibly proud to have a talented team of academics and researchers, whose contributions have truly global significance. Professor Pamme's encapsulated research excellence in every possible sense – utilising ground-breaking technology in an international collaboration to make a huge difference to the lives of those that most need it."*[98]

Signs of sustainability

Despite the short research timeframe, the project has led to both short- and longer-term impacts. Through workshops and conferences, dissemination and outreach have reportedly led to a change in the audience's views, opinions, and behaviours.[99] Workshops and demonstrations aimed at school children have contributed to technical knowledge communication to a wider, non-specialised audience[100].

More could have been done to ensure the sustainability of the project's results and activities had the research timeframe been longer. **Additional follow-on activities could have included exploring possibilities for commercialising the device or rendering it available to users from rural communities.** This would have considerably improved its prospects for on-the-ground impact and sustainability of the research group.

The team is currently looking for further funding opportunities to resume their collaboration on a new project, but these have not yet materialised. The UK side of the partnership was able to apply research techniques to other areas of investigation, with a high potential for impact (IFAST, see above). This showcases the applicability and potential interest in research findings and methodologies, including beyond the South African context.

Complementarity and coordination

The project had clear goals to reduce the incidence of waterborne diseases and ultimately improve the health of communities who rely on unsafe drinking water. More time was required to perfect, revise and distribute the technology, therefore the project has not demonstrated impact in terms of mainstreaming or uptake of best practice. Another project has stemmed from the work in this collaboration which has led to the development of a quick, low-cost device, IFAST, which helps improve diagnosis of maternal infections in Kenya, which is now reaching its clinical trial phase. Although this collaboration focuses on a different thematic area of intervention and different country context, it did stem from research findings and methods applied in this collaboration. This is a good example of the potential this research to influence policy and practice in complementary areas.

6.4 Conclusions

- **This project aimed to provide a low-cost and instrument-free mechanism to evaluate water quality levels**. It focussed on the delivery of treated water (such as rainfall or water from rivers) for daily use at the household level, thus supporting low-income, marginalised households to access clean and safe water for consumption. The research directly aligned with South Africa's priorities in tackling water security and water quality issues.

[98] University of Hull (n.d.) 'University of Hull Professor shortlisted for 2020 Newton Prize'. Available at: https://www.hull.ac.uk/work-with-us/more/media-centre/news/2020/university-of-hull-professor-shortlisted-for-2020-newton-prize
[99] Research Fish (2018) The British Council Report no. 174351216, 26 April 2018.
[100] Ibid.

- **The team partially achieved its objectives.** Although the collaboration resulted in important research findings, more time would have been needed to investigate this device's potential commercialisation. The project reached its testing phase by the time of completion. The research outcomes were then taken forward and applied through a further Newton Fund project in Kenya.
- **The collaboration resulted in participation in multiple engagement activities,** in the form of workshops and conferences, and the drafting of a literature review and the publication of a peer-reviewed article.[101]
- **The collaboration and testing outcomes provided the groundwork for a further Newton Fund project** carried out by the UK AH in Kenya. The work conducted under that project won the Newton Prize in 2020.
- **The collaboration between CSIR and the University of Hull was highly effective and complementary**, and the partnership overall was reported as being very positive and built on mutual esteem. Knowledge and expertise were exchanged between the countries through workshops and visits on site visits.
- **UK science and innovation opportunities opened up because of the Fund, and the international profile of the University of Hull was strengthened through their participation in the Newton Fund**. The team is currently looking for further funding opportunities, though joint funding opportunities have not yet materialised.

Lessons learned and points to consider going forward

- The project made considerable progress in its research, but **more time and funding would have been required to carry out additional testing and potentially take the product to the market.** No follow-on funding has been available to continue progressing this research in South Africa. The research has enabled other projects to stem from this work, with the potential to impact other countries, notably Kenya.
- **Engagement activities have been successful in disseminating project findings and research**. Most importantly, the collaboration has enabled knowledge transfer among both countries and researchers. Continuing these engagement activities, such as workshops and further publication of articles, could lead to changes in practices and the potential continuation of research efforts in this field.

Annex 1 – Methodology

Research methods and data collection approach

[101] Ngamsom et al. (2017). A Microfluidic Device for Rapid Screening of E. Coli. 0157:H7 Based on IFAST and ATP Bioluminescence Assay for Water Analysis, Chemistry (Weinheim an der Bergstrasse, Germany), pp. 12754-12757. Doi: 10.1002/chem.201703487.

The country case studies are central to our Final Evaluation approach and involved an intensive period of remote research by the evaluation team.

Preparation for the research included a document review of country-specific documents on South Africa's research and development context. Documents reviewed include the evaluation's South Africa End line Assessment and the updated Country Situation Note. We also conducted a literature review of additional documentation on South Africa's science and innovation landscape and existing UK-South Africa collaboration activities. Project-specific documentation, such as application forms, progress and final reports, were reviewed for each action included in the study, where provided by the Delivery Partner, local partners or researchers.

The document review was accompanied by **remote research with respondents in South Africa and in the UK** in November and December 2020. Three main categories of stakeholders were interviewed: i) in-country UK representatives and Newton Fund in-country team, ii) UK and local funders, and iii) participating researchers. In some cases, additional university staff, such as university leadership or other research teams, were also interviewed.

Our data collection was complemented with an analysis of the pathway to impact for each action, which can be found in Annex 4. Here, we analysed each project's trajectory to impact by placing it within the Newton Fund Theory of Change. This allowed us to visually represent the pathway to outputs, outcomes and impact of each activity and highlight its (potential) contribution to broader Newton Fund goals.

Limitations of the research approach

The short timeframe for country case study research meant that we could only include three **projects within our case study.** These are not representative of all Newton Fund activities as a whole. The short timeframe also limited the number of stakeholders we were able to interview in South Africa. The volume of documentation provided varied by project, thus limiting the possibility of triangulating findings. The case study findings reflect the data provided by each project and what is available online.

Research findings have been triangulated across different stakeholder groups and various sources of documentation (project documents and online resources such as the RCUK Gateway to Research portal). However, the research team could not independently verify statements by all the different contributing stakeholders or verify what was reported in the documentation.

Additionally, the COVID-19 pandemic resulted in the need to revisit our data collection approach, particularly in terms of our 11 country case studies. The case study research was originally scheduled to take place in three waves of partner country visits between March and August 2020. The inability to travel internationally and the closure of offices, embassies, universities, and research centres required switching to a **remote-based approach**, as agreed with BEIS in March 2020.

In revising our case study approach, we recognised that switching to a remote-based approach would have likely implications on the quality of data collected, as outlined in our April 2020 Concept Note. The quality of interviews could have been affected for several reasons, including:

- problems with connectivity, technical issues and limited telephone or internet coverage, which posed the risk of lowering the quality of calls and cause loss of rapport, creating abrupt feelings in interviews and affecting the depth and quality of our findings.

- the absence of visual or nonverbal cues, inability to observe behaviour and body language, with the risk of telephone interviews becoming mechanical and cold.
- having little opportunity to establish rapport with respondents and having potentially shorter times for interviews as respondents may more easily become fatigued by telephone compared to face-to-face interaction.
- limited engagement, low response rates and little interest in participating in our research, which might limit the breadth and depth of our findings.
- the inability to visit laboratories or facilities, and limited scope for unplanned interviews with additional staff members, researchers, or others in the same institution.
- fewer opportunities for check-ins and informal conversations with in-country teams (ICTs), who are a rich source of data.

We mitigated these issues in several ways, where:

- we included additional time for document review prior to interviews so that conversations moved on to speaking about results, emerging impact, and challenges (to take into account for shorter interview times and potentially lower quality interviews). However, it is important to consider that availability and quality of project data and information varied considerably across sampled interventions.
- we favoured video interviews wherever possible to limit the lack of nonverbal cues and to help establish rapport with respondents.
- we had several email exchanges prior to interviews to create an initial connection and rapport with participants, and to set out the objectives and areas covered in the interviews by sharing topic guides prior to our calls.
- we organised follow-up interviews wherever possible to fill any remaining information gaps brought about by having shorter interview times. We also gathered interviewee insights on additional respondents and carried out additional interviews which emerged from email exchanges and interviews.
- we organised regular check-ins with ICTs via email or telephone and delivered online presentations and validation sessions with each ICT to share emerging findings after having carried out all interviews. This allowed us to ensure we had accurately reflected the Newton Fund's experience in each country.

Annex 2 – Case Studies Sampling Overview

This Annex summarises the sampling approach used for the country case studies which inform the Final Evaluation of the Newton Fund. Detail on the approach and criteria used to develop the sample for the case studies is annexed to Tetra Tech's Newton Fund Final Evaluation Report.

Final evaluation country sample

A total sample of 11 countries with three calls per country (totalling 33 calls) was agreed with the Department of Business, Energy, Innovation and Science (BEIS).

The countries selected for the country sample were China, Malaysia, Chile, Turkey, South Africa, Brazil, India, Philippines, Jordan, Peru and Kenya. The sample includes three additional countries (Jordan, Kenya and Peru)[102] due to the Newton Fund's expanded scope. Six of these countries were included in the Mid-Term Evaluation (MTE)[103] of the Newton Fund case study research.[104]

The criteria used for the country selection were:

- coverage of all regions covered by the Newton Fund.
- coverage of different levels of existing innovation and capacity of partner countries (as defined by the 2015 Global Innovation Index rankings and BEIS' initial assessment of capacity).
- learning opportunities from new ways of working regionally in countries that either graduated from the DAC list or have ODA sensitivities; or operating in/ recovering from crises.
- the inclusion of Peru, Jordan, Kenya (countries that have not been explicitly included in the evaluation scope until now).

Non-selection of countries (or calls) does not reflect significance, quality or importance.

Proposed sample of calls and projects

Data from BEIS' Newton Fund Activity Tracker (January 2020)[105] enabled the evaluation to determine 'call' activity and identify three 'calls' per country, giving a total of 33 calls in the sample. The following criteria were used to develop the call sample:

- ensuring coverage of all DPs.
- ensuring coverage of the three different pillars.

[102] Jordan, Kenya and Peru were not included in the MTE data collection, as they had just joined the Newton Fund. BEIS agreed to carry out in-depth case studies in the three new countries to ensure coverage of activities there.
[103] Mid-Term Evaluation of Newton Fund (2018). Accessible here.
[104] These were: China, Malaysia, South Africa, Brazil, India and the Philippines. Mexico and Egypt, which were part of our MTE sample, have been replaced with Turkey and Chile respectively to increase opportunity for learning.
[105] The BEIS 'Activity Tracker' is an Excel-based internal monitoring tool by BEIS and updated quarterly by the UK Delivery Partners.

- reflecting emphasis on spending/thematic priorities in each country.
- allowing for longitudinal analysis by including six projects analysed as part of the MTE.

The outcome of the call sampling approach allowed for the identification of specific projects under each selected call. This was achieved in consultation with DPs, BEIS ODA Research and Innovation and ICTs.

The project sample allows for coverage of all DPs and pillars within the Newton Fund portfolio. Six projects were analysed as part of the MTE and again at Final Evaluation to allow for longitudinal analysis. The sample list of 33 calls and projects is annexed to Tetra Tech's Newton Fund.

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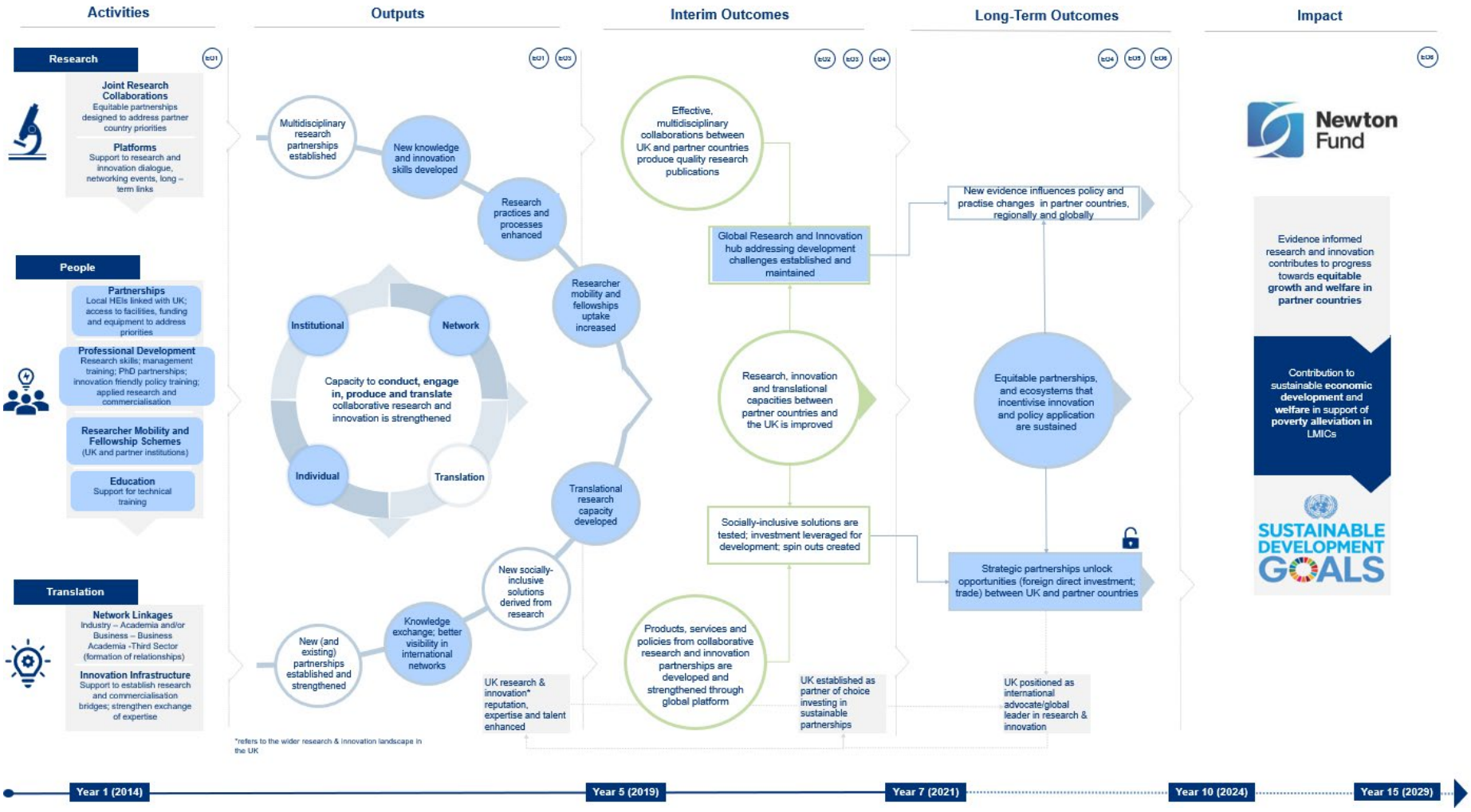
Annex 4 – Theories of Change per Action[106]

Figure 5: Development in Africa with Radio Astronomy (DARA)



[106] The figures present the pathways to impact for the three projects reviewed in this case study, set within the overall Newton Fund theory of change. Specific pathways to impact for each project are indicated by the blue shaded shapes in each figure.

Figure 6: Newton International Fellowships – Unseen Migration

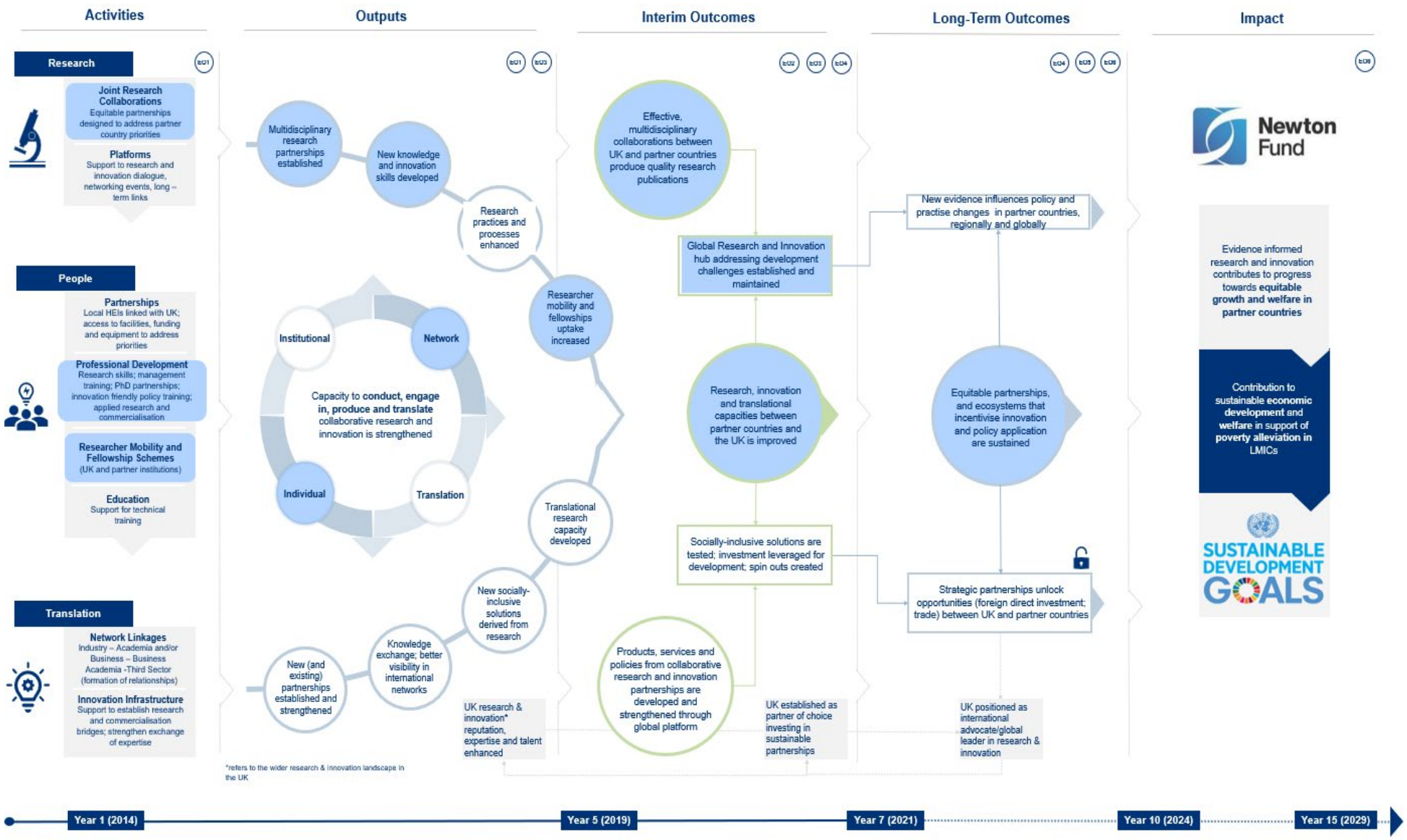
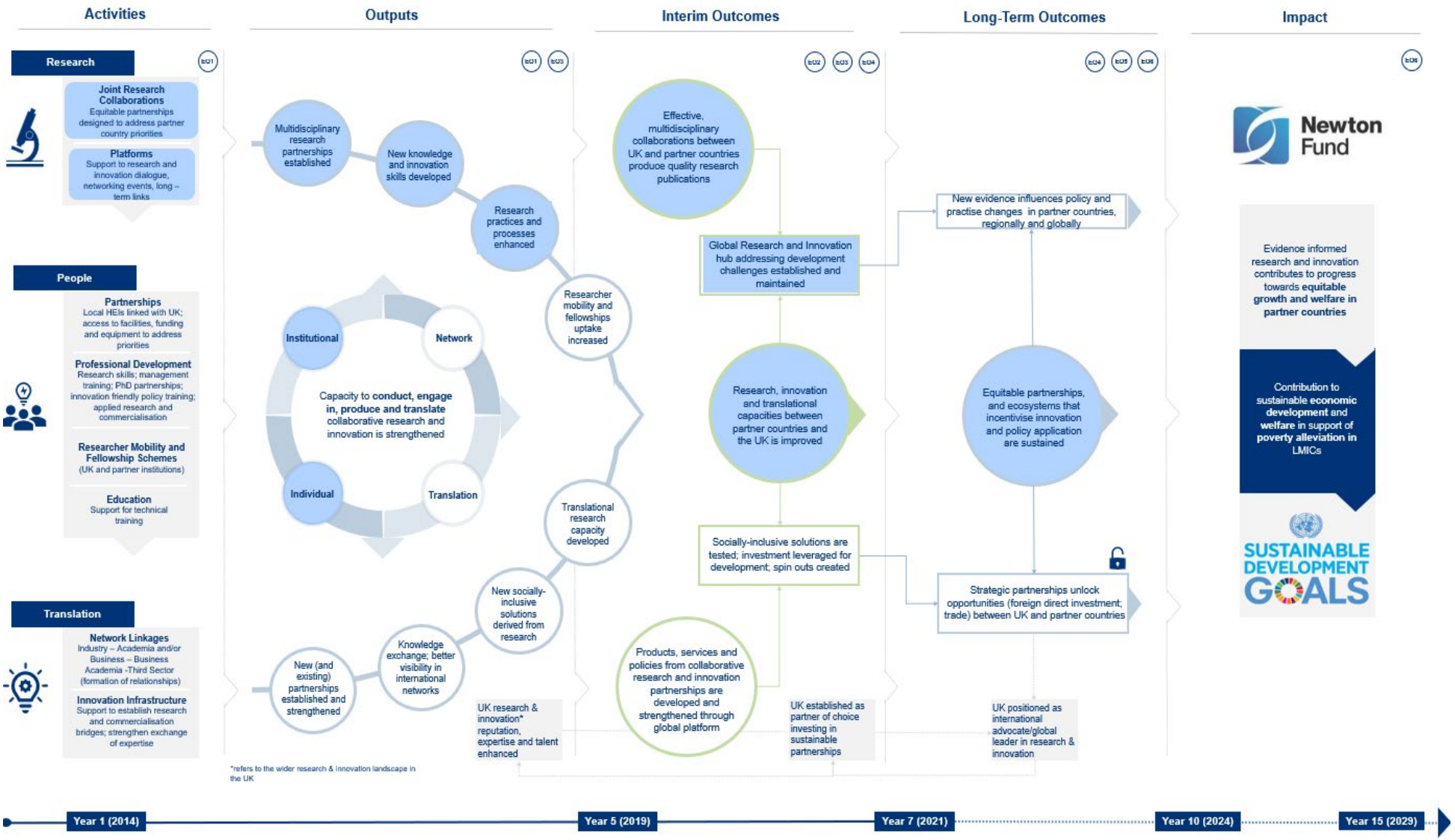


Figure 7: Institutional Links – Water quality



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