Newton Fund

Newton Fund South Africa Newsletter Edition

Technopreneurship in South Africa

The Newton Fund Leaders in Innovation Fellowship (LIF) programme fellows with industry partners at the LIF promo event, ahead of the two-day in-country workshop, held on 26 November 2019 in Sandton, South Africa.

INSIDE THIS ISSUE:

Entrepreneurship in South Africa's Informal Economy

"On your shoulders rests the challenge of giving science a face that inspires our youth to seek out science, engineering and technology"

Big Science Big Data: Third Big Data Africa School

Department for Business, Energy & Industrial Strategy

science & innovation
Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA

Contents

Editorial

Dear Reader,

In the past year the activities of the UK-South Africa Newton Fund translation pillar have widened and deepened. The Newton Fund has embarked on a UK-SA joint entrepreneurship and innovation collaboration with its delivery partners in support of South Africa's socio-economic development.

We hope that this newsletter edition will give our readers numerous reasons to stay connected with us.

If you would like more information about the UK-SA Newton Fund and stay updated with Newton Fund quarterly newsletters, events and funding opportunities, please send an email to **Newton.SouthAfrica@fco.gov.uk**. Follow us on our social media platforms - Twitter: **@NewtonFund** or visit our website at **www.newtonfund.ac.uk**.

Katekani Chabalala
Newton Fund Officer
Contact editor: Katekani.Chabalala@fco.gov.uk

Foreword

British High Commission Head of Africa Science and Innovation Network: David Barnes

I write this foreword having been in post in Pretoria for around two months and having been struck by the level of collaboration between South Africa and the UK across the board in science and innovation. The Newton Fund programme in South Africa is a great example of this partnership in action with both countries playing their part in delivery and realising our goal–a deeper, broader science relationship.

This issue provides an insight into three of the programmes the UK and South Africa run in partnership: the Leaders in Innovation Fellowship (LIF) programme, the Global Innovation Partners Programme (GIPP), and Developing Africa through Radio Astronomy (DARA). Three very different programmes but all demonstrating the variety and talent here in South Africa that the UK is proud and determined to continue this partnership.
I recently had the opportunity to speak to a number of LIF alumni who spoke in glowing terms of the support they had received from the South African Technology Innovation Agency and the UK's Royal Academy of Engineering. At the GIPP workshop, I listened to entrepreneurs in townships explain the challenges they face to grow their businesses. There was a shared sense of purpose across stakeholders to work through those challenges and the clear need for a multi-faceted response.

Having had the pleasure of attending aspects of the DARA Big Data School, I saw for myself how much participants had grown and developed during the school. This skills development was not only in new technical skills but also problem solving, leadership, teamwork and communication. These essential "soft skills" are a necessity for the modern scientist operating in a global, collaborative setting. This is a fantastic example of the partnership approach between South Africa and the UK in developing people. The number of former students who had returned to lend their expertise was testament to this, several of whom were now completing PhDs in the UK on DARA linked projects.
Since the last newsletter appeared, the United Kingdom has published its International Research and Innovation Strategy.

South African Department of Science and Innovation Director of Bilateral Relations in Europe and Gulf States: Khaya Sishuba

I make these remarks at an opportune time for our science and technology relations with the UK. Firstly, we have emerged from a UK-South African Science and Innovation Joint Commission meeting which was led by senior government officials from both sides whose remit was to review and recommit to collaborative activities of the partnership. Secondly, the Department of Science and Innovation has released a White Paper on Science, Technology and Innovation. These two developments augur well for our partnership as both sides view the partnership to be growing and progressing well.

The introduction of the White Paper on Science, Technology and Innovation from the South African side will, no doubt pave a clear path for the partnership in areas of cooperation that will be impactful on our relations and equally meet the development challenges we face. To single out one dominant area in the new White Paper: it puts emphasis on facilitating innovation. This is decisive, as we seek to inculcate a culture of innovation aimed at improving competitiveness in our National System of Innovation.

The focus of this newsletter on the three Newton Fund flagship programmes mainly, the Leaders in Innovation Fellowship (LIF) programme, Global Innovation Partners Programme (GIPP) and the Big Data Africa School initiatives, highlights the depth and forward thinking in our partnership. It further illustrates that our partnership has a strategic reach beyond the bilateral focus, given that other countries in our region are also active participants in the partnership. We are very much pleased by this development in our partnership.
I hope this newsletter edition will give you a glimpse of a rich tapestry of collaborative initiatives between South Africa and the UK and that it will also invigorate a fresh outlook on how we frame our partnership in advancement of the Newton Fund initiatives and broader cooperation between South Africa and the UK.

Training a New Generation of Leaders in Innovation

Amelia Marutle (Newton Fund), Shaarad Sharma (Royal Aacademy of Engineering), Khaya Sishuba (DSI), Keneiloe Kganane (LIF fellow), Petro Erasmus (LIF fellow), Lino Velev (Farstar), Ntleko Meloduis (LIF fellow) and Fuzlin Levy-Hassen (TIA) attending the LIF in-country workshop. Keneiloe, Petro and Ntleko are the top three fellows who won the LIF pitching competition held in the UK.

The South African economy requires citizens with innovational and entrepreneurial skills to thrive in the technological changing global world. The UK–South Africa Newton Fund Leaders in Innovation Fellowship (LIF) programme brings together emerging leaders who have developed innovations that have the potential to contribute to the social and economic development of South Africa through commercialisation. Launched in 2014, the year-long training LIF programme brings together innovators from 16 other Newton Fund partner countries including Kenya, Egypt, Brazil, China and Malaysia.

The National Development Plan (NDP) recognises science, technology and innovation (STI) as part of the key drivers of inclusive and sustainable growth, job creation and socio-economic reform. The implementation of the NDP in promoting STI is reinforced by the Department of Science and Innovation (DSI) White Paper on STI which sets out the South African government's long-term policy approach for the STI sector. "In the NDP, the issue of innovation performs a critical part in changing the economy of the country," said DSI Director of Bilateral Relations in Europe and the Gulf States, Khaya Sishuba, speaking at the LIF in-country workshop held on 27 November 2019 in Sandton, South Africa.

The two-day LIF workshop hosted by Newton Fund delivery partners, the South African Technology Innovation Agency (TIA) in collaboration with UK's Royal Academy of Engineering (RAEng), was designed to showcase the talent of South African technopreneurs and equip innovators with critical skills to commercialise their products.
TIA's Acting Chief Executive Officer, Fuzlin Levy-Hassen, highlighted the strides achieved through the LIF programme in contributing to South Africa's transformation agenda. "Since its inception in 2014, the year-long programme has successfully run for the past five years with 68 innovators across all sectors being supported composed of 70% females, 55% black persons and 60% youth," she said.

Reiterating how inclusive innovation can be achieved, TIA's Head of Innovation Skills Development, Senisha Moonsamy, echoed that industry partners together with mainstream universities ought to form collaborations with South African historically disadvantaged institutions for capacity building. "If you look at those universities they are poorly funded and don't have industry partners on board," Moonsamy said.

The year-long training programme lays the foundation for launching a product and emphasises skills such as negotiation, team-building, resilience and effective communication. "It is incredibly inspiring to apply your mind and expertise to these type of causes which seek to make real impact in the communities through engineering and innovation solutions to societal challenges," said RAEng Senior Manager for International Partnerships, Shaarad Sharma.

The LIF programme provides its alumni with a lifetime membership in a thriving global community. LIF beneficiary, Abide Ncube, is a Managing Director of Sky Vintage, an e-waste collection company specialising in recycling electronic waste equipment. Ncube noted the value of international exposure through the programme. "I now have means to enter other markets through strategic partnership development with peers from other countries. This development means that come the launch period, the model [e-waste collection bin] can gain traction and sustainability through this newly found network," he said.
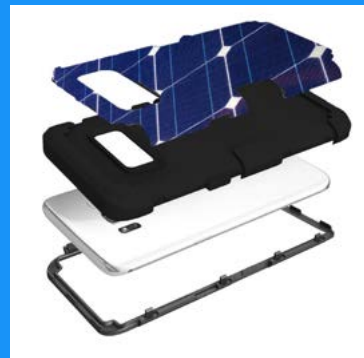
Greener Innovations

Smartphone Pocket Charger Powered by the Sun

Solar energy presents opportunities for technopreneurs to transition towards eco-innovations for a greener economy. Investing in solar energy innovations is vital for South Africa's energy transition in achieving Sustainable Development Goal (SDG) 7 on affordable and clean energy. Founder of Nosi-BEAM Energy, Fortunate Nosi, is an entrepreneur exploring greener innovations with his NB-Pocket smartphone solar energy charger that assists smartphone users who need reliable and sustainable battery charging accessories.

Prototype of NB-Pocket smartphone charger developed by Fortunate Nosi. COPYRIGHT – NOSI-BEAM 2019

Fortunate Nosi, the founder of NB-Pocket smartphone solar energy charger.

The overall goal is to reduce the significant electrical power consumption of smartphones. Nosi who is also a LIF programme alumnus, is looking for a product development partner who will help him achieve technology development for his product and a partner that will assist with funding in order to test the prototypes that will be developed.

"I believe the biggest beneficiaries will be South Africa and surrounding African countries because the successful development of the NB-Pocket will mean an introduction to a new product which will maintain access to the smartphone devices," said Nosi, explaining how his innovation is a solution to supply a product that uses solar energy in order to provide smartphone users with constant power supply for their devices.

Nosi-BEAM Energy's target market are smartphone manufacturing companies, network providers that supply smartphone accessories, and smartphone accessories' distributors. "I believe research partnership is essential, as it impacts on the credibility of our research and allows us to collaborate with leading institutions which have international recognition," said Nosi, elaborating on the benefits of partnering with international institutions through the Newton Fund.

For further information about Nosi-BEAM Energy visit the website at www.nosibeam.com or connect through social media using Twitter, @NOSIBEAMENERGY.

Technopreneurs Lead in Economic Development

South Africa remains a net importer of technology to stimulate economic development. However, an increasing number of South African technopreneurs are emerging to participate in the country's transition towards a knowledge-intensive economy. This dialogue with the Black Science, Technology and Engineering Professionals' (BSTEP) Chairperson, Mpho Madisha, aims to understand how technopreneurs impact on and contribute to South Africa's inclusive growth and shift into a prosperous knowledge economy. Madisha, a successful technopreneur served as a role model to the Leaders in Innovation Fellowship (LIF) programme alumni during the two days in-country workshop.

BSTEP Chairperson, Mpho Madisha

What is Technopreneurship?

A technopreneur is a new age entrepreneur who makes use of technology to invent a new innovation and brings it to market. Actions in support of broad-based and grassroots innovation and entrepreneurship can strongly sustain a process of inclusive growth. To achieve inclusive economic growth the Black Science, Technology and Engineering Professionals' (BSTEP) RedBench programme aims to support technopreneurs as a way to addressing the low levels of successful high tech start-ups among the previously marginalised black communities in South Africa.

"We want to cultivate a spirit of entrepreneurship to as many engineers and scientists as possible, while acting as a support desk to activate start-ups. This is key, as we have few Small Medium Enterprises in the high tech space in black communities," said BSTEP Chairperson, Mpho Madisha, who heads the non-profit organisation established in 2005.

Uplifting the Informal Economy

The advocacy organisation recognises the integration of entrepreneurship, science, engineering and technology as key drivers to attaining economic development. "We see science as a key thrust to achieving economic development," said Madisha. BSTEP's vision is to promote inclusive innovations through programmes, such as RedBench, which are aimed at facilitating the growth of scientific and engineering ideas into potential start-up businesses with good value proposition among black professionals.

Madisha explains that the idea of supporting black professionals emanates from uplifting the second economy. Former South African President, Thabo Mbeki's speech about South Africa being divided into "two nations" reflects a duality of economies with a sophisticated financial and industrial base, known as the "First Economy", having grown alongside an underdeveloped informal economy, known as the "Second Economy". Madisha explains that "the black community is behind and needs a lot of support for them to catch-up".

In support of South Africa's National Development Plan (NDP) that provides a policy framework for tackling the triple challenges of poverty, inequalities and unemployment, BSTEP seeks to reduce unemployment by placing engineering graduates in companies. The majority of these students are later absorbed and offered employment at these companies. "We have had almost 350 students placed in different companies; the majority of them ending up being absorbed in those companies," Madisha said. BSTEP empowers young professionals to further pursue their doctoral studies in order to be influential within research institutions, state-owned entities and the corporate world.

RedBench Help Desk Support

The RedBench programme helps alleviate some of the challenges faced by technopreneurs, and provides a help-desk which supports its members with information related to funding, prototyping, market research and intellectual property management.

Madisha stressed the need for the development of venture capital to fund early-stage small businesses with high growth potential. "We engage with various stakeholders to provide support to our members, for instance, with funding information about the Industrial Development Corporation, Small Enterprise Development Agency and the Newton Fund's LIF programme," said Madisha.

Research and Development is of importance to improve the link between innovation and business requirements. Madisha emphasised the importance of the practical application of the innovation idea and the importance of market research: "if you have a market, you have a business," he said.

"We see science as a key thrust to achieving economic development."

The Future of Education

Madisha explains that the future of work in the fourth industrial revolution requires learners to be exposed to coding as this will equip them with critical reasoning and problem-solving skills. BSTEP facilitates high school outreach support programmes to further excellence in mathematics and science among youth from disadvantaged backgrounds under its student chapters initiative. Establishing the student chapters provide high school learners with exposure to a career in science. "You solve a child's problem, you solve South Africa's problem," he said.

Bart Doorneweert (Source Institute), Mpho Madisha (BSTEP) and Khaya Sishuba (DSI) at the LIF in-country workshop.

What is needed to drive self-sustainable entrepreneurship in South Africa's informal economy?

In this article, we explore the complexities, challenges and success stories of the township entrepreneurship ecosystem. The South African Department of Science and Innovation (DSI) hosted a workshop on 9 October 2019 in partnership with Innovate UK to discuss findings from the Newton Fund Global Innovation Partners Programme (GIPP). The GIPP is a pilot programme which aims to contribute towards strengthening and supporting entrepreneurship and innovation in the informal economy in South Africa with particular focus on the township ecosystems.

"We want to exist within already existing markets where the consumer is"

Panel members in discussion at the GIPP workshop hosted by DSI in Pretoria.

Townships in South Africa are typically underdeveloped and racially segregated urban areas, built on the periphery of towns and cities. As townships and informal settlements have the most severe socio-economic issues, the township entrepreneurial ecosystem is a potential driver that can contribute to the transformation agenda and redress the massive inequalities.

Panel discussions held at the GIPP workshop with participants in the GIPP project and a range of stakeholders from government, academia, township business representative bodies, businesses (corporates SMEs), and civil society actors, addressed challenges encountered by start-up entrepreneurs in South Africa. The National Development Plan (NDP) highlights that South Africa has a comparatively low start-up rate to that of other emerging market economies. Furthermore, a relatively high proportion of these start-up businesses are survivalist in nature. A survivalist business is a type of business that is not considered to have growth prospects or provide sustainable employment. The GIPP workshop debated possible solutions focusing on what South Africa needs to do to promote new businesses and enhance the potential of small businesses to grow.

Investing in Small Growing Businesses

Small growing businesses operating in the informal township ecosystem have restricted cash-flow due to entrepreneurs utilising profits for their daily needs. It is crucial to provide access to seed funding especially for early stage entrepreneurs. The CEO of the Township Entrepreneurs Network, Sicelo Mbonani, argued that there are massive funding opportunities to support township entrepreneurs, however, the funding rarely filters down to beneficiaries of the intended programmes. "A high percentage of the funding for entrepreneurial programmes is allocated to administrators of the programme rather than participants" Mbonani said. This statement reflects the need for entrepreneurship schemes to maximise the value and resources provided to beneficiaries.

Barrier to Entry in Value Chains

The existing value chains in South African markets tend to make it difficult for start-up entrepreneurs to access the market. In particular, this restricts start-up local manufacturers from accessing the already existing market structures within large retail firms. The panel at the GIPP workshop debated the South African government's intervention in engaging with privately owned retail firms to permit local manufacturers to operate in the already existing value chains and infiltrate the stores with proudly South African brands. "We want to exist within already existing markets where the consumer is," stated Mbonani.

Infrastructure Development

The lack of adequate infrastructure facilities affects small businesses operating in informal settlements. The CEO of E-Kasi Entrepreneurs, Elvis Sekhaolelo, debated the prioritisation of local entrepreneurs to be active within the manufacturing sector. "We need to capacitate small businesses with infrastructure to be producers of products, instead of consumers of products," said Sekhaolelo.

The South African government has initiated projects in support of capacitating local entrepreneurs with infrastructure: a particular example is the development of the Riversands Incubation Hub. Mbonani argued that incubation hubs are often not integrated into communities that ought to be benefiting from the development. "Riversands Incubation Hub is far away from the markets and not many people will walk in to purchase your product," said Mbonani. The Township Entrepreneurs Network aims to stimulate the township economy through developing manufacturing hubs located in townships.

Failure to increase infrastructure investment in informal settlements poses a risk to the sustainability of small growing businesses, specifically, due to legislative compliance issues. The South African Bureau of Standards (SABS) mandates businesses to comply with standards and register an operational space. The SABS requirements affect local entrepreneurs, especially survivalist entrepreneurs producing goods in their own homes. This is problematic as this practice does not comply with health and safety requirements.

Capacity Building and Skills Development

Improving the quality of skills development in support of entrepreneurs remains significant as there are serious gaps. Strengthening the township entrepreneurial ecosystem through skills training can assist entrepreneurs with quality business models to avoid start-up failure.

Capacitating entrepreneurs to perfect their products and to ensure that they are acceptable on the market is also crucial. Skills sets related to administrative costing and finance workshops are critical for entrepreneurs to work with experts in that field. Mbonani stated that "not all entrepreneurs are great CEOs" and partnering entrepreneurs with business administrators is a key solution that could advance their businesses to the next level.

Nurturing Small Businesses

The nurturing of local small growing businesses is at the heart of reducing poverty and inequalities. Entrepreneurship contributes to alleviating poverty through the creation of employment opportunities. Empowering entrepreneurs by nurturing small growing businesses also protects the domestic economy. Competition from larger retail stores with strong purchasing power and external players in the township ecosystem affect the potential growth of small businesses.

Township Entrepreneurs Network

Township entrepreneurship remains a key South African government priority. In November 2019, President Cyril Ramaphosa announced that the Township Entrepreneurial Fund is in its final stages for implementation. This fund will be beneficial to entrepreneurs operating within the township eco-system. One of these is the founder of the Township Entrepreneurs Network, Sicelo Mbonani, who participated in a discussion panel during the Global Innovation Partners Programme workshop. Mbonani shared his journey of encouraging township communities to participate in the economy through entrepreneurship.

The Township Entrepreneurs Network was founded in 2014 with the aim of addressing challenges confronted by entrepreneurs operating within the township economy. Founder and CEO of the Township Entrepreneurs Network, Sicelo Mbonani, discovered a vacuum in the representation of black entrepreneurs in the entrepreneurial sector within South Africa.

Although the South African government and the private sector encourage entrepreneurial engagements through seminars and training workshops, these discussions are usually held in developed areas and are not readily inclusive of previously marginalised communities including entrepreneurs operating in the township economy. Addressing this issue in particular and the vision of how the Township Entrepreneurs Network came into existence, Mbonani explained that "we were looking for development, exposure and a place to belong as township entrepreneurs."

Sicelo Mbonani

There was a bit of disengagement between that audience and us in terms of understanding where we are from, what makes up our market because the dynamics are completely different in the suburbs and the township market and therefore we were not completely satisfied with the interventions or engagements," Mbonani said.

Prior to its establishment, the Township Entrepreneurs Network conducted research focusing on the township sector. The findings indicated that 90% of black entrepreneurs operating in the informal township economy are survivalists. The Township Entrepreneurs Network designs programmes aimed at empowering the entrepreneurs to advance their businesses. "We challenge their perspective to think beyond just being survivalists," Mbonani said.

The Township Entrepreneurs Network has a membership of 620 entrepreneurs and its socio-economic impact within the East Rand regions of the Gauteng province where it is based, is evident through supporting survivalists' businesses to enter the mainstream economy. "If we were not to act at all, the township market will be lost to non-township cohabitants," said Mbonani.

The Township Entrepreneurs Network is introducing a first of its kind "Township Council" that aims to represent township entrepreneurs in the eco-system. The network of entrepreneurs will participate in outreach programmes in schools to make entrepreneurship fashionable to learners.

Women and Entrepreneurship in South Africa

The youth and women have a 40-45% success rate in entrepreneurship, according to research conducted by Aspen Network of Development Entrepreneurs (ANDE).
The findings were presented by ANDE Regional Chapter Manager in South Africa, Michelle Yorke, at the UK-SA Global Innovations Partners Programme (GIPP) workshop hosted by the Department of Science and Innovation.

The GIPP workshop facilitated a dialogue about women in entrepreneurship focusing on pertinent issues that affect women and their role and contribution to the South African economy. The empowerment of women and their participation in the economy is essential for gender equality and ensures sustainable development of a country.

Michelle Yorke presenting the ANDE Gauteng entrepreneurial snapshot at the GIPP workshop.

"Female entrepreneurs are not given the necessary support that they need; there is a lot of gender bias from investors and this affects their success rate in entrepreneurship," said Yorke emphasising on how ANDE research is mainly focused on addressing the United Nations (UN) Sustainable Development Goals (SDG) on gender equality.

Yorke presented the Gauteng entrepreneurial ecosystem snapshot that provides an in-depth look into programmatic support available to entrepreneurs in South Africa's economic hub, funded by the UK's Department for International Development (DFID).

The workshop participants explored the viability of specific measures introduced to address the equality and empowerment of female entrepreneurs. "Representation is everything; women are not adequately represented in the entrepreneurial ecosystem," said Ecosystem Development for Small Enterprises Township Strategy Junior Expert, Wendy Lambert.

Addressing the common challenge of access to infrastructure in the townships, Lambert stressed the need for security measures in areas where there is already infrastructure development for communities to access information through free Wi-Fi. "Within our townships, we get a place where we can access free Wi-Fi; however, it's not safe for children and vulnerable people," she said.

Understanding the complex issues of infrastructure development and how it can contribute to the empowerment of women, the workshop participants conceded that there needs to be more social facilitation and research conducted. "If I do not have access to 24 hours electricity or clean water in the area where my business is located, how is it going to impact my business and level of productivity," said Lambert.

DARA Big Data Africa School students attending a session at the school.

BIG SCIENCE BIG DATA

Big data science will open new research avenues and create new business models which will be crucial if South Africa is to participate effectively in the Fourth Industrial Revolution (4IR). "In order to compete in the 4IR, Africa must develop the relevant skills now, and the Big Data Africa School has proven to be an effective initiative in training young people in the context of the 4IR," said South African Radio Astronomy Observatory (SARAO) Programme Manager for Strategic Partnerships for Human Capacity Development, Dr Bonita de Swardt, speaking at the third Big Data Africa School held from 6 to 16 October 2019 in Cape Town, South Africa.

The UK–South Africa Newton Fund DARA Big Data Africa School is an extension of the Development in Africa with Radio Astronomy (DARA) programme which aims to offer data science skills training to students.

This initiative delivered by SARAO and the UK's University of Manchester aims to introduce fundamental data science and techniques to talented young science and engineering students, who have an interest to develop their skills and knowledge in working efficiently on extremely large data sets in any research environment.

Twenty-five young science and engineering graduates from South Africa, and the eight Square Kilometre Array (SKA) Africa partner countries, were selected out of 200 applicants to participate in the 10-day School.

"THE FACT THAT THIS THIRD BIG DATA AFRICA SCHOOL HAS BROUGHT TOGETHER STUDENTS FROM THE EIGHT SKA AFRICAN PARTNER COUNTRIES, FROM DIFFERENT FIELDS, IS A TESTIMONY THAT ASTRONOMY CAN CONTRIBUTE TO THE BROADER SOCIETAL NEEDS OF THE CONTINENT."

Other African countries involved in the programme include Namibia, Botswana, Kenya, Zambia, Ghana, Madagascar, Mozambique and Mauritius. "I am pleased to see that the SKA project is contributing to big data training in Africa. The fact that this 3rd Big Data Africa School has brought together students from the eight SKA African partner countries, from different fields, is a testimony that astronomy can contribute to the broader societal needs of the continent. I am grateful that our partnership with the UK through the Newton Fund and the DARA initiative, is equipping a new generation of data entrepreneurs, data scientists and data professionals," said Department of Science and Innovation Director of Multiwavelength Astronomy, Takalani Nemaungani.

Takalani Nemaungani speaking at the 2019 Big Data Africa School.

Dr Monika Obrocka presenting at the 2019 Big Data Africa School.

Although SKA Africa partner countries have limited expertise in radio astronomy, the joint collaboration with UK delivery partners seeks to close this gap through knowledge transfer. "We want to support and deepen the UK-South Africa science and innovation," said British High Commission Head of Africa Science and Innovation, David Barnes.

Women in Data Science

The 2019 Big Data Africa School hosted an industry session, themed "Showcasing Women in Data Science", to reflect on the participation of women in the field of big data sciences and to showcase their personal stories leading to successful careers in this demanding field. "The reason for including this particular session is to emphasise the importance of women in data sciences. In our big data science initiatives, we are very selective of our participants, we do make sure that women are represented as equally as our male counterparts," said Dr de Swardt, highlighting the important issue of the inclusion of women and how male scientists continue to dominate in the field.

Sharing her experience about how it is rare for young females living in rural Kenya to access higher learning institutions, Rongo University BSc in Physics and Mathematics student, Mercy Zacchaeus, explained that "in the village that I come from very few people go to university; it's also quite a challenge to have your family support you in funding your studies, especially, for a girl child." Zacchaeus received funding from the Kenyan government to support her in her undergraduate studies and hopes to pursue a Master's degree in Physics in the UK.

The industry session was presented by women leading in their particular field of data science, which included Praekelt.org Data Scientist, Dr Monkia Obrocka, who works on the Patient Engagement Lab Project, involving the design and delivery of innovative experiments across mobile platforms, focusing on understanding the human aspects driving health behaviour change at scale. The session was facilitated by the Head of the Jodrell Bank Interferometry Centre of Excellence at the University of Manchester, Prof Anna Scaife. Over half of the Newton Fund South Africa's grant recipients are women leading in key research work.

Inclusion of Historically Disadvantaged Institutions in Big Data Programmes

To address inequalities in South Africa's higher education, the selection process for the Big Data Africa School students considered graduates from historically disadvantaged institutions (HDIs). "Since I am from a historically disadvantaged institution, we do a lot of theoretical work and the courses lack practical skills. I learned about what a telescope is and it was my first time using it and learning how it works," said Beverly Mashamba, Bachelor of Science Honours student at University of Venda, highlighting the challenges of infrastructure in HDIs.

In April 2019 the Global Challenges Research Fund (GCRF) and SARAO hosted an in-country workshop focusing on 10 HDIs and new universities in South Africa. The workshop was hosted at one of South Africa's new universities, Sol Plaatje University in Kimberley in the Northern Cape province, with the aim of cultivating participation of HDIs in the DARA Big Data Africa programme. As a result of the workshop, this year's Big Data Africa School was attended by students from University of Venda and University of Western Cape.

University of Venda Bachelor of Science student, Beverly Mashamba, at the 3rd Big Data Africa School.

Representation of the SKA Africa partner countries: South Africa, Botswana, Ghana, Kenya, Madagascar, Mauritius, Mozambique, Zambia and Namibia.

Big Data Africa School Presentations

The 3rd Big Data Africa School aims at exposing students to critical skills needed to work with extremely large data sets, as well as the tools and technologies used to ensure efficiency when dealing with the data. The transfer of this skill set is achieved by students working in groups on real-life data in areas that include healthcare, astronomy, radio astronomy and sustainable agriculture. Students are guided and mentored by a team of experts in the relevant focus area for the duration of the school, with their final projects to be presented to a panel of industry experts by the end of the school.

Big Data Africa School students with leading experts from a variety of research industries in higher education, data services, supercomputing and radio astronomy.

Big Data Science in Healthcare

Big data analytics gives healthcare providers clinical insights, which allow them to prescribe treatments and make clinical decisions with greater accuracy to enhance health outcomes of patients. "The late diagnosis of lung cancer is the leading cause of cancer deaths," said University of Pretoria, Bachelor of Engineering student, Madeleine van der Linde. The healthcare group presentation was aimed at using big data science for early detection of lung cancer. The group demonstrated how data science techniques can be used to represent 3D medical images of patients diagnosed with lung cancer and how big data can assist with the process of tracking the changes of the cancer tumour over time and seeing things that are not visible to the naked eye.

The project leader for big data science in healthcare was Newton Fund DARA Big Data scholar, Lameck Amugongo, who is pursuing a PhD in Cancer Sciences at the University of Manchester with a thesis focusing on investigating tumour changes in lung cancer patients with the aim to personalise treatment.

Big Data Africa School students including Scott Eyono, Tshenolo Daumas, Madeleine van der Linde, Matthew Monney, Jedidia Andrianaly and Mendrika Rakotomanga presenting on the importance of big data science in the healthcare sector.

Radio Astronomy and Fast Radio Bursts

In radio astronomy, mysterious bursts of radio waves seem to take place in the sky, often outshining all the stars in the galaxy. In a blink of an eye, these mysterious objects can release enough energy to power the world for three centuries. The radio astronomy group presentation focused on hunting down fast radio bursts with data from Breakthrough Listen Project. Breakthrough Listen is the largest ever scientific research programme aimed at finding evidence of civilisations beyond the Earth.

"Our main objective in this project is to try to confirm the discovery of the source of fast radio bursts," said Rongo University BSc Physics and Mathematics student, Mercy Zacchaeus. Demonstrating how to remove radio interference, University of KwaZulu-Natal Master of Science student, Mziyanda Mngqibisa, explained that "[w]hen you observe with radio telescope, you also pick-up interference and sometimes it mixes with your data, so it's not easy to see which is good data and which is not," he said. The project leader for big data in radio astronomy is Junior Developer, Ben Hugo, who is based at the South African Radio Astronomy Observatory (SARAO).

Big Data Africa School students Paul Akumu, Mercy Zacchaeus, Tankiso Mosa, Mziyanda Mngqibisa and Beverly Mashamba presenting on radio astronomy.

Big Data Enhancing Sustainable Agriculture

The application of data-intensive techniques to satellite Earth observation data sets is of importance to the study into mapping and analysing urban areas and land cultivation. "The size of the global population of humans is increasing rapidly. With this increase in the number of human beings across the earth, there is a greater need for people to build houses; however, this comes at a cost of invading of cultivated land," said University of the Witwatersrand Master of Engineering student, Kelvin da Silva.

The group presentation illustrated the use of Earth observation data to classify the effects of rapid increase of populations in urban areas' agricultural land. The sustainable agriculture project group leader was Newton Fund DARA Big Data PhD Scholar, Edward Salakpi, enrolled at the University of Sussex.

Kelvin da Silva, Rendani Sitholimela, Chabo Bobe, Chileshe Mutale and Joseph Mwatukange presenting their study about mapping and analysing urban areas and land cultivation using satellite Earth observation data, during the Big Data Africa School.

Cognitive Radio

A cognitive radio is a radio that can be programmed and configured dynamically to use the best wireless channels in its vicinity to avoid user interference and congestion. The cognitive radio group presented on the understanding of our immersion in a radio world. "We can use these skills to improve engagements in astronomy and fields related with data science," said Madagascar student, Christian Randrianarisoa. The cognitive radio group leader was SARAO Data Scientist, Dr Richard Armstrong.

The cognitive radio team: Christian Randrianarisoa, Amieroh Abrahams, Laone Matshediso, Ramiro Saide and Corbyn Langley, presented their study findings on understanding our immersion in a radio world.

The Detection of Anomalies in Astronomy

The Square Kilometre Array phase one project will produce two terabytes of data per second. University of Pretoria Bachelor of Science Honours student, Karina Santana, elaborates that "there is no way us as human beings can analyse the data by ourselves, so we need a little bit of help from machine learning to analyse the data."

The astronomy team demonstrated how to detect anomalies in the era of big data. "Anomalies are observations that do not follow the behaviour of the normal observations," Santana said. The astronomy team was led by SARAO researcher, Dr Michelle Lochner.

The Big Data Africa School astronomy team: Sumari Hattingh, Karina Caitlin, Ulrich Vinckers, Haja Randriamanantena, Kushatha Ntwaetsile and Angelique Cooke, presented on the detection of anomalies in astronomy.

Big Data Africa School Awards

The 2019 Big Data Africa School hosted a networking session held on 14 October to recognise students for their leadership skills, for showing the most improvement and for being an effective communicator. Prizes included an Amazon gift voucher and a free online Google Cloud certification course-the latter sponsored by industry partner, SIATIK. The CEO of SIATIK, Ashton Fourie, can be seen in the awards pictures with David Barnes and Dr Bonita de Swardt.

Best Performing Group Award

The Cognitive Radio astronomy group were the recipients of the award for the best performing group. They were awarded for their overall performance and team work which demonstrated creativity and initiative in understanding their data set.

Leadership Award

Two Leadership Awards were presented to University of the Witwatersrand Master's in Electrical Engineering student, Kelvin da Silva, and University of Rongo BSc in Physics and Mathematics graduate, Mercy Zacchaeus. "The Big Data Africa School is the best school that I have attended so far. Since I have no background in machine learning it was initially a challenge, but also interesting. With the mentors and the whole team ready to help, I was able to pick up the challenge. I was surprised and delighted to receive a Leadership Award and I am grateful for being selected and I will do my best to merit this recognition," said Zacchaeus.

Most Improved Award

University of Zambia Bachelor of Science Honours graduate, Chileshe Mutale, was awarded with the Most Improved Award. "This has been one of the most helpful and interesting data schools that I have ever attended. There has been so much emphasis on understanding methods, achieving group learning outcomes and results. It has really been a safe space to ask and grasp any concept. The willingness to share information and help each other progress is encouraging," said Mutale.

Effective Communicator Award

Two awards were made to University of Pretoria graduates, Madeleine van der Linde (Bachelor of Industrial Engineering) and Karina Santana (Bachelor of Science Honours), for being Effective Communicators. "I was happily surprised to receive the award. I am honoured to be chosen out of a group of brilliant people for my communication and leadership skills. I'd like to thank the organisers and judges for selecting me, I really appreciate it and all that they have done throughout the School," said Santana.

Applying Astronomy Data Analysis to enhance Disaster Forecasting (AstroCast)

Edward Salakpi is a Ghanaian pursuing his doctoral studies at the University of Sussex, under the Newton Fund DARA Big Data scholarship programme. Salakpi penned this report about his research to develop robust models for forecasting agricultural drought and predicting the impact of drought on the livelihoods of Kenyan communities.

By Edward Salakpi

Drought is a naturally occurring phenomenon characterised by extended periods of dryness due to the lack of water. It can be sub-categorised into several types of drought: meteorological drought caused by prolonged periods of no rainfall; hydrological drought due to shortage of water in streams and lakes; agricultural drought which occurs as result of soil moisture deficit; and socio-economic drought caused by the scarcity of food as a result of drought conditions.
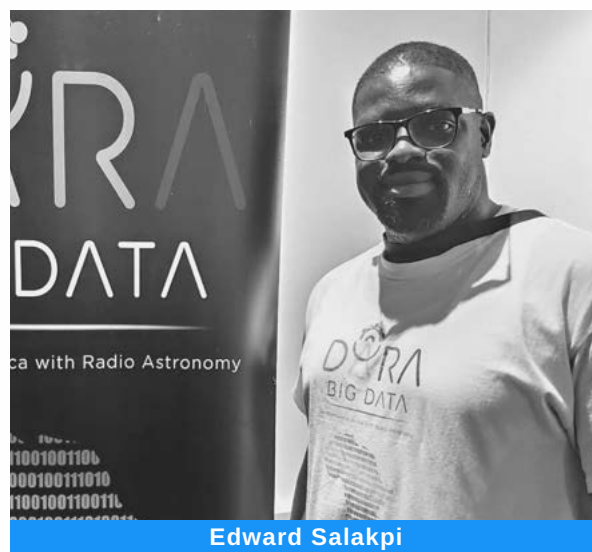
Though these are usually referred to as types of drought, one could also think of them as drought progression stages, because rainfall deficit can lead to low levels of water in lakes and soils which can eventually result in agricultural and socio-economic drought where its impact is mostly felt.

Droughts occur in many parts of the world, but African countries, especially the East African region, are amongst the worst hit. According to the UN, the 2012 drought in the region affected over 12 million people and led to the loss of life and livelihoods with Kenya being one of the worst affected countries. Although systems have been put in place to monitor drought and provide timely information to aid relief efforts, these systems do not forecast.

An Early Warning System (EWS) can provide reliable estimates of future climate events for disaster risk preparedness. An EWS is 20 times more effective in reducing losses, than post-disaster relief.

AstroCast is a project that is funded by the Global Challenges Research Fund (GCRF), and focuses on applying data-intensive techniques used in Astronomy to satellite Earth observation data sets. AstroCast aims to develop drought forecast models to be used for disaster risk mitigation.

This work was done in collaboration with the Kenya National Drought Management Authority (NDMA), and the focus was on studying and forecasting agricultural drought indicators. The overall goal was to mitigate the impact of drought, which also aligned perfectly with the SDG-13 (Climate Action): "Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries".

Edward Salakpi

Our expected outcome was to help the NDMA change their current approach of just monitoring and reporting monthly drought conditions in their bulletins, to include forecast information produced by models developed by the AstroCast project.

The NDMA monthly bulletins and reports are co-produced with the authorities in all the counties in Kenya. Based on these reports, the NDMA is able to trigger the drought contingency fund which is transferred to affected counties for drought mitigation. However, accurate and timely forecasts in these bulletins may enable funds to be committed earlier and allow for more effective mitigation.

In an attempt to address this, the AstroCast team, developed a highly skilled data-driven model that is able to predict the Vegetative Condition Index (VCI), a satellite-based drought metric, with a lead time of up to six weeks. The model was also able to predict the NDMA alert threshold (VCI<35) four weeks in advance with a success rate of about 89% and a false alarm rate of around 4%.

Following a visit by the UK AstroCast team to Kenya in May 2019 to demonstrate our model, the NDMA expressed interest in improving their current practice by including our 2-6 weeks forecasts of VCI and its trend in their monthly bulletins.

The AstroCast team has since then put in place an implementation plan and is currently working to fully automate the process and produce weekly forecasts.

These early interventions will be beneficial to communities and especially pastoralists living in the arid and semi-arid regions in Kenya by saving lives and reducing other negative socio-economic and health impacts resulting from natural hazards. It also has the potential to benefit the national economy in Kenya by allowing disaster mitigation funds to be used more efficiently. The Project Lead is Professor Sebastian Oliver and the Co-Lead is Dr Pedram Rowhani, both from the University of Sussex.

IMPACT OF RADIO ASTRONOMY IN AFRICA

Radio Astronomy is perceived as a driver for sustainable development within developing countries. This is evident through the matched funding provided by the UK-South Africa Newton Fund partnership, which aims to use expertise in radio astronomy through mobilising human capital development of science, technology, engineering and mathematics (STEM) skills that underpin the emergence of a strong developed economy. Newton Fund delivery partners, the UK Science and Technology Facilities Council (STFC), South Africa's National Research Foundation (NRF) and the Square Kilometre Array (SKA), developed a research programme in the area of astronomy in Africa centred on the Africa Very Long Baseline Interferometry Network (AVN). The Development in Africa with Radio Astronomy (DARA) programme is aimed at empowering a new generation of young people to develop STEM skills in sub-Saharan African countries.

BIG DATA FOR SUSTAINABLE AGRICULTURE: VICTOR MPHUNDU

The DARA project provides its trainees with new high tech skills and an awareness of the wider world of opportunities to apply these for the purpose of economic development. A particular example is that of Victor Mpundu from Zambia who took part in the DARA training programme after graduating as an Environmental Engineer.

"The DARA program introduced me to Agri Big Data, which can help in decision making in agriculture and increase Zambia's agricultural productivity. As an Environmental Engineer who majored in climate change science and its effects on agriculture, Agri Big Data is an exciting programme, one which I believe holds the answer to agricultural success for the developing countries of the world especially in Africa," said Mphundu.

Victor Mphundu carrying out noise risk assessment measurements on machinery at a mineral exploration site as part of his consulting business.

While working in this capacity for large companies, Mphundu started a small consulting firm with some of his university classmates. The DARA experience inspired Mphundu to try and expand the services that his small business could offer by utilising remote sensing data from satellites. He was also keen to use his new Python programming skills to develop more sophisticated data analysis techniques and to explore the possibility of using big data analytics.

After a visit to Zambia by the DARA Business Consultant, Mphundu is currently carrying out customer research to see if he can expand his client base and the services he could offer based on customer demand. He was also advised to gather further information from the UK's Satellite Applications Catapult on how to build his business further. Hence, the experience of DARA's UK industrial partners is helping to foster new entrepreneurial activity in the African partner countries.

EARTH OBSERVATION DATA: ESTHER KUNAKA

The DARA project makes its trainees aware of the many different ways in which the techniques used in radio astronomy could be utilised for practical impact on the ground here on Earth. One closely related area is that of geodesy, part of which involves using observations of cosmic radio sources with telescopes to very accurately locate the Earth. This can be linked to a local network of Global Navigation Satellite System (GNSS) stations to provide an accurate International Terrestrial Reference Frame.

This was the subject of the Master thesis by Esther Kunaka from Zambia who entered the DARA programme after graduating in Mathematics. Funded by DARA, Kunaka investigated adding additional GNSS stations to the single station that Zambia currently has. "Coming from a background where little attention was given to science, I gave up on my dream of becoming a scientist and decided to pursue Mathematics. While I was in my final year, representatives for DARA came to our University. After hearing their talks about the DARA project, AVN and SKA, I wanted to be part of the projects," said Kunaka.

The accurate coordinate system enabled by a network of stations is essential for applications involving land development, field mapping and infrastructure engineering. After completing her MSc, she is looking to commercialise this research and form a partnership with geo-scientists and software engineers. Her initial plan is to install additional GNSS stations and sell the improved terrain location data to power distribution companies.

Following meetings with the DARA Business Consultant, Kunaka is carrying out market research, determining the minimum cost of service provision and developing links with a potential funder for her business.

"I have been able to share the knowledge and skills that I have obtained during DARA training which has resulted in a lot of people countrywide wanting to be part of the DARA project. My passion for research and science have been rekindled and I have become an inspiration to a lot of students thanks to DARA," Kunaka said.

Esther Kunaka at the Hartebeesthoek Radio Astronomy Observatory in South Africa where she received her practical training in radio astronomy and geodesy.

BIG DATA IN AGRICULTURE: SAUL PIRI

The DARA project has changed many people's lives in profound ways. Take Saul Phiri from Zambia. Phiri was brought up in a small village in rural Zambia where there was no electricity. This meant that the night skies were clear and he found listening to stories from the village elders of the supernatural powers that reside beyond the stars fascinating. "What resides in you surely never dies it just sleeps and will wake up one day. It was not until I got the information about DARA that everything I ever wished for came to reality. I joined the basic training to try and reach to the supernatural powers that resides beyond our stars as we used to be told," said Piri.

Many days of school were missed working in the fields to ensure the family did not starve. Despite coming top at primary school, secondary school fees were a huge barrier. With help from the local church and a teacher he eventually excelled again and won a government bursary for a university degree followed by a Master's in Senegal.

Back in Zambia, Phiri could finally pursue his dream of astronomy with the DARA programme and he is now studying for a PhD in the UK. "Through DARA I have met other students, scientists, prominent people from the corporate world from different African countries and beyond. This has resulted in a network of people with a similar goal, which is development and well-being of humanity whilst pursuing the frontiers of knowledge," said Piri.

Phiri has acquired many skills such as designing research problems, dealing with technology, using computers to analyse data, and reporting to different audiences. Phiri would love to put these skills to use in agriculture, something which he did as a child on a small scale for survival and would now like to do at a commercial level one day. He has discussed methods for improving agricultural yields in the future with the DARA Business Consultant.

Saul Phiri on a visit to Goonhilly Earth Station Ltd., the UK industry partner with the DARA project.

Open Calls

Newton Fund Opportunities

All new funding opportunities are posted on our website when they are announced. For more information refer to the Newton Fund website: https://www.newtonfund.ac.uk/funding/funding-opportunities/