

South Africa-Japan STI Partnership

NRF-JST-JSPS

Joint Research and Mobility Programmes

2016 - 2021





Contents

An Overview of the South Africa-Japan STI Partnership	2
NRF's Partnership with Japan	3
Aim, Objectives, and Scope of this Report.....	5
PART A	
South Africa-Japan Research Mobility Programme	6
PART B	
Africa-Japan Collaborative Research (AJ-CORE) Programme	12
PART C	
Funders' Profile	25
TABLES	
Table 1 SATREPS projects across all regions.....	2
Table 2 SATREPS projects with South African researchers	3
Table 3 Top 10 African countries with highest research co-publications with Japan	4
Table 4 Science engagement activities and the target audience	11
FIGURES	
Figure 1 Overall number of funded projects, 2016 - 2021	7
Figure 2 Funded researchers by gender, 2016 – 2021	8
Figure 3 Race of funded researchers, 2016 – 2021	8
Figure 4 Age categories of funded researchers, 2016 – 2021	8
Figure 5 Number of awarded grants per higher education institution, 2016 – 2021	9
Figure 6 Value of awarded grants per higher education institution, 2016 – 2021	9
Figure 7 Supported thematic areas, 2016 – 2021	10
Figure 8 Postgraduate students exchanges, 2016 – 2021	10
Figure 9 Project Related Outputs: 2016-2021	11

An Overview of South Africa-Japan STI Partnership

The Science, Technology and Innovation (STI) cooperation between South Africa and Japan was formally established in 2003 with the signing of an agreement between the South African Department of Science and Innovation (DSI) and the Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT). In the decade since, South Africa and Japan have supported long-term multi- and inter-disciplinary collaborative research between South African and Japanese researchers. This bilateral partnership has supported research and development projects in food systems, climate change, water, energy, health and agricultural sciences, among others.

The commitment of both countries to strengthening the STI bilateral relations is evident in the range of bilateral activities that have taken place since the signing of the agreement in 2003. Cooperation exists through joint research and development (R&D) projects in specific research areas by means of calls for proposals as well as technical cooperation through official development assistance (ODA). All projects and activities under the STI cooperation strongly support human capacity development (HCD) and knowledge and technology transfer.

There are a number of R&D projects between South Africa and Japan supported through ODA. For example, the Japanese government, through its Ministry of Foreign Affairs (MOFA); MEXT; the Japan International Cooperation Agency (JICA); the Japan Science and Technology Agency (JST); and the Japan Agency for Medical Research and Development (AMED); promotes and supports international joint research through a programme called the Science and Technology Research Partnership for Sustainable Development (SATREPS). Based on the needs of developing countries, SATREPS aims to address global issues that lead to research outcomes of practical benefit to both local and global societies.

SATREPS projects are selected each year from project proposals submitted by Japanese research institutions. In the first fourteen years beginning in April 2008, a total of 168 projects commenced in 53 countries, see Table 1 below.

Table 1 SATREPS projects across all regions

Area	Number of eligible countries	Number of projects
Asia	14 countries	91 projects
Africa	21 countries	42 projects
Latin America/Caribbean	9 countries	25 projects
Other regions	9 countries	10 projects

A total of 68 international joint research projects in 36 countries are currently in progress as SATREPS projects in Environment and Energy, Bio resources, Disaster Prevention and Mitigation, and Infectious Diseases Control. In South Africa, researchers' participation in SATREPS opportunities is coordinated through the DSI. Proposals submitted in South Africa are subject to endorsement at Government level (by the DSI), and subsequent recommendations for funding are made to the Japanese authorities. However, the final decision concerning funding is made exclusively by the Japanese authorities, and funding is only through the Japanese government on a unilateral basis according to their own procedures and criteria.

To date, a total of six projects with South African researchers have been funded through SATREPS. Three of these projects are currently active under the theme: Low Carbon Society/Energy.

See Table 2 on the next page:

Table 2 SATREPS projects with South African researchers

No	Project title	Japanese institution(s)	South African institution(s)	Project start year	Project duration
Theme: Low Carbon Society/ Energy					
1	Development of New Ammonia Synthesis System using Renewable Energy and Hydrogen.	National Institute of Technology (KOSEN), Numazu College		2021 (ongoing)	5 years
2	Development of a Carbon Recycling System toward a Decarbonised Society by using Mineral Carbonation.	Institute of Multi-disciplinary Research for Advanced Materials (IMRAM), Tohoku University	Cape Peninsula University of Technology (CPUT)/ University of Cape Town (UCT)/ University of Western Cape (UWC)/ Council for Geoscience (CGS)	2020 (ongoing)	5 years
3	Production of Biofuels Using Algal Biomass.	Nagoya University / Tokyo University of Agriculture and Technology / Aichi Shukutoku University	Durban University of Technology (DUT)/ EThekweni Municipality/ Agricultural Research Council (ARC)/ Technology Innovation Agency (TIA)	2015 (completed)	5 years
Theme: Infectious Disease					
4	Establishment of an Early-warning System for Infectious Diseases in Southern Africa Incorporating Climate Predictions.	Nagasaki University / Japan Agency for Marine-Earth Science and Technology (JAMSTEC)	Alliance for Collaboration on Climate and Earth Systems Science (ACCESS)	2013 (completed)	5 years
Theme: Environment/ Energy (Climate Change)					
5	Prediction of Climate Variations and its Application in the Southern African Region.	Japan Agency for Marine-Earth Science and Technology (JAMSTEC) / The University of Tokyo	Applied Centre for Climate and Earth Systems Science (ACCESS)	2009 (completed)	3 years
Theme: Disaster Prevention and Mitigation					
6	Observational Studies in South African Mines to Mitigate Seismic Risks.	Ritsumeikan University / The University of Tokyo / Tohoku University / National Institute of Advanced Industrial Science and Technology (AIST)	Council for Scientific and Industrial Research (CSIR) / Council for Geoscience (CGS) / University of Witwatersrand (WITS)	2009 (completed)	5 years

In 2014, the two governments decided to launch a joint publication to mark the 10-year anniversary of the successful bilateral partnership in science and technology. This publication highlighted some of the notable STI achievements between the two countries.

NRF's Partnership with Japan

The National Research Foundation (NRF) partnership with Japan started in 2005 through an agreement with the Japan Society for the Promotion of Science (JSPS). This partnership aimed at supporting research mobility between South African and Japanese researchers. In 2009 the NRF signed a second agreement with the Japan Science and Technology Agency (JST) for supporting long-term multi- and inter-disciplinary collaborative research between South African and Japanese researchers. These partnerships have supported international mobility, research and development projects in different thematic areas including food systems, climate change, water, energy, health, agricultural sciences, and social sciences, among others.

To date, Japan remains one of South Africa's critical and strategic partner as it boasts the world's third largest economy and is among the world's largest producers of scientific papers and research. Japan is a leading research nation and technology supplier. It is the third largest research nation in terms of share of global scientific production and is a leader in trade and industry, and R&D expenditure. The Japanese Science and Innovation System is commonly recognised as a leading Science and Innovation System. In 2018, Japan's gross domestic expenditure on research and development (GERD) was 3.28 per cent as compared to South Africa's at 0.75 per cent. In 2019, Japan had 5 347 researchers /million population, which is one of the highest in Asia.

South Africa ranks among the top two African countries with a high proportion of research publications with Japan. Other countries with significant interactions with Japan include Morocco, Ethiopia, Ghana, Kenya, Tunisia, Nigeria, Tanzania and Zambia. As indicated in Table 3.

Table 3 Top 10 African countries with highest research co-publications with Japan in 2021

COUNTRY	Publication Outputs	% Collaboration
Japan	1327895	
Egypt	6953	0.52
South Africa	4878	0.36
Morocco	1472	0.11
Nigeria	1145	0.09
Kenya	914	0.07
Ghana	559	0.04
Tunisia	555	0.04
Ethiopia	537	0.04
Tanzania	408	0.03
Zambia	403	0.03

The NRF's partnership with Japan goes beyond the bilateral agreements signed with both the JST and the JSPS. All three agencies (NRF, JST and JSPS) are active members of the Global Research Council (GRC) – a virtual organisation, comprised of the heads of science and engineering funding agencies from around the world, dedicated to promoting the sharing of data and best practices for high-quality collaboration among funding agencies worldwide. The NRF and the JSPS serve on the GRC Governing Board.

<https://www.globalresearchcouncil.org>.

The Science Granting Councils Initiative (SGCI) in sub-Saharan Africa aims to strengthen the capacities of science granting councils in the region in order to support research and evidence-based policies that will contribute to the continent's economic and social development. As part of the SGCI, Japan, through the Africa-Japan Collaborative Research (AJ-CORE) Programme, implemented jointly by the NRF and the JST, aims to support joint research and innovation projects in environmental science between researchers from Japan and 16 SGCI participating African countries. <https://sgciafrica.org/>.

Japan is a National Member Organisation (NMO) of the International Institute for Applied Systems Analysis (IIASA), of which South Africa is also a member. Research collaborations between IIASA and Japan have been highly productive since the institute was founded in 1972. Key aspects of this beneficial relationship since 2010 have involved cooperation with more than 40 Japanese organisations and resulted in over 460 scientific publications and a range of research advances <http://iiasa.ac.at>.

The Belmont Forum is an international group of funding agencies and scientific organisations that are involved in the support of global environmental change research that aims to further accelerate and develop work in that field by mobilising researchers and funding through international cooperation in order to address the various challenges facing the sustainability of human society and to contribute to achieving the UN's Sustainable Development Goals (SDGs). Both the NRF and the JST are members of the Belmont Forum. <https://www.belmontforum.org>.

Japan is a member of Future Earth, a global network of scientists, researchers, and innovators collaborating for a more sustainable planet. The Future Earth Regional Office for Southern Africa (FEROSA) is hosted by the NRF. Further to this, in March 2022, the NRF was selected to host the Africa Future Earth Global Secretariat Hub. The Africa Hub joins eight global hubs, namely Japan (Tokyo), United States (Boulder and Fort Collins, Colorado, and Fairfax, Virginia), Canada (Montreal), China (Beijing), France (Paris), South Asia (Bengaluru), Sweden (Stockholm), and Taiwan (Taipei). The Japan office of Future Earth is supported by the Science Council of Japan (SCJ); the Research Institute for Humanity and Nature (RIHN); the National Institute for Environmental Studies (NIES); the University of Tokyo Institute for Future Initiatives (IFI); and other supporting organisations. Launched in 2015, Future Earth is the primary global body that advances international collaboration among researchers and stakeholders to identify and generate the integrated knowledge needed for successful transformations in global sustainability science. Major organisations affiliated with Future Earth includes International Science Council (ISC); Belmont Forum; the United Nations Educational, Scientific, and Cultural Organisation

(UNESCO); the United Nations Environment Programme (UNEP); the United Nations University (UNU); and the World Meteorological Organisation (WMO) <https://futureearth.org>.

Further to the above-mentioned networks, there are many other strategic global and regional networks through which the two countries foster and enhance their bilateral STI research partnership such as the South Africa Japan Universities (SAJU) Forum and the Tokyo International Conference on African Development (TICAD).

Aim, Objectives and Scope of this Report

This report highlights selected achievements and general outcomes; and elucidate impact of this support on strengthening the research capacity of researchers in the two countries. These success stories are illustrated through two main programmes:

- ❑ The **Research Mobility Programme** between the NRF and the JSPS which is implemented through the annual cycles of joint research mobility calls between the two countries. A total of 17 joint calls have been launched to date. This programme supports the mobility of researchers, scientists, postdocs and doctoral students within joint research projects. Projects are funded within all thematic areas of focus for a maximum period of two years. **The details of this programme are provided in PART A of this report.**
- ❑ The **Africa-Japan Collaborative Research (AJ-CORE) Programme** between the NRF and the JST. Through this programme the NRF and JST publish annual calls supporting consortia projects in environmental sciences for a maximum of three years. The calls are launched in partnership with the 16 SGCI African countries. Two calls have been launched to date. **PART B of the report provides detailed information on funded projects and the consortia research partners.**

PART A:

South Africa-Japan Research Mobility Programme

Since the inception of this Research Mobility Programme with JSPS and the launch of the first joint mobility call in 2005, there has been, to date, a total of 17 joint calls for research mobility between South African researchers and their Japanese counterparts. Over 70 collaborative research projects have been supported thus far emanating from the 17 joint calls. The 18th joint call was launched in early July 2022 and will support collaborative projects starting from 2023 onwards.

In 2015, JSPS and the NRF engaged the United Nations University Institute for the Advanced Study of Sustainability (UNU-IAS), coordinated by Prof Masafumi Nagao, to undertake a 'stocktaking exercise' to analyse the collaborative research projects that have been funded between 2006 and 2015. From this analysis it was found that the partnership supported 16 Japanese and 11 South African higher education and research institutions and approximately 150 Japanese and 200 South African researchers within the 25 funded projects that were reviewed. The partnership also enabled around 95 Japanese and 115 South African team members to take part in the research exchange visits. This was a remarkable feat, especially when considering that, in the academic tradition of both countries, the other country had not been a 'natural destination' for seeking research partnership and also that there had been a noticeable gap in the level of development of research infrastructure between the two countries.

Further to this, the stocktaking exercise revealed that the programme had been quite instrumental in encouraging initiation of new research partnerships with stimulating interactions, significant shared learning, and effective research skill transfer. The programme was particularly useful for promoting capacity building on the South African side through exposure of South African researchers to the frontier research facilities, methods, and practices and their interactions with world-leading Japanese scholars.

This current analysis highlights achievements within those collaborative projects awarded between 2016 and 2021 (inclusive). Of the 134 applications that were received during this six-year period, approximately 117 were reviewed positively and recommended for funding, with a total of 23 collaborative projects awarded. See Figure 1 below:

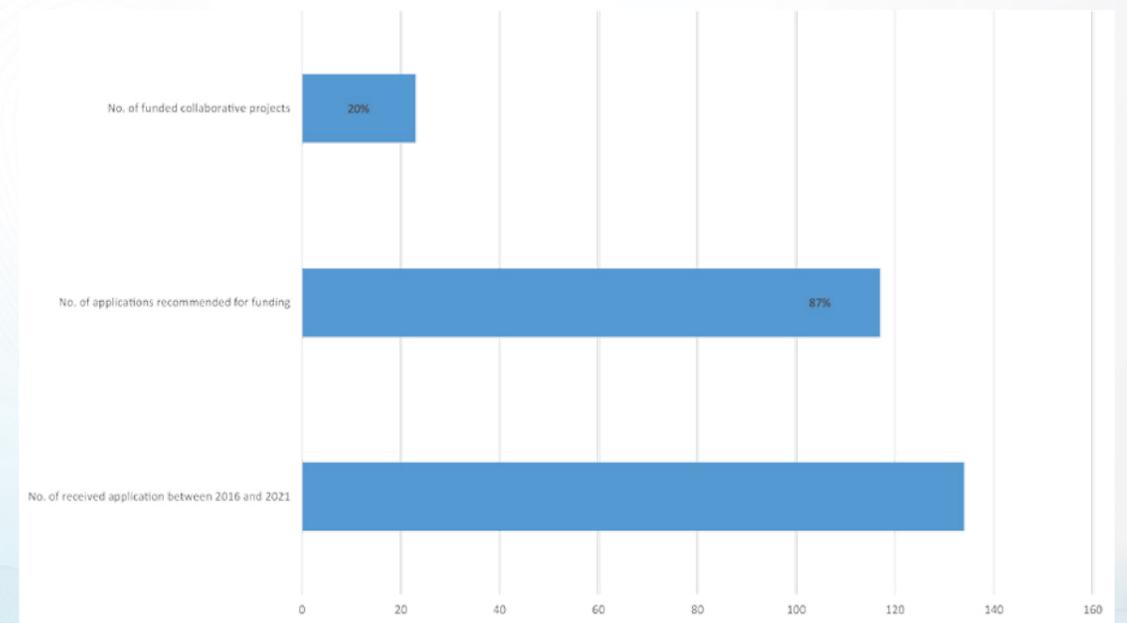


Figure 1 Overall number of funded projects, 2016 - 2021

On the South African side, 65% of supported researchers are male and 35% are female (see Figure 2 below).

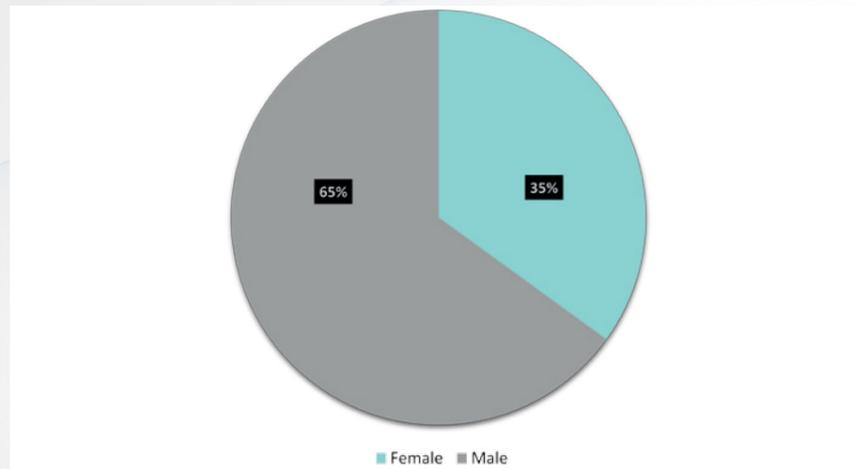


Figure 2 Funded researchers by gender, 2016 – 2021

On the South African side, a total of 61% of supported researchers are Black African with 30% Whites and 9% Coloureds. Indian researchers have not been successful during this six-year period (see Figure 3 below). Only 17% of the supported researchers were non-South Africans. The majority of supported researchers were South African citizens.

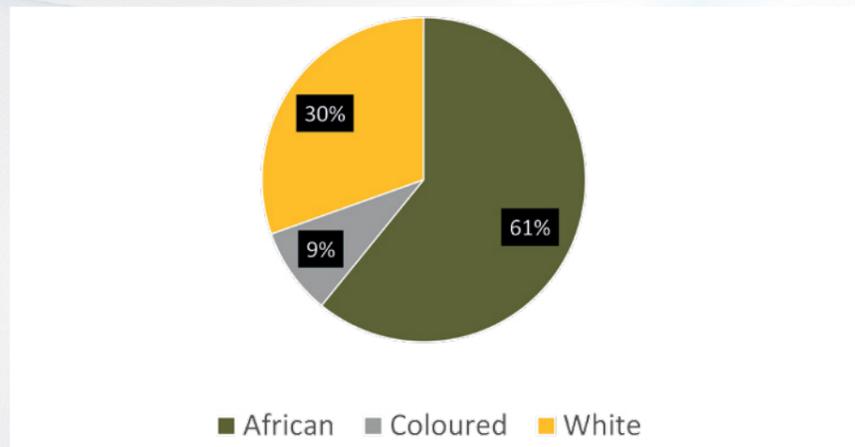


Figure 3 Race of funded researchers, 2016 – 2021

Close to 50% of supported researchers were between the ages of 41 and 50, followed by 22% of researchers within the 51 to 60 age category. Therefore, 70% of supported researchers were between 41 and 60 years of age. See Figure 4 below.

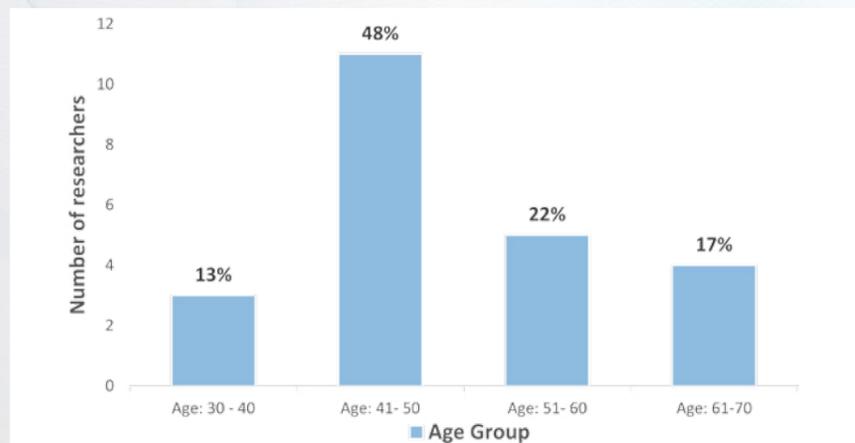


Figure 4 Age categories of funded researchers, 2016 – 2021

A total of 12 South African institutions participated in the programme over the six-year period. As illustrated in Figure 5 below, the University of Cape Town (UCT) received the highest number of grants followed by the Agricultural Research Council (ARC) and the University of Johannesburg (UJ).

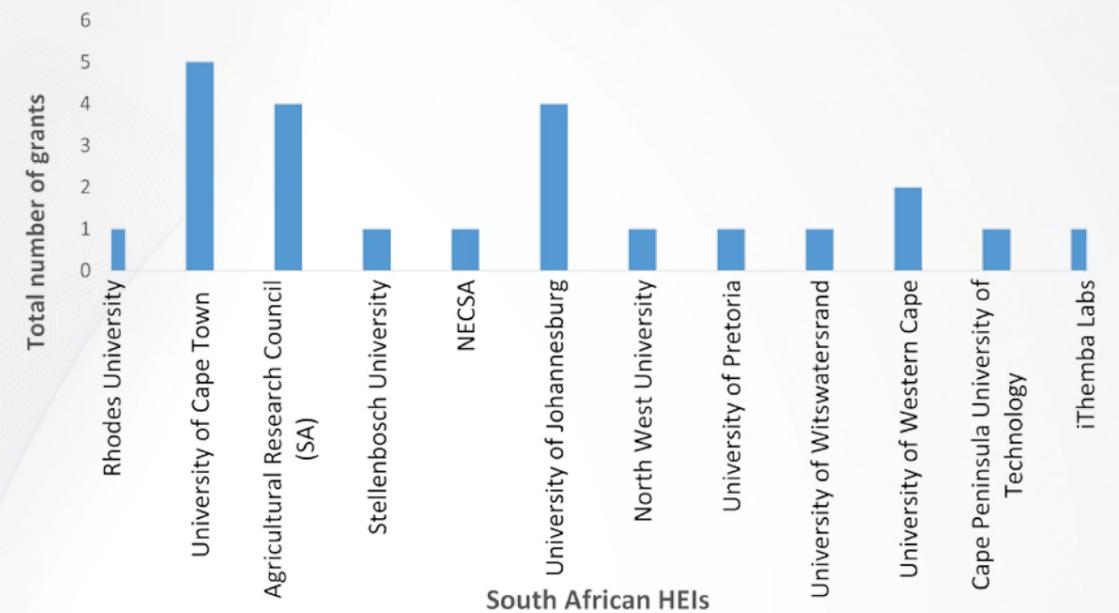


Figure 5 Number of awarded grants per higher education institution, 2016 – 2021

More than R19 million has been invested for all institutions. See Figure 6 below for details on the value of awarded grants per institution.

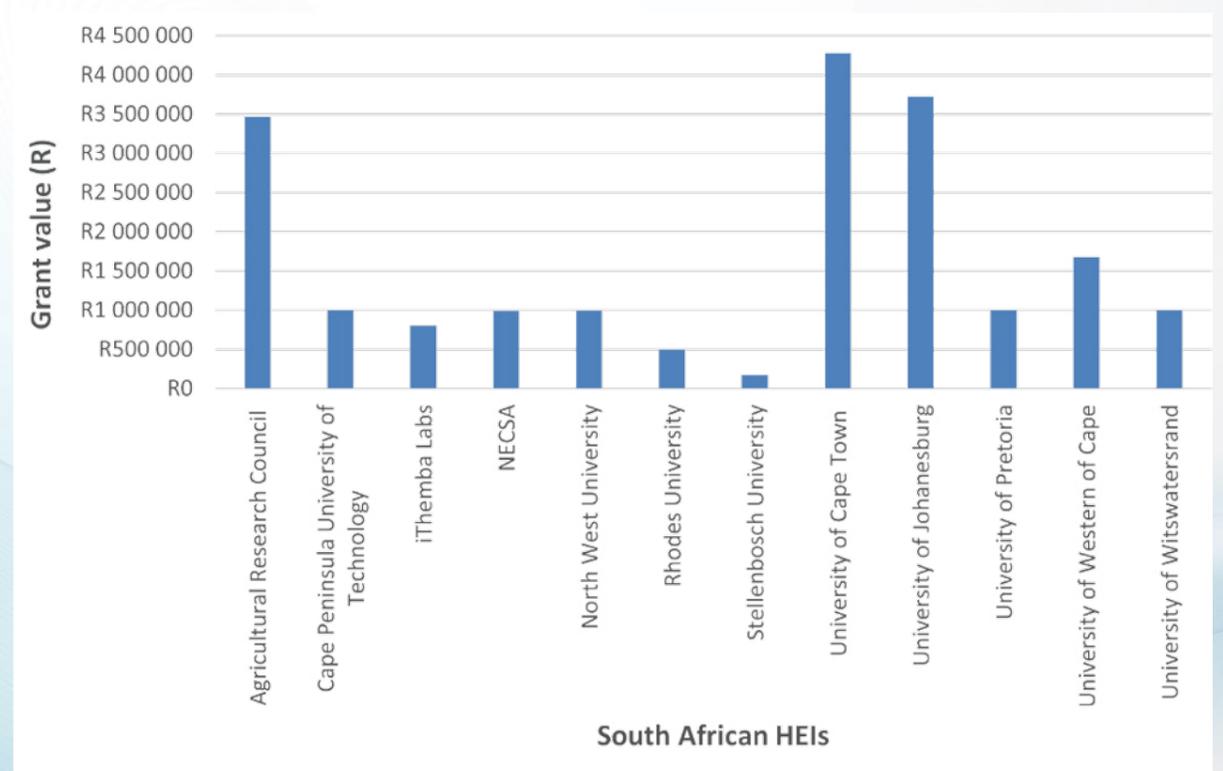


Figure 6 Value of awarded grants per higher education institution, 2016 – 2021

The majority of the projects supported are within the Natural Sciences, at 65%, and only 13% of the funded projects are in the humanities and social sciences, as evidenced in Figure 7 below.

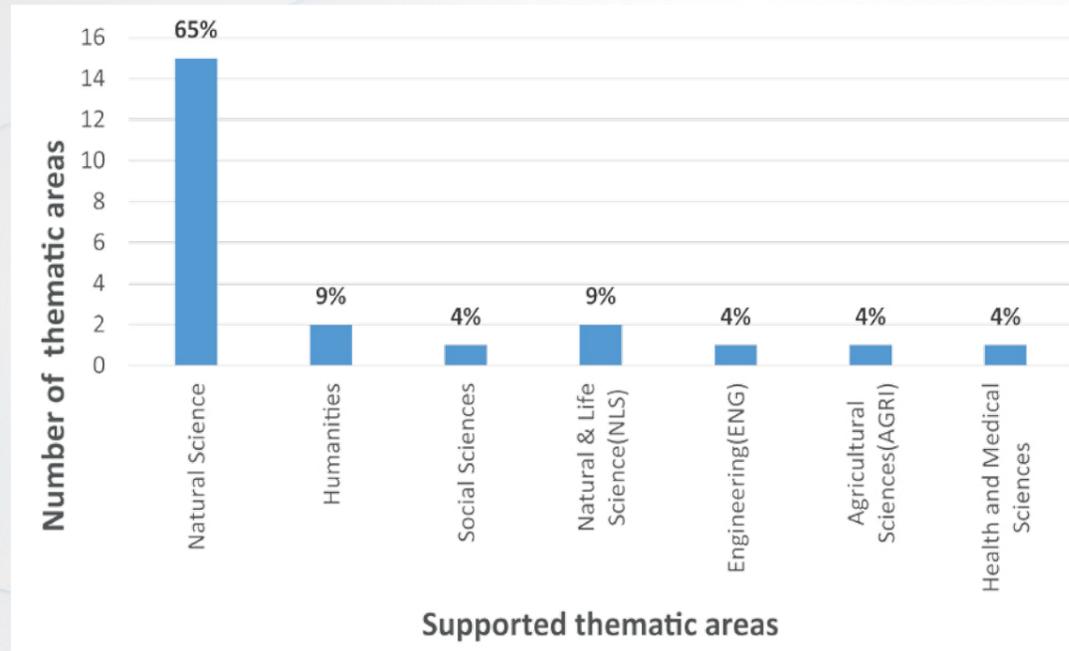


Figure 7 Supported thematic areas, 2016 – 2021

The awarded grants were used mainly for international workshops and seminars. South African researchers facilitated a total of 19 international workshops during the six-year period under review. The funds were also utilised to facilitate research fieldwork conducted in either Japan or South Africa by the lead researchers, and numerous exchange visits at Master's and Doctoral level (see Figure 8 below). Master's students were also graduated from this programme. Overall postgraduate student exchanges consisted mainly of Master's and Doctoral students at 83% combined. Of the total number of postgraduate students supported through this programme, 59% were female and 73% were Black Africans.

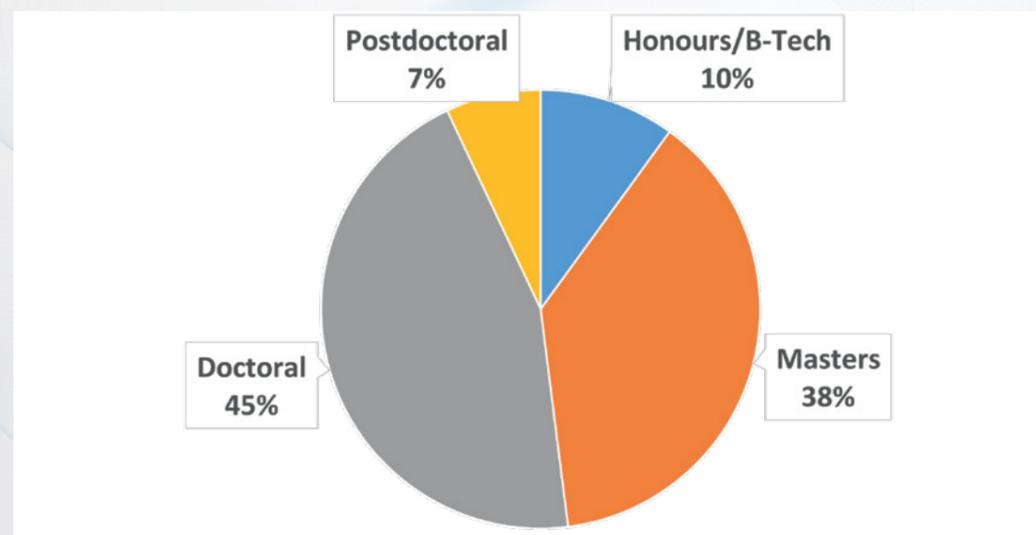


Figure 8 Postgraduate students exchanges, 2016 – 2021

Further to this, the programme produced a number of publications. As can be seen in Figure 9 below, over 120 publications were produced from the 23 funded projects with 52% of these being joint articles in refereed/peer-reviewed Journals followed by other significant conference papers at 13%.

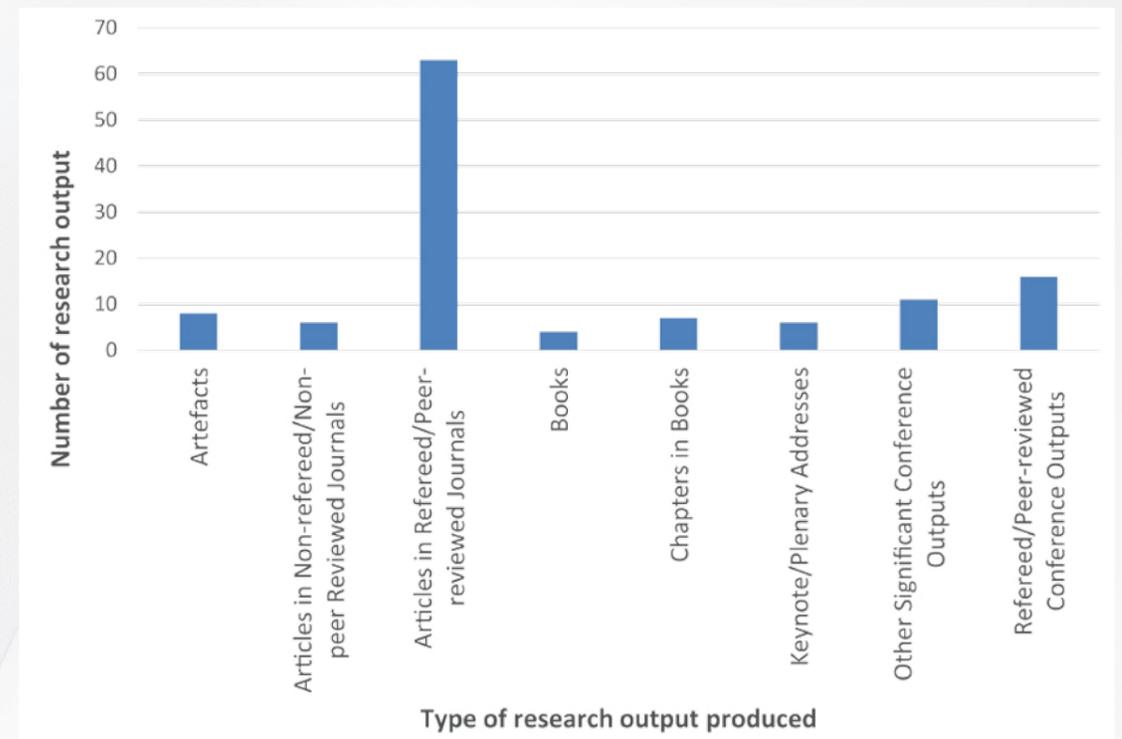


Figure 9 Project Related Outputs: 2016-2021

Over 30 science engagement activities were conducted during the six-year period under review. These included activities such as science communication, education and training interventions, science awareness campaigns, policy and practice actions, and community engagement activities. Table 4 below provides details on the different science engagement activities and the stakeholders engaged.

Table 4 Science engagement activities and the target audience

Science Engagement Category	Activities	Intended Audience
Community engagement projects (collaborative work with communities or community groups to address identified issues)	<ul style="list-style-type: none"> Oral presentations at conferences Field meeting 	<ul style="list-style-type: none"> Governments and policymakers Diplomats
Education and training interventions (including both formal and informal education-based initiatives)	<ul style="list-style-type: none"> Articles in local newspapers Club meetings 	<ul style="list-style-type: none"> General public and funders Forensic practitioners
Policy and practice actions (initiatives and interventions aimed at shaping policy agendas and policy instruments)	<ul style="list-style-type: none"> Training and mentoring Public talks 	<ul style="list-style-type: none"> Academics and university students University management
Science awareness (including awareness campaigns, debates, interactive events, public participation actions, profile-raising etc.)	<ul style="list-style-type: none"> Videos on YouTube Channel and other online platforms 	<ul style="list-style-type: none"> High school students and teachers Industry representatives
Science communication (public engagement includes media, art, theatre, science journalism & training, exhibitions etc.)		<ul style="list-style-type: none"> Law enforcement personnel



PART B: **Africa-Japan Collaborative Research (AJ-CORE) Programme**

The NRF and JST explored the possibility of deepening Japan's partnership with African countries in 2018 through a workshop themed: "Japan-Africa Equal Partnership in Science, Technology and Innovation (STI) for Sustainable Development" held on 6 December 2018 in Dakar, Senegal. In line with the outcomes of this workshop, the two funding agencies conceptualised a new programme for supporting long-term collaborative research intensive consortia projects between researchers. This new programme, now popularly known as AJ-CORE, i.e. Africa/Japan Collaborative Research, aims to support joint research and innovation projects in environmental science between researchers from Japan, South Africa and the 15 African countries whose ministries and granting councils are a participating member in the SGCI.

The intent is to create a long-term platform for African and Japanese researchers to build and connect knowledge to increase research impact whilst exploring new development paths to enhance human capacity development in STI. The programme aims to assist researchers to find new ways to accelerate transitions to sustainable development and contribute to SDGs. Environmental science serves as a central theme for all AJ-CORE calls. This chosen research area seeks to contribute to SDGs 2, 3, 6, 7, 11, 12, 13, 14, and 15. The AJ-CORE call for proposals invites consortia composed of at least three research organisations (and/or private and public practitioners) from three different countries, i.e. South Africa, Japan and an SGCI African country, to submit research and innovation project proposals driven by local demands and including an approach that contributes to enhancing impact.

The AJ-CORE first call for proposals was launched in December 2019 and supported four consortia projects with funding by the NRF; JST; the Ministère de l'Enseignement supérieur et de la Recherche et de l'Innovation (MESRI) in Senegal; and Fonds National de la Recherche et de l'innovation pour le Développement (FONRID) in Burkina Faso. The projects from this first call are supported for three years (2021 – 2023).

The second call also supported four consortia projects funded again by the NRF; JST; and the Ministry of Tertiary Education, Research, Science and Technology of Botswana. These projects are also supported for a 3-year period (2022 - 2024). All eight consortia projects involve researchers from South Africa, Japan, Botswana, Burkina Faso, Ghana, Senegal and Zambia.

The third call will be launched in early 2023 for funding in 2024 – 2026.

Below is the profile of the eight AJ-CORE projects and supported researchers. Only the Principle Investigators/ Lead Researchers are highlighted per project.

Project 1: ToRePs

Full Title: Field and Mechanism-based Toxicity Research on Pesticides in Africa

The African continent has experienced rapid economic development over the last decade. Agriculture is one of the most important sources of economic growth in many African countries. At the same time, Africa has major challenges, i.e. vector-borne diseases and crop damage and, therefore, pesticide use in Africa is by far the largest in terms of infectious disease control and agriculture. Africa is in the spotlight as the largest development frontier, although it has prioritised economic activities over addressing its pollution issues. The lack of data concerning environmental pollution in this area has been highlighted. The toxicity related to pesticide exposure range from acute to chronic poisoning. Of particular concern are the low pesticide levels that lead to chronic exposure toxicity. Unlike acute toxicity, chronic toxicity does not manifest as overt toxicity responses, thus its relevance to health and environmental hazards is not known.

This study focuses on emerging and legacy pesticides as current environmental pollutants of concern in Africa and to elucidate the mechanisms of toxic action occurring under actual field conditions in highly contaminated areas. A major outcome of the project will be to link toxic modes of action at different levels of biological organisation that have not been connected until now, and it will be possible to clarify, for the first time, a toxic mechanism that has become a black box. To this end, new analytical methods to detect

toxicological effects, fusing -omics techniques with epidemiological studies will be used to address the challenges. Capacity building is also a major product of this research. A research and education platform will be created for human resource development between the four participating countries working on this research theme. Students and young researchers will be exchanged between South Africa (North-West University), Zambia (University of Zambia), Ghana (Kwame Nkrumah University of Science & Technology), and Japan (Hokkaido University).

Expected research outputs include pesticide exposure data of human/animal from regions with high levels of environmental pollution. It is anticipated that more than four research papers will be published annually, presentation of preliminary results at conferences or meetings, the establishment of a database and dissemination of progress via the project website. The main research activities that will be undertaken by the respective research collaborators are i) dust surveillance and clarification of particulate pollution levels in house-holds; ii) elucidating mechanisms of pesticide toxicity at environmentally relevant levels based on in vitro and in vivo tests; and iii) establish and maintain a repository for human and animal field and mechanism-based data (toxicological and residue levels) from African countries. This information will make a major contribution to risk assessment of pesticides in Africa countries. This collaborative research project anticipates strengthening the African toxicological research network and capacity building for young researchers.

The research team:

Prof Victor Wepener is a Professor in Zoology at North-West University. He is the co-leader of the Water Research Group, where he undertakes research in the broad field of aquatic ecotoxicology (including nano-ecotoxicology). He has published extensively (165 papers) in this field. He is the leading proponent of ecological risk assessment in South Africa. He chairs the DSI's Environment, Health and Safety Nano Risk Assessment platform in this capacity. He is also the head of the National Aquatic Bioassay Facility, which is a state-of-the-art research facility comparable with international laboratories.



Dr Kaampwe Mayovu Muzandu is a Lecturer of Pharmacology and Toxicology at the University of Zambia School of Veterinary Medicine. Besides teaching undergraduate and postgraduate students, he derives much pleasure in participating in research focused on environmental contaminants ranging from toxic metals to organic chemicals affecting both humans and animals. Kaampwe is the Chairperson of the Technical Committee on Clinical Trials and Pharmacovigilance for the Zambia Medicines Regulatory Authority in the public domain. His primary role is to offer advice on the safety and efficacy of medicines, review clinical trial applications, and conduct causality assessments of suspected adverse drug reactions.



Prof Mayumi Ishizuka received her PhD in Veterinary Medicine in 1998 at Hokkaido University, Japan. Her research area is toxicology and she has an interest in the xenobiotic-metabolism, including species differences in Phase I and II enzymes, e.g. cytochrome P450 and glucuronosyltransferase. Her research interest is not limited to human and laboratory animals, but also she expands her expertise in wildlife. In addition, she challenges to clarify the toxicological effects of xenobiotics such as drugs, veterinary drugs, heavy metals, POPs, and pesticides, on humans and animals. She published the results of these researches in more than 200 scientific articles.



Prof Osei Akoto is a Professor at the Department of Chemistry, KNUST, Kumasi, Ghana. He joined the Department as a faculty member in 2005. His current research is focused on the environmental impact of toxic substances and their processes in the interface between humans and their surrounding environment, the origin and dispersion of environmental pollutants (pesticides, PAHs and heavy metals), human exposure, and associated health hazards, and ecotoxicology. In addition, he has collaborated actively with researchers in other disciplines. Prominent among his research are the studies on "Environmental Impact of toxic substances on wildlife and species differences", collaborative research work between KNUST and the Laboratory of Toxicology, Hokkaido University, Japan.



Project 2: WatSAP

Full Title: Environmentally Sound Water Management for Sustainable Agricultural Practices in South Africa and Botswana: Collaboration between Africa and Japan

Managing agricultural-based nutrient contamination at river basins to enhance water quality not only provides people with clean water and improved ecosystem services but also with means to guarantee water resources management and nature conservation. This project aims to push the research frontier in the nexus between environmental challenges and water management in the agriculture sector through collaboration between researchers in South Africa, Botswana, and Japan. The purpose of this research is to explore the conditions under which technological and collective actions measures taken by farmers may improve water quality and enhance the stock of fresh water available to various sectors within society to promote sustainable farming practices in rural communities in South Africa and Botswana.

The overall aim of this project is, firstly, to provide a better understanding of the water quality improvement associated with the implementation of agri-environmental policy instruments as well as environmental policies that aim not only at reducing the amount of fertilisers and pesticides used at the farm level but also at inducing adoption of water-efficient technologies for irrigation. Secondly, this project explores scenarios that capture the evolution of a growing population and climate variability and evaluate the extent to which such new dynamics would affect the water systems in South Africa and Botswana.

This is done through an appropriate elaboration of the theory of change that takes into consideration local conditions and institutional settings. Furthermore, the project will develop economic modelling based on the specific hypothesis regarding the socio-economic and technological characteristics of agricultural practices in the selected sites. These exploratory approaches provide a good opportunity to identify and compute key additional benefits associated with the implementation of AEPs: net water balance, impacts of environmental changes on agricultural productivity and food security, farm-related employment, and overall provincial and national growth strategy. This will inform on the relationship between climate change, food production, and water resources management.

Therefore, the interdisciplinary team made of scientists from South Africa, Botswana and Japan will shed light on the role of public policies in improving agricultural water management, reducing water pollution, and enhancing the quality of the ecosystem services. A particular emphasis is also given to the role of community-based water quality monitoring programs to promote water quality regulation and sustainability of water resources. Strong linkages between water resources management and institutional quality are also explored, through a use of several empirical techniques. The project will produce outputs which will be organised in three main formats: scientific articles that will be published in academic journals, policy briefs that will be shared with the involved water and agriculture-related policymakers, and a final report that will be produced after completion of the project grant. Annual reports will be also supplied by March of every year in South Africa. In publishing the papers, the team makes a scientific contribution to the field of environmental and agricultural economics in water-stressed countries and, in doing so, it extends the stock of current knowledge.

The research team:

Prof Djiby Racine Thiam is an Associate Professor at the School of Economics at the University of Cape Town (UCT), South Africa. His research focuses on environmental and resources economics, agricultural economics, and development economics. His work has been published in several international journals in the field. He is a member of the Editorial Board of the academic journal *Water Economics and Policy*. He is heading a research team of postdoctoral, PhD, and Master's students at UCT. Djiby's philosophy is to support and stimulate social change through academic insights and capacity building. Beyond his scholarly contribution, he has provided policy insights to several institutions in Africa regarding sustainable water and energy policies to promote long-term sustainable development both in rural and urban communities. He works on discrete choice experiment, impact evaluation techniques, and mathematical economics from a methodological standpoint. Before joining UCT, he had international experience in Germany, the Netherlands, the USA, and France.



Dr Wame Lucretia Hambira is a Senior Research Scholar with the Okavango Research Institute of the University of Botswana. She holds a PhD in Geography from the University of Oulu, Finland, and an MSc in Environmental Economics, from the University of York (UK). Her research entails analysing national and sub-regional policy frameworks to identify gaps in mainstreaming sustainable development and the green economy, determining the effects of climate change on livelihoods and national economies, and identifying potential response trajectories. She has worked on several national and international projects that provide academic insights to promote sustainable development in Botswana.



Prof Daiju Narita is an Associate Professor and environmental economist who joined the faculty of GPES in September 2017. Before the appointment, he worked at Hokkaido University, JICA (Japan International Cooperation Agency) Research Institute; the Kiel Institute for the World Economy (in Germany); and MEXT. His main research interest lies in the economics of climate change, particularly theoretical and applied evaluations of economic costs on various aspects of climate change. The research involves using and examining methodological frameworks of environmental economics, such as risk analysis and economic valuation of non-market ecosystem services. At the same time, it also deals with cross-disciplinary collaboration with natural scientists. His other research interests include sustainable development and energy issues.



Project 3: DREAM

Full Title: Development of Resilient E-Farming for Agro-climate Risk Management in African Multi-Environments

In many parts of the world, the number of people vulnerable to natural disasters due to adverse weather patterns such as droughts, floods, and wind storms, is increasing. In South Africa, crop production varies considerably from year to year due mainly to rainfall variability. Years of poor harvests affect the economy negatively, which is highly reliant on the agricultural industry. In 2015/16, the country faced severe drought, resulting in highly reduced summer crop production. Thus, drought is the biggest risk to agriculture in South Africa, and the main challenge we are facing is how to use climate information for risk management strategies that assist in coping with rainfall variability.

In Senegal, extreme events such as floods or droughts also affect different sectors of the economy, including the agricultural sector. These events result from climate variability. The project seeks to undertake research to develop a decision support system framework aimed at helping farmers, agricultural extension officers, agricultural risk officers, agricultural cooperative consultants, and policymakers in the province to make informed decisions related to climate risks affecting dryland agricultural production in South Africa and Senegal.

The project aims at advancing science and technology in agro-climate risk management in sub-Saharan Africa by utilising weather forecasts and climate projections, and by developing a decision support system that generates possible climate change adaption actions to enhance food and nutritional security. Also, the project intends to improve medium-range forecasting together the target

use of established seasonal climate forecast and downscaled climate change scenarios. Furthermore, it attempts to improve crop modelling for climate-smart agricultural technologies, and to develop strategies for drought mitigation under changing climate.

The anticipated project outputs will be new knowledge generated in agricultural and earth sciences; capacity building of young researchers for the next generation research; and development of new technology on drought risk management for stakeholders including researchers, farmers, and experts.

The research team:

Dr Mitsuru Tsubo is an agricultural meteorologist focusing on climate risk management in agroecosystems. His career started as a postdoctoral researcher at the University of the Free State. He then took a postdoctoral Research Fellowship at the University of Queensland, Australia. In 2006, he was appointed as an Associate Professor at the Arid Land Research Center of Tottori University in Japan. From 2013 to 2018, he joined the Agricultural Research Council as a research team manager in agrometeorology. Currently, he is a Full Professor at the Arid Land Research Center. He has authored and co-authored over 100 publications



Dr Mokhele Moeletsi completed a PhD in agrometeorology at the University of the Free State in 2010. He has been working in the field of meteorology and climate change for the last 20 years, mainly as an agrometeorologist and researcher. He is currently employed by the Agricultural Research Council as a Research Team Manager for agrometeorology and climate change. His research interest includes climate change/variability impacts on agriculture, agricultural greenhouse gas emissions modelling, and carbon management. He has published over 50 peer-reviewed articles in the field of agrometeorology and climate change. He is a C2 NRF-rated scientist.



Dr Gualbert Séaphin Dorégo is a geographer/geometrician who estimates agricultural yields by geospatial data and agro climatology on climate risks for agriculture, satellite indices for agricultural insurance, and climate risks for agriculture soil fertility map. Research Assistant from 2004-2006, then Research Fellow at ISRA in 2008 at the National Laboratory for Research on Plant Production until 2014. Since 2014 at the National Center for Agronomic Research (CNRA/ISRA) within the Agro bioclimatology laboratory, he directs (since 2018). Dr Dorégo has participated in the supervision and reception of Master's and thesis students in climatology and climate change. Dr Dorego is an author and co-author of a dozen publications



Project 4: WELCOME

Full Title: Assessing the State of Water-Food-Energy Nexus in a Transboundary Catchment

The Kariba Catchment hosts the Lake Kariba Reservoir, which was built in the late 1950s mainly to provide water for hydropower production. Lake Kariba's upper and lower catchment areas drain from the five riparian states of Angola, Namibia, Botswana, Zambia, and Zimbabwe. Rainfall and runoff are key drivers of reservoir inflow. River inflows are sensitive to climate change and variability. Lake Kariba Dam and the entire catchment is of tremendous importance to Zambia in regards to population lives, agriculture and fisheries, energy feeding the economy, particularly copper mining, and small- to medium-scale enterprises as well as a tourist destination.

The upstream sub-catchments are either sparsely gauged or ungauged, making the prediction of upstream runoff difficult. Besides the hydropower demand on the reservoir, it also supports other economic activities in the basin such as cultivation agriculture, fishing, tourism, and water transport. The catchment is intensively cultivated by small- and large-scale farmers who use several agrochemical products. These products are normally in low concentration and tend to sorb onto soils and biota where they concentrate with potential harm to the aquatic ecosystem. The continued increase in the change of land use due to unsustainable catchment resources utilisation such as river hydrology for large-scale irrigation schemes, schemes. Hydropower production, fisheries, infrastructure

development like roads and bridges construction have led to the threat of climate change/variability requires an assessment of available resources to plan for catchment allocation and management.

The study aims to enhance the water resources of the Lake Kariba Reservoir environment for sustainable energy, livelihoods, and ecosystem health. The objectives of the study include investigating the Lake Kariba Catchment water balance and potential climate impacts and investigating the catchment ecosystem health and water quality from competing uses in the Lake Kariba Catchment environment; developing a framework for stakeholder participation in water governance of the Kariba Catchment environment; and using remotely sensed data in spatial and temporal impacts of competing uses on the Kariba Catchment environment.

The expected outcomes of the study are establishing a database of water quantity, quality, water balance models, land cover and land use, and stakeholders' participation and to support the establishment of water user association and the formulation of a regulatory framework and strategies for sustainable IWRM of the Lake Kariba environment.

Inventory of ecosystem services provided by Lake Kariba and its environments including measures for and threats to sustainability report on the status of governance decentralisation at reservoir catchment level detailing key factors affecting the governance decentralisation process. This knowledge will help in reviewing existing decentralisation policies; designing appropriate decentralisation mechanisms; and implementing decentralisation policies for sustainable management of multipurpose reservoirs. Spatial and temporal water quality status reports will be produced given the competing uses; model solute transport from the upstream to the downstream of Lake Kariba and implications on the environment. At least 4 journal articles will be published.

The research team:

Professor Luke Chimuka is a Full Professor of Environmental Analytical Chemistry at the School of Chemistry, University of the Witwatersrand. He is also a Research Group Leader for the school's Environmental Analytical Chemistry Research group. He was the Chief Editor of the South African Journal of Chemistry. He has published over 170 scientific journals and trained more than 70 MSc and PhD students combined. Has won awards such as the first prize in The Innovation Hub Gap Biosciences Category 2015; the South African Chromatographer of the Year, 2011; and the 2017 Award for Innovation Excellence from the Wits Annual Research Celebrations.



Prof Imasiku Anayawa Nyambe is a Full Professor of Geology in the Geology Department of the School of Mines and Coordinator of the University of Zambia (UNZA) Integrated Water Resources Management (IWRM) Centre. He is the Chairholder of the OR Tambo Africa Research Chair Initiative (ORTARCHI) in Water Conservation. Professor Nyambe is a former Director of Research and Postgraduate studies in the Directorate of Research and Graduate Studies from 2009 to 2017, responsible for research and postgraduate studies at the University of Zambia. He has been Vice-President of the Intergovernmental Hydrological Programme (IHP) Bureau Africa Region 5A (2019-2021) as well as a member of the UNESCO's Intergovernmental Council on IHP representing Zambia (2017-2021).



Prof Yoshitaka Uchida is an Associate Professor of Environmental Biogeochemistry at Hokkaido University, Japan. His work focuses on nutrient cycles in soils, water and the atmosphere, specifically nitrogen and carbon. Also, he researches contaminated and degraded soils across the world, including sub-Saharan African soils. Furthermore, he is interested in sustainable agricultural management by balancing and optimising soil nutrient status and microbial communities that control the nutrient cycles.



Project 5: EMAAM

Full Title: Application of eDNA Metabarcoding for Assessment and Prediction of Faunal Biodiversity of African Mangrove Ecosystem

Mangroves provide various essential ecosystem services including a nursery function to many species; carbon storage; coastal protection; and water filtration and pollution remediation. Mangrove ecosystems are rich in biodiversity and provide essential ecosystem services to humanity. Despite this, many aspects of their ecology are poorly understood and their biodiversity remains undersampled, making it difficult to manage these ecosystems. The study aims to create a species inventory of invertebrates in African mangrove ecosystems to be analysed by further eDNA metabarcoding methods targeting both East African and West African mangrove systems. The ultimate goal of this study is to develop an effective and standardised, multi-taxa biomonitoring tool by using aquatic environmental DNA for African mangrove ecosystem.

The eDNA approach will serve as a new indicator for evaluating species biodiversity in mangrove ecosystems. The study will provide prediction of species distribution under different climate change scenarios. To achieve this goal, a reference library (database) for DNA barcoding is indispensable, and its construction will be implemented jointly by South Africa, Japan and Senegal. The objectives of the project include establishing the reference databases for mangrove macrofauna with a strong focus on fish, brachyurans and molluscs called macrobenthos from East and West African mangrove ecosystems. Comparison of the macrofaunal and meiofaunal composition between mangroves experiencing different levels of pressure by using metabarcoding techniques at mangrove sites experiencing different pressures will be done. This will provide an opportunity to provide baseline biodiversity information, critical to measuring future impacts in ecologically important sensitive habitats such as the mangrove forests identified for this study.

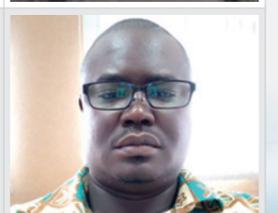
The anticipated outcome for this study includes peer-reviewed publications in national and international journals. The journals will include DNA barcoding of mangrove macrofauna in East African and West African mangroves; monitoring the anthropogenic impacts on mangroves using metabarcoding as a tool; biophysical drivers of mangrove macrofauna on the African continent; and an assessment of eDNA as a monitoring tool on the African continent.

The research team:

Prof Tadashi Kajita is a Professor at the Iriomote Station, Tropical Biosphere Research Center, at the University of the Ryukyus, Japan. He is also a Professor at the United Graduate School of Agricultural Sciences, Kagoshima University. He earned his PhD degree in Biology from Tohoku University, Japan. His research interests include Plant Taxonomy, Molecular Systematics, Ecology and Population Genetics. Prof Kajita has led many successful international research projects on mangroves and pantropical sea-dispersed plants. His accolades included the Japan Society for Plant Systematics (2015) and the Botanical Society (2013). Prof Kajita currently leads a Core-to-Core international collaborative project on eDNA metabarcoding in mangroves supported by the Japan Society for the Promotion of Science.



Prof Jean Fall is an Associate Professor at the Cheikh Anta Diop University in the Institute of Fisheries and Aquaculture. He completed his PhD in Applied Biological Science in Marine Resources from the University of Miyazaki. The Inland Fisheries and Aquaculture previously employed Prof Fall, the Ministry of Fisheries of Senegal and the National Agency of Aquaculture in Senegal. He has published many papers on fisheries and marine.



Dr Nasreen Peer is a Lecturer at the Stellenbosch University, currently focusing on the biodiversity, ecology and taxonomy of Southern African mangrove ecosystems. Specifically, her research considers the change in diversity and distribution of mangrove-associated gastropods and brachyurans with a shifting climate. In addition, Dr Peer is interested in exploring local communities' role in conservation with a strong emphasis on traditional ecological knowledge. She has also worked in and collaborated with colleagues in other fields, including the ecology of estuarine lakes, the ecology of tufa stromatolite ecosystems, and the taxonomy of freshwater crabs in South Africa.



Project 6: FORENS

Full Title: Food and Livelihood Resilience from Neglected and Underutilised Plant Species in Western Africa

FORENS is situated at the interface of food security, rural livelihoods, environmental sustainability, and climate change. It will specifically explore how domesticated neglected and underused plants plant species (NUS) that cater for different needs such as food, fiber, fodder, or medicinal properties (but have reduced importance in the current agricultural systems associated with low diversification) can provide locally feasible solutions to this nexus. This nexus constitutes one of the major sustainability challenges in sub-Saharan Africa (SSA) and is linked with progress across multiple SDGs.

FORENS aims to understand and assess the potential of NUS to enhance the resilience of agroecosystems and local communities in Western Africa to environmental change. The study will specifically focus on identifying mechanisms and pathways through which NUS enhances the resilience of agroecosystems and local communities and identify the local characteristics, uses, and traits of selected NUS that increase their resilience to environmental change. Furthermore, it will identify the factors that affect the adoption and utilisation of selected NUS at the household level, and the associated impacts on livelihoods and food security. The study will explore the future potential and scaling up opportunities for selected NUS and also develop policy and practice recommendations and training material on NUS benefits, and disseminate to appropriate end-users to enhance NUS visibility.

The expected outcome of the study includes improving the capacity and understanding of local communities and entrepreneurs about the multi-dimensional benefits of NUS on food security, health, and rural livelihoods. Improve NUS production, uptake, and effective marketing through value chain improvement and improve the position of NUS as feasible solutions to foster climate change adaptation, genetic resource conservation, and environmental sustainability. Furthermore, it seeks to improve research capacity on NUS research in SSA.

The deliverables beneficiaries include several peer-reviewed papers summarising the research findings; one sourcebook outlining existing NUS practices; one agronomic toolkit outlining good NUS practices and a knowledge management system; one benchmarking tool for comparing among NUS practices and farming systems; two policy briefs and/or op-eds targeting non-academic audiences; and presentations in academic conferences and in-country seminar.

The research team:

Prof Lindiwe Majele Sibanda is a recognised leader, practising farmer and esteemed policy advisor with a career spanning 30 years. She currently serves as Director and Chair of the African Research Universities Alliance - Centre of Excellence in Sustainable Food Systems (ARUA-SFS) at the University of Pretoria. Prof Sibanda is also the incoming Research Chair for Sustainable Food Systems at the Future Africa Institute, University of Pretoria. She is also hosted by the University's Centre of Advancement of Scholarship as a Senior Research Fellow. Prof Sibanda is an SDG12.3 Champion on Reducing Food Loss and Waste and sits on multiple international boards including: Nestlé SA, World Vegetable Centre and the One CGIAR System Board. In previous roles, Prof Sibanda has served as the Chief Executive Officer and Head of Diplomatic Mission, Food, Agriculture and Natural Resources Policy Analysis Network (FANRPAN) and Vice-President at the Alliance for a Green Revolution in Africa (AGRA). The award was initially made to Prof Mbow, who has since left the University of Pretoria.



Prof Gasparatos Alexandros is an Associate Professor of Sustainability Science at the Institute for Future Initiatives (IFI), University of Tokyo. He is also an Adjunct Associate Professor at the United Nations University Institute for the Advanced Study of Sustainability (UNU-IAS). Before joining the University of Tokyo, he conducted research at the University of Oxford (2011-2013), UNU-IAS (2008-2011) and the University of Dundee (2006-2008). As an ecological economist, he is interested in developing, refining, and applying sustainability assessment and ecosystem services valuation tools. He has applied such tools in different topics such as food security, renewable energy, energy policy, green economy, and urban metabolism, in geographical contexts as diverse as Bangladesh, Brazil, China, Ghana, Indonesia, Japan, Kenya, Malawi, Malaysia, Mozambique, Myanmar, Swaziland and the UK.



Professor Mame Samba MBAYE is a Lecturer in Environmental and Agricultural sciences. His training activities are related to botany, biodiversity, and weed science. His research activities are mainly focused on flora and vegetation analysis both in natural ecosystems and in agro systems. He deals also with scientific leadership, positive youth development. He is actively participating in the governance bodies of UCAD. Currently, he is Director of Incubation, Extension and Community support of UCAD. He is the former Director of Environment of UCAD and was also the Head of Plant Biology Department of UCAD. He is the coordinator of the program UCAD RURALE.



Prof Adjima Thiombiano is a Senior Professor in Plant Biology and Ecology, Leader of a research team on biodiversity and ecosystem services' evaluation, and member of many international research groups. He has coordinated many research programs with the most important focused on status and socio-economic evaluation of biodiversity in West Africa (funded by BMBF, Germany from 2000 to 2007), on sustainable use of natural resources in West Africa (funded by EU from 2005 to 2010), on Understanding and combating desertification to mitigate its impact on ecosystem services (funded by EU from 2010 to 2015) and on climate change resilience of ecosystem services (funded by Danida since April 2021). He is author and co-author of more than 165 scientific publications dealing mainly with biodiversity assessment, productivity and ecosystem services (including carbon stock evaluation), socioeconomic evaluation of plant communities and restoration of sahelian ecosystems based on local species. He is author and co-author of 15 scientific and academic books. He has supervised and co-supervised more than 20 PhD candidates in Burkina Faso, in West African countries and in Germany.



Project 7: SusMine

Full Title: Sustainable Well-being Through Rapid Detection, Remediation and Stakeholder Awareness of Contaminants in Environments Impacted by Mining Activities

One third of the world population has limited access to clean water, a condition which threatens human health, agriculture, and economic development. This environmental problem exists in many African countries and communities. Resource-based economies and industrialisation have resulted in various pollution and contamination problems to the environment. Common among these is heavy metal contamination in soils and water bodies due to mining activities, coal burning, and other industrial activities.

The main goal of the project is to develop a holistic strategy that addresses emergent environment issues emanating from mining

activities in parts of Botswana. This will be achieved through the development, integration and application of technologies for the rapid and reliable detection of pollutants, remediation, and rehabilitation strategies of heavy metals and micro plastics in contaminated environments.

The study largely seeks to address the water contamination problem by providing heavy metal-free water and food to communities impacted by mining activities and also make a tangible contribution to improving the health and wellbeing of people who are exposed to the dangers arising from mining and related activities. The objectives of the project are the (i) establishment of a database of heavy metals and micro plastics contamination profile along with their impact on human and ecosystem health in the mining areas in Botswana; (ii) developing site-specific phytoremediation and rhizosphere engineering technologies for heavy metals contaminated environments and mine tailings in Botswana; (iii) establishment of farming strategies to reduce heavy metal contamination in food crops and animal products from heavy metal-contaminated agricultural and pasture areas; (iv) developing improved utilisation of phytoremediation biomass, agricultural waste for efficient and cost effective wastewater treatment; and (v) synthesis of nanostructured metal forms for application as antimicrobial agents in water treatment. An additional objective is the enhancement of strategies in reducing of the uncontrolled plastic waste (micro plastic) to improve the quality of soil and water.

Under the project, a low cost ceramic biochar-based composite filter for the removal of heavy metals and microorganisms in water will be developed and evaluated for reusability and durability testing in mining communities.

The project is expected to produce new scientific and technological contributions from synergistic efforts of the assembled consortium. The major expected output is the development of new technologies towards soil decontamination, water purification, and heavy metals detection by e smartphone-based toxic metal detection devices. The scientific results will be disseminated in the form of original peer-reviewed papers, presentations at international conferences, technical reports, and exhibitions at science fairs.

The research team:

Prof Nhamo Chaukura is an Associate Professor with Sol Plaatje University, South Africa. He holds a BSc (Honors) in Chemistry, MSc in Analytical Chemistry (University of Zimbabwe), MA in Educational Studies (University of Sheffield), and a PhD in Materials Chemistry (University of Manchester). He was awarded a postdoctoral Fellowship at the University of South Africa, where he is currently a Research Fellow. Previously, He has worked as a Senior Lecturer and Associate Professor at many universities and in the food and chemical industries in Zimbabwe and the United Kingdom. Nhamo sits on the editorial boards of Environmental Technology and Innovation, Recent Innovation in Chemical Engineering, and Frontiers in Water Quality. His research involves nanomaterials, low-cost porous materials for environmental remediation, and analytical chemistry techniques for detecting micropollutants in environmental systems.



Prof Izabela Irena Rzeznicka is a Professor at the Graduate School of Science and Engineering of Shibaura Institute of Technology. She obtained her MSc Eng degree in the adsorption and catalysis field from Poland's Lodz University of Technology. After a short research exchange study at the University of Louis Pasteur, France and Hokkaido University, Japan, she joined the Division of Materials Science, Graduate School of Environmental Earth Science, Hokkaido University, where she obtained her PhD in the field of environmental surface science. She continued her research as a postdoctoral Fellow at the University of Pittsburgh, USA, RIKEN and the University of Tokyo, Japan. In 2010, she joined the Tohoku University Department of Chemistry as an Associate Professor and Shibaura IT in 2016 as a Full Professor. Her current academic interests include nanostructures for energy and health application, focusing on electrocatalysis and sensing.



Prof Venice U Ultra, Jr is an Associate Professor at the Department of Earth and Environmental Science, at Botswana International University of Science and Technology, Botswana. He obtained his PhD in agro-environmental chemistry at Ehime University, Japan, and postdoc in rhizosphere biochemistry at Korea Forest Research Institute. His research interests include rehabilitation and ecological restoration of the heavy metal contaminated environment; wastewater treatment and reuse, impacts of climate change parameters on forest trees physiology; carbon dynamics and rhizosphere processes; organic farming promotions; establishment and development of soil quality criteria based on the application of soil microbial community structures and soil enzymatic activities, and development of microbial-based inoculants for plantation crops, and application of microbial-based agro technologies in agriculture and environment. Currently, he is working on several projects in Botswana and the Philippines.



Project 8: CO-CO WASH

Full Title: Co-creation of a Community-based Water, Sanitation and Hygiene Model with Children and Youth

Globally, approximately two billion people drink faecal-contaminated water, and 4.5 billion use unimproved sanitation systems risking faecal contamination (WHO 2019). Studies have shown that improvements in water, sanitation and hygiene (WASH) have the capability of reducing global disease burden by 10% by preventing pathogen transmission. Notably, improvements in WASH have gained even greater prominence with the current fight against COVID-19 (Lin et al 2020, Corburn et al 2020). The relationship between WASH and health can be better understood through the lens of the Social Determinants of Health (SDH) (WHO, 2008). The SDH include factors such as where we are born, grow, live, work, and age. The SDH posits that these factors influence people's ability to be healthy through determining access to safe and quality services, e.g. WASH, education, waste management; healthcare, and overall individual health and wellbeing. Notably, the systems that affect our health and wellbeing as individuals also affect entire communities.

The main aim of the CO-CO WASH Project is to assess WASH in the peri-urban areas of South Africa, Zambia, and Botswana for the purpose of co-creating a regional, inclusive WASH and health model for meaningful community participation (intervention) with local children and youth taking an active role. The objectives of the project include identifying national and regional similarities and differences in peri-urban, WASH and disease trends, WASH and health service provision and to identify factors defining peri-urban WASH. The project will analyse the peri-urban WASH ecosystem (implement the basal CO-CO WASH Model). Furthermore the project will focus on co-creating, co-designing and assessing the amended CO-CO WASH model with young locals and other WASH stakeholders (intra-community) and also identify barriers and enablers to community intervention in peri-urban WASH management and health promotion (intra-community and intercommunity).

The anticipated output of the project will be to produce a compilation of studies on WASH in the Southern Africa region through a systematic literature review. Local and regional policy briefs will be produced on peri-urban WASH and health aimed at 2030 and beyond. A documentary series on the state of peri-urban WASH and health in, and strategies and recommendations for the Southern Africa region will be produced. The empirical research will be undertaken guided by health and social assessment theories and frameworks and published in journal papers. Furthermore, local WASH exhibitions and community meetings will be carried out in the research sites for the purpose of co-creation, co-design and sharing overall results of the study. One international symposium to share findings and draw attention to the state of peri-urban WASH in, and strategies and recommendations for the southern Africa region will be held to reflect on the learnings from the study.

The research team:

Dr Catherine Sutherland is an urban geographer specialising in environmental, water, sanitation and climate governance, focusing on informal settlements and peri-urban areas in Durban. The theory and practice of transdisciplinary research, local environmental change, urban governance, state-citizen relations and social transformation, and how these shape urban sustainability in cities in the south, are of particular interest. Her research includes investing in ecological infrastructure in catchment rehabilitation projects, social assessment of innovative water and sanitation systems, and informal settlement upgrading. She is an academic in the School of Built Environment and Development Studies, University of KwaZulu-Natal, Durban.



Prof Taro Tamauchi is a Professor at the Faculty of Health Sciences and the Director of the Center for Environmental and Health Sciences at Hokkaido University, Japan. He has a BS, an MS and a PhD in Health Sciences from the University of Tokyo. He does intensive fieldwork in hunter-gatherer societies, rural villages, and informal/peri-urban settlements in developing countries to understand the lifestyle and health of local populations and their adaptation to their living environments. His research interests include water, sanitation, hygiene, and participatory action research, particularly with local children and youth.



Prof Charles Michelo is a Professor of Epidemiology and Founding Dean of the first School of Public Health in Zambia's University of Zambia School of Public Health (UNZA-SPH). He is the Director of Harvest Research Institutes at Harvest University. His research interest that started with a focus on HIV surveillance systems has evolved to include a broader aspect of health systems but concentrated on medical education for One Health, infectious diseases, maternal & adolescent health, non-communicable diseases (NCDs) and now focuses on community health systems functioning in terms leadership and governance. Furthermore, he not only serves on various corporate entities and boards, but also has also been pivotal in transforming public health training and practice in Zambia by helping establish other universities and the Zambia National Public Health Institute.



Prof Wellington R.L. Masamba is the Head of the Chemical and Forensic Sciences Department at Botswana International University of Science and Technology. He holds a PhD in Analytical Chemistry from the University of Florida in Gainesville, United States of America. His research is focused on environmental analytical chemistry, including water, soil and air quality. His research includes diffusive methane fluxes in the Okavango Delta, drinking water and wastewater quality, carbon cycling in the Okavango Delta, mobility of groundwater arsenic, water defluoridation, and the fate of pesticides in arid subtropics and use of *Moringa stenopetala* and *Moringa oleifera* for removal of metals and non-metals from water.



PART C: Funders' Profiles

SOUTH AFRICA: National Research Foundation (NRF)

The NRF was established as an independent government agency through the National Research Foundation Act (Act No 23 of 1998). The NRF was found following a system-wide review conducted by the Department of Arts, Culture, Science and Technology (DACST). The new entity incorporated the functions of the research funding agencies that were previously servicing various sections of the research community, namely the former Centre for Science Development (CSD) of the Human Sciences Research Council (HSRC) and the former Foundation for Research Development (FRD) that included several National Research Facilities.

As a government-mandated research and science development agency, the NRF funds research, the development of high-end Human Capacity and critical research infrastructure to promote knowledge production across all disciplinary fields. The goal of the NRF is to create innovative funding instruments, advance research career development, increase public science engagement, and establish leading-edge research platforms that will transform the scientific landscape and inspire a representative research community to aspire to global competitiveness. The NRF promotes South African research and innovation interests across the country and internationally. Together with research institutions, business, industry, and international partners builds bridges between research communities for mutual benefit that contributes to National Development.



Prudence Makhura
Director: Collaborative Grants and Initiatives



Ms Nombuso Madonda
Professional Officer
NP.Madonda@risa.nrf.ac.za

JAPAN: Japan Science and Technology Agency (JST)

In October 1996, the JST was formed by merging two organisations, the Japan Information Centre of Science and Technology (JICST) and the Research Development Corporation of Japan (JRDC). In October 2003, JST was reorganised as an independent administrative institution that plays a central role to implement the Japan's Science and Technology Basic Plan.

JST is a mission-oriented R&D institution who connects a wide range of stakeholders so as to generate new value for society and contribute to interest of people as well as global well-being through various science, technology, and innovation (STI) research activities in accordance with national and global agenda. JST supports a wide range of research activities including funding for strategic basic research, academia-industry cooperation, and international/global research cooperation, science communication, fostering human resources in STI, and developing platforms for STI information etc.



Mr Osamu KOBAYASHI
Director
Department of International Affairs



Ms Junko SHIRAISHI
Deputy Manager
Department of International Affairs
shiraish@jst.go.jp

JAPAN: Japan Society for the Promotion of Science (JSPS)

JSPS is an independent administrative institution, established by way of a national law for the purpose of contributing to the advancement of science in all fields of the natural and social sciences and the humanities. JSPS plays a pivotal role in the administration of a wide spectrum of Japan's scientific and academic programs. While working within the broad framework of government policies established to promote scientific advancement, JSPS carries out its programs in a manner flexible to the needs of the participating scientists. Its main functions are to foster young researchers, promote international scientific cooperation, award Grants-in-Aid for Scientific Research, support scientific cooperation between the academic community and industry, and collect and distribute information on scientific research activities.



Mr MIWA Yoshihide
Governing Director
Headquarters for International Affairs
kenkyouka13@jps.go.jp

BURKINA FASO: National Research and Innovation Fund for Development (FONRID)

Established in 2011 (decree 2011-828/PRES/PM/MRSI/MEF), FONRID is a governmental agency specially dedicated to financing research and innovation projects in Burkina Faso. Though FONRID has legal and management autonomy, it is under the technical supervision of the Ministry of Scientific Research and Innovation and the financial oversight of the Ministry of Finance of Burkina Faso. The mandate of FONRID is to fund research projects, intermediate between partners, provide support for scientific and technical publications, and fund and organise conferences. FONRID provides a framework for mobilising funds for research and innovation activities in the public and private sectors and serves as a framework for the government's financial commitment and its partners in support of research and innovation for development. In addition, FONRID acts as an intermediary between national, bilateral or multinational partners and public or private research and innovation structures in negotiations to fund research and innovation projects and programs.



Dr Hamidou H. Tamboura
Director General
hh_tamboura@hotmail.com

BOTSWANA: Department of Research, Science and Technology (DRST)

DRST is a department of the Ministry of Tertiary Education, Research, Science and Technology of Botswana. DRST's vision is to be the leader in the coordination and development of Research, Science and Technology. It is mandated to coordinate and provide leadership in science and technology in Botswana. The key service areas of DRST are policy and legislation, intellectual property rights, monitoring and evaluation, science and technology, planning and forecasting and data management. DRST consist of two main core business divisions, the coordination and development division and the policy and legislation division. The coordination and development division monitors and evaluates the availability and adequacy of research infrastructure, equipment, and human resources in Research Science, Technology and Innovation (RSTI).

Therefore, it effectively monitors and evaluates R&D in science and technology-related activities and issues research permits. The policy formulation division is responsible for providing leadership in developing science and technology policies and reviewing and revising RSTI policies and legislation to create a conducive environment for the advancement of RSTI. In addition, the policy formulation unit promotes international cooperation in RSTI by implementing Agreements signed between Botswana and partner countries.



Mr Abraham Mathodi
Chief RST Officer
amathodi@gov.bw

SENEGAL: Directorate of Financing of Scientific Research and Technological Development (DFRSDT)

The Directorate of Financing of Scientific Research and Technological Development (DFRSDT), established by the Presidential Decree of 2014, is under the General Director of Research and Innovation (GDRI) authority. The DGRI is under the Minister of Higher Education and Research and Innovation's management and is responsible for coordinating and harmonising research and innovation activities. In addition, GDRI assists the Minister in implementing the research and innovation policy and the pooling of resources. As part of its mission, the GDRI ensures the strengthening of links between the various components of the national research system to promote synergies and support research.

DFRSDT promotes measures that encourage the involvement of the national research community in collaborations. DFRSDT plans and monitors the implementation of all fund management procedures whilst ensuring the follow-up and control of the funds disbursed. DFRSDT also establishes partnerships at national and international levels. Furthermore, it creates a system of financing research activities, diversifies financing resources, and promotes scientific and technical culture.



Prof Soukèye Dia Tine
Director
soukeye.diatine@gmail.com



Co-authors: Prudence Makhura and Nombuso Madonda
Content coordinator: Peacemaker Zenda
Copy edit: Patrick Saunders
Design and layout: Georgiet Hammond
Published by the National Research Foundation, July 2022