TANZANIA

Country Report 2021

Summary of RSIF in Tanzania

10 Tanzanian RSIF doctoral scholars enrolled

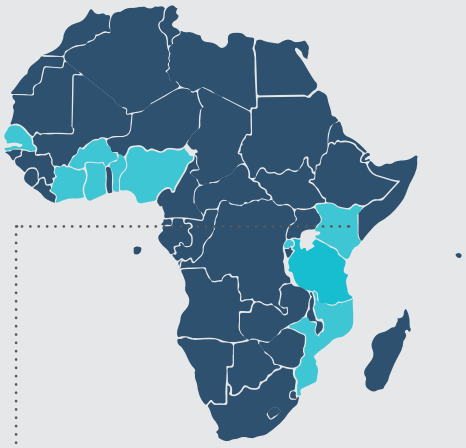
16 PhD scholars and faculty trained

14 Trainings held

The PASET Regional Scholarship and Innovation Fund

PASET
Partnership for Skills in Applied Sciences, Engineering & Technology

An Africa-led initiative to bridge the skills gap in Applied Sciences, Engineering, & Technology



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Contributing countries: Benin, Burkina Faso, Côte d'Ivoire, Ghana, Kenya, Mozambique, Nigeria, Rwanda and Senegal have made or are at the final stages of making contributions to PASET RSIF, in addition to the Government of Korea, the ACP Innovation Fund of the European Union and the World Bank.

RSIF IS THE FIRST PAN-AFRICAN SCIENCE FUND OF ITS KIND

RSIF is the first Pan-African Science fund of its kind connecting innovative minds to resources for revolutionary solutions.

It is the flagship product of PASET, an initiative led by African governments aimed at building skills of citizens of sub-Saharan Africa countries in the field of applied sciences, engineering, and technology for national economic growth on the continent. RSIF builds sustainable doctoral training, highly advanced research and innovation ecosystems to develop transformative technologies in Africa for economic growth and development.

At least 40% of the beneficiaries are women and priority is given to young faculty without a PhD.

Tanzania's collaboration with RSIF

Tanzania participated at the 5th PASET Forum and has expressed its intention to contribute to RSIF. The Minister of Education, Science and Technology represents Tanzania in the PASET Governing Council (GC), and the Director for Science, Technology and Innovation, sits in the PASET Executive Board (EB).

The potential of Tanzania's innovative expansion due to investment in RSIF is multiplied when leveraged by the funds through matching support from various donors, including the Government of Korea, international partner institutions and others.

By contributing to RSIF, Tanzania will benefit from joint resource mobilization with other countries and capacity building for PhDs and research and innovation far into the future. PASET aims to mobilise over USD 500 million into the RSIF permanent fund, with an estimated 20% to be allocated to research and innovation projects for the benefit of citizens and institutions of participating countries. Many African countries are interested to be part of this.

RSIF competitively selects and harnesses the brightest minds with:

(i) doctoral scholarships at Host Universities in Africa and 'sandwich' training at selected International Partner Organizations, (ii) research awards, and (iii) innovation awards to faculty of graduated RSIF scholars.

PASET members have prioritized five cutting-edge thematic areas that will drive growth on the continent:

- ICTs including big data & artificial intelligence
- Minerals, mining & materials engineering
- Energy including renewables
- Food security & agribusiness
- Climate change

BENEFITS TO CONTRIBUTING GOVERNMENTS

As a contributor to RSIF, Tanzania would benefit in more ways than through the cost-effective training of its doctoral students.

Countries also benefit from efficient centralized administration of the scholarship and other grants, support for the RSIF scholars to ensure that they complete on time, as well as regular monitoring reports on the progress of their students. The pooling of funds, the highly competitive selection of host universities, international partners and students, and the efficient administration of the fund enhances the value and increases the benefits.

Tanzania's participation in RSIF will benefit the entire Tanzanian higher education, science and innovation ecosystem. All RSIF scholars will undergo high quality doctoral training in competitively selected SSA universities partnered with international universities, with study abroad for part of the time, at a fraction of the cost of sending students abroad for a full time PhD. On successful completion of the PhD, the students will be eligible for research and innovation grants.

Highly Skilled Human Capital as a Driver for the Tanzania National Development Plan

The rationale for RSIF is that Africa requires world class scientists in priority thematic disciplines that are relevant to national economic growth across sub-Saharan Africa. Some of these areas include orphaned research areas such as mining, minerals and materials science, energy and information and communication technology among others. This African led program aims to support the training of African innovators and leaders, with focus on women and faculty, to be able to strengthen the capacity of universities to train at the doctoral level and undertake innovative and impactful research for the future needs of the country.

Photo: RSIF Scholar Emmanuel Kifaro at the Poster Exhibition, 5th PASET forum in Kigali, Rwanda, May 2019.

NURTURING HIGH-IMPACT PARTNERSHIPS

and Strengthening Research and Innovation capacity at the Sokoine University of Agriculture and the Nelson Mandela African Institution of Science and Technology

Photo: Training of postgraduate students in nanopre next-generation sequencing at Sokoine University of Agriculture.

In 2018, Sokoine University of Agriculture (SUA), Africa Centre of Excellence for Infectious Diseases of Humans & Animals in Southern & Eastern Africa (SACIDS), was competitively selected as an RSIF African Host University in the PASET priority thematic area of Food Security and Agribusiness. The selected PhD programme at SUA is at SACIDS. SUA is hosting thirty RSIF funded doctoral scholars.

Similarly, in 2019, Nelson Mandela African Institution of Science and Technology (NM-AIST), Africa Centre of Excellence: Water Infrastructure and Sustainable Energy Futures (WISE – Futures), was competitively selected as an RSIF African Host University in the PASET priority thematic area of Minerals, Mining and Materials Engineering. The selected PhD programme at NM-AIST is in Materials Science and Engineering (MaSE). NM-AIST is hosting twelve RSIF funded doctoral scholars.

As RSIF African Host Universities, SUA and NM-AIST benefit from various capacity building and technical support, such as strengthening internationalization and accreditation.

SUA and NM-AIST benefit from linkages with other RSIF AHUs as well as with RSIF international partner institutions for the RSIF's 'sandwich programme' - whereby students spend 6-24 months at an advanced institution conducting collaborative research.

RSIF has supported the establishment of research networks to support SUA and NM-AIST. For example, faculty members from SUA and NM-AIST participated in a study visit to Mohamed VI Polytechnic (UM6P), Morocco to identify areas for research collaboration and student sandwich training along with ten other universities.

Photo: RSIF host university agreement between SUA, NM-AIST and *icipe*, the Regional Coordination Unit for RSIF, was signed in Nairobi, Kenya in presence of the PASET Governing Council and the Executive Director of the PASET Executive Board on the 7 October 2019. Read more

SUA and NM-AIST have received video-conferencing equipment and related facilities to enhance e-learning, particularly as a response to the pandemic. RSIF is also providing increased access to a wide range of scientific journal resources to the SUA and NM-AIST libraries and its students.

To help universities respond to COVID-19, icipe has provided two training workshops on 'The use of Online Educational Resources in Higher Education' and on 'Online Educational Resources as a Response to the COVID-19 Crisis' co-organized by EPFL (Switzerland) and University Mohammed VI UM6P (Morocco). A training was also done on 'Helping Faculty Deliver their Courses Online during the COVID-19 Crisis' with the Director of Digital Innovation at Arizona State University.

Strengthening university innovation and delivery of personal protective equipments (PPEs) – eight session training were provided by Worcester Polytechnic Institute (WPI), Boston, USA on COVID-19 and 3D printer assembly as well as printing of face masks, face shields and respirator. Universities were able to learn practically how to print various PPEs and supplied these to hospitals and to the public.

RSIF Training Courses Provided:

1. Research Communications and social media
2. Digital Storytelling
3. Reference management & open access
4. Grant writing
5. E-Resources
6. Grievance address mechanisms
7. Sexual harassment
8. Strategies for a successful PhD
9. PhD proposal writing
10. Responsible conduct of research including research ethics
11. Introduction to information literacy
12. Introduction to research methods and statistics, data analysis and management
13. Science presentations
14. Science posters

Training Applied Researchers in Science and Engineering Fields

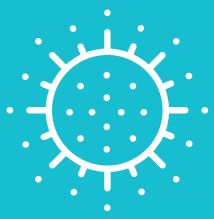
Scholarships have been awarded to more than 180 RSIF PhD Scholars in total from across sub-Saharan Africa. Ten of these are Tanzanians. More scholars will be selected in Cohort 4 in late 2021.

The Tanzanian RSIF graduates are equipped with advancing technologies and strategic research skills for innovation solutions. This provides opportunities for building new university departments that respond directly to national priorities, boosting Tanzania's capacity to train at the PhD and postdoctoral level. With the ability to undertake high quality research, Tanzania will be well positioned to lead improved outputs, ranking and prestige.

Breaking Barriers for Women in Science

> **Women's participation in research remains low in Africa, with women making up only 30% of the science community. RSIF is shifting that perspective.**

70% (Seven of ten) of the Tanzanian RSIF PhD scholars in the first three cohorts are female. RSIF assigns attention to not only women, but also, underrepresented groups, seeking to promote family-friendly policies as well as language and accessibility measures.



RESILIENCE OF RSIF SCHOLARS: COVID-19 CHALLENGES AND LESSONS LEARNT

In a published article, three female RSIF PhD scholars on international sandwich placements in Korea and USA, discuss the impact of COVID-19 pandemic on their personal lives and research journeys. Their immense resilience to pursue despite the unprecedented challenges is evidence of the determination and caliber of RSIF scholars. While the COVID-19 pandemic is affecting all scientists in general, women scientists, especially those with young families, are uniquely impacted . RSIF not only ensures that women scientists enter and thrive in PhD programmes, but also, guarantees that all its scholars are able to circumvent the challenges related to the pandemic. *icipe*, RSIF's RCU is already providing support to scholars in various ways, including online training support, and psychosocial support on issues like mental health. In addition, RSIF is working with partner universities and students towards timely progression in research and overall course completion.

https://www.universityworldnews.com/post.php?story=20201208123315401

CATALYZING RESEARCH

to Generate Transformative Technologies for Innovation and Development

Faculty members engaged in PhD training at SUA and NM-AIST are eligible to apply for RSIF Research and Innovation Awards. These competitive grants enable faculty members to advance their research and to help their PhD students generate exceptional research results to solve pressing African challenges.

See repository of RSIF Scholar Research here

Innovation spurs from collaborative knowledge sharing.

RSIF's establishment of international networks provides SUA and NM-AIST with a global pool of like-minded innovators. For example, faculty study visits were supported to Japanese universities to learn about university-industry linkages.

RSIF provides research and innovation funding for staff at SUA and NM-AIST. Currently funded are three projects that bridge the gap between scientific research and practical innovative solutions. RSIF is encouraging partnership with international partners and private firms to leverage some of the brightest minds on the continent. This will contribute to enhanced partnership in higher education, science and innovation ecosystem and collaboration in training, research and innovation.

RSIF INNOVATION PROJECT:

Loading of a master mix into a polymerase chain reaction (PCR) plate before PCR. The master mix contains Taq DNA polymerase for the amplification of nucleic acids during PCR.

Developing an Innovation Ecosystem within SUA for Replication and Contribution to Growth of the East African Bioeconomy

Project Title: Innovative Biosystems for Self-sufficiency in Molecular Biology Reagents in Africa

Project leader: Prof. Esron Karimuribo, SUA

Collaborating partners:
1. Tanzania Engineering and Manufacturing Design Organisation (TEMDO)
2. The Catholic University of Leuven (KU Leuven), Belgium

This project seeks to create an "Innovative University" ecosystem by bringing research, innovation, teaching, commercialization, and smart partnerships under one roof, within the existing teaching University environment at Sokoine University of Agriculture (SUA). As a model, it aims to nurture an innovative biosystem that will create self-sufficiency in molecular biology reagents for use by the university's postgraduate students and research scientists, first in Tanzania and then East African Community (EAC) and Southern African Development Community (SADC). SUA and its collaborating partners will develop pilot spin-off projects, beginning with the production of Taq DNA polymerase enzyme.

Through internal consultations and external engagement, the project aims to strengthen the Technology Transfer Office of the university to improve its innovation management capacity. In addition, it will strengthen the innovation policy environment to stimulate innovation and entrepreneurship at SUA. Faculty and University leaders will be trained on innovation transformation in higher education to enable them to play an active role in the innovative transformation of the University.

As a result, the project seeks to develop an innovation ecosystem within SUA and replicate this in other Agricultural and Life Sciences Universities.

RSIF RESEARCH PROJECTS:

Regulating the Fluoride Content in Water for Clean Water and Good Health

Project Title: Fluoride removal from drinking water using capacitive deionization

Project leader: Dr. Yusufu Abeid Chande Jande, NM-AIST

Collaborating partners: Hanyang University, Energy and Environmental Engineering Lab, Korea

Capacitive deionization (CDI) is an emerging desalination technology which has various merits compared to the conventional methods such as reverse osmosis and thermally based ones. In recent years, some researches have been focusing on developing CDI materials for fluoride removal. High concentration of fluoride in water (above 1.5 ppm) causes dental and skeletal fluorosis problems. Most of the Rift Valley region in Eastern Africa, water sources contain high concentration of fluoride. This makes the existing water unsafe for drinking.

This project intends to produce a capacitive deionization (CDI) stack that will be used to remove fluoride from water targeting the Ngaramtoni area in Arusha. CDI as an emerging technology consumes less energy compared to traditional methods. This research intends to design the CDI system for defluoridation using the biomass-based electrode materials (agricultural wastes like rice husks).

This project will increase availability of clean and safe water by regulating the fluoride content in water within the recommended World Health Organization levels. It will also contribute to the Sustainable Development Goal 6 on Clean Water and Sanitation and Goal 3 on Good Health and Well-being.

Increasing quality of dried fruits, medicinal herbs and vegetables for improved livelihoods and income

Project Title: Solar-assisted heat pump dryer with energy storage for drying biomaterials

Project leader: Dr. Thomas Kivevele, NM-AIST

Collaborating partners:
1. Alpha Thermal Process, LLC (ATP)
2. US Department of Agriculture (USDA), Eastern Regional Research Center, USA
3. Empowering Africa Consulting Group LLC, USA
4. Innovative Technology and Energy Center (iTEC), Arusha Tanzania

Integrating heat pump and thermal storage systems to the solar dryer will enable the system to work even when the sun is not active mostly in the evening and nighttime.

Fruits, medicinal herbs and vegetables which are traditionally sun-dried, are often of poor quality due to the complexity in controlling the rate of drying and the extent of cell damage. Over forty percent of agricultural produce in developing countries is wasted, not only due to lack of storage and processing facilities, but also due to limited knowledge of processing technologies.

Economic considerations, environmental concerns and product quality aspects are the three main goals of drying process research in the food industry. In many cases, the drying process is applicable to seasonal biomaterials, so that they can be stored for as long as possible and be available out of season. Apart from direct sunlight drying, many farmers in Africa use firewood and fossil fuel burning, electrical and diesel engine heating. These methods result in smoke and other emissions which have negative effects on human health and contribute to climate change.

This project is proposing a solar-assisted heat pump dryer integrated with thermal energy storage system for drying fruits, medicinal herbs and vegetables. The technology can further be used for drying grains, fish etc. This technology is not well-known in sub-Saharan Africa climatic conditions.

Read more

SPOTLIGHT ON AFRICA'S FUTURE LEADERS

in Science, Engineering and Technology

"This study aims to generate knowledge on the differential diagnostic method for the two swine haemorrhagic viral diseases in case of outbreaks in the country. In addition, the findings will contribute towards building capacity for designing and application of modern methods for diagnosis of such transboundary animal diseases."

RSIF PhD scholar Emmanuel George Kifaro - Sokoine University of Agriculture (SUA), Tanzania.

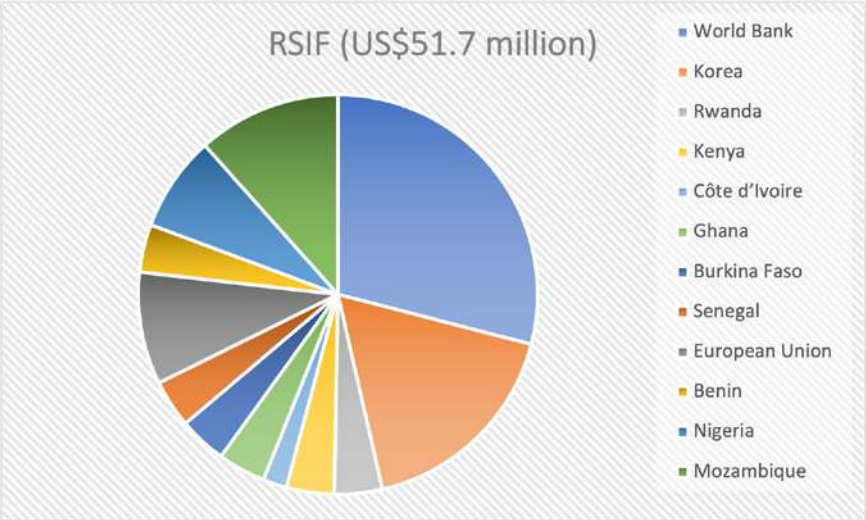
Africa Centre of Excellence for Infectious Diseases of Humans & Animals in Southern & Eastern Africa (SACIDS), with sandwich research placement at the Korea Institute of Science and Technology, Korea.

Tanzanian RSIF scholars and Research Areas

Name	Research Area	RSIF African Host University
Happyness Ngonyani	Assessing indigeneous knowledge, technology and its adoption to policies related to transboundary water resources and landscape management as a tool for climate change mitigation in African communities	Bayero University Kano, Nigeria, Africa Centre of Excellence in Dryland Agriculture (CDA)
Rehema Mrutu	Microbial engineering to mitigate methane emission in ruminant livestock	
Emmanuel George Kifaro	Development of microparticles RNA separation and detection method for selected RNA viruses from non-invasive matrices	Sokoine University of Agriculture (SUA), Tanzania, Africa Centre of Excellence for Infectious Diseases of Humans & Animals in Southern & Eastern Africa (SACIDS)
Julius Joseph Mwanandota	Genomic Surveillance of important sheep and goat respiratory diseases for improved productivity through strategic diseases control in Tanzania	
Mercy Mmari	Edible insects of Tanzania; Diversity, nutrients composition and contribution to livelihood among Tanzanian societies	
Sambwe Fundikira	Efficacy assessment of bio-control preventive actions in maize to reduce human mycotoxin exposure in Tanzania	
Ruth Lorivi Moirana	Investigation of the efficiency of biochar on enhancing methane production and denitrification process in wastewater treatment	Nelson Mandela African Institution of Science and Technology (NM-AIST), Tanzania, Africa Centre of Excellence: Water Infrastructure and Sustainable Energy Futures (WISE – Futures)
Alfredy Tusekile	Removal of heavy metals from water by capacitive deionization electrode materials derived from chicken feathers	
Hashimu Hamisi	High strength geopolymer concrete (HSGC) cured at ambient temperature with improved workability; A blend of nanosilica, RHA and Pugu Kaolin in Tanzania	
Theofrida Maginga	Using machine learning model for image-based early disease detection on cereal crops in Tanzania	University of Rwanda, Africa Centre of Excellence in Internet of Things (ACEIoT)

See repository of RSIF Scholar Research here

THE FIRST PAN-AFRICAN SCIENCE FUND INTUITIVELY DESIGNED FOR GROWTH



RSIF is designed for sustainability and has two components: (i) the General Fund and (ii) the Permanent or Endowment Fund, with proceeds to capitalize the general fund.

Country contributions have been earmarked to scholarships, and in some cases to support research and innovation projects, aligned with national needs. So far, most countries have focused on doctoral training.

More importantly, RSIF aims to create a permanent vehicle for supporting science, technology and innovation capacity building through an endowment fund that is being established by the governments.

Tanzania is encouraged to take up a leading role in PASET through contributing to RSIF and investing in the RSIF permanent fund for lasting returns.

Tanzania can explore innovative ways of raising more funds for RSIF. By providing tax incentives for private sector companies investing in RSIF, by recommending RSIF to its development partners and by making a fixed annual budgetary allocation to RSIF, Tanzania will be in alignment with its commitment to PASET's vison.

African governments make good their pledges for advanced training in applied sciences and technology, as continental demand soars.

RSIF provides full doctoral scholarships and grants for research and innovation, to boost technical and scientific capacity for the advancement and use of transformative technologies to tackle Africa's most pressing challenges.

Read more

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Please contact the RSIF-RCU at *icipe* for further details.

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