REPUBLIC OF RWANDA

NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

ncst National Council for Science and Technology

Science and Technology Foresight for Research and Innovation Cooperation

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PREAMBLE: This newsletter highlights foresight activities conducted by NCST and stakeholders to inform current and future Science, Technology and Innovation policies to accelerate national economic growth. These include the recent STI conferences that gave insights into building resilience for prevention of pandemics, and transitioning agriculture and food as an engine of growth. It also emphasizes the role of establishing incentives for researchers and building strategic partnerships for Research and Development capacity building to boost innovation outputs.

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Dr. Christophe Mpirimbanyi being awarded by the Hon. Minister of Education and Co-Chair of NCST Council, Dr. Valentine Uwamariya

The 1st Rwanda STI Conference Panel discussion on "Strategic investment to mitigate epidemics and pandemics".

Field visit at LEAPR Labs where NCST awardees are showcasing some of the funded projects to SIDA team

Panel discussion on how to strengthen the role of STI in transforming agriculture and food systems during the 2nd Africa Wide STI Conference

Using Science and Technology to Mitigate Covid-19 Pandemic: Building Resilience for Prevention of Future Pandemics

Dr. Eugene Mutimura[1], Dr. Isambi Sailon Mbalawata[2], Prof. Timothy Brown[3] Prof. Agnes Binagwaho[4]

[1]Executive Secretary, National Council for Science and Technology (NCST)
[2]Research and Scientific Development, African Institute of Mathematical Science (AIMS)
[3]Professor at Carnegie Mellon University Africa (CMU-A)
[4]Vice Chancellor at University of Global Health equity (UGHE)

Background: On March 31 - April 1, 2022, the National Council for Science and Technology (NCST) organized the 1st Rwanda Science, Technology and Innovation (STI) conference where experts in different fields convened to provide considerations of how data was used to inform policy in response to COVID-19 and can be used to build resilience in preparation for future pandemics. The conference theme was, ***"Leveraging the potential of Science and Technology to Mitigate Challenges associated with COVID-19 Pandemic in Developing Countries"*** and was officially opened by the Minister of Health, Hon. Dr. Daniel Ngamije (Figure 1). The COVID-19 pandemic resulted in dramatic loss of human life worldwide. It presented numerous challenges to public health. And, it disrupted the social-economic development of all nations, especially for developing countries. However, developing countries, despite their limited capacity, have implemented intervention strategies in efforts to mitigate the spread of the pandemic and for minimizing the negative impact on the economy. The COVID-19 pandemic posed a major crisis to society due to the uncertainty of normal business operations forcing corporate and commercial businesses to create innovative solutions to ensure that they remain functional.

Purpose and context: There was a vital need for a scientific conference to deliberate on how science and technology can support the wellbeing of society and better respond to adjustments of social and economic demands and innovation for a positive impact and a thriving society. Therefore, there was a need to mitigate challenges associated with COVID-19, and building resilience for sustainable prevention of future pandemics. This conference attracted abstracts from many countries such as Cameroon, Ethiopia, India, Ivory Coast, Kenya, Nepal, Nigeria, Rwanda, Senegal, Sri Lanka, Tanzania, and Uganda, only to mention a few. It also created an essential global platform that demonstrated scientific progress using technology to address the COVID-19 crisis. First, the crucial contribution of science and technology in addressing the health care challenges, but also in supporting the society and economy in times of major turmoil. Second, the importance of collective demand for scientific expertise and coordination. Conference participants deliberated on advancements of science such as use of artificial intelligence, data science and robotics to improve and fast-track COVID-19 management, containment and predicting. There was a special focus on trend of the pandemic as well as improving human health through vaccination.

Figure 1: Hon. Minister of Health Dr. Daniel Ngamije: Official Opening of the 1st Rwanda STI Conference March 31-April 1, 2022

Figure 2: Guest of Honour: Hon. Dr. Daniel Ngamije, Keynote speakers and the Scientific Organizing Committee at the 1st STI Conference March 31-April 1, 2022

Conference themes, objectives and proceedings: The conference objectives and themes are summarized in Figure 3. The themes focused on science and technology, building resilience to crises and to mitigate the impact of COVID-19 pandemic, monitoring impact of COVID-19 pandemic, public health and COVID-19 management and vaccines and the future for developing countries.

Participants at the 1st Rwanda STI Conference

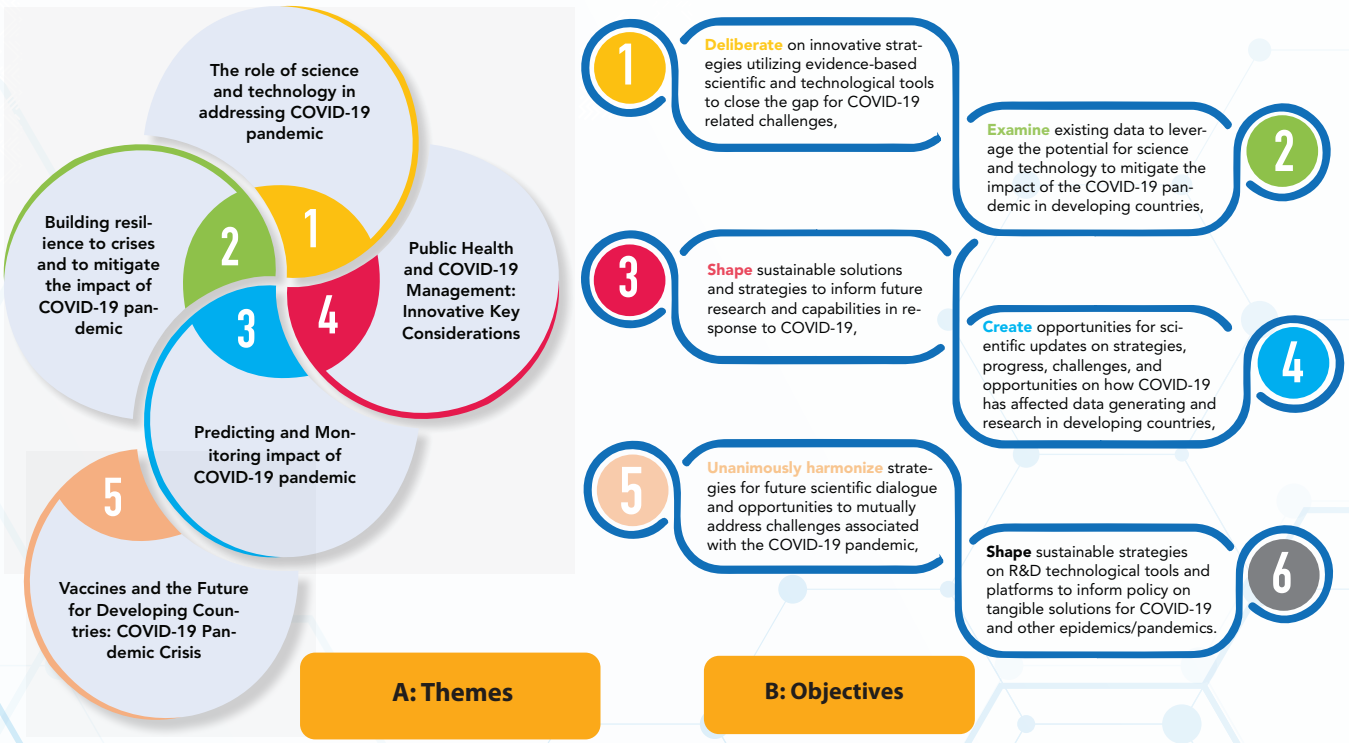


Figure 3: The 1st Rwanda STI Conference Themes and Objectives

There was a panel discussion on 'Strategic investment to mitigate epidemics and pandemics" (Figure 4). The panel discussion was led by Ms. Noella Bigirimana the Deputy Director General of Rwanda Biomedical Center (RBC). Panelists include Prof. Agnes Binagwaho, Professor of Pediatrics and the Vice chancellor of the University of Global Health Equity (UGHE), Dr. Claude Mambo Muvunyi, Professor of clinical microbiology and laboratory medicine and DG of RBC, Prof. David Kelvin professor of Microbiology and Immunology at Dalhousie University of Halifax Canada, and Ms. Melissa Rusanganwa, Director of Public Affairs at Zipline Drone company in Rwanda[1] .

Figure 4: Panel discussion on "Strategic investment to mitigate epidemics and pandemics". From left to right are Ms. Noella Bigirimana , Prof. Agnes Binagwaho, Prof. Claude Mambo Muvunyi, Prof. David Kelvin and Ms. Melissa Rusanganwa during the 1st Rwanda STI Conference

Outcomes

The following were the conference outcomes:

1. A summary of the conference proceedings including data on digital divide and data on key gaps to address COVID-19 pandemic and other health threats, in developing countries;
2. Prioritized Strategies and Programs for driving sustainability evidence-based programs to address COVID-19 pandemic;
3. Dissemination of the best abstracts findings in selected journals, and conference proceedings in Newsletters and Media houses
4. Provide Awards to best abstracts in the category of:
   - *Distinguished Research Achievement Award*
   - *Best Female Scientist Award*
   - *Distinguished Science and Technology Award &*
   - *Rising Star Award*

Considerations for building resilience to combat future pandemics: COVID-19 pandemic has revealed how interdependent the world is and how extreme inequalities in technology and innovation capacity affect more societies in low- and middle-income countries (LMICs) in a manner unfavorable to all humans. In Rwanda like other LMICs, there is inadequate robust infectious disease surveillance and control, lack of ultramodern high-tech laboratory infrastructure and low-level frontier technology and untimely low capacity for diagnostic tests of viral infectious diseases. In this milieu, the risk for future pandemics is real and eminent. The balance of risk and public health policy regarding strategic innovative approaches to combat COVID-19 and future pandemics would favor robust and realistic policies. Political will is going to be vital to develop and strengthen institutions to implement endorsed policies, ensure national coordination of public health functions and favorable global partnerships.

Conversely, many affluent countries with presumably better health institutions and political systems have not been very successful in their responses to the pandemic. The existing global system with outstanding and convincing policies succumbed to COVID-19 pandemic. The pandemic revealed genuine cracks in our societies policies and global networks. It would seem that in the 21st Century several identified policy challenges of deficient and modest planning for large scale epidemics and pandemics have been addressed. However, contextually relevant homegrown approaches on better health

[1]Zipline is an American company working in Rwanda since 2016 to use drones to deliver blood, medicines and vaccines to remote rural areas.

and political systems seem more mandatory than ever to prevent global health crises and threats. How can Rwanda and the global community specifically from resource-limited settings in Africa collaborate with their partners to successfully respond to the current and future health threats? If aspirations for Rwanda and Africa are to ensure resilience and preparedness on future pandemics, then there is a need for building capacity for better prevention and control measures. Pandemic preparedness needs the broad far-reaching approaches of determined investment in research and development to develop technology for efficient emergency response and long-term preparedness. Central to success is sustainable development of health security, good governance to ensure accountability as well as security and trust at all national levels.

Future directions: Contextual research in Rwanda and Africa is required to share best practices and evidence-based policy decisions to cope-up with immediate impact of the pandemic, and beyond to save future generations from crises of the next pandemics. Building resilience to future pandemics may require health and political leadership, strong commitment in terms of policy but also robust implementation approaches. Formulation of policy and strategies may go through several stages from inception, formulation, adoption to conclusion, and even in cases of inexistence of high-quality data, public health policy should be evidence-based. Based on the data that was examined, we propose the following sustainable solutions and strategies to inform future policy and implementation that will be done by all levels of governance including health institutions, academia, government sector and private sector and non-for-profit organizations.

Conclusions: Our analysis of available evidence on response to COVID-19 pandemic and measures to prevent future pandemics by Rwanda and many low- and middle-income countries in Africa lead to five main conclusions.

First, available evidence suggests limited holistic focus on pandemic preparedness and strategic planning against future infectious disease threats. COVID-19 pandemic has revealed the importance of how interdependent the global society is and how Africa is more affected by extreme inequalities in technology and innovation capacity. Health policy and strategies should focus on ambitious investment in research and development for high-technology for diagnostics tests, vaccine and therapeutics manufacture.

Second, early responses to infectious disease outbreaks traditionally rely on epidemiologic data and public response to mitigate disease and epidemic outbreaks. COVID-19 pandemic has demonstrated a more inclusive approach to integrate multi-lateral collaboration and to balance social, economic and political considerations to build resilience to prevent and sustainably prevent future pandemics.

Third, COVID-19 pandemic has accentuated the potential for strengthening frontier technological capabilities of Artificial Intelligence (AI), data science, Internet of Things (IoT), robotics, and drones for better technology-driven healthcare systems to enhance institutionalization, and to prepare for the next pandemic.

Fourth, public health management of viral infectious disease outbreaks should focus on both imminent and future human resource and infrastructure capacity development and preparedness. There is a need for continuous mobilization of local and global partnerships to invest and dedicate efforts for prevention of future pandemics, and emphasis on local human capacity building in this domain is required to ensure availability of capable monitoring and response teams.

Fifth, the role of healthcare and political leadership is paramount in the prevention of infectious disease outbreaks and pandemic prevention. Multidisciplinary experts and systems strengthening is essential for multi-sectoral leadership coordination, as well as adaptability of resource mobilization while ensuring adherence to strategic operational and accountability standards.

Future pandemics caused by virulent viral and novel viruses will potentially result in similar challenges and tragedy. The approach we have presented will be useful for strategic planning and policy consideration to curtail risks associated with future pandemic challenges.

Science and Technology for Agriculture Transformation: 2nd Africa Wide Science, Technology, and Innovation (STI) Conference

Dr. Marie Chantal Cyulinyana[1], Mr. Kayumba Theogene[2], Dr. Athanase Nduwumuremyi[3]

[1]STI Foresight Analyst at Rwanda National Council for Science and Technology
[2]Data Mining Analyst at Rwanda National Council for Science and Technology
[3]Senior Scientist at Rwanda Agriculture and Animal Resources Development Board

Background: African Governments have demonstrated commitment to Science, Technology, and Innovation (STI) and have consequently developed institutions and strategies to spearhead the integration of STI at the heart of national and continental sustainable economic development policies. In 2010, 74% of African Governments had dedicated ministries or departments mandated to promote STI through the development of policies and implementation strategies. Accordingly, regional agencies like Network of African Sciences Academies (NASAC) which had grown to 28 member's states in 2020[2] , demonstrating the continent's interest in STI. NASAC and other like-minded organizations have been critical in building the capacity of the members as independent advisors to the Governments on science, technology and innovations and strengthening the voices of science to be heard by policy and decision makers in Africa.

The African Union (AU) has led initiatives to promote the role of Science in the Africa development agenda. In 2005, the Africa's Science and Technology Consolidated Plan of Action (CPA) brought together all African Union Commission (AUC) Programs on Science and Technology of the New Partnerships for Africa's Development (NEPAD). The CPA sought to support the integration of Africa into the global economy and the eradication of poverty through biodiversity, biotechnology, and indigenous knowledge; energy, water, and desertification; materials sciences, manufacturing, laser, and post-harvest technologies; information and communication technologies; and mathematical sciences.

During the 2nd Africa wide STI conference, the executive secretary of the Rwanda National Council Science and Technology (NCST), in his presentation mentioned the establishment of AfCFTA as one of the opportunities for market expansion and how beneficial it is for agriculture sector in the conference context.

Existing Opportunities: An enabling Policies

African Union

AU Member Countries Create History by massively signing the AfCFTA Agreement in Kigali

Ratified May 2019

The AfCFTA Agreement: 54 African countries into a single market of 1.3 billion people.

Enhancing sustainable markets, create an economic bloc of GDP $3.4 Trillion USD,

Expected to grow with consumer and business spending $6.7 trillion by 2030.

There are other examples of Enabling Policies

Figure 1: Dr Eugene Mutimura Presentation during 2nd Africa Wide STI conference

[2]https://au.int/sites/default/files/newsevents/workingdocuments/33178-wd-stisa-english_-_final.pdf

The African Agricultural Technology Foundation (AATF), the Government of Rwanda through its Ministry of Agriculture and Animal Resources (MINAGRI), and the African Union Development Agency - New Partnership for Africa's Development (AUDA-NEPAD) through the African Biosafety Network of Expertise (ABNE) have collaborated to hold the 2nd Africa Wide Conference on the STI, which took place in Rwanda from 26th to 28th April 2022 under the theme ***"Deepening Conversations to strengthen the role of Science, Technology, and Innovation (STI) in transforming agriculture and food systems in Africa"***. This conference was hosted by Government of Rwanda, MINAGRI. The first one was held in Uganda in 2017.

The 2nd Africa Wide Conference on STI brought together Continent's decision makers and influencers such as the Ministers of Agriculture, the Ministers of Science, Technology and Innovation, the Ministers of Economic Planning and Development, the National Councils of Science and Technology (NCSTs), the National Development Planning Commissions (NDPCs), Researchers and Academia to name a few.

Figure 2: Invited Guests and Delegates during the two-day 2nd Africa Wide Conference on the Science, Technology, and Innovation (STI)

Conference Focus: The conference facilitated a high-level conversation on how to galvanize political will on STI in Africa for sustainable economic growth and agricultural transformation. The conference also shared updates and new research findings to provide an opportunity for dialogue on how to bridge the STI Policy and Practice. During the conference, the track records of STI progress and investments were presented. Participants identified the gaps and made some resolutions on how STI has been embedded in the economic development.

The conference broad topics were:

1. Role of STI in Agenda 2063: Bridging STI, Policy and Practice;
2. The State of STI Governance Framework in Africa: Gaps and Opportunities for Modern Technologies;
3. State of Science, Technology and Innovation in Agricultural and Food Systems sector in Africa;
4. Alignment of Education and Research to Africa's developmental Needs;
5. Agricultural Biotechnology Research Development: Current Status, Gaps and Opportunities;
6. Role of Communication and Information in STI for Agricultural Development in Africa.

Integration of Science and Technology into the National Development Agenda

During this conference the Executive Secretary of the National Council for Science and Technology (NCST) was invited to present on "Integration of Science and Technology into the National Development Agenda" emphasizing on five (5) important points; Global aspects on STI and Policy; Application of STI in Agriculture; Existing Opportunities; Benchmarking/Learning from Others on use of STI in Agriculture for productivity, The Future of STI and Agriculture.

Figure 3: Panel discussion on how to strengthen the role of Science, Technology, and Innovation (STI) in transforming agriculture and food systems. From Left to right; Dr. Patrick Karangwa (DG, RAB), Dr. Martin Bwalya (KMPE, AUDA-NEPAD), Dr. Canisius Kanangire (ED, AAFT) and Dr. Eugene Mutimura (ES, NCST Rwanda)

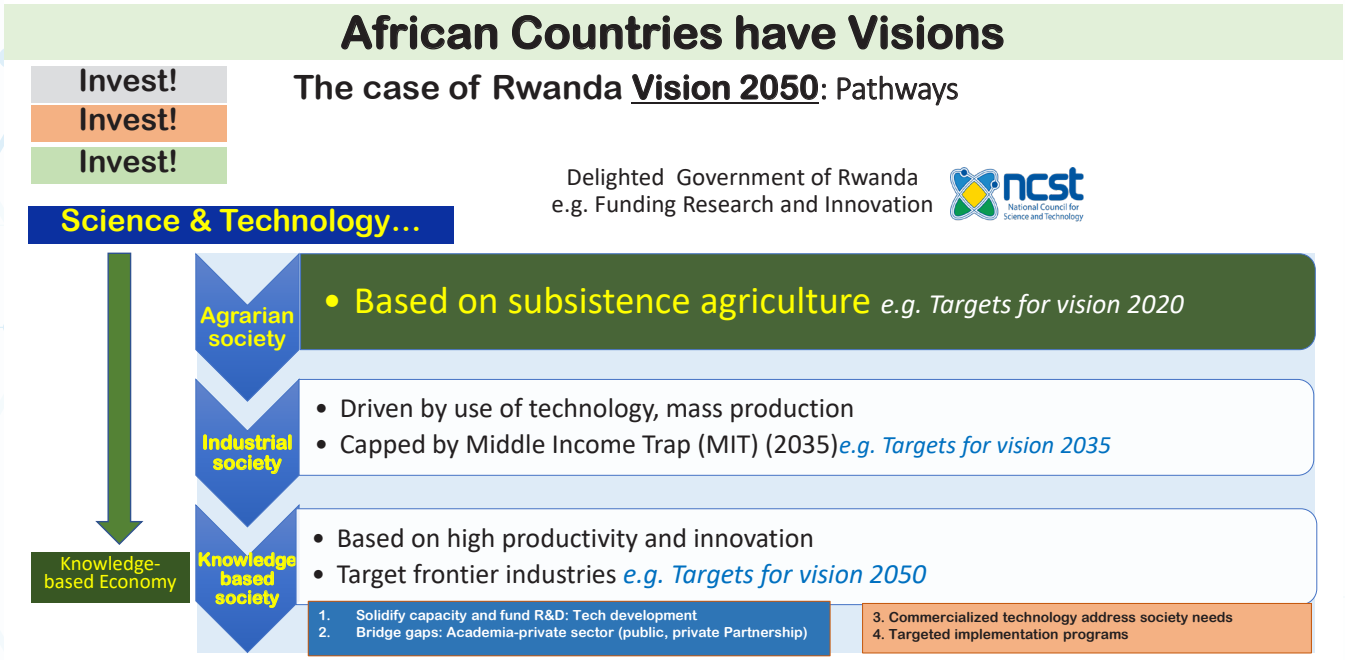


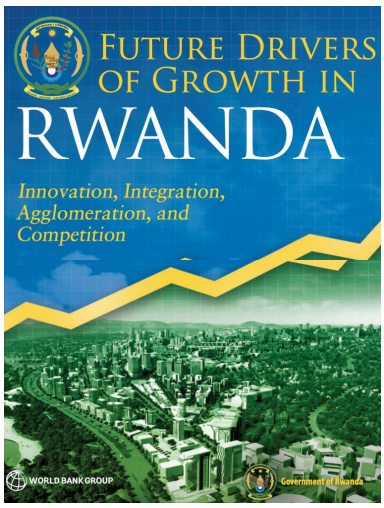
Figure 4: The Africa we want: The case of Rwanda Vision 2050: Pathways

STI in Agriculture for Development: Technological advancements in agriculture provide vast potential for farmers, entrepreneurs, and investors to improve the productivity and efficiency of agriculture in Africa at a time when numerous factors, such as population growth and climate change threaten food security. Africa agricultural development is central to the achievement of Africa's Agenda 2063[3] and her contribution to Sustainable Development Goals (SDGs). Agriculture is one area that has remained untapped by Technology in Africa, arguably making many actors believe that the production and productivity gaps in the sector is partly due to its minimal integration of STI, particularly modern technologies.

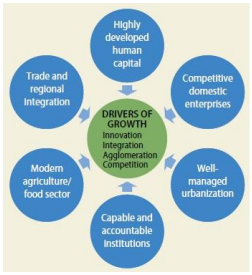
Strategies for enhancement of the smart agriculture: The core of the agenda of the role of STI in agriculture, is to connect science with end users in a more effective way for the benefit of society: Empowering farmers and building food security sustainably. In addition to that, a more productive, efficient and competitive agriculture sector is critical to improve rural economies, where the majority of the population in Africa live. The future of Africa depends on agriculture.

[3]https://au.int/en/agenda2063/overview

Planning: STI in Agriculture for Development



- Rwanda's strategy: 4 essential and interdependent drivers: **innovation, integration, agglomeration, and competition**
- These future drivers of growth would receive the necessary boost from reforms in six high-priority areas – including **agricultural modernization**



- Agriculture: major source of national income and growth for Rwanda, accounts for close to **70% of employment**, more than **30% of GDP**, and more than **50% of exports of goods**.
- The R&D survey: **42.86%** has been reported in medical, health, **agriculture and veterinary** sciences.

References: 1) Future Drivers of Growth in Rwanda: Innovation, Integration, Agglomeration, and Competition by the World Bank Group and Government of Rwanda; 2) Rwanda National R&D Survey Report 2018/2019, National Council for Science and Technology, 2021

Figure 5: The Role of STI in Agriculture the way forward to Agenda 2063

Policy → Addressing Challenges → Target: Growth

Policy for Strong Growth in Agriculture

- Supportive policies have helped to boost agricultural production
- Government efforts to develop new irrigated land and improve existing land through improved terraces contributed to agricultural growth
- Big data technologies

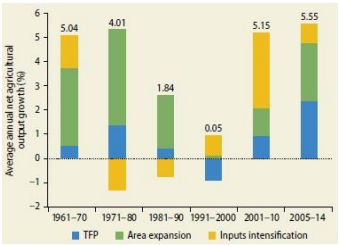
Securing the Natural Resource Base for Innovation

- Agriculture: most natural resource–dependent of all economic sectors
- Rainfall patterns: more variable, with projections of a 20% increase in variability by the 2050s REMA 2011)
- The development & use of agricultural technologies: abiotic and biotic stresses to cope

Emerging Policy Challenges

- **Expansion of the land devoted to agriculture (1960s and 1970s)**
- **The scope for further expansion of agricultural land is limited**
- **Use of tech: adapted fertilizers and increase farmers' use of better seeds**

Decomposition of sources of agricultural growth in Rwanda, 1961–2014



Targeting Larger Markets for Growth

- Competing in global food markets requires achieving high food quality and safety
- Boosting agricultural exports
- Rwanda needs to establish a globally competitive industry

Policies to Achieve Rapid and Sustainable Growth in Agriculture

- To produce **the transformative** growth rates, both public and private sector expertise in agriculture must be leveraged

Figure 6: Good Strategies for Enhancement of the Smart Agriculture in Rwanda

Home Grown Solutions: The emergence of modern technologies such as Artificial Intelligence, robotics, gene therapy, gene editing, stem cell therapy and the increasing importance of big data among others have come to the fore and the conference provided a space to appreciate how different governments in Africa are managing the emergence of these new technologies. The conference revealed that the medical world has greatly benefited from modern technology through COVID-19 vaccinations which are a product of modern genetic technologies. The safety of COVID-19 vaccines may be leveraged to dissuade people from fears they have harbored on genetically modified organisms (GMOs). NCST coordinates na-

tional STI efforts and provides support in terms of funding best innovative R&D projects aiming at development of solutions to challenges that have impact on the community. The total funding committed amounts to over four (4) billion frw in National Research Innovation Fund (NRIF). Two (2) of several other research grant schemes are, the **Rwanda Innovation Challenge**; and the Sector **Strategic Research** in Sustainable and renewable energy, and food security and modern agriculture. The figure below provides examples of some of the funded projects aiming at tangible solutions in food security and modern agriculture.

Figure 7: NCST Awardee, Alex during the 1st Rwanda STI conference exhibition where his giving explanation to the Guest of of Honor, on how the production process of Cricket flour is done.

Figure 8: Some home grown solutions funded by NCST; Mobile solar powered cold storage to reduce post-harvest losses and Cricket farming projects

Launch of the Open Forum for Agricultural Biotechnology-Rwanda chapter: The Open Forum for Agricultural Biotechnology (OFAB) is a partnership platform that contributes to creation of an enabling environment for biotechnology research, development, and deployment for the benefit of smallholder farmers in Africa. Driven by a vision of sustainable food security and agriculture-driven economic development in Africa, OFAB enhances knowledge and awareness on agricultural biotechnology to build understanding of the technology and inform decision making. Established by the African Agricultural Technology Foundation (AATF) in 2006, OFAB operates in ten countries: Kenya, Uganda, Tanzania, Ethiopia, Ghana, Burkina Faso, Nigeria, Rwanda, Mozambique, and Malawi.

Figure 9: On Wednesday 27th October 2021, The Hon. Minister of Agriculture and Animal Resources Hon. Dr. Gerardine MUKESHIMANA (the 4th from left on front raw) officiated the launch of the Open Forum for Agricultural Biotechnology OFAB Rwanda chapter

The upcoming OFAB Media Awards (OMAs): The OFAB Media Awards was initiated to; i) promote excellence in science journalism and appreciate the contribution of journalists in promoting sustainable agricultural technologies particularly agricultural biotechnology and ii) reward the critical roles played by journalists in promoting constructive dialogue on modern biotechnology through responsible, professional, ethical, and effective reporting. The culmination of the Award is the OFAB Africa Media Awards contest that brings together OFAB country level finalists from which the overall winners are selected. The call will culminate in celebrating and awarding three winning journalists in the categories of: Television, Radio and Print & Online. The **eligibility** to enter the competition: 1) Journalists who have been reporting on agricultural biotechnology in your country, 2) Articles submitted for consideration should have been published within the past 1 year to the date of submission in 2022. The **Categories** for the award will be 1) Print and Online (Newspapers, Magazine and Online), 2) Radio (Audio or podcast), and 3) Television. **Prizes**: Each category will produce 1) category winner, 2) runner-up. The winners of each category will be eligible to participate in OFAB Africa Media Wards (OMAs) scheduled for end of the year 2022 in the country to be announced. Submission Modalities, the Journalists are encouraged to submit entries by sharing: 1) Articles should not be older than 1 year on the date on submission for entry, 2) Published articles. The URL should be from a media house and not a personal blog. 3) YouTube and SoundCloud links to TV and Radio stories respectively; and, 4) Links to 3 of their best self-appraised articles or stories. 5) The entries (active links) should be submitted online through E-mail (to be communicated later). 6) If an entry is not accessible online, scanned articles should be submitted through the E-mail, 7) Entries should be submitted no later than 1st August, 2022.

Partnership Development for Research Capacity Building and R&D Funds Mobilization

Dr. Louis Sibomana[1] and Mr. Felly M. Kalisa[2]

[1]Head of Science Technology Development and Outreach at National Council for Science and Technology

[2]STI Policy Analyst at National Council for Science and Technology

Background: In today's economic world, public-private partnership in research and innovation can leverage broader economic and social benefits from joint investments to accelerate innovation and technological solutions to address key challenges of the economy and societal wellbeing. Partnership contributes to new innovation capabilities, improve connectivity between key players in national innovation systems and provide compatible incentives to all stakeholders[4].

Under the competitiveness and integration pillar of the Rwanda Vision 2050[5], Rwanda aspires to become a knowledge intensive economy through fostering excellence in Research and Development (R&D). This requires Rwanda to strengthen her Science, Technology and Innovation (STI) capabilities by increasing human capital, and R&D funds, among others. To achieve this objective, effective and strategic national, regional and international collaboration and partnerships is key.

The Government of Rwanda considers that enhancing cooperation in the fields of science and innovation through bilateral, multilateral, regional and international collaborations is key to strengthening Rwanda's national innovation system performance. Further, the National Council for Science and Technology (NCST) has a mandate, among others; to manage the National Research and Innovation Fund (NRIF) and mobilize funds, and to cooperate and collaborate with other advanced regional and international institutions of excellence with similar mission. In addition, the STI policy (approved by the Cabinet in June 2020)[6] has the objectives to increase R&D and innovation financing; to improved STI capacity and knowledge networks development, and to promote STI collaboration, among others.

It is in this regard that, in addition to various investments by the Government of Rwanda, and in order to strengthen STI collaboration, NCST has established various regional and international cooperation with several institutions in order to boost capacity building and R&D funding in Rwanda.

Existing partnerships

Science Granting Councils Initiative (SGCI) partnership: NCST is a member of the Science Granting Councils Initiative in sub-Saharan Africa (SGCI) since 2015. SGCI is a multi-funder initiative aiming at strengthening the capacities of 15 science granting councils in Sub-Saharan Africa in order to support research and evidence-based policies that will contribute to economic and social development. The funders of SGCI include the United Kingdom's Foreign, Commonwealth and Development Office (FCDO), Canada's International Development Research Centre (IDRC), South Africa's National Research Foundation (NRF), Swedish International Development Cooperation Agency (SIDA) and the German Research Foundation (DFG).

Under cooperation scheme with other councils within East Africa Community, NCST in collaboration with Uganda National Council for Science and Technology (UNCST), Commission for Science and Technology (COSTECH)-Tanzania, National Research Fund (NRF)-Kenya, and East African Science and Technology Commission (EASTECO), co-funded the following two (2) cross-border research projects under the Cooperation Grant Initiative supported by the SGCI:

[4]OECD (2016), "Strategic public/private partnerships", in OECD Science, Technology and Innovation Outlook 2016, OECD Publishing, Paris. DOI: https://doi.org/10.1787/sti_in_outlook-2016-10-en

[5]Republic of Rwanda, "Vision 2050", https://www.minecofin.gov.rw/fileadmin/user_upload/Minecofin/Publications/REPORTS/National_Development_Planning_and_Research/Vision_2050/English-Vision_2050_Abridged_version_WEB_Final.pdf

[6]Science, Technology and Innovation Policy, National Council for Science and Technology, Republic of Rwanda, https://www.ncst.gov.rw/index.php?eID=dumpFile&t=f&f=25653&token=d6f1aeb0bb872e3c6792c0e26ac9318b77b72b0e

1. Bioequivalence Study Validation Using a Locally-Manufactured Brand of Amoxicillin Capsules: Laying Foundation for the up scaling of Bioequivalence Studies in East Africa;
2. Development of safe mass rearing tools and value addition for the desert locust (Schistocerca gregaria Forskal) value chain in East Africa- Locust4Industry.

Each of the two projects received up to 120,000 USD in total. Out of this 120,000 USD, 100,000 USD was given by SGCI and 20,000$ were given by the aforementioned councils with a commitment of 5,000 USD each.

In addition to co-funding research projects, NCST as a member of SGCI has benefited from various trainings in order to boost its capacity to support the development and application of STI in Rwanda. Among the trainings received, NCST staff and stakeholders were trained in various areas including research management, STI policy development, Intellectual Property Rights, and STI indicators.

Partnership with the Canadian International Development Research Centre: In 2020, NCST entered into an agreement with International Development Research Center (IDRC) for research and innovation funding amounting to 500,000 CAD to support eight (8) research projects under Sector Strategic Research Grant scheme for two (2) priority areas, namely, Sustainable and renewable energy, and Food security and modern agriculture.

The main desired impact of this ongoing agreement between NCST and IDRC is to establish quality research outputs that directly address challenges within the aforementioned two priority sectors, both in terms of fostering research uptake and boosting the capacity of scientists and researchers, especially in line with gender inclusion and private sector engagement. Specifically, the grant project has the objectives to: (i) Fund research projects in Sustainable Energy, Modern Agriculture and Food Security in Rwandan universities and research institutes; (ii) Strengthen NCST's capacity in research management and fund mobilization; (iii) Foster collaboration between universities and private sectors; and (iv) Support and promote women in research and innovation.

Partnership with African Union Development Agency (AUDA-NEPAD): As part of human capital and knowledge network development, NCST and AUDA-NEPAD have a good partnership on strengthening research and innovation performance measurement systems. In 2018, NCST conducted a National R&D Survey for the 2015/2016 reference period and produced the National R&D Analysis Report. Prior to conducting the survey, AUDA-NEPAD provided technical support and capacity strengthening to NCST on the measurement of national research and innovation performance, as well as the conduct of surveys. As a continuation of this collaboration, the AUDA-NEPAD is strengthening the capabilities of NCST and stakeholders in Rwanda to use robust science, technology and innovation indicators in policy making, designing and measurement of R&D and innovation performance.

In March 2021, NCST in partnership with AUDA-NEPAD conducted one-week workshop for capacity training and stakeholder's engagement for research and innovation performance. The training aimed at engaging with stakeholders within the national R&D and innovation systems of Rwanda on sector specific R&D innovation performance measurement and mapping for improved policy response on using innovation and R&D to drive socio-economic growth.

Partnership with Global Research Collaboration for Infectious Disease Preparedness: NCST is a member of Global Research Collaboration for Infectious Disease Preparedness (GloPID-R) since July 2021. GloPID-R is a unique international network of major research funding organizations on global scale to facilitate an effective research and rapid response to infectious disease outbreak. Also, GloPID-R promotes collaboration and coordination among funders based on common goals and principles as well as identify gaps to align funding with research needs, especially in low income countries.

The aim of this NCST and GloPID-R collaboration is to collaborate on research funding for improved health systems to advance research and to address epidemics and pandemics specifically during COVID-19 crises and beyond, as well as to allow NCST and other Rwandan institutions to benefit from the global network of funding bodies.

REPUBLIC OF RWANDA
NATIONAL CONCIL FOR SCIENCE AND TECHNOLOGY

AUDA - NEPAD
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National Council for Science and Technology

Capacity Training Workshop and Stakeholders Engagement for Research & Innovation Performance Surveys
Facilitated by AUDA-NEPAD: 22-26 March 2021

Training will build Capacity to support:
Research & Experimental Development (R&D) Survey for 2018-2019 from 1st April- 31st May 2021

Dr. Esperance Munganyinka, Head of NRIF Department, NCST

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Figure 1: Keynote Speakers during 22-26 March 2021 Capacity Training Workshop Organized by NCST and AUDA-NEPAD

Partnership with Private Sector Federation (PSF): Public-private partnerships in research and innovation have been considered as key element to drive, boost and optimize collaborative research and innovation-led growth and economic development. Recognizing this and the important role of science, technology, research and innovation for social-economic transformation into a knowledge-based and service-oriented economy in Rwanda, on the 11th November 2021, the NCST has signed a Memorandum of Understanding (MoU) with the Private Sector Federation (PSF) aiming to facilitate collaboration between NCST and PSF and their stakeholders to utilize science and technology tools and research to boost small- and large-scale businesses for improved innovations and promotion of industrial development. The main goal of this NCST-PSF partnership is to promote joint collaboration aimed at strengthening science, technology and research-based innovation, specifically focusing on supporting and funding experimental R&D projects through collaborations between academia- private sector.

Among key activities of the singed MoU include to promote academia-private sector collaboration through establishment of research and innovation programs driven by knowledge transfer partnerships between academia and industry; to boost business' competitiveness and productivity through funded partnerships with academics and researchers; to jointly identify and/or connect regular forums and conferences relevant medium and large private sector industries, research institutions and other various implementers of science and technology related programs; and to co-organize and facilitate capacity building workshops, meetings and forums with academia and industries to attain measurable meaningful and reliable collaboration that aim at strengthening opportunities for increasing the proportion and quality of a continuum R&D based innovations.

Figure 2: NCST signed an MOU with PSF to Promote Academia Private Sector Collaboration to Promote R&D Based Innovations

Future partnership programs: The future partnership plan of NCST is to establish new collaborations to improve research and innovation funding and quality of research and innovation output that address societal challenges.

Partnership to establish Grand Challenges Rwanda: NCST is mobilizing a consortium of stakeholders including Bill & Melinda Gates Foundation and Science for Africa Foundation to establish Grand Challenges Rwanda Chapter that is envisaged to generate more research funding opportunities and to fund Big Ideas, Bold Minds to support research for technology development in specific priority areas.

In this regards, NCST is currently discussing with Africa Science Foundation to develop an agreement for the establishment of Grand Challenges Rwanda focusing on ground-breaking innovative research in two national priorities under the STI Policy, namely Life and Health Sciences, and Resilient Environment and Climate Change.

Potential partnership with Swedish research and innovation agencies: NCST is in discussion with Swedish research and innovation agencies including Swedish International Development Agency (Sida) and Vinnova to explore opportunities for partnership to support research and innovation in Rwanda under the theme "Strengthening Rwanda R&D and Innovation Excellence through Global Partnership" program. The overarching goal of this NCST-Sida-Vinnova partnership is to strengthen the cooperation between Rwanda-Sweden research and innovation funding institutions, and will contribute and strengthen STI and R&D excellence in Rwanda, and is considered as vital to scientific cooperation that would leverage on Rwanda's unique opportunities to leap frog the STI and R&D transformative agenda to invent, create, innovate based on the broad collaborations that would be established. Moreover, this partnership program will incentivize and promote research and innovation-led growth with the ambition to a rise from the current Rwanda R&D intensity of 0.69%[7] to at least 1% by 2024.

In order to understand what NCST is doing in terms of funding research and innovation, and explore areas of collaborations, various meetings between NCST, Sida, Vinnova and Embassy of Sweden in Rwanda have been conducted, as well as visits to researchers and innovators who are being funded by NCST and hosted by various institutions including LEAPR Labs, Rwanda Polytechnique (RP-IPRC), and the University of Rwanda.

Figure 3: Field visit at LEAPR Labs where NCST awardees are showcasing some of the fund projects to SIDA team (left) and Ambassador of Sweden in Rwanda Visit to NCST (Right)

The key areas of Sweden and Rwanda collaboration include STI funding and support systems; STI governance and research management; STI and R&D strategies for multilateral cooperation. In particular, the expected outcomes are upon strategies for collaboration between NCST and Swedish research and innovation funding entities such as agreed platform of collaboration between Rwanda and Sweden STI and R&D agencies for priority areas of joint STI and R&D funding; injected inspiration and improved experience and practice of NCST for fostering STI and R&D performance in Rwanda; and explored opportunities for multilateral cooperation for institutional capacity of national and local STI and R&D actors.

[7]Rwanda National Research and Experimental Development (R&D) Survey for 2018/2019, NCST report, October 2021 https://www.ncst.gov.rw/fileadmin/user_upload/NCST/Publications/Reports/Report_2018-19_R_D_Survey.pdf

Strengthening Research and Technology Development: Awarding the Best Innovative Researchers

Dr. Japhet Niyobuhungiro[1], Dr. Didacienne Mukanyiligira[2], and Mr. Florent Uwacu[3]

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Background: As a nation with limited natural resources yet devoted to human resources development, Rwanda continues to benchmark from developed countries to consistently focus on leveraging its human capital and build an effective National Innovation System (NIS)[8]. The current focus is on innovation, creativity, and research to contribute to country's economic growth and the larger base to become a global knowledge economy.

Rwanda's NIS has reached the interface between the incipient and maturing level of development of a NIS. Indeed, substantial efforts have been put in place to primarily support production and management capabilities in incipient NIS including Building managerial and organizational capabilities, initiation of collaborative projects, development of STEM skills and engineering, building R&D infrastructure, and elimination of barriers to physical, human, and knowledge capital.

Before the country can start to expand the support to invention and technology-generation capabilities, there is a need to continue increasing the focus on supporting technology adoption and imitation capabilities which are characteristics in a maturing NIS. These include building technological capabilities, link industry and academia, improve the quality and relevance of research, and incentivizing R&D projects and researchers.

Rationale for incentivizing best researchers and innovators: In order to build research and technology development quality, there is a need to build and strengthen excellence in research and technology development to create opportunities for innovations to flourish. The goal is to incentivize and nurture unique scientific research efforts to catalyze the growing potential of diverse intellectual outcome. The program continues to enhance collaborations, harnesses vibrant scientific contributions towards technology development and innovation for Rwanda. Strengthening excellence requires support to researchers and innovators to growth their professional career path, to build research capacity and advance research activities in collaboration with national and global partners. This increases their professional career growth through short-term training, research work, capacity building through skills training, conference attendance, product or service development or prototyping and publications.

Awarding the best innovative researchers as part of creating incentives for researchers to develop new technologies and to create and adapt innovations that benefit industries is very important and will enable Rwanda to take advantage of local innovation. In fact, providing awards and prizes to recognize and reward research of outstanding quality can boost researcher's confidence, broaden their connections and collaborations, and increase their research visibility and impact. Moreover, it is one way of motivating young researchers and innovators.

The National Council for Science and Technology Research Awards 2022: The National Council for Science and Technology (NCST) and its stakeholders, namely the University of Rwanda (UR), Rwanda Biomedical Center (RBC), University of Global Health Equity (UGHE), Carnegie Mellon University Africa (CMU Africa), Af-

[8]National Innovation System (NIS) is hereby defined as a network of Rwanda's public and private research and technology development institutions working together through their leaders, scientists, researchers and innovators to provide a framework within which the government form and implement policies that ensure constant collaborations to initiate and implement research and technology development efforts for diffusion of new technologies (create, store and transfer the knowledge, skills and artefacts of new technologies) to influence the innovation process to result into high innovative performance of national firms.

rican Institute of Mathematical Sciences (AIMS), Private Sector Federation (PSF) have organized the 1st Rwanda Science, Technology and Innovation Conference 2022. The conference took place at the Kigali Convention Center (KCC) from March 31st to April 1st 2022 under the theme "Leveraging the Potential of Science and Technology to Mitigate Challenges Associated with COVID19 pandemic in Developing Countries". This conference aimed to provide a platform for science, technology, and innovation's players from all over the world to deliberate on technologically innovative efforts underway as humanitarian responses to the COVID-19 pandemic.

One of the expected outcomes from the conference was to award best researchers in the category of:
Distinguished Research Achievement Award, Best Female Scientist Award, Distinguished Science and Technology Award, and Rising Star Award. The awarding ceremony was conducted in partnership with MasterCard Foundation.

Distinguished Research Achievement Award:

The Distinguished Research Award aims to recognize a researcher's contribution to their field of Science, especially considering the recent developments in the field. Candidates are required to provide citations from a specified academic publishing database. There are no age restrictions.
Dr. Mpirimbanyi obtained Distinguished Research Achievement Award for the quality and oral presentation of his research entitled, "Impact of COVID-19 on Surgical Care in Rwanda".

Dr. Christophe Mpirimbanyi is a consultant General Surgeon with more than 4 years of practice as a general surgeon, and experience in managing elective and emergency (both trauma and non-trauma) surgical patients.

Dr. Mpirimbanyi and his colleagues have studied the impact of COVID-19 pandemic on Surgical Care in Rwanda, and have provided critical information on how COVID-19 pandemic has affected surgical care delivery in Rwanda. Their findings suggest commendable resilience of surgery systems specifically outpatient services. Additionally, these data provide critical information on how surgical care providers will in the future collaborate with other healthcare providers to assess preparedness of any pandemic or infectious disease outbreak on surgical care delivery in Rwanda. Dr. Mpirimbanyi has implemented various research studies, presented at various conferences and published on trauma, patients' outcomes of care and surgical delivery with over 20 manuscripts in international journals, particularly emergency surgery either as the main author or co-author.

In terms of contribution to science, Dr. Mpirimbanyi studies have contributed to significant impact on surgical care and outcomes focusing on surgical infection, delivery of emergency general surgery for both traumatic and non-traumatic patients, and surgical outcomes determining gaps in care delivery and bridging surgical care delivery gaps. His studies on

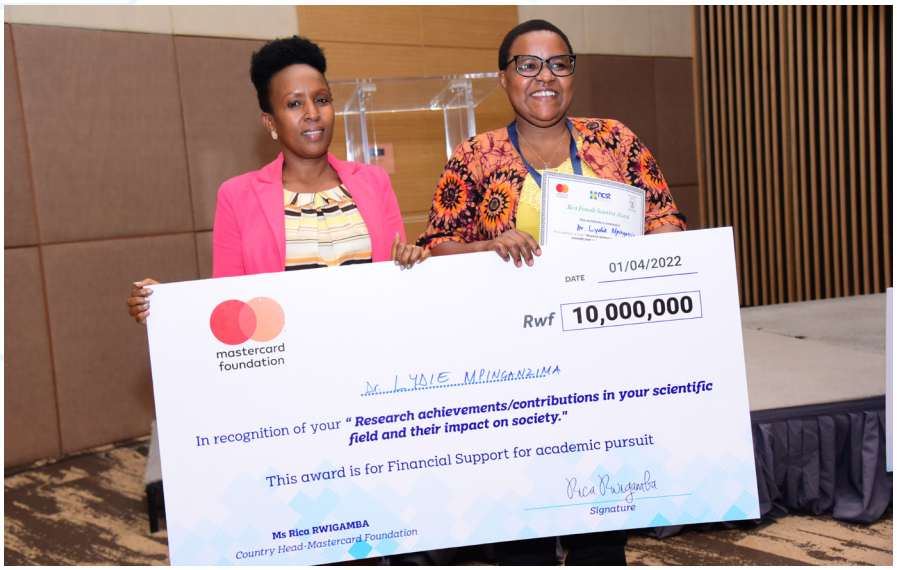
surgical infections highlight how comorbidities constitute the risk factors for adverse outcomes if multidisciplinary preventive measures are not taken.

Additionally, Dr. Mpirimbanyi has contributed to health system strengthening and access to care through his studies describing the emergency general surgery care at district hospitals, from which he co-authored manuscripts estimating the cost of laparotomy for patients with acute abdomen conditions at Rwandan district hospitals and led studies describing delays in general surgery patients and other factors. These studies have highlighted the need for improved access to general surgery near rural population to improve surgical care for majority of citizens. Dr. Mpirimbanyi is the current Secretary General of Rwanda Surgical Society, and has professional leadership and management skills gained during his training and practice where he occupied different leadership positions. The award was granted by NCST.

Best Female Scientist Award:

The Best Female Scientist Award aims to recognize a female scientist for her research achievements/contributions in her scientific field and their impact on society. This award is given to a woman who is a leader in her field, and whose research outputs and productivity are widely recognized, has published in indexed and internationally recognized journals, and has made a significant impact. There is no age constraint regarding the candidate.

Dr. Mpinganzima received the Best Female Scientist Award for the quality and oral presentation of his research entitled, "Compartmental Mathematical Modelling of Dynamic Transmissions of COVID-19 in Rwanda".



Dr. Lydie Mpinganzima is a senior lecturer in the Department of Mathematics, at the University of Rwanda. During her PhD studies, she developed various iterative methods for solving the Cauchy problem for the Helmholtz equation, and the later has applications related to the wave propagations. Through her research on "Numerical Analysis of nanophotonics" she obtained a postdoctoral position from the Gothenburg University and the Chalmers University of Technology, Sweden in 2016.

Dr. Mpinganzima and her colleagues have developed a mathematical modelling framework for predicting and monitoring the COVID-19 pandemic in Rwanda. Their findings suggest that developed models have the potential to help in understanding the disease transmission dynamics, as well as give insights into the effectiveness of control strategies by providing forecasts of the disease burden on the country and hence provide insights into policy decision making.

Additionally, Dr. Mpinganzima and her research team have a plan to connect the developed models to existing database through a well-designed App to automate data processing and produce a dashboard to allow quick actions from healthcare authorities. The model has the potential to be adapted for other epidemics and infectious diseases.

[9]https://scholar.google.com/citations?user=af2GJwkAAAAJ&hl=en

She has extraordinary research achievements and contributions to Mathematics and Applied Mathematics, including her widely recognized research outputs, her publications in indexed and internationally recognized journals, including Inverse Problems in Science and Engineering, Computers and Mathematics with Applications, International Journal of Mathematical Modelling and Numerical Optimization, and Transactions of the Institute of Measurement and Control. Moreover, she has made several presentations at conferences[9] .

The significant impact she has had in her field, includes:

- Contribution to quality of teaching: Driven to help students understand mathematics and its applications in their fields of study; Mentor junior staffs in teaching mathematics.
- Scientific impact: (i) Research project "Mathematical modeling of cardiovascular-respiratory system for sportsmen and patients in Rwanda", Contribution on analyzing the impact of physical activities on reducing cardio-vascular diseases. (ii) Research project: "Numerical Analysis of nano-photonics", Contribution on the design of metamaterials. (iii) Current research project: "Predicting and monitoring the impact of Covid-19 pandemic in Rwanda"
- Community outreach activities Mentorship: (i) Participation in mentorship activities aiming to increase the number of girls and women in basic sciences through EANWoBAS (Eastern Africa Network of Women in Basic Science) and RAWISE. (ii) Organization of workshop aiming to encourage young female scientists. (iii) Contribution to international mathematics day (Pi-Day) and preparation secondary students to PAMO (Pan African Mathematics Olympiads). This award was granted by MasterCard Foundation.

Distinguished Science and Technology Award:

The Distinguished Science and Technology Award recognizes individuals whose research roles contribute to solutions related to global challenges such as the acceleration of new technologies. Their research and innovation outputs include creation of tangible products, prototypes, etc. Moreover, these individuals are leaders who embody, encourage, and promote the inclusion of young people, as well as inspire others to pursue and persist in technical careers. There is no age constraint regarding the candidate.

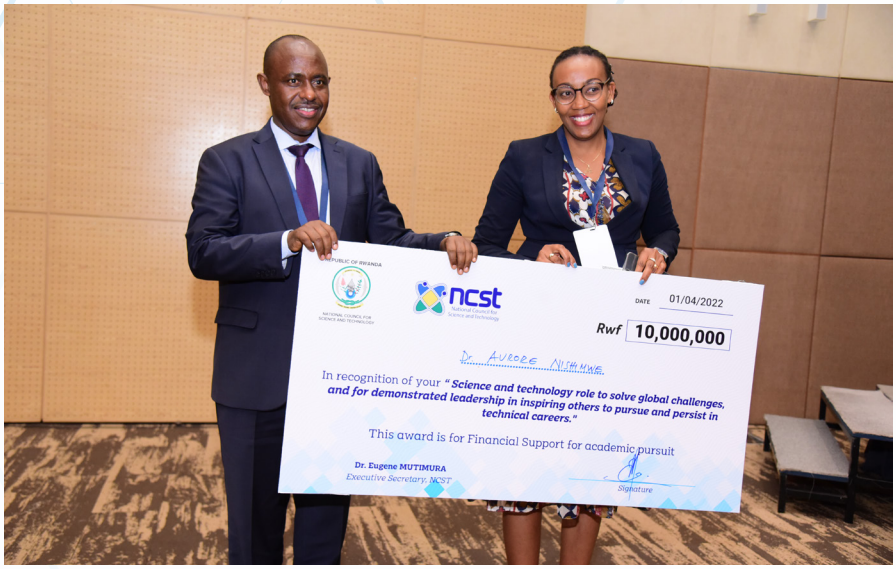
Dr. Nishimwe Aurore obtained Distinguished Science and Technology Award for the quality and oral presentation of her research entitled, "Leveraging Artificial Intelligence and Data Science Techniques in Harmonizing, Sharing, Accessing and Analyzing SARS-COV-2/COVID-19 Data in Rwanda (LAISDAR Project)".

Dr. Aurore Nishimwe is a researcher and Lecturer in Health Informatics, College of Medicine and Health Sciences, University of Rwanda. Dr. Nishimwe holds a PhD degree in Public Health specialization in E-Health Implementation Research from University of Witwatersrand, South Africa. Her areas of research interests include public health implementation research, e-Health such as telemedicine and health informatics.

Dr. Nishimwe and her colleagues are conducting this study to leverage the artificial intelligence (AI) and data science techniques in harmonizing datasets to support Rwandan government needs in monitoring and predicting the COVID-19 burden, including on hospital admissions and overall infection rates. The project gathers the existing data including hospital electronic health records (EHRs), the COVID-19 testing data and link with longitudinal data from community surveys. An open source tools from Observational Health Data Sciences and Informatics (OHDSI) is being used to harmonize hospital EHRs through the Observational Medical Outcomes Partnership (OMOP) Common Data Model (CDM). The ultimate project outcome is the dynamic prediction modelling for

[10]https://orcid.org/0000-0002-8019-2561

COVID-19 pandemic in Rwanda. In terms of contribution to science, Dr Nishimwe has published a number of scientific articles in global peer-reviewed journals such as in Informatics for health and Social Care, Human Resources for Health and Global heart, and has served as a reviewer of scientific journal and has presented at national and international conferences[10] Dr. Nishimwe is a member of different professional bodies such as International Medical Informatics Associations (IMIA), International Society for Telemedicine and e-Health (ISfTeH), and Corporate member of Rwanda Health Informatics Organizations (RIO). Also, Dr. Nishimwe is One Health fellow under the One Health Fellowship collaborative project between Tufts University, University of Global Health Equity and University of Rwanda, which is funded by the Cummings Foundation. In addition, Dr. Nishimwe developed and implemented a mentorship program, "The women in Science Initiative (WIS)" in partnership with RAWISE. The WIS aimed at inspiring future young female scientists by raising awareness of opportunities for science-based careers in Rwanda.



Rising Star Award:

The Rising Star Award is awarded to early-career researchers who have held a PhD/Master's degree no more than 5 years at the time of the award, and who have already produced important work. The award aims therefore to contribute to their recognition and provide them with the means to continue their commitment to science with energy and passion. This award is given to a young scientist under 40 years for men and 45 years for women for his/her innovation in creating a physical or tangible solution or theoretical work, contributing to science and useful for the society.

Dr. Yongabo obtained Rising Star Scientist Award for the quality and oral presentation of his research entitled, "COVID-19 and science systems in Africa: an opportunity to build forward better".

Dr. Yongabo Parfait is a researcher and lecturer at the University of Rwanda, and the Program Impact Lead for the MasterCard Scholars Program at the University of Rwanda. Dr. Yongabo holds a PhD Degree in Research Policy from Lund University, Sweden with a specialization in Research and Innovation Management. His research interest is in innovation studies, policy analysis, knowledge systems analysis and research impact evaluation.

Dr. Yongabo study provides more insights on the role that science granting councils (SGCs) in Africa in supporting science, technology and innovation ecosystems prior to, during and in the recovery phase of the COVID-19 pandemic. The findings highlight the need for rethinking how and where decisions are made on where to spend funding for research, especially public funding, which can play a critical role in responsiveness and resilience to crises such as COVID-19 pandemic.

In terms of contribution to science, Dr Yongabo has contributed to the development of research policy, innovation man-

[11]https://scholar.google.com/citations?user=AQSD7I0AAAAJ&hl=en

agement, technology transfer and entrepreneurship at the University of Rwanda. He has been involved in local and international collaborative research projects with several institutions such as FAO, Sida, Belspo, EU-JRC unit, University College London and University of Johannesburg; and contributed to the development and operationalization of policy instruments for knowledge-based development to promote on the Rwandan agriculture innovation system.

Dr Yongabo published a number of scholarly works in the form conferences, scientific and technical reports and high impact scientific journals such as Tylor and Francis and Springer. either as the main author or co-author[11] . He was awarded by the International Association for Great Lakes Research (IAGLR, Canada) as an outstanding young researcher in 2014 and he was awarded by the Rwanda Innovation Endowment Fund in 2015 as a young researcher with an innovative project to address

the community problems. The awarded project was on value addition for fisheries products in Rwanda as a means to fight malnutrition. In the same line of research entrepreneurship, he was nominated among the 11 African young entrepreneurs from Rwanda by the RUFORUM.

Awarding ceremony: Each award includes a certificate and a ten million Rwanda Francs (10 million RWF) prize which will be utilized as eight million Rwanda Francs (8 million RWF) for funding a project for the awardee's professional career development and other academic pursuit, while two million Rwanda Francs (2 million RWF) will be utilized for the management and logistical support to implement the project. The career development may include but not limited to facilitation for a specified relevant research training, support contributing to publications, conference registration and attendance, air ticket and hotel and others. The awardees have been informed of and have agreed to follow the monitoring framework established by the National Council for Science and Technology (NCST). The awarding ceremony was officiated by the Hon. Minister of Education and Co-Chair of NCST Council, Dr. Valentine Uwamariya, who handed the Distinguished Research Achievement Award to Dr. Christophe Mpirimbanyi. The Distinguished Science and Technology Award was given to Dr. Aurore Nishimwe by the Executive Secretary of NCST, Dr. Eugene Mutimura.

The Best Female Scientist Award and the Rising Star Award have been handed to Dr. Lydie Mpinganzima and Dr. Parfait Yongabo respectively by the Program Partner at MasterCard Foundation Ms. Ruth Mukakimenyi.

Furthermore, the awarding ceremony was graced by several guests of honor including Vice Chancellors of universities, and Director General of government institutions.

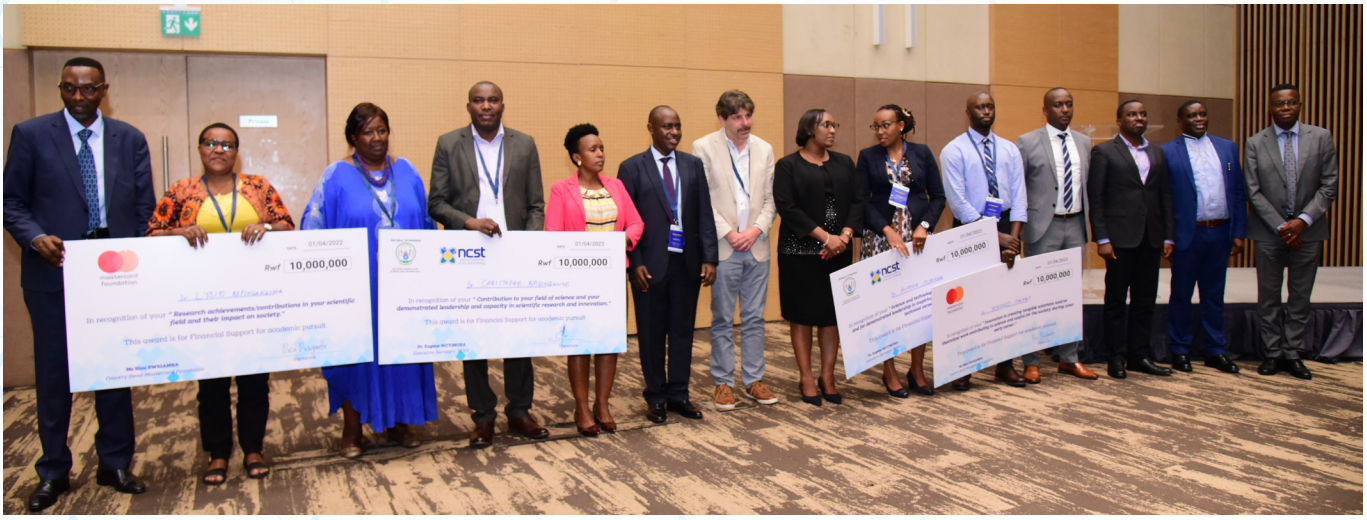


Photo of all awardees with guests of honor. (Left to Right): Dr. Christian B. Sekomo (DG NIRDA); Prof. Agnes Binagwaho (VC UGHE); MS. Ruth Mukakimenyi (Program Partner at MasterCard Foundation).; Dr. Eugene Mutimura (ES NCST); Prof. David Kelvin (Professor at Dalhousie University Canada); Dr. Valentine Uwamariya (Hon. Minister of Education and Co-Chair of NCST Council); Prof. Claude M. Muvunyi (DG RBC); Dr. Patrick Karangwa (DG RAB); Fr. Dr. Fabien Hegenimana (VC INES Ruhengeri); Prof. Sam Yala (Center President AIMS Rwanda).

Conclusions and recommendations: Incentivizing researchers plays a big role in encouraging innovation and it should be part of transforming Rwanda's universities. Universities should have awards and incentives in place for publication, providing researchers who publish with additional resources for research. In countries such as South Korea, encouraging researchers to publish innovative research has been a key part of the strategy for developing a world-class tertiary education[12] . In the particular Rwandan context, there is a need to encourage researchers to adapt existing innovations to the Rwandan context, in order to have impact on the community.

In addition, as highlighted[13] in high-income countries, the private firms play a big role in incentivizing research and innovation through financing universities' research to solve industrial production challenges. The private sector can effectively advocate for research and technology development through for example: Encouraging business enterprise entities to actively participate in activities relating to intraregional research and transfer of technology; Support to public research and innovation and its transfer to local businesses; Support and promote R&D based waste management techniques and recycling technologies; Support Science and technology interventions to promote value addition in various channels of export commodities and the Made in Rwanda programme.

However, given the nascent status[14] of the private sector in Rwanda, the government will have to continue to play a leading role to: Strengthen NIS through continuous human capital, institutional, and organizational capacity building; Improving quality of scientific research and fostering R&D excellence; Providing incentives for private sector to perform and invest into R&D; in collaboration with all stakeholders, strengthen regional and international collaborations in R&D through private-public dialogue (PPD).

[12]Lee, S.J., Jung, H. (2021). Higher Education in the National Research System in South Korea. In: Aarrevaara, T., Finkelstein, M., Jones, G.A., Jung, J. (eds) Universities in the Knowledge Society. The Changing Academy – The Changing Academic Profession in International Comparative Perspective, vol 22. Springer, Cham. https://doi.org/10.1007/978-3-030-76579-8_9

[13]World Bank and Government of Rwanda. 2020. Future Drivers of Growth in Rwanda: Innovation, Integration, Agglomeration, and Competition. Washington, DC: World Bank. doi:10.1596/978-1-4648-1280-4

[14]Business and Investment Climate Survey 2019