



# Strengthening Research and Development Through Partnerships

NCST Quarterly Newsletter - Issue No: 005 September 2022

**PREAMBLE:** Science, Technology, Research play a key role to the development of Rwandan society. They provide fundamental tools for transformation of wealth creation and improved quality of life and economic growth of society. This newsletter highlights the forthcoming engagement with Rwandan researchers in diaspora. It also presents the rationale on the Research and Innovation Mobility (RIM) Grant as a tool to improve R&D and an initiation of strategic partnerships with the East African Science & Technology Commission (EASTECO) and the Embassy of Israel in Rwanda. It also pinpoints two interventions: one by Amb. Dr. Diane Gashumba at the Development Research Conference (DevRes2022) in Uppsala, Sweden and NCST contribution during UN High-Level Political Forum 2022 on Sustainable Development on 12<sup>th</sup> July 2022.

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**Dr. Jack Ngarambe**  
Kyung Hee University  
in South Korea.



**Mr. Alain Patrick Ndengera**  
Consultant in Quebec  
Canada



**Dr. Jimmy Nsenga**  
Software Tech  
Architect in Belgium



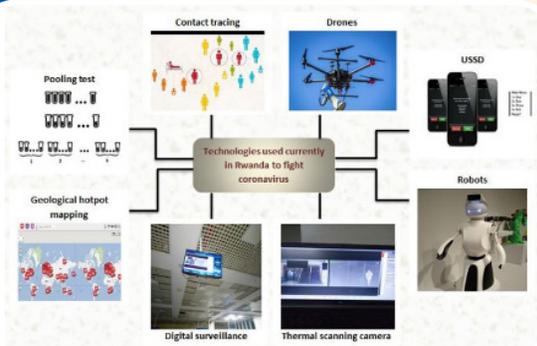
**Dr. Joseph Hategekimana**  
University of Turku in  
Finland



**Dr. Maxima Binama**  
Harbin Institute of  
Technology (HIT),  
China



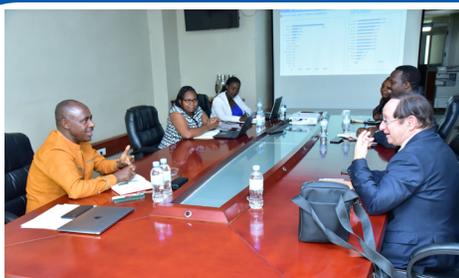
## ENGAGING RWANDAN DIASPORA SCIENTISTS



Technology tools used to address Covid-19



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Establishing Partnerships with Embassy of Israel:  
Meeting H.E Dr. Ron Adam



Meeting by the Executive Secretary of NCST and Executive Secretary of  
EASTECO at EASTECO

# Engaging Rwandan Diaspora to Strengthen Technology and Innovation Growth

Eugene Mutimura<sup>1</sup>, Jack Ngarambe<sup>2</sup>, Jimmy Nsenga<sup>3</sup>, Joseph Hategekimana<sup>4</sup>

Alain Patrick Ndengera<sup>5</sup>, and Maxima Binama<sup>6</sup>

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<sup>6</sup>Lecture at Harbin Institute of Technology (HIT), China

**BACKGROUND:** Diaspora communities are populations from a given nation living abroad and having ties and exchanges of various types with the community both in their native and destination countries<sup>1</sup>. As many global diasporas, Rwandan Community Abroad (RCA) in this bulletin denoted as "Rwandan Diaspora" have powerful sources of external potential to contribute to Rwanda's National Innovation System (NIS) development. In this bulletin, NIS refers to a continuum of technology and innovation flow: research and development (R&D), technology development and validation, and technology principles proven into actual system in operational environment. Thus, NIS may include creative enterprises and institutions such as universities and research institutions at national level, and an interconnected system of infrastructure and collaborations that create and transfer knowledge and skills that evolve with new technologies. On 16<sup>th</sup> March 2022, through the facilitation of the Ministry of Foreign Affairs and International Cooperation (MINAFFET), National Council for Science and Technology (NCST) held a virtual meeting with leaders of RCA to examine and

develop a strategy for collaborations with scientists, researchers, innovators, tech investors and philanthropists to contribute and strengthen NIS excellence in Rwanda.

**RATIONALE:** Diaspora communities have high potential to enhance broad collaborations including in the areas of NIS strengthening application and diffusion of technology, R&D programs, skills development, and contribution to overall industrial and economic growth. Our goal is to continue to engage and scale up collaborative opportunities with Rwandan Diaspora, specifically engaging renowned scientists, researchers, innovators, tech investors and philanthropists to strengthen partnerships and leverage science, technology and innovation (STI) and R&D programs performance. This shall improve human scientific capacity in national institutions and contribute to innovation growth. Of note, some diaspora communities have had large share of their countries' economic growth. New Zealand's diaspora has grown markedly in recent decades to one of the largest compared to general population. In 2016, the New Zealand diaspora was 13.5% of the national pop-

ulation and had the 3<sup>rd</sup> highest share of economic growth among the Organization for Economic Co-operation and Development (OECD) countries. This highlights the potential for broadening collaborations in the application and diffusion of technology in Rwanda. It has been observed that Diaspora communities support long-term economic growth of their nations<sup>2</sup>. They contribute 0.6% to the economy of emerging and developing countries, with a high potential for sub-Saharan Africa.

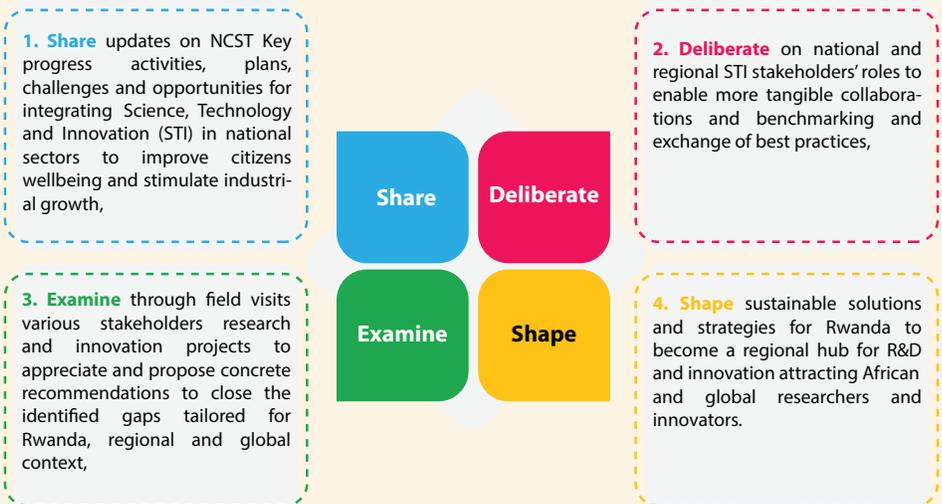
**CONTEXT:** In March 2022, a meeting took place with Rwandan Diaspora as part of NCST efforts to broaden collaborations in the areas of STI. This is aligned to the STI Policy (June 2020) under objective 2: **Increased Scientific and Technology Output**. This objective has a strategy that highlights the need of engaging STI and R&D Rwandan diaspora through "**Strengthening the cooperation with the Diaspora and International scientists and innovators**". One of the recommendations of the March 2022 meeting was to: a) establish a platform of profiles of education, place of work, expertise and areas of interest for STI and R&D for scientists,

<sup>1</sup>Taslakian et al., 2022 Global Health Action Vol 15, 2009165 <https://doi.org/10.1080/16549716.2021.2009165>

<sup>2</sup>How Diasporas Can Boost Home-Country Growth by Pritha Mitra et al 2016 accessed on 23rd August 2022 at <https://blogs.imf.org/2016/05/18/addition-by-subtraction-how-diasporas-can-boost-home-country-growth/>

researchers and innovators from RCA; and b) to invite scientists, researchers and innovators from RCA for a visit in Rwanda to discuss STI and R&D progress and opportunities both in Rwanda and globally through conferences, workshops and seminars.

Therefore, on 3-7<sup>th</sup> October 2022, NCST will host several field visits and symposium as a preliminary engagement of 5 Rwandans from Diaspora.



**Figure 1.** Main objectives of the NCST-Rwandan Diaspora collaboration in technology and Innovation for Development

The latter are expected to be a springboard for more interactive collaborations with broader RCA. Among the 5 invited Rwandans from Diaspora, two will also provide public lectures at symposiums and participate in networking workshops with NCST Council Members on 6-7<sup>th</sup> October 2022. The October 2022 Diaspora symposium goals are elaborated in Figure 1.

**PRELIMINARY ENGAGEMENT:** The 3-7<sup>th</sup> October 2022 program shall include the 5 selected Rwandans from Diaspora namely Dr. Jack Ngarambe (South Korea), Mr. Alain Patrick Ndengera (Canada), Dr. Jimmy Nsenga (Belgium), Dr. Joseph Hategekimana (Finland) and Dr. Maxima Binama (China) who will participate in field visits at selected Rwanda technology and innovation infrastructures.

<p><b>Dr. Jack Ngarambe</b> Kyung Hee University in South Korea.</p>  <p><b>Dr. Ngarambe</b> is an architectural engineer at Kyung Hee University in South Korea with interests in urbanization, energy poverty, data-driven machine learning to improve the energy performance of cities and communities.</p>	<p><b>Mr. Alain Patrick Ndengera</b> Consultant in Quebec Canada</p>  <p><b>Mr. Ndengera</b> is a computer scientist in software development, enabling software security (security planning, designing software architecture, maintaining security of software and source code review, penetration testing).</p>	<p><b>Dr. Jimmy Nsenga</b> Software Tech Architect in Belgium</p>  <p><b>Dr. Nsenga</b> is a Senior Software Tech Lead/Architect and Research Scientist interested in emerging tech-driven projects, managing, designing and developing (IoT) software and systems, and coordinating the technology transfer to end-user companies.</p>	<p><b>Dr. Joseph Hategekimana</b> University of Turku in Finland</p>  <p><b>Dr. Hategekimana</b> is researcher in Food Biotechnology, Engineering, Food Processing, and Safety. Founder of Guhaha Ltd, a B2C and C2C E-commerce platform in Rwanda, and co-founder of Hills Connect Oy based in Finland.</p>	<p><b>Dr. Maxima Binama</b> Harbin Institute of Technology (HIT), China</p>  <p><b>Dr. Binama</b> works has research and teaching roles in performance analysis and optimization of hydraulic machinery and application to hydroelectric energy generation technologies. Has studied and published in thermophysics of Thermofluids in energy systems.</p>
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## LOOKING INTO THE FUTURE

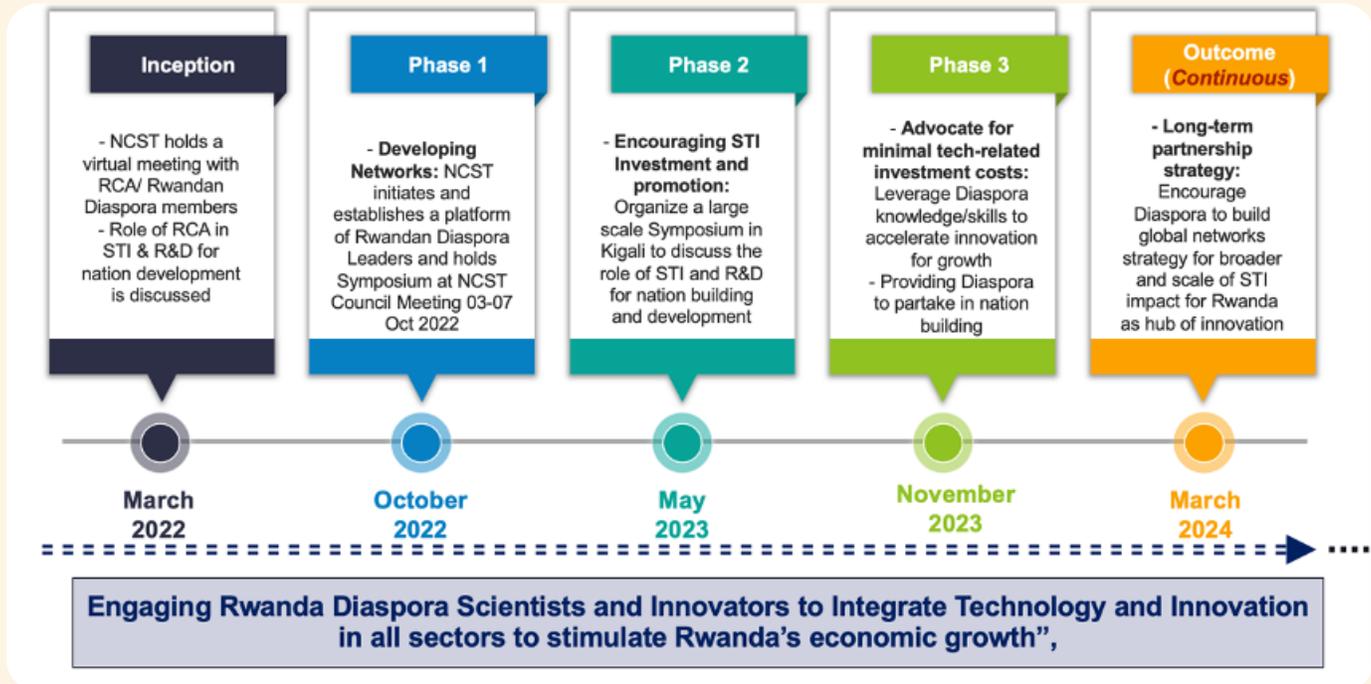


Figure 2. Looking into the Future: Timeline of NCST-Rwandan Diaspora collaboration agenda

We are looking forward to developing broader collaborations with a wider network of scientists and innovators from Rwanda Diaspora in areas of science, application of technology and innovation (Figure 2). This shall be a springboard to trigger and stimulate an evolution of Rwandan diaspora-led broad array of R&D outcomes and innovations. Our goal is that Rwanda's development is anchored by industrial growth based on technology, and a regional African hub of scientific and knowledge-led economy through:

**a. Developing networks:** Our goal is to develop and strengthen essential networks for deepening building partnerships through communication that enables tangible research and technology application with Rwanda Diaspora in the field of science, technology and innovation (STI).

**b. Encouraging investment:** We will encourage and support Rwandan Diaspora investment in the areas of technology and innovation growth such as collaboration research and development (R&D), application of novel technology developed in high-income countries.

**c. Reducing technology-related investment costs:** We will provide advocacy to Rwandan Diaspora, their collaborators, innovators, investors and philanthropists who intend to invest in R&D and technology development projects. These may include grant schemes, prototypes, private sector investor in any application and diffusion of technology. This shall also include improving infrastructure for R&D, shared core resources, removing any barriers encouraging and fostering market on technology proof of concepts in Rwanda.

**d. A strong partnership strategy:** We will continue to provide key progress on technology development to advance novel innovations to improve citizens wellbeing and stimulate industrial growth. Through Rwanda Diaspora networks, we will engage and mobilize elites and their leaders to encourage collaborative projects to close the identified technology gaps in Rwanda, and also ensure regional and global context partnerships such as attracting African and global researchers for Rwanda to become a regional hub for R&D and innovation.

The long-term goal is to attract more diaspora, strong and high-end collaborations with an array of opportunities so that Rwanda becomes a hub for broader technology investment now and in the future.

# Cooperation in Science, Technology and Innovation (STI): Partnership with EASTECO and Israel to Strengthen STI and R&D in Rwanda

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**BACKGROUND:** Engaging in a strategic partnership is an important response to some of the issues affecting the scientific and technological world, including restrictions in policies, and inadequacy in coordinating networks of innovators and researchers. The National Council for Science and Technology (NCST) was created in that spirit with the mandate, among others, to cooperate and collaborate with other advanced regional and international institutions of

excellence with similar mandate.

Partnership may be informal or formal. A partnership is informal when there is no signed agreement but there is a collaboration between two or more institutions whereby, they jointly implement activities agreed on. As for the formal partnership, there is an established and signed collaboration agreement between two or more institutions. In this form of partnership, institutions are abided by the signed

agreement. However, before establishing a formal agreement, there is a need for an initiation process between institutions willing to partner by signing the agreement as a proof that they have a common interest.

In this regard, NCST has recently initiated strategic partnerships with the East African Science and Technology Commission (EASTECO) and the Embassy of Israel in Rwanda.

## EAST AFRICAN SCIENCE AND TECHNOLOGY COMMISSION (EASTECO)

Established as an institution of the East African Community (EAC) by the Summit of the EAC Heads of States in 2007 and operational in Kigali since 2015, its objective is to promote and coordinate the development, management and application of Science and Technology in EAC Partner States to support socio-economic development, and regional integration to increase investment in STI as key drivers and

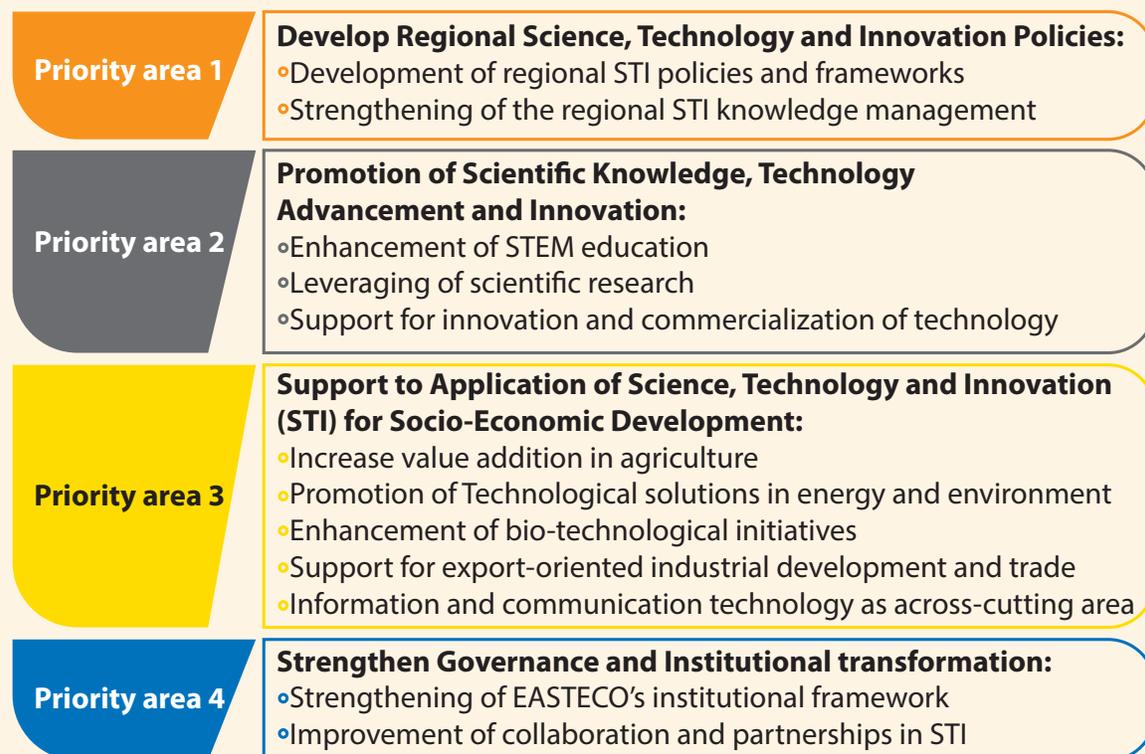


Figure 1. Four EASTECO Strategic Priority areas

enablers of sustainable regional development and socio-economic transformation, as well as creating an enabling environment for their application. In compliance with 6<sup>th</sup> EAC Development Strategy, 2022-27 and EASTECO Strategic Plan 2022-2027, EASTECO Activities cover

the above mentioned Strategic Priority areas (Figure 1). Obviously, EASTECO and NCST have a common mission of strengthening cooperation in scientific research, technology development and innovation. Both institutions acknowledge the critical role played by STI in

addressing Sustainable Development Goals and in economic growth and recognize the need to execute specific collaborative activities to promote the development, dissemination and application of STI for a better life of EAC citizens.

## EMBASSY OF ISRAEL IN RWANDA

Science and Technology in Israel is one of the country's most developed sectors. This state of the art has led the country to becoming a pioneer in technologies, profitable business opportunities, and high investments return. Therefore, renowned companies such as Tata and Citi bank just to mention a few, have established innovation centers in Israel. This was achieved because the Government supported and invested in Israel's innovation ecosystem and became the world's 2<sup>nd</sup> highest R&D expenditure as a percent of GDP (4.3%) in 2015. The following was the strength of Israel's focus: Highly innovative companies operating in the country; Strong R&D capabilities; Educated and skilled workforce; Government Support; Investment Support; and a

Flexible, Creative Economy. Israel is sharing its experience and supporting the advancement of Science and Technology through its Embassies in various countries, where, Israel has currently established many STEM centers in Ethiopia, South Soudan, Kenya and Rwanda.

The Embassy of Israel in Rwanda has initiated activities to support in the area of Science and Technology where, currently, the Embassy of Israel in Rwanda has funded the implementation of STEM Power Lab located at the University of Rwanda with the purpose to strengthen Mathematics and Science education by introducing hands on enrichment program in Science, Technology, Engineering and Mathematics disciplines for pre

University youth. This hub will enable youth to become innovators and researchers at early age.

On the other hands, Rwanda has made significant progress, and continues to develop its institutional policies and infrastructure for improved R&D productivity to drive industrial growth and citizens wellbeing. A cooperation between Israel and Rwanda shall strengthen application of science and technology and improve innovation to leverage Rwanda's vision 2050 to become a high-income economy.

Therefore, there is a strong need for NCST to learn and benchmark from the innovation ecosystem of Israel.

## AREAS OF PARTNERSHIP WITH EASTCO AND EMBASSY OF ISRAEL IN RWANDA

**Ongoing activities with EASTCO:** For partnership initiation with EASTECO, several meetings have been conducted including the recent meeting that took place on 18<sup>th</sup> July 2022 at EASTECO premises in Kigali (Figure 2). The purpose of the meeting was to examine opportunities for collaboration and strengthen partnerships to promote ap-

plication of STI in Rwanda and the EAC region. The discussion focused on sharing updates on Key Achievements by EASTECO, sharing updates on Key Achievements by NCST, examining areas of partnerships to advance STI in Rwanda and EAC region, and shaping sustainable opportunities in STI for mutual collaboration.



*Figure 2. Meeting co-chaired by the Executive Secretary of NCST and Executive Secretary of EASTECO at EASTECO premises*

Both institutions have already identified possible areas and the form of cooperation. The main areas of cooperation under this partnership will include but not be limited to promotion and coordination of the development, management and application of science technology and innovation applicable in the following forms:

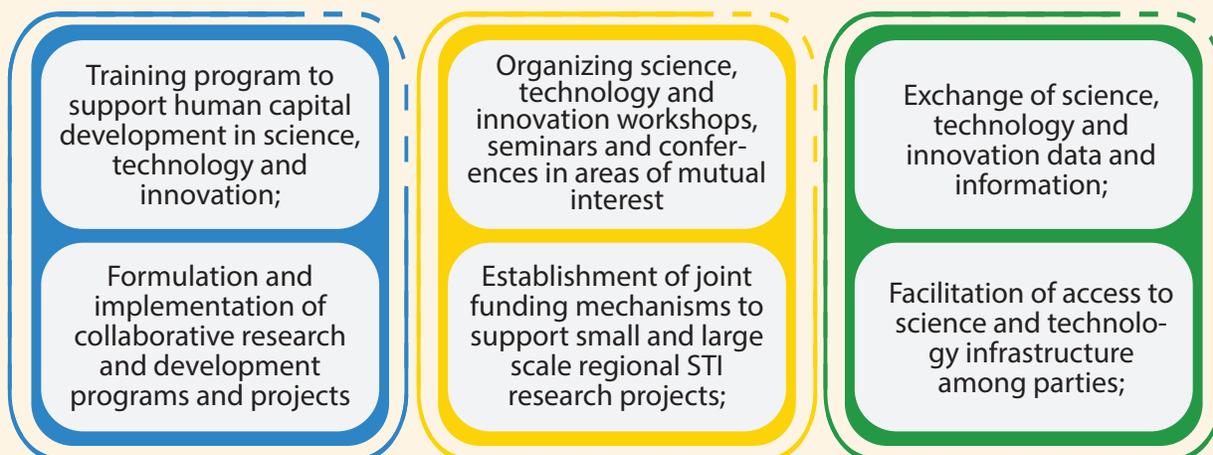


Figure 3. The main areas of cooperation between EASTECO and NCST

**Ongoing activities with Embassy of Israel in Rwanda:** On 20<sup>th</sup> July 2022, a meeting was conducted between NCST staff and H.E. Amb. Dr Ron ADAM with Mr. Espoir Serukiza Economic Advisor, Embassy of Israel in Rwanda. The meeting was co-chaired by H.E. Amb. Dr. Ron ADAM and Executive Secretary

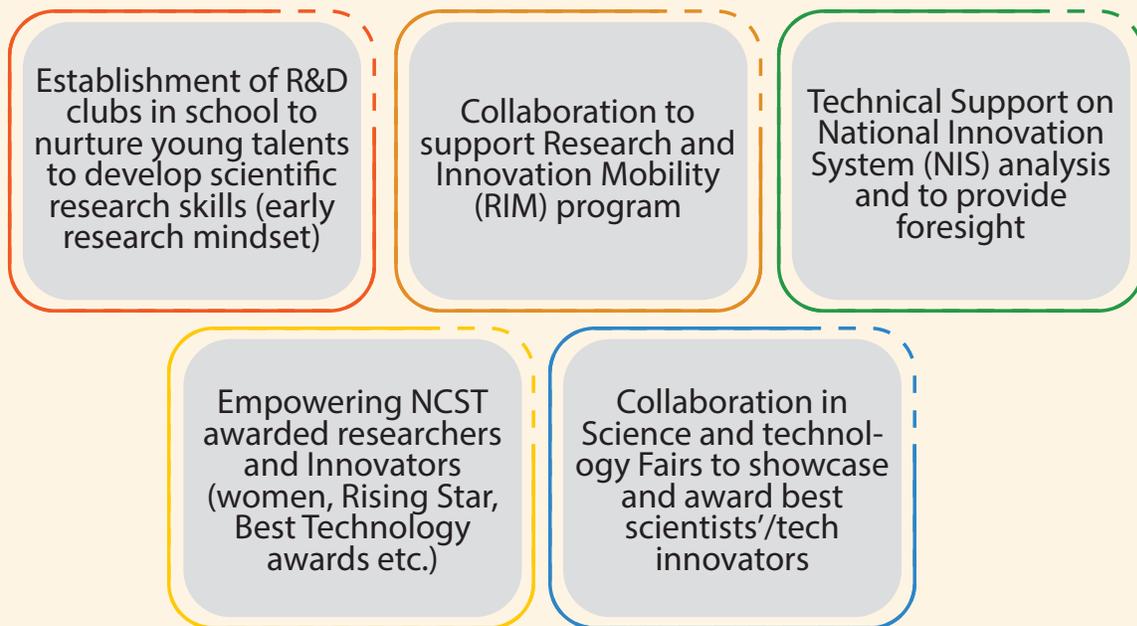
of NCST Dr. Eugene Mutimura. The goal of this meeting was to solidify the cooperation in application of STI for Rwanda development, specifically leading to high-quality livelihoods of citizens and industrial growth. The meeting focused on mechanisms of cooperation to improve R&D efficiency to develop prod-

ucts and services, create jobs and enhance entrepreneurship. In short, the meeting explored areas of cooperation between Israel and Rwanda to support the national scientific and innovation agenda for Rwanda development.



Figure 3. Meeting co-chaired by His Excellence Ambassador of Israel in Rwanda Dr. Ron Adam and the Executive Secretary of NCST at NCST

**The outcomes of the aforementioned meeting and proposed areas of collaboration :**The main potential areas of collaboration under the collaboration between Embassy of Israel in Rwanda and National Council for Science and Technology (NCST) include but not limited to the following:



*Figure 3. The main areas of cooperation between Embassy of Israel in Rwanda and NCST*

# Boosting Early Career Researcher's Capacity Mechanism: Research and Innovation Mobility (RIM) Grant

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**BACKGROUND:** Improving high quality and standards of life for Rwandans is an important pillar of Rwanda's Vision 2050, and this is well enshrined in the National Strategy for Transformation (NST-1) as the medium-term plan to achieve this vision.

The Government of Rwanda considers Science, Technology and Innovation (STI) as key enablers to implement the country's medium to long-term growth ambitions. The current STI Policy embodies the mission to Establish a vibrant innovation system as the foundation of Rwanda's economic development for increased productivity, competitiveness, realizing a knowledge-based, progress towards middle/high-income economy. As such the STI Policy vision is to attain an innovation-driven society through efficient/effective use of knowledge and technology utilization and R&D to accelerate Rwanda's economic

transformation especially in the area of technology for industrial development focusing on 6 priority areas:

1. Sustainable energy,
2. Food security and modern agriculture,
3. Life and health sciences,
4. Local production and value addition (Manufacturing),
5. Digital services, products and lifestyles, and
6. Resilient environment and natural resources.

In order to put this into practice, the Government of Rwanda is committed to funding research and technology development through National Research and Innovation Fund (NRIF) to enhance opportunities for data-driven innovations to improve the wellbeing of Rwandan citizens and transform industrial development. In order to address the current and emerging national social, economic, and environmental challenges, it is

imperative to promote and provide funding for high-quality research and development (R&D) projects addressing specific challenges affecting citizens.

In order to optimally leverage current and future investments in STI and R&D, current efforts must go hand in hand with strengthening the National Innovation System, especially through continuous human capital and institutional capacity development; improving collaborations to increase quality of scientific research and fostering R&D excellence. In this regard, the National Council for Science and Technology is implementing various initiatives and activities. These include the newly launched Research and Innovation Mobility (RIM) Grant and collaboration with scientists and innovators from the Rwandan Community Abroad. The later are expected to conduct a field visit in Rwanda in October.

## RESEARCH AND INNOVATION MOBILITY (RIM) GRANT

To enhance human capital development in research and innovation leading to knowledge creation and technology transfer

To promote concrete initiatives in terms partnerships between national and global institutions to strengthen the modernization and internationalization of Rwandan academic and research institutions, industry and companies

To enhance mobility of researchers and innovators, leading to technology creativity, employability and entrepreneurship

To enable Rwandan researchers and innovators to access resources easier, and expose them to more global opportunities

On 18<sup>th</sup> August 2022, the National Council for Science and Technology (NCST) launched the Request for Applications for Research and Innovation Mobility (RIM) Grant<sup>3</sup>.

Figure 1. RIM specific objectives

<sup>3</sup> <https://www.ncst.gov.rw/news-detail/request-for-proposals-research-and-innovation-mobility-rim-grant>

**FUNDING PURPOSE:** The main aim of the Research and Innovation Mobility (RIM) Grant is to support researchers and innovators to travel & undertake collaborative research at an internationally renowned host university/lab or center of excellence.

The goal is to help eligible researchers/innovators with transformative ground breaking innovative research projects leading to products and services as unique solutions, to improve their research competencies and optimally develop their innovations through exchange, best practices and experiences abroad.

Successful applicants from evolving Rwandan industries, companies, academic laboratories will travel outside Rwanda in highly recognized labs, industries, innovation hubs and other relevant settings for practical learning in order to further develop their work to the next technology readiness level leading to products and services and transfer knowledge and technology, as well as strengthen the ties between partner institutions, and contribute to national ambition of becoming a knowledge-based society.

**ELIGIBILITY AND FUNDING MODALITIES:** This funding instrument targets high-quality project proposals from researchers from national private sector and industries, universities, research institutions, and those from other institutions and organizations. The proposal should demonstrate existing promising and tangible works (for example, available prototypes, prod-

ucts and services), which need further development, improvement and scaling up to market, skills for global practices. Therefore, RIM Grant aims at supporting applicants with outstanding innovations such as products, services or an innovative process/approach to be further developed through experiential work in renown global laboratories and innovation hubs. RIM grant awardees will be researchers and innovators who wish to advance their work in countries with high quality research and innovation infrastructure and under training and mentorship of highly qualified renown experts in their fields.

Research and innovation proposals that underscores application and investigations using digital frontier technologies such as research on humans and machine learning and proposals that combines application of any frontier technologies will be funded. The funding opportunity will support research fostering excellence in any priority areas and preferably focusing on application of frontier technologies to develop technology and innovation resulting in product and services that will transform national economy and modernize the lives of Rwandans.

This grant scheme requires that applicants seek partnership or recommendations from well globally known academia and research institutions, industry and companies as host institutions of applicants during the period of mobility outside Rwanda. That is, applicants are encouraged to seek collaborations from well-established and renowned universities, research

labs, technology companies or industries to ensure high quality outcomes.

The funding will amount to approximately eight thousand (8,000) USD for a period of 2 months abroad at host institution.

The Research and Innovation Mobility (RIM) Grant is expected to encourage scientists, researchers and innovators to acquire stronger knowledge and skills and contribute to improve the quality and relevance of research and innovation learning through exchanges of practices and experience abroad to complete their training with competences useful for their careers. In addition, the RIM grant will contribute to the development of products and services that can be commercialized and deployed and lead to increased startups. Therefore, the field visit of some Rwandan researchers in Diaspora will be an added value to this initiative.

**Request for Applications (RFA)**  
**Research and Innovation Mobility Grant**

**Objectives and Expected Outcomes**  
The National Council for Science and Technology announces Research and Innovation Mobility (RIM) grant to support researchers and innovators to travel & undertake collaborative research at an internationally renowned host university/lab or center of excellence. The applicant should already have established contact at the host institution, and have a research/innovation strategy to develop further.

**The goal is to help eligible applicants, through exchanges and best practices and experiences abroad, to improve their research competencies to optimally develop their innovations and contribute to national ambition of becoming a knowledge-based society.**

**Eligibility**  
The applicant must be a Rwandan scientist, researcher or innovator with a PhD degree or Master's degree in the field falling under the six priority areas, and must be employed by a University, research institution or R&D Private Company in Rwanda. They must be granted appropriate leave of absence. The applicant must submit a research and innovation proposal and plan together with the host institution. The project should have potential to lead to products and services development. The funding opportunity will support research fostering excellence in any priority areas.

**How to apply**  
The application should be submitted electronically based: First register in the RIGMS application portal: <https://rigms.ncst.gov.rw>, where application templates (i.e., proposal format and all details to this RFA can be found). In case of technical problem or if you have questions or require further information, you can submit your queries via email to: [research@ncst.gov.rw](mailto:research@ncst.gov.rw) or call on +250781030798

**Important Dates**  
18<sup>th</sup> August 2022: RIM grant Call Open  
1st September 2022: Session for Questions and Answers Applicants and NCST  
16<sup>th</sup> November 2022: Deadline for Submission (all closes)  
16<sup>th</sup> December 2022: Pre-selection (administrative check)  
31<sup>st</sup> January 2023: Peer Review Process  
10<sup>th</sup> March 2023: Notification of outcome  
28<sup>th</sup> March 2023: Signing agreements and Award Ceremony  
3<sup>rd</sup> April 2023: Disbursement of funds and start of project implementation

**Package**  
The funding package is \$8000 for two (2) months. This will cover, return air tickets, Transportation, Accommodation, Living expenses, Travel insurance, etc.

info@ncst.gov.rw | www.ncst.gov.rw | @NCSTRwanda

Figure 2. RIM request for application poster

# Research and Innovation for National Development: Transforming R&D for Sustainability

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**BACKGROUND:** Science, technology, research and innovation play a key role to the development of the economy of Rwandan society and any other nation. They provide fundamental tools for transformation of wealth creation, improvement of the quality of life and real economic growth and transformation in any society. The Government of Rwanda through the National Strategy for Transformation (NST1)<sup>4</sup> and the National Vision 2050<sup>5</sup> underscores the need for promoting research and devel-

opment (R&D) and innovation as key drivers of science, technology, and industrial development for economic transformation.

Rwanda's ambition to leverage the potential of science, technology and innovation (STI) is consonant with regional and international commitments. These include the United Nations (UN) Agenda 2030 for sustainable development highlighting the role of STI as key means to promote the attainment of the Sustainable Development Goals

(SDGs); the African Union (AU) 10-year Science, Technology and Innovation Strategy for Africa (STISA 2024) emphasizing the need to place STI at the epicenter of Africa's socio-economic development and growth; and the establishment of the East African Science and Technology Commission (EASTECO) to promote and coordinate the development, management and application of science and technology to support EAC regional integration and socio-economic development.

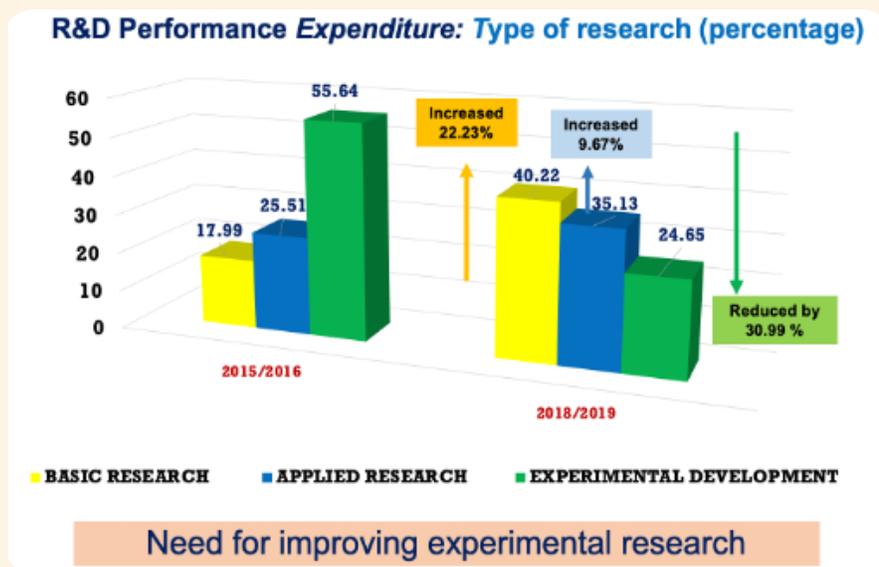


Figure 1. Changes in types of research

Although, there have been considerable progress and investment in promoting science, technology, research and innovation within public and private instructional frameworks in Rwanda and globally, there is a need for transformative approaches and strategies to ensure that research and innovation are leading to sustainable development. Indeed, within national priorities, basic research (essentially that of universities and research centres) continues to predominate over applied science and experimental develop-

ment as per NCST R&D Survey report<sup>6</sup> (Figure 1). It is on recognition of the above that this article discusses the importance of research and innovation for national development as well as the key approaches for transforming R&D and innovation for national sustainable development with focus on Rwanda.

<sup>4</sup>The 7 Years Government Programme: National Strategy for Transformation (NST1) 2017-2024.

<sup>5</sup>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](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)

<sup>6</sup>NCST Report (October 2021): Rwanda National Research and Experiential Development (R&D) Survey for 2018/2019, [https://www.ncst.gov.rw/fileadmin/user\\_upload/NCST/Publications/Reports/Report\\_2018-19\\_R\\_D\\_Survey.pdf](https://www.ncst.gov.rw/fileadmin/user_upload/NCST/Publications/Reports/Report_2018-19_R_D_Survey.pdf)

## IMPORTANCE OF SCIENCE, TECHNOLOGY, RESEARCH AND INNOVATION FOR NATIONAL DEVELOPMENT :

The 2030 Agenda for Sustainable Development and the SDGs highlights the urgent need to move towards new models of growth and development, with more sustainable and inclusive patterns of consumption and production<sup>7</sup> where STI is positioned as one key action areas for achieving SDGs. Specifically, innovation is the most visible focus of SDG #9: "Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation", while SDG #9.5 emphasizes on the need to "enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries by 2030"<sup>8</sup>. Also, the AU Strategy for Africa (STISA-2024) emphasizes on the needs for Africa to become knowledge-based economies through: "**Building resilient economic growth & promoting sustainable industrialization while fostering innovation**".

## SCIENCE TECHNOLOGY AND INNOVATION (STI) IN ACHIEVING SDGs:

STI is the potential tool for accelerating progress in achieving the SDGs to expand the evidence available to appraise the challenges associated with each SDG, and inform the set of possible solutions to address socio-economic challenges through production, dissemination and use of knowledge to improve human well-being<sup>9</sup>. Nevertheless, for STI to effectively drive the

achievement of the SDGs, there must be the requisite plan to direct its application in the respective national priorities and strategies.

In this context, countries have started to incorporate STI into national development plan and strategies, and many have set up coordinating structures for coherent implementation. For example, the Government of Rwanda intends to integrate and mainstream STI in national policies and strategies through effective and efficient application of knowledge, tools, scientific research and technological innovation towards addressing societal challenges, exploring opportunities, and ultimately establishing a global competitive knowledge-based economy.

Moreover, beyond disciplinary or sectoral STI contributions (such as for food, health or energy), interdisciplinary approaches and science-policy interfaces are necessary for interlinkages across multiple SDGs, enabling policymakers to pursue synergies and manage trade-offs (such as between economic and social or environmental goals). In fact, the effective engagement of various stakeholders, including government, academia, research institutions, civil society, private sector and international organizations, is essential in unleashing the potential of STI contribution towards global goals. This can be through identifying, sharing and promoting best practices and methodologies for localized and customized applications of STI. One of

the many effective approaches to facilitate such multi-stakeholder engagements and international partnerships is the development of the STI for SDGs roadmap<sup>10</sup>.

## STI FOR SDGS ROADMAPS :

STI for SDGs roadmaps are regarded as operational and concrete action plans and strategies useful in strengthening national, regional and local STI systems for SDGs and in effectively mobilizing national efforts and resources. That is, the roadmaps offer opportunities for countries ownership and strengthening of capacities, as well as for international partnerships to harness STI for the achievement of the SDGs. Further, STI for SDGs roadmaps are considered as potential instruments that can be used by countries to integrate SDGs in STI policy agendas. In 2021, two UN General Assembly resolutions (A/RES/75/316 and A/RES/76/213) recognized the role of STI for SDGs and advocated for increased partnerships and collaborations.

In 2019, the Inter-Agency Task Team on Science, Technology and Innovation for the SDGs (IATT) launched the Global Pilot Programme on STI for SDGs Roadmaps with an initial group of five pilot countries (Ethiopia, Ghana, India, Kenya and Serbia), and further in February 2021, Ukraine also joined the programme making the number of pilot countries to six. This programme supports pilot countries in developing their STI for SDGs roadmaps following the framework described in the "Guidebook for the Preparation

<sup>7</sup>United Nations Sustainable Development Summit 2015, 25-27 September 2015, New York, <https://sustainabledevelopment.un.org/post2015/summit>

<sup>8</sup>Transforming Our World: The 2030 Agenda for Sustainable Development, A/RES/70/1, United Nations

<sup>9</sup>Science, Technology and Innovation for Achieving the SDGs: Guidelines for Policy Formulation, United Nations Inter-Agency Task Team on Science, Technology and Innovation for the SDGs and UNIDO, WORK STREAM 6: UN capacity-building programme on technology facilitation for SDGs, April 2022

<sup>10</sup>United Nations Inter-Agency Task Team on Science, Technology and Innovation for the SDGs and European Commission, Joint Research Centre, Guidebook for the Preparation of Science, Technology and Innovation (STI) for SDGs Roadmaps, EUR 30606 EN, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-30613-9, doi:10.2760/724479, JRC124108

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of STI for SDGs Roadmaps". In the context of the Annual Multi-Stakeholder Forums for STI supported by the IATT, **Dr. Louis Sibomana** (Head of Science Technology Development and Outreach Department at NCST, Rwanda) participated virtually on UN High-Level Political Forum 2022 on Sustainable Development on 12 July 2022 under the theme: "**Innovation ecosystems in Sub-Saharan Africa: the path towards localized STI for SDGS roadmaps**"<sup>11</sup>.

The UN High-level political forum side event was an occasion to share preliminary findings on the analysis of innovation ecosystems in Africa, as well as at sharing experiences and the expectations of pilot countries for STI for SDGs roadmaps. In particular, the objectives of the High-level political forum side event were:

- Sharing progress and achievements in the development of STI for SDGs roadmaps in the context of the Global Pilot Programme;
- Discussing needs, challenges and expectations for the development of STI for SDGs roadmaps with a specific focus on the African context, taking into account recovery plans to build back better from COVID-19 and the present risk of energy and food crisis;
- Providing insights on the next steps for further applications of STI for SDGs roadmaps and development of the Partnership in Action

In his presentation, **Dr. Louis Sibomana** gave an intervention on the needs and challenges on

the design of STI for SDGs roadmaps in Sub-Saharan Africa, in particular Rwanda. He pointed out that existing Rwanda's policies and strategies are aligned with the SDGs and other regional and global development plans. Also, he mentioned that developing an STI roadmap for the SDGs will not only complement ongoing tasks, but will also fit very well with existing strategies, which will accelerate technology adoption and implementation in Rwanda.

### TRANSFORMING R&D AND INNOVATION FOR SUSTAINABLE DEVELOPMENT :

On August 22-24, 2022, **Dr. Diane Gashumba**, Ambassador of Rwanda in Nordic Countries, Europe, attended the Development Research Conference (DevRes2022)<sup>12</sup> in Uppsala, Sweden. The DevRes conference is a multi-disciplinary forum for researchers working in fields linked to development and sustainability. In particular, the aim of the DevRes2022 conference was to promote networking and collaboration between researchers, public agencies, policy makers, organizations and practitioners, in order to find solutions for poverty and develop strategies for the future of sustainable development.

The theme of DevRes2022 was "**Transforming Development Research for Sustainability**", to discuss progress and strategies towards achievement of the UN Agenda 2030, with a particular focus on how we can achieve sustainability in health for both humans and our planet looking at transforming large parts of our society and restructuring

systems specifically research and innovation within our society such as food and energy production, urban planning, digitization, education, preventive health work as well as health and social care. Further, the DevRes2022 intended to explore both new forms of research cooperation and the generation of new knowledge.

During the DevRes 2022 Conference, **Dr. Diane Gashumba** delivered a Keynote speech on Transforming Development Research for Sustainability where she discussed the importance of research and innovation for sustainable development, the challenges associated with R&D for sustainability, the needs for transformative research, and Rwanda's experience in response to Covid-19, as well as achievements of research and innovation in Rwanda.

In her presentation, **Dr. Diane Gashumba** mentioned that research and innovation are central for the development of new knowledge, innovative products and services that enable economic growth (higher productivity, industrial competitiveness, and ultimately prosperity) in all societies (Figure 2).

<sup>11</sup>UN High-Level Political Forum Side Event co-organized by Serbia Mission to UN, European Commission - Joint Research Centre, UN-DESA, UNESCO, 12 July 2022

<sup>12</sup><https://www.devres2022.org/>

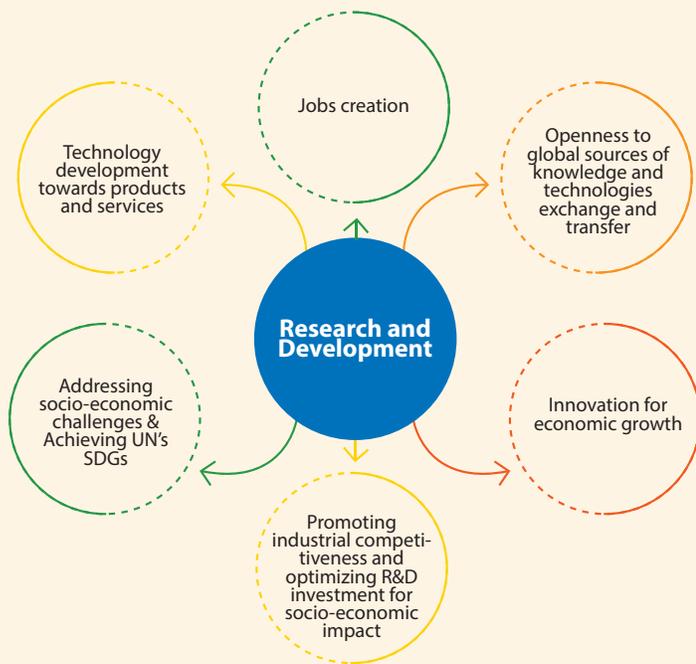


Figure 2. R&D for national development

technology adaption and transfer, policies/strategies development

- Increased R&D and innovation investment: needs to increase funding as a percentage of GDP in particular for developing countries. For example, the R&D as a percentage of GDP ranges from 0.3% to 1% in most African countries (Rwanda: 0.69%), as compared to European countries (Finland

3.5%, Sweden 3.9%), USA 2.7%), as well as Japan, Singapore and Korea 2% to 3%. In order to achieve the AU target to raise R&D to at least 1% in 2024, **Dr. Diane** called a strong international partnership for R&D and Innovation investment to mobilize R&D and Innovation funding from public and private sectors

Moreover, **Dr. Diane Gashumba**

Further, **Dr. Diane** argued that traditional research approach focuses on publications and knowledge creation, but with limited societal impact and entrepreneurship. Thus, there is a call for transformative research. That is, needs for multi-levelled transformative research and innovation through:

- Societal transformation: Solving real-world problems collaboratively through research and innovation (including applied research) addressing research questions from society
- Collaborations between researchers, policy-makers, civil society organizations, public institutions, regulatory and professional bodies and industry at all stage of the research process towards improved national innovation systems
- Strengthened national, regional and international partnerships on research and innovation for SDGs: capacity building, emerging

shared the capability for Rwanda in utilizing technology to address the Covid-19 pandemic and vaccination to save lives. Besides, social distancing, face masks, hand washing and sanitizing, PCR diagnostics and testing, clinical management and vaccine administration of Covid-19, Rwanda has put in place different technologies to fight against Covid-19 pandemic (Figure 3).

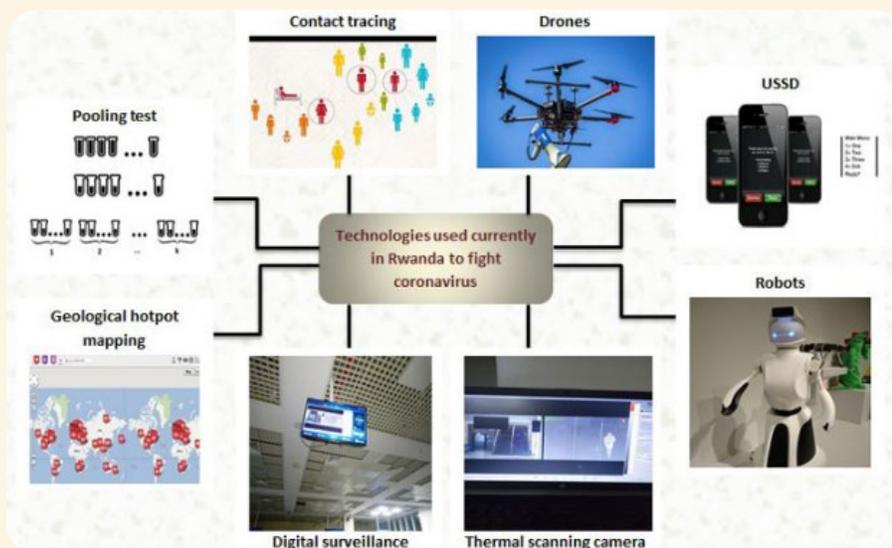


Figure 3. Examples of technology tools used in Rwanda to address Covid-19

These include self-screening/testing app (USSD: unstructured supplementary services data, by dialing \*114#) to facilitate early detection of the infection; geological hotspot mapping in contact tracing; drones to broadcast the appropriate information to the public in regards to the pandemic outbreak, mode of transmission and preventive measures as well as for delivering blood, medication and food; and robots and machinery to store the data of patients during diagnosis and treatment. Fur-

ther, data science techniques such as Artificial Intelligence (AI) were used in all services to determine the best economic proceedings at a high level of granularity primarily in analyzing and harmonization of Covid-19 containment strategies.



Figure 4. Distribution of Vaccines in Rwanda

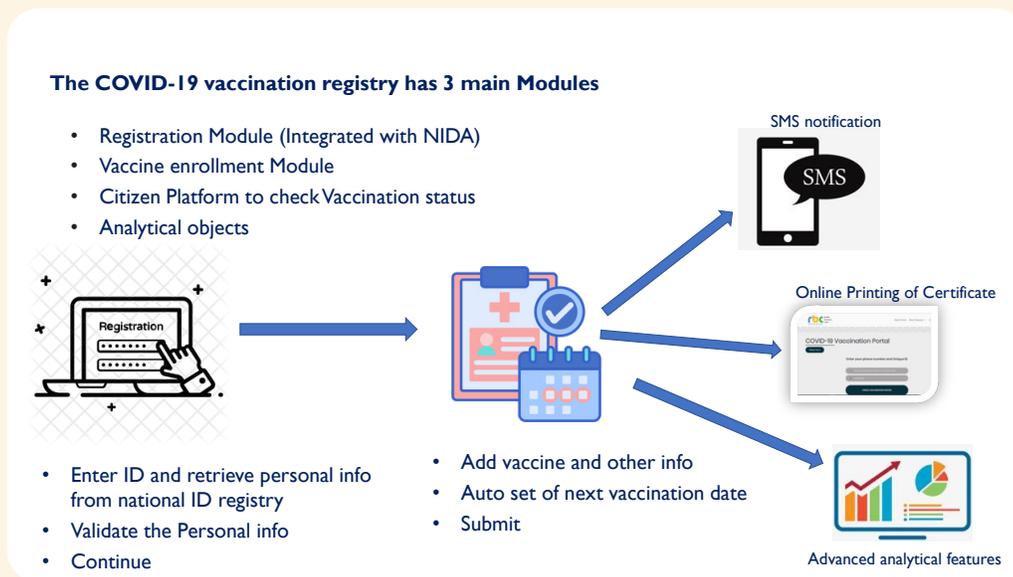


Figure 5. Covid-19 Vaccination Registry in Rwanda

ture), use of data and technologies to guide decisions making, and community support and engagement.

In concluding her keynote speech, Dr. Diane Gashumba recommended more effort to

support research and innovation for global health transformation. Among different strategies, there is a need to strengthen research capacity and promote interdisciplinary research through collaboration (e.g, North-South partnership) to perform applied

health research, application of emerging technologies to transform healthcare services and delivery, and mobilize R&D and innovation funding from public and private sectors.

Furthermore, for the vaccine acquisition, delivery and scale up, and data reporting, Rwanda has put in place a timely strategy and supply chain for collecting data, storage and transportation of vaccination up to the population (health centers). These include the use of Internet of Things (IoT) technology for real-time remote monitoring of temperatures sensitive vaccines and storage monitoring (Figure 4).

In addition, Rwanda established an online Covid-19 vaccination registry (web-based and mobile app, and SMS system) where a user can check the status of the vaccination and download Covid-19 certificate (Figure 5). Further, Dr. Diane Gashumba shared the lesson learned from Rwanda experience for future pandemic preparedness, for instance the importance of leveraging pre-existing resources (infrastruc-

## Annex:

### Profiles of the Rwandans in Diaspora participating in assessment and symposium in 03-07 October 2022.

**Dr. Jack Ngarambe**

Kyung Hee University in  
South Korea



Dr. Jack Ngarambe is an architectural engineer at Kyung Hee University in South Korea with interest in sustainable built environments, building physics and control. He is a lecturer on novel technologies in designing resilient and sustainable built environments, net-zero energy and passive building designs, statistical theories and research methodologies. Dr. Ngarambe is also involved in extensive urban sustainability projects funded by the National Research Fund of Korea (NRF), Korea Energy Agency (KEA), Korea Energy Technology Evaluation & Planning (KETEP).

Areas of collaborations include promotion of urban livability agenda, increased urbanization, energy poverty and the changing climate, as well as advanced data-driven machine learning to improve the energy performance of cities and communities. The use of reinforcement learning for optimized building control, deep-learning practices to model urban heat and its effects on urban populations. He is also keenly interested in the use of green materials to mitigate increased temperatures in cities.

Mr. Alain Patrick Ndengera is a computer scientist who graduated from University of Quebec in Montreal (undergraduate) and from University of Sherbrooke in Longueuil in Canada (graduate) studies in software engineering. He is an IT consultant for 20 years and is an Expert in application integration and service administration in the AWS cloud. Mr. Ndengera scientific interests are in the areas of software development, knowledge-based system, cloud application architecture and application integration. He has strong skills in design, development, documentation and support of multi-tier and distributed computing systems.

Potential areas of collaboration include Secure software development including enabling software security (security requirements planning, designing software architecture from a security perspective, adding security features, etc.) and maintaining the security of software and the underlying infrastructure (source code review, penetration testing).

**Mr. Alain Patrick  
Ndengera**

Versatile IT Consultant  
Canada



**Dr. Jimmy  
Nsenga**

Senior Software Architect



Dr. Jimmy NSENGA is a Senior Software Tech Lead/Architect and Research Scientist with >10 years in applied research of ICT and > 5 years of experience crafting production-ready user-centric software in different industries such multimedia, rail transportation, HR and IPTV. During his long research career at CETIC, a Belgian-based applied research center in ICT, Dr. Nsenga has worked on preparation and implementation of different European and Belgian-funded ICT research projects such as FP7, Horizon 2020, CWALity DE, WB Health Wallonia. Today, he is currently applying those science-driven skills in software industry focusing on architecting innovative digital solutions that leverages emerging open-source technologies such as IoT, AI, microservices and so on. Dr Nsenga is also currently a visiting senior lecturer and researcher at the African Center of Excellence in IoT (ACEIoT) hosted at University of Rwanda (UR).

Potential of collaborations include preparing emerging tech-driven project proposals, managing research projects and teams, technically design-

ing and developing (IoT) software and systems, and last but not least planning and coordinating the technology transfer to end-user companies. In addition, Dr. NSENGA has 3 US patents in the domain of wireless multi-antenna DSP and fingerprint-based watermarking of audio songs (<https://patents.justia.com/inventor/jimmy-nsenga>); and more than 50 research publications (<https://scholar.google.com/citations?user=gWk5NAsAAAAJ&hl=fr>).

Dr Joseph Hategekimana is an experienced Food Scientist/Technologist with over 10 years in research at different universities and research institutions in Rwanda, China and Finland. He is a lecturer of Food Science and Technology: Food Biotechnology, Food Engineering, Food Processing, Food Chemistry, Food Safety and Legislation etc. His scientific research areas of interest are in science and technology that focus on the areas of food biopolymers and colloids, and in particular on the development of food-based structured delivery systems for bioactive components. Currently, Dr Joseph is a researcher at University of Turku (Finland) where his work focuses on food product development and the processes between the idea and real product. Dr Joseph is also a founder and managing director of Guhaha Ltd, a B2C and C2C E-commerce platform based in Rwanda, and co-founder of Hills Connect Oy based in Finland.

**Dr Joseph Hategekimana**

University of applied sciences, Finland



Potential areas of collaboration with Dr Joseph would involve the elaboration and implementation of policies and legislation important for the food industries for Food Consumer Protection, the Industrial Research and Technological Development (RTD or R&D), Design and Implementation of pilot scale to industrial scale Food Laboratories, as well as Food Nanotechnology, Food Engineering, Food Processing and Food Product Development and in particular, the development of food-based structured delivery systems for bioactive components. He aims to create new knowledge and technological breakthrough, which regenerates science and supports the research and development of food companies.

**Dr. Maxime Binama**

Harbin Institute of Technology (HIT), China



Dr. Maxima Binama's main duties include curricula and syllabi development, delivering course materials, participation in the organization of scientific events. Dr Binama is also involved in coordination, planning, implementation and monitoring scientific research projects, and application of research funds.

Potential areas of collaboration with Dr. Binama are related to his research and teaching roles and include research interests include performance analysis and optimization of hydraulic machinery and application to hydroelectric energy generation technologies. Dr. Binama has studied thermodynamics of Thermofluids in energy systems, and published peer reviewed journal journals (Binama, Maxime - Author details - Scopus) and conference proceedings such as IEEE Conference, IOP conference on Energy Technologies, Elsevier journals such as the Renewable and Sustainable Energy Technologies, Renewable Energy, Applied Energy, and Energy. Furthermore, He is involved in different research projects as PI or Co-PI.