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Strengthening Knowledge Capacity through Diverse Programs and Instruments for Informed STI Policy Development

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PREAMBLE: In our continuous effort to enhance capacity and develop informed Science, Technology, and Innovation (STI) policy engagements, the National Council for Science and Technology (NCST) was actively engaged in various programs and initiatives. This newsletter highlights five key topics reflecting our commitment to leveraging diverse research and scientific programs and instruments for impactful outcomes. From NCST's significant role in the 2024 International Network for Government Science Advice (INGSA) Conference to the advancements in Research and Development (R&D) programs towards commercialization, each initiative underscores our dedication to fostering knowledge synthesis, policy development, and capacity building. We are exploring the strides made in monitoring and evaluation, training workshops, and the imperative role of ongoing Project Management Professional courses in fulfilling our mandate.

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Embracing the future with Science and Technological Evolution: INGSA 2024 Conference

Eugene Mutimura , Esperance Munganyinka, Marie Chantal Cyulinyana , and Louis Sibomana
National Council for Science and Technology, Rwanda

The International Network for Governmental Science Advice (INGSA) held its 5th International Conference at Kigali Convention Centre (KCC) in Kigali, Republic of Rwanda on 1-2 May 2024, under the theme, "The Transformation Imperative: Expanded Evidence for Inclusive Policies in Diverse Contexts". The conference attracted close to 300 participants from over 65 countries, and from all continents.

The 5th INGSA Conference was officially opened by The Right Hon. Prime Minister of the Republic of Rwanda Dr. Édouard Ngirente who underscored the need to prepare a workforce with the necessary scientific skills and capacity to meet the demands of both private and public labour markets. The Prime Minister's presence and remarks at the Conference signifies Rwanda's political commitment to acknowledging the importance of science-based policy, the role science advise plays in shaping Rwanda's developmental agenda, and indeed what science advise should play in Africa and within a global context. In a nutshell, political will is imperative for national development through science advice, Science produces knowledge, knowledge provides options for political agenda, and political commitment then enables and finances science to thrive and continue to generate products for the global public good.

INGSA Official Opening

The success of INGSA 2024 was a result of several players at national and international level. This narrative focuses on the national-level efforts at INGSA 2024. The conference received funds from the Ministry of Education and University of Rwanda as the major supporters of this conference, together with the main conference funding partner, the Fonds de recherche du Québec (FRQ) Canada.

In his remarks, included in the INGSA 2024 viewpoint compendium[1], the Minister of Education Hon. Gaspard Twagirayezu highlighted: "INGSA 2024 takes place in Rwanda, the first time in Africa; making Rwanda the first African destination for this global event" and that: "This is in line with many initiatives in Rwanda, including the recent ground-breaking of the BioNTech Plant and the first mRNA vaccine manufacturing in Africa. The value of INGSA 2024 to Rwanda and Africa in developing the science advise ecosystem cannot be overemphasized".

In the compendium, the University of Rwanda Vice Chancellor, Dr. Didas Kayihura Muganga, provided his viewpoints under the theme, "Navigating the intersection of Science Advise and Policy Making: Addressing Silent Demands and Claims". He underscored the need to enhance synergy between science and policy to drive sustainable development that address pressing social- economic challenges.

[1] https://static1.squarespace.com/static/6542688e4f86cd6ae0cf0d88/t/6629ef59cd314429168ec7e4/1714024296963/INGSA 2024_v1.7-small-+NEW.pdf

Prof. Rémi Quirion, Chief Scientist of Québec and President of INGSA, under the theme, "Leaving no one behind"; highlithed the fact that "Science advise and science diplomacy have never been more relevant. The importance of organizations like INGSA has never been greater. We must continue to find new ways to support evidence-informed policy and governance practices at all levels. We must broaden the base of evidence and adapt advise to diverse contexts. Our training also must adapt to changing contexts and demands, something that was not obvious ten years ago".

Key Panel discussions on "Disruptive Technologies: Impact and Leadership from Africa", and "Navigating the intersection of Science Advise and Policy Making:

INGSA-Africa Hub Rwanda

Under the umbrella of INGSA-Africa's mission to provide world leading opportunities and skills development to practitioners at the science-to-policy interface, INGSA established in 2022 the INGSA Rwanda Hub hosted by University of Rwanda, and mostly funded by the Quebec government, Canada. The establishment of INGSA-Africa Hub Rwanda is evidence of existing efforts by Rwanda to actively invest in evidence-to-policy ecosystems, and to ensure that Science, Technology and Innovation (STI) play a key role in the implementation of the national development goals. In addition to the Hub, these investments include STI policy and related strategies, funding instruments, and establishment of institutions to support implementation towards attaining and sustaining an innovation-driven society through efficient and effective application of knowledge and technology. These investments include the establishment of various public institutions to support the development, management and application of STI such as the National Council for Science and Technology (NCST), the National Industrial and Research Development Agency (NIRDA), the Rwanda Information Society Authority (RISA), and establishment of various Centers of Excellence at University of Rwanda, as well as support to renown global Universities and research institutions such as Carnegie Mellon University Africa (CMU-Africa) in Kigali, African Institute for Mathematical Sciences (AIMS) in Kigali, University of Global Health Equity (UGHE) among others.

The INGSA-Africa Hub Rwanda will build on the existing efforts to offer opportunities broadly in Africa to understand, coordinate, strengthen the role of science and technology to inform policy on the African continent. While it is currently building its capacity, the hub will aim at increasing the regional capacity for science advice, impacting society by raising awareness, conducting trainings and encouraging research on advisory principles, processes and practices, as well as networking opportunities in Africa and globally.

INGSA Events on Translating Research into Policy and Practice

The INGSA 2024 Conference provided a platform for policy exchange, capacity building, and research across diverse global science advisory organisations and national systems. Several speakers from various national institutions, including National Council for Science and Technology (NCST) were actively engaged and participated in various parallel sessions, offering diverse scientific insights and perspectives. Dr. Esperance Munganyinka from the NCST participated in a panel discussion on Science Granting Councils and Innovation Agencies, highlighting the role of Rwanda National Research and Innovation Fund (NRIF) in reshaping Science Technology and Innovation systems. She underscored the existing challenges and opportunities in science and technology emphasizing effective STI policy guidance and the utilization of research outcomes across sectors.

The NCST Executive Secretary, Dr. Eugene Mutimura participated in one of the satellite sessions which was organized by the Frontiers Research Foundation with the support of the African Academy of Sciences, focusing on transformative science solutions for Africa's challenges. Discussions centred on planetary boundary science, academic community challenges, and strategies for systemic change toward a climate-resilient future.

Furthermore, Dr. Mutimura moderated a panel on "Disruptive Technologies: Impact and Leadership from Africa," exploring how these technologies reshape innovation landscapes globally and in Africa.

Another equally important session was entitled "Systemic Institutional Innovation: Creating Better Conditions for Transformative Evidence - Informed Policy-Making" advocating for evidence-informedpolicy-making, where Dr. Louis Sibomana participated and highlighted Rwanda's efforts in linking science with public policy to address the United Nations Secretary-General Sustainable Development Goals (SDG) and foster societal transformation.

Additionally, Dr. Munganyinka participated as a panelist in a session which was co-organized by the Canadian International Development Research Centre (IDRC) and the UK Foreign Commonwealth and Development Office (FCDO) making links with the Science Granting Councils Initiative (SGCI), entitled "Science granting councils and innovation agencies as advocates for strong national STI systems".

The main goal of this session was to provide insights on how research funding agencies make their research more impactful through efforts related to knowledge translation and different approaches to research excellence, taking into account gender equity and inclusivity, as well as open science approaches.

Participation of NCST Team in various Panel Presentations and Activities at INGSA 2024

During the conference a letter of intent was signed between the Rwanda National Council for Science and Technology (NCST) represented by Dr. Mutimura, and the Fonds de recherche du Québec (FRQ) represented by Prof. Quirion. The partnership is aimed at mutual scientific exchange, organization of scientific forums, as well as mutually supporting and funding collaborative research between Rwanda and Québec institutions specifically to leverage opportunities for better collaborations of academia and private sector. The vision is to support programs that focus on application of frontier technologies, including the use of artificial intelligence (AI) in Food Security, Biodiversity and Climate Change and any other areas of interest that shall be defined in the course of implementation.

Overall outcomes within an STI perspective

The key messages of INGSA 2024 focused on the importance of science-informed decision-making and the need to strengthen capacity building in science advice and science for impact, engaging more stakeholders through collaboration and partnership. Furthermore, it was underscored that there is a need to adopt and adapt technology models and solutions to address societal challenges, and trust to the science advice between science, politics and society.

In his article in Nature World View, Prof. Alfred Bizoza highlighted the need for increased political commitment to embrace evidence, empower young African leaders, foster collaborations within and beyond borders, and adapt to digital innovations that aid systematic change.[2] The success of INGSA 2024 Conference was a result of both INGSA Programme committee members as well as organization committee members.

The authors of this narrative express their utmost gratitude to all organizers of INGSA 2024 Conference including but not limited to Mr. Pascal Gatabazi, Chief Technical Officer in the Ministry of Education (Chair of the Local Organizing Committee), Prof. Alfred Bizoza, Team Leader of INGSA-Africa Hub Rwanda, Mr. Grant Mills, Programme Officer, INGSA Secretariat, Ms. Virginie Auger, Principal Advisor for INGSA and International Affairs, Office of the INGSA President, Dr. Marie Chantal Cyulinyana, Science and Technology Foresight Analyst (NCST) and Ms. Melissa Umutoni from Rwanda Convention Bureau, among other.

Signing Letter of Intent between NCST and FRQ on use of AI in Food Security, Biodiversity and Climate Change

[2] A Bizoza 2024. Meet Africa's challenges with African know-how, Vol 629, May 2. (https://www.nature.com/articles/d41586-024-01249-4)

The Outcome of Training of Rwanda National Council for Science and Technology (NCST) Staff on Project Management Professional Course (PMP) for Fulfilling NCST's Mandate

Theogene Kayumba and Faustin Amani Bugabo
National Council for Science and Technology, Rwanda

The National Council for Science and Technology (NCST), Rwanda has a pivotal role in driving the country's scientific and technological advancement. One of its core mandates is to foster an environment conducive to scientific research and technological innovation, ensuring that Rwanda continues to compete on a global scale. To achieve this mission, NCST continuous to maintain a highly skilled workforce capable of managing complex projects efficiently and effectively. Besides NCST staff have embarked to extensive fund mobilization from external sources to leverage on existing funding for national research and innovation fund (NRIF), as well as funding for Science, Technology and Development Outreach (STDO). The introduction of Project Management Professional (PMP) training for NCST staff has been a strategic move aimed at enhancing the staff project management capabilities, thereby ensuring that the organization can fulfill its mandate more effectively.

Project management is essential in the context of NCST's operations. Given the complexity and scope of the projects undertaken by the Council from scientific research initiatives to managing funding research and innovation schemes having a robust project management framework is crucial. Effective project management ensures that projects are completed on time, within the planned budget, and to the desired quality standards. It also facilitates better resource allocation, risk management, and stakeholder engagement, all of which are critical for the success of NCST's initiatives.

Overview of the Training

The PMP certification is a globally recognized credential that demonstrates an individual's competence in project management. The training covers a wide range of topics, including project initiation, planning, execution, monitoring, and closure. It also emphasizes critical soft skills such as leadership, communication, and problem-solving. Providing NCST staff with PMP training, aimed to equip the staff with the knowledge and skills necessary to manage projects more effectively.

Enhancing Project Management Skills

The first significant outcome of the PMP training is the enhancement of project management skills among NCST staff. The comprehensive curriculum of the PMP course ensures that participants gain a deep understanding of project management principles and best practices. This knowledge enables them to apply systematic approaches to planning, executing, and closing projects. As a result, NCST projects will be more likely to meet their objectives, deliver value to stakeholders, and contribute to the Council's overall mission.

Improved Resource Allocation and Utilization

Effective project management involves meticulous resource planning and utilization. Undoubtedly, the PMP training has equipped NCST staff with the skills to allocate resources efficiently, ensuring that human, financial, and material resources are used timely and optimally. This is particularly important for NCST Secretariat, where resources must be managed judiciously to maximize their impact. It is evident that the staff will better manage resources efficiently leading to cost savings, reduced wastage, and better outcomes for NCST projects.

Enhanced Risk Management

One of the critical components of PMP training is risk management. Participants learned how to identify, assess, and mitigate risks throughout the project lifecycle. This proactive approach to risk management was essential for to minimize and mitigate high levels of uncertainty and complexity for the projects implemented. By effectively managing risks, NCST will prevent potential issues from escalating into significant problems, ensuring that projects stay on track and deliver the intended results.

Strengthened Stakeholder Engagement

Effective stakeholder engagement is crucial for the success of NCST projects. The PMP training emphasized the importance of communication and stakeholder management, teaching participants how to engage with stakeholders effectively, manage their expectations, and address their concerns. By improving stakeholder engagement, NCST will build stronger relationships with partners, collaborators, and beneficiaries, fostering a supportive environment for its initiatives.

Improved Approach to Project Monitoring and Evaluation

Monitoring and evaluation are critical aspects of project management that ensure projects are progressing as planned and achieving their objectives. The PMP training provided NCST staff with the tools and techniques to monitor project performance systematically and evaluate outcomes rigorously. This has enabled NCST staff to identify areas for improvement, make data-driven decisions, and continuously enhance the effectiveness of its projects to ensure optimal success.

Achieving NCST's Mandate

The ultimate goal of PMP training was to enhance NCST's ability to fulfill its mandate. By building a workforce that is proficient in project management, NCST will ensure that its projects are successful and aligned with its strategic objectives. The improved efficiency, effectiveness, and impact of NCST's projects directly contribute to the Council's mission of promoting scientific research and technological innovation in Rwanda.
The PMP training program for NCST staff has been a strategic and commendable investment that will yield significant benefits for the Council and its mission. By enhancing project management skills, improving resource allocation, strengthening risk management, and fostering better stakeholder engagement, PMP training will enable NCST to execute its projects more effectively. This, in turn, ensures that NCST can fulfill its mandate of driving scientific and technological advancement in Rwanda. As NCST continues to build its project management capabilities, it will be better positioned to achieve its strategic goals and contribute to Rwanda's development and global competitiveness.

Enhancing Capacity In Knowledge Synthesis and Policy Briefs Writing Skills

Esperance Munganyinka, Didacienne Mukanyiligira and Paul Nampala
National Council for Science and Technology, Rwanda

Introduction

Irrefutable evidence is essential for optimizing government decisions and serves to facilitate process of achieving positive and / or desired outcomes. Evidence-informed approaches encourage innovation by identifying successful practices and encouraging adoption. Practitioners in different sectors of the economy and policymakers have opportunity to learn from evidence-based solutions and adapt them to new contexts. In essence, therefore, evidence fosters a culture of continuous learning and in particular evidence-based policymaking supports policymakers to assess the impact of policies, learn from failures and improve overtime. Evidence supports effective resource allocation and helps officials to strategically allocate resources to programs and policies that are proven to be effective. It ensures that public funds are spent efficiently, promoting transparency and budgeting.

From the foregoing, the importance of evidence-informed policy-making cannot be over emphasized. Evidence-informed policy-making has been defined as a process whereby multiple sources of information, including statistics, data, and the best available research evidence, are consulted before making decisions related to planning, implementing, and (where relevant) altering public policies, programs, and services. In essence, it ensures that decision-making is well-informed by rigorous research evidence for promoting effective and informed governance. Nonetheless, policymakers face several challenges with evidence-informed policy-making (Table 1).

Table 1: Challenges encountered by policymakers with regard to use of evidence

Challenge	Description
Information overload	• Policymakers often receive an overwhelming amount of data, research papers, reports and recommendations • Sorting through this vast information can be time consuming and sometimes confusing • The risk that relevant evidence might get lost in the process, leading to suboptimal decisions
Cognitive Shortcuts	• Policymakers rely on mental shortcuts (heuristics) due to time constraints and cognitive limitations on particular issues • These shortcuts can lead to biases and oversimplification of otherwise very important / sensitive issues • For example, they might prioritize information from trusted sources of follow prevailing narratives without critically evaluating the evidence
Confirmation Bias	• Policymakers tend to seek information that confirms their existing beliefs • This bias can hinder objective decision-making and prevent consideration of alternative viewpoints.
Time Pressure	• Policymakers work in fast-paced environments with tight deadlines • Lack of time for thorough analysis may lead to hasty decisions based on shortcuts when making decisions based on incomplete information
Complexity of Issues	• Many policy issues are multifaceted, involving social, economic, and environmental factors • Policymakers must navigate this complexity while avoiding oversimplification

Addressing the challenges highlighted in Table 1 requires strategies such as promoting evidence synthesis, providing concise summaries, and fostering critical thinking skills among policymakers. This can be achieved by encouraging researchers and scientists to undertake knowledge synthesis and package information and data as appropriate in presentation formats that are user-friendly to policymakers. As opposed to other forms of scholarly articles through which knowledge generated is shared with the public, policy briefs are deemed effective for delivering key policy messages that can be useful for policy decision-making. In light of this the National Council for Science and Technology (NCST), Rwanda organized a convening event for research scientists to engage through a cohort learning on how to write policy briefs.

Highlights of training workshop on knowledge synthesis and writing of policy briefs and scientific manuscripts, held in Musanze, April 2nd – 5th 2024

A training on Knowledge synthesis and writing of policy briefs and scientific manuscripts took place from April 2-5, 2024, and was coordinated by the National Council for Science and Technology (NCST). The rationale of this training was to equip researchers with skills to translate knowledge and application of research findings as a deliberative process between producers and users of research is critical to determine and promote reasonable interventions and paths and improve services to promote better health and social well-being of a population.

The main goal of this training was to equip the researchers with advanced knowledge synthesis techniques, skills in crafting compelling policy briefs and skills to develop effective communication strategies for translating research findings and contribute to informed decision-making. Specifically, the training workshop was intended to facilitate researchers and NCST staffs to draft and develop papers, policy briefs from the available data with a view to generate publications.

The workshop attracted several participants from various institutions including, NCST; University of Rwanda, Institut d'Ensignement Superieur de Ruhengeri (INES Ruhengeri); Rwanda Agricultural and Animal Resources Development Board (RAB) and Coventry University.

The workshop was facilitated by Dr. Paul Michael Nampala, a Technical expert at NCST; Dr. Alfred Bizoza; Dr. Nathan Taremwa, experts from UR-CAVM; and Prof. Ijumba from Coventry University. Additionally, NCST staff, namely Dr. Esperance Munganyinka and Dr. Louis Sibomana, also facilitated the training. There were four groups of researchers, and each group produced a draft policy brief.

The facilitation process was hands-on and entailed experience sharing and delivery of tips on effective writing and communication which enabled participants to acquire skills in scholarly writing with a focus on policy brief and journal manuscripts development.

Each facilitator was assigned to a research group and will continue to mentor the researchers until the policy briefs and journal manuscripts are submitted for publication. The expected outputs of the workshop were (1) Four near final policy briefs developed and ready for further refinement and publication, and (2) Journal manuscripts – the research teams present at the workshop used the skills gained and experiences shared to polish up their respective manuscripts into advanced drafts to be further refined and subjected to peer-review in targeted impact journals.

Participants were well versed with writing journal manuscripts and they found the training sessions a time well spent getting acquitted with crafting policy briefs. Based on the enthusiasm and interest generated, participants resolved (a) To organize a side meeting during the 2nd STI conference for researchers to present their research work to policymakers and receive feedback from articles audience;

(b) That the NCST should undertake the following:

(i) Hold annual capacity building sessions on policy brief development to enhance skills of scientists and catalyze generation of policy briefs in various disciplines.

(ii) Organize workshops with policymakers to provide a platform for researchers and scientists to share information on topical issues in scientific discovery and science implementation.

(iii) Establish a series of published policy briefs, as a publication outlet for policy messages from research and development engagements in Rwanda.

(iv) Compile and host on its website a list of credible journals for Rwandan researchers to publish their scientific papers.

(v) Advocate for researchers to include a science page every day in popular newspapers, and other media channels.

The training workshop was made possible through grant funding under project No. 110256-004 "Scaling and Knowledge Translation Support to the Science Granting Councils" supported by International Development Research Centre "IDRC".

Advancements in R&D Programs towards Commercialization of Research and Innovation Outputs in Rwanda – Insights from the 2022-2023 R&D Survey Report

Japhet Niyobuhungiro[1], Benjamin Nabaana[1], Louis Sibomana[1], Marie Chantal Cyulinyana[1], Victor Muvunyi[2], and Florent Uwacu[3]

[1]National Council for Science and Technology, Rwanda
[2]Ministry of ICT and Innovation, Rwanda
[3]Business Research Center, Private Sector Federation, Rwanda

1. Background

Rwanda's Vision 2050 outlines an ambitious agenda for socio-economic transformation, positioning the country as a knowledge-based, innovation-led economy with a goal to become an upper middle-income country by 2035 and a high-income country by 2050. Central to this vision is the advancement of an efficient National Innovation System (NIS) through research and development (R&D) programs and their successful implementation leading to tangible outputs, their uptake and commercialization. In this regard, Rwanda has made significant strides in R&D inputs and outputs, with an increasing focus on transitioning innovative research outputs into commercial products and services. This article highlights key advancements in R&D programs, the challenges faced in commercialization, and strategic recommendations to enhance the uptake of research outputs as well as technology transfer and commercialization of R&D in Rwanda.

2. Current status of key advancements in R&D Programs

According to the findings of the most recent National Research and Experimental Development (R&D) Survey for FY 2022/2023, the R&D intensity in Rwanda has reached 0.79% of GDP, growing from 0.66% in 2015/2016, as shown in Figure 1. The R&D intensity in an economy is the gross domestic expenditure on research and experimental development (GERD) expressed as a percentage of Gross Domestic Product (GDP). It is a measure of the innovation capacity as well as investments on innovation strategies for wealth creation and economic development. Although this shows a good progress made, more efforts are still required to meet the long- overdue target of 1% of GDP recommended by the African Union. Furthermore, according to Rwanda's vision 2050, Rwanda has a target to reach an R&D intensity of 1.5% of GDP by 2035 and 3% of GDP by 2050 accordingly.

In addition, Rwanda has made very good progress in establishing a national ecosystem conducive to R&D and innovation. This includes policies such as STI policy that focuses on creating an enabling environment and financing for R&D and innovation as well as national strategies for transformation that prioritize science, technology, and innovation as key drivers of economic growth. It also includes strategic efforts for Institutional Strengthening and establishment of research and innovation funding instruments. Moreover, there are established institutions that create synergy for enhanced capabilities in supporting industrial innovation and development and funding opportunities to provide financial support to public and private institutions including startups and small and medium enterprises (SMEs) focusing on high-tech and innovative products applicable in agriculture, health, transport, and other sectors focusing on different technology readiness levels from concept phase all the way up to commercialization phase. These institutions include National Council for Science and Technology (NCST) hosting National Research and Innovation Fund, Green Fund (FONERWA), Rwanda Development Board hosting Rwanda Innovation Fund (RIF), National Industrial Research and Development Agency (NIRDA), among others. For example, NCST in partnership with African Centre for Technology Studies (ACTS) is currently funding and supporting five (5) projects which exhibited proof of concept towards scale up and commercialization.

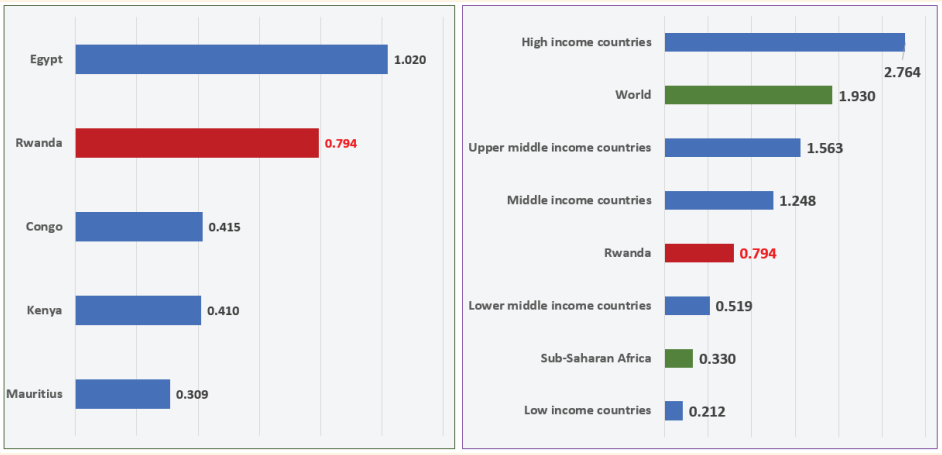

Figure 1: *GERD as a percentage of GDP: Sample comparison of African Countries (Left) and World Bank Income Groups (Right)*

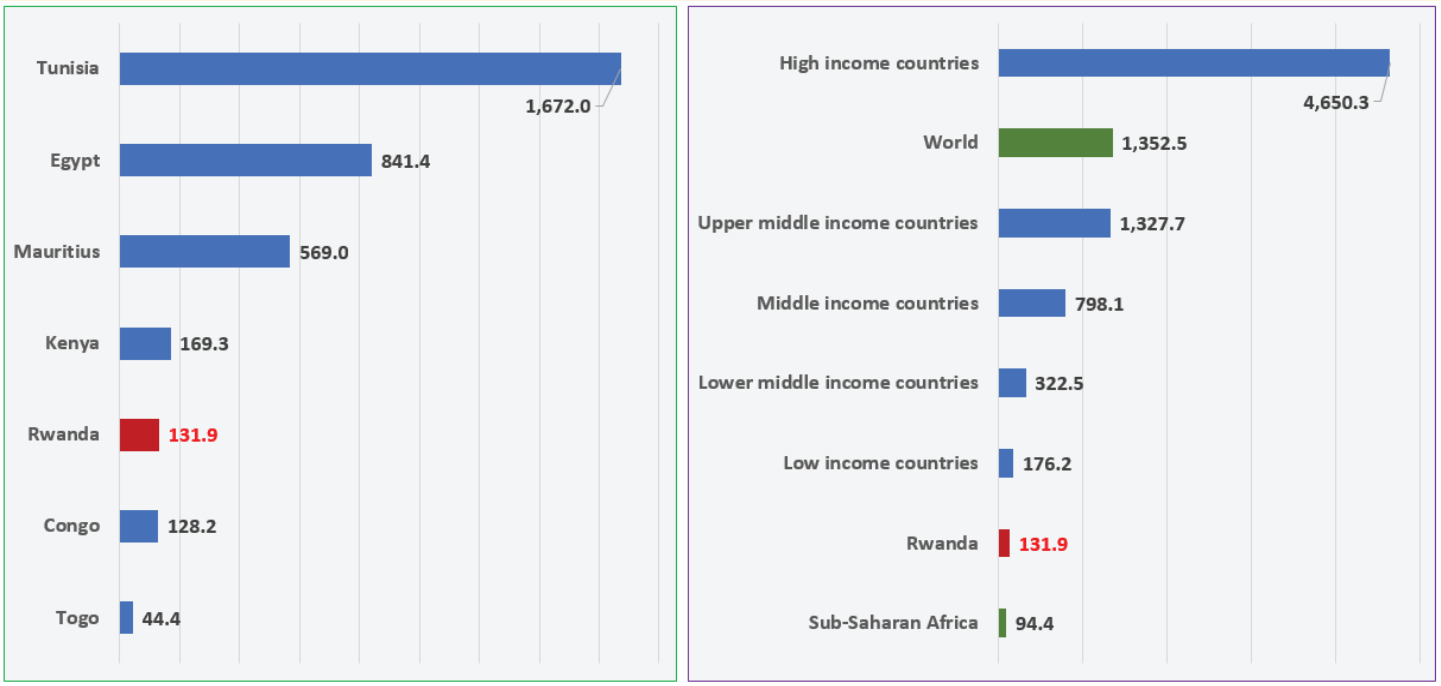

Figure 2: *Researcher full time equivalents (FTEs) per 1 million inhabitants: Sample comparison of African Countries (Left) and World Bank Income Groups (Right)*[4]

Furthermore, a key aspect in commercialization of research and innovation is Academia-Industry Collaborations. In this context, interventions have been made, and universities are playing a key role in facilitating cutting-edge research and its application in technology-driven sectors, as well as expanding partnerships with local industries to drive applied research. The private sector also plays a pivotal role by investing in R&D, providing funding, and offering real-world insights that guide academic research towards practical applications. Innovation Hubs and Incubators also play a key role by providing critical support to technology startups, offering mentorship, networking opportunities, and prototyping facilities. In addition, the ongoing Startup act pioneered by the Ministry of ICT and Innovation (MINICT) will provide incentives and startup funds to strengthen these Entrepreneurship and Innovation Support Organizations (EISOs).

However, more efforts are still needed to close the existing research and innovation gap between academic research and industry application.

3. Challenges in commercialization of research and innovation outputs

Despite the remarkable progress made, several challenges still need strategic interventions and concerted efforts to address them in order to keep the momentum and reap the benefits of an efficient National Innovation System (NIS) in the long-term. Below, we outline five key challenges.

The first challenge is the **low level of business R&D performance**. The national R&D performance by the business sector is very low. In 2015/2016, 2018/2019, and 2022/2023, the business expenditure on R&D (BERD) as a percentage of GERD was 6.83%, 7.93%, and 6.0 %, respectively, representing very low and minimal improvement over time. Similarly, in 2015/2016, 2018/2019, and 2022/2023, the BERD as a percentage of GDP was 0.045%, 0.055%, and 0.047%, respectively. The absence of the business sector in R&D activities can have far-reaching negative implications for long-term economic growth, due to slow innovation, decreased productivity, weak knowledge spillovers and transfer, reduced competitiveness, and limited job creation.

The second challenge is **limited access to R&D and innovation financing**. Despite the available funding instruments, many researchers and innovators still face challenges in accessing adequate financing to scale their projects. Access to financing, especially for the business enterprises, is a significant barrier to R&D investment, particularly for small and medium-sized enterprises (SMEs).

[3] R&D Survey 2022/23: https://www.ncst.gov.rw/publication?tx_filelist_filelist%5Baction%5D=list&tx_filelist_filelist%5Bcontroller%5D=File&tx_filelist_filelist%5Bpath%5D=%2Fuser_upload%2FNCST%2FPublications%2FR_D_Survey_2022-2023_Validation_Workshop%2F&cHash=dba0695a3ce3825a8eb7a1102dbf03da

[4] LPA: https://web.archive.org/web/20070106003042/http://uneca.org/itca/ariportal/docs/lagos_plan.PDF

5 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] Data source: Rwanda National R&D Survey 2022/2023 and New UIS Data for SDG 9.5 on Research and Development (R&D): http://data.uis.unesco.org/index.aspx?queryid=3684

The third challenge is the **low level of university - industry collaboration**. Collaboration between businesses, research institutions, and academia is essential for fostering innovation ecosystem and driving R&D investment in the business sector. The current R&D survey has established a significantly lower collaboration in the business sector compared with other sectors, with an average of 2.7 (somewhat adequate) on a scale from 1 (not at all) to 7 (to a great extent) measuring the extent to which institutions collaborate with businesses and universities on research and development (R&D).

The fourth challenge is the **low rates of R&D human capital and skills gap**. The survey has observed that Rwanda is lagging behind in terms of research personnel contribution to R&D, measured as number of researchers in full-time equivalent (FTE) per 1 million inhabitants. Rwanda scores 132, below the average of low-income countries with a score of 176, see Figure 2. Moreover, a significant number of industry companies report a lack of a skilled workforce capable of conducting R&D, particularly in emerging or high-tech industries. This highlights the need to align the skills produced by educational institutions with the needs of the industry.

The fifth challenge is **market application readiness**. The survey indicates that Rwanda tends to produce only an extremely small number of patents, while its academia continues to produce a number of publications. This indicates a significant degree of separation between research conducted and industrial application. In this aspect, many research projects lack the necessary market analysis and business planning, hindering the smooth transition from research to market-ready products and successful commercialization of innovations.

4. Recommendations

In efforts to achieve economic growth, sustainable development in Rwanda, and diversification of the local production known as Made in Rwanda, policymakers, industry leaders, academia, and innovators must collaborate to create a vibrant innovation ecosystem that supports the commercialization of R&D. This ensures that Rwanda not only generates innovative research but also translates it into market-ready products, verifiable through registered patents and trademarks, with tangible economic benefits for its citizens. To attain this, several strategic interventions are necessary, including enhancing and consolidating ongoing efforts and new initiatives to address highlighted challenges.

Firstly, there is need to **strengthen existing industry-academia linkages** by encouraging more collaborative projects between universities and industries through co-funded research initiatives. Develop training programs that align academic outputs with industry needs and build entrepreneurial capacities through implementation of entrepreneurship training programs within academic and research institutions to equip researchers with business acumen.

Secondly, there is need to **Enhance funding mechanisms** by expanding existing fund instruments to cater for more sector-specific venture funds, providing targeted support, offering mentorship and advisory services to startups on market analysis, business planning, and scaling strategies. Furthermore, there is also a need to improve the evolving regulatory frameworks regarding IP protection to promote investment and commercialization process for innovative businesses.

Moreover, there is need to **promote success stories** by showcasing successful commercialization cases to inspire and guide emerging innovators, and facilitate networking events that connect researchers with potential investors and industry partners, as well as **conducting training programs for researchers and innovators** to enhance their entrepreneurship skills.

In addition, we need to **streamline efforts through consistent R&D programs tailored to the themes of the EISOs such as R&D in agriculture, health, manufacturing (3D, etc.) with a focus on emerging technologies** to enhance the potential for competitiveness and industrial application readiness.

Finally, there is also a need to **consolidate public-private sector collaboration** by encouraging business R&D investment. The government sector needs to increase and strengthen collaboration with the private sector in short to medium-term R&D projects as well as long-term R&D strategies.

By fulfilling these recommendations, Rwanda can build a robust innovation ecosystem that bridges the gap between research and market application, fostering economic growth and delivering significant benefits to its citizens.

Monitoring, Evaluation, and Learning: Key Insights and Future Directions

Didacienne Mukanyiligira & Jean Louis Niragire
National Council for Science and Technology, Rwanda

Background

Empowering the research sector as a source of innovations and new and improved methods of doing things is central to NCST's expansive research vision. In this piece, we go over some of the primary actions taken by scientists in an effort to strengthen and advance domestic research outputs.

Through a variety of funding programs developed under the National Research Innovation Fund (NRIF), which is overseen by NCST, scientists from the public and private sectors collaborated to find answers to urgent national issues. With the global crises of pandemics, draughts, floods, and landslides, as well as hunger, incurable diseases, and climate change in mind, researchers in Rwanda developed various approaches to addressing and resolving issues related to these challenges, adhering to UN SDGs, and other protocols set up to confront them.

In this quarter, research yielded advanced results (March-June 2024), from studies on the production and value addition to locally produced goods, the application of emerging technologies to boost the effectiveness of readily available intelligent solutions, to the development of organic fertilizers production to enable farmers to easily obtain fertilizers at reasonable prices.

The research was expanded on the use of smartphones as personal digital assistants to benefit those with non-communicable diseases, such as type B diabetes, thereby improving the quality of life for those who are ill. As artificial intelligence (AI) develops towards strengthening current systems, researchers are using it to create a database of nutrients for foods and food products that are readily available. These studies focused on various methods used in growing crops, harvesting and storing, and processing and preserving agricultural harvests.

The NCST established a grant scheme on Preventing Malnutrition and Stunting with the aim of funding researchers with best ideas on fighting against malnutrition and stunting. Four (4) research projects were selected for funding, two (2) project in each area. Some of these projects' aims and progress are presented below.

AI - Based Personalized Nutrition Assistant System for Available Food Products in Rwanda

This project aims at combatting malnutrition and stunting in Rwanda through the development and implementation of a system based on Artificial Intelligence (AI) algorithm to support people who consume the available food in Rwanda meeting their daily diet.

Figure 1: *The adequate nutrition and balanced diet*

The project emphasizes the importance of adequate nutrition and balanced diet as essential for the evolution of children as well as the wellbeing for adults, and how dietary habits and choices play a significant role in the quality of life, health and longevity.

The general aims of the project are centered on:

- Establish a database of nutrients for available foods and food products in Rwanda
- Develop a dietetic, physical exercise and home sanitation best practice for Rwanda.
- Develop a user friendly, affordable and easily accessible e-platform.
- Generate an AI based Algorithm
- Conduct practical experiments and research for adequate nutrition services to validate the applicability of the guideline.
- Conduct Capacity building and public awareness adequate nutrition, AI, mobile and Web-based applications.

National Program for Sustainable Usage of Organic Fertilizers (NAPROSUOF)

Another project funded, aiming to improving the management of soil fertility towards addressing food insecurity and rural poverty, and tacking the challenges that the fertilizer value chain in Rwanda faces in order to enhance fertilizer adequacy, access, consumption and raise agricultural productivity.

This project contributes on dealing with numerous aspects that include aspect of high food demand caused by Increasing population, climate change, unpredictable rainfall, and soil fertility depletion.

The project gives prospects as the fertilizers being developed are at the same level of the industrial one, and in addition to this, these fertilizers help in soil recreation that has been destroyed by many factors including intensive farming, steep slopes, and erosion.

Figure 2: *Soil Fertility Depletion (L) and Soil Fertility Restoration (R)*

The first pilot outputted fertilizers that are already being used by farmers, and the furtherance of this study is expected to yield improved and quality fertilizers.

At the completion of the study, the industry will be built to mass produce and farmers will have easy access to the fertilizers and the estimated price will be lower compared to the existing, hence anticipated impact on the agriculture development of in Rwanda.

Figure 3: *NAPROSUOF Organic fertilizers development and Expected Outcome*

There have been concurrent studies conducted on production of biological pests control solutions, production of improved organic fertilizers, the enrichment of seeds & germplasms, and improving food security through production and value addition of local harvests. The following figures illustrates more.

Figure 4: *Production of Organic Fertilizers*

Other studies focused on natural phenomena that mixes thermal and non-thermal ground water, the use of Internet of Things in Monitoring special cases of high cold chains; adding value to local production as the use of stinging nettle (igisura) in the manufacturing of poultry feed; Investigating household food and nutrition security status among children aged under five years, and all these studies are changing and impacting how things are being done today.

Training Workshop on Grants Management and Administration: Enhancing Skills and Strategies

Esperance Munganyinka, Marie Chantal Cyulinyana and Benjamin Nabaana
National Council for Science and Technology, Rwanda

The National Council for Science and Technology (NCST) recently organized a critical three-day training workshop on Grants Management, Monitoring, Evaluation, and Learning (MEL) at the Classic Resort Lodge in Musanze from May 21-23, 2024. This workshop aimed to enhance the competencies of grant management officers, M&E officers, financial officers, auditors, and researchers across various Rwandan institutions.

Purpose and Participation

The core objective was to equip participants with essential knowledge and skills tailored to the specific requirements of funding agencies. This comprehensive training covered various phases and timelines crucial for project implementation, ensuring the successful execution and achievement of project goals. Participants hailed from prominent institutions including the University of Rwanda, Rwanda Agricultural and Animal Resources Development Board (RAB), National Industrial Research and Development Agency (NIRDA), Integrated Polytechnic Regional College (IPRC) Kicukiro, IPRC Tumba, Beno Holdings LTD, Tech Adoptor Ltd, and Nutrifam Ltd.

Dr. Esperance Munganyinka, Head of NRIF Department

Monitoring, Evaluation, and Learning workshop

Workshop Structure and Key Activities

The workshop was meticulously designed to cover critical aspects of grant management and MEL:

- Introduction to NCST's research and innovation grant processes, project management principles, and breakout sessions on institutional MEL frameworks.
- Detailed discussions on grant management tools, NCST's grant management frameworks, and leadership in M&E, followed by group discussions and feedback sessions.
- Individual work sessions, plenary presentations, and final remarks from the Executive Secretary of NCST.

Key Recommendations

The workshop concluded with key recommendations for NCST and partner institutions:

For NCST:

- To update the existing M&E Tool to include key components on job creation that links with indicators for national NST-1 and 2,
- To develop and include financial guidelines into its grant agreements and information put on NCST website mainly on Allowable and Unallowable Costs,
- To conduct due diligence before grant award (e.g.: include External Audit reports during submission of grant, good completion letters of previous grants and other requirements,

Monitoring, Evaluation, and Learning workshop training

- To organize orientation meetings with the Principal Investigator (PI) when grant is awarded and also when new tools and systems are put in place,
- To ensure that there is collaboration with institutional leaderships to strengthen grants management, and MEL systems,
- To increase the frequency of M&E of progress for projects supported,
- To Improve the level of communication among reasearch team and all other stakeholders involved on both host institution and PIs,
- To regularly organize the capacity building workshops for PIs and grant managers to ensure improved coordination and management of the grants,
- To develop a policy and guidelines for monitoring the project impact to the community as the project is being implemented and after the completion of the project,
- To provide advocacy on procurement process for research purposes,
- To improve time for training and go thoroughly into the content.

For Host/Partner Institutions:

- Strengthen /Establish Grant Management offices,
- Avail M&E personnel to support/ ease the M&E Processes,
- Implement external audits where applicable for proper grants management and compliance,
- PIs and Grant managers/ Financial offices are encouraged to collaborate for efficient and effective project implementation.

Conclusion

These training workshops demonstrate NCST's commitment to enhancing grant management practices in Rwanda. By implementing the recommendations and insights gained, NCST and partner institutions can significantly improve project outcomes, ensuring effective utilization of grants to drive research and innovation in the country. The collaborative efforts and shared knowledge from these workshops will undoubtedly contribute to the sustained growth and development of Rwanda's scientific and technological landscape.