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Empowering Innovation: Insights from the National R&D Survey 2022/2023 and 2nd Rwanda STI Conference 2024

NCST Quarterly Newsletter - Issue No: 013 - July– September 2024

PREAMBLE: This 13th edition of NCST newsletter is showcasing Rwanda's unwavering commitment to advancing research, science, technology, and innovation as cornerstones of national development. This issue highlights two pivotal events: The Dissemination Workshop of the Rwanda National Research and Experimental Development (R&D) Survey 2022/2023 outputs, which provided key insights into Rwanda's progress towards its Vision 2050 goals, and the Second Rwanda Science, Technology, and Innovation (STI) Conference 2024, which gathered over 300 participants to explore climate-resilient agriculture practices through innovative solutions. These events underscore Rwanda's leadership in leveraging STI to drive socio-economic transformation, emphasizing the need for collaboration, knowledge sharing, and investment in research to ensure sustainable development and improved livelihoods.

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Guest of Honor alongside speakers and members of the organizing committee at the 2nd Rwanda STI Conference

A researcher presenting innovative research products at the exhibition during the 2nd Rwanda STI conference

Hon. Minister of Education and Rwanda Polytechnic Vice Chancellor awarding a female researcher at the 2nd Rwanda STI Conference ceremony

One of the Group photo of panelists from one of the panel discussions at the 2nd Rwanda STI Conference

NCST Grant Awardees with NCST staff at the Dissemination Workshop for the 2022/2023 R&D Survey

Guest of Honor at the Dissemination Workshop for the 2022/2023 R&D Survey presenting an award to an NCST Grant recipient

Dissemination Workshop on Rwanda's National Research and Experimental Development (R&D) Survey 2022/2023

Japhet Niyobuhungiro[1], Felly Migambi Kalisa[1], Marie Chantal Cyulinyana[1], Theogene Kayumba[1], Benjamin Nabaana[1], Patrick Rebero[1], and Innocent Ngaruye[1,2]

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Summary

Industrialized nations have been monitoring the R&D for a very long time, because R&D statistics form a sound evidence base required to understand how knowledge creation and dissemination contributes to economic growth and societal wellbeing. They have also produced the Frascati Manual[1], a standard measurement guideline that has been in use since 1963, to support this demand for evidence through a similar terminology and statistics that are internationally comparable. Furthermore, over time, more African countries are recognizing the importance of utilizing STI metrics to monitor national policy achievements and assess progress toward the SDGs and STISA goals[2].

On Tuesday, 13th August 2024, the National Council for Science and Technology (NCST) held a Dissemination Workshop at Marriott Hotel, Kigali, to present the findings of the Rwanda National Research and Experimental Development (R&D) Survey for reference year 2022/2023. The event was attended by representatives from various stakeholder organizations, including those from the business sector, government, higher education, private non-profit institutions, and development partners. The survey findings mark a significant milestone and required efforts to strengthen the National Innovation System (NIS) in Rwanda's journey towards achieving its Vision 2050 goals through the promotion of science, technology, research, and innovation as key drivers for socio- economic development.

Background on the Strategic Importance of the R&D Survey in Rwanda

Research and Development (R&D) is a cornerstone for any country's economic progress as it is one of the key enablers and input to innovation in the context of the overall efforts made in a knowledge- based economy. Particularly, Rwanda is keen on leveraging innovation growth for socio- economic transformation. Under the Vision 2050, the Government of Rwanda underscores and prioritizes R&D as a key driver of technological development, industrial growth, and overall socio-economic advancement for improved quality of living for its citizens.

In fact, according to Rwanda's vision 2050, Rwanda has a target to reach an R&D intensity[3] of 1.5% of GDP by 2035 and 3% of GDP by 2050, as it continues to progress towards meeting the long overdue target of 1% of GDP recommended by the African Union.

The 2022/2023 R&D Survey, conducted by NCST plays a vital role in tracking the country's progress toward these goals by supplying data that supports decision-making and policy development. Indeed, R&D statistics form a sound evidence base required to understand how knowledge creation and dissemination contributes to economic growth and societal wellbeing.

Therefore, the R&D survey serves as an essential tool for assessing the performance and effectiveness of the Rwanda's National Innovation System (NIS). As such, by collecting and analyzing R&D statistics, the survey offers insights into the current status of scientific research and technological innovation advancements in the country. Furthermore, it aligns with global standards, specifically monitoring the country's progress towards achieving Sustainable Development Goal (SDG) Number 9, which focuses on building resilient infrastructure, promoting inclusive and sustainable industrialization, and fostering innovation. Target 9.5: Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, particularly in developing nations. This includes fostering innovation and significantly increasing the number of research and development workers per million people, as well as public and private investment in research and development by 2030. More specifically, Indicator 9.5.1: Research and development expenditure as a proportion of GDP; and Indicator 9.5.2: Researchers (in full-time equivalent) per million inhabitants.

[1] ***Frascati manual:*** The Frascati Manual is a set of internationally recognized guidelines for collecting and reporting data on research and development (R&D). Developed by the Organization for Economic Co-operation and Development (OECD), it provides standardized definitions, classifications, and methodologies for measuring R&D activities.

[2] ***STI:*** STI stands for Science, Technology, and Innovation. It refers to the integrated approach of fostering scientific research, technological advancements, and innovative practices to drive economic growth, societal well-being, and sustainable development; SDGs: SDGs stands for Sustainable Development Goals. Specifically, R&D falls under SDG9: Industry, Innovation, and Infrastructure: Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation; STISA: STISA stands for the Science, Technology, and Innovation Strategy for Africa. After STISA-2024, the next iteration of STISA-2034 is under development: https://shorturl.at/h2qPg

[3] Gross Domestic Expenditure on Research and Development (GERD) expressed as a percentage of Gross Domestic Product (GDP) indicates the R&D intensity in an economy, and is a measure of the innovation capacity as well as a measure of investments on innovation strategies for wealth creation and economic development.

Dissemination Workshop Highlights

The workshop commenced with a welcome and introductory session led by Mr. Kalisa M. Felly, STI Policy Analyst at NCST. Following this, Dr. Eugene Mutimura, Executive Secretary of NCST, delivered the opening remarks, offering an overview of the national R&D landscape, emphasizing achievements, identifying gaps, and outlining future strategies to sustain R&D progress.

Dr. Japhet Niyobuhungiro, R&D Analyst at NCST, made a detailed presentation on the findings from the Rwanda National R&D Survey 2022/2023. The presentation highlighted key R&D indicators, including:

- R&D expenditure measures in the business, government, higher education, and private non-profit sectors, and the overall gross expenditure on R&D.
- R&D intensity; and measure the level at which basic, applied and experimental development research are conducted in the country.
- R&D funding by source and sector of performance.
- R&D personnel and their distribution by level of formal qualification, occupation, field of research, age, gender in headcount (HC) and Full Time Equivalent (FTE) who are directly involved and participate in implementation of R&D activities.
- Research productivity including R&D outputs in terms of publications and intellectual property rights (patents, trademarks, copyrights, etc.).
- Relevant international comparisons in terms of R&D survey indicator statistics.
- Gaps and strategies to bolster national R&D.

Remarks from NCST Executive Secretary and officials of Research and Development institutions during the dissemination of the 2022/2023 National R&D Survey findings.

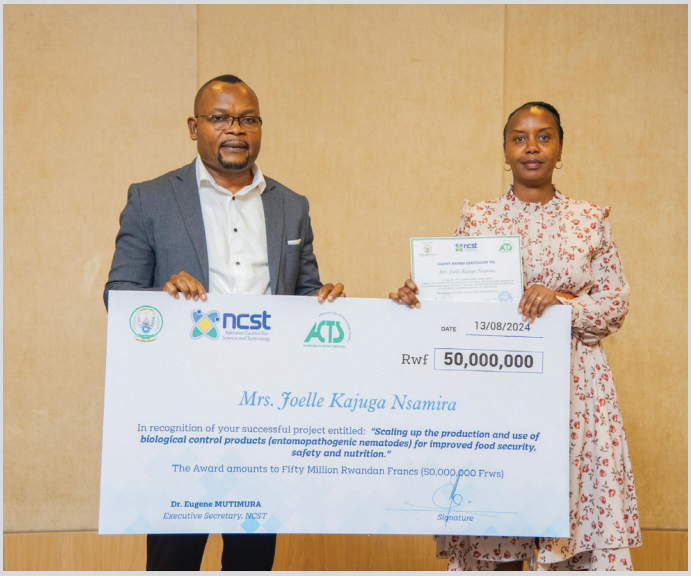
These indicators are vital for understanding Rwanda's current position in the global research and innovation ecosystem.

A key portion of the dissemination workshop focused on an interactive session where participants took part in a Q&A and shared their perspectives on how to implement the survey's recommendations.

This session aimed to foster a collaborative approach to strengthening Rwanda's R&D and innovation ecosystem, ensuring that the findings translate into actionable strategies that benefit all economic sectors in Rwanda.

Research Grant Awards Ceremony

The event also featured a grant awarding ceremony led by Dr. Esperance Munganyinka, Head of the National Research and Innovation Fund (NRIF) Department. This ceremony is in a broader perspective of recognizing research and innovation excellence through awarding grants to innovative projects that have the potential to address national challenges in priority areas such as food security, malnutrition, and the local production of fertilizers, and those that have global impact such as impact of climate change on health. The research grants and implemented projects are expected to catalyze research and provide scalable solutions that will have impact on Rwanda's development.



Presentation of awards to the grant winners, followed by a group photo with the invited officials

Way forward Building a Robust and Effective R&D and Innovation Ecosystem

In his closing remarks, the guest of honor, Mr. Pascal Gatabazi, Chief Technical Advisor at MINEDUC, representing the Honorable Minister of Education, praised the NCST for successfully conducting the R&D Survey. He highlighted Rwanda's commitment to fostering an effective, robust R&D ecosystem that supports innovation-driven growth. The insights gained from this 2022/2023 R&D Survey will guide the development of strategic interventions to address the identified gaps in order to continue enhancing Rwanda's scientific and technological capabilities.

As the country continues to progress toward its ambitious Vision 2050 goals, the role of R&D and innovation in shaping Rwanda's future is crucial. The NCST, through its efforts in fostering collaborations, aims to ensure that Rwanda meets its targets in scientific, technological, research and innovation advancement. The Dissemination Workshop of Rwanda National Research and Experimental Development (R&D) Survey 2022/2023 at Marriott Hotel was a testament to this ongoing commitment and a step forward in realizing a more effective NIS in Rwanda.

The full report and data can be accessed through the link:

https://www.ncst.gov.rw/index.php?eID=dumpFile&t=f&f=105946&token=e4133091cbfcc46425b305d3cc8f248edcdab239

Insights on the 2nd Rwanda STI Conference 23-24 September 2024

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[3]INES Ruhengeri,
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Introduction

The National Council for Science and Technology (NCST) andThe Ministry of Agriculture and Animal resources (MINAGRI) in collaboration with national and international partners, successfully hosted the 2nd Rwanda Science, Technology, and Innovation (STI) Conference on September 23-24, 2024, at the Kigali Convention Centre. With over 300 participants, the conference brought together experts, researchers, policymakers, and innovators to address one of the most pressing global challenges-***climate change's impact on agriculture.*** With the theme ***'Promoting Climate-Resilient Agriculture through Science, Technology, and Innovation for Enhanced Food Security and Nutrition'***. This event fostered collaboration, knowledge sharing, and networking opportunities. It served as a platform to explore innovative solutions, leveraging technologies like Artificial Intelligence, Internet of Things, precision agriculture, etc, aimed at transforming agriculture and ensuring food security for all.

Photo 1: Guest of Honor, Conference Stakeholders, Organizing Committee and speakers

The success of the 2nd Rwanda STI Conference was a result of collaborative efforts across institutions dedicated to research and innovation. The conference provided a platform for networking and knowledge sharing, encouraging participants to think beyond their disciplines and embrace multidisciplinary approaches. It was a call to action for experts, innovators, and policymakers to leverage science, technology, and innovation in tackling climate resilience in agriculture and ensuring sustainable food security.

This conference highlighted the vital role of science, technology, and innovation (STI) in shaping the future of climate-resilient agriculture. Bringing together par-

ticipants from around the globe, the event fostered critical discussions on bridging the digital divide and addressing data gaps essential for promoting sustainable agriculture. The conference also provided a platform for sharing cutting-edge technologies, reinforcing the commitment to transforming agricultural systems toward greater resilience and sustainability. This two-day event provided a vibrant platform for stakeholders to exchange knowledge, collaborate on innovative solutions, and explore the transformative potential of cutting-edge technologies in agriculture. It featured a diverse array of activities, including keynote speeches, panel discussions, paper presentations, exhibitions, and an innovation pitching session. Stakeholders from academia, industry, government, and civil society engaged in impactful discussions aimed at advancing agriculture through cutting-edge technology and innovation.

Highlights from the Conference

Opening Remarks: The conference was officially opened by Hon. Dr. Ildephonse Musafiri, the Rwandan Minister of Agriculture and Animal Resources. He emphasized the urgent need to address the challenges posed by climate change to agricultural systems, by highlighting the importance of technology and innovation. The Honorable Minister stressed the significance of Artificial Intelligence (AI), big data, and precision farming, in addressing food security and climate resilience.

During the opening of the 2nd Rwanda STI Conference, Hon. Minister Dr. Ildephonse Musafiri toured the exhibition stands, where he was introduced to a variety of innovative products developed by Rwandan researchers in the agriculture sector. These innovations aim to address the pressing challenges in agriculture, with several mature solutions being pitched to potential investors. There is a strong optimism that some of these innovations will be scaled up in the near future, driving impactful advancements in Rwanda's agricultural landscape.

Photo 3: Hon.Dr. Ildephonse Musafiri vising exhibitions

Keynote Addresses:

Prof. Eugénie Kayitesi from the University of Pretoria, delivered a compelling keynote on the role of integrated agri-food systems and post-harvest technologies as pivotal drivers for sustainable and climate-resilient agriculture. Prof. Kayitesi emphasized the deep connection between agriculture, climate change, and sustainable development, highlighting the vulnerability of farmers due to climate change and the significant contribution of the agri-food system to environmental degradation. In Rwanda, 40% of fresh produce is lost before reaching consumers, worsening food insecurity. She called for investment in post-harvest infrastructure, food processing, and sustainable resource use to build a climate-resilient agricultural system.

Dr. Canisius Kanangire, Executive Director of the African Agricultural Technology Foundation (AATF), presented an insightful keynote on strategies and best practices for enhancing food processing, storage, and market access. Dr. Canisius emphasized that while genetic gains have improved agricultural productivity in Africa, post-harvest losses-ranging from 5-29% across crops-significantly erode these benefits. These losses are due to poor storage, pests, and limited market access. He highlighted the need for low-carbon processing techniques, genetic innovations like delayed ripening, and sustainable post-harvest management. To ensure long-term impact, scalable technologies, infrastructure investment, and supportive policies are essential.

Emeritus Prof. Ken Giller from Wageningen University discussed on "Big Data – Small Farms," focusing on the opportunities and challenges of utilizing big data to enhance climate resilience in smallholder farming systems. Prof. Giller highlighted the urgent need for Africa's agricultural sector to meet the demands of a growing population while protecting the environment and adapting to climate change. While agricultural technologies have advanced, the challenge lies in effectively implementing this knowledge. He emphasized the potential of "data-driven agriculture" to provide precise, localized farming advice but acknowledged the difficulties in scaling it. Promising approaches, such as ICT applications and radio, could help overcome knowledge barriers and support resilient agriculture.

Dr. Hakizumwami Birali Runesha from the University of Chicago showcased how Artificial Intelligence (AI) and emerging technologies are transforming agricultural productivity and efficiency. Dr. Bilari emphasized how AI and emerging technologies like precision farming and IoT are revolutionizing agriculture by increasing productivity, optimizing resource use, and promoting sustainability. He highlighted AI-driven tools that enhance food security while addressing challenges like infrastructure gaps, digital literacy, and ethical considerations.

Dr. Peter Minang, Director for Africa and Global Coordinator at CIFOR-ICRAF, delivered a keynote speech on the importance of promoting gender and social equity in agriculture. Peter emphasized the vital role of integrating gender and social equity into climate-resilient agriculture policies and practices. He highlighted the need for supportive policies that encourage equitable participation, focusing on gender-disaggregated data and community engagement to address disparities in land ownership, financial inclusion, and market access. The presentation also explored strategies for empowering women farmers and overcoming social barriers, showcasing best practices from CIFOR-ICRAF.

Panel Discussions:

The conference featured engaging panel discussions on topics like policy integration for climate-resilient agriculture, collaboration between academia, industry, and the public sector, and the transformative potential of emerging technologies namely blockchain, AI, and vertical farming.

Policy Integration and Effectiveness for Climate resilient Agriculture to enhance Food Security and Nutrition.

The panel emphasized that climate-resilient agriculture is essential for addressing the challenges of climate change and ensuring food security and nutrition. Effective policy integration across sectors like agriculture, environment, and health is crucial to promote sustainable practices, support smallholder farmers, and enhance collaboration for stronger agricultural resilience.

Strategies and practices for improving food processing, storage and access to markets

The panel highlighted the crucial role of a resilient agrifood processing sector in creating jobs, connecting producers to urban markets, and ensuring access to nutritious food. As demand for high-value foods rises, effective processing and storage methods are essential for delivering healthy diets efficiently. Experts discussed innovative strategies and technologies that add value to farming products while promoting sustainability in food processing in Rwanda, and Africa in general.

Policy and implementation: Application of Disruptive technologies for food systems transformation

The panel emphasized Africa's potential to meet the projected 50% increase in global food demand by 2050 through its abundant resources and favorable agricultural conditions. It was well discussed that Disruptive technologies including blockchain, AI, and vertical farming can revolutionize agricultural value chains and enhance food safety and access. The discussion focused on the importance of effective policies, international collaboration, and capacity building to develop sustainable and inclusive food production systems that bolster food security and drive economic growth across the continent.

Enhancing the Utilization and Protection of Intellectual Property for Agri-Business Enterprise Growth

The panel discussed the rapid evolution of the agricultural sector driven by innovations in technology, biotechnology, and sustainable practices. They highlighted the importance of intellectual property (IP) as a vital tool for fostering innovation and competitive advantage, yet noted that many African countries underestimate its significance due to a lack of awareness and capacity to leverage IP systems. To address the challenges of securing rights and protection for agricultural innovations, the panel explored strategies to enhance IP utilization and support the growth of agribusiness enterprises by protecting their research outputs.

Oral and Poster Presentations

The conference featured a dynamic array of oral and poster presentations, showcasing cutting-edge research in agricultural innovation. Out of 27 accepted oral presentations, 20 were delivered across various subthemes, highlighting diverse scientific contributions and addressing key topics namely biotechnologies, mechanization, food processing, climate-smart farming, and sustainable agricultural technologies. Additionally, 8 poster presentations out of 13 accepted ones provided visual insights into ongoing research efforts, further enriching the conference's discourse. These presentations revolved around critical themes including genetic strategies for improved crop yields and the socioeconomic implications of agricultural policies, fostering a comprehensive understanding of the challenges and opportunities within the agricultural sector. This platform facilitated meaningful exchanges among researchers, practitioners, and policymakers, driving forward the conversation on advancing agriculture in the face of evolving challenges.

Some Oral presentions of research works

Exhibition as key driver on Innovate & Invest: Bridging Opportunities for Growth in Agricultural Innovations

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[2]Private Sector Federation

Background

The "Innovate & Invest" exhibition, which took place during the 2nd Rwanda Science and Technology Conference on September 23-24, 2024, at the Kigali Convention Center (KCC), represented a milestone event for the advancement of agricultural innovation in Rwanda. Organized by the National Council for Science and Technology (NCST), in collaboration with prominent stakeholders such as the Ministry of Agriculture and Animal Resources (MINAGRI), the University of Rwanda (UR), Private Sector Federation (PSF), and the African Agricultural Technology Foundation (AATF). This event was aimed at fostering climate-resilient agricultural practices to improve food security and nutrition in the region. The exhibition served as a critical platform to bridge the gap between innovative agricultural technologies and investment opportunities. By bringing together investors, representatives from the private sector, policymakers, and technology startups, the event facilitated meaningful dialogues that are essential for the future of agriculture in Rwanda. This year's theme, *Innovate & Invest: Bridging Opportunities for Growth in Agricultural Innovations*, underlined the importance of leveraging science and technology to tackle food security challenges in the face of climate change.

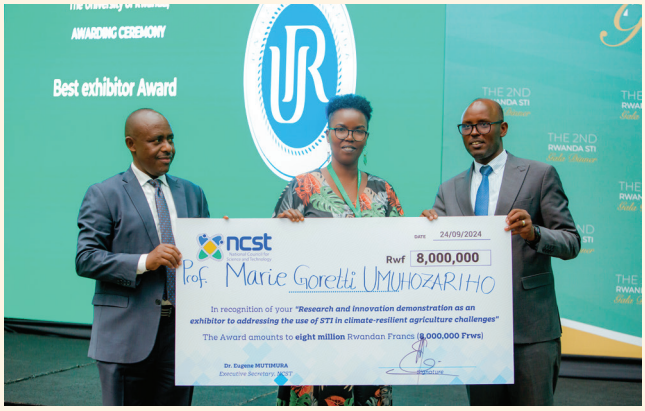
Showcasing Agricultural Innovations

The event featured 20 exhibition booths, where cutting-edge agricultural technologies were showcased. Start-ups and innovators from across Rwanda and the region displayed interactive demos, prototypes, and presentations of their products and services. From precision agriculture solutions to advancements in biotechnology, the exhibition demonstrated the power of innovation in transforming agriculture. Highlights included projects such as the development of bio-pesticides, IoT-powered irrigation systems and climate monitoring systems for agricultural value chains. The exhibition provided attendees with a firsthand look at innovations poised to revolutionize farming practices and enhance productivity. For investors, this was an opportunity to explore novel business solutions, collaborate with tech startups, and identify investment opportunities that align with the growing demand for sustainable agricultural technologies.

Pitch Sessions

One of the highlights of the exhibition was the pitch sessions, where researchers and innovators presented their innovative business ideas and investment proposals to investors, industry experts, and policymakers. These pitch sessions not only allowed researchers and innovators to secure funding but also provided them with critical feedback to refine their business models and strategies. The diversity of ideas presented, ranging from AI-driven farming solutions to nutrient-rich food production innovations, sparked significant interest from investors. 12 pitches were made and one of them got a prize for her innovative idea and product as the best exhibitor.

Innovation Awards: Celebrating Excellence



Another key feature of the exhibition was the Innovation Awards, which recognized outstanding innovations and their contributions to agricultural solutions. These awards celebrated excellence across various categories, including climate-smart agriculture, precision farming, and food security solutions. By spotlighting top-performing exhibitors, the event motivated participants and encouraged further investment in innovative solutions that address critical challenges in the agricultural sector.

Impact on the Entrepreneurial Ecosystem

The "Innovate & Invest" exhibition left a lasting impact on Rwanda's entrepreneurial and innovation ecosystem. By creating a space for knowledge exchange and meaningful networking, the event enabled startups to build partnerships with investors, private sector representatives, and government officials. Informal networking sessions provided additional opportunities for stakeholders to connect, exchange ideas, and explore collaborative projects.

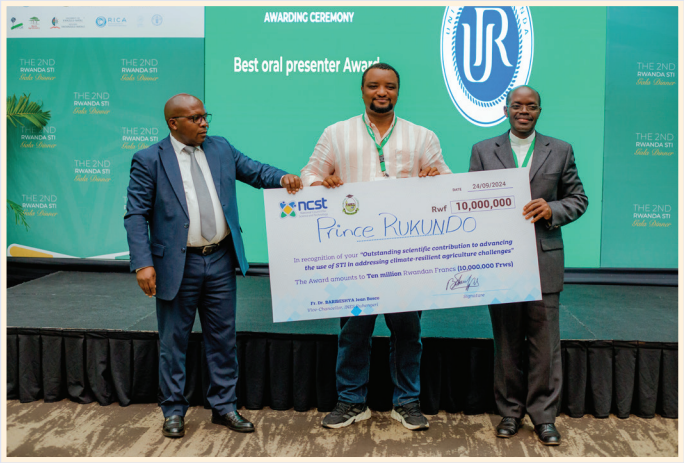
The event also reinforced Rwanda's commitment to nurturing a robust science, technology, and innovation (STI) ecosystem that supports the growth of agricultural technologies. By giving startups access to funding and critical resources, the exhibition is expected to have a ripple effect on the overall growth of the agriculture sector in Rwanda, driving both economic growth and food security for the nation.

Recommendations and Way Forward

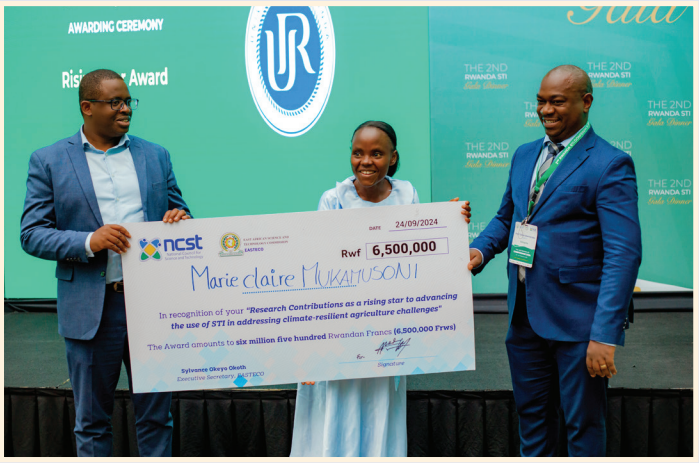
Recommendations	Way Forward
Strengthen Collaboration Between Research and Private Sector: Foster continued engagement between academia, innovators, and the private sector to enhance the uptake of research outputs and promote 'Made in Rwanda' products.	Create platforms for regular interaction and partnership-building opportunities between NCST awardees, researchers, and private sector actors to commercialize innovations effectively.
Enhance Intellectual Property (IP) Utilization and Protection: Address the challenges of IP faced by the private sector and academia, particularly in the agricultural sector, to protect innovations and drive business growth.	Implement awareness and capacity-building programs on IP rights and systems, targeting both researchers and the private sector to ensure better utilization and protection of innovations.
Increase Investment in Agri-Business Innovation: Encourage private sector investments in agricultural innovations, particularly those pitched during the event, to scale up and commercialize products.	Leverage exhibitions and pitching sessions to attract more investors and support innovators in securing the resources needed to bring their products to market.
Support Commercialization of Innovations: Provide financial and logistical support to award-winning innovators like Prof. Marie Goretti Umuhozariho, to help them commercialize their innovations and expand market reach.	Develop structured funding mechanisms and mentorship programs to guide innovators through the commercialization process and ensure successful market entry.
Promote Knowledge Sharing and Capacity Building: Facilitate ongoing knowledge exchange between academia, policymakers, and the private sector to address gaps in innovation uptake and strengthen the agriculture sector.	Organize regular panel discussions and workshops to address sector-specific challenges and collaboratively find solutions, ensuring a sustainable ecosystem for innovation.

Recognition of best scientists and innovators, and Concluding remarks:

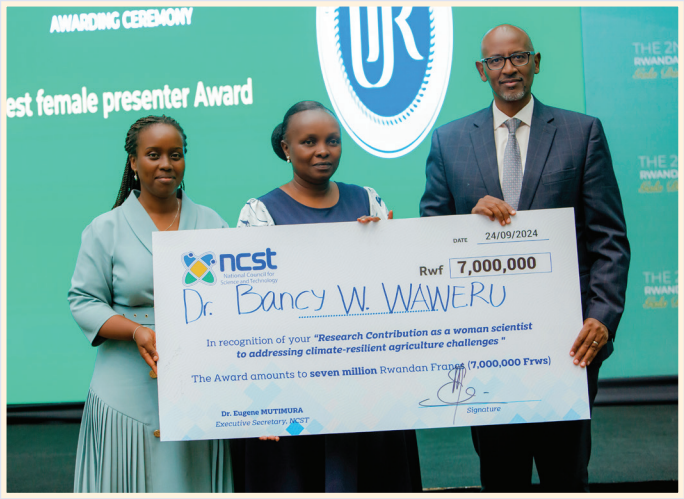
The conference concluded with a Gala Dinner and an Awarding Ceremony, where distinguished individuals were recognized for their contributions to addressing climate-resilient agriculture challenges:



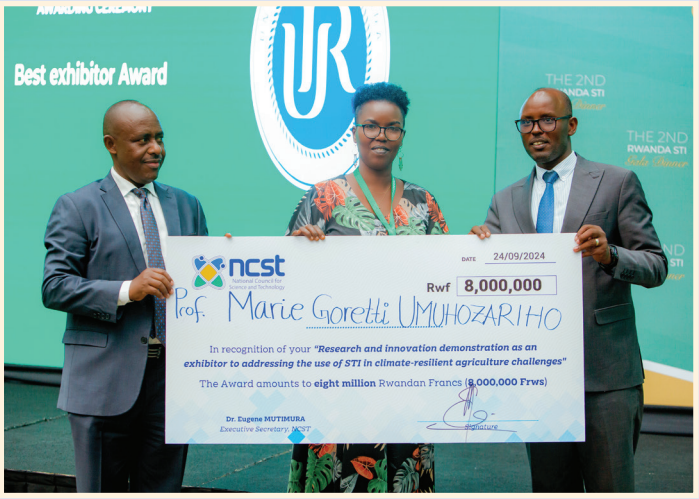
The Best Scientist Award was presented to Prince Rukundo, valued at 10,000,000 Rwf.



The Rising Star Award was presented to Marie Claire Mukamusoni, valued at 6,500,000 Rwf.



The Best Female Scientist Award was granted to Dr. Bancie W. Waweru, valued at 7,000,000 Rwf.



The Best Exhibitor Award was awarded to Prof. Marie Goretti Umuhozariho, valued at 8,000,000 Rwf.

Hon. Minister of Education recognizing master's completion of studens from Singapore

Group photo of all awarded presenters

Additionally, the conference recognized nine students from Nanyang Technological University (NTU), Singapore, for their achievements in fields like AI, Smart Manufacturing, and Materials Science.

Hon. Minister of Education, Joseph Nsengimana, honored these students for their accomplishments in advanced fields such as Artificial Intelligence, Smart Manufacturing, Computer Automation, Materials Science, and Electrical Power.

Hon. Minister Joseph Nsengimana's Concluding Remarks:

The concluding remarks at the conference were delivered by the Guest of Honor and Minister of Education Hon. Joseph Nsengimana who reaffirmed Rwanda's commitment to utilize science, technology, and innovation to the development of national priority areas, specifically in advancing agriculture sector. He also commended the international collaborations fostered during the event and encouraged continued investment in science and technology to achieve sustainable development goals.

Hon. Nsengimana noted, "*As we concluded the 2nd Rwanda Science and Technology Innovation Conference 2024, we reflected on the invaluable collaborations and insights shared over the past two days. The theme of promoting climate-resilient agriculture through science and technology underscored the urgent need for innovative solutions to tackle the challenges posed by climate change.*" Minister Nsengimana indicated that remarkable advancements in precision agriculture and emerging technologies, are critical and Rwanda's leadership in fostering diffusion of emerging technologies ins important for social economic growth. He further encouraged participants to continue the momentum of implementing the conference recommendations, fostering partnerships and driving sustainable practices that ensure food security and resilience for future generations.

Conclusions and the way forward

The 2nd Rwanda STI Conference was a resounding success, bringing together a diverse group of stakeholders to address the challenges posed by climate change to agriculture. The event facilitated knowledge exchange, fostered partnerships, and laid the foundation for advancing climate-resilient agricultural practices in Rwanda

Some of the key recommendation and action points from the conference are as follow:

i. **Strengthen Policy Frameworks**: Develop integrated and harmonized policies that align with climate resilience goals in agriculture, ensuring effective implementation across different sectors.

ii. **Promote Climate-Smart Agriculture (CSA):** Identify and prioritize specific CSA practices suitable for Rwanda, considering local contexts and farmers' socio-economic conditions.

iii. **Enhance Farmers' Education and Training**/Human capital development in advancing agricultural technology: facilitate capacity building for farmers through training programs that focus on the adoption of innovative agricultural technologies and sustainable practices.

iv. **Foster Collaboration Across Disciplines**: Encourage collaboration among stakeholders from academia, industry, and government to share knowledge and implement effective agricultural solutions.

v. **Invest in Infrastructure**: Improve storage facilities and transportation networks, such as feeder roads, to reduce post-harvest losses and enhance market access for farmers.

vi. **Address the issue of post-harvest Food Loss and Waste**: Implement strategies that utilize AI and machine learning to minimize food losses at post-harvest levels through improved management and logistics.

vii. **Incorporate Cultural Perspectives**: Recognize and integrate cultural and heritage perspectives into

agricultural practices and policies to enhance community engagement and ownership.

viii. **Support Investment in Research and Development**: Encourage investments in agricultural research to drive innovations that improve food security, nutrition, and sustainability.

ix. **Build Networks for Collaboration:** Each participant should establish at least three connections to foster ongoing collaboration and knowledge sharing in the agricultural sector.

x. **Develop and implement effective policies:** This is critical to facilitate the adoption of disruptive technologies, such as blockchain, AI, and vertical farming, to transform food systems across Africa. On this the action Point**:** Establish international collaboration and capacity-building programs that equip stakeholders with the necessary skills and knowledge to leverage these technologies, ultimately enhancing food safety, access, and sustainability in agricultural value chains.

xi. **Increase acquisition of intellectual property (IP) rights and patents through better awareness and understanding:** There is an increasing need for applying and acquiring IP rights among agri-business enterprises, innovators and farmers to foster innovation and secure protection for agricultural innovations. Action Point is to develop targeted training programs and resources that educate stakeholders about the importance of IP, its benefits, and how to effectively navigate the IP landscape, thereby enhancing the utilization and protection of IP to support agri-business growth.

xii. **Promote the integration of big data and data-driven agriculture solutions** in smallholder farming systems to enhance climate resilience and improve productivity. **Action Point:** Develop and implement scalable ICT applications and communication strategies, such as radio broadcasts, to provide smallholder farmers with precise, localized farming advice and essential information, thereby overcoming knowledge barriers and supporting sustainable agricultural practices.

xiii. **Leverage Artificial Intelligence (AI) and emerging technologies** to transform agricultural productivity and efficiency, focusing on sustainable practices. Action Point: Implement training programs that enhance digital literacy among farmers and agricultural stakeholders, while simultaneously addressing infrastructure gaps. This will enable effective utilization of AI-driven tools and precision farming technologies, ultimately improving food security and promoting sustainable agricultural practices.

xiv. **Integrate gender and social equity considerations into climate-resilient agriculture** policies and practices to promote equitable participation and empower women farmers. Action Point: Develop and implement supportive policies that utilize gender-disaggregated data and foster community engagement, focusing on addressing disparities in land ownership, financial inclusion, and market access. This should include training programs and initiatives that empower women farmers and share best practices, such as those from CIFOR-ICRAF, to enhance their role in agriculture.

xv. Establish Post-Harvest Management and easy Market Access mechanisms: There is a strong need to establish and implement affordable post-harvest management practices, as these losses hinder the sustainable agriculture. The establishment of decentralized, community-owned storage facilities and the use of affordable technologies in reducing losses and improving food security may as well impact the management of the yields.

Market access and the link between farmers, governments, and consumers are also crucial. The panel emphasizes that sustainable production must meet consumer demands while also benefiting farmers economically.

The two-day event reaffirmed Rwanda's leadership in promoting the integration of science and technology into agricultural practices and highlighted the essential role of collaboration among sectors to achieve sustainable and resilient agricultural systems.

The National Council for Science and Technology extends its heartfelt gratitude to the Government of Rwanda for its unwavering commitment to fostering Science, Technology, and Innovation as key pillars for national development. We are especially thankful for the government's support in making the 2nd Rwanda STI Conference a reality, providing an invaluable platform for researchers, scientists, practitioners, and policymakers to explore and address emerging trends in agricultural research for climate-resilient agriculture. Furthermore, we express our deep appreciation to the various national and international stakeholders who played a role in the success of this event. Your contributions, in one way or another, have been instrumental in bringing this conference to fruition.