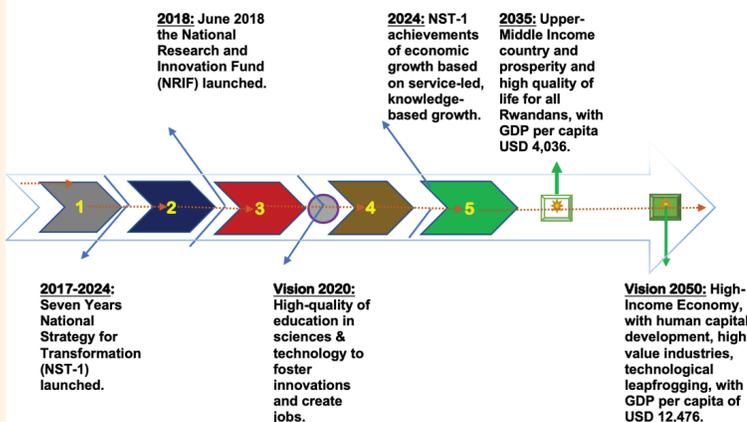# Advancing the Status of STI and Research and Development in Rwanda

NCST Quarterly Newsletter - Issue No: 002 - December 2021

PREAMBLE: Rwanda's Status of Science, Technology and Innovation (STI) as well as Research and Development (R&D) continues to be accelerated by strong national leadership and commitment by stakeholders to support innovation development as products and services to improve the wellbeing of citizens. This newsletter highlights some of important areas as investment trajectory for STI for sustainable development.

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Rwanda's Investment Trajectory in STI for Sustainable Development

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Background: Rwanda National Council for Science and Technology (NCST) continues to support the Government of Rwanda's agenda for social and economic development by accelerating the impact of Science, Technology and Innovation (STI) and Research and Development (R&D) programs. Despite several challenges like uncontrolled catastrophes of landslides and mudslides, COVID-19 pandemic and unpredictable impacts associated Delta and Omicron variants, Rwanda continues to make developmental progress. For instance, in the third quarter of 2021, Rwanda's GDP at current market prices increased from Frw 2,453 billion to Frw 2,746 billion in the same quarter of 2021[1].

Unique investment in STI: The role of science, technology and innovation, and the potential for knowledge creation in Rwanda is enormous. The Government of Rwanda has made strong commitment through enormous resources invested in institutional development and infrastructure that enable, 'knowledge creation as wealth creation'. Over the last decade, renown Universities and Centers of Excellence (COEs) have been supported and established. These Universities and COEs support advancement of STI and R&D to enable national development and knowledge transfer for social economic growth. Examples include African Institute of Mathematical Sciences (AIMS), Carnegie Mellon University-Africa (CMU-Africa), University of Global Health Equity (UGHE) and a number of COEs at University of Rwanda such as Centers of Excellence in 'Internet of Things (IoTs), which focuses on interconnecting objects and sensors (collectively, "things") via the Internet to train Rwandans and Africans in the field of IoTs. The 'Bio-medical Engineering and e-Health', and 'Data Science' are few examples of how institutional support can advance STI and R&D programs. For instance, the 'Data Science' CoE continues to support how data science revolution supports national data interfaces, web-based platforms in biomedical, statistical, engineering to support training and utilization of 'big data' revolution to stimulate evolution of an Africa-led sustainable data science for Rwanda to become an African hub.

Collaborations: In terms of collaborations, NCST continues to leverage opportunities for collaborations. For instance, collaborations with Bioinnovate Africa and Rwandan relevant partner institutions have been established. These collaborations have supported Rwanda and Eastern Africa to understand better and promote the wellbeing of the society through healthier foods, safer medicines, useful substances from biological waste and other environmentally friendly processes. These are in manufacturing, distribution and consumption of goods and services. The goal is to increase economic and social value of regionally traded biological-based goods and services, on converting biological waste into useful material (thus promoting circular production), and connecting national, regional and global biological-based value chains. Bioinnovate Africa is hosted by Icipe (International Centre for Insect Physiology and Ecology) in Nairobi Kenya, the headquarters for PASET (Partnership for Skills in Applied Science, Engineering & Technology). In 2013, Rwanda is among the countries that pioneered an Africa's homegrown PASET program to fund and develop human resources capacity for STI and R&D, and to train a critical mass of PhD students through Regional Scholarship and Innovation Fund (RSIF). As a result of NCST partnership with Bio-Innovate Africa, a number of Rwandan researchers are working on NCST funded projects such as 'Capitalizing on Marigold Bio-Pesticide Properties to Leverage the output of natural products as "Made in Rwanda" and "Enhancement of Production technologies, quality and competitiveness of Rwanda banana beverage product"

Reports on STI and R&D: The 2021 first report on Rwanda's Science, Technology and Innovation (STI) Status for Fiscal Year (FY) 2019/2020 provide useful information on Rwanda's status of STI ecosystem. The report indicates that the STI indicators demonstrate significant progress in terms of technology utilization and adoption. For instance, ease of doing business, access to ICT as well as leveraging digital transformation for growth were ranked high.[2] There was a high level of adoption of emerging technology such as Telemedicine rev-

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[1] Rwanda National Institute of Statistics (NISR) Report GDP National Accounts (Third Quarter 2021) accessed at https://www.statistics.gov.rw/publication/gdp-national-accounts-third-quarter-2021 on December 22, 2021.

[2] The 2021 Report of Rwanda STI reference FY 2019/20 at https://www.ncst.gov.rw/fileadmin/user_upload/NCST/Publications/Reports/STI_Status_Final_Report_August-2021.pdf

olutionizing the healthcare system in Rwanda. Telemedicine was reportedly significantly improving the quality of patients' healthcare through better accessibility and efficiency. It was reported to reduce the need of patients to travel i.e. overcoming geographic barriers, providing better clinical support, offering various types of communication devices, and improving patient outcomes. Another example is use of robotics in management of COVID-19 to perform temperature screening, taking readings of vitals, delivering video messages and to detect people not wearing masks then instruct them to wear masks properly. Besides, WHO has recommended Rwanda for use of drones for prevention of COVID-19 infection. Drones were deployed to compliment radio and TV messages, community health workers and other community leaders by bringing educative messages directly to residents by air.[3] It is worthwhile to note that drones have been used in Rwanda since 2018 for blood delivery to rural areas, and more recently for larvicide spraying to prevent malaria. Drones have been facilitating distribution of medicines for chronic patients during COVID-19 lockdown in Health sector, to topography in Agriculture, and taking pictures to promote tourism in the country. The 2021 national Research and Experimental Development (R&D) survey report for FY 2018/2019 indicates increase in the Gross Domestic Expenditure on R&D (GERD) within 3 years; and R&D intensity, the GERD percentage of national GDP increased from 0.66% in FY 2015/2016 to 0.69% in FY 2018/2019 (Table 1.A). With a total of 1,924 researchers, Rwanda has a score of 152 researchers per 1 million inhabitants (Table 1.B), with females accounting for 35.7%, a commendable progress from 25.07% in 2015/2016.

This makes Rwanda rank fairly well regionally and internationally in terms of female proportion of researchers. There was also a high proportion of 77.4% publication outputs from higher education, and commendable national collaborations that accounted for 54.7% of total R&D collaborations.
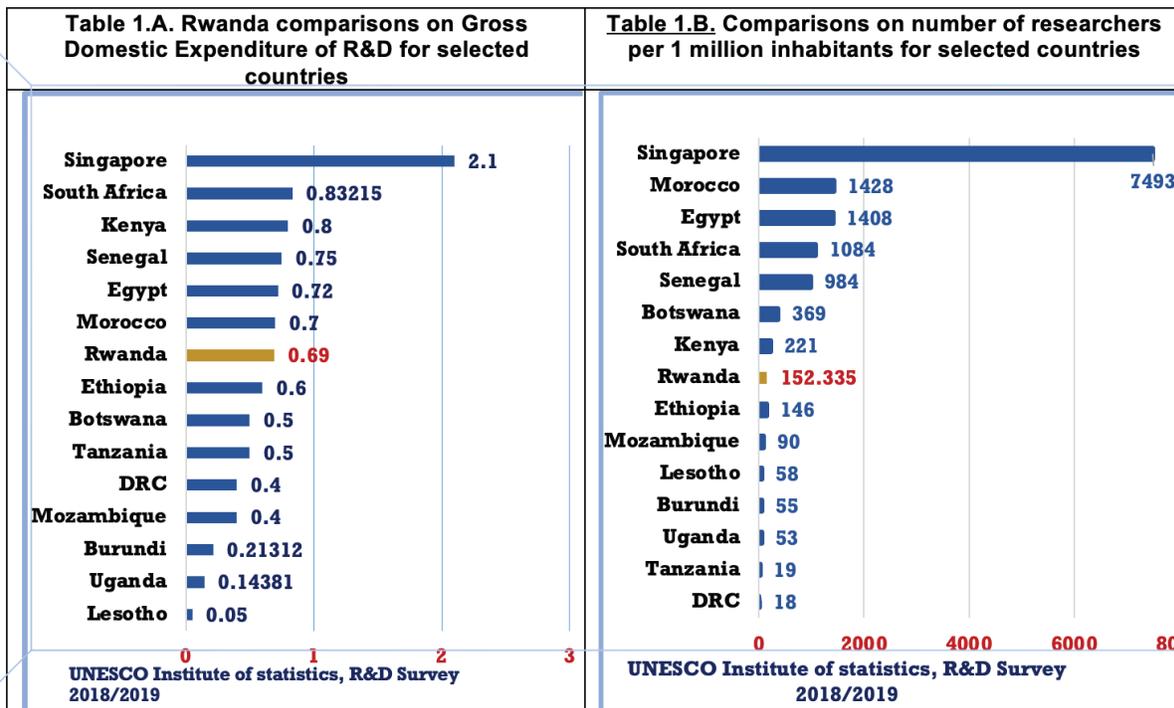
Despite the progress, Rwanda's innovation outputs such as products and services commercialized, patents, intellectual property registered, publications, copy rights, inventions disclosed were reportedly lower than in many countries. It is also worth noting that GERD as a percentage of national GDP of 0.69% is lower than the African Union (AU) 10-Years Science Technology and Innovation Strategy for Africa (STISA- 2024) target of 1% adopted in June 2014 at the 23rd Ordinary Session of African Union Heads of State and Government Summit[4]. The terrific news is that in most countries at the edge of progress, innovations inputs precede or come prior to innovations outputs. Secondly, Rwanda has the potential to develop a critical mass of scientists from several Centers of Excellences and through regional and global collaborations, and if Rwanda's strategic investments in STI and R&D continues, the country will be on the right path to the desirable economic transformation.

Strong National Leadership to accelerate STI: The milestones attained by Rwanda as a country are associated with visionary leadership since the conception of NST-1 in 2017, to establishment of NRIF instrument in 2018. The NST-1 goal was to support realization of development trajectory from Vision 2020 towards Vision 2050, underscoring the role of STI and R&D to accelerate growth towards achieving a high standard of living for Rwandans (Figure 1).
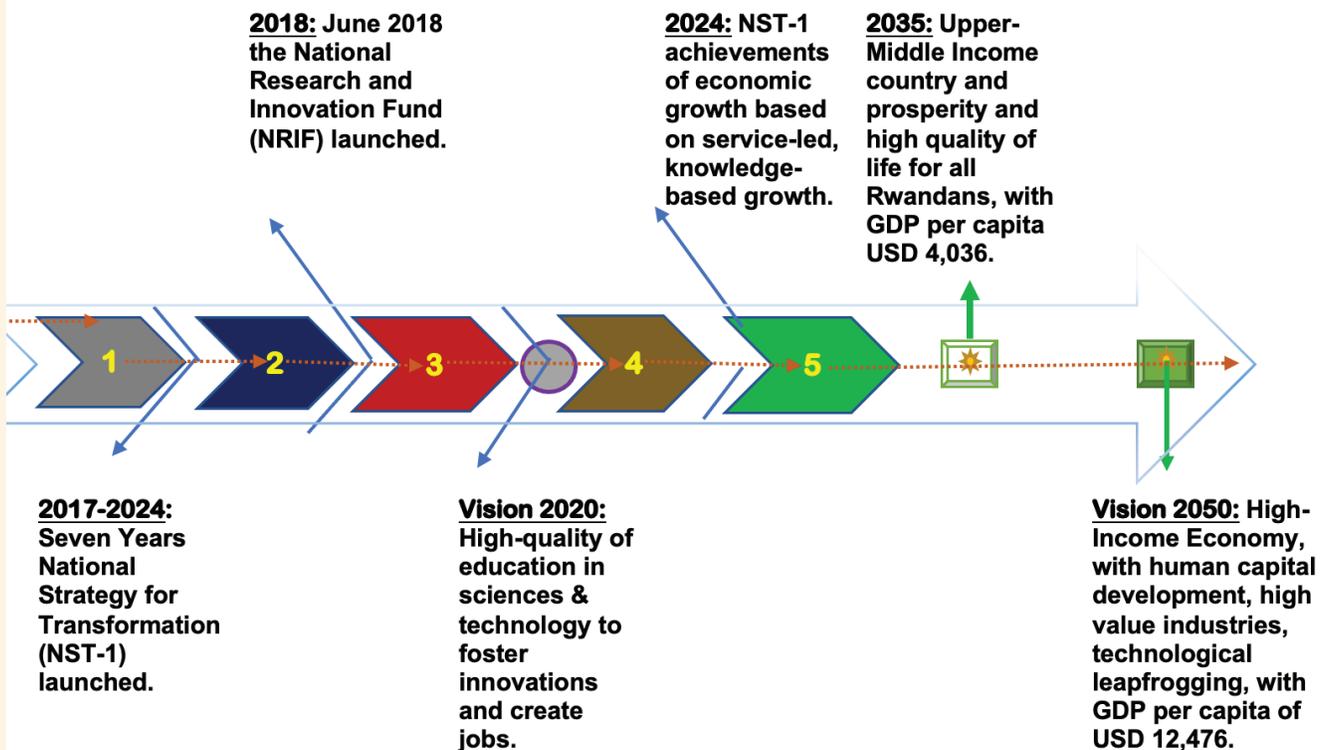
This quite well links with Vision 2020, a 20-year strategy to transform economy with annual growth rate of at least 7%. A lot has been achieved to contribute to creation of a productive middle class through vital innovations and profits, and fostering entrepreneurship through adoption of STI and R&D programs and to create jobs and improve citizens well-being. Rwanda continues to provide high-quality educational services in sciences and technology necessary for consolidating development gains made in the short and medium term. Rwanda is yet to achieve a middle-income status but achieved tremendous higher standard of living with USD 1240 per capital in 2020 (Figure 1).

Overall, the landmark for realization of Rwanda's NST-1 goals is to accelerate economic growth based on private sector and industry growth consolidating sustainable progress through service-led and knowledge-based economic growth. Rwanda has established a technology center to enhance digitalization and Artificial Intelligence (AI). This is to enhance R&D and advanced technological solutions in areas such as AI, security and protection of critical infrastructure. In the near future (prospects for 2022), Rwanda will be one of African countries to start a manufacturing Plant for COVID-19 Vaccines to save lives for Rwandans, Africans and beyond. Rwanda is committed to leverage these investments that require more strategic support, specifically to edge funding for academia and industry collaboration. The goal is to advance R&D performance and output towards more innovations in various areas, and to develop technology solutions and services and foster sustainable industrial growth in Rwanda.

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[3] WHO Report. COVID-19 response in Rwanda: Use of Drones in Community awareness July 2020 at https://www.afro.who.int/news/covid-19-response-rwanda-use-drones-community-awareness

[4] The African Union 10-Year Technology and Innovation Strategy for Africa (STISA-2024) adopted in June 2014 at https://au.int/sites/default/files/newsevents/workingdocuments/33178-wd-stisa-english_-_final.pdf

Table 1.A. Rwanda comparisons on Gross Domestic Expenditure of R&D for selected countries

Country	Value
Singapore	2.1
South Africa	0.83215
Kenya	0.8
Senegal	0.75
Egypt	0.72
Morocco	0.7
Rwanda	0.69
Ethiopia	0.6
Botswana	0.5
Tanzania	0.5
DRC	0.4
Mozambique	0.4
Burundi	0.21312
Uganda	0.14381
Lesotho	0.05

UNESCO Institute of statistics, R&D Survey 2018/2019

Table 1.B. Comparisons on number of researchers per 1 million inhabitants for selected countries

Country	Value
Singapore	7493
Morocco	1428
Egypt	1408
South Africa	1084
Senegal	984
Botswana	369
Kenya	221
Rwanda	152.335
Ethiopia	146
Mozambique	90
Lesotho	58
Burundi	55
Uganda	53
Tanzania	19
DRC	18

UNESCO Institute of statistics, R&D Survey 2018/2019

Figure 1: Rwanda's Science and Technology Trajectory for Sustainable Social Economic Growth

2018: June 2018 the National Research and Innovation Fund (NRIF) launched.

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Improving R&D Outputs Through Partnerships

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[1]R&D Analyst at National Council for Science and Technology, [2]Head of Applied Research & Development & Foresight Incubation Department NIRDA, [3]Director of Advocacy, Private Sector Federation

Background: Research and Development (R&D) plays a critical role in driving the National System of Innovation and contributing to the country's socio-economic development targets. Indeed, R&D is important as a key driver for evidence-based innovation. R&D including basic research, applied research and experimental development eventually contributes to knowledge generation and knowledge deepening, which are a prerequisite for technology development and R&D-based innovations. Rwanda continues to provide a conducive environment for R&D performance through approval of STI Policy, establishment of the National Research and Innovation Fund (NRIF) funding instruments and establishment of several centers of excellence. Currently, there is a need to facilitate academia-industry collaboration to generate innovative ideas to solve challenges that affect the Rwandan society including low quality and quantity of agricultural production, low levels of engineering and manufacturing output, and inadequate innovations in public health sector as few examples. The 2020 Global Innovation Index Report has shown that Rwanda performed better in innovation inputs (79th out of 131 countries) than innovation outputs (112th out of 131 countries).

As indicated by the World Bank (2017 and 2018) report, Rwanda can benchmark from the top 5 countries in R&D output based on their spending percentage of GDP. These include Israel, South Korea, Switzerland, Sweden and Japan. Example in 2018, Israel spent 4.95% of GDP on R&D, which is related to Israel's high innovation output resulting in technology driving its economic sectors development. There is no doubt that Rwanda will continue to benchmark from developed countries to more support researchers through private sector R&D investment tax waiver and provision of incentives to researchers as a way to recognize the role of R&D as a powerful driver of innovation. This will contribute to national economic growth, job creation and market competitiveness.

National R&D data for FY 2018/2019: In order to set effective STI policies and to assess how STI and R&D contribute to economic growth and societal wellbeing, in-depth understanding of the performance of the national innovation systems is required to benchmark and monitor progress. As such, there is need to regularly conduct the assessment of the STI and R&D performance by examining the trends in STI investment, growth, productivity, overall environment and R&D outputs to provide evidence on how they contribute to economic growth and societal well-being. The statistics on R&D performance are used to support informed decision-making in public and private sectors. In this context, the National Council for Science and Technology (NCST) which has the mandate among others to advise the Government on national priorities in the field of STRI and modalities for financing such programs; and to prepare and disseminate annual report on the status of science and technology, has carried out the Rwanda National R&D Survey for the reference year 2018/2019, considering the previous survey of 2015/2016 as the baseline.

The survey established that, as a result of increased efforts to promote research in Rwanda, Gross Domestic Expenditure on R&D (GERD) has increased from over Frw 44 billion in 2015/2016 to over Frw 70 billion in 2018/2019. In terms of type of research conducted, the reports established a notable increase in performance of both basic and applied research, and a decline in experimental development in the 2018/2019. In fact, the proportional share of GERD allocated to the experimental development decreased from 55.64% in 2015/2016 to 24.65% in 2018/2019.

As a recommendation, universities and research institutions should continue to collaborate with the private sector to boost experimental development through collaboration between academia and industry for the up-take of collaborative R&D projects leading to innovative technology development relevant to community needs.

Funding Rwanda Innovation Challenge (RIC) for Innovations: On 11th November 2021, the dissemination of STI Report for FY 2019/20 and R&D Report for FY 2018/19, was officially launched by Hon. Minister of Education Dr. Valentine Uwamariya who also serves as Co-Chair of NCST Council (Board). This was also an occasion to launch a two-phase funding scheme called **"Rwanda Innovation Challenges for Academia-Industry Research and Development Collaboration Grant (RIC- R&D)"**. Phase I: Development, testing and implementation of R&D ideas that have commercialization & technology absorption potential. Funding of up to 90 million Frw for a period of 12 to 18

months. Phase II: Scaling up projects that have already achieved proof of concept during phase I. Funding between 300-500 million Frw for up to 5 years (60 months).

The outcome of RIC-R&D grant scheme will support improved performance of experimental development enabling Rwanda to tap into opportunities to use technology development to create prototypes and innovations. This will support industrial growth, create jobs and impact labour market. RIC-R&D will provides funding opportunities to promote knowledge transfer partnerships among industry/private sector and academia through development and implementation of special R&D projects leading to innovative solutions in six (6) key priority areas.

Launch of RIC-R&D Grant Scheme

Promoting Academia-Industry Partnerships: In order to increase strategic collaboration between academia and the private sector, the NCST through NRIF is currently funding nineteen (19) research projects during the year 2021-2024. The main goal of this funding scheme is to promote research collaboration between academia and industry/private sector to address specific community needs that promote the well-being of Rwandan population. The scheme is also envisaged to ensure that the funded projects fuel industrial productivity and fast-tracking Rwanda's economic transformation especially in the area of technology for industrial development.

Partnership with the private sector: The NCST has signed a Memorandum of Understanding (MoU) with the Private Sector Federation (PSF) aiming to facilitate collaboration between NCST and PSF and their stakeholders to utilize science and technology tools and research to boost small- and large-scale businesses for improved innovations and promotion of industrial development. Expected outcomes include increased awareness and engagement of stakeholders in local production and "Made in Rwanda" value addition, as well as increased quality and quantity of entrepreneurs and jobs created as a result of this partnership.

The signed MOU will also promote Academia-private sector collaborations to improve R&D-based innovations

Finally, as we recover from the pandemic, R&D will play a key role in underpinning private sector growth and job creation, said Christine Lagarde, President of the European Central Bank at the opening of the World Economic Forum's Pioneers of Change summit (see: https://bit.ly/3pKHUUs). In fact, R&D outputs contributes to the lifeblood of many private sector organizations, bringing new products and services to market. It's also important to national economy and plays a crucial role in GDP growth. Through the NCST, the Government of Rwanda is adopting a paradigm shift by taking steps to improve existing and create new strategic funding Mechanisms that are specifically well designed to make sure that we tap into the country's knowledge base and utilize it in a manner that contributes to technology and industrial development. Such funding Mechanisms include **RIC- R&D grant which is going to be implemented through academia-industry partnerships and contribute to improved R&D outputs.**

NCST signed a MOU with PSF to promote Academia-private sector collaborations to improve R&D-based innovations

The case of predicting and monitoring the impact of COVID-19 pandemic in Rwanda

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Background: Rwanda has an ambition to leverage the transformative potential of Science, Technology, and Innovation (STI) to position herself as a globally-competitive knowledge based economy. This strategic orientation is founded on the premise that knowledge is essential to addressing social-economic challenges, and is a key driver of growth, competitiveness, and is indispensable in achieving high quality of living. The Government of Rwanda through the National Strategy for Transformation (NST-1) and Vision 2050 envisions the need for Rwanda to promote Research, Development and Innovation, as a key enabler for national economic and social transformation especially in the area of technology for industrial development. Rwanda has specifically established R&D funding instrument through the National Research and Innovation Fund (NRIF) to facilitate researchers who are expected to play a critical role in finding solutions to address social, economic and environmental challenges, as well as increasing research performance and productivity, and stimulate competitiveness.

COVID-19 Pandemic in Rwanda and interventions: On 14 March 2020, *Rwanda* confirmed its first *COVID-19* case which ranked *Rwanda* the *19*th African country to report the existence of the disease on its land. The interventions started across the country to fight against this virus including lockdowns, control and surveillance systems, and measures to limit the spread of the disease. Moreover, research activities on this pandemic were also taken into consideration where researchers, Institutions (RBC, IPAR-Rwanda), Universities (UR, INES-Ruhengeri); development partners (World Bank, UNDP), public institution (NCST) intervene as research implementers or/and funders of research activities on COVID-19.

Research on COVID-19 in Rwanda: Various research activities on COVID-19 Pandemic are implemented under various support. For instance, through the National Research and Innovation Fund at NCST, seventeen (17) research projects were supported with a total amount of around 1 billion Rwandan Francs to address COVID-19 pandemic into four main areas based on priorities that would address national interest: a) improving diagnostics; b) society resilience; c) innovative protective equipment; and d) monitoring and predicting the impact of COVID-19 pandemic.

Research projects are being implemented for instance to provide longitudinal datasets hub for predicting and monitoring COVID-19 evolution in the community and mitigation measures outcomes in Rwanda; to develop a mathematical modeling framework for predicting and monitoring the COVID-19 pandemic in Rwanda. Developed models will help in understanding the disease transmission dynamics, as well as give insights into the effectiveness of control strategies. In addition, a research project is being implemented to predict the risk of SARS-Cov2 infection and co-morbidity and reducing socioeconomic Impacts by identifying the high-risk population.

Predicting and Monitoring the Impact of COVID-19 pandemic: Clinical presentations of COVID-19 range from no symptoms (asymptomatic) to severe pneumonia. In European countries, 30% of diagnosed COVID-19 cases were hospitalized and 4% had severe illness, and this changes from time to time depending on availability and use of vaccines and measures to prevent ad curtail COVID-19. The trend is similarly high in the America countries, and higher in some countries. In most African countries, morbidity and mortality rates are lower than in European and American countries. The existing research studies will use existing data to generate a model to predict COVID-19 infection and morbidity rates to inform policy and practice on measures for containment and slowing the virus spread to prompt 'flattening of the curve' of COVID-19 infection, as well as continuation of social economic activities. Besides, from a public healthcare perspective, the goal is to assess and characterize public health preparedness levels in terms of setting up quarantine facilities to prevent risks of widespread infectious and assess uncertainties associated with the virus regarding infectivity during the incubation period and recovery.

Predicting the risk of SARS-Cov2 infection and co-morbidity and reducing socioeconomic impacts: identification of high-risk population: The goal of the project to validate the use of the plasma oxidative status as an early biomarker for stratifying sub-populations which are at higher risk to develop severe COVID-19. Early identification of individuals at risk is expected to provide a better use of the public health resources, to prioritize the delivery of vaccines, and to reduce the mitigation measures – including schools and economic activity closure or limitations- for those who are predicted to be at low risk of severe outcome. The rational for achieving this important goal is that severe COVID-19 is mostly due to an exacerbated inflammatory response, of autoimmune nature, which affects vascular endothelium and lung epithelium. Individuals with an unbalanced oxidative status are less likely to compensate this inflammatory state and can thus develop serious outcomes.

Objectives: Objective of the project is to carry out a community-wide analysis of the oxidative status of healthy population by using the Free Radical Analytical System (FRAS) technology to measure the derivative-Reactive Oxygen Metabolites (d-ROMs) and plasma antioxidant test (PAT), based on the evaluation of the redox potential of capillary blood (collected through simple and noninvasive finger prick). This analysis is expected to define a background signal of the oxidative status in the studied community and to identify those individuals who are statistically unbalanced in terms of oxidative level and/or antioxidant potentials. These individuals will be evaluated for underlying clinical conditions and, where the case, flagged for potentially high risk of inflammatory outcome. A secondary -but still very important- objective is to train the researchers and technical operators to the use of novel medical devices at high technological content

through strengthening the collaboration with external partners i.e. University of Parma, Italy.

Preliminary Findings / achievements: A consultative meeting with different stakeholders (including clinical staff and local leaders) was organized for the presentation of the project, active inclusiveness/engagement, and identification of hotspots and development of protocols. In addition, a throughout training session was organized on sample collection and analysis using the new equipment's of FRAS technology for the measurements of the level of oxidative stress and antioxidant capacity.

Training staff: sample collection and analysis (University of Parma and INES- Ruhengeri)


Data & Sample collection process at different public places (e.g. University and markets)

A population-wide screening was carried out in Musanze district, between March-June 2021. Blood samples collected from more than 1300 volunteers were screened and their demographic data were recorded. The overall oxidative status of individuals was assessed by measuring spectrophotometrically d-ROMs and PAT.

The preliminary findings are very interesting. First, a sharp normal distribution of values was obtained, indicating the technical robustness of the analyses. Then, a marked difference was noted in the value of the oxidative status, but not on the antioxidant potential, of the Musanze population with respect to the published data on European (Caucasian) population[5]. The collected data indicated a statistically significant higher average of dROMs. The reason for this is being investigated and can be attributed to several causes, including nutrition, exposition to high UV radiation and genetic background variability. Another very interesting preliminary findings is that the value distribution allowed to identify people with extreme values in both high and low directions.

Individuals with high d-ROMs values (coupled with low PAT values) are those tentatively classified as a higher risk of developing a severe form of COVID-19 and consequently need to be followed up. Individuals with very low values of d-ROMs, a condition which is rather infrequent in the Caucasian population, can be at risk of developing infections-possibly as a consequence of underlying and non-diagnosed comorbidities or an unbalanced nutritional state-since the production of physiological level of plasma reactive oxygen species is one of the main defense mechanisms against infective pathogens including SARS-CoV2[6].
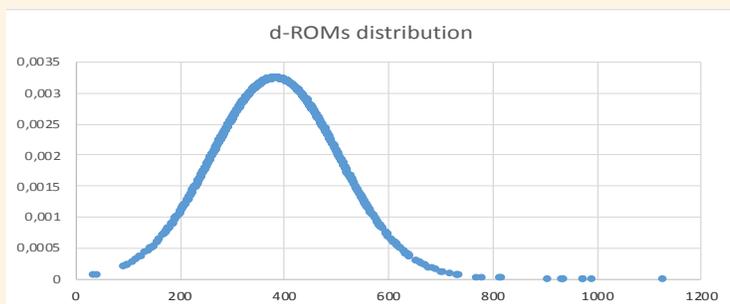
The average d-ROM is 384.4, with a SD of 123.1. The value is significantly higher than expected, as this value corresponds to a medium-high oxidative stress according to the averaged values for a health -Caucasian- population.
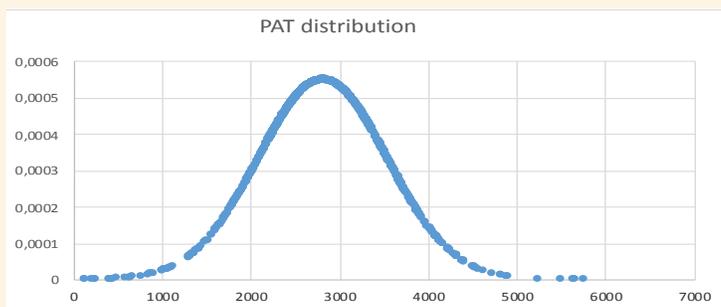
The average value of 2853.6, with a standard deviation of 635.7. The value is at the upper limit of what is considered normal according to the published data for healthy Caucasian populations.

Expected outputs and outcomes: While the implementation of project has been partly delayed due to the continuous SARS-Cov2 waves and the consequent contentment measures, we expect all the major expected outcome to be achieved. The results can stratify the population on the basis of their plasma competence in clearing oxidative stress and/or the use of oxygen radicals to cope with infection. This would constitute an ideal approach to identify and isolate only individuals who are at risk to develop hyperimmune response and sustained inflammatory states[7]. This is particularly important in the context of the SARS-Cov2 pandemics, but it is also of great significance for non-communicable conditions such as nutritional unbalance, cancer, inflammation. Furthermore, it will contribute at implementing an efficient system of measure and analysis of biomarkers for oxidative stress as surrogate points for the risk of hyperimmune response[8], in the perspective of an efficient and optimized use of clinical resources as well as preservation of socioeconomic activities[9].

In addition, this study will report the first –to the best of our knowledge- a community-wide analysis on the oxidative status of the population in Sub-Saharan Africa, and can become a best practice also for other countries. Last but not least, the project has allowed to increase the exposition of Rwandan scientists i.e. INES-Ruhengeri staff, to new technology and scientific approaches and to strengthen the scientific collaboration with University of Parma, Italy.

Finally, these preliminary results give a more systematic analysis and provide an operational basis for the use of the d-ROMs and PAT tests for screening/follow-up purposes and may help public decision makers to take the right measure in the interest of both the public health and the public wealth. This is particularly relevant in the context of public health preservation and of optimal allocation of public health systems resources for preservation of socioeconomic activities. In the second phase of the project, individuals with COVID-19 infection, those who are recovered, and those who have been double dose vaccinated against SARS-Cov2 will be screened. This will allow to project the oxidative status of people exposed to the virus on the curve of the general population, thus indicating windows of values which are more likely to be associated with poor outcomes.

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Science Technology and Innovation Outreach Activities: The case of using Robots in sensitizing citizens to fight against COVID-19 Pandemic

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Background: One of the mandates on the National Council for Science and Technology is to mobilize funds and manage the National Research and Innovation Fund (NRIF); and to promote science and technology community outreach activities. Through this, ZoraBots Africa got an award of 150,000,000 Frw to implement a 4-years project entitled "*The use of Smart Robotics in Healthcare for big data analysis to inform decision making in Realtime and to prepare for future epidemics*".

As an anticipated outreach activity, ZoraBots Africa offered to help with the competition in Nyarugunga sector, where they deployed Robots in two sites: Nyarugunga health center and Legacy clinics. These robots had been programmed to sensitize through instant messages inviting people to continue complying with government regulations to prevent coronavirus and messages of hope to come back to real life soon.

Robotics, design, construction, and *use* of machines (*robots*) to perform tasks done traditionally by human beings. This is a technology which is needed in time like this.

In 2020, Rwanda has installed a series of robots in an effort to minimize the risk of medical staff catching coronavirus. The robots carry out simple tasks, like checking temperatures and monitoring patients by delivering video messages and detecting people not wearing masks then instruct them to wear masks properly, thus reducing human exposure to the disease. Through the above-mentioned tasks, the robots cut the number of bedside visits that doctors have to make.

Technology adoption in the fight against Covid-19 pandemic: On 28th September 2021, the National Council for Science and Technology (NCST), in partnership with Nyarugunga Sector and ZoraBots Africa launched the campaign to sensitize the population against COVID-19 through Science and Technology Innovation by Engaging Robots in sensitizing people to the progress of Covid-19 pandemic recovery journey and to continue complying with government regulations to prevent the spread of COVID-19 as life gets to near normal. The main objective on this launch was to measure the impact of using science and technology innovation project i.e. robots to raise awareness of the citizen on COVID-19 pandemic in Nyarugunga sector.

Community Outreach Activities to address society challenges: The event took place at Nyarugunga Health Centre and was officiated by the Executive Secretary of the National Council for Science and Technology, Dr Eugene Mutimura, the Executive Administrator of Kicukiro Sector, the Executive Secretary of Nyarugunga Sector, and the CEO of ZoraBots Africa. In attendance, were other official authorities from Kicukiro District such as National Police and Military officers and a selected number of Nyarugunga sector citizens who represented others.

From left ZoraBots CEO, Nyarugunga sector ES, Kicukiro District Executive Administrator, RDF Representative in Kicukiro District, ES NCST, Nyarugunga Health Centre, Rwanda Police Representative in Kicukiro District

Zorabot Engineer during the launch of the campaign On 28th September 2021, where he was showing how robots work
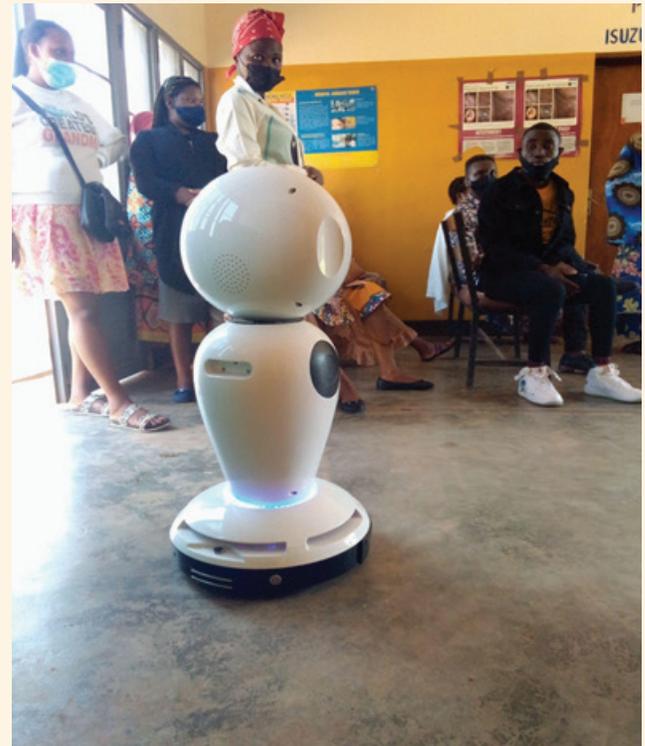
This activity is one of the NCST outreach activities intended to bring Science and Technology Innovative (STI) projects to solve societal problems. Specifically, this was in line with using robotics technology in sensitizing the prevention of Covid-19 pandemic under the campaign organized by the City of Kigali in partnership with the National Police of Rwanda, awarding the best sectors for preventing COVID-19, from 13-September-2021 to 15-October-2021. The competition was for all sectors in Kigali City to come up with innovative way/means in sensitizing people to continue complying with government regulations to prevent the spread of COVID-19.

The use of Robots: ZoraBots Africa in partnership with NCST deployed three robots: Pepper and James at Nyarugunga Health Center and Legacy Clinics to support Nyarugunga Sector participating in the competition. The robots deployment came as a way of supporting the existing approaches/protective measures (Kandagirukarabe, wearing masks and social distancing) being used to limit the spread of COVID-19 with an objective to enforce them by disseminating messages about the coronavirus, reminding people about measures to prevent COVID-19 pandemic, giving messages of hope telling people that we will win the fight of covid-19 pandemic, that we are in a good stage of winning this battle, and thanking all people who continue to respect all measures of fighting covid-19.

The significance and benefits from this community outreach activity: The aim of this campaign was to increase the number of people complying with covid-19 pandemic regulations, as well as increase the number of people vaccinated.

In the Nyarugunga Health Centre and Legacy Clinics, people were interested to hear what James and Pepper were saying and thereafter wear a face mask appropriately and respect social distancing measures. In addition to that, many patients reached out to Zorabot engineers to ask about the place where vaccination was taking place.

Robot Pepper *at Legacy Clinic in Nyarugunga Sector, Kicukiro District delivering programmed messages to prevent Spread of COVID-19 to people at the Clinic.*

Robot James *at Nyarugunga health center in Kicukiro District, delivering Programmed messages to people to prevent Spread of COVID-19 to people at the Clinic.*

Robots raise the happiness of patients thanks to their incredible movement. Many people at Legacy Clinics were surprised how the robot called pepper was doing its job by helping hospitals to spread messages about covid-19 prevention measures and vaccination programs.

Hospital community staff and patients suggested the deployment of more robots for other tasks such as health insurance verification and even robots that can handle payments. They also requested for a robot that can notify patients when to meet doctors by mentioning their names, room number, and the doctor they are meeting.

After one month of this activity, the following were observed:

i.   Compliance with COVID-19 measures increased remarkably due to robots delivered messages

ii. Most people in hospitals did not have more information about vaccination programs, and some patients tried to ask Zorabot engineers who were present during the activity where this was happening.

iii. The use of robots helped children who have trouble disturbing in hospitals to become quieter and watch the robots moving around disseminating messages.

iv. People did not know the use of technologies, in particular, the use of robots in healthcare, and increasingly focused on how robots play an important role in the fight against COVID-19 in teaching people about measures of preventing covid-19 and telling them about vaccination programs.

v.   The pandemic has proven to be a crosscutting challenge affecting Rwanda in all sectors (Health, Economy, Education, Agriculture, etc. It therefore requires different sometimes innovative solutions with available resources like robots.

Ongoing NCST Request for Applications

REQUEST FOR APPLICATIONS - EXTENDED

" Women in Science Research and Innovation Grant"

Goal:
To Provide funding opportunities to high-end women scientists-led innovative R&D projects leading to technology-driven products and services as innovative outcomes.

Women Scientists and Engineers with PhD degree or Master's degree are eligible

New Application period:
26TH OCTOBER 2021 - 30TH JANUARY 2022.

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REPUBLIC OF RWANDA

NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

RIC-R&D
KEEP DISCOVERING & INNOVATING
11TH NOVEMBER 2021

Request for Applications

RWANDA INNOVATION CHALLENGES FOR ACADEMIA-INDUSTRY RESEARCH AND DEVELOPMENT COLLABORATION GRANT (RIC- R&D)

Application Period:
11TH NOVEMBER 2021 - 28TH FEBRUARY 2022.

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NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

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Leveraging the Potential of Science and Technology to Mitigate Challenges Associated with COVID-19 pandemic in Developing Countries

Hybrid, in Kigali, 31st March - 1st April 2022

Rwanda Biomedical Centre

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