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Leveraging Science, Technology and Innovation to reduce noncommunicable diseases in Mauritius

TECHNICAL REPORT FOR THE STI FOR SDGs ROADMAP

Elci, S., Galindo, M., Rialland, P., Madhou, M.

Sarcina, A. (Ed.)

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ABSTRACT

STI for SDGs roadmaps are strategic policy frameworks that leverage STI to tackle localised sustainability challenges. They are supported by analyses based on different data sources and grounded in participatory and co-creation approaches that involve various stakeholders from the public and private sectors, NGOs, and academia.

The STI for SDGs roadmap in Mauritius focuses on the role of STI in reducing NCDs. The analysis included in this report brings to design the STI for SDGs roadmap, and is based on extensive inputs from official data sources on STI and NCDs, as well as information collected from local and international stakeholders involved in initiatives relevant for NCDs in Mauritius through workshops, a survey, and interviews.

The analysis of the STI system in Mauritius shows potential to leverage STI to reduce NCDs. The country has a growing STI ecosystem, with increasing investments in R&D and a rising number of scientific publications, particularly in health-related research.

However, there are several areas where STI can help to reduce NCDs in Mauritius. For instance, STI and data infrastructures are important impediments to improving prevention and treatment. Moreover, horizontal challenges such as low coordination within the STI system must be tackled to leverage the full potential of Mauritius to reduce NCDs.

The roadmap proposes policy actions to address these challenges, including improving coordination and collaboration, developing STI infrastructures and key enablers, and enhancing the role of traditional medicine to provide more holistic treatments.

The successful implementation of the roadmap requires a collaborative effort from various stakeholders. The roadmap will contribute to the achievement of the SDGs, particularly SDG 3, SDG 10, and SDG 11.

FOREWORD BY THE JOINT RESEARCH CENTRE OF THE EUROPEAN COMMISSION

I am pleased to share the report on the role of science, technology, and innovation (STI) for Sustainable Development Goals (SDGs) in Africa, with a spotlight on Mauritius. The report stems from a collaboration of the Joint Research Centre (JRC) and the Directorate General for International Partnerships (DG INTPA) of the European Commission (EC). This project embodies the long-standing commitment of the EC to fostering STI as a cornerstone for achieving sustainable development, in line with the African Union-European Union Innovation Agenda and Global Gateway initiative.

The challenge-oriented STI for SDGs roadmaps approach, pioneered by the JRC and based on the collaboration with the United Nations, is an innovative framework designed to align STI policies with the ambitious goals set by the 2030 Agenda for Sustainable Development. Roadmaps are strategic policy and governance frameworks based on evidence and participatory deliberation. Their goal is to ensure that STI contribute effectively to addressing localised sustainability challenges.

The development of STI for SDGs roadmaps is a participatory process that brings together diverse stakeholders, including policymakers, researchers, industry leaders, international partners, and civil society. Roadmaps capture collective knowledge and experience of these actors to respond to the specific needs and localised challenges.

Mauritius has engaged actively in developing its STI ecosystem by working together with both local and global partners. STI are important in speeding up the changes that benefit all communities. This STI for SDGs Roadmap, created in cooperation with the Mauritius Research and Innovation Council (MRIC), emphasises the importance of STI in reducing non--communicable diseases (NCDs).

We hope that the roadmap will become a useful framework for policy makers and stakeholders engaged in reducing NCDs in Mauritius and policy practitioners in other countries working on similar challenges.

I would like to express my sincere appreciation to the Mauritian partners at MRIC and all contributors who have made this report possible. Your insights and expertise are invaluable as we continue to make collective efforts to mobilise STI for sustainable development.

The JRC is proud of having supported this participatory initiative and remains committed to providing evidence-based scientific support to the policymaking process. We look forward to witnessing the positive impact of our joint efforts in Mauritius and the strengthened Africa-Europe collaboration.

Mikel Landabaso

Director – Fair and Sustainable Economy
Joint Research Centre, European Commission

FOREWORD OF THE MAURITIUS RESEARCH AND INNOVATION COUNCIL

In February 2023, the MRIC started a collaborative project with the Joint Research Centre of the European Commission on STI for SDGs. I am delighted that the report, *Leveraging Science, Technology and Innovation (STI) to Reduce Noncommunicable Diseases (NCDs)* is being launched. The report which is a policy framework will enable Mauritius to leverage STI to tackle the most important health problems that the country is facing. This collaborative effort aligns with the fight against NCDs, which is a priority, not only for Mauritius but also a worldwide challenge.

Health and Wellness has been a major focus area of innovation at the Council besides being central to the SDGs, mainly SDG 3: Good Health and Well-being. The majority of deaths and disabilities in Mauritius are due to noncommunicable diseases (NCDs) such as diabetes, cardiovascular diseases, cancers, and respiratory illnesses. Addressing this public health crisis is critical, and there is no doubt that leveraging STI is essential for an effective and sustainable response.

The National Integrated Non-Communicable Diseases (NCDs) Action Plan 2023-2028 issued by the Ministry of Health and Wellness in 2023, clearly identified the need for Mauritius to promote and support national capacity for high quality Research and Development for the prevention and control of NCDs. The STI for SDG report will contribute significantly to the formulation of an explicit Health Research Agenda in Mauritius. It will provide a strong basis upon which such an agenda can be developed. Through detailed analysis, stakeholder engagement, and international best practices, key areas have been identified where innovation can contribute to the reduction of NCDs. This work not only emphasizes the importance of science-driven approaches but also validates the potential for these methodologies to be applied across other sectors.

The report was a product of a rigorous, consultative and inclusive process involving local stake holders and experts from different backgrounds. It adheres to a structured approach laid down by the Joint Research Centre (JRC) of the European Commission, whose advice greatly helped us in ensuring we work around international best practices.

This initiative demonstrates the role of international partnerships in knowledge transfer. I hope that this initiative will forge the way to further collaborative initiatives with the Joint Research Centre of the European Commission.

At the outset this report identified the potential effects of STI investment in traditional medicine innovations, digital health technologies and nutrition/food technology on NCD prevalence mitigation in Mauritius. These recommendations

are not only practical and implementable; they are also ground breaking and transformative- providing a clear direction for how innovation can be harnessed to spearhead health improvements.

This report is not the end, it is really a new page for NCDs battle in Mauritius. We can scale up this work now. The approach used by the experts of the JRC can be extended to other national health concerns such as obesity. Co creation can help us to pave our path towards a healthier and more vibrant community by innovating!

To conclude, I would like to express my deepest gratitude to the European Commission, through the Joint Research Centre (JRC) and the Directorate-General for International Partnerships (DG INTPA) for their support in developing this STI for SDGs Roadmaps. The invaluable support and expertise of the JRC resource persons have been crucial in this endeavor. The team at the MRIC and all participating stakeholders are commended for all inputs provided. We are excited about the future of this collaboration and look forward to seeing the positive impact of these initiatives on the health and well-being of our population. Together, we will continue to leverage the power of science, technology, and innovation to achieve meaningful, sustainable improvements in public health.

I reiterate my warmest thanks to the JRC especially Dr Angela Sarcina, Dr Pierre Rialland, and Dr Michal Miedzinski as well as Dr Sirin Elci, JRC Consultant for their inordinate provision of assistance and expertise. My staff and all participating stakeholders from other institutions are once more commended for their inputs and work. I have no doubt that this roadmap will be a game changer in the Mauritian Health Innovation framework and help the country to explore the full potential of STI in the fight against NCDs.

Professor Theesan Bahorun, G.O.S.K

Executive Director
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This report was developed in conjunction with the Joint Research Centre (JRC) and the Directorate-General for International Partnerships (DG INTPA) of the European Commission, focusing on Science, Technology, and Innovation for Sustainable Development Goals Roadmaps in Sub-Saharan Africa.

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The authors would like to extend their gratitude to the Mauritius Research and Innovation Council (MRIC) for the fruitful collaboration. In particular, Dr. Theesan Bahorun and his team, for his vision and active participation in STI for SDGs processes, as well as for providing essential data and information, feedback on the report, as well as their ongoing commitment to developing STI for SDGs roadmaps.

We would like to express our deepest appreciation for their vision and support the Honourable Deepak Balgobin - Minister of Information Technology, Communication and Innovation, Dr ORI Bhooshun - Director General Health Services – Ministry of Health and Wellness, Dr KOWLESSUR Sudhirsen, C.S.K, MA, PhD – Director Health Promotion and Research – Ministry of Health and Wellness, Professor (Dr) MOHEE Romeela, C.S.K – Commissioner – Higher Education Commission.

We are extremely grateful for the enthusiast participation of the stakeholders in interviews, workshops, as well as those who responded to surveys. Their contribution were instrumental in the design of the roadmap in Mauritius. We would like to thank ABC Group, Axonova Pharma Ltd, the Delegation of the European Union to the Republic of Mauritius, the Economic Development Board, the Food and Agricultural Research and Extension Institute, the Higher Education Commission, the High Performance Centre-Mauritius Multisports Infrastructure Ltd, the Mahatma Gandhi Institute & Rabindranath Tagore Institute, the Mauritius Institute of Education, the Mauritius Institute of Health, the Mauritius Multisports Infrastructure Ltd, the Mauritius Sports Council, the Mauritius Sugarcane Industry Research Institute/Mauritius cane industry authority, the Ministry of Education, Tertiary Education, Science and Technology, the Ministry of Foreign Affairs, Regional Integration & International Trade, the Ministry of Information Technology, Communication and Innovation, the M-Kids Association, the National AIDS Secretariat, Ministry of Health and Wellness, the NCD unit Rodrigues (Rodrigues Regional Assembly, the Open University of Mauritius, the Rajiv Gandhi Science Centre, Statistics Mauritius,

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EXECUTIVE SUMMARY

PURPOSE AND APPROACH OF THE STI FOR SDGs ROADMAP

Science, Technology, and Innovation (STI) play a key role in achieving the Sustainable Development Goals (SDGs). In 2022, the Joint Research Centre (JRC) and the Directorate General for International Partnerships (DG INTPA) of the European Commission joined forces launching the project science, technology and innovation (STI) for Sustainable Development Goals (SDGs) Roadmaps in Africa. The objective of the project was to improve directionality and effectiveness of STI policies to contribute to the SDGs in line with the EU priorities for STI cooperation with Africa as expressed in the AU-EU Innovation Agenda.

To develop the roadmap in Mauritius the JRC partnered with the Mauritius Research and Innovation Council (MRIC), a leading institution designing and implementing STI policy. Following stakeholder consultations, the recommendation was to focus the project on the role of STI in reducing Noncommunicable diseases (NCDs) in Mauritius.

The project used a participatory and co-creation approach, involving stakeholders from the public and private sectors, NGOs, international partners and academia. The roadmap was informed by the stakeholder workshop held in Mauritius on 25 March 2024, and a series of interviews with the local and international stakeholders involved in initiatives relevant for noncommunicable diseases in Mauritius.

CHALLENGES AND OPPORTUNITIES TO REDUCE NONCOMMUNICABLE DISEASES

Although Mauritius has accomplished significant economic milestones and development outcomes, it is currently facing major health issues, especially the increasing prevalence of noncommunicable diseases (NCDs). NCDs were responsible for the majority of premature deaths and disability in 2019, making up 84.20% of the DALYs lost, according to Mussango et al. (2019). The high occurrence of NCDs in Mauritius is closely associated with behavioural risk factors like excessive alcohol and tobacco consumption, lack of physical activity, and unhealthy eating habits. In 2021, the standardized obesity prevalence was 36.2%, emphasising the significant impact of obesity on non-communicable disease prevalence (GoM, 2022b).

The analysis of the STI system in Mauritius shows potential to leverage STI to reduce NCDs. Mauritius has a growing STI ecosystem, with increasing investments in R&D and a rising number of scientific publications, particularly in health-related research. The country's performance in the Global Innovation Index (GII) indicates strengths in institutions and market sophistication but highlights the need for improvements in business sophistication and

infrastructure. Intellectual property data shows a strong domestic emphasis on trademarks, suggesting a vibrant business environment, but a lower number of patent applications indicates a reliance on foreign innovations. There are several areas where STI can help to reduce NCDs in Mauritius:

- Improve coordination and collaboration to provide holistic responses to NCDs
- Develop health information systems and research infrastructures
- Develop new research expertise to provide holistic treatments
- Develop artificial intelligence and digital solutions for health diagnosis and prevention
- Develop healthcare innovation to reduce unhealthy behaviours

EXISTING POLICIES MOBILISING STI TO REDUCE NCDS

The overarching policy guiding Mauritius' innovation strategy is the National Innovation Framework (NIF) for 2018-2030. One of the objectives of the NIF is to establish "top-class healthcare", illustrating the commitment to integrating health dimensions into various aspects of the framework. The National Roadmap for Research and Innovation (2023-2027) prioritises a total of six thematic areas including Health and Wellness Innovation. To contribute to the development of this national roadmap for the health and wellness sector, a working group consisting of expert stakeholders was established. This group developed four main R&I strategic orientations, which are outlined in the 2022 report (MDPA, 2022):

- Promoting innovative technology/practices
- Harnessing the potential contribution of new fields of health and wellness to economic growth;
- Innovating for a healthier population;
- Innovative governance mechanism to improve the delivery of institutions.

PROPOSED POLICY ACTIONS FOR THE ROADMAP

The successful implementation of this roadmap requires a collaborative effort from various stakeholders, including government bodies, research institutions, the private sector, and international partners. To address the challenges and opportunities identified, the following policy actions are proposed:

- **Improve coordination and collaboration to provide holistic responses to NCDs:**
  - Ensure the autonomy and strengthen the operational capacity of the MRIC to oversee STI policies and their implementation
  - Implement a health technology assessment (HTA) framework
  - Develop and implement a comprehensive national framework for traditional and integrative medicine in Mauritius;
  - Integrate Mauritius into the WHO's "Grassroots Innovations on NCDs".

- Develop and implement a comprehensive national framework for traditional and integrative medicine in Mauritius.
- Design and implement a Public Procurement for NCD Innovation programme.
- Create an 'NCD Solidarity Diaspora Community for Mauritius'.
- Develop a multi-level strategy to provide NCD patient pathways for integrated care.

- **Develop health information systems and research infrastructures:**
  - Implement a health technology assessment (HTA) framework specifically designed to evaluate the cost-effectiveness, clinical utility, and societal impact of new health technologies and interventions targeting NCDs.
  - Develop and deploy mobile health applications specifically tailored for NCD management.
  - Design and implement a policy instrument to facilitate the adoption of advanced food and nutrition technologies among micro, small and medium-sized enterprises (MSMEs).
- **Develop new research expertise to provide holistic treatments:**
  - Enhance the capabilities of healthcare professionals in managing NCDs through comprehensive innovation-driven training programmes.
  - Develop and fund research programmes with clinical trials to scientifically test promising treatments from traditional medicine.
  - Develop and implement a strategy and programme to drive innovation in the creation of healthier food alternatives by public research institutes. Establish a state-of-the-art genomic research centre to support the development of personalized medicine approaches for NCDs.
- **Develop healthcare innovation to reduce unhealthy behaviours:**
  - Strengthen the National Campaign to prevent NCDs by elevating public awareness about their preventability, using innovative communication strategies.
  - Organise a nationwide Social Innovation Competition aimed at preventing NCDs
  - Launch an initiative to adopt the Nutri-Score labelling system.
  - Launch a comprehensive Urban Health and Environment Initiative aimed at preventing NCDs through behavioural change interventions and modifications to the built environment.
  - Implement a scheme to support local farmers in adopting hydroponic and vertical farming techniques, aimed at increasing the production of nutrient-rich vegetables and fruits.

INTRODUCTION

Science, Technology, and Innovation (STI) constitutes a pivotal tool helping countries to reach Sustainable Development Goals (SDGs). The European Commission, through the Joint Research Centre (JRC) and the Directorate-General for International Partnerships (DG INTPA) is actively involved in supporting African countries in developing STI for SDGs Roadmaps. These policy frameworks are conceived to enable countries to leverage STI to tackle any sustainability issue pertinent to their nation for which STI can play an important role.

JRC and DG INTPA have embarked on a project to develop STI roadmaps in six African countries: Mauritius, the Gambia, Malawi, Namibia, Rwanda, and Seychelles. The project involves providing methodological support and guidance to formulate these roadmaps. This initiative is in line with the European Union's Global Gateway strategy, which is a connectivity strategy aimed at bolstering collaboration and investments between Europe and partner countries. It is also part of the implementation of the AU-EU Innovation Agenda, encouraging collaborative efforts in research, science and technology.

Since 2022, there has been a collaborative relationship between the Government of Mauritius, the Mauritius Research and Innovation Council (MRIC), and the JRC of the European Commission. These STI-focused roadmaps dwell on synergistic effort involving international experts working closely with local parties in a creative manner. These frameworks are not only products of collective inputs but also serve as a catalyst to create long-term partnerships, both locally and internationally, to effectively address sustainability challenges.

In line with the highly participative nature of the STI for SDGs roadmaps, the sustainable issue of reducing noncommunicable diseases was identified through a meticulous process involving document reviews and interviews with key figures. Then, under the leadership of the MRIC, this policy priority was selected not only for its relevance in Mauritius, but also due to the potential of STI to address it. To prioritise specific STI needs and investment areas to reduce noncommunicable diseases, structured discussions, an online survey, and deliberations during an in-person workshop in Mauritius with representative stakeholders took place.

In Mauritius, NCDs are the primary cause of premature mortality and disability in the country, accounting for 84.20% of the disability-adjusted life years (DALYs) lost in 2019 (Mussango et al., 2019). The major contributors include cardiovascular diseases, diabetes mellitus, malignant neoplasms, and respiratory diseases. The prevalence of NCDs in the country is strongly linked to behavioural risk factors, such as harmful use of alcohol and tobacco, physical inactivity, and unhealthy diets. Notably, in 2021, the overall

standardised prevalence of obesity was 36.2%, underlining the critical role of obesity in the prevalence of NCDs (GoM, 2022b).

The report includes key insights and strategic recommendations to reduce NCDs in Mauritius through targeted and synergistic STI investments. The first chapter of this report highlights the main key sustainability issues related to NCDs in Mauritius. The second chapter of this roadmap describes the current strengths and weaknesses of the STI system in Mauritius to address NCDs. The third chapter deep dives into gaps and STI opportunities to reduce noncommunicable diseases. This chapter paves the way for the fourth chapter, which summarises STI needs to be prioritised to reduce noncommunicable diseases. Finally, the fifth section includes concrete actions and policy instruments to tackle noncommunicable through STI in Mauritius.

1. AN OVERVIEW OF THE SUSTAINABILITY CHALLENGE FOR MAURITIUS

1.1 DESCRIPTION OF THE CHALLENGE AREA

Mauritius is situated in the Indian Ocean with a population of approximately 1.3 million people. Despite its geographical challenges as a Small Island Developing State (SIDS), the country has successfully transitioned from a low-income, agriculturally based economy to an upper middle-income diversified economy with a per capita income exceeding $10,000. This transformation is highlighted by significant growth in its industrial, financial, and tourist sectors. According to the World Bank, Mauritius stands as a beacon of economic success in Sub-Saharan Africa *(World Bank, n.d.)*. The country's success is underpinned by a stable democracy and a diversified economy that now encompasses tourism, manufacturing, fisheries, ICT, and financial services -the latter accounting for 40% of GDP. Mauritius' commitment to education and infrastructure, along with its openness to foreign investment, has also stimulated growth in various sectors, including a pharmaceutical industry post-COVID-19 *(EC, n.d.-b)*.

Despite its strengths and significant economic achievements, Mauritius faces considerable health challenges, particularly with the rising incidence of noncommunicable diseases (NCDs). NCDs, also known as chronic diseases, are not directly transmissible from person to person and typically have long durations. They arise from a combination of genetic, physiological, environmental, and behavioural factors. The main types of NCDs include cardiovascular diseases, such as heart attacks and strokes; cancers; chronic respiratory diseases, including chronic obstructive pulmonary disease and asthma; and diabetes *(WHO, n.d.-b)*.

These diseases threaten both the health of the population and the economic stability and development journey of Mauritius. They are the primary cause of premature mortality and disability in the country, accounting for 83.14% of the disability-adjusted life years (DALYs) lost in 2019. The major contributors include cardiovascular diseases, diabetes mellitus, malignant neoplasms, and respiratory diseases, which together represent 56.6% of NCD-related DALY loss *(WHO, n.d.-a)*. Science, technology, and innovation (STI) can play a crucial role in the prevention and treatment of NCDs. Accordingly, under the JRC-facilitated STI for SDGs Roadmap study, Mauritius has identified its sustainability challenge as:

"Mobilising science, technology and innovation to address noncommunicable diseases in Mauritius"

In light of the aforementioned factors, the decision to prioritise NCDs in Mauritius was further influenced by a range of interconnected considerations. The prevalence of NCDs in the country is strongly linked to behavioural risk factors, such as harmful use of alcohol and tobacco, physical inactivity, and unhealthy diets. These issues lead to metabolic and physiological changes, including raised cholesterol, high blood pressure, increased blood glucose levels, and overweight/obesity, which are significant risk factors for NCDs *(Musango et al., 2020)*. Notably, in 2021, the overall standardised prevalence of obesity was 36.2%, with higher rates among women (41.6%)

compared to men (29.9%), underlining the critical role of obesity in the prevalence of NCDs *(GoM, 2022b)*. Furthermore, a general lack of awareness about healthy eating habits, exemplified by the average salt intake among Mauritians, which is significantly higher than WHO recommended levels, contributes to hypertension and other health issues. This situation is exacerbated by the high costs and limited availability of healthy food options *(Musango et al., 2020)*.

Another risk factor is linked with environmental issues. Environmental degradation in Mauritius, particularly from the excessive use of pesticides and heavy reliance on fossil fuels, introduces harmful chemicals into the food chain and compromises air quality, contributing to respiratory issues and other health complications that directly undermine the population's health and safety *(EC, n.d.-a)*.

The government's response includes providing free healthcare services and increasing health expenditure to 6.39% of GDP in 2021 according to WHO, reflecting a strong commitment to health. It has also implemented public education campaigns and increased taxation on harmful substances like alcohol, tobacco, and sugar to combat NCDs. These measures are integral to broader health policies aimed at achieving universal health coverage and addressing SDG 3 targets *(MoFARIT, 2019; Musango et al., 2020)*. However, the high cost of the healthcare system, one of the most expensive in Africa, underscores the need for more financially efficient and sustainable healthcare spending, given the high prevalence of NCDs and their management costs. To further enhance its healthcare strategy, the government aims to position Mauritius as a medical tourism hub *(MTPA, n.d.)*, which could provide additional revenue streams and improve the sustainability of the healthcare system.

Recognising the critical role of STI in NCD control, Mauritius is exploring various strategies to combat these diseases. By leveraging technology in health education, screening, prevention, and early detection, STI has the potential to significantly enhance NCD management. The adoption of both technological solutions, such as telemedicine and mobile health applications, and non-technological innovations, like community-driven behavioural change initiatives, are essential. While challenges exist, particularly in technology adoption and affordability, the potential of STI in managing NCDs remains promising. As the field of STI continues to advance, emerging technologies like artificial intelligence and genetic engineering hold the potential for significant advancements in NCD prevention and treatment. Therefore, through an effective deployment of STI, Mauritius can transform its healthcare system, empower individuals to lead healthier lives, and ultimately achieve sustainable development goals related to health and well-being.

1.2 SUSTAINABILITY CHALLENGE IN NATIONAL POLICIES, STRATEGIES AND PLANS

In the current Government Programme (2020-24), Mauritius positions its people as its foremost asset, underlining the importance of social inclusiveness, empowerment, and equal opportunities as foundational pillars for enhancing living standards and sustainable development. The programme is aimed at driving the economy to high-income status through a strong emphasis on technology and innovation. This strategy is intended to foster greater economic growth, ensure equality, and promote shared prosperity. Moreover, the programme places a significant focus on promoting gender equality to ensure fair representation and support the advancement of women in Mauritius, all while upholding strong democratic values and human rights *(GoM, n.d.)*. To effectively deliver on its vision of sustainable development, the programme emphasises several priorities that specifically address health and noncommunicable diseases (NCDs):

- **Improving the Well-being and Quality of Life of Citizens:** This priority is central to enhancing health-related outcomes as it focuses

on upgrading healthcare services, promoting healthy living, and greater engagement of the population in sports. It also includes modernising public health facilities, which are essential for improving the management and treatment of NCDs.

- **Transformational Development of Rodrigues and the Outer Islands:** While this priority covers a broad range of initiatives, its relevance to health and NCDs comes from its commitment to enhancing the healthcare system in these regions. This includes increasing water supply through new desalination and storage technologies, which are essential for preventing diseases and supporting overall public health.

Moreover, the *'Public Infrastructure for an Innovative Mauritius'* priority aims to modernize the public transport system, enhance flood defences, ensure continuous access to utilities, rehabilitate water infrastructure, and promote renewable energy adoption. These infrastructure improvements encourage healthier lifestyles, such as increased physical activity and reduced exposure to environmental pollutants, thus indirectly reducing the risk of lifestyle-related NCDs. Similarly, the *'A Sustainable and Green Society'* priority focuses on investing in clean energy, waste management, mitigating the risks from climate change, and protecting marine resources. By tackling pollution and enhancing waste management, this initiative contributes to decreasing the prevalence of respiratory diseases and other health conditions linked to environmental factors.

In the Government Programme, STI is positioned as central to achieving numerous priorities. The programme outlines a vision for the development and modernisation of scientific infrastructure which includes the creation of a new Faculty of Medicine and Health Sciences at the University of Mauritius. This initiative will feature state-of-the-art medical facilities, some of which will specialise in managing NCDs like cancer. These developments are designed to significantly enhance the "Improving the Well-being and Quality of Life of Citizens" priority by advancing healthcare education and increasing access to specialised medical services. Similarly, in alignment with the "Building the Economy of the Future" priority, the programme plans to establish a Marine Biotechnology hub and develop infrastructure such as technology parks and innovation labs. These initiatives aim to foster innovation, stimulate economic growth, and position Mauritius as a leader in cutting-edge technological innovation *(GoM, n.d.)*.

The programme also aims at leveraging technology and innovation for the achievement of various other priorities, contributing directly or indirectly to the prevention and treatment of NDCs. The achievement of the priority 'Education and Skills for the World of Tomorrow' requires an environment conducive to learning through modern digital technology, and 'Building Economy of the Future promotes investments in cutting-edge technologies, including artificial Intelligence, robotics, the Internet of Things and blockchain. For example, The Bank of Mauritius is working on the creation of a central bank digital currency and is further developing a modern technology-driven payment system. Under the priority 'Public Infrastructure for an Innovative Mauritius', the focus is on integrating state-of-the-art technologies and modern management systems in the water sector. This also includes promoting renewable energy production using bagasse and incentivising the use of LED technologies and electric vehicles. Under the priority 'Transformational Development of Rodrigues and the Outer Islands', the government aims to tackle water scarcity by supporting new technologies for desalination and storage, ensuring a stable and sustainable water supply for the region *(GoM, n.d.)*.

The Government Programme is effectively complemented by the Health Sector Strategic Plan for 2020-24 *(MoHW, 2020)*, which focuses on addressing the high burden of NCDs in Mauritius, including cardiovascular diseases, diabetes, cancer, chronic respiratory diseases, and kidney diseases. This strategic emphasis aims to reduce incidence and improve quality of life by tackling the major health challenges posed by NCDs. Key strategies include:

- **Scaling up prevention and control measures:** This involves enforcing public health regulations on tobacco and alcohol, implementing new food regulations targeting salt, trans fats, and nutrient profiling, and executing WHO-recommended "NCD Best Buys" *(WHO, n.d.-b)* to reduce risk factors. In addition, the plan includes the development and implementation of a national action plan on obesity and collaboration with relevant ministries to promote physical activity.
- **Strengthening governance:** The plan calls for the development of a national service framework and an integrated NCD action plan focused particularly on cancer, cardiovascular diseases, and diabetes. It also involves operationalising a national multi-sectoral NCD Committee to ensure a coordinated approach across various sectors and stakeholders.

The National Sport and Physical Activity Policy also plays a key role in addressing NCDs in Mauritius by promoting an active lifestyle, which is essential for improving quality of life and well-being. This policy highlights the importance of creating an environment conducive to health through the digitalisation of the sports and physical activity landscape. Digitalisation aims to enhance consumer experiences and facilitate knowledge sharing, which in turn can inform future decisions related to policy, strategy, and funding. To support these goals, the policy outlines the development of a sports and physical activity portal that would centralise data, making it more accessible and useful for monitoring and promoting physical activity. Moreover, the establishment of an innovation centre focused on sport and physical activity is planned support to the start-up and SME sector *(MoYS, 2018)*.

Mauritius has put in place several government strategies and action plans that directly address various dimensions of NCDs. The National Cancer Control Programme (NCCP) 2022-2025, for example, targets the growing issue of cancer, recognising it as the third leading cause of death in the country. The programme focuses on reducing the incidence and mortality of the five most prevalent cancers: breast, cervical, colorectal, prostate, and lung. Its strategies include promoting healthy lifestyles for prevention, implementing national screening programs for early detection, upgrading facilities for surgery, radiotherapy, and chemotherapy, expanding palliative care services, and establishing a research unit. A significant investment has been made in modern National Cancer Hospital which was launched in May 2024, It is equipped with advanced technologies, highlighting the key role played by science and technology in implementing these strategies *(GoM, 2022d)*. Another national strategy document linked with NCDs is the National Action Plan for Tobacco Control for 2022-2026 which aims to reduce tobacco consumption and exposure to second-hand smoke through advocacy, revised legislation, and enforcement. Key strategies include implementing plain packaging, regulating e-cigarette sales, and increasing awareness campaigns. The plan also explores the potential role of mobile applications for cessation support, indicating an openness to leveraging technology in achieving its objectives *(GoM, 2022c)*.

The National Integrated Care for Older People (ICOPE) Strategic and Action Plan addresses the needs of older individuals by promoting person-centred, integrated care. This plan includes strategic objectives such as community engagement, workforce capacity building, and legislative improvements, with a focus on early identification and management of declines in physical and mental capacities. It also aims to strengthen support systems for caregivers and promote age-friendly environments. While the plan does not explicitly focus on science and technology, it recognises the potential of e-health and digital innovations to improve data collection, service coordination, and self-management for older individuals *(GoM, 2023)*.

While not directly related to NCDs, Mauritius has actively engaged with international frameworks to address broader developmental vulnerabilities that directly or indirectly impact the challenge. The country aligned with the SAMOA Pathway,

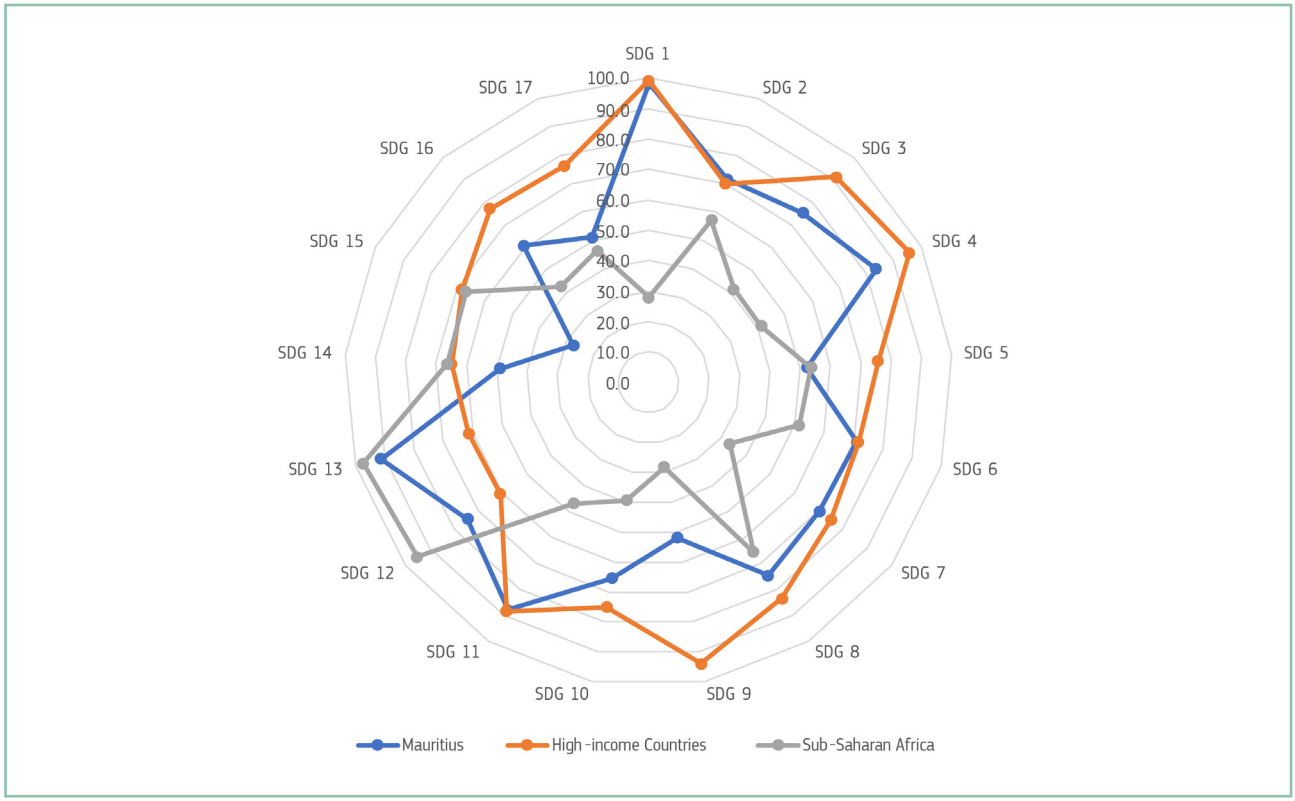
adopted in 2014, which supports the 2030 Agenda for Sustainable Development and focuses on mitigating the vulnerabilities of SIDS. In 2018, Mauritius played a key role by hosting a preparatory meeting for the SAMOA Pathway's Mid-Term Review, which facilitated regional dialogue and strategy development. Despite these efforts, the implementation of the SAMOA Pathway has encountered several challenges, including coordination issues, a lack of comprehensive data, insufficient legislative enforcement, and the absence of frameworks to assess impacts *(MoFARIT, 2019)*. Further embracing international goals, in 2016, Mauritius aligned with the 'Agenda 2063: The Africa We Want' of the African Union, actively working to integrate the First Ten Year Implementation Plan (FTYIP) into its national development strategies. By 2017, Mauritius had successfully incorporated 19 of the 20 FTYIP goals into its development strategy. The only goal not included was related to continental financial and monetary institutions, which was deemed less relevant for the small island nation *(MoFARIT, 2019)*.

1.3 PROGRESS TOWARDS THE SDGs WITH RESPECT TO THE CHALLENGE AREA

Addressing the challenge of NCDs in Mauritius aligns closely with several SDGs, notably SDG 3, which focuses on "good health and well-being", SDG 10, aimed at "reduced inequalities", and SDG 11, promoting "sustainable cities and communities". The country's progress in these areas, along with other SDGs, will play a crucial role in effectively tackling the issue of NCDs.

While there is no explicit SDG strategy or action plan in the country, during the 2019/20 Budget exercise, ministries, departments, and other public entities were asked to incorporate relevant SDG targets to monitor progress and clarify the integration of these goals into national policies *(MoFARIT, 2019)*. Yet, the Government Programme 2020-24, while extensively referencing sustainability, does not explicitly mention the SDGs.

FIGURE 1.
SDG INDEX SCORE (2013)



Source: Sachs et al., 2023

As indicated in ***Figure 1***, Mauritius shows commendable SDG performance in achieving SDG 1 (No Poverty), where its score is nearly on par with that of high-income countries. The government's efforts in SDG 13 (Climate Action) are also notable, surpassing even high-income countries with a score of 91.4, reflecting a strong commitment to environmental sustainability. However, its progress in SDG 15 (Life on Land) lags behind, with a score significantly lower than both high-income countries and Sub-Saharan Africa, highlighting a need for enhanced environmental conservation measures. While Mauritius outperforms Sub-Saharan Africa in SDG 5 (Gender Equality), there remains room for improvement to match high-income countries. Furthermore, the economy, as reflected by SDG 8 (Decent Work and Economic Growth) and SDG 9 (Industry, Innovation, and Infrastructure), requires further strengthening.

An analysis of SDG 3 ("good health and well-being") which is closely related to addressing NCDs, reveals that Mauritius is performing better than the average for Sub-Saharan Africa. According to the 2023 SDG Index, the country has achieved several SDG targets, including reducing neonatal mortality rates, mortality rates for children under five years old, adolescent fertility rates, and increasing the number of births attended by skilled health personnel. However, the country faces significant challenges in other health indicators. For example, only 96% of infants and children under 12 months received the third dose of DTP and 96% for the first dose of measles *(WHO, 2023[1])*, falling short of the 100% target. Furthermore, life expectancy at birth in Mauritius was 74 years in 2022, noticeably lower than the 72 years which is the global life expectancy as per United Nations[2]. The Universal Health Coverage (UHC) index of service coverage in Mauritius scored 65 in 2019, compared to 83.13 in high-income countries 13 *(Sachs et al., 2023)*.

While Mauritius has indeed made significant progress in improving health outcomes and extending life expectancy, the significant burden

1 *Data available at:* ***https://www.WHO.int/news/room/fact-sheets/detail/immunisation-coverage***.

2 *Data available at:* ***https://data.WorldBank.org/indicator/SP.DYN.LE00.IN?namedesc=false***.

TABLE 1.
SELECTED NCD INDICATORS (2021)

Disease/Risk Factor	Prevalence	Trend
Diabetes Mellitus	19.9% (21.6% men, 18.5%women)	Decreased since 2015
Hypertension	27.2% (26.9% men, 27.5%women)	Stable since 2015
Overweight (BMI)	36.0% (38.7% men, 33.8%women)	Decreased since 2015
Obesity (BMI)	36.2% (29.9% men, 41.6%women)	Decreased since 2015
High Cholesterol (≥ 5.2 mmol/L)	34.8% (39.6% men, 30.8%women)	Decreased since 2015
Current Smoking	18.1% (35.3% men, 3.7%women)	Decreased since 2015
Harmful Alcohol Consumption	15.4% (26.3% men, 4.5%women)	Cannot be compared
Physical Activity (≥ 600 METs/week)	67.0% (73.6% men, 61.4%women)	Increased since 2015
Chronic Kidney Disease (eGFR < 60ml/min)	3.9% (3.7% men, 4.1%women)	Stable since 2015
Asthma	7.5% (6.8% men, 8.0%women)	Decreased since 2015

Source: GoM, 2022a

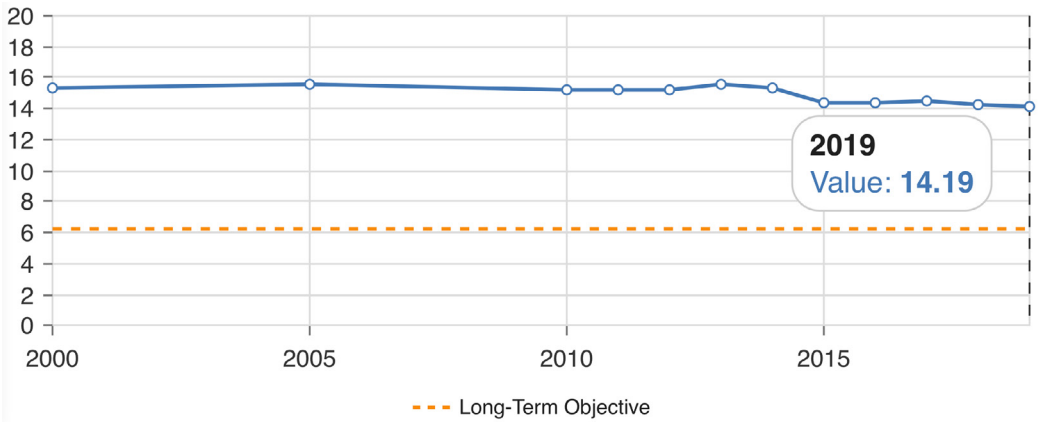
of NCDs remains a substantial challenge in fully achieving SDG 3. The Mauritius Non-Communicable Diseases Survey 2021 offers valuable insights into the current status of NCDs and their risk factors within the population. Key findings from this survey are summarised in ***Table 1***, which underlines both areas of progress and persistent concerns. These details highlight the need for ongoing attention and intervention to effectively combat the NCD epidemic and advance Mauritius closer towards achieving SDG 3.

The country's performance concerning SDG 2 (Zero Hunger) also reflects significant issues linked to dietary health. ***Table 1*** reveals that although there has been some progress in reducing overweight and obesity rates since 2015, the prevalence remains alarmingly high. More than one-third of the population continues to struggle with overweight and high cholesterol levels, with these conditions being more prevalent among men than women. Furthermore, obesity affects over one-third of the population, with a notably higher impact on women than men.

Mauritius has made significant progress in SDG 11 (Sustainable Cities and Communities) by promoting physical activity, with 67% of the population achieving WHO-recommended activity levels, according to the data given in ***Table 1***. These efforts play a key role in reducing the risk of NCDs such as heart disease, stroke, and diabetes. However, challenges remain in ensuring sustainable urban environments. Persistent air quality concerns are highlighted by the fact that the annual mean concentration of PM2.5 significantly exceeds the WHO target, as shown in ***Figure 2***. The poor air quality contributes to a higher incidence of respiratory illnesses, cardiovascular diseases, and lung cancer. Furthermore, the country faces the challenge of managing approximately 17,000 tons of hazardous waste annually *(UNDP, n.d.-a)*. Effective waste management strategies are essential to prevent environmental contamination and mitigate health risks associated with water and air pollution.

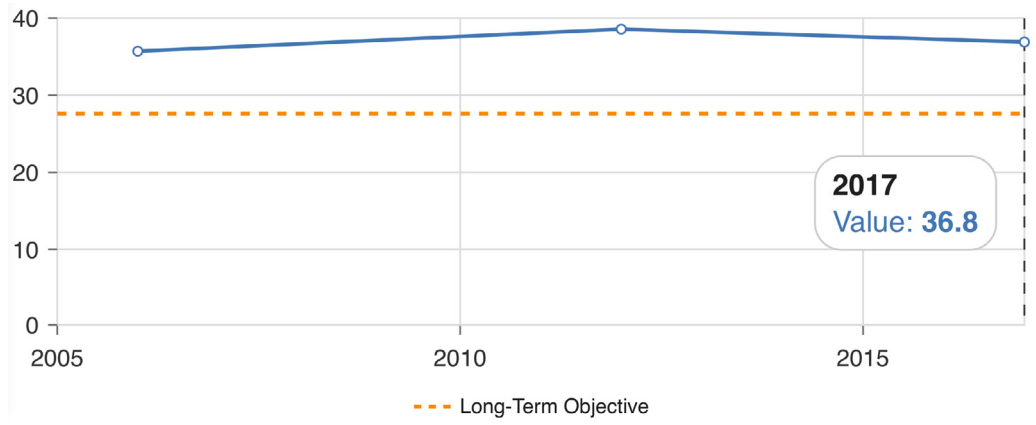
Despite some advances in healthcare accessibility, Mauritius still faces significant challenges in meeting SDG 10 (Reduced Inequalities). The GINI coefficient, which measures income inequality, is currently at 36.8, significantly above the ideal target of approximately 28, as illustrated in ***Figure 3***. This economic inequality translates into uneven access to quality healthcare services, disproportionately affecting vulnerable populations. In addition, factors such as education and living conditions play critical roles in health disparities, further complicating the incidence and treatment of NCDs.

FIGURE 2.
ANNUAL MEAN CONCENTRATION OF PARTICULATE MATTER OF LESS THAN 2.5 MICRONS IN DIAMETER (PM2.5) MG/M³



Source: Sachs et al., 2023

FIGURE 3.
GINI COEFFICIENT



Source: Sachs et al., 2023

2. FITNESS OF INNOVATION SYSTEM TO ADDRESS THE SUSTAINABILITY CHALLENGE

2.1 STI POTENTIAL AND PERFORMANCE WITH A FOCUS ON THE SUSTAINABILITY CHALLENGE

Mauritius does not have specific statistics on STI performance and potential in health or NCDs. Nevertheless, *Table 2* presents key indicators related to the country's R&D investments. The latest available data on R&D intensity (gross expenditures on R&D (GERD) as a percentage of the gross domestic product (GDP)) experienced a marginal reduction from 0.35% in 2019 to 0.3% in 2021. The distribution of R&D expenditure by sector of performance in the period 2019 to 2021 revealed a public sector-dominated landscape, with the government sector accounting from 54% to 74 % of all R&D spending. This contrasts with the business enterprise sector, which contributed to 2.2% -19 %, and the higher education sector, which accounted for 21% to 23 % (Mauritius Research and Innovation Council, 2019-2020).

Between 2019 and 2021, there was a notable increase in human capital for R&D, as evidenced by the rise in the number of researchers per million inhabitants from 700 full-time equivalents (FTE) in 2019 to 723 FTE in 2021. The representation of female researchers has been constant at 48% thoughout this time period.

Despite growing emphasis on STI, the country continues to face challenges in attracting students to STEM fields. Common perceptions of science and technology subjects as challenging, coupled with uncertainties about the career opportunities they offer, contribute to lower enrolment rates. To address these issues, the government and educational institutions are taking proactive measures. These include enhancing the STEM

TABLE 2.
KEY R&D INDICATORS FOR MAURITIUS

Indicator	2019	2020	2021
GERD as share of GDP	0.35%	0.37%	0.3 %
Share of R&D expenditure performed by Business Enterprise	19.39%**	2.2%	11%
Share of R&D expenditure performed by Government	54%**	74.19%	64%
Share of R&D expenditure performed by Higher Education	21.5%**	23%	20%
Share of R&D expenditure performed by Private non-profit	5.46%	1%	5%
Researchers per million inhabitants (FTE)	700**	717	763
Share of female researchers (FTE)	48%	48%	48%

Source: Mauritius Research and Innovation Council R& D sheet, 2019-2021).

curriculum, upgrading laboratory facilities, and launching campaigns aimed at shifting public perceptions about careers in STI. Furthermore, partnerships with industry leaders are being developed to provide students with practical experience and showcase the real-world applications of their education for building a skilled workforce that can support Mauritius' ambitions to create an innovation-driven economy *(Roopchund, 2023)*.

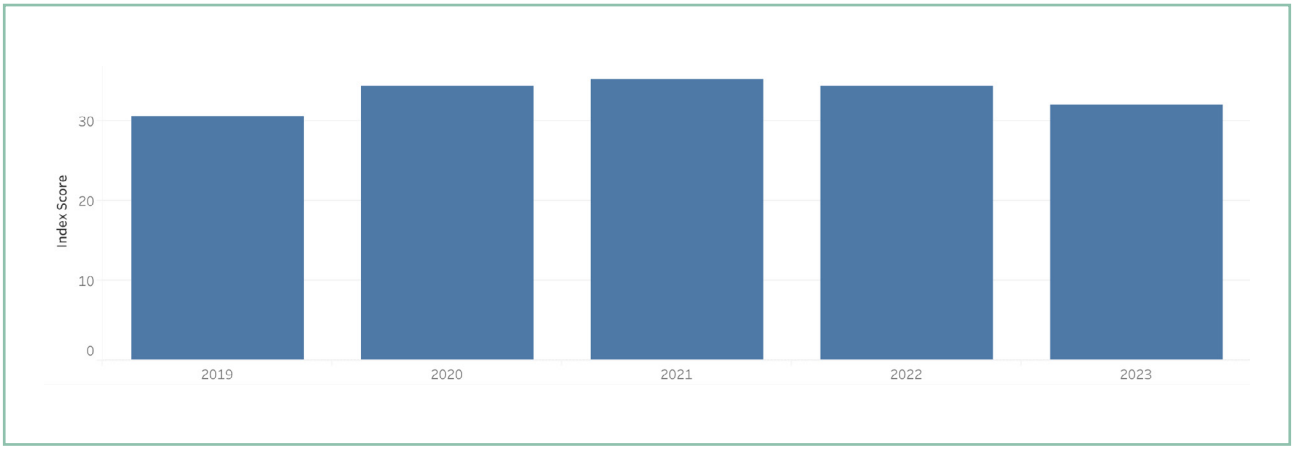
Mauritius' efforts in the innovation landscape are further underlined by its robust performance in the Global Innovation Index (GII) (***Figure 4***). In 2023, it ranked first among the 28 economies in Sub-Saharan Africa and tenth among the 33 upper-middle-income group countries.

As shown in ***Figure 5***, Mauritius demonstrates a mixed performance across the various dimensions of innovation. The country's strengths lie in the 'Institutions' pillar, indicating a stable political environment and effective government policies conducive to innovation. 'Market Sophistication' is another area where Mauritius performs relatively well, securing the 24th position among 132 countries, which can be attributed to factors such as the availability of credit and the ease of protecting minority investors. However, the country faces challenges in the 'Business Sophistication' dimension, ranking 91st, suggesting a need for improvement in areas like innovation linkages and knowledge absorption. 'Human Capital and Research' show promise, but the 'Infrastructure' pillar remains a concern, highlighting the need for further investments in ICT and general infrastructure. In terms of innovation outputs, Mauritius needs to improve 'Knowledge and Technology Outputs' and 'Creative Outputs' by effectively translating innovation inputs into tangible outputs *(WIPO, 2023)*.

An assessment using the Mauritius National Health Research System (NHRS) Barometer score has evaluated the performance and progress of its national health research system *(Musango et al., 2023)*. This tool is particularly significant as part of the WHO's initiatives to track health research effectiveness, especially in Africa. ***Figure 6*** depicts the country's positive progression in its Barometer score; however, when compared to other African countries, it lags in several critical dimensions except for finance.

According to the 2020 data for the African region provided by EDCTP, 2022, Mauritius shows underperformance in key areas: it scored 79% in Governance of Research for Health, 89% in Developing and Sustaining Resources for Research for Health (R4H), 61% in Producing and Using Research, and 54% in Financing of R4H. Particularly, it faces a significant deficit in governance, notably lacking a national Research for Health Policy, a strategic Research for Health plan, and a prioritised national research agenda for health *(Musango et al., 2023)*.

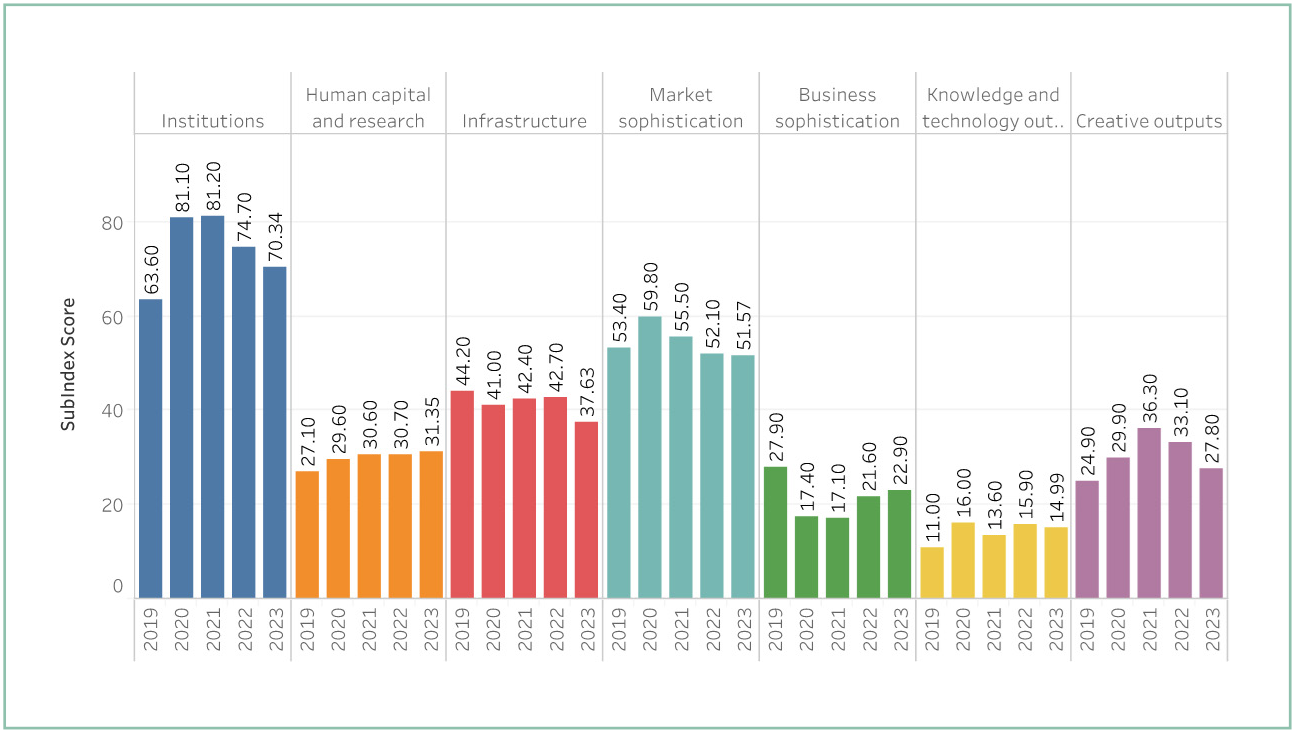
FIGURE 4.
PERFORMANCE OF MAURITIUS IN THE GLOBAL INNOVATION INDEX



Source: WIPO, 2023

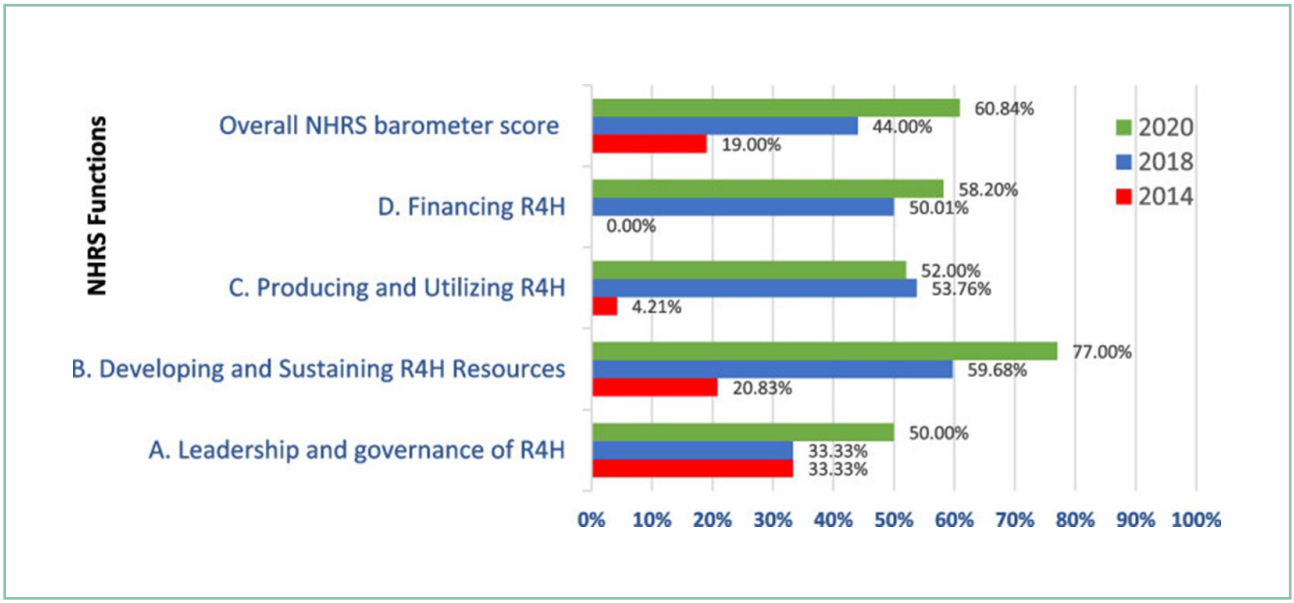
Furthermore, the country's capacity in 'Developing and Sustaining Resources for R4H' is another area of concern. Its rate of universities and colleges conducting R4H per million population stands at 3.157, markedly lower than Cabo Verde's rate of 5.39. Moreover, Human Resources for Health Research (HRHR) in R4H per 100,000 population is 3.157, which is significantly less than the regional average of 12 *(EDCTP, 2022; Musango et al., 2023)*.

FIGURE 5.
BREAKDOWN OF MAURITIUS' SCORES IN THE GLOBAL INNOVATION SUB-INDICES



Source: WIPO, 2023.

FIGURE 6.
COMPARISON OF MAURITIUS NATIONAL HEALTH RESEARCH SYSTEM BAROMETER SCORE (PERCENTAGE)



Source: (Musango et al., 2023)

Complementing the assessments of Mauritius' performance in producing and utilising R4H, *Figure 7* illustrates significant growth in scientific publications per million inhabitants from 2011 to 2019. Over this period, the number of publications in Mauritius increased more than fourfold, from 75 in 2011 to 343 in 2019. This rate of growth notably surpasses that of the Sub-Saharan Africa region, which experienced a more modest increase from 27 to 45 publications per million inhabitants during the same timeframe. Despite this remarkable progress, the country lags behind high-income economies, where the publication rate per million inhabitants consistently remained high, reaching 11,042 in 2019.

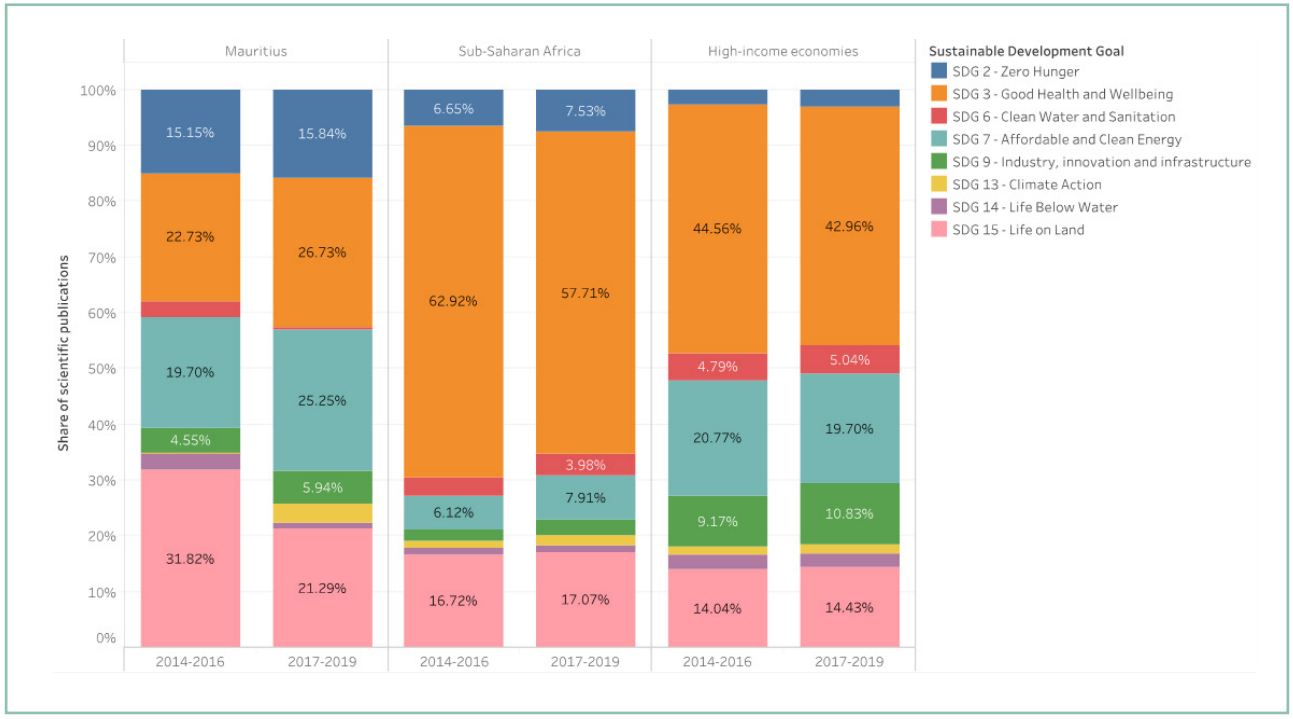
FIGURE 7.
PUBLICATIONS PER MILLION HABITANTS

Source: UNESCO, 2021

Figure 8 illustrates the distribution of scientific publications according to their respective SDGs. During the period from 2014 to 2016, "Life on Land" (SDG 15) was the predominant focus, accounting for nearly one-third of the total publications. However, from 2017 to 2019, there was a notable shift in research priorities towards "Good Health and Wellbeing" (SDG 3), which emerged as the largest sector for scientific output. In addition, "Affordable and Clean Energy" (SDG 7) and "Life on Land" (SDG 15) maintained a significant share of publications. This transition reflects a broader pattern observed not only in Mauritius but also across Sub-Saharan Africa and, to a lesser extent, in high-income countries, where "Good Health and Wellbeing" commonly leads in total publications.

Mauritius' intellectual property (IP) landscape, as depicted in *Table 3*, reveals a strong emphasis on trademark applications, particularly from residents.

FIGURE 8.
SHARE OF SCIENTIFIC PUBLICATIONS BY SDG



Source: UNESCO, 2021

TABLE 3.
INTELLECTUAL PROPERTY (IP) IN MAURITIUS

Year	Patents applications		Trademark applications		Industrial design applications	
	Non-resident	Resident	Non-resident	Resident	Non-resident	Resident
2018	13	16	32	318	20	8
2019	23	4	187	316	11	18
2020	19	6	62	396	2	14
2021	14	6	34	462	3	9
2022	8	-	6	383	2	4

Source: WIPO, n.d.

This indicates a vibrant domestic business environment where companies recognise the importance of brand protection. The steady increase in resident trademark applications over the years demonstrates a growing awareness of the value of IP. In contrast, patent applications remain relatively low, with a notable discrepancy showing more applications from non-residents than residents. This pattern suggests that Mauritius is more dependent on foreign innovations rather than fostering its own R&D activities. While there is significant interest in the aesthetic and functional enhancements of products, as seen in the number of industrial design applications, these are still fewer than trademark applications. In addition, the decline in industrial design applications over the years from both residents and non-residents might signal a shifting focus or potential challenges in this sector, possibly due to changing market demands or regulatory landscapes.

Mauritius has become an attractive destination for innovation and investment, thanks to its favourable tax regime and streamlined regulatory framework. The country's entrepreneurial ecosystem, which includes over 100 start-ups, hubs, and investors, is actively engaging with global challenges. According to ***Figure 9***, a significant proportion of these start-ups -more than half- are directly targeting SDGs, particularly focusing on "Decent Work and Economic Growth" (SDG 8), "Affordable and Clean Energy" (SDG 7), and "Reduced Inequalities" (SDG 10). Furthermore, a considerable number of start-ups are making indirect contributions to "Sustainable Cities and Communities" (SDG 11) and "No Poverty" (SDG 1) *(JRC, 2024)*.

As indicated in ***Figure 10***, the entrepreneurial ecosystem of the country is characterised by a focus on key sectors such as fintech, cleantech, and jobs. These sectors are not only driving economic growth but also contributing to the achievement of multiple SDGs. Fintech start-ups in Mauritius are working towards financial inclusion and providing accessible lending services, while cleantech start-ups are promoting the adoption of solar energy and other sustainable solutions. The jobs sector, represented by start-ups like Hellojob, is facilitating employment opportunities and skills development. Despite the limited number of disclosed deals, the investment landscape in Mauritius remains robust, with fintech and cleantech being the top-funded sectors. However, it is important to note that a portion of these investments comes from companies that are registered in Mauritius but not operationally active in the country *(JRC, 2024)*.

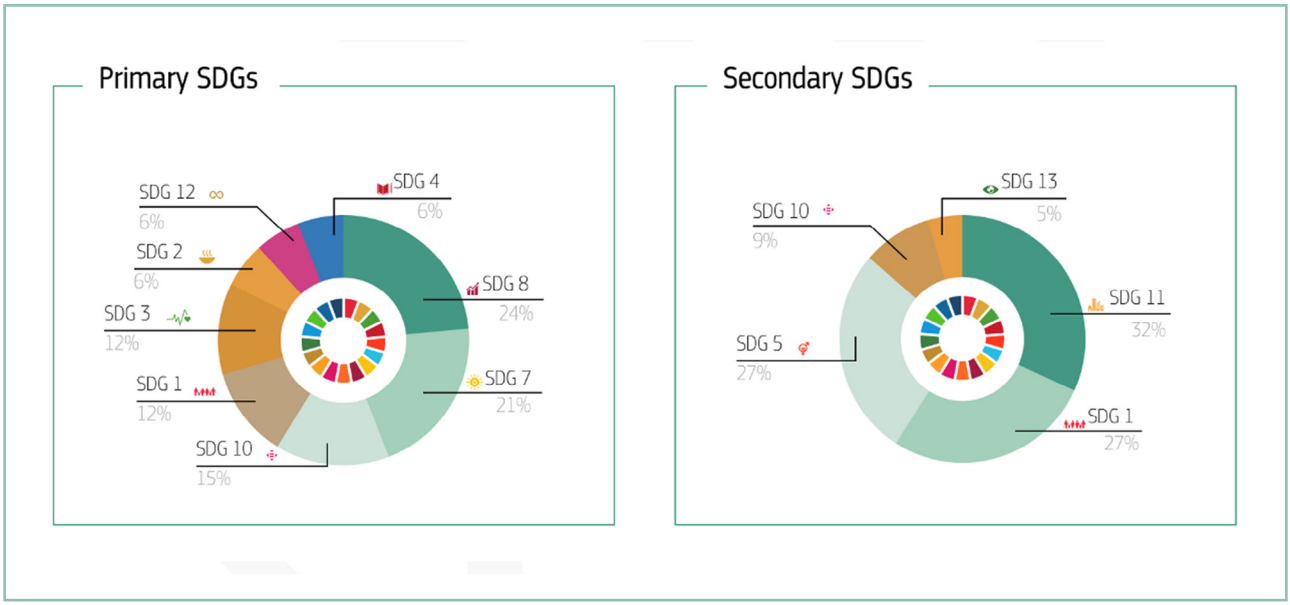
2.2 MAIN STI ACTORS AND INNOVATION COLLABORATIONS

The national innovation ecosystem in Mauritius is in the process of development. As illustrated in ***Figure 11***, in addition to the key actors of the STI system such as the Mauritius Research and Innovation Council, the country has a number of institutions active in health and NCD issues. The broader STI system involves ministries and other public bodies, private companies and representatives of the business sector, non-governmental organisations (NGOs), higher education institutes, research performers, among others. Furthermore, international and regional organisations are significant actors within the system, acting as funders and catalysts of STI through their projects and programmes.

Brief description about the main actors in the STI system that are closely linked with the challenge area of NCDs is given below.

At the STI policy and oversight level, the Ministry of Information Technology, Communication, and Innovation (MITCI) holds the primary mandate for steering STI policy in Mauritius. Its mission is to leverage information and communication technologies along with innovation to transform Mauritius into a high-income, inclusive, and green economy by 2030 *(MRIC, n.d.-b)*. Under MITCI, the Mauritius Research and Innovation Council (MRIC) plays a key role in promoting and leading innovation through collaborative and inclusive research that aims to foster growth, liveability, and harmony, ensuring that the innovation ecosystem aligns with national development goals *(MRIC, n.d.-b)*.

FIGURE 9.
PRIMARY AND SECONDARY SDGs TARGETED BY COMPANIES OPERATING IN MAURITIUS

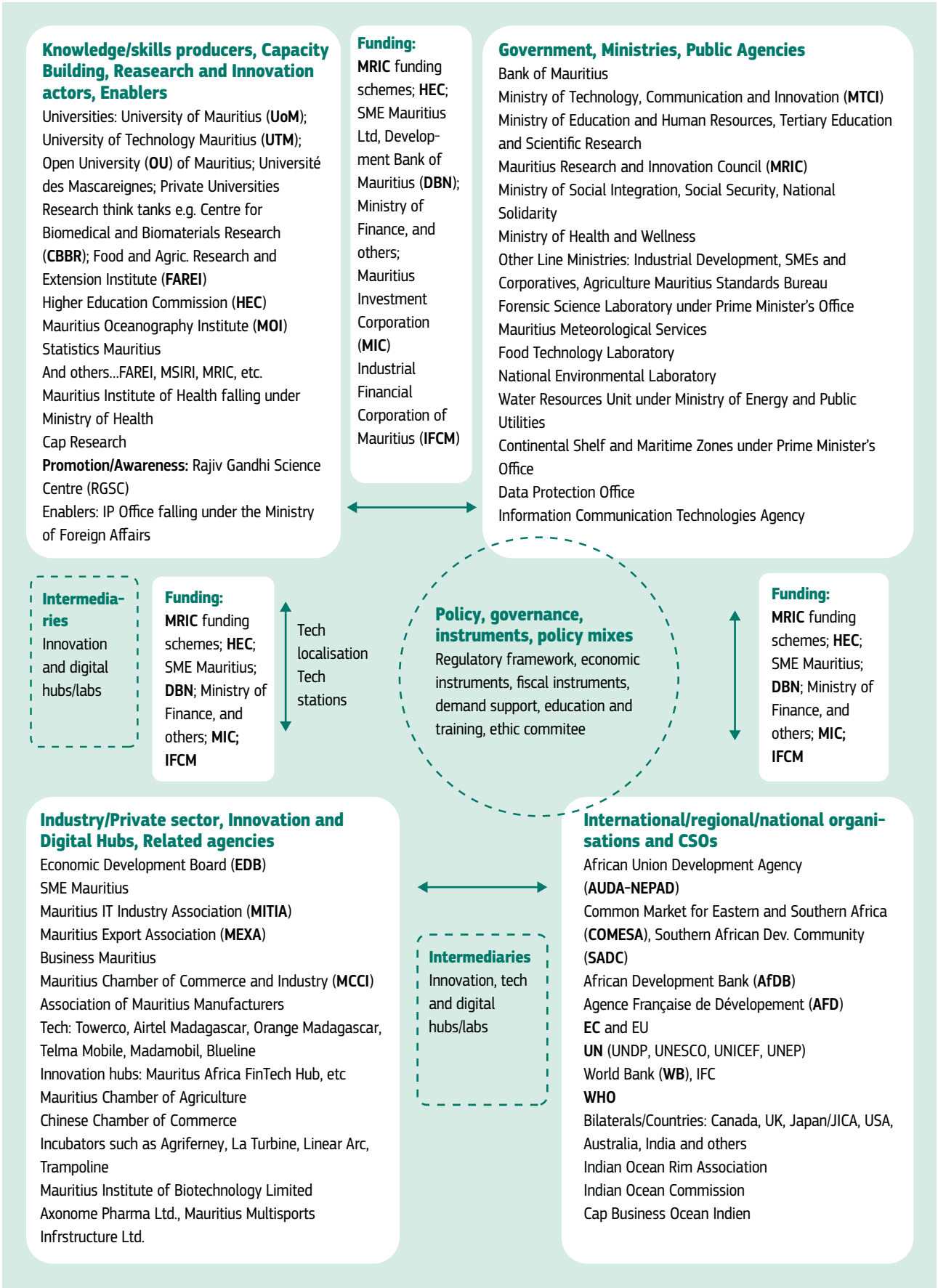


Source: Daniels et al., 2024

FIGURE 10.
DISTRIBUTION OF COMPANIES IN MAURITIUS BY SECTOR AND PRODUCT

Source: Daniels et al., 2024

FIGURE 11.
ACTORS AND STAKEHOLDERS IN MAURITIUS' STI SYSTEM



Source: JRC, 2024, complemented by Author

Parallel to these efforts, the Ministry of Health and Wellness is tasked with ensuring that quality and equitable health services are accessible to the entire population. Its responsibilities include the development of comprehensive health services, healthcare delivery, health promotion, disease prevention, treatment facilities provision, control of medical practices, training for health professionals, and advising local government authorities on health services *(MoHW, n.d.)*.

With respect to the implementation of policies, the Economic Development Board (EDB) serves as the primary government agency responsible for strategic economic planning in Mauritius. Its mandate includes promoting Mauritius as an attractive investment and business centre, a competitive export platform, and an international financial centre *(EDB, n.d.)*. This positioning is crucial in enhancing Mauritius' global economic profile and attracting foreign investment. In the domain of higher education, the Higher Education Commission (HEC) manages and oversees the sector. It is responsible for allocating public funds and fostering the planning and coordination of development within post-secondary education and training *(HEC, n.d.-b)*. This role is vital for ensuring that the educational framework supports the broader economic and innovation strategies of the nation. Furthermore, the Mauritius Investment Corporation Ltd (MIC), fully owned by the Bank of Mauritius, operates as a state-owned investment company. It manages and invests funds on behalf of the government, aiming to diversify the country's investment portfolio and generate sustainable returns. The MIC plays a critical role as a strategic accelerator for Mauritius' economic recovery and development *(MIC, n.d.)*. Furthermore, the Development Bank of Mauritius Ltd (DBM) serves as a development finance institution focused on accelerating socio-economic development within the country. DBM offers a range of financial products and services, including loans for agricultural activities, trade, services, and business vehicle purchases. It also supports the purchase of machinery and equipment and aids in the modernization of enterprises *(DBM, 2022)*.

The main organisations responsible for performing R&D include the Centre for Biomedical & Biomaterials Research (CBBR), the Food and Agricultural Research and Extension Institute (FAREI), the Mauritius Oceanographic Institute (MOI), the Mauritius Institute of Biotechnology Ltd (MIBL), Cap Research Ltd, , and the Mauritius Institute of Health (MIH) and Axonova Pharma Ltd. Hosted by the University of Mauritius, the CBBR specifically focuses on health applications, particularly studying non-communicable diseases *(CBBR, 2019)*. MIBL is a state-owned company established in 2021 with the aim of accelerating the manufacturing of pharmaceuticals and vaccines, conducting high-level biotechnological research, testing and commercialising *(MIBL, n.d.)*. It also plans to establish a biotech incubator to attract foreign investors and researchers, becoming a central element of the ecosystem MIBL aims to create. Cap Research Ltd is notable as the first Clinical Research Organization (CRO) in Mauritius and the Indian Ocean region, specializing in conducting clinical and therapeutic trials across phases I, II, and III, thereby advancing the development of new medical treatments. Finally, the Mauritius Institute of Health (MIH) focuses on enhancing health and quality of life through dedicated training and health systems research, significantly improving public health practices and outcomes across the nation *(MIH, n.d.)*. Collectively, these institutions support Mauritius's strategic goals in research and development, particularly in health and social sciences, forming a robust foundation for scientific progress and innovation.

One of the leading institutions for the development of STI human capital in the field is the Faculty of Science at the University of Mauritius, which offers a broad spectrum of academic courses across various disciplines such as biosciences, chemistry, mathematics, physics, medicine, and health sciences *(UoM, n.d.-b)*. Similarly, the University of Technology Mauritius enhances sustainable development through academic and capacity-building programs and scholarly activities, including its School of Health Sciences that conducts research in neuroendocrinology, nutritional sciences,

and applied clinical nutrition *(UTM, n.d.)*. Université des Mascareignes broadens the educational scope with undergraduate and postgraduate programs in Sustainable Development and Engineering, Business and Management, and Information and Communication Technology, alongside offerings in artificial intelligence and renewable energies *(Roopchund, 2023; UdM, n.d.)*. Polytechnics Mauritius offers programmes in health sciences and nursing, IT, and emerging technologies *(PolyMU, n.d.)*. In addition, the Rajiv Gandhi Science Centre (RGSC) acts as a science centre that aims to promote S&T through non-formal education programmes. It targets the general population, especially primary and secondary school students, with interactive science exhibitions, contests, student conferences, and standard talks to draw interest in science *(RGSC, n.d.)*.

Intermediaries and facilitators play an important role in supporting the innovation ecosystem. Among them, Business Mauritius is a coordinating body that represents over 1,200 local businesses in Mauritius. It represents them in various forums and offers services supporting business and community development, including SME support and sustainability initiatives *(Business Mauritius, 2020)*. Turbine, a subsidiary of ENL Limited, a prominent private business group in Mauritius, assists start-ups by helping them address their early-stage challenges. It facilitates connections with corporate partners and provides quality, professional services to support their growth and scalability (Turbine, 2020). Furthermore, LinearArc Solutions operates as an incubator that supports start-ups from ideation through to implementation, offering crucial mentorship and training to guide them along their entrepreneurial journey *(LinearArc Solutions, n.d.)*.

The regulatory and standardisation landscape of the NCD-related STI ecosystem in Mauritius is shaped by several key entities, each playing a critical role in ensuring compliance and promoting best practices across various sectors. The Clinical Research Regulatory Council, for instance, oversees the regulation and control of clinical trial licenses, ensuring that research activities adhere to ethical and safety standards *(EDB, 2023)*. The Pharmacy Council of Mauritius regulates the pharmacy profession, managing the processes from registration and training to continuing professional education and disciplinary actions, supported by a Code of Practice *(PCoM, n.d.)*. The Mauritius Standards Bureau promotes industry and economic growth through its focus on standards development, product testing, quality assurance, and metrology *(MSB, n.d.)*. Furthermore, the Mauritius Accreditation Service (MAURITAS) accredits laboratories, inspection bodies, and certification bodies, working to establish mutual recognition agreements internationally *(MAURITAS, n.d.)*. Finally, the Food Technology Laboratory under the Ministry of Agro-Industry and Food Security sets standards in the food industry as a COMESA Food Safety Reference Laboratory, holding ISO/IEC 17025 laboratory accreditation *(MoAIFS, n.d.)*.

Several private sector companies play integral roles as stakeholders in Mauritius' ecosystem, each contributing to the healthcare landscape. T1 Diams is a non-profit organisation dedicated to supporting individuals with Type 1 diabetes. It operates a specialized centre that provides comprehensive care, including medical equipment, psychosocial follow-up, and therapeutic education, ensuring that patients receive proper management *(T1 Diams, n.d.)*. Axonova has distinguished itself by establishing the first high-content screening platform in the region for pharmaceutical and nutraceutical testing, aiming to become the reference laboratory for exploratory research and bio-analytical testing in Sub-Saharan Africa *(Axonova, 2012)*. C-Care stands out as a leading provider of medical care not only in Mauritius but also in the Indian Ocean region, offering a range of healthcare services *(C-Care, n.d.)*. Africa Healthcare Network is focused on expanding access to world-class, lifesaving care at an affordable cost throughout Africa, thereby enhancing the quality of healthcare across the continent *(Africa Healthcare Network, 2022)*. Lastly, Erada Technology Alliance is making significant advancements with its rapid diagnostic technology. Its main goal is to enable the accurate detection of early asymptomatic infections and identify disease carriers, playing a crucial role in controlling the spread of diseases *(ERADA, 2015)*.

Despite the robust framework established in Mauritius to address health challenges through its STI system, there are notable challenges that impede its effectiveness. Inter-sectoral research coordination among key actors, notably the Ministry of Health and Wellness, MRIC and MIH is reportedly insufficient *(Musango et al., 2023)*. This situation can lead to fragmented efforts and inefficiencies in addressing health issues in general, NCDs in particular. Moreover, the absence of a sectoral research and innovation (R&I) policy or strategy for health hinders the prioritisation and alignment of research activities with national health goals *(Musango et al., 2023)*.

Another significant concern is the capacity of local institutions to conduct high-quality research. As explained by stakeholders, institutions like MIH lack adequate laboratory capacity for clinical trials, which is essential for advancing medical research and innovation. Furthermore, government funding for health R&D is significantly below the regional and international target of 2%, limiting the scope and impact of R&I initiatives.

Therefore, to effectively address the challenge of NCDs, Mauritius needs to tackle the existing systemic challenges within its STI framework. Enhancing coordination among key stakeholders, increasing investment in research capacity and infrastructure, and developing a clear national health research policy are essential steps to optimise the impact of the country's health research system.

2.3 STI POLICY AND GOVERNANCE IN RELATION TO THE CHALLENGE AREA

The overarching policy guiding Mauritius' innovation strategy is the National Innovation Framework (NIF) for 2018-2030. This strategic initiative is dedicated to "creating an ecosystem for innovation to facilitate the transition of Mauritius from a middle-income economy to a high-income innovation-driven economy". Moreover, it aims to establish "top-class healthcare" as one of its final objectives, illustrating the commitment to integrating health dimensions into various aspects of the framework. The NIF consists of four main elements that together construct a comprehensive approach to fostering innovation across multiple sectors *(MoTCI, 2018)*:

- **Innovation capacity building:** NIF prioritises the development of innovation capacity across various levels: national, industry, company, and individual. Nationally, it focuses on enhancing the Technology Transfer Office (TTO) and creating an AI Council to lead digital initiatives. At the industry level, it promotes collaboration between academia and businesses to stimulate innovation-led growth. For companies, the emphasis is on attracting top-tier talent and fostering a culture of organisational learning aimed at continuous innovation. Individually, the framework advocates for cross-disciplinary learning and specialised skills development, especially in STEM fields, preparing a workforce equipped for innovative challenges. In addition, it supports regional and international collaborations to drive economic growth and expand market demand, reinforcing Mauritius' global presence in innovation.

- **Innovation infrastructure:** NIF emphasises the key role of infrastructure in driving innovation, with strategic plans to develop smart cities and advanced information and communication technology (ICT). It seeks to establish Poles of Innovation, Research and Innovation Bridges, and Industry-Centred Incubators, all designed to nurture a vibrant ecosystem for innovation. Furthermore, it fosters support at both the company and individual levels by advocating for Public-Private Innovation Centres and Collaborative Blue Ocean Research Labs. These initiatives are aimed at increasing research activities and facilitating the creation of new startups, enhancing the overall capacity for innovation within the region.

- **Innovation incentives:** To stimulate innovation, NIF promotes the implementation of public-private partnership (PPP) models, IP policy incentives, and R&I funding schemes. It

also emphasises the importance of strengthening the legal framework for IP rights to enhance Mauritius' engagements on regional and international levels. By encouraging industry-specific IP policy incentives, the framework aims to protect commercial ideas and technologies, ensuring that inventors and businesses can secure and capitalize on their innovations.

- **Major R&I measures:** NIF incorporates strategies to embrace emerging technologies such as AI, fintech, and blockchain, while also promoting social innovation to tackle societal challenges. It seeks to cultivate a culture of innovation through the implementation of awards and challenges, and it defines grand challenges specifically aimed at overcoming barriers to economic development. Health-related initiatives are integrated into these measures. For example, the use of ICT is recognised as a driver for essential services like healthcare. Similarly, the promotion of social innovation is targeted to address NCDs, substance abuse, and adolescent reproductive health, among others.

The NIF is complemented by a National Roadmap for Research and Innovation (2023-2027) that was developed by the MRIC in consultation with the public and private sectors. The roadmap prioritises a total of six thematic areas: Blue and Green Innovation, Health and Wellness Innovation, Financial Innovation, Social and Grassroots Innovation, Travel, Tourism and Entertainment Innovation, and IT, Emerging and Enabling Innovation. This roadmap will be prioritised by those ministries that do not have a strategic plan or whose plans are more than two years old.

To contribute to the development of this national roadmap for the health and wellness sector, a working group consisting of expert stakeholders was established. This group developed four main R&I strategic orientations, drawing on both local situation analysis and international trends. These orientations are outlined in the 2022 report *(MDPA, 2022)*:

- **Promoting innovative technology/ practices:** This strategic orientation includes the implementation and expansion of digital health technologies, alongside the adoption of other innovative technologies and practices. Expected outcomes include several areas: reduced electricity and petrol costs for the Ministry of Health and Wellness, enhanced service delivery in public hospitals, and improvements in care, research, and support -especially in the prevention of NCDs. This orientation is designed to foster a multi-disciplinary approach and encourage intersectoral collaboration among various actors within the health system.

- **Harnessing the potential contribution of new fields of health and wellness to economic growth:** This strategic orientation envisions the implementation of R&I across various sectors including traditional/ayurvedic medicine, sports, the ageing population (silver economy), healthcare tourism, and medical education. This approach is anticipated to yield significant economic benefits, such as increased revenue from the fees and expenditures of foreign students, higher hotel occupancy rates, and increase in related sectors like food, transport, and leisure. It also aims to strengthen Mauritius' relationships with African states through scholarships, enhancing knowledge transfer and attracting foreign direct investment. Another expected outcome is the positioning of Mauritius as a premier destination for wellness tourism, particularly focusing on combating NCDs through Ayurvedic practices. As such, this orientation promotes the local adaptation and application of evidence-based Ayurvedic treatments for NCDs, with new research initiatives planned for the six Ayurvedic clinics and improved service delivery by Ayurveda professionals.

- **Innovating for a healthier population:** This strategic orientation targets a comprehensive approach to health, addressing communicable and non-communicable diseases as well as mental health concerns. It emphasises the importance of initiatives designed to reduce substance abuse, ensure a decent living environment, and support ageing

with dignity and respect. It also promotes increased dialogue among various health actors to develop personalised treatment plans for individuals, enhancing patient-centred care. Moreover, it focuses on improving the health outcomes of senior citizens by better managing geriatric issues and aims to influence the dietary behaviours of the youth by using athletes as role models. These concerted efforts are designed to create a holistic and integrated health system that adapts to the needs of all age groups and health challenges.

- **Innovative governance mechanism to improve the delivery of institutions:** It aims to develop a clinical and regulatory framework for postgraduate medical training to ensure a conducive learning environment. It also targets establishing a professional setting for clinical trials, aligning Mauritius with international standards, and positioning it to gain recognition from the global pharmaceutical and biotech industries. The plan leverages over two decades of research on endemic medicinal plants for commercialisation, expected to attract investment from the food, pharmaceutical, and cosmetic sectors seeking unique bio-active ingredients for health products. This initiative also provides new opportunities for small-scale farmers to cultivate medicinal plants, thereby enhancing the country's biodiversity and positioning Mauritius in the international biotech arena with its unique genetic resources. Finally, the strategy aims to tap into the dynamic global nutraceutical market, which has seen significant growth in recent years.

In line with its innovation-driven approach, Mauritius' healthcare system has adopted a data-driven method for decision-making and evaluation. The Mauritius Non-Communicable Diseases Survey, which is used to monitor the effectiveness of interventions against NCDs, has reported promising trends, such as a decrease in diabetes prevalence and an increase in physical activity levels. However, a critical issue identified by stakeholders is the disconnection between research findings and policy implementation. Despite producing valuable research outcomes, there is often a significant gap in translating these findings into actionable policies and interventions. This challenge highlights the need for improved mechanisms to ensure that research directly informs policy decisions and effectively contributes to public health enhancements.

Key programmes put in place by the government to support STI and can directly and indirectly help address NCDs challenge include the following:

- **National SME Incubator Scheme (NSIS):** NSIS is designed to stimulate socio-economic growth by supporting innovative start-ups through by a network of seven accredited business incubators. It fosters collaboration among stakeholders to strengthen the entrepreneurial ecosystem. NSIS provides structured training and mentoring in three phases: pre-incubation (idea to prototype), incubation (plan to start-up), and acceleration (scaling the business). Since its inception in December 2017, NSIS has assessed 271 project applications and graduated 22 start-ups *(MRIC, n.d.-c)*.

- **Proof of Concept Scheme (PCS):** PCS is targeted at start-ups, MSMEs, large enterprises, and collaborations with research/academic institutions to help innovators turn their research results and ideas into prototypes and establish viable business cases. PCS prioritises health and wellness, among other fields such as social and grassroots, IT and emerging technologies, and Rodrigues innovation. Funding of up to Rs 1 million (21,200 Euro) per project is available for a project duration not exceeding 12 months. Awards are made on a competitive basis *(MRIC, n.d.-c)*.

- **Collaborative Research and Innovation Grant Scheme (CRIGS):** CRIGS supports innovation collaborative projects between local companies and higher education institution. A matching grant of up to Rs 5 million (106,000 Euro) is provided to successful applications for a project duration of up to 24 months *(MRIC, n.d.-c)*.

- **Research and Innovation Bridges (RIB):** RIB allows local companies to collaborate with international companies or research institutions on joint R&D projects having commercialisation potential. This synergy aims to bridge the gap between theoretical research and practical, market-driven applications, with an end goal of innovation that can be translated into tangible economic benefits. Successful applicants may be awarded a matching grant up to Rs 10 million (212,000 Euro) *(MRIC, n.d.-c)*.

- **Social Innovation Research Grant Scheme (SIRGS):** SIRGS aims to stimulate social innovation in the local Mauritian context by encouraging NGOs, public funded bodies, and private sector companies to collaborate with academic and research institutions. The projects submitted should aim to address societal challenges such as the integration of vulnerable groups, equal opportunities, and environmental issues. A critical component of the SIRGS-funded projects is a robust research methodology that clearly articulates and evaluates the intervention, ensuring the solution is both novel and practically applicable to the societal issue addressed. A grant of up to Rs 1 million (21,200 Euro) is provided per project for a project duration not exceeding 24 months *(MRIC, n.d.-c)*.

- **Pole of Innovation Grant Scheme:** It is designed to promote economic development by supporting advanced research and partnerships between local and international entities. Eligible participants include relevant ministries and parastatal bodies, local academic and research institutions, private sector organisations and NGOs. Matching grants up to Rs 9 million (190,100 Euro) is provided per pole with an annual maximum ceiling of Rs 3 million (63,600 Euro) for a duration of 36 months *(MRIC, n.d.-c)*.

- **Intellectual Property Promotion Scheme (IPPS):** Implemented jointly by the MRIC and the Industrial Property Office (IPO), IPPS aims to boost creativity and innovation by supporting patent applications and industrial design registrations *(MRIC, n.d.-c)*.

- **Rodrigues Research and Innovation Grant Scheme (RRIGS):** The RRIGS aims at advancing R&I in the island in line with the National Innovation Initiative. It is open to Rodrigues-registered entities, including cooperatives, enterprises, NGOs, as well as departments and commissions under the Rodrigues Regional Assembly. Funding is awarded to proposals that demonstrate a high potential for R&I and align with the priority areas of Rodrigues, addressing the island's needs through innovative approaches. The maximum grant allocated to successful applicants is Rs 800,000 (16,900 Euro) per project, with a maximum duration of 24 months *(MRIC, n.d.-c)*.

- **MPhil/PhD scholarship:** The HEC annually awards a number of scholarships to successful undergraduate students to undertake research at MPhil/PhD on a full-time or part-time basis at the local universities. The scholarship covers an annual tuition fee up to a maximum of Rs 75,000 (1,600 Euro) and a monthly stipend of Rs 16,500 (350 Euro) for MPhil; Rs 18,300 (390 Euro) for PhD students *(HEC, n.d.-a)*.

- **HEC postdoctoral research fellowships:** HEC makes provision annually for two full-time postdoctoral research fellowships (subject to availability of funds) at local publicly funded university. The monthly stipend for HEC postdoctoral fellowships is Rs 32,500 (690 Euro) without publication in peer-reviewed journals or Rs 34,350 (730 Euro) with publication(s) in peer-reviewed journals *(HEC, n.d.-a)*.

- **Mauritius-Africa Scholarship Scheme:** It offers 50 scholarships to successful applicants who are resident citizens of African Union member states for full-time, on-campus diploma, undergraduate, or postgraduate studies at public universities in Mauritius. The scholarship covers up to four years or the minimum course duration, whichever is less. SADC country awardees receive Rs 100,000 (2,130 Euro) annually, while non-SADC awardees get Rs 160,000 (3,400 Euro), paid directly to HEIs for tuition and related costs. In addition, awardees receive a monthly allowance of Rs 12,500 (265 Euro) *(HEC, n.d.-a)*.

- **Capacity development and awareness programs:** Recognising the value of holistic health practices, programmes are emerging in the areas such as yoga and Ayurvedic cuisine. The Mauritius Institute of Management (MGI), for example, offer short-term yoga courses, introducing participants to techniques that promote well-being. In addition, HEC, in collaboration with the Ayush Chair of the University of Mauritius, organise courses on Ayurveda principles teaching the preparation of balanced meals for optimal health.

The notable programmes initiated and supported by the international organisations and NGOs to help address NCDs include the following:

- "One Patient, One Record" eHealth project initiated by UNDP aims to modernise Mauritius' public healthcare services by leveraging technology to create a more cost-efficient, patient-centric, and accountable system for managing patient records, details, and test results. It has a budget of Rs 600 million (12.1 million Euro) and tangible results from first phase is planned to be obtained at the Jawaharlal Nehru Hospital in August 2024 extending to other hospitals, health centres, community centres, and medical clinics within three months *(UNDP, n.d.-c)*.

- The ISLANDS project of UNDP supports the government to effectively manage healthcare waste. It aims to protect human health and the environment from the harmful effects of hazardous chemicals and wastes and includes activities such as updating the Mauritius Network Service system used by the Dangerous Chemicals Control Board and conducting a feasibility study for a centralised treatment facility for healthcare waste *(UNDP, n.d.-b)*.

- Mauritius is part of a project called Health Systems Strengthening for Universal Health Coverage, which is jointly funded by the European Union and the Grand Duchy of Luxembourg and implemented by the WHO. It aims to support national health policies, strategies and plans to increase universal health care and improve technical and institutional capacities for health systems *(EEAS, n.d.)*.

- The 5-2035 is a programme promoted by the 5-2035 Global Foundation for Community Health (GFCH), a non-profit organisation created by the Mauritian scientific diaspora (GFCHealth, n.d.-a). The 5-2035 vision aims to reduce the prevalence of type 2 diabetes in Mauritius to 5% by 2035 and revolutionise the country's healthcare system. It plans to train a network of 1,500 community health nurse practitioners and 150 community health doctors, and establish new institutions to enable the transformation. The ultimate goal is to dramatically improve health outcomes in Mauritius and create a community health model that can be transferred to the rest of the world *(GFCHealth, n.d.-b)*.

Despite concerted efforts, Mauritius continues to face significant challenges in implementing policy instruments to address NCDs, as evidenced by desk and field research. A major issue is the suboptimal coverage of NCD interventions, highlighting substantial gaps in effectively reaching the population *(Musango et al., 2020)*. This challenge arises from several factors, notably a lack of explicit priority-setting approaches where clear and structured mechanisms is essential for efficiently allocating resources and addressing urgent health needs. In addition, securing adequate funding and investment, particularly from the private sector, remains a critical difficulty. Establishing clear guidelines and processes for managing and disbursing funds is important to attract and facilitate investment in NCD-related initiatives (Musango et al., 2020). Further compounding these issues is inadequate interagency cooperation, which significantly impedes the necessary multi-sectoral response essential for tackling NCDs effectively. Moreover, improving stakeholder engagement on new initiatives and policy instruments are needed to ensure that stakeholders are well-informed and their inputs are integrated into policy development, leading to more effective and sustainable solutions.

3. GAPS AND AREAS OF OPPORTUNITY TO ADDRESS THE SUSTAINABILITY CHALLENGE

3.1 GAPS IN INNOVATION SYSTEM CAPACITIES AND POLICIES TO ADDRESS THE CHALLENGE

This study identified several gaps within Mauritius' STI system that hinder effective responses to NCDs. Some of the key challenges include, among others, insufficient coordination, suboptimal resource allocation, inadequate policy support, human resources shortages, and infrastructural limitations. This section summarises these critical shortcomings, which were highlighted by stakeholders through participatory approaches and corroborated by various documents.

- **Insufficient coordination:** There is a notable fragmentation within the STI system in Mauritius, particularly in coordination between government bodies, research institutions, the private sector and other actors. Stakeholders reported various isolated initiatives but noted a lack of cohesive strategy and integration. This fragmentation leads to inefficiencies, duplication of efforts, and missed opportunities for collaborative advancements in tackling NCDs. Furthermore, insufficient collaboration and communication between higher education institutes, research organisations, the private sector, and international partners hinders progress in health-related STI. This limits the multidisciplinary approach needed to address complex health challenges like non-communicable diseases, restricting the sharing of knowledge, resources, and technologies that could improve research outcomes and innovation efficiency *(MDPA, 2022; MoTCI, 2018; Musango et al., 2023)*. It is observed that the issue of weak coordination and communication is linked to the absence of a robust STI governance framework, which may be overseen by MRIC. However, the Council is not autonomous and operates under the Ministry of Information Technology, Communication and Innovation. A pervasive issue throughout the innovation system of Mauritius is the need for capacity building and establishing a common understanding of the key concepts and practices in STI policy-making and implementation. For example, although the term "research and innovation" is often used interchangeably with STI, in Mauritius, there is a perception among some stakeholders that these are distinct concepts. In addition, essential elements of the STI policy cycle, notably monitoring and evaluation, are not yet ingrained in the policy-making culture.

- **Lack of a national R&I strategy for NCDs:** Mauritius is in the process of developing a national roadmap for technology, research, and innovation within the health and wellness sector. However, the country lacks a dedicated national strategy that specifically addresses R&I for NCDs. This deficiency significantly hinders the systematic approach required to effectively tackle this sustainability challenge. Without a comprehensive strategic framework, it becomes particularly difficult to prioritise R&I, allocate necessary resources, and stimulate STI collaboration among stakeholders critical for preventing and managing NCDs. Linked with this issue, the country lacks clear prioritisation in health budget allocations, particularly regarding

NCDs. The utilisation of national health accounts and evidence from cost-effectiveness analysis in resource allocation is still in its nascent stages. This preliminary phase often leads to potential misallocation of resources, which in turn hinders the health system's capability to effectively target interventions that could alleviate the burden of NCDs. Therefore, these gaps not only affect the overall health outcomes but also the economic efficiency of the system *(Musango et al., 2020)*. Within this framework, Rodrigues Island requires a specific attention due to its unique challenges. A territorial innovation strategy and initiatives addressing its pressing gaps is needed with respect to NCDs, which should include, among others, collecting and analysing NCD-related data for informed policymaking, training specialized human resources such as nurses in diabetes care, investing in public education, digitalising health services, and developing essential infrastructure like sports facilities.

- **Inadequate support for STI in health:** There appears to be inadequate policy support specifically tailored to foster the development and integration of STI in the health sector in Mauritius. While general policies for R&I exist, stakeholders highlight a deficiency in targeted policy instruments and regulatory frameworks that address the unique challenges of applying STI to health, particularly in managing NCDs. This results in a policy environment that fails to fully leverage the potential of innovations to improve health outcomes (MDPA, 2022; MoTCI, 2018). In addition, various steps of the research process do not function effectively. Stakeholders reported, for example, cumbersome processes for obtaining clinical trial permits, a high level of bureaucracy in R&I support programs, and the absence of a holistic approach covering the health value chain from food systems to healthcare delivery in addressing the NCD challenge. Moreover, government funding allocated to research specifically targeting NCDs in Mauritius is insufficient. Current investment levels significantly lag behind regional and international benchmarks recommended for health research funding3 *(MDPA, 2022; Musango et al., 2023)*. Further compounding these challenges is the gap in the integration of scientific evidence into clinical practice and health policy for NCDs. Despite ongoing efforts to conduct surveys and gather data on NCDs, there remains a significant disconnect in the structured process for the coordinated development, quality assurance, updating, and monitoring of NCD management guidelines and protocols. This issue leads to potential inconsistencies in NCD care and may result in suboptimal treatment outcomes and inefficient use of resources *(Musango et al., 2020)*.

- **Insufficient investments in R&D human resources and infrastructure:** There is a notable shortfall in the number of health research personnel, which limits the country's capacity to conduct research and develop innovative solutions, constraining the advancement of knowledge and the application of new technologies and methodologies critical for improving NCD outcomes *(MDPA, 2022; Musango et al., 2023)*. Moreover, Mauritius faces a scarcity of research facilities specifically dedicated to NCDs *(MDPA, 2022; Musango et al., 2023; Roopchund, 2023)*, impeding the ability to conduct high-quality research, drug trials, and intervention studies essential for developing new treatments. This gap in infrastructure is further exacerbated by a significant reliance on international collaborations to support local capabilities. Moreover, Mauritius struggles with ineffective interoperable patient data transfer systems and has not yet fully institutionalised national NCD registries. This technological and data gap severely hinders the efficient collection, sharing, and analysis of health data, which are crucial for informed decision-making and effective NCD management *(Musango et al., 2020)*. The underutilisation of data is a critical

3 *The Commission on Health Research for Development and the WHO Regional Committee for Africa recommend to allocate at least 2% of the annual health sector budget to research activities for health (Musango et al., 2023)*

factor that limits the capacity to formulate and implement effective health strategies and policies through data-driven approaches.

- **Sociocultural factors related to NCD:** According to stakeholders, the cultural factors, such as aversion to change, and preferences for unhealthy diets, deeply ingrained in local cuisine and social practices, create a significant challenge to promoting healthier lifestyles. There is also a significant trend towards fast food consumption, exacerbated by aggressive marketing and advertising by fast food companies. Moreover, the stigma associated with certain NCDs and the lack of awareness among the general population hinder early detection and effective management of these conditions. This gap may lead to the development of interventions that are not tailored to the specific needs and preferences of the local population, resulting in lower adoption rates and reduced effectiveness. Furthermore, the limited understanding of the social determinants of health, including cultural norms, beliefs, and practices, may hinder the ability to identify and address the root causes of the high prevalence of NCDs in the country. As a result, these gaps in the STI system may exacerbate the burden of NCDs on the population, leading to increased healthcare costs, reduced quality of life, and premature mortality.

3.2 OPPORTUNITY AREAS TO MOBILISE STI FOR THE CHALLENGE

The analysis of the gaps in the STI system to address NCDs enabled to identify several opportunities to reduce NCDs in Mauritius. To leverage sectoral opportunities, improved coordination, collaboration and STI infrastructures are preconditions. Desk research and stakeholder consultations highlighted the potential of several sectoral opportunities related to traditional medicine, artificial intelligence, and social and urban innovation.

IMPROVE COORDINATION AND COLLABORATION

NCDs is a multifactorial challenge that needs a holistic response. Due to the multidimensional nature of NCDs, mobilising key stakeholders in health, education, agri-food and ICT, through joint R&I programmes is key. To provide an adequate response to NCDs, both to improve treatments and prevention, national and international coordination are needed. In particular, it may facilitate access to the most recent technology, enhance research and skills, develop new treatments, and improve funding effectiveness.

Stakeholder discussions highlighted that collaborations with European institutions could bring advanced technologies to Mauritius, and at the same time facilitate knowledge transfer, improve research methodologies, and provide advanced tools for disease management and prevention. In this context, the assignment of a National Contact Point to provide guidance, practical information and assistance to stakeholders on Horizon Europe programme and other EU schemes will be an important step for Mauritius.

Enriching treatment options by including traditional medicine could also enhance local capacities in both research and treatment. This integration would not only enable diversify treatment options but also stimulate local research and education in these practices. Higher capacity in traditional medicine may also reinforce the role of prevention to address NCDs, which is a key lever to reduce NCDs.

Stakeholder consultations also highlighted opportunities to improve access to funding and funding effectiveness in healthcare through collaboration. More specifically, collaboration between the government, academic institutions, the private sector (including foreign investments), and Mauritian diaspora may enable to streamline R&I activities on NCDs. In turn, this could facilitate international partnerships for strategic R&I investments in healthcare.

To facilitate coordination and collaboration, Mauritius could establish a robust STI strategic

framework with prioritised actions, while at the same time strengthening its R&I capacity. This approach would not only direct efforts and resources towards the most pressing health issues related to NCDs but also ensure that R&D and innovation activities align with national health priorities. Such alignment would enhance the effectiveness and efficiency of the health research system in addressing challenges caused by NCDs.

DEVELOP STI INFRASTRUCTURES AND KEY ENABLERS

The enhancement of the health information system is an essential step for Mauritius to manage NCDs effectively *(Musango et al., 2020)*. An integrated solution would ensure that patient data are easily accessible across different levels of the healthcare system, enhancing continuity of care and enabling better disease monitoring, prevention and management. Establishing comprehensive national registries for NCDs would allow Mauritius to track disease trends, evaluate the effectiveness of interventions, and plan public health responses more effectively.

Moreover, investing in research infrastructure at higher education institutions can significantly enhance the national capacity to address NCDs through R&I. By improving facilities, skills and resources, these institutions can conduct more comprehensive and impactful research in the field. These actions are important not only for a better understanding and management of these diseases but also for raising the next generation of health researchers who can generate innovative health solutions tailored to the specific needs of the local population *(Musango et al., 2023)*.

Within the STI ecosystem, the establishment of biotechnology incubators, as discussed by stakeholders, presents a unique opportunity to focus on NCDs. By encouraging the creation and development of start-ups to develop solutions and technologies aimed at combating NCDs, Mauritius can transform the healthcare system. These incubators could serve as hubs for creating new diagnostic tools, treatments, innovative services and preventive technologies specifically tailored to the local needs, further strengthening the country's capacity to tackle the NCD burden.

DEVELOP RESEARCH EXPERTISE TO PROVIDE HOLISTIC TREATMENTS

To provide holistic treatments to patients, stakeholders emphasised the potential and the need for a robust nutraceutical industry in Mauritius. Nutraceutical industry could use local plant resources, promoting economic growth and providing public health benefits by offering products that help manage conditions like diabetes and hypertension. Stakeholder also highlighted the untapped potential of Ayurveda to enrich the set of treatments available to patients.

Improving research capacity to develop an expertise in testing natural remedies that could enrich allopathic treatments is a requirements. In particular, clinical trial are needed, both to test natural remedies and build a consensus on their efficiency, and improve the set of treatment options for patients.

While there are efforts for setting up such industries, a comprehensive legal and regulatory framework is required to ensure its success. Moreover, a nutraceutical industry would benefit local agriculture and biotechnology sectors *(MDPA, 2022)*.

DEVELOP ARTIFICIAL INTELLIGENCE AND DIGITAL SOLUTIONS FOR HEALTH DIAGNOSIS AND PREVENTION

The integration of artificial intelligence (AI) solutions in health data analytics presents a significant opportunity to enhance the monitoring and prediction of NCDs, as they can analyse large datasets quickly and with high accuracy, enabling the prediction of trends and potential outbreaks of diseases such as diabetes or cardiovascular issues. This capability allows for timely interventions and better resource allocation in healthcare. For instance, AI applications in pilot projects for cardiovascular disease screening[4] have shown

4 *A cloud-based AI system for analysing heart scans was successfully tested by the CVON-AI Consortium in the Netherlands. The AI's performance matched expert*

promising results and could be expanded to cover other NCDs, thus enhancing preventive healthcare measures and potentially reducing the overall healthcare burden.

In addition to AI, mobile health applications are necessary for enhancing public awareness and management of NCDs. For example, stakeholders recommend the expansion of mobile health platforms like MoBienet *(MoBienet, n.d.)* to include features such as personalised health tracking and medication reminders. These applications can serve as effective tools for health education, self-management of diseases, and providing direct access to health services, which is particularly beneficial in remote or underserved areas.

DEVELOPING HEALTHCARE INNOVATION TO REDUCE UNHEALTHY BEHAVIOURS

Enhancing health literacy through social innovation in Mauritius is crucial for empowering individuals to make informed health decisions. Innovation-driven initiatives to educate the public about the risks associated with alcohol and tobacco use, high sugar and salt intake, unhealthy diets and physical inactivity leading to obesity can significantly reduce the prevalence of NCDs. Improved health literacy fosters a proactive approach to health management and aligns with global health recommendations, potentially leading to better overall health outcomes and reduced healthcare costs *(MDPA, 2022)*. Health education campaigns should target all age groups and be delivered through various channels, such as schools, community centres, and media outlets, to ensure maximum reach and impact.

To further address the root causes of NCDs, comprehensive physical education and nutrition programs can be implemented at all school levels, incorporating family involvement to extend the application of learning outcomes into daily life. Stakeholders urge the government to re-integrate regular physical activity and healthy eating requirements into the school curriculum to ensure that new generations develop lifelong habits that prevent NCDs. Further steps in this direction should include urban innovative actions and other measures such as making sidewalks and cycling paths available and accessible, and building sports facilities in districts to encourage active lifestyles among community members of all age groups.

Finally, stakeholders note that implementing policies such as a stronger sugar tax and regulations on unhealthy food advertising could significantly influence public health outcomes. While a sugar tax exists to some extent, stakeholders believe it is not effective enough to change behaviours. By implementing regulatory innovations that promote healthy food, the government can directly reduce the burden of NCDs associated with poor diet and lifestyle choices. These reforms would also encourage food producers to innovate healthy options, contributing to a healthier national diet and potentially stimulating economic growth in the food sector.

analysis with high accuracy, leading to its integration into a user-friendly web application (Benjamins et al., 2019)

4. PARTICIPATORY DELIBERATION OF CHALLENGE-ORIENTED STI AREAS

The chapter introduces STI areas considered most impactful in reducing NCDs in Mauritius, in line with SDG3, SDG10, and SDG11. The following descriptions of the STI areas are based on stakeholder consultations (interviews, workshops and an online survey) and information available to the team at the time of conducting the study (February-May 2024). These challenge-oriented STI areas capture the STI horizontal and sectoral gaps and opportunities described in ***Chapter 3***.

4.1 KEY CHALLENGE-ORIENTED STI AREAS EMERGING FROM THE STUDY

LEVERAGING TRADITIONAL KNOWLEDGE AND INTEGRATIVE MEDICINE

As often highlighted by stakeholders, Mauritius has a high potential and willingness to adopt and integrate traditional and integrative medicine innovations such as Ayurvedic practices and other holistic health approaches. Ayurveda focuses on preventive care by promoting a balanced lifestyle, including diet, exercise, and stress management, which can prevent or reduce the risk of NCDs. Integrative medicine, which combines these traditional practices with conventional medical treatments, offers a more comprehensive and personalised healthcare approach. The country's potential in these areas is supported by a combination of regulatory frameworks, cultural acceptance, and a growing interest in alternative medicine, which is supported by both the government and private sectors.

A significant step in this direction was taken in 1989 with the adoption of the Ayurveda and Other Traditional Medicine Act, which was enacted to recognise and regulate the practice of traditional medicines, including Ayurveda, in the country. The act marked Mauritius as one of the few countries outside India to officially regulate Ayurvedic practice through legal means *(GoM, 2022a)*. It not only facilitated the institutionalisation of Ayurveda into the public health system but also supported bilateral cooperation with India, enhancing the practice and acceptance of Ayurveda in the country. Starting in 1992, it allowed for the establishment of Ayurvedic clinics in government hospitals and medical clinics, which were regulated under the provisions of this act *(Urquiza-Haas & Cloatre, 2023)*.

The Traditional Medicine Board in Mauritius, operating under the aegis of the pharmacy board, mandates the registration of Ayurvedic practitioners, ensuring that the practice of Ayurvedic medicine is regulated. This regulatory body plays a key role in maintaining the standards and safety of traditional medicine practices on the country. In addition, the government has established an Ayurvedic Committee within the Ministry of Health and Wellness to oversee the importation and regulation of Ayurvedic medicine. However, there is a noted absence of a legal framework specifically acknowledging Ayurvedic pharmacies, an area where further regulatory development is needed *(Elaheebocus & Mahomoodally, 2017)*.

Mauritius' multicultural society is highly receptive to traditional and integrative medicine, largely due to its diverse population which includes a significant proportion of people of Indian descent. This demographic has historically used Ayurvedic medicine, and its practices have been integrated into the broader Mauritian culture *(Elaheebocus &*

Mahomoodally, 2017). The use of medicinal plants and traditional remedies is widespread, not only within the Indian community but also among other ethnic groups. For instance, the Chinese community in Mauritius also has a rich tradition of using herbal remedies, which has been documented and studied, showing a significant integration of traditional Chinese medicine into local healthcare practices *(Mahomoodally & Muthoorah, 2014)*.

Within this perspective, the healthcare sector in Mauritius is evolving with a noticeable shift towards including integrative and alternative medicine. The country has, at the same time, become a hub for medical tourism for the region, which includes wellness and alternative medicine therapies. This transformation not only serves to the local population but also attracts tourists seeking holistic health treatments, contributing to the economy. The presence of global healthcare companies and the importation of medical devices and pharmaceuticals further support this sector. The government incentives for medical device manufacturers and the importation of alternative medicines indicate a supportive economic environment for the growth of traditional and integrative medicine *(CNN, 2018; S-GE, n.d.)*.

Furthermore, the country hosts organisations that conduct research and offer educational programmes in traditional medicine. The University of Mauritius and other research institutions have been involved in ethnopharmacological surveys and studies that explore the medicinal properties of local plants *(Suroowan & Mahomoodally, 2016)*. These studies contribute to the global body of knowledge on herbal medicine and reinforce the local understanding and acceptance of these practices.

The research on traditional medicine in Mauritius has been further strengthened by the significant contributions of local scientists, including former President Ameenah Gurib-Fakim. Gurib-Fakim's work focused on advancing scientific research on the country's medicinal plants, with the goal of documenting and potentially commercialising their unique properties. By bridging traditional herbal knowledge with modern scientific practices, this research aimed to open up new avenues for economic development and enhance healthcare options in Mauritius. The involvement of high-profile figures like Gurib-Fakim underlines the national importance placed on leveraging indigenous botanical resources for both health benefits and economic gains *(Urquiza-Haas & Cloatre, 2023)*.

Despite these strengths, challenges need to be addressed to fully harness the potential of traditional and integrative medicine in Mauritius. The lack of a comprehensive legal framework specifically for Ayurvedic pharmacies and the need for more trained professionals in this field are among the areas of improvement *(Elaheebocus & Mahomoodally, 2017)*. Moreover, while there is substantial use of traditional medicine, standardised practices and integration into the formal healthcare system need to be improved.

NUTRITION AND FOOD TECHNOLOGY INNOVATIONS

Mauritius faces significant challenges in ensuring food security and adopting advanced food and nutrition technologies, which are crucial in addressing obesity, diabetes, and hypertension. The country's capacity to achieve food systems transformation is influenced by several factors, including government policies, infrastructure, education, and international partnerships.

The government has demonstrated a commitment to addressing food security and nutrition through various policies and strategic plans. The National Plan of Action for Nutrition 2009-2010 outlines the approach to improving nutritional outcomes for the population, which is essential in combating NCDs *(GoM, 2009)*. It includes strategies for promoting appropriate diets and healthy lifestyles and reducing malnutrition-related diseases, among others.

The Mauritius Artificial Intelligence Strategy highlights the potential for AI to contribute to sectors such as food and beverages. The AI strategy document recommends the adoption of AI

applications in areas such as food sorting, supply chain management, hygiene monitoring, and equipment cleaning. Since most food and beverage companies in Mauritius are already automated to some degree, implementing AI should not require very high investments (MDPA, 2018). These technological advancements could play a key role in enhancing food quality and reducing the prevalence of NCDs by ensuring healthier food production processes.

Education and research are significant areas for improvement in adopting and developing food and nutrition technologies. In this respect, current efforts are made by the University of Mauritius that offers programs in Nutritional Sciences designed to prepare students to work at the forefront of nutrition and health sciences *(UoM, n.d.-a)*. These programmes provide the necessary knowledge and skills to understand and apply advanced food technologies, which are vital in addressing the rising concerns of NCDs in the country.

International partnerships also play a role in enhancing capacities in food and nutrition technologies. The Food and Agriculture Organization (FAO) has initiated a project to improve the food control system in Mauritius, which includes an assessment of the national food control system and the development of strategies to improve public health and economic development *(FAO, n.d.)*. This project is part of a broader effort to strengthen capacities and governance in food and phytosanitary control in the region, aiming to mitigate the impact of NCDs through improved food safety and quality.

Furthermore, the Joint SDG Fund of the UN supports Mauritius in developing increased self-reliance on local production through sustainable agricultural practices, including the production of low-cost bio-fertilizers from seaweeds *(Joint SDG Fund, n.d.)*. This initiative addresses food security and promotes healthier food technologies by reducing reliance on imported chemical fertilizers, which is crucial in the fight against NCDs by promoting the availability of healthier food options.

Additionally, stakeholders highlighted the need for enhanced monitoring and control of pesticide use in agriculture through technological solutions. Stakeholders suggested amending the Pesticides Act to include closer monitoring of pesticide sales through the issuance of permits, which would be facilitated by technological tracking systems. These systems could employ low-cost sensors as well as AI and data analytics to ensure compliance and safer food production processes. Stakeholders also emphasised the importance of incentivising local production of healthy crops through targeted taxation policies and other measures such as rebates and educational tax benefits for farmers who adopt healthier crop production practices. By promoting the cultivation of nutrient-rich foods locally, these policies aim to improve dietary quality and reduce the incidence of diet-related NCDs such as diabetes and heart disease.

Despite these efforts, Mauritius faces several challenges in adopting advanced technologies for the food sector. These include the high costs of implementation, which can be a barrier for small and medium-sized enterprises (SMEs) without adequate financial incentives or support. There is also a significant skills gap in the local workforce regarding the operation and maintenance of new technologies, necessitating targeted training and education programs. Improvements in technological infrastructure, such as reliable internet connectivity and energy supply, are needed to support technology adoption effectively. Furthermore, resistance to change from traditional practices and the need for integration across the entire supply chain further complicate the adoption process *(MDPA, 2018)*.

HEALTH DATA MANAGEMENT AND ANALYTICS

Mauritius has the potential to significantly improve its healthcare system through effective health data management and analytics. This includes the utilisation of big data analytics and the implementation of electronic health records (EHRs). Such innovations can lead to better healthcare decision-making, improved patient outcomes, and increased overall system efficiency.

The implementation of EHRs has been studied in various settings, including the Central Flacq Hospital, where the transition has shown both benefits and challenges *(Putteeraj et al., 2022)*. Improved accessibility and reliability of patient information are key benefits, while challenges often relate to staff adaptation to new technologies and the integration of these systems into daily medical practices. Furthermore, Mauritius recognises the potential of big data analytics in the health sector. Analysing large datasets can help identify trends in disease outbreaks, predict patient admissions, and improve the overall quality of care.

Several initiatives are underway to digitise health records and move away from traditional paper-based systems. The "One Patient, One Record" initiative, supported by UNDP, is a significant step in this direction *(UNDP, n.d.-c)*. The project aims to create a unified digital record for each patient, facilitating seamless data sharing and coordination across various healthcare facilities. By providing healthcare professionals with quick access to accurate and comprehensive patient data, this initiative is expected to enhance patient care, improve decision-making, and reduce redundancy in tests and treatments. Implementing the e-health project at Jeetoo Hospital under the "One Patient, One Record" initiative is also a notable step towards leveraging big data to create a more integrated and efficient healthcare system.

In spite of these advancements, several challenges hinder the full realisation of health data analytics and management potential in Mauritius. Data quality, security, and interoperability among different health information systems remain key concerns *(Putteeraj et al., 2022)*. Also, the existing infrastructure may not adequately support the extensive data requirements of big data analytics. Concerns regarding data privacy and security also necessitate robust protective measures. Furthermore, there is a critical need for skilled professionals capable of analysing and interpreting big data effectively. Updates to legal and regulatory frameworks are also essential to facilitate the adoption of new technologies and enable data sharing among various stakeholders in the health sector *(Mohabeer et al., 2019)*.

CLINICAL RESEARCH AND TRIALS IN NCD THERAPIES

Mauritius has been actively positioning itself as a hub for clinical research, capitalising on its strategic location, political stability, and diverse population. These factors make it an attractive destination for pharmaceutical companies and research organisations seeking to conduct clinical trials, including those focused on NCD therapies.

The Mauritian government has demonstrated a strong commitment to developing a robust framework and infrastructure for clinical research, recognising its potential to improve healthcare services and address health challenges, including NCDs. The Health Sector Strategic Plan 2020-2024 outlines the goal of institutionalising health research to enhance the quality of healthcare services *(MoHW, 2020)*. This covers strategic actions such as:

- Developing a National Health Research Policy and Strategy: This would provide a clear roadmap for prioritising and coordinating clinical research efforts, including those related to NCD.
- Strengthening the capacity of Ethical Research Committees: Ensuring ethical oversight and participant protection is essential for conducting high-quality clinical trials.
- Creating a prioritised health research agenda: This would identify key areas of focus for clinical research, potentially involving NCD prevention, diagnosis, and treatment.

The establishment of the Clinical Research Regulatory Council, along with an Ethics Committee and a Pharmacovigilance Committee, further demonstrates Mauritius' dedication to maintaining high standards in clinical research. These bodies play a critical role in reviewing and approving clinical trial protocols, ensuring adherence to ethical guidelines and prioritising participant safety. The adoption of the Clinical Trials Act is expected to attract further investment in drug clinical trials, particularly those related to NCDs. The Act

provides a clear legal framework for conducting clinical trials, offering reassurance to investors and researchers *(GoM, 2017)*.

Furthermore, stakeholders reflected on past experiences of conducting clinical trials at the university level, specifically focusing on diabetes and cardiovascular diseases. These reflections underlined the critical need for sustained financial support to continue and expand such research initiatives. They also emphasised the importance of collaboration with health authorities, highlighting the necessity for a cohesive approach to enhance the scope and effectiveness of clinical trials. Stakeholders stressed that this collaborative effort is essential to ensure that the trials are not only well-funded but also well-integrated within the national health strategies to combat NCDs effectively.

Despite these advancements, challenges remain in fully realising Mauritius' potential in clinical research for NCD therapies. A key issue is the absence of applied research, as the health sector in the country primarily functions as a service provider. Also, there is a need to further develop research infrastructure and capacity *(GoM, 2017)*. Addressing these requirements will be important in translating the existing potential into tangible advancements in NCD research and treatment. Lastly, stakeholders highlighted that currently, most trials are conducted within the private sector, limiting participation and potential benefits for a large segment of the population. They believe opening up hospitals for clinical trials and ensuring equitable access would be a significant step forward.

DIGITAL HEALTH TECHNOLOGIES AND INNOVATIONS

Mauritius, with its focus on healthcare service sector, is well-positioned to embrace and expand digital health technologies. The increasing use of smartphones and medical apps by healthcare providers demonstrates a readiness to adopt more sophisticated digital solutions. This technological shift is further supported by the presence of global healthcare players and investments in multi-speciality centres of excellence that adopt top technologies *(MDPA, 2018)*. These innovations have the potential to elevate the quality of care for both local and international patients, enhancing Mauritius' appeal as a medical tourism destination while simultaneously improving efforts to address NCDs.

The country has already made progress in adopting digital health technologies such as telemedicine, remote patient monitoring, and wearable devices. For instance, the Digital Initiatives Group at I-TECH (DIGI) has collaborated with the Mauritius Ministry of Health and Wellness to optimise health workflows and facilitate the rapid processing of COVID-19 test results *(go2itech, n.d.)*. The deployment of OpenELIS, an open-source electronic laboratory information management system (LIMS), has increased capacity at the national reference laboratory and improved the workflow between regional flu clinics and reference labs *(go2itech, n.d.)*.

The positive attitude towards e-health among healthcare workers is encouraging, with many recognising benefits such as improved efficiency and ease of information flow. Key opinion leaders, including physicians and nursing managers, play an important role in driving the adoption and implementation of e-health technologies across the sector *(Putteeraj et al., 2022)*. This supportive environment suggests that Mauritius could progress in e-health by leveraging digital technologies such as remote support for surgeries and e-training to extend healthcare services regionally and globally, thus contributing to addressing NCDs.

Nonetheless, several challenges need to be addressed to effectively improve healthcare delivery through digital health technologies. Ensuring the privacy and security of health data is of significant importance as the country expands telemedicine services. Building trust among users by demonstrating robust security measures and compliance with global data protection standards is essential *(MDPA, 2018)*. In addition, navigating complex regulatory and ethical landscapes is

essential, including obtaining patient consent and addressing the ethical implications of using AI in clinical settings *(MDPA, 2018)*. Furthermore, developing a supportive policy and legislative framework is needed. Such a framework should address privacy concerns, align with international data protection laws, and ensure compliance with global health information standards *(Putteeraj et al., 2022)*. Technological infrastructure and organisational readiness also create remarkable barriers. Healthcare professionals require adequate training, and new systems should not be overly complex or disrupt existing workflows *(Putteeraj et al., 2022)*. Finally, implementing digital health technologies requires substantial investments in hardware, software, and training programmes. Effective investing in these areas remains a challenge, particularly when balancing healthcare funding against other national priorities. Ensuring that investments in e-health are both effective and sustainable is a necessity for Mauritius for the long-term success of these initiatives *(Putteeraj et al., 2022)*.

4.2 PROPOSED STI AREAS FOR INVESTMENT

Challenge-oriented STI area	Specific gaps and needs	Specific enablers	Possible STI investments	Key stakeholders	Relevant initiatives
Traditional and integrative medicine innovations	Improve coordination and collaboration Develop STI infrastructures and key enablers Enhance the role of traditional medicine Lack of comprehensive legal framework for Ayurvedic pharmacies Need for more trained professionals in traditional and integrative medicine Standardized practices and integration into the formal healthcare system need improvement	High potential and willingness to adopt traditional and integrative medicine Growing interest in alternative medicine supported by government and private sectors Multicultural acceptance and integration of traditional practices Medical tourism for wellness and alternative therapies Research and educational programs in traditional medicine Potential for economic development through commercialization of medicinal plants	Integration of traditional practices with conventional medical treatments Development of regulatory frameworks for Ayurvedic pharmacies Training programs for professionals in traditional and integrative medicine Research on medicinal properties of local plants and their commercialization Support for innovative solutions combining traditional and modern healthcare practices	Traditional Medicine Board Ministry of Health and Wellness Ayurvedic Committee within the Ministry of Health and Wellness University of Mauritius (UoM) Research institutions Local scientists and high-profile figures (e.g., Ameenah Gurib-Fakim) Global healthcare companies Private sector (alternative medicine providers)	Ayurveda and Other Traditional Medicine Act (1989) Establishment of Ayurvedic clinics in government hospitals (since 1992)
Nutrition and food technology innovations	Improve coordination and collaboration Develop STI infrastructures and key enablers Develop artificial intelligence for health diagnosis and prevention Develop social and urban innovation for health Ensuring food security Addressing obesity, diabetes, and hypertension High implementation costs for SMEs Skills gap in local workforce for new technologies Technological infrastructure improvements needed Resistance to change from traditional practices Need for integration across the supply chainprevention	Government commitment through policies and strategic plans Potential of AI applications in food technology International partnerships to enhance capacities Sustainable agricultural practices Promotion of local production of healthy crops Technological solutions for pesticide monitoring and control	Adoption of AI in food sorting, supply chain management, hygiene monitoring, and equipment cleaning Education and training programs in Nutritional Sciences Development of low-cost bio-fertilizers from seaweeds Use of AI and data analytics for pesticide monitoring Incentivising local production of healthy crops	Ministry of Health and Wellness Ministry of Agro-Industry and Food Security. University of Mauritius (UoM) Food and Agriculture Organization (FAO) Joint SDG Fund of the UN Local food and beverage companies Farmers and agricultural stakeholders	National Plan of Action for Nutrition 2009-2010 Mauritius Artificial Intelligence Strategy FAO project to improve the national food control system Joint SDG Fund initiatives for sustainable agricultural practices Amendment of the Pesticides Act for better monitoring and control Educational programs in Nutritional Sciences at the University of Mauritius

Challenge-oriented STI area	Specific gaps and needs	Specific enablers	Possible STI investments	Key stakeholders	Relevant initiatives
Health data management and analytics	Develop STI infrastructures and key enablers Staff adaptation to new technologies Integration of data systems into daily practices Data quality issues Security and privacy concerns Interoperability among different health information systems Infrastructure limitations Need for skilled professionals in big data analytics Outdated legal and regulatory frameworks	Improved healthcare decision-making Better patient outcomes Increased system efficiency Trend identification in disease outbreaks Prediction of patient admissions Enhanced patient care and reduced redundancy in tests/treatments Unified digital records for seamless data sharing	Utilisation of big data analytics Implementation of electronic health records (EHRs) Digitisation of health records Development of robust data security measures Training programs for big data analytics professionals Updates to legal and regulatory frameworks for technology adoption	Ministry of Health and Wellness Ministry of Information Technology, Communication and Innovation Healthcare professionals Central Flacq Hospital Jeetoo Hospital United Nations Development Programme (UNDP)	“One Patient, One Record” initiative E-health project at Jeetoo Hospital Studies on EHR implementation at Central Flacq Hospital
Clinical research and trials in NCD therapies	Develop STI infrastructures and key enablers Absence of applied research Health sector functioning primarily as a service provider Need for further development of research infrastructure and capacity Limited participation in trials within the private sector Challenges in opening up hospitals for clinical trials	Mauritius as a strategic location for clinical research Strong governmental commitment and supportive policies Potential to attract further investment in drug clinical trials Past experiences and reflections on diabetes and cardiovascular disease trials Potential for increased collaboration with health authorities	Development of a National Health Research Policy and Strategy Strengthening capacity of Ethical Research Committees Creating a prioritised health research agenda Establishment of Clinical Research Regulatory Council, Ethics Committee, and Pharmacovigilance Committee Adoption of the Clinical Trials Act	Ministry of Health and Wellness Clinical Research Regulatory Council Pharmacovigilance Committee Health authorities Ethical Research Committees Pharmaceutical companies Research organisations University of Mauritius (UoM) University researchers Private sector participants	Health Sector Strategic Plan 2020-2024 National Health Research Policy and Strategy Clinical Trials Act

Challenge-oriented STI area	Specific gaps and needs	Specific enablers	Possible STI investments	Key stakeholders	Relevant initiatives
Digital health technologies and innovations	Improve coordination and collaboration Develop STI infrastructures and key enablers Develop artificial intelligence for health diagnosis and prevention Develop social and urban innovation for health prevention Ensuring privacy and security of health data Navigating complex regulatory and ethical landscapes Developing a supportive policy and legislative framework Technological infrastructure and organizational readiness Adequate training for healthcare professionals Balancing healthcare funding with other national priorities Substantial investments needed in hardware, software, and training	Improving quality of care for local and international patients Enhancing Mauritius' appeal as a medical tourism destination Addressing non-communicable diseases (NCDs) Adopting more sophisticated digital solutions Expanding telemedicine services Leveraging digital technologies for remote support and e-training International collaboration (e.g., with global healthcare players)	Telemedicine Remote patient monitoring Wearable devices Remote support for surgeries E-training for healthcare services Electronic laboratory information management systems (LIMS) AI in clinical settings	Mauritius Ministry of Health and Wellness Healthcare providers Key opinion leaders (physicians, nursing managers) Global healthcare players National reference laboratory Regional flu clinics	Collaboration between DIGI and Mauritius Ministry of Health and Wellness Deployment of OpenELIS Efforts to improve workflow and rapid processing of COVID-19 test results
Behavioral Research	Develop STI infrastructures and key enablers Absence of applied research Need for community at large to be responsive to awareness campaigns held by Ministry of Health and Wellness Challenges in uptake of healthy habits by population	Improving quality of care for patients Addressing non-communicable diseases (NCDs) Adopting evidence-based approach to policy formulation Targetting of resources towards vulnerable segments of the population	Expertise and capacity to conduct national behavioral research in relation to NCDs Use of method to obtain real-time data during the course of a participant's daily life	Mauritius Ministry of Health and Wellness Healthcare providers Key opinion leaders (physicians, nursing managers) MRIC	Health Sector Strategic Plan 2020-2024 National RoadMap for Research and Innovation (2023-2027)

5. CONCLUSION AND ACTION PLAN FOR THE STI FOR SDGs ROADMAP

5.1 KEY CONCLUSION AND POLICY MESSAGES

Mauritius faces considerable health challenges, particularly with the rising incidence of NCDs. The prevalence of NCDs in the country is strongly linked to behavioural risk factors, such as harmful use of alcohol and tobacco, physical inactivity, and unhealthy diets. Moreover, environmental degradation, particularly from the excessive use of pesticides and heavy reliance on fossil fuels, contributes to respiratory issues and other health complications that directly undermine the population's health and safety *(EC, n.d.-a)*.

Document analysis and stakeholder consultations highlighted the potential of the STI system to reduce NCDs in Mauritius. First, by leveraging technology in health education, screening, prevention, and early detection, STI has the potential to significantly enhance NCD management. For instance, the adoption of technological solutions, such as telemedicine and mobile health applications. Moreover, stakeholder consultations revealed the need for non-technological innovations such as community-driven behavioural change initiatives, which may be particularly efficient at improving prevention.

In 2021, gross expenditures on R&D as a percentage of the GDP amounted to 0.37%[5], and increased despite Covid-19. In line with this, between 2017 and 2020, there was a notable increase in human capital for R&D, which benefitted health research. More specifically, the share of scientific publications targeting SDG 3 Good Health and Wellbeing increased in the past few years, and it has become the first SDG to which research contributes.

The STI system demonstrates a mixed performance across the various dimensions of innovation (Global Innovation Index). More specifically, the levels of human capital and research show promise, but the infrastructures remain a concern, highlighting the need for further investments in ICT and general infrastructure. Stakeholder consultations highlighted the need to prioritise the development of data infrastructures and associated data collection tools to centralise patient data. Such system would both enable to improve prevention, and treatment options, in particular through AI-driven solutions.

Mauritius' intellectual property (IP) landscape reveals a strong emphasis on trademark applications, particularly from residents. In contrast, patent applications remain relatively low, with a notable discrepancy showing more applications from non-residents than residents. This pattern suggests that Mauritius is more dependent on foreign innovations rather than fostering its own R&D activities. Besides increasing investments in R&D infrastructures, supporting MSME to innovate and adopt technology must be encouraged. Therefore, we recommend the design and the implementation of a policy instrument to facilitate the adoption of advanced food and nutrition technologies among micro, small and medium-sized enterprises (MSMEs).

Despite several policy instruments and concerted efforts, Mauritius continues to face significant challenges in implementing policy instruments

5 *This is however below the STISA-2024 recommended target of 1%.*

to address NCDs, in particular due to a lack of collaboration and cooperation. First, research faces a significant deficit in governance, notably lacking a national Research for Health Policy, a strategic Research for Health plan, and a prioritised national research agenda for health *(Musango et al., 2023)*. There is also a lack of explicit priority-setting approaches where clear and structured mechanisms is essential for efficiently allocating resources and addressing urgent health needs. To address this gap, we recommend to develop and implement a unified national STI governance framework for NCDs under the leadership of the MRIC.

To bring a holistic response to the issue of NCD innovative treatments must be encouraged. To better leverage its potential in traditional medicine, Mauritius may develop research expertise to test scientifically test the impact of natural remedies. Moreover, it may develop and implement a comprehensive national framework for traditional and integrative medicine. Such measures could also reinforce the attractiveness of Mauritius in medical tourism. Urban innovation is also needed, for instance to encourage different types of mobility, in particular walking and cycling. To support such behavioural changes, we recommend launching a comprehensive Urban Health and Environment Initiative aimed at preventing NCDs through behavioural change interventions and modifications to the built environment. To further enrich treatment options, we recommend integrating Mauritius into the WHO's "Grassroots Innovations on NCDs" initiative to actively participate in a dynamic exchange of innovative solutions and practices aimed at combating NCDs through community-driven approaches.

Stakeholder consultations revealed detrimental changes in food habits in the past decades, and more appetite towards unhealthy food. Therefore, we recommend to develop and implement a strategy and programme to drive innovation in the creation of healthier and affordable food alternatives by public research institutes. Developing a R&I Strategy and Programme for Public Research Institutes on Non-Sugar Added Healthy Food Products may contribute to impactful innovations. Designing and implementing a policy instrument to facilitate the adoption of advanced food and nutrition technologies among micro, small and medium-sized enterprises (MSMEs) must also be prioritised.

Finally, to reinforce prevention, improving stakeholder engagement on new initiatives and policy instruments are needed to ensure that stakeholders are well-informed and their inputs are integrated into policy development, leading to more effective and sustainable solutions. We recommend launching a national campaign to raise public awareness about healthy habits to prevent NCDs. Moreover, to improve the impact of prevention campaign, we recommend organising a nationwide Social Innovation Competition aimed at preventing NCDs through creative, effective and practical solutions. Initiatives such as the launch of the Nutri-Score labelling system, similar to the one implemented in the EU, could also enhance consumer awareness about the nutritional quality of food products.

5.2 PROPOSED POLICY ACTIONS FOR THE STI FOR SDGs ROADMAP

This section presents an action plan that outlines essential investment areas and policy instruments aimed at addressing the challenge of NCDs through STI, with the goal of contributing to the SDGs. The actions identified are based on comprehensive inputs from stakeholders, gathered through workshops, interviews, and surveys, ensuring that they are contextually relevant and feasible. The following table categorises these actions by specifying responsibilities, expected outputs, and timing.

Gaps / Opportunities	Actions	Lead	Partners	Output and outcomes	Timing for initiation* **Short term is defined as within 2 years; medium term spans from year 2 to year 5; and long term refers to the period beyond year 5.*
Improve coordination and collaboration	**1. Improved STI governance for increased R&I for NCDs** Ensure the autonomy and strengthen the operational capacity of the MRIC to oversee STI policies and their implementation, in line with international best practices. Ensure that the Council develops and implements a unified national STI governance framework for NCDs that integrates all aspects of the R&I policy cycle to address the challenge; coordinates the efforts of all stakeholders in the national STI system by establishing necessary mechanisms for effective communication and collaboration among actors; conducts monitoring and evaluation, including impact assessment, of policies and policy instruments; and promotes, facilitates, and coordinates international collaborations and partnerships. Assign MRIC as the National Contact Point for Mauritius in Horizon Europe programs and other EU schemes, thereby enhancing Mauritius' integration into international R&I networks with a focus on NCDs.	Prime Minister's Office *After necessary high-level arrangements, implementation of the action will be lead MRIC.*	Ministry of Health and Wellness; Ministry of Education, Tertiary Education, Science and Technology; Ministry of Finance, Economic Planning and Development and other relevant line ministries; higher education institutes, hospitals, private sector, and NGOs	A robust national STI governance framework that enhances policy-making and implementation for NCDs; improved national and international integration of R&I efforts.	Short Term
Improve coordination and collaboration **Develop STI infrastructures and key enablers**	**2. Health Technology Assessment Framework** Implement a health technology assessment (HTA) framework specifically designed to evaluate the cost-effectiveness, clinical utility, and societal impact of new health technologies and interventions targeting NCDs. This framework will support informed decision-making in health policy and investment, ensuring that technologies not only provide value for money but also effectively address the health needs of the population concerning NCDs. The HTA process will be transparent and inclusive, engaging stakeholders from various sectors.	MRIC	Ministry of Health and Wellness, Mauritius Institute of Health, University of Mauritius, World Health Organization (WHO)	An established HTA framework that guides the adoption of effective and efficient health technologies.	Short Term
Develop innovation for health prevention	**3. National NCD prevention and awareness campaign** Strengthen the National Campaign to prevent NCDs significantly reduce the prevalence of NCDs by elevating public awareness about their preventability, using innovative communication strategies such as targeted social media campaigns, interactive e-learning modules, and gamified mobile health applications. Ensure that this approach leverages engaging, game-like elements to motivate users to adopt healthier behaviours through challenges, rewards, and social interaction. Collaborate with local leaders, healthcare professionals, and community organizations to create culturally sensitive educational programs that address deep-seated dietary habits and social practices contributing to NCDs. Form partnerships with local media to offer an alternative to fast food marketing by promoting consistent messages about healthy eating and active living. Ensure interventions are tailored effectively to local communities by conducting ongoing research on the social determinants of health that influence NCD prevalence. Utilise diverse media platforms to disseminate health messages tailored to different demographic groups, and integrate innovative educational technologies in school programs to engage children, families, and youth with interactive content that promotes early preventive measures. Also, conduct community-based health screenings using portable diagnostic technologies to facilitate early detection and management of NCDs.	Ministry of Health and Wellness and MRIC	Relevant ministries and public agencies, Mauritius Institute of Health, media, NGOs, education institutes, private sector representatives	A well-informed public with increased engagement in NCD prevention.	Short Term
Develop STI infrastructures and key enablers **Develop artificial intelligence for health diagnosis and prevention**	**4. Capacity building for NCD care** Enhance the capabilities of healthcare professionals in managing NCDs through comprehensive innovation-driven training programmes. These programmes will focus not only on the latest patient care techniques but also on integrating and applying cutting-edge research and technology in healthcare settings. Training will include updates on recent advancements in NCD care, use of innovative diagnostic tools, and technology-enhanced treatment methods, among others.	Ministry of Health and Wellness	MRIC, Mauritius Institute of Health, University of Mauritius, International Medical Universities	A skilled healthcare workforce proficient in modern, research-based NCD care practices.	Short Term

Gaps / Opportunities	Actions	Lead	Partners	Output and outcomes	Timing for initiation* **Short term is defined as within 2 years; medium term spans from year 2 to year 5; and long term refers to the period beyond year 5.*
Improve coordination and collaboration **Develop STI infrastructures and key enablers**	**5. NCD Solidarity Diaspora Community for Mauritius** Drawing on the experience from the 5-2035 project (see Section 2.3), create an 'NCD Solidarity Diaspora Community for Mauritius'. The community will function as a support system for the country to address the NCD challenge by systematically transferring knowledge, technology, and experience to Mauritius. It will also assist in identifying and transferring global knowledge and technologies to build local capabilities and attract talent and investment for innovation in health value chain in Mauritius. Develop regular engagement strategies that include, among others, hosting an annual international symposium, creating virtual collaboration hubs, and organising knowledge transfer and expert exchange programmes.	Ministry of Health and Wellness	MRIC, relevant line ministries, Economic Development Board (Mauritius Diaspora Scheme), higher education institutes, private sector representatives and NGOs	An engaged global diaspora network formed by specialists and professionals from the area of health value chain contributing to knowledge and technology transfer, fostering investment opportunities, and establishing international partnerships in the sector.	Short term
Develop innovation for health prevention	**6. Social Innovation Competition for NCD Prevention** Organise a nationwide Social Innovation Competition aimed at preventing NCDs through creative, effective and practical solutions. This competition will invite individuals, community groups, NGOs, and private sector companies to jointly develop and implement innovative projects that address key aspects of NCD prevention, such as healthy living, physical activity, community engagement, and technology use. Each category of the competition will have two components: one for the general population of Mauritius and a specific component tailored for those applying from Rodrigues, ensuring that solutions are suitable for the unique contexts of each region. Selected projects will receive grants to implement their ideas, and emphasis will be placed on collaborative approaches with high impact potential that involve multiple stakeholders.	MRIC and Ministry of Health and Wellness	Relevant line ministries, education institutes, civil society, community leaders, private sector	A portfolio of funded projects across Mauritius and Rodrigues that drive social innovation in NCD prevention. Strengthened collaboration between local communities, government, education institutes and private sector to combat NCDs.	Short term
Develop innovation for health prevention	**7. Nutri-Score Labelling System to Improve Dietary Choices** Launch an initiative to adopt the Nutri-Score labelling system, similar to the one implemented in the EU that enhances consumer awareness about the nutritional quality of food products. The system could use a color-coded label with letters (A to E) to indicate the healthiness of food products based on their nutritional content. Implementing Nutri-Score in Mauritius involves developing a regulatory framework that requires food manufacturers and importers to display this label on all packaged food products. The system will rate foods based on nutrients to limit (such as sugars, saturated fats, and salt) and nutrients to encourage (such as fibre, protein, and natural oils from fruits, vegetables, pulses, and nuts).	Ministry of Health and Wellness and Mauritius Food Standards Agency	Relevant line ministries. Consumer Association of Mauritius, higher education institutes, local food manufacturers and importers, NGOs	Nutritional scoring labels on all packaged food products. Increased consumer awareness and healthy dietary choices across the population.	Medium Term
Develop research expertise **Improve coordination and collaboration**	**8. Develop research programmes to improve treatment** Develop and fund research programmes with clinical trials to scientifically test promising treatments from traditional medicine. To identify potential treatments to test, the programme must organise stakeholder consultations with all relevant stakeholders, in particular traditional medicine practitioners. Partnerships with foreign universities may be envisaged to leverage the experience from countries who are already integrating formally traditional medicine in treatments.	Ministry of Health and Wellness	MRIC; Ministry of Education, Tertiary Education, Science and Technology; Traditional Medicine Board; University of Mauritius; Mauritius Institute of Health; Private Sector Traditional Medicine Practitioners; International Health Organisations; Local Community Health Centres; NGOs in Health and Wellness	Traditional medicine fully integrated into the national healthcare system ensuring safety, efficacy, and quality of traditional medical practices and products.	Medium term

Gaps / Opportunities	Actions	Lead	Partners	Output and outcomes	Timing for initiation* **Short term is defined as within 2 years; medium term spans from year 2 to year 5; and long term refers to the period beyond year 5.*
Improve coordination and collaboration **Enhance the role of traditional medicine**	**9. Framework for Traditional and Integrative Medicine** Develop and implement a comprehensive national framework for traditional and integrative medicine in Mauritius. This initiative will involve updating and creating new regulations under the guidance of the Traditional Medicine Board, ensuring that all practices, including Ayurveda and other traditional health modalities, meet contemporary health standards while preserving indigenous knowledge. The framework aims to formalize the practice across the island, including: standardizing qualifications for practitioners, regulating and controlling the quality of herbal medicines and treatments, establishing ethical guidelines for practice, and incorporating traditional medicine into the public healthcare system.	Ministry of Health and Wellness	MRIC; Ministry of Education, Tertiary Education, Science and Technology; Traditional Medicine Board; University of Mauritius; Mauritius Institute of Health; Private Sector Traditional Medicine Practitioners; International Health Organisations; Local Community Health Centres; NGOs in Health and Wellness	Traditional medicine fully integrated into the national healthcare system ensuring safety, efficacy, and quality of traditional medical practices and products.	Medium term
Improve coordination and collaboration **Develop innovation for health**	**10. Collaboration with WHO for Grassroots Innovation on NCDs** Integrate Mauritius into the WHO's "Grassroots Innovations on NCDs" initiative to actively participate in a dynamic exchange of innovative solutions and practices aimed at combating NCDs through community-driven approaches. It will involve Mauritius becoming a key player in the WHO NCD Lab, which supports promising grassroots innovations to achieve scale. Through an active participation in the NCD Lab, Mauritius will gain access to a wealth of knowledge and innovative strategies that combine new technologies, outside-the-box thinking, and multidisciplinary approaches.	Ministry of Health and Wellness	MRIC, WHO, relevant ministries and public bodies, higher education institutes, NGOs	Enhanced innovation in NCD management	Short term
Develop research expertise **Develop STI infrastructures and key enablers** **Improve coordination and collaboration**	**11. R&I Strategy and Programme for Public Research Institutes on Non-Sugar Added Healthy Food Products** Develop and implement a strategy and programme to drive innovation in the creation of healthier food alternatives by public research institutes, aiming to significantly reduce the incidence of NCDs like diabetes and obesity. This initiative will be integrated into the existing strategies and programmes of public food research institutes. It will focus on developing a wide range of healthy food products, emphasizing those without added sugars, using natural, nutritious ingredients, and containing a low amount of salt. The program will also include extensive consumer research to ensure the developed products are both culturally acceptable and appealing to the market. Also, it will assess the nutritional impacts of these new foods, promote sustainable production practices, and encourage partnerships with academic, industry, and international entities to leverage collective expertise and expand market access.	MRIC	Ministry of Agro Industry and Food Security; public research institutes; Ministry of Health and Wellness, Ministry of Education, Tertiary Education, Science and Technology; Ministry of Finance, Economic Planning and Development; private sector representatives, incubators and other innovation intermediaries; higher education institutes	Healthy food products available to public for reduced NCD rates linked to lower sugar and salt consumption.	Short term
Develop STI infrastructures and key enablers **Develop innovation for health prevention**	**12. Mobile health solutions for NCD management** Develop and deploy mobile health applications specifically tailored for NCD management. These applications will include features such as personalised health tracking, medication reminders, and options for virtual consultations. The development will be conducted in partnership with local companies to ensure the apps are accessible and affordable for all Mauritians, including those in remote or underserved areas. This initiative aims to integrate these new applications into existing platforms like MoBienet, enhancing them with additional functionalities for health education, disease self-management, and direct access to health services. This approach will improve health outcomes by enabling a more informed and proactive approach to health management among the population, aiming to reduce the prevalence of NCDs in Mauritius.	Ministry of Information Technology, Communication and Innovation	MRIC, Ministry of Health and Wellness, Ministry of Education, local ICT companies, healthcare providers	Mobile applications widely used for NCD management featuring enhanced functionality for health monitoring and remote care.	Medium Term

Gaps / Opportunities	Actions	Lead	Partners	Output and outcomes	Timing for initiation* *Short term is defined as within 2 years; medium term spans from year 2 to year 5; and long term refers to the period beyond year 5.*
Develop STI infrastructures and key enablers **Develop innovation for health prevention** **Develop research expertise**	**13. Urban Health and Environment Initiative for NCD Prevention** Launch a comprehensive Urban Health and Environment Initiative aimed at preventing NCDs through behavioural change interventions and modifications to the built environment. This initiative will tackle air, water, and soil pollution; create safe infrastructure for walking, cycling, and active living; and regulate exposure to tobacco, alcohol, and unhealthy foods and beverages. By integrating health-focused policies, innovative programs, and infrastructural improvements, the initiative will seek to reshape urban lifestyles and environments for NCD prevention. The initiative will also include a research component to collect and analyse data on the effectiveness of these interventions. This data will provide insights to guide and refine future urban health initiatives, ensuring they are evidence-based and effectively tailored to meet the specific needs of urban populations.	Ministry of Health and Wellness Ministry of Energy and Public Utilities Ministry of Education, Tertiary Education, Science and Technology	MRIC, Ministry of Housing and Land Use Planning, other relevant ministries, higher education institutes, private sector, NGOs	Enhanced urban environments that promote healthy living and reduce NCD risk factors. Comprehensive data and insights from implementation research to guide future urban health initiatives.	Medium term
Develop STI infrastructures and key enablers	**14. MSME Food Tech Support Programme** Design and implement a policy instrument to facilitate the adoption of advanced food and nutrition technologies among micro, small and medium-sized enterprises (MSMEs) to address significant challenges in food security and combat NCDs like obesity, diabetes, and hypertension. By providing financial incentives, educational programs, and infrastructure enhancements, the initiative will seek to ease the integration of technology in the food sector. It will include partnerships with educational institutions for training, collaborations with international organizations to leverage global innovations, and the development of a supportive policy framework.	MRIC	Ministry of Agro Industry and Food Security; Ministry of Health and Wellness, Ministry of Education, Tertiary Education, Science and Technology; Ministry of Finance, Economic Planning and Development; private sector representatives, incubators and other innovation intermediaries; higher education institutes		Medium Term
Develop for health prevention	**15. Hydroponic and Vertical Farming Advancement Scheme** Implement a scheme to support local farmers in adopting hydroponic and vertical farming techniques, aimed at increasing the production of nutrient-rich vegetables and fruits. This initiative will include financial incentives, technical training, and ongoing support from agricultural experts to ensure sustainable practices and high yields. The increased availability of healthy produce is expected to contribute to better dietary habits and help prevent diet-related NCDs. A special subcomponent for schools will integrate hydroponic systems into curriculums through health promotion activities designed to improve green space use, enhance dietary habits, and provide hands-on learning about sustainable agriculture. The overall increase in the availability of healthy produce is expected to contribute to better dietary habits and help prevent diet-related NCDs in new generations.[6]	Ministry of Agro-Industry and Food Security Ministry of Education, Tertiary Education, Science and Technology	University of Mauritius, International Fund for Agricultural Development (IFAD), Food and Agriculture Organization (FAO), and local farmers' associations, International Fund for Agricultural Development (IFAD)	Increased local production of vegetables and fruits using sustainable methods.	Medium Term
Develop STI infrastructures and key enablers	**16. Precision Medicine Initiative** Establish a state-of-the-art genomic research centre to support the development of personalized medicine approaches for NCDs. This initiative will foster collaborations with international genomic databases and local research institutions to significantly enhance Mauritius' genomic research capabilities. It will focus on funding advanced genomic studies and the development of treatment protocols that are tailored to individual genetic profiles. The aim will be to improve the efficacy and reduce the adverse effects of NCD treatments by integrating personalised medicine into healthcare practices.	MRIC	Ministry of Health and Wellness, Mauritius Institute of Health, University of Mauritius, private sector	Establishment of a genomic research centre and development of personalised NCD treatment protocols.	Long Term

6 School-based hydroponic planting, integrated with health promotion activities, has been shown to be feasible and, to a certain extent, useful in improving dietary habits, and resistance to substance use among early adolescent students in secondary schools in urban areas (Kwok et al., 2021).

Gaps / Opportunities	Actions	Lead	Partners	Output and outcomes	Timing for initiation* **Short term is defined as within 2 years; medium term spans from year 2 to year 5; and long term refers to the period beyond year 5.*
Improve coordination and collaboration **Develop STI infrastructures and key enablers**	**17. Public Procurement for NCD Innovation** Design and implement a Public Procurement for NCD Innovation programme by establishing clear goals to source and adopt innovative solutions for the prevention, management, and treatment of NCDs. To this end, initiate a collaborative platform for governments, healthcare providers, and technology innovators to exchange ideas and resources; adapt procurement processes to foster innovation, incorporating competitive funding grants, simplified regulatory approvals, and pilot projects to assess new technologies or treatments. In this process, facilitate partnerships between the public and private sectors and academic/research institutions to utilise shared knowledge, expertise and resources effectively, ensuring that the innovations are scalable and sustainable. Moreover, set up robust monitoring and evaluation frameworks to track the programme's impact and make necessary adjustments to strategies over time.	Ministry of Health and Wellness MRIC	Relevant ministries and public agencies, private sector companies, academic institutions, NGOs	New technologies developed and integrated into the healthcare system to improve NCD prevention, diagnosis, and treatment.	Long term
Improve coordination and collaboration **Develop STI infrastructures and key enablers**	**18. Development of a multi level strategy to provide NCD patient pathways for integrated care** A care pathway constitutes a complex care strategy for decision-making and the organization of processes in the care of complex chronic patients, avoiding the fragmentation of care. Health professionals play a decisive role in the implementation, development, and evaluation of care pathways. Integrated care is ideally suited to respond to care needs in this context via proactive and well-coordinated patient-centered multidisciplinary care, using new technologies to support patient self-management and to improve the collaboration between caregivers. This transformation requires a multi-level strategy with the simultaneous and synergistic implementation of various interventions. The care pathway of the complex chronic patient in today's healthcare reality constitutes a valuable care strategy based on NCD standards and practices which responds to the needs of these patients and their caregivers in complex settings, by avoiding fragmentation of care. Due to their leadership roles, health professionals are in an ideal position to ensure the correct implementation of these care pathways. A permanent evaluation and monitoring of facilitators and barriers to the implementation process is necessary to guarantee the continuity and quality of care in the health system.	Ministry of Health and Wellness	MRIC	New Patient Care Pathways integrated into the healthcare system to improve NCD prevention, diagnosis, and treatment.	Medium Term

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LIST OF ABBREVIATIONS

AI	Artificial Intelligence
CBBR	Centre for Biomedical & Biomaterials Research
CRIGS	Collaborative Research and Innovation Grant Scheme
DBM	Development Bank of Mauritius Ltd
EDB	Economic Development Board
EDCTP	European & Developing Countries Clinical Trials Partnership
EHRs	Electronic Health Records
EU	European Union
FAO	Food and Agriculture Organization
FAREI	Food and Agricultural Research and Extension Institute
FTYIP	First Ten Year Implementation Plan
GII	Global Innovation Index
HEC	Higher Education Commission
ICT	Information and Communication Technology
IFAD	International Fund for Agricultural Development
I-TECH	International Training and Education Center for Health
JRC	Joint Research Centre
MAURITAS	Mauritius Accreditation Service
MDPA	Ministry of Digital Transformation, Innovation and Entrepreneurship
MIBL	Mauritius Institute of Biotechnology Ltd
MIC	Mauritius Investment Corporation Ltd
MIH	Mauritius Institute of Health
MITCI	Ministry of Information Technology, Communication, and Innovation
MOAIFS	Ministry of Agro-Industry and Food Security
MOHW	Ministry of Health and Wellness
MOI	Mauritius Oceanographic Institute
MRIC	Mauritius Research and Innovation Council
MSB	Mauritius Standards Bureau
MSMEs	Micro, Small and Medium-sized Enterprises
NCDs	Non-Communicable Diseases
NIF	National Innovation Framework
NSIS	National SME Incubator Scheme

PCS	Proof of Concept Scheme
PCoM	Pharmacy Council of Mauritius
R&D	Research and Development
RIB	Research and Innovation Bridges
RRIGS	Rodrigues Research and Innovation Grant Scheme
SADC	Southern African Development Community
SDGs	Sustainable Development Goals
SIRGS	Social Innovation Research Grant Scheme
SMEs	Small and Medium-sized Enterprises
STI	Science, Technology, and Innovation
TTO	Technology Transfer Office
UHC	Universal Health Coverage
UoM	University of Mauritius
UN	United Nations
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
WHO	World Health Organization
WIPO	World Intellectual Property Organization

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ANNEXES

ANNEX I. METHODOLOGY

I.1. OVERALL METHODOLOGICAL APPROACH

The STI for SDGs roadmap methodology is based on a challenge-oriented research design based on desk research and participatory methods to identify STI areas relevant for addressing selected sustainability challenges. The approach uses quantitative and qualitative data and participatory deliberation methods.

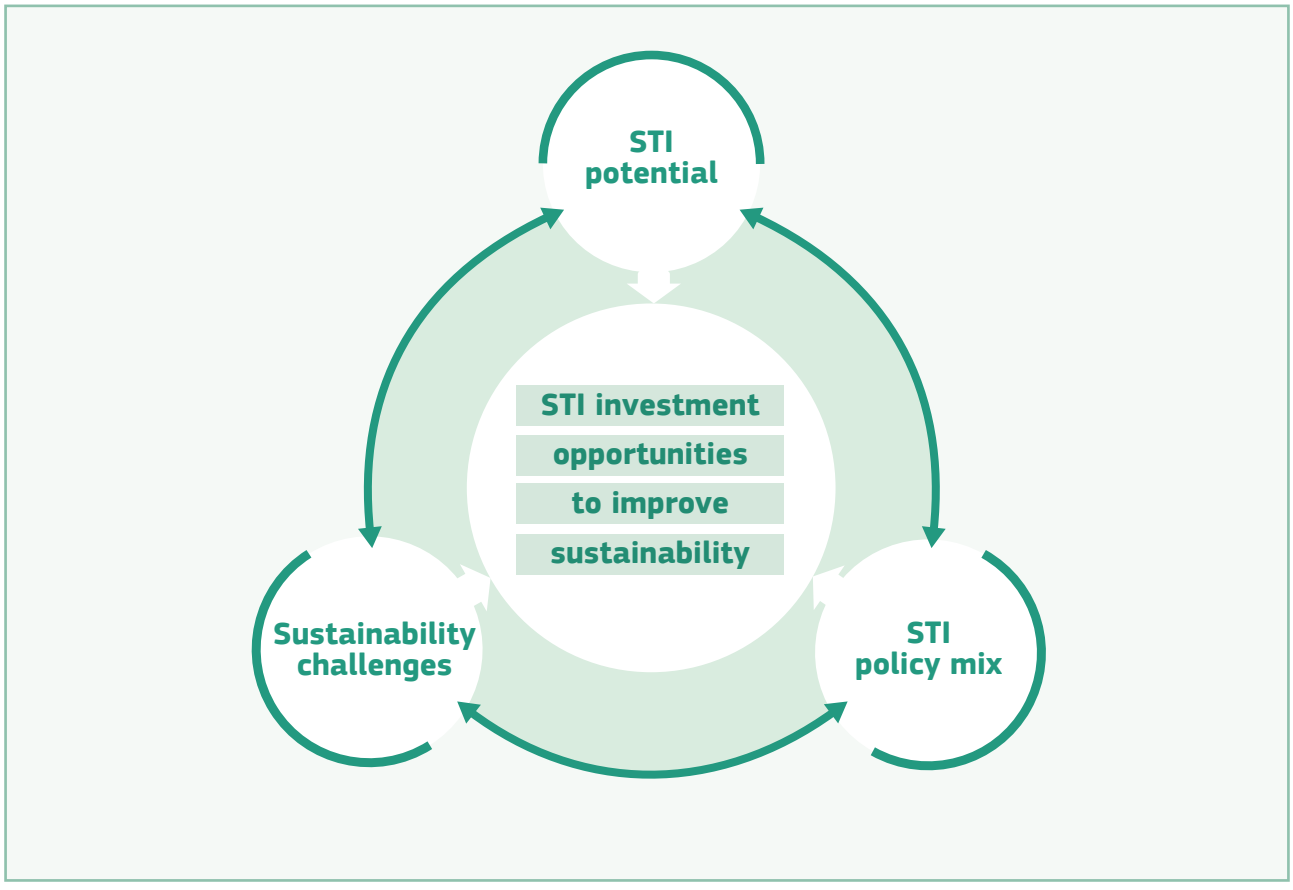
The methodology consists of three interconnected components laying the ground for the roadmap:

- Situational analysis;
- Selection and scoping of sustainability challenge;
- Deliberation of key STI areas to address the challenge.

The approach follows the underlying logic of roadmap in a sense that it addresses three lead questions: Where are we? Where do we want to go? How do we get there? The challenge-oriented approach allows to identify STI gaps and opportunities based on comparing the current and emerging needs related to the sustainability challenges in focus and to analyse the fitness of STI system and policy to address those needs. The approach is by design iterative and interactive. For example, situational analysis prepares the ground for the selection of the key challenge addressed by roadmaps but then dives into the selected challenges (see *Figure 12*).

The overall approach relies on a close collaboration between JRC and the country team. The process is designed to encourage and enable country team to take ownership and influence the process by selecting and scoping the challenge area and by co-organising the fieldwork and consultations.

FIGURE 12.
KEY COMPONENTS OF STI FOR SDGs ROADMAP



SITUATIONAL ANALYSIS

The situational analysis of the STI for SDGs roadmaps prepares the evidence base for the roadmap. It focuses on three key areas:

- Sustainability challenges faced by the country;
- STI potential to tackle sustainability challenges;
- Policy mix and governance mechanisms focused on STI.

The analysis enables to identify gaps and opportunities in the STI ecosystem to address sustainability challenges at the country level.

The initial desk research enables to identify key sustainability challenges faced by the country and the existing STI capacity to address these challenges. The in-depth analysis allows to co-define areas for STI investments with high social and environmental impact. The analysis of each pillar relies on quantitative and qualitative data. *Table 4* describes a non-exhaustive list of the data collected for the STI for SDGs roadmaps.

SELECTION AND SCOPING OF SUSTAINABILITY CHALLENGE

Based on the initial diagnosis and preliminary stakeholder consultations, the country teams proposed a challenges area for the roadmap. The initial diagnosis was conducted by JRC and independent experts and shared with country team for feedback. JRC and independent experts engaged in a series of meetings with country team to discuss alternatives and scope the roadmap. An online workshop was conducted to consult the choice and scope the focus.

Considering the resources and time available for the STI for SDGs project, the decision was to focus roadmaps on one challenge in order to demonstrate and to further co-develop the overall approach. The selected challenges were to be among challenges recognised in strategic national policy documents and should be framed to highlight the potential role of STI in addressing specific localised sustainability challenges. The areas were not selected based on their relative importance (e.g. they did not have to be of the highest political priority).

DELIBERATION OF STI INVESTMENT AREAS

To identify promising STI areas where mobilising research and innovation could help respond to the selected challenges, JRC in collaboration with the country teams conducted country visits including a multi-stakeholder workshop (20-50 participants) and a series of stakeholder interviews (10-20 interviews). The situational analysis provided essential material for the workshops designed to identify STI challenges and opportunities, and highlight potential investment opportunities. Based on these consultations and a close collaboration between the experts and the country teams, the technical reports propose tailor-made action plans to leverage variety of policy and governance tools to mobilise STI for the selected sustainability challenges.

TABLE 4.
DATA COLLECTED FOR THE SITUATIONAL ANALYSIS

Elements of analysis	Quantitative analysis	Qualitative analysis
Sustainability challenges	• Socio-economic indicators • SDG indicators (targets) • Quantitative evidence used in diagnostic documents underpinning NDP and policy documents	Primary data • Face-to-face and online stakeholder interviews • Web-based stakeholder survey • In-person and hybrid stakeholder workshop Secondary data • Qualitative evidence used in diagnostic documents underpinning NDP and policy documents • Literature review (including academic and grey literature)
STI potential	• Scientific performance (e.g., bibliometric data on publications and citations; R&D personnel) • Technology and innovation indicators (e.g. R&D expenditures; patent data, Global Innovation Index (GII))	Primary data • Face-to-face and online stakeholder interviews • Web-based stakeholder survey • In-person and hybrid stakeholder workshop Secondary data • Literature review (including academic and grey literature)
STI policy mix		Primary data • Face-to-face and online stakeholder interviews • Web-based stakeholder survey • In-person and hybrid stakeholder workshop Secondary data • innovation ecosystem actor mapping • Document analysis (strategies and plans, instruments, and investment programmes)

Source: authors' elaboration

I.2. COUNTRY-SPECIFIC OBSERVATIONS

SUSTAINABILITY CHALLENGE

The country team proposed the following challenge: Leveraging STI to improve food self-sufficiency in the Gambia.

SITUATIONAL ANALYSIS

The country report is based on the qualitative evidence sourced, see *Table 5*.

The sources of quantitative data included

- SDG Platform
- UNESCO
- World Bank Indicators
- WIPO (e.g. GII)

DELIBERATION OF STI INVESTMENT AREAS

The respondents to survey and workshop participants were asked to identify areas for investment based on the comprehensive list of areas prepared based on desk research. Both survey and workshop included open questions allowing stakeholder to formulate their own areas. The stakeholder were asked to share their view on impact and existing capacity level in the country to mobilise STI in the areas. Based on the workshop materials, interviews and the desk research, the experts highlighted STI areas for investment and further development.

TABLE 5.
SOURCES OF THE QUALITATIVE DATA SUPPORTING THIS STI FOR SDGs ROADMAP

Method	Qualitative analysis
Stakeholder interviews	• 25 face-to-face interviews conducted between 30/01/2024 and 1/02/2024 • 2 online interviews conducted between 5/02 and 30/02 2024 • Stakeholder profiles (9 government, 5 academia., 5 NGOs, 2 IOs and donors, 3 companies)
Stakeholder workshops	Hybrid stakeholder workshop • 24 stakeholders (7 government including agencies, 5 academia, 2 NGOs, 7 IOs and donors, 3 companies) • Workshop held in on 29/02/2024 In-person stakeholder workshop • 51 stakeholders (26 government including agencies, 7 academia., 3 NGOs, 8 IOs and donors, 7 companies) • Workshop held on 25/03/2024
Stakeholder survey	• 30 responses received (survey open between 06/03/2024 and 26/03/2024)

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