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Mobilising Science, Technology and Innovation to Improve Climate Resilience of Rural Communities in Namibia

TECHNICAL REPORT FOR THE STI FOR SDGs ROADMAP

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TABLE OF CONTENTS

ABSTRACT

Science, Technology, and Innovation (STI) play a key role in achieving the Sustainable Development Goals (SDGs). The Joint Research Centre (JRC) and the Directorate General for International Partnerships (DG INTPA) of the European Commission joined forces launching the project on STI for Sustainable Development Goals (SDGs) Roadmaps in Africa. The report lays the foundation for STI for SDGs roadmap in Namibia with the focus on the challenge to mobilise research and innovation to increase resilience of rural communities to climate change, considering the localised challenges of the water-food-energy nexus and the role of indigenous knowledge. The report identifies areas for further investment in STI and proposes policy and governance mechanisms to increase impact of innovation in the challenge area. This report is based on stakeholder workshop and interviews and the desk study. The work has been undertaken in collaboration between JRC and the Ministry of Higher Education, Technology and Innovation (MHETI) and the National Commission on Research, Science and Technology (NCRST) of Namibia.

FOREWORD FROM THE JOINT RESEARCH CENTRE OF THE EUROPEAN COMMISSION

It is with great pleasure that I present the report on the role of science, technology, and innovation (STI) for Sustainable Development Goals (SDGs) in Africa, with a spotlight on Namibia. The report is a result of the 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 the Global Gateway initiative.

The challenge-oriented STI for SDGs roadmaps approach, pioneered by the JRC and based on the collaboration with the UN, 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.

Namibia's roadmap focuses on the role of science, technology and innovation, including indigenous and local knowledge, to increase the resilience of rural communities to climate change, while considering the localised challenges of the water-food-energy nexus. The roadmap was developed in close collaboration with colleagues from the Ministry of Higher Education, Technology and Innovation (MHETI) and the National Commission on Research, Science and Technology (NCRST).

We hope that the roadmap will become a useful framework for policy makers as well as local and international stakeholders working towards improving resilience and wellbeing of rural communities in Namibia, in particular the most vulnerable groups in remote rural areas.

I would like to express my sincere gratitude and appreciation to the Namibian partners at MHETI and NCRST and to all stakeholders and contributors involved in the process. 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 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 Namibia and to the strengthened Africa-Europe collaboration.

Mikel Landabaso

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

FOREWORD FROM THE MINISTRY OF HIGHER EDUCATION, TECHNOLOGY AND INNOVATION OF NAMIBIA

Namibia upholds Science, Technology and Innovation (STI) as a strategic enabler for economic progression and as a means for providing solutions to socio-economic challenges. Namibia, through the Ministry of Higher Education, Technology & Innovation, has therefore undertaken to develop responsive Science, Technology and Innovation (STI) policy frameworks and programmes geared towards building capacity in the various nodes of the National System of Innovation. At the heart of the country's STI Policy mix is the delivery of essential public goods and attainment of prosperity for all.

The Namibia National Planning Commission conducted its first Sustainable Development Goals (SDGs) baseline study in 2019 and has since published three Voluntary National Review reports on the implementation of the SDGs. Namibia's commitment in achieving the Sustainable Development Goals is evident from the robust alignment of the indicators of national and sectoral development plans to the localized SDGs indicator framework, as outlined in the SDGs-NDP5-Indicator Framework of 2019.

Science, Technology and Innovation are catalysts to achieving SDGs. To ensure STI policy relevance and impact, the country adopted a multi-stakeholder participatory approach to policy development and programme setting. This ensures the inclusion of specific community needs and challenges in development plans and to improve the adoption of solutions from grassroots level.

Namibia has ratified key international instruments and installed policies and laws to promote the protection of natural resources and to mitigate the impact of climate change. STI policies can equally be leveraged to strengthen the country's resilience.

The Science, Technology & Innovation for Sustainable Development Goals (STI4SDGs) Roadmap report focuses on the role of Science, Technology and Innovation in increasing resilience of rural communities to climate change, with specific focus on the localized challenges of the water-food-energy nexus and the role of indigenous knowledge. The analysis sheds light on the strengths and weaknesses of STI policies mix and its responsiveness in addressing challenges relating to the water-food-energy nexus. Importantly, the report identifies gaps and recommends key policy areas for improvement.

I therefore call on all stakeholders and development partners to use this document as a reference for devising strategies to improve the responsiveness of STI policies to societal and economic challenges in the country.

Dr. Alfred van Kent

Executive director
Ministry of Higher Education, Technology and Innovation

ACKNOWLEDGEMENTS

We would like to acknowledge the support from the Ministry of Higher Education, Technology and Innovation (MHETI) and the National Commission on Research, Science and Technology (NCRST) in facilitating the successful implementation of the project in Namibia. Our sincere gratitude go to Dr Alfred Van Kent, the Executive Director of MHETI, and Prof Dr Anicia Peters, the Chief Executive Officer of the NCRST, for their leadership and seconding the staff members of the two institutions to lead the country project team.

We would like to express our deep gratitude to Dr Nhlanhla Lupahla, General Manager of Research, Science, Technology, and Innovation Coordination and Support at the NCRST and Dr Natascha Cheikhyoussef, Deputy Director of Innovation at MHETI for their strategic guidance and active engagement in the process. Special words of appreciation are due to Ms Florence V. Kavirindi and colleagues at MHETI for their continuous support and crucial role in preparing the national workshop and making it a success.

We would like to express our warmest thanks to our colleagues at the Delegation of the European Union to Namibia for their engagement, sharing key local contacts and generous hospitality during our stay in Windhoek. We would like to thank Mr Federico Berna, Head of Cooperation, Mr Hervé Rousseau and Mr Gonçalo Andresen Guimarães Leitão. Special thanks go to Mr Hervé Rousseau for his invaluable support and making us feel so welcome during our stay in Windhoek.

We owe a debt of gratitude to all stakeholders who found time for an interview with us and actively contributed to the workshop. We would like to thank speakers at the workshop: Dr Lisho Mundia, Director of Research and Innovation at MHETI, Mr Gernot Piepmeyer (NCRST, now at MHETI) and Prof Heike Winschiers-Theophilus of Namibia University of Science and Technology (NUST).

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 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 AU-EU Innovation Agenda.

This initiative is a collaborative effort between JRC and the Ministry of Higher Education, Technology and Innovation (MHETI) and the National Commission on Research, Science and Technology (NCRST) of Namibia. Following stakeholder consultations and the recommendation from the NCRST the decision was taken to focus the project on the role of STI to increase resilience of rural communities to climate change, considering the localised challenges of the water-food-energy nexus and the role of indigenous knowledge. Rural communities in Namibia are increasingly impacted by the negative consequences of climate change, in particular by droughts affecting agriculture and health.

The methodology adopted for the roadmap is built on the experience of smart specialization strategies (S3) and adapted to the rationale of STI for SDGs roadmaps as defined by the United Nations Inter-Agency Task Team (UN IATT) in cooperation with JRC. The approach involved a comprehensive desk study, interactive stakeholder workshops, and in-depth interviews to gather empirical evidence and stakeholder views on future investments in research and innovation. The final workshop in Otjiwarongo, which included over 50 participants from various sectors, and interviews with 18 stakeholders, provided detailed insights into the local challenges and potential STI interventions.

CHALLENGES AND OPPORTUNITIES OF MOBILISING STI FOR IMPROVING CLIMATE RESILIENCE

Rural communities in Namibia are increasingly impacted by the negative consequences of climate change, particularly through droughts that affect agriculture and health. Namibia's geographic environment, characterized by the vast Namib and Kalahari deserts, results in a relative scarcity of water, with low precipitation averaging only 285 mm per year and high evaporation rates. Namibia is experiencing an increase in hot days and a decrease in precipitation across the country, heightening its vulnerability to natural disasters such as droughts, flooding, water scarcity, extreme heat, and wildfires. These climate change impacts are bringing new and exacerbating existing socio-economic

and environmental challenges, affecting agricultural capacity, cereal yields, dam capacity, water dependence ratios, energy dependence, and key areas such as transportation and health.

The water-energy-food nexus is particularly relevant in understanding the cross-cutting impacts of climate change on Namibia's economy, society, and natural environment. Rural communities, in particular, are at risk of water, energy, and food poverty, and are more prone to suffer from the effects of climate change. However, these communities can also be sources of creativity and innovation, with potential in indigenous knowledge and traditional practices that could contribute to resilience in the face of climate change challenges.

The report identifies a number of opportunity areas for STI to improve climate resilience in Namibia:

- Climate smart agriculture: Investing in research and development of climate smart agricultural and technologies that increase productivity while adapting to and mitigating the effects of climate change
- Community-based resource management: Building on established good practices of community-based models for land and resource management with positive impacts on community well-being and environmental conservation.
- Water management technology: Development of innovative water technology, such as water-efficient irrigation, water harvesting techniques, and desalination technologies suitable for arid environments;
- Renewable energy value chains: Building local capacity in renewable energy value chains, including solar, wind, and bioenergy, to reduce dependence on imported energy and create local economic opportunities;
- Small-scale solar home energy solutions: Investment in affordable and scalable solar energy solutions for rural electrification, which can be financed through innovative payment schemes;
- Grassroots bioeconomy innovation: Scaling up grassroots innovations in agriculture, food, biomass for energy, and nature conservation that are adapted to local conditions and climate resilience;
- Indigenous knowledge valorisation: Leveraging indigenous knowledge systems for innovation in agriculture and water management, such as drought-resistant crops, traditional water conservation methods, and sustainable land management practices.

EXISTING POLICIES MOBILISING STI FOR FOOD SYSTEM TRANSFORMATION

Namibia's policy landscape demonstrates a strong recognition of the challenges posed by climate change, especially for rural populations. High-level policy documents and sectoral policies acknowledge the importance of addressing climate change and its impact on water, energy, and food security.

However, there is a gap in explicitly linking STI to these challenges, particularly in the context of rural communities. While sectoral policies recognize the relevance of research and innovation, there is a need for more detailed development of STI opportunities and goals within these contexts. The report points to several challenges STI policy faces to be more effective in strengthening rural climate resilience. These challenges include insufficient policy coordination and integration across different policy domains, weak coordination of international investments, limited funding and implementation capacity of STI policies and programs, and underdeveloped entrepreneurial ecosystems especially in rural areas. Another challenge could be the focus on "big ticket" opportunities, such as green hydrogen and offshore oil exploration, which might overshadow and compete with investments aimed at strengthening local STI capabilities and place-based approaches addressing localised challenges. These challenges confirm the need for a more coordinated approach to STI policy to deliver on the ambition to address urgent challenges facing Namibian communities.

PROPOSED POLICY ACTIONS FOR THE ROADMAP

The action plan for the STI for SDGs roadmap outlines several key areas for investment and policy instruments to strengthen rural communities' resilience to climate change through STI. These include:

- Establishing a cross-ministerial committee led by the Prime Minister to coordinate policies and implementation across various domains related to climate resilience.
- Creating a national multi-stakeholder platform to facilitate the identification of common problems and innovative solutions.
- Developing a network of regional and mobile research and innovation labs to support place-based research and innovation potential.
- Building strategic intelligence and an evidence base for policies through research collaboration networks and a virtual think tank.
- Establishing an internationally recognized testing laboratory to cater to both public and private research and innovation needs.
- Focusing on strategic international resource mobilization to access funding opportunities and build capacity for local benefits.

INTRODUCTION

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 is to improve directionality and effectiveness of STI policies to contribute to the SDGs in line with the EU priorities for STI cooperation with Africa. The roadmaps support the implementation of the AU-EU Innovation Agenda, a framework that fosters cooperation in research, science, and technology.

The STI for SDGs roadmaps are strategic policy frameworks mobilising STI to address key societal challenges and contribute to the SDGs. The roadmaps create complementarities and synergies between relevant public interventions supporting STI implemented across policy areas and sectors. JRC has adapted the methodology to collect evidence and stakeholder views on the future investments in research and innovation addressing country-specific sustainability challenges. The methodological approach builds on the experience of smart specialisation strategies (S3) in the European Union and beyond and the adaptation of S3 approach to the rationale of STI for SDGs roadmaps[1] as defined by United Nation's Inter-Agency Task Team (UN IATT) in cooperation with JRC. JRC and DG INTPA are working towards the design of STI roadmaps with a selection of six African countries, including the Gambia, Mauritius, Namibia, Malawi, Rwanda and Seychelles. STI for SDGs Roadmaps are the product of close collaborations between international experts and local stakeholders in a participatory and co-creation environment.

To develop the roadmap in Namibia the JRC partnered with the Ministry of Higher Education, Technology and Innovation (MHETI) and the National Commission on Research, Science and Technology (NCRST). Following stakeholder consultations and the recommendation from the NCRST the decision was taken to focus the project on the role of science, technology and innovation (STI) to increase resilience of rural communities to climate change, considering the localised challenges of the water-food-energy nexus and the role of indigenous knowledge. Rural communities in Namibia are increasingly impacted by the negative consequences of climate change, in particular by droughts affecting agriculture and health. Public policy can play a central role in strengthening STI capabilities and provide support to development and diffusion of innovative approaches that increase local resilience to climate change while creating multiple benefits for rural communities and ecosystems.

1 *See **Background paper: Overview of the existing STI for SDGs roadmapping methodologies** co-published by JRC and IATT.*

The report is based on desk study, including literature review and data analysis, and empirical research comprising two interactive stakeholder workshops and in-depth interviews. More than 50 participants representing the public and private sectors, non-governmental organizations, international organisations, and academia took part in the final workshop in Otjiwarongo held on 30 April 2024. Face-to-face interviews were conducted with 18 stakeholders to gain detailed insights from key stakeholders.

This report first includes a succinct overview of the evidence of the climate change related challenges faced by the rural communities in Namibia (***Chapter 1***). It then analyses fitness of the Namibian innovation system and STI policies to address the challenge (***Chapter 2***). Based on this background diagnosis, gaps and areas of opportunity for STI are proposed which are further elaborated as possible areas of investment, based on the empirical evidence collected during the project (***Chapter 3***). The report concludes with key findings and policy messages and a tentative list of policy actions proposed for the STI for SDGs roadmap (***Chapter 4***). The report is aimed as a consultative document presented for the consideration of the Namibian policy makers as well as development partners investing in Namibia.

1. AN OVERVIEW OF THE SUSTAINABILITY CHALLENGE FOR NAMIBIA

1.1. DESCRIPTION OF THE CHALLENGE AREA AND PROGRESS TOWARDS THE SDGs

GROWING CLIMATE CHANGE PRESSURES IN NAMIBIA

Namibia's societal and economic development has always been closely linked to its special geographic environment. With the vast Namib and Kalahari deserts occupying a significant part of the country, Namibia is characterised by its relative dearth of water, a combination of low precipitation (only 285 mm per year *(World Bank, 2024)*, most of it in the Caprivi strip in the North East (see ***Figure 1***) and almost no perennial rivers or streams beyond seasonal ephemeral flows. Rainfall tends to be highly variable, with evaporation rates as high as 83% *(Mapani, Shikangalah, & Mwetulundila, 2023)*.

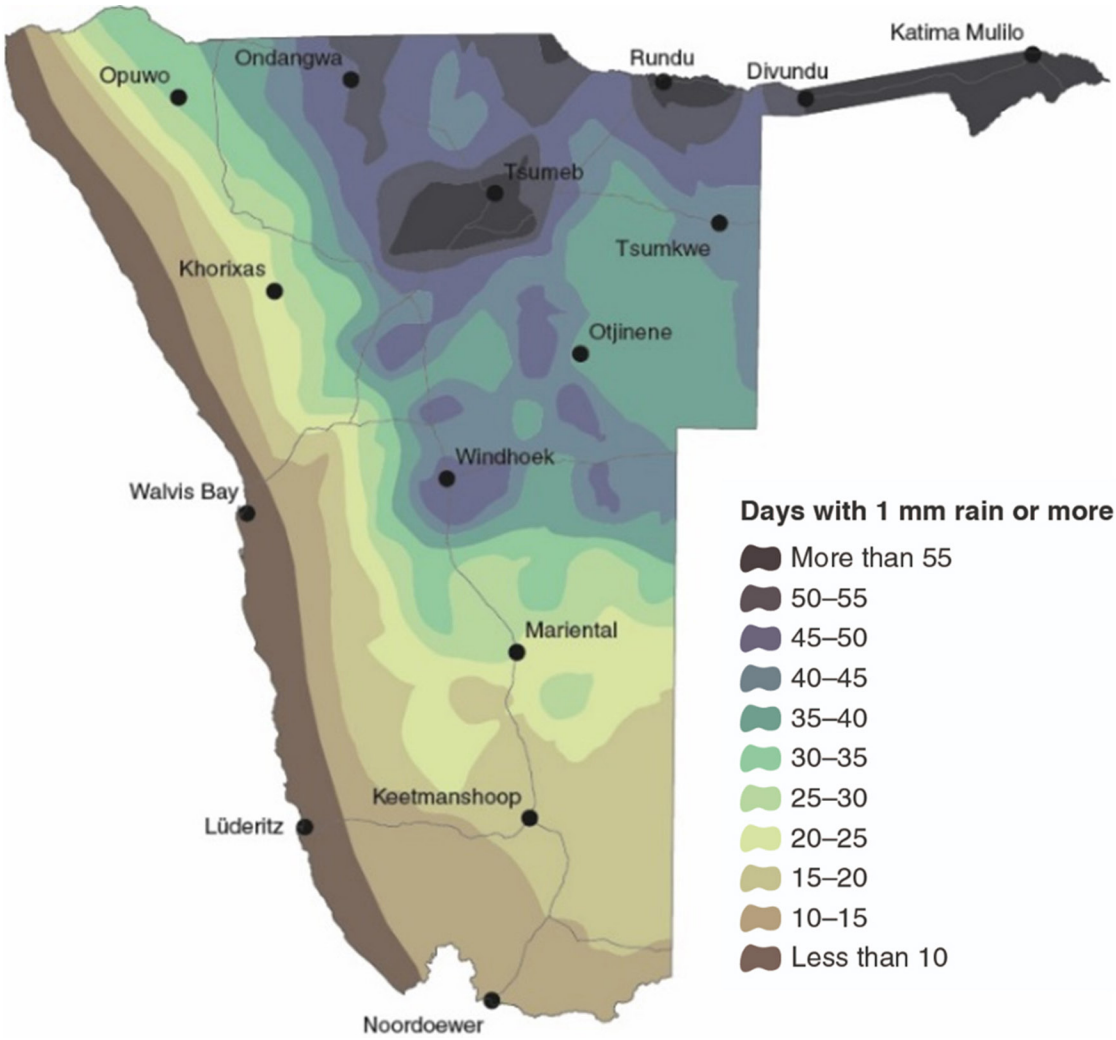
Most of the human history in Namibia did not involve permanent settlements focused on agriculture, but rather followed pastoralist models such as the Khoikhoi (in particular the Nama) and later (after the Bantu migrations) the Herero and Kavango, or hunter gatherers like the San or Damara peoples. An exception to this pattern are the peoples living closer to the Namibia-Angola border, where the Kavango use a mixture of fishing and subsistence agriculture, benefitting from the Kavango river.

In total less than 5% of Namibia's land is suitable for agriculture *(von Oertzen, Schneider, & Heyns, 2024)*. From the late 19th century onwards, German and Boer settlers arrived as a part of colonial rule, establishing large cattle farms from confiscated lands. As such, beyond the Northern zones, the population increase of the past century, its economic and societal activity, has been mostly dependent on the extraction of water via more than 100,000 boreholes from underground aquifers, as well as water storage via large dams such as the Hardap and Neckartal dams.

Namibia is exposed to climate change with the projected increase of hot days and less precipitation across the country (see ***Figure 2***). The country is highly vulnerable to natural disasters, notably droughts, flooding, water scarcity, extreme heat, and wildfires *(von Oertzen, Schneider, & Heyns, 2024)*. Flooding is an annually recurring event in the country with impacts growing year on year, particularly in the northern and north-eastern regions *(World Bank Group, 2021)*.

The impacts of climate change is bringing new and exacerbating existing socio-economic and environmental challenges faced by Namibia (see ***Figure 3***). The Climate Vulnerability Index suggests the country is highly sensitive to climate change in a number of areas, including agricultural capacity and cereal yields, dam capacity and water dependence ratios, dependence on imported energy and hydropower generation capacity and other key areas such as transportation and health.

FIGURE 1.
PRECIPITATION MAP OF NAMIBIA



Source: (Namibia Nature Foundation, 2024)

FIGURE 2.

ANNUAL TEMPERATURE AND PRECIPITATION PROJECTIONS (TOP); NUMBER OF HOT DAYS (BOTTOM)

FIGURE 6. Multi-Model (CMIP5) Ensemble Projected Changes (32 GCMs) in Annual Temperature (top) and Precipitation (bottom) by 2040–2059 (left) and by 2080–2099 (right), Relative to 1986–2005 Baseline under RCP8.5[29]

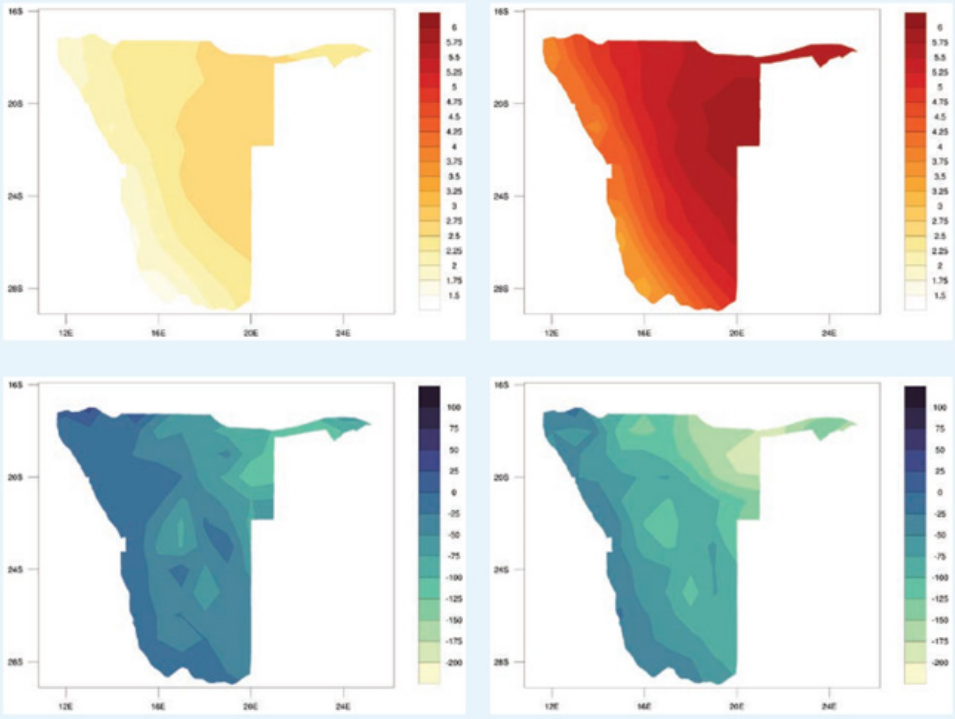
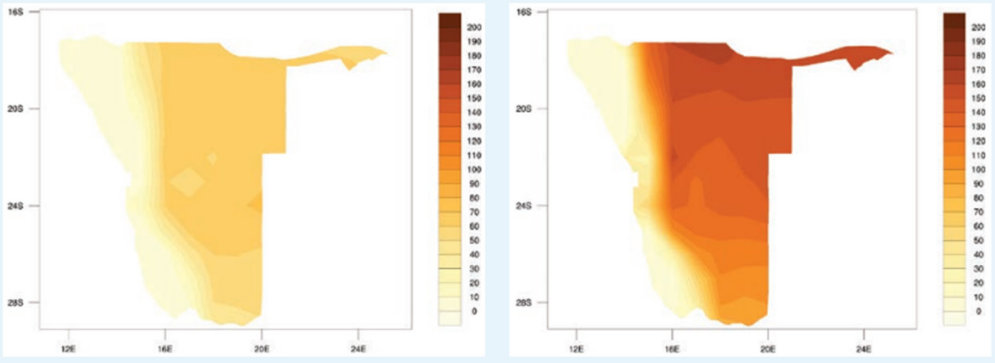
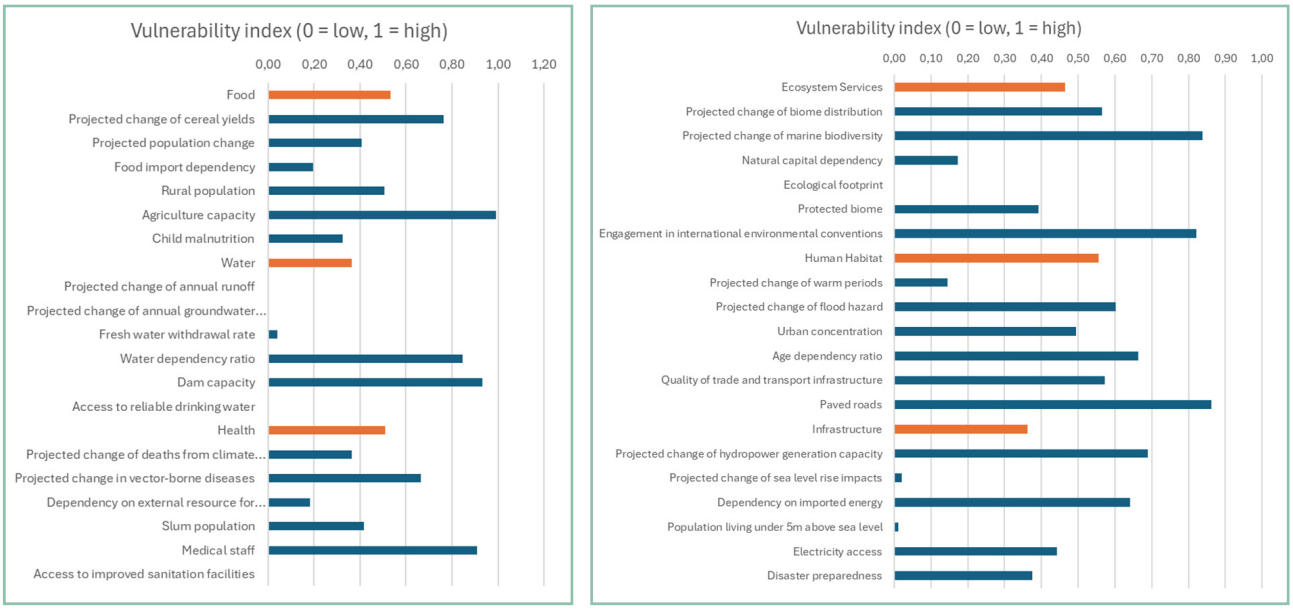


FIGURE 18. Projected Number of Hot Days (Tmax >35°C) in Namibia for 2040–2059 (left) and 2080–2099 (right) (RCP8.5, Reference Period, 1986–2005)[107]



Source: World Bank Group, 2021

FIGURE 3.
CLIMATE VULNERABILITY INDEX, BY CATEGORY (GAIN, 2024)



CLIMATE CHANGE AND THE WATER-ENERGY-FOOD NEXUS

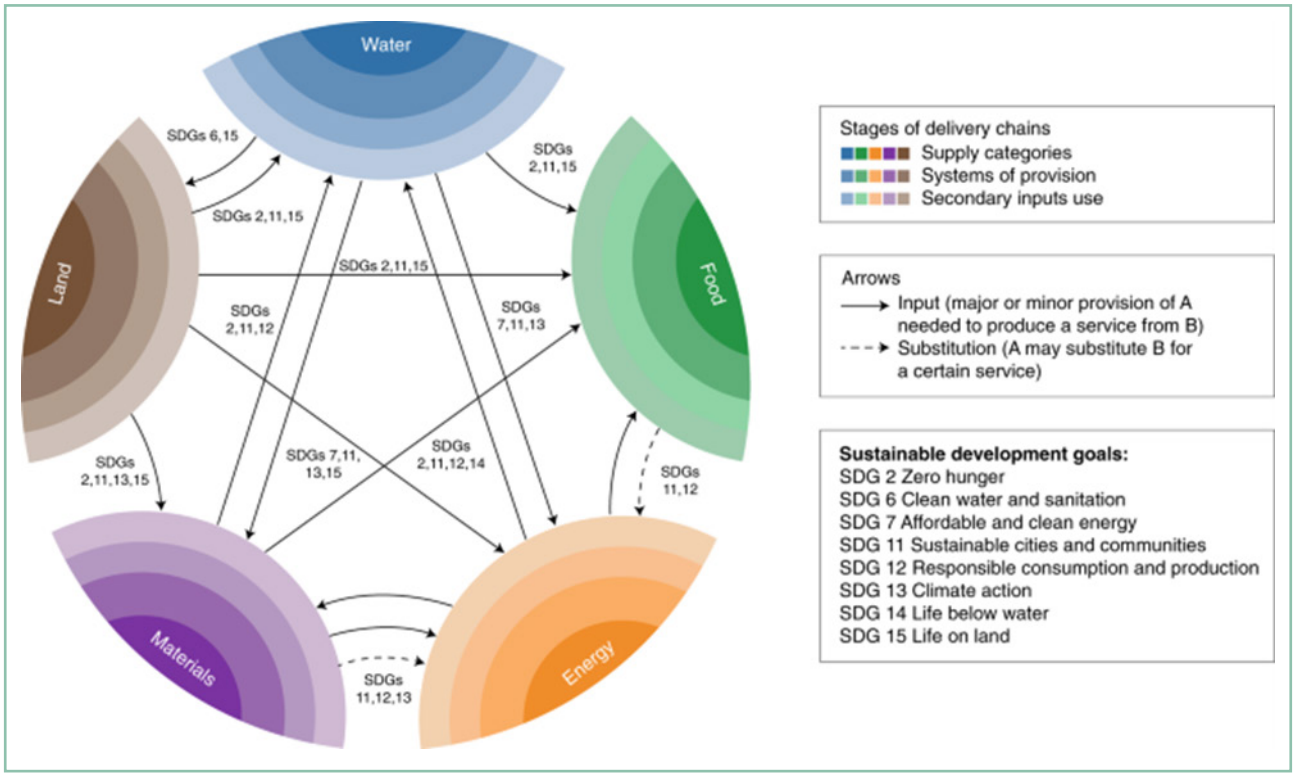
The climate change challenges have cross-cutting impacts on Namibia's economy, society and natural environment. The concept of the water-energy-food nexus is one approach to address these challenges in a holistic and systemic way. The nexus embraces a set of context-specific critical interlinkages between two or more natural resources used in delivery chains towards systems of provision for water, energy, food, land and materials *(Bleischwitz, Spataru, VanDeveer, & al., 2018)*.

The water-energy-food nexus approach rests on the premise that water, energy and food systems are fundamentally interlinked, meaning that the actions in any one area have effects in one or both of the other areas *(FAO, 2024)*. Examples of such interlinkages, dependencies and potential synergies, include:

- Water is needed for irrigation for agriculture and livestock needs.
- Irrigation require energy to operate, with decentralised energy (such as solar energy) providing new opportunities for affordable irrigation strategies.
- Food waste can be used to produce energy in a form of bio-gas or bio-fuels.
- Energy production often requires water as in the case of hydropower and hydrogen generation.
- Water supply requires energy for water distribution.
- Water desalination is energy intensive.

A recent study by the World Bank on the climate risks for Namibia identified significant risks of climate change for the water, energy and food nexus *(World Bank Group, 2021)*. On water, a total reduction of 20-30% by 2080 is expected, resulting in additional salinisation challenges. In terms of agriculture, growing cereals will be more difficult (decline between 20-50%), with carrying capacity for (European) breeds of cattle dropping by 50% by 2080. On the other hand, some other crops like Bambara Groundnut could benefit, while the impact on fishing is uncertain. On energy, the reduction in precipitation will result in less hydropower energy generation, while reducing on increased energy demand during the more frequent hot days for air conditioning. Finally, climate change will also put pressure on human and animal health, due to increased heat stress, cholera (during floods) and malnutrition.

FIGURE 4.
EXAMPLE OF THE NEXUS PERSPECTIVE ON THE SDGs



Source: (Bleischwitz, Spataru, VanDeveer, & al., 2018)

In order to provide a perspective on the current state of the water-energy-food nexus, we will first briefly present the current situation of water, energy and food security respectively, before focusing on the nexus challenges specifically. Throughout, we will integrate a place-based perspective in order to not obfuscate substantial differences between rural and urban contexts.

In terms of **water security**, it is important to note that Namibia's geography makes for a rather unique landscape of water access. Outside of the perennial rivers on the Northern (Okavango, Zambezi, Kunene rivers) and Southern (Orange River) borders, water is only constantly available through storage or boreholes. Up to 65% of Namibian water supply is from boreholes, with 35% coming from surface water sources *(Namibia Water Corporation, 2023)*. The latter are in particular vulnerable to the regular droughts, given the high variability of the rainfall, and such water resources in semi-arid regions are often associated to poor water quality due to higher sediment pollution risks *(Faulstich, Arendt, Reinhardt-Imjela, & al., 2023)*.

Fortunately, Namibia is well-endowed with rich underground aquifer water resources, with current extraction rates being less than 1% annually of total reserves (see ***Table 1***), with more untapped potential. However, there are substantial concerns regarding the risk of pollution due to illegal boring activities, as well as the risk of pollution emanating from mining or agricultural activities *(Hamutoko, Wanke, & Voigt, 2016)*. Moreover, the Windhoek aquifer, responsible for providing water to over 15% of the total Namibian population, is considerably more depleted, and as such water availability in aquifers may not always match the location of demand *(Tredoux, Merwe, & Peters, 2009)*. Despite these challenges, there has also been substantial progress on some of the water-related sustainable development goals (SDG 6). For instance, the population using at least basic drinking water services increased from 75% in 2000 to 86% in 2022 (***Table 1***). It is important to

TABLE 1.
SDG 6 (CLEAN WATER AND SANITATION) INDICATORS

	2000 value	Current latest value	Long term objective
Population using at least basic drinking water services (%)	75%	86% (2022)	100%
Population using at least basic sanitation services %	28%	36% (2022)	100%
Fresh water withdrawal (freshwater withdrawal as a proportion of available freshwater resources)	0.9	0.86	<12.5
Anthropogenic wastewater that receives treatment	NA	5 (2020)	100

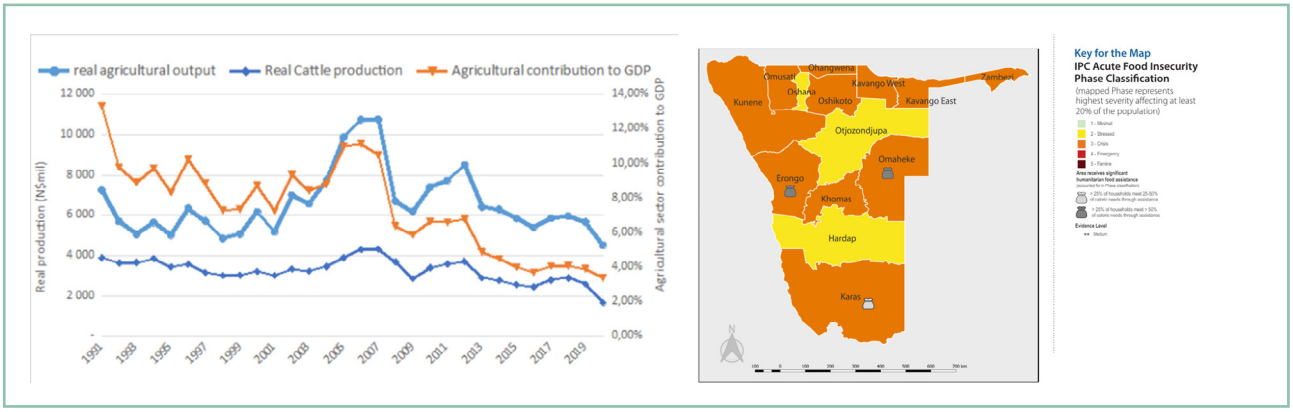
Source: (Sustainable Development Report, 2024)

note that these figures hide a discrepancy between urban and rural situations, with urban coverage being close to 100%, while rural coverage ranges around 80% *(AFDB, 2021)*.

In terms of **food security**, Namibia is seeing the effects of droughts that have an impact on agriculture, both in terms of crops as well as livestock. While regular droughts continuously affect food production in Namibia, more extreme droughts can lead to mass culling of livestock, such as during the drought of 2019 *(Schwieger, 2023)*. Livestock is an important source of food security, in particular for rural pastoralists groups, and these rural communities are therefore particularly affected. However, agricultural output and livestock production has been in an almost constant decline since 2007 (see ***Figure 5***, left panel). Food insecurity is quite wide spread outside major urban centres, with regions like Erongo, Omaheke and Karas needing a substantial part of assistance to ensure enough nutrition (see ***Figure 5***). The food security challenges differ between Namibian regions with the north western regions and informal settlements of the country being more vulnerable *(UN Food System Coordination Hub, 2021)*.

According to the World Food Programme, Namibia ranked 78th out of 116th countries in terms of hunger, with 24% of children suffering from malnutrition. In total 80% of Namibia's food is imported, making the country vulnerable to trade, currency development or value chain shocks like Covid-19 *(WFP, 2024)*. Food security is embedded in Namibia's SDG commitments and targets (SDG

FIGURE 5.
AGRICULTURAL OUTPUT (left) AND FOOD INSECURITY IN NAMIBIA (right)



Source: (Bach, 2021)

TABLE 2.
SDG 2 INDICATORS

	2000 value	Current latest value	Long term objective
Prevalence of undernourishment	16%	17.1% (2022)	2.5%
Prevalence of stunting in children under 5 years of age	29%	22.7% (2013)	0%
Prevalence of wasting in children under 5 years of age	10%	7.1% (2013)	0%
Prevalence of Obesity	9%	16.9% (2022)	3%
Cereal Yield (tonnes per hectare of harvested land)	0.39	0.65 (2022)	7

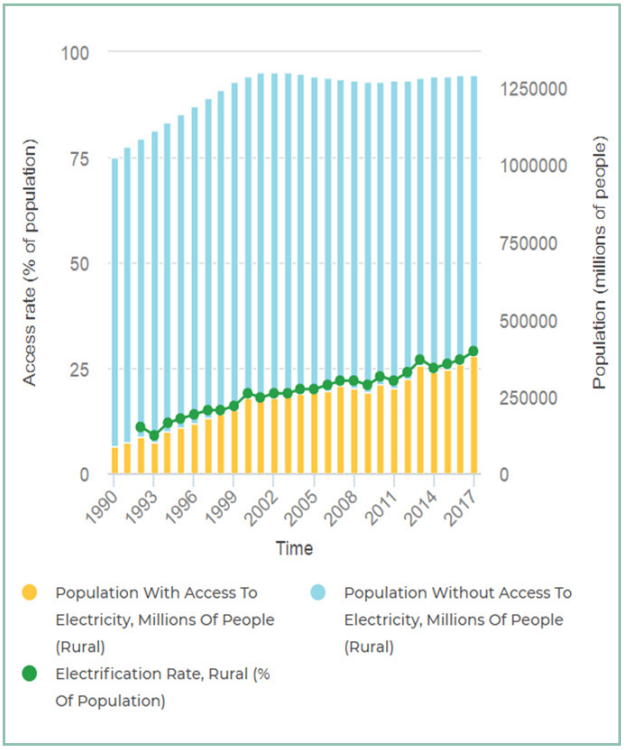
Source: (Sustainable Development Report, 2024)

2). Although there is some progress on some of the indicators, Namibia is not yet fully on track to achieve the set targets by 2030 (***Table 1***).

Namibia is endowed with a variety of indigenous **energy resources** *(von Oertzen, Schneider, & Heyns, 2024)*. Despite this abundance, the country is relatively energy insecure from a macro perspective. For its electricity generation, it is highly dependent on import (primarily from South Africa), with 61% of energy imported *(Ministry of Industrialisation and Trade Namibia, 2024)*. In 2020, 60% of total energy use in Namibia is based on oil, 2% coal, and 38% renewables. The latter consists of 76% Bioenergy, 15% hydroenergy and 8% solar, and <1% wind *(IRENA, 2024)*. To address this problem there have been recent initiatives to invest more in both own conventional energy sources (oil and gas) and renewable energy sources, such as solar and wind, as well as the use of biomass from encroaching bush *(Energypedia, 2024)*. However, so far the use of renewable energy sources has grown at a relatively slow pace, not keeping up with overall demand growth.

From a consumption perspective, Namibia has made significant advances in its electrification rate. Electrification increased from 28% in 2000 to 55% in 2020. While rural areas clearly have lower electrification rates, there has been a significant increase from 18% to 27% over the same period as well (***Figure 6***). The progress in providing affordable access to energy is evident in the SDG 7 indicators demonstrating improvements in access to electricity, clean fuels and technologies for cooking (***Table 3***). Despite these advancements, energy poverty remains a concern, with a recent study showing that Windhoek households spend up to 18% of their monthly income on electricity *(Seibes, 2023)*.

FIGURE 6.
ELECTRIFICATION RATE, RURAL



Source: (Bach, 2021)

TABLE 3.
SDG 7 (AFFORDABLE AND CLEAN ENERGY) INDICATORS

	2000 value	Current latest value	Long term objective
Population with access to electricity	26%	5%	100%
Population with access to clean fuels and technology for cooking	34%	47%	100%
Co2 emissions from fuel combustion per total electricity output (MtCO2/ Twh)	1.2	2.93 (2022)	0
Renewable energy share in total final energy consumption	16%	21% (2020)	55%

Source: (Sustainable Development Report, 2024)

The water-energy-food nexus does not just provide a lens to analyse the trade-offs and challenges in managing the ensemble of water, energy and food security. It also offers a perspective to explore opportunities to address multiple of these challenges simultaneously and coherently through challenge-oriented policies and concrete place-based projects and investments (see, for example, von *Oertzen, Schneider, & Heyns, 2024*).

RURAL RESILIENCE TO CLIMATE CHANGE PRESSURES

While Namibia has been rapidly urbanising, with 54% of Namibians living in urban areas in 2022 versus 44% 10 years prior, a significant part of the population still lives in rural contexts. Given the low population density and large distances in Namibia, rural places are often remote, and as such face challenges in terms of integration into the nation-wide economy. The rural-urban divide is evident from some of the headline poverty and employment statistics, with poverty rates being 19% in urban areas but double (38%) in rural areas, with 75% of rural youth populations being unemployed. The figures are even direr for disadvantaged ethnic communities *(Namibia, 2022)*.

Rural communities in Namibia are particularly vulnerable to climate change that accentuates mutual dependencies and trade-offs within the water-energy-food nexus. With fewer resources to mitigate or adapt to these challenges, rural populations are at risk of water, energy and food poverty, as well as more prone to suffer from the climate change *(Angula & Kaundjua, 2016)*. Despite all this, rural areas can also be important sources of creativity and innovation, building on human, cultural and network capital in relatively close-knit communities. A well-known example is the successful community-based land and resource management models, such as those in the Community Based Rangeland and Livestock Management, which have seen extensive positive impacts on the wellbeing of communities and the environment *(D. Layne Coppock, 2022)*.

Moreover, Namibia is well-known for its preservation and exploitation of indigenous knowledge, typically also situated in rural contexts. Such traditional and indigenous knowledge, for instance on local resilient crops and livestock breeds, food preservation techniques etc., have potential to be particular relevant in the face of the water-energy-food challenges and the compounding effects of climate change (see for instance: *(Newsham & Thomas, 2011)*. In the next sections, we will further explore the positive examples of such rural resilience and opportunities of indigenous knowledge.

THE CHALLENGE DEFINITION FOR THE STI FOR SDGs ROADMAP

The specific challenges emerging at cross-roads of water, energy and food security are closely linked to Namibia's changing climate. Climate change is bringing about pressures accentuating existing vulnerabilities and trade-offs between water, energy and food systems in particular in rural areas.

Building on the analyses of the challenges as described above, the country team in Namibia - the *Ministry of Higher Education, Technology and Innovation (MHETI) and the National Commission on Research, Science and Technology (NCRST)* – proposed the main challenge for this roadmap to:

"deliberate ways to leverage science, technology and innovation (STI) to increase resilience of rural communities to climate change, considering the localised challenges of the water-food-energy nexus and the role of indigenous knowledge"

An important dimension of the challenge is the focus on risks and benefits of STI for rural communities. How should the country to manage "big ticket" opportunities, such as the promise of

BOX 1. KEY DEFINITIONS FOR THIS ROADMAP

Resilience

- The ability to withstand or recover from negative setbacks to a desired trajectory

Climate change

- The changing of weather patterns due to the increased levels of greenhouse gasses in the atmosphere, resulting in surface temperature increases and rainfall variability, causing both floods and droughts.

The water-energy-food nexus:

- "The concept that water security, energy security and food security are fundamentally interlinked, meaning that the actions in any one particular area often can have effects in one or both of the other areas (FAO).

Indigenous Knowledge Systems

- The knowledge, practices, and beliefs developed and passed down through generations by indigenous peoples. These systems encompass a wide range of areas, including medicine, agriculture, spirituality, philosophy, security, and governance systems, as well as conservation, and are often deeply interconnected with Indigenous cultures and ways of life.

green hydrogen and the off-shore oil reserves or the IA and digital revolution, to ensure that benefits also reach the disadvantaged and vulnerable communities? How can research and innovation help localise global challenge and ensure that vulnerable communities co-develop and co-own of their development paths?

1.2. THE SUSTAINABILITY CHALLENGE IN NATIONAL POLICIES, STRATEGIES AND PLANS

As introduced in the previous section, the geographic realities of Namibia has made it very aware of its sensitivity to climatological patterns. It is there perhaps no surprise that Namibian policy makers have from a very early stage recognised the compounding challenge of climate change, in particular for its rural populations. This is for instance evidenced by the following excerpt from the first page of Namibia's National Water Policy White Paper, developed as early as 1999, 16 years before the Paris Agreements bringing climate change more systematically on the world wide policy agenda.

> *"When I was a boy, the ponds and waterholes used to last the whole year through. Now they are dry and empty. When the rains came and filled the Oshanas, we used to take our baskets and go fishing. Now the fish baskets hang from the roof poles as ornaments. They are never used. We walked to school through long grass as high as our arm-pits, as far as you could see. Now the grass has all gone and there is nothing for the cattle to eat." Witness to the changing water landscape in the Cuvelai basin Oshakati, October 1999.*
>
> *Source: (Ministry of Agriculture, Water and Rural Development, 2000, p. 1)*

In order to analyse the recognition and framing of the challenge in Namibia's policies, we subsequently investigate its framing first in high-level policy documents, second in sectoral policies and finally in STI-policies (see Table 4 for an overview). For each policy document, we have reviewed whether key concepts are explicitly present in these documents.

In terms of high-level policy documents, we see a clear recognition of the challenge of rural resilience in the face of climate change. In Namibia's Sixth National Development Plan (NDP6), climate change is referred to as one of the main 'megatrends', and sets strengthening resilience mechanisms as one of the three main pillars for Namibia's future development (along with recovery and transformation). While not explicitly referring to a nexus approach, it incorporates an 'integrated horizontal and vertical planning approach', and discusses water, energy and agriculture/food challenges. These areas are not just seen as challenges, but also as opportunities, in particular the green and blue economies.

Another recent high-level policy strategy, the Harambee National Prosperity Plan II, also directly acknowledges the importance of climate change, with President's Geingob's foreword mentioning 'recurrent droughts, recorded to be the worst in recent history and spurred by the Climate Change phenomenon' causing economic and societal distress. The policy strategy itself directly includes aspects of promoting rural resilience in the face of climate change, and has investment areas planned for water, energy and food. While the nexus is not explicitly discussed, the linkages between these different challenges are extensively recognized. More broadly speaking, it is noteworthy to mention that Namibia has been a strong supporter of the SDG framework, with it submitting to regulatory voluntary reviews with support from the highest political level *(UN High-Level Political Forum on Sustainable Development, 2021)*.

TABLE 4.
MAPPING OF KEY POLICY DOCUMENTS AGAINST THE CHALLENGE AND STI OPPORTUNITIES

Key Policy Documents	Climate Change Vulnerability	Water-Energy-Food Nexus in context of climate change Challenge	Rural Communities	Role of STI for the WEF Challenge	Role of STI for WEF challenge in the context of Rural Communities	Role of Indigenous Knowledge
High-level Policy Strategies						
Vision 2030 (2004)		/(not in the context of climate change	X	/ (not explicitly linked)	/ (not explicitly linked)	X
National Development Plan 6	X	/ (Not explicitly nexus context)	X	/ (not explicitly linked)		
Harambee National Prosperity Plan (2020)	X	X	X			
Sectoral Policies & Strategies						
National Energy Policy (2017)	X	X	X	X	/ (skills, entrepr-eneurship)	
National Renewable Energy Policy (2017)	X	X	X	X	X	
National Water Supply and Sanitation Policy (2008)	X	X	X	/ (skills, SMEs)	/ (skills, SMEs)	
Namibia Agriculture Policy (2015)	X	/ (no energy)	X	X		
National Environmental Education and Education for Sustainable Development Policy (2019)	X	X	X	X		X
National Forest Policy	X	/ (no Energy)	X	X	X	X
Namibia's Green Hydrogen and Derivatives Strategy (2022).	X	X	X	X		
National Policy on Climate Change (201)	X	X	X	X	X	X
National Determined Contribution (NDC) Plan (2023, updated version)	X	X	X	X		
Regional Planning Development Policy for Namibia (1997)		X	X	X (technology, SMEs)	X (technology, SMEs)	X
Rural Development Strategy (2014-2018)	X	/ (no energy)	X	X	X	
National policy on Micro, Small and Medium Enterprises in Namibia (2016-2021)		X (not in nexus context)	X	/ (mentioned but not linked to challenge)		

Key Policy Documents	Climate Change Vulnerability	Water-Energy-Food Nexus in context of climate change Challenge	Rural Communities	Role of STI for the WEF Challenge	Role of STI for WEF challenge in the context of Rural Communities	Role of Indigenous Knowledge
National Technical and Vocational Education and Training (TVET) Policy (2021)				/ (mentioned but not linked to challenge)	X	X
Growth at Home Policy (Competition Policy) 2020		X		/ (mentioned but not linked to challenge)		X
STI Policy*						
Revised National Science, Technology And Innovation Policy (Nstip) (2020-2030)	X	X		X		
National Action Plan For Namibia's Science, Technology, And Innovation Policy (2022)	X	X	X	X	X (specifically in the context of STEM education)	X
Namibia Space Science And Technology Policy, 2021	X	/ (Focused on Food)		X		
National Bioeconomy Strategy (2024)	X	/ (Limited Water)	X	X	X	X

**A draft Indigenous Knowledge Systems Policy is in preparation. Due to its early stage, it is not considered fully in this analysis.*

The review of Namibia's main relevant sectoral policies in terms of the challenge area recognition bring forward a few main observations. Firstly, almost all Namibia's policies and strategies – outside a few documents older than 20 years - recognise the challenge of climate change, and the specific vulnerability of Namibia to it. For instance, the Rural Development Strategy directly mentions climate change adaptation as one of its priorities, and proposes integrated and pro-active spatial planning to address these challenges.

Second, when we focus on whether the role of the nexus between water-energy and food is recognised, we see that most sectoral policies from line ministries recognise the interdependence between these challenges, and position their specific policies within the context of this nexus. As noted before, this is not explicitly done using the 'nexus' frame, but the dependencies are generally clearly articulated, although in some instances the role of Energy is left out from the analysis. Third, we can conclude from this review that Namibia's policies are relatively consistently recognising the urban-rural divide and the specific challenges facing its rural communities. Most strategies have specific ambitions, targets or planned actions for these rural settings.

Next, we focus on the potential of STI in providing solutions that could contribute to addressing these challenges. Here we see a different pattern emerging. While the high-level policies in strategies often in broad terms allude to the importance of technology or innovation, these are not explicitly linked to challenges. However, when we move to the more specific sectoral and departmental policies, we do see that most sectoral policies recognise the relevance of research and innovation in their sector, although some touch only on the softer related aspects such as general skill development, entrepreneurship and technology

diffusion, or the role of SMEs. Several of these policies even specifically refer to the rural context when addressing the opportunity of innovation, such as the National Policy on Climate Change and – perhaps unsurprisingly – the Rural Development Strategy. Some examples of policy documents explicitly acknowledging the role of STI in the challenge area are presented in box below (see ***Figure 7***).

The analysis reveals two noteworthy 'gaps' in terms of policy attention for the role of STI in the challenge area. First of all, the National Policy on Micro, Small and Medium Enterprises and related strategic plans do not appear to have a 'directional' component in their policy and strategy, meaning that technology and innovation are mostly perceived as tools for economic development, rather than also sources of potential solutions for societal and environmental challenges. Similarly, the 'Growth at Home' policy is almost exclusively focused on economic aspects. Secondly, the National Science, Technology and Innovation Policy (NSTIP 2020-2030) does recognise this opportunity, but does not develop in detail these opportunities and needs specifically in the context of rural contexts in terms of goals or instruments. It does, however, foresee a role for regional councils to support local innovation and develop technology parks.

Finally, this roadmap specifically also looks at the potential role of indigenous knowledge as a source for potential innovation and solutions in the challenge area. Indigenous rights are recognised in the Namibian constitution under Article 5. In terms of acknowledgement of indigenous knowledge in policy documents, we see a more scattered picture emerging, with the term being used only in a handful documents, but notably not in the National Science, Technology and Innovation Policy or the Rural Development Strategy. However, both the STI Action Plan as well as the National Bioeconomy Strategy, also developed under the auspices of the MHETI and NCRST puts indigenous knowledge at the core of its strategy (see ***Figure 8***).

FIGURE 7.
EXAMPLES OF STI OPPORTUNITIES IN KEY POLICY DOCUMENTS

Innovative business models addressing rural energy needs are also becoming more popular in the sub-Saharan Africa region including small-scale solar home energy solutions financed through affordable payment schemes. Given the significant rural electrification needs in Namibia, government funds for research and enabling these business models by working with the private sector to address gaps shall prioritize efforts that address rural energy goals.

(Renewable Energy Policy, p.42)

The Directorate is undertaking forestry research on species trials, for purposes of afforestation and amenity plantings, improvement and promotion of indigenous fruit trees and dune stabilization among others. The Directorate, through the execution of community-based forestry projects, is gradually expanding its research capacity to cover institutional arrangements that will deliver the desired results in the development of partnerships, particularly in the communal areas.

(Forestry Policy, p. 9)

The Namibia Green Hydrogen Research Institute (NGHRI) will conduct R&D and help localize the value chain. It will function as a distributed Science and Technology Park for university-industry-government consortia to conduct R&D and capacity-building, promote entrepreneurship and incubate innovative projects. Self- contained mini-campuses in Lüderitz, Windhoek and Walvis Bay will have state- of-the art infrastructure, fully equipped laboratories, R&D stations, private sector and government representative offices, an entrepreneurship and start-up incubation centre and training facilities. As part of R&D capacity-building, the NGHRI will offer formal degree programmes (Masters, PhDs) and a training centre for short skill/upskill/reskill programmes.

(Green Hydrogen Strategy, p33.)

Climate change research needs to be properly coordinated and the benefits optimised to meet the needs of policy makers in Namibia and Southern Africa. Attention needs to be focussed on projects that will assist with mitigation of and adaptation to climate change and address specific areas of vulnerability. Further, development and demonstration projects are required to show the advantages and acceptability of a variety of technologies related to climate change. There are some solid foundations in this area on which to build including, inter alia, renewable energy demonstration projects and the long-term environmental observation networks such as LTER and BIOTA Southern Africa. In addition indigenous adaptation mechanisms and strategies need to be researched to determine their effectiveness and replicability.

National Climate Change Policy, p. 20

Establish a water technology innovation park with a bank on all new and indigenous technologies for water resource development, use and management.

National Action Plan For Namibia's Science, Technology, And Innovation Policy, p.19

FIGURE 8.
NATIONAL BIOECONOMY STRATEGIC OBJECTIVES

STRATEGY 1

- *Create a platform to market indigenous innovations and their widespread benefits;*
- *Valorise indigenous products and services.*

STRATEGY 2

- *Capacitate the nation on indigenous resources profiles;*
- *Conduct nationwide education campaigns to inform the masses on indigenous resources of economic importance and how best communities can ensure they benefit from their natural abundance.*

STRATEGY 3

- *Facilitate the integration of Bioeconomy in sectoral policy instruments;*
- *Engage and sensitise policymakers on the importance of legislation that advocates for indigenous knowledge protection;*
- *Integrate the protection of indigenous knowledge into mainstream legislation.*

Source: National Bioeconomy Strategy, 2024, p24.

2. FITNESS OF INNOVATION SYSTEM TO ADDRESS THE SUSTAINABILITY CHALLENGE

2.1. STI POTENTIAL AND PERFORMANCE WITH RESPECT TO THE CHALLENGE AREA

In order to assess the performance of the Namibian Science System, we will in this section in turn look at key indicators for R&D, scientific outputs, innovation and innovation outputs in order to capture both activity and output levels for research and innovation.

RESEARCH AND DEVELOPMENT ACTIVITIES

Table 5 presents the key indicators for research and development activities in Namibia. This report benefits from the recent publication of the Namibia R&D-survey, providing new estimates for key STI statistics for the first time since 10 years. The figures show a clear pattern of increasing R&D activity across the board, with GERD as a share of GDP increasing from 0.02% just after independence to 0.76% in 2021/2022. While this is below the AU Target of 1%, Namibia is among the top performing African countries, only behind Egypt (1.02%) and Rwanda (0.76%). The share of business R&D has also increased from 11% in 2013/14 to 21.7% in 2021/22, indicating strong private spending on R&D. We have seen a large shift from Government to Higher Education institutions, which is most likely due to a reclassification of entities. The number of researchers per million inhabitants has also significantly increased from 2502 in 2013/2014 to 3439 in 2021/2022, with notably almost parity (49.5%) in terms of female researchers. Equally positive is the increase in enrolment in tertiary education which has quadrupled from 7% to 28% between 2006 and 2020. As such, in terms of human capital and R&D-spending, Namibia is increasing its system capacity to conduct research and innovation activities.

TABLE 5.
KEY INDICATORS FOR NAMIBIA'S STI SYSTEM (NCRST, 2024)

Indicator	Prior edition R&D survey (2013/4)	Most recent Figures from R&D Survey (2021/22)
GERD as share of GDP	Increasing from 0.02% (1992) to 0.35 (2014)	0.76%
Share of R&D expenditure performed by Business Enterprise	11%	21.7%
Share of R&D expenditure performed by Government	45.9%	3.3%
Share of R&D expenditure performed by Higher Education	6%	72.5%
Share of R&D expenditure performed by Private non-profit	4%	2.5%
Researchers per million inhabitants (FTE)	2502	3439
Share of female researchers (FTE)	38.7	49.5%
Enrolment in tertiary education (ISCED 8)	From 7% (2006)	28% (2020)
Female enrolment in tertiary education (ISCED 8)	NA	37% out of total

When we relate this capacity to the challenge area, we can build on the insights from the UNESCO Science Report (2021), as presented in ***Figure 9***. Namibia has a relatively high share of graduates in the fields related to natural sciences and agriculture, as well as social sciences, which in general could support research and innovation activities in the challenge area. However, Namibia performs quite poorly in terms of the number of engineering graduates, which could be a serious constraint in terms of more technological and engineering oriented innovation and solution development and implementation.

RESEARCH OUTPUTS

In terms of publications, Namibia produced 645 citable publications in 2022 (Scimago, 2024), and publications by Namibian researchers were cited 6604 times. This brings Namibia to 26th and 25th place in Africa respectively (121st worldwide), which is quite impressive given its relatively small population. We also see that Namibia is growing its scientific output at an impressive rate, with only 117 publications in the year 2010, thereby featuring twice the growth rate as neighbouring African scientific powerhouse South Africa.

Another good measure for the quality of research is competitiveness in internal competitive funding programmes. The most notable among these, for which systematic data also is available, are the EU Framework Programmes. Namibia has been involved in 20 Horizon 2020 projects, with in total 8.9m EUR contributions from the EU for Namibian partners. This shows that Namibia, given its small size and research base, is a relatively active participant in international competitive funding. These projects are primarily focused on societal challenges (15 out of 20), but with a substantial portion (5 out of 20) also focusing on scientific excellence. Namibia is also active in regional relevant research partnerships, including the NEPAD African Networks of Water Centres of Excellence (EU) and the Southern African Science Service Centre for Climate Change and Adaptive Land Management.

When assessing the performance of scientific output in terms of the challenge area, one can build on recent insights from the UNESCO Science Report as well as the JRC (see ***Figure 10***). Namibia's publications are quite diverse in terms of their scientific area. Excluding health research (which traditionally dominates African scientific research), we see notably high shares for environmental sciences (16%), ICT, Math and Statistics (11%) and cross-cutting strategic technologies (10%). When combined with the JRC analysis, a mixed picture emerging with Namibia scoring high in some of the SDGs relevant to the challenge area (Life on Land), but low on some very important SDGs for the challenge area (Affordable and Clean Energy, Zero Hunger). On the other hand, data from NUST, one of the largest Research Universities in Namibia, interestingly shows that the majority of their funded research projects (64%) is related to Indigenous Knowledge Systems and Sustainability, and a substantial

FIGURE 9.
HUMAN CAPITAL IN R&D (UNESCO, 2021)

	Natural sciences	Engineering	Medical sciences	Agriculture & veterinary	Social sciences	Humanities & arts
Angola (2016)	28.7	7.1	8.7	28.5	22.0	5.0
Congo, Dem. Rep. (2015)	37.6	5.2	7.9	26.0	15.1	4.5
Eswatini (2015)	13.6	3.7	33.9	16.8	25.5	4.5
Lesotho (2015)	38.4	26.0	–	33.5	2.0	–
Madagascar	34.5	24.9	8.7	9.5	14.1	8.3
Mauritius	17.8	7.3	3.4	21.3	8.7	1.8
Mozambique (2015)	22.1	8.3	11.6	22.2	35.8	–
Namibia (2014)	31.0	2.9	3.5	18.7	37.2	0.6

other share (23%) to the Water-Energy-Food nexus, followed by the Natural Resources and Value Chain Sustainability (5%). This difference could be due to a delay between project activity and scientific publication outputs, or due to a difficulty in translating the research activities to concrete scientific outputs. These results show that there is certainly potential for the cross-cutting, interdisciplinary research needed to address the challenge area. More effort (and investment) is needed, however, to effectively steer research outputs towards nexus research.

INNOVATION ACTIVITY AND OUTPUTS

In order to assess the activity and outputs of Namibia in terms of innovation, we look at a mix of aspects, including patenting activity, entrepreneurship ecosystem, startups and related economic indicators. Namibia registers around 9 patents a year *(WIPO, 2021)*, showing patenting activity is relatively limited in absolute terms. There is a relatively high volatility in these indicators given the small size of the system. While knowledge intensive employment is increasing (from 15% in 2014 to 18% in 2018), the percentage of graduates in science & engineering is decreasing (18% in 2014 to 9% in 2020). Access to ICT has been increasing in the last decade, but high tech exports have been decreasing substantially (100m+ in 2013/14, 20m in 2020).

Firms in Namibia have low innovation rates in terms of launching products or services new to the market, and are not very well connected to other sources of innovation such as research institutes *(NCRST, 2019)*. A picture emerges of a private sector that is struggling with realising enough investments and results in competitiveness and productivity through human capital and investments. This situation is not unique for upper middle income countries like Namibia. While Namibia performs relatively poor in absolute term (***Figure 11***, top panel), it performs roughly about as expected in relative terms when correcting for its GDP per Capita (***Figure 11***, bottom panel).

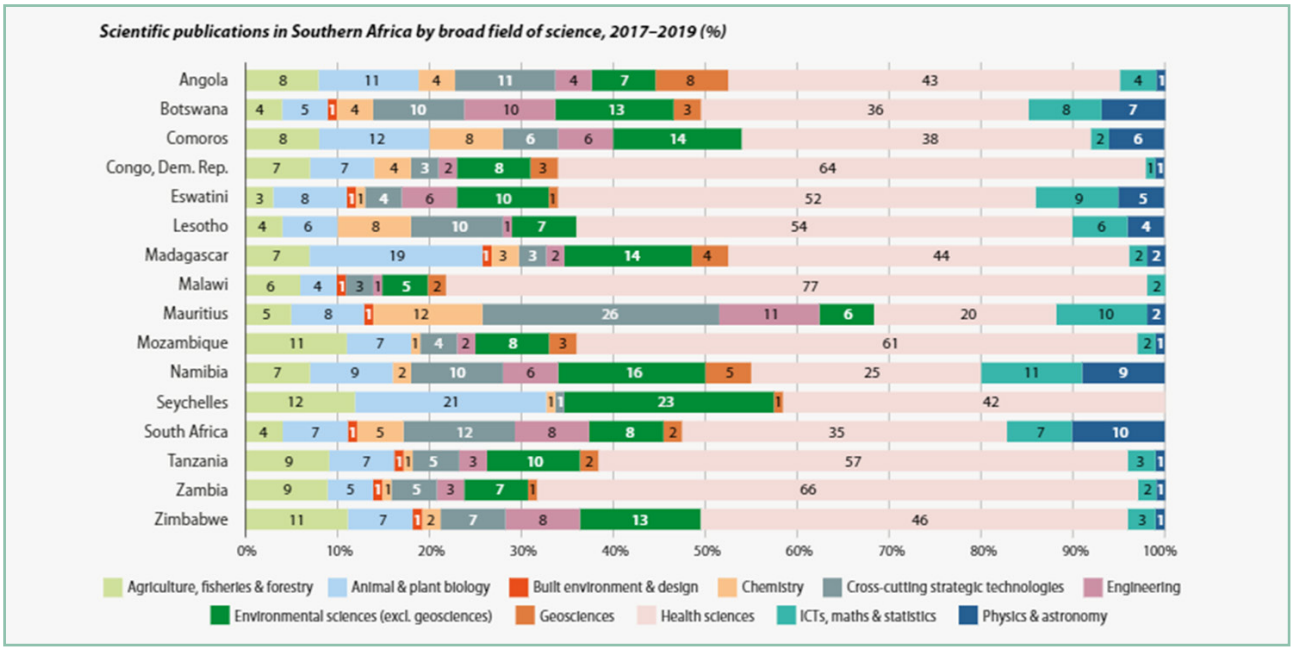
An important output of an innovation ecosystem are successful new start-ups that attractive external investment, as these new companies can be an important source for solutions and system-wide productivity. A few recent notable examples of Namibian Startups include:

- Flushh (Waterless Toilets)
- Jabu (B2B Marketplace)
- Marginalised Mirror (agricultural restoration in indigenous communities)
- Nam-Oceanic Kelp Production Enterprise (AKA NamKelp)
- Afridrones (farm inspection services)
- Glowdom (e-learning for Namibian youth)
- Mindsinaction (STEAM training, maker space).

In ***Section 3.2*** we will discuss in more detail the wider entrepreneurial ecosystem actors.

The JRC has analysed the main sectors, products and SDG-areas of the Namibian innovation system. The analysis finds the top sectoral focus of Namibian start-ups is Agriculture and Waste Management, and in terms of products the main areas are livestock, solar energy and recycled products. In terms of their primary SDG focus, Zero Hunger (SDG2), Responsible Consumption and Production (SDG 12) and Renewable and Affordable Energy (SDG 6) are the main sectoral SDGs, with Climate Action (SDG13) also featuring prominently as a secondary SDG. With a large number of societally-driven start-ups Namibia's entrepreneurial ecosystem is certainly already highly focused on challenges related to climate change adaptation and nexus.

FIGURE 10.
NAMIBIA'S PERFORMANCE PER RESEARCH AREA (top: (UNESCO, 2021), bottom: (JRC, 2023)

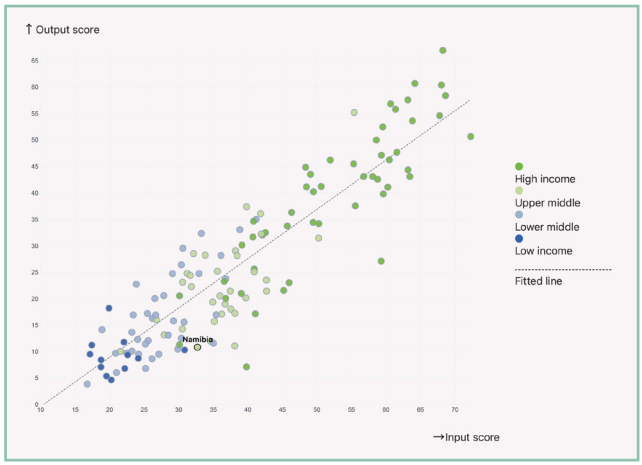


NAMIBIA – SUMMARY OF SCIENTIFIC PERFORMANCE

ATTRIBUTE	VALUE
I. OVERALL SCIENTIFIC IMPACT SCORE	4/5
I. OVERALL SCIENTIFIC IMPACT TREND	decreasing
I. TOP SCIENTIFIC DOMAIN	Physical Sciences & STEM
I. TOP SCIENTIFIC DOMAIN TREND	no change
II. OVERALL H2020 FUNDING SCORE	3/5
II. OVERALL MSCA FUNDING SCORE	1/5
III. TOP 3 SDG CATEGORIES	Life Below Water, Life on Land, Quality Education
III. BOTTOM 3 SDG CATEGORIES	Affordable and Clean Energy, Gender Equality, Zero Hunger
V. TOP H2020 PARTNERS	South Africa, Botswana, Ghana, Mozambique, Burundi
V. TOP POTENTIAL COLLABORATORS	Botswana, South Africa, Zambia, Zimbabwe, Angola

Source: authors' own based on Scopus and CORDIS data.

FIGURE 11.
GLOBAL INNOVATION INDEX PERFORMANCE NAMIBIA (WIPO, 2023)



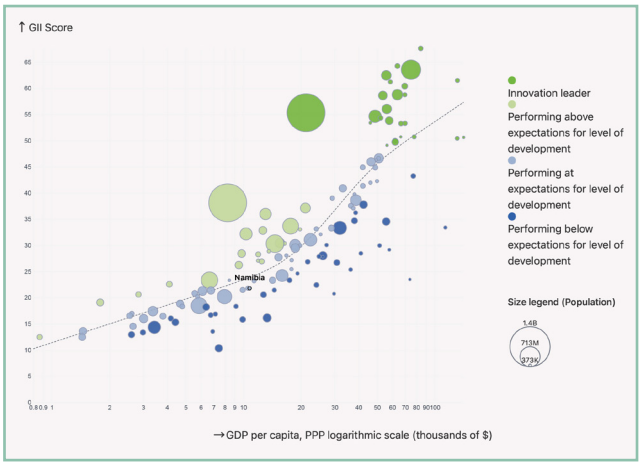
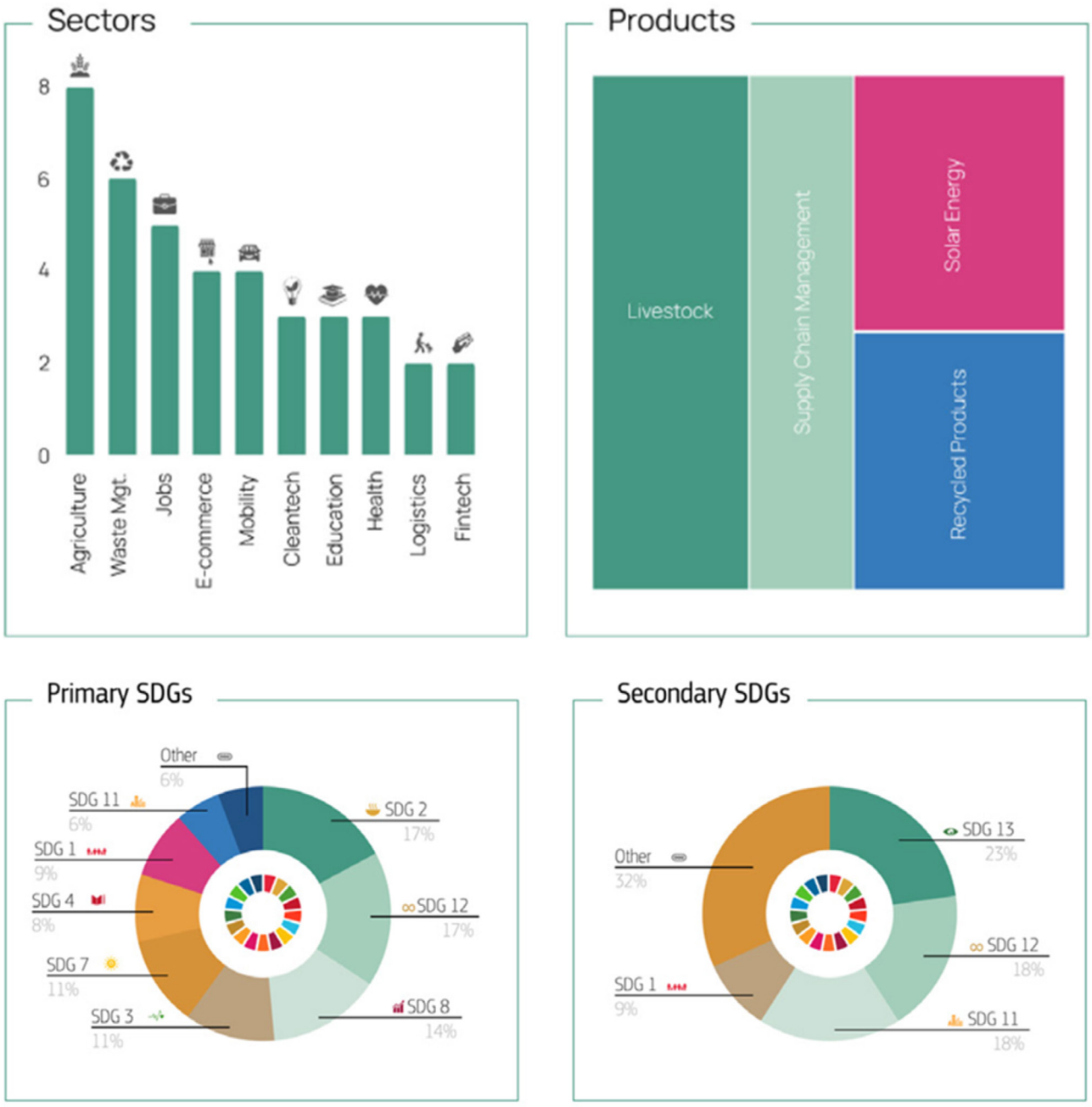


FIGURE 12.
NAMIBIAN INNOVATION ECOSYSTEM PROFILE



Source: (JRC, 2023)

2.2. MAIN STI ACTORS AND INNOVATION COLLABORATIONS

MHETI and NCRST coordinate with other line ministries such as Trade and Industry, Agriculture, Health and Education, as well as with sister agencies such as the National Council for Higher Education, as well as the National Training Authority. The National Planning Commission is involved for high-level strategic policy planning. The NRCST is also the main national body for providing funding, but also coordinates the interface with international partners, both at regional, bilateral and multilateral level.

At regional level, Namibia is closely embedded in the Southern Africa Development Community (SADC). Several STI-related initiatives operate at SADC level, such as the Southern African Science Service Centre for Climate Change and Adaptive Land Management. The NCRST, together with MHETI, also has close relationship with multilateral and UN donors, including UNESCO, AFDB, World Bank, GCF, as well as bilateral development partners, in particular GIZ, AFD, FCDO, EU, SIDA and Finland.

Namibia's public research capacity is concentrated in a relatively small number of institutions. The University of Namibia (UNAM) with a broad research profile, and the Namibia University of Science and Technology, which has a strong focus on STEM subjects, albeit with an interdisciplinary focus as well. The Ministry of Agriculture also has its own research department, carrying out agronomic research. In addition to those, there are a small number of not-for-profit research performers present, including the Gobabeb Research Institute focusing on desert research, and the Institute for Public Policy Research, a think tank focusing on governance and policy research.

Private actors in the Namibian STI system are rather sparse, with limited large R&D-performing enterprises present in Namibia. Some of the large telecom companies such as Telecom Namibia, MTC, Cell One, MWEB Namibia, Internet Techs Namibia are engaged in digital innovation activities.

Namibia has a growing ecosystem of active techhubs, supporting startups through various services such as coaching, incubation, acceleration etc. Key tech hubs in Namibia include Startup Namibia/Basecamp, CCHUB Namibia, MEDI-Venture Incubator, Demola Namibia Hubs and Omaheke Innovation Village. Interestingly, the latter is not situated in the economic and political capital Windhoek, but in one of the least populated regions of Namibia. NUST Also provides a design lab for entrepreneurial students.

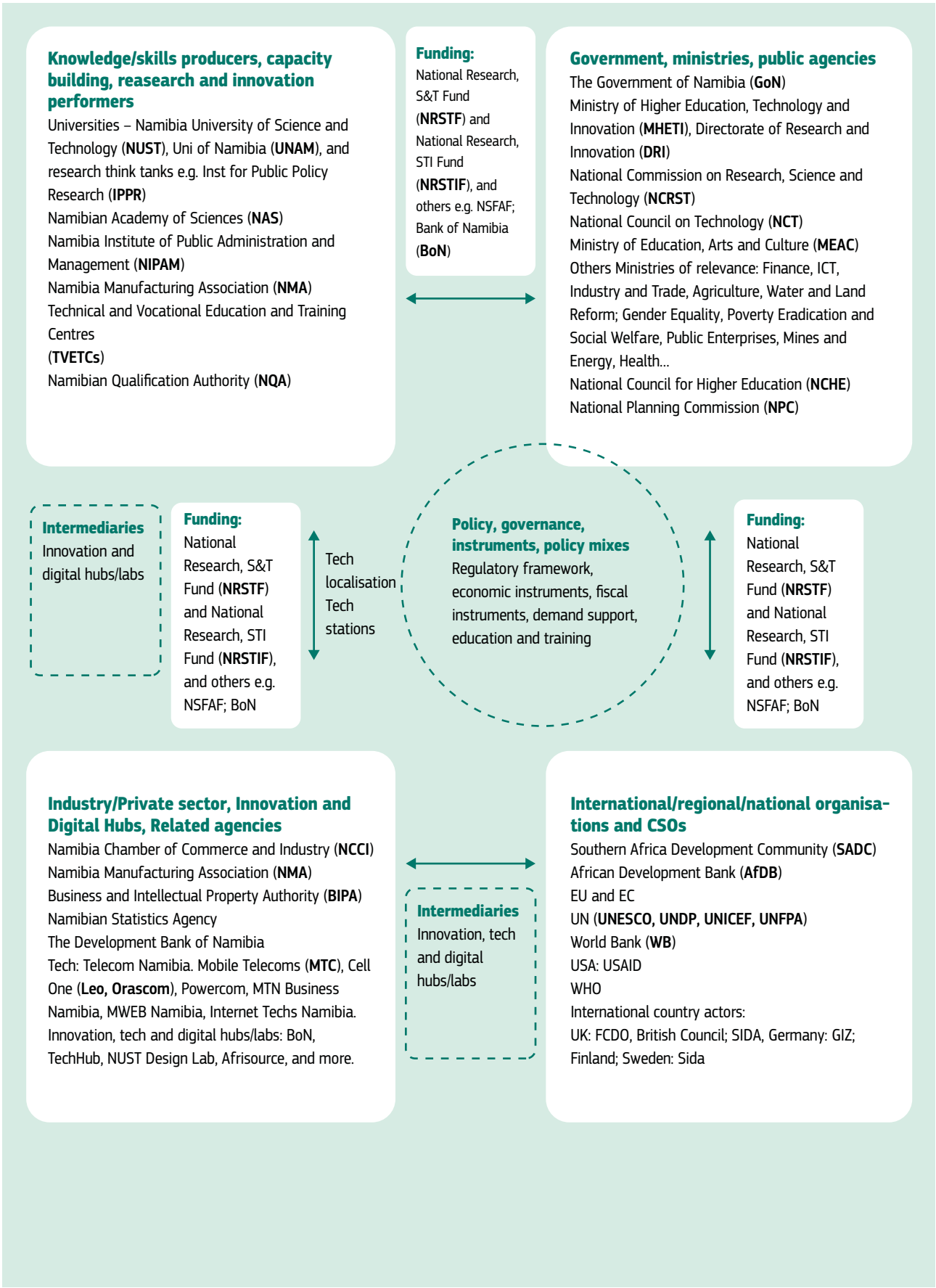
There are several public and private funders that fund scale-up and growth of enterprises active in Namibia. Key players include the Namibia Investment Fund and the Green Climate Fund (EIF Facility), as well as the Development Bank of Namibia.

2.3. STI POLICY AND GOVERNANCE IN RELATION TO THE CHALLENGE AREA

An overview of Namibia's Science, Technology and Innovation System in terms of its key actors is given in ***Figure 13*** From the policy side, the coordination of the STI system falls under the responsibility of the Ministry of Higher Education, Technology and Innovation (MHETI) as main policy body, with the National Council for Research, Science and Technology (NCRST) as the main implementing body.

Other relevant implementing bodies include the Business and Intellectual Property Authority, Communications Regulatory Authority. These bodies closely collaborate in further development of the science and innovation system of Namibia. The main national policy governing the STI System is the Revised National Science, Technology and Innovation Policy (NSTIP) for 2020-2030, with its legislative foundation being the Research, Science and Technology Act of 2004 (Act 23 of 2004). It is built around 8 main objectives and 20 underlying strategies (See ***Table 6***).

FIGURE 13.
OVERVIEW OF NAMIBIA'S STI SYSTEM



Source: (JRC, 2023)

TABLE 6.
OVERVIEW OF NSTIP'S MAIN OBJECTIVES AND STRATEGIES

Objectives	Related Strategies
1. To improve the Policy, Legislative and Regulatory Environment	■ Align STI legislative and regulatory environment and frameworks to national, regional and international development policies ■ Build national capacity to enhance the use of scientific data for evidence-based policy development ■ Improve Standards for Technology Support Institutions
2. To promote strategic partnerships and collaborations	■ Engage with private sector and build public-private partnerships ■ Strengthen national, regional and international partnerships
3. To improve scientific and technical competences in Science, Technology, Engineering and Mathematics (STEM)	■ Strengthen human resources in STEM and increase fte of researchers ■ Build capacity in the creation, management and use of intellectual property works
4. To improve gender mainstreaming in STEM	■ Establish and improve programmes that support women's participation in STEM ■ To support the role of women in innovation systems
5. To promote a culture of science, technology, innovation and entrepreneurship	■ Promote public understanding of science, technology and innovation ■ Promote technology audits by enterprises ■ Establish national innovation promotion schemes ■ Strengthen small en medium scale enterprises
6. To accelerate research in the areas of technological advancement in TVET	■ Support technical and vocational research skills ■ Promote research to bridge the gap between TVET and higher education
7. To improve research and innovation infrastructure provision	■ Develop and improve effectiveness of research and innovation infrastructure ■ Develop and improve national platforms of research and innovation excellence
8. To increase scientific productivity and technological output	■ Increase research and innovation for manufacturing and industrial competitiveness.

2.4. POLICY IMPLEMENTATION AND SUPPORT PROGRAMMES[2]

A first take-away from our review of policy instruments is that direct domestic funding of core STI activities (such as research and innovation grants) is quite limited, with most of the research and innovation activities taking place within a project context, often funded (mostly) by international partners. Most of the domestic spending is a mix between overhead and staffing costs. In 2023, NCRST spent 8.6m N$ - 430k EUR or 21% on expenditures related to its mandate, and 32.8 N$ - 1.65m EUR – or 79% on administrative and support services. This limited funding for direct activities directly targeted at beneficiaries (as opposed to the many other science system activities for which the NRCST is responsible), was mostly used in the context of the organisation of science promotion events and relatively focused training activities for entrepreneurs and innovators. In total over a period of 2 years, across all activities, 132 entrepreneurs were coached, 52 products/service development were supported through advice, and financial support was provided to 6 companies *(NCRST, 2024)*. The Ministry of Agriculture does have its own research department with substantial research activities as a sectoral ministry. A major new development in STI-related national policies is the Environmental Investment Fund, with over N$ 2.3b (115.6m EUR) in anticipated funding for environmentally-related investment, such as in the green hydrogen value chain, see ***Figure 14***.

However, Namibia is active in international projects that have an innovation component (see Table 8 below). Typically, these projects have a strong challenge-oriented focus where innovation is seen as an important part of the solution, and hence these projects are often closely aligned with the challenge addressed by the roadmap. In particular the Biodiversity and BioInnovation projects (GIZ) are directly related to supporting opportunities for business model innovation, supporting sustainable (rural) development and commercialisation of indigenous knowledge. Similarly, Make IT Africa (GIZ, EC) support incubation and scale-up, including specifically in the green hydrogen sector. However, there are limited projects focused on research activities, although Namibia is notably present in a few relevant Horizon2020 Europe projects (such as Smart Energy Solutions). Finally, there is notable development on fundraising for green hydrogen, with a 1bn Sovereign Wealth Fund in development, focused on green hydrogen. However, this instrument does not (yet) integrate an STI-component into its approach.

Overall, there is substantial activity, but due to the project-based structure and limited coordination between development partners, the actions together do not constitute a full STI-instrument mix addressing the challenge area. Two of such projects are highlighted in ***Figure 15***.

2 *Note that we focus here on policy instruments that directly include STI(-related) activities, such as programmes funding research, innovation and technology diffusion projects, or related initiatives such as entrepreneurship, skills development etc. We focus only on instruments that are currently in the implementation phase, not on general foreseen actions or ambitions in the future which still have to materialise. The section is not exhaustive and presents the main instruments as identified through desk research and interview partners. Private initiatives are not included here but presented in the section on the innovation ecosystem.*

TABLE 7.
OVERVIEW OF KEY NATIONAL INSTRUMENTS (SELECTION)

Instrument	STI component	Link to Challenge Area	Volume of Funding / Scope	Type of Instrument
NCRST Fund	Funding Research and Innovation	Challenge area is mentioned as priority under the NSTIP	At the moment not funded	Fund for grants
Environmental Investment Fund – Ministry of Climate Change	Includes business model innovation focused on nature-based enterprises	Linked to an ecosystem-based adaptation approach	In total N$ 2.3b (115.6m EUR) over 10 years	Grants
Namibia Agricultural Mechanisation and Seed Improvement Project (until 2022) – Ministry of Agriculture	Technology diffusion	Focus on sustainable crop and livestock management	N$1.42b (71.37m EUR) between 2018-2022 (AFDB)	Direct implementation programme
FembioBiz (NRSRT)	Entrepreneurship and business development support	Focus on the agri-food value chain, and bioeconomy more broadly	~50k per year (500k per year for 9 African countries)	Training Awards
Grassroots innovation Programme (NCRST))	Social innovation, entrepreneurship support	Not explicitly	Probably limited scope (1 training in 2022/23)	Training
Boost-up Series (NCRST)	Entrepreneurship support, incubation	Not explicitly	3-part series of start-up events	Training/coaching, events
National Science Fair (NCRST)	Science promotion among youth	Not explicitly	Annual event	Event
National Student Research Symposium (NSRS) and National Research Symposium (NRS)	Networking, Research exchange	Not explicitly	Annual event	Event
Science-granting Councils Initiative 2 (NRCST)	International cooperation, capacity building in the science system	Projects on agriculture, biotechnology, water and IKS	Five research projects, 3 innovation projects (2023)	Capacity building for science policy makers, nrcrst
Apprenticeship scheme (National Training Authority)	Skills development	Not explicitly.	About 500 employees in 50 companies (2019-2020)	Training/ apprenticeship
Ministry of Agriculture Research Programme	Research programme	Sustainable agriculture	Scope/ volume unclear	

FIGURE 14.
RELEVANT EXAMPLE OF NATIONAL PROGRAMME IN THE CHALLENGE AREA

The **Environmental Investment Fund of Namibia** is a fund created by Act 13 of 2011 by the Parliament of the Republic of Namibia. Its overall aim is to ensure the sustainable use of resources in Namibia. It funds environmental projects in the field of recycling, circular economy and renewable energy, amongst others, primarily through concessional loans. By mid-2024, the current loan book is N$12.9m (650k EUR). It also supports various projects through grants, including research, technology and innovation projects, and hosts several initiatives (UNDEP GEF, SUNREF) and is the official country implementing partner for the Global Climate Fund and the Global Environment Facility. EIF is also a participant in the new SDG Namibia One Fund, Namibia's dedicated green hydrogen blended finance vehicle with designated 1b target (23m funded so far by national and international investors).

Environmental **Investment** Fund of **Namibia** | ensuring sustainability

TABLE 8.
PROJECTS IMPLEMENTED WITH INTERNATIONAL PARTNERS

Instrument	STI component	Link to Challenge Area	Volume of Funding / Scope	Type of Instrument
SUNREF Programme (AFD)	Business model innovation focused on energy finance	Focuses on the Energy Component	45m EUR	Green Credit
Green Bond Initiative (EU/ INTPA)	Funding green innovation	Focus on renewable energy		
Twinning for Standards (EU/ INTPA)	Standards development	Not specific	1.6m EUR	Capacity Building
Technical assistance (TA) to enhance value addition, market access and competitiveness of private sector in Namibia in order to promote trade under the EPA	Value addition, market access of private sector	Linked to agrifood value chains		Technical assistance/capacity building
Water Management Programme (AFD)	Research capacity building for water management	Direct link to water challenge and drought	1m	Capacity building
Biodiversity Economy Project (2019-2023), GIZ	Business model innovation	Direct link to climate change, sustainable agriculture and environmental challenges in rural contexts	5m EUR (2019-2023)	Direct implementation programme
Bio Innovation in Africa (BIA) Project (GIZ) – Phase 2	Innovation, market access for new products	Direct link to climate change, sustainable agriculture and environmental challenges in rural contexts	NA	Grants, around value-chain projects
Water Security (UNESCO)	Education, awareness raising	Link to water risks	15k USD	Education, Awareness raising
Strengthening Science, Technology and Innovation Systems for Sustainable Development in Africa (SSTISSDA), (SIDA/UNESCO)	Science system strengthening, capacity building for NCRST	No specific link.	NA	Capacity Building for Science System (public officials)

Instrument	STI component	Link to Challenge Area	Volume of Funding / Scope	Type of Instrument
Make IT Africa (GIZ, European Commission):	promoting innovation and entrepreneurship,	Linked to Green Hydrogen opportunities	NA	Capacity building, training for entrepreneurs
Africa Regional Scholarship and Innovation Fund for Applied Sciences, Engineering and Technology	Research training (PhD), short courses, research funding (PhD projects)	No specific link	(Unclear if still open)	Training
AfricaMaVal (Sustainable Raw Materials): Horizon Europe (partner: NUST)	Research & Innovation project	Sustainable value chains, in particular around mining (link to energy)	Small role for Namibia	Research project
SESA (Smart Energy Solutions): Horizon Europe: NUST	Local living labs, co-development of scalable and replicable solutions	Focus on decentralised renewables	Namibia one of the imple-mentation partners	Research project
SDG Namibia One (Invest International NL, EIB)	Not explicated	Focus on hydrogen	1bn blended financing vehicle	Sovereign Wealth Fund

FIGURE 15.
RELEVANT EXAMPLES OF INTERNATIONAL COOPERATION PROJECTS IN THE CHALLENGE AREA

AfricaMaVal (Horizon Europe)

AfricaMaVal aims to build an EU and Africa business networking on the whole CRM value chains. AfricaMaVal is a 42-month project gathering 18 partners from 11 countries. It is coordinated by BRGM, the French Geological Survey. The consortium gathers African and European experienced organisations, associations, and networks deeply anchored and involved in the raw material domain with specific expertise, and knowledge. n a co-development perspective, AfricaMaVal project aims to develop an EU-Africa partnership ensuring a responsible sourcing of mineral resources for the European industry while granting a sustainable local co-development in the best Environmental, Social and Governance (ESG) conditions and leading to a long-terms business environment for European and African companies.

Indeed, while the development of the African mining sector will expand the availability of ECRM for EU supply chains, the increased investment and financing can allow the EU to exert leverage on raw material supply chain conditions in order to improve their sustainability profile.

This will be achieved for instance by linking sustainability requirements in project financing with recent consumer-driven trends of Environmental, Social, and Governance (ESG) investment and enhancing the integration of ESG challenges into business models.

NUST is the partner on behalf of Namibia

Source: ***https://africamaval.eu/***

BioInnovation (GIZ)

BioInnovation Africa supports African-European business partnerships for biodiversity-based value chains that are based on high ethical, social, and environmental standards, including equitable benefit-sharing and the sustainable use of Africa's genetic resources.

The objective is to promote social-ecological change and reconcile environmental and socio-economic sustainability in biodiversity-rich areas for the benefit of all. BioInnovation Africa supports the implementation of ABS (Access and Benefit Sharing) frameworks, strengthening stakeholder capacities in provider countries through blended learning trainings on inter alia the valorisation of biodiversity, business development and ABS negotiation skills.

The project also offers both providers and users general advice on ABS contracts and facilitates the development of IT-based online systems for ABS applications, permitting and monitoring. As part of benefit-sharing for conservation activities, the project supports the roll-out and implementation of national guidelines for benefit sharing mechanisms and concepts for financing instruments. To encourage biodiversity-based value chains and long-term business relations between providers and users, the project facilitates various knowledge exchange formats and sector dialogues. Likewise, BioInnovation Africa promotes technology transfer to increase local value addition and the creation and improvement of green jobs in provider communities

Source: ***https://www.giz.de/en/downloads/Project%20Factsheet_BioInnovation%20Africa_EN.pdf***

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

3.1. PARTICIPATORY IDENTIFICATION OF OPPORTUNITIES AND CHALLENGES

In the previous chapters we have analysed the challenge area, the existing policy landscape, and the research and innovation system capabilities to mobilise STI to increase climate resilience of rural communities in Namibia. The next step was the identification of priority investment areas, where the needs of the challenge can be addressed by STI investments, considering the existing innovation capabilities (this chapter). This deliberation was followed by concrete policy recommendations aiming to strengthen the STI system's capabilities to deliver on current and future STI investments in Namibia (Chapter 5). Given the pilot character of this roadmap, we first explicitly reflect on the participatory approach taken in 4.1, before presenting the solution areas in 4.2, which are based on a synthesis of the participatory approach, desk research and interviews.

In line with the STI Roadmaps for SDGs approach, the identification of the priority investment areas was conducted in highly participatory manner. This participatory approach started with iterative engagement with the national counterparts of the NRCRST and MHETI to define the scoping of the challenge and analyse the policy landscape and science and innovation capabilities, but found

FIGURE 16.
WORKSHOP PARTICIPANTS

Source: authors

its apex in various interviews with Namibian stakeholders and an extensive full-day opportunity identification workshop on 30 April 2024.

The workshop was designed to combine stakeholder experiences, informed with evidence from this study, into an important basis for concrete substantive potential areas for investment. The workshop included more than 50 participants, including public officials from the main STI bodies (MHETI and NCRST), different sectoral ministries, representatives from regional councils, academic experts, members of women groups, members of youth entrepreneurship groups.

The formal opening by senior MHETI (Dr Lisho Mundia) and NRCST (Dr Nhlanhla Lupahla) was followed by introductory presentations: the STI for SDG methodology (JRC, Dr Michal Miedzinski), the concept of indigenous knowledge (by Namibian expert Prof Heike Winschiers-Theophilus), the policy landscape (Mr Gernot Piepmayer, NCRST), and the challenge area analysis (Dr Matthias Ploeg, JRC Expert).

The participatory sessions of the workshop followed three discussion rounds.

ROUND 1. COLLECTIVE DISCUSSION ON THE CHALLENGE AREA AND ITS FRAMING

Using an online live voting tool, combined with plenary discussion, we found that the overall challenge area resonated significantly with the workshop participants. In terms of important aspects, participants mentioned food security (10 times), water scarcity/drought (7 times), and affordable energy (2 times) as aspects directly in the nexus. Interestingly also related topics were mentioned, including lack of mobility/ transport infrastructure, animal health, and rights of indigenous knowledge. In general, a recurring finding was that (animal and human) health could almost be considered a fourth aspect of the nexus perspective, given the close relationship between water & food security and health.

ROUND 2. IDENTIFICATION AND MAPPING OF OPPORTUNITIES

In the second session, the participants focused on the identification and mapping of the main STI-related opportunities for the challenge area. Participants were asked to first individually come up with 3-5 potential solutions (either technological or non-technological), and then in a small group of 8-10 participants map these opportunities along a matrix covering both the potential impact (vertical axis) and the existing capabilities to implement the solutions. Using the matrix helped to create a diverse mix of 'high-difficulty-high-reward', priority investments and 'low-hanging-fruit'. Using different coloured post-its helped participants to generate not just technological solutions (which is an immediate response typically), but keep the solutions also open to different types of innovations.

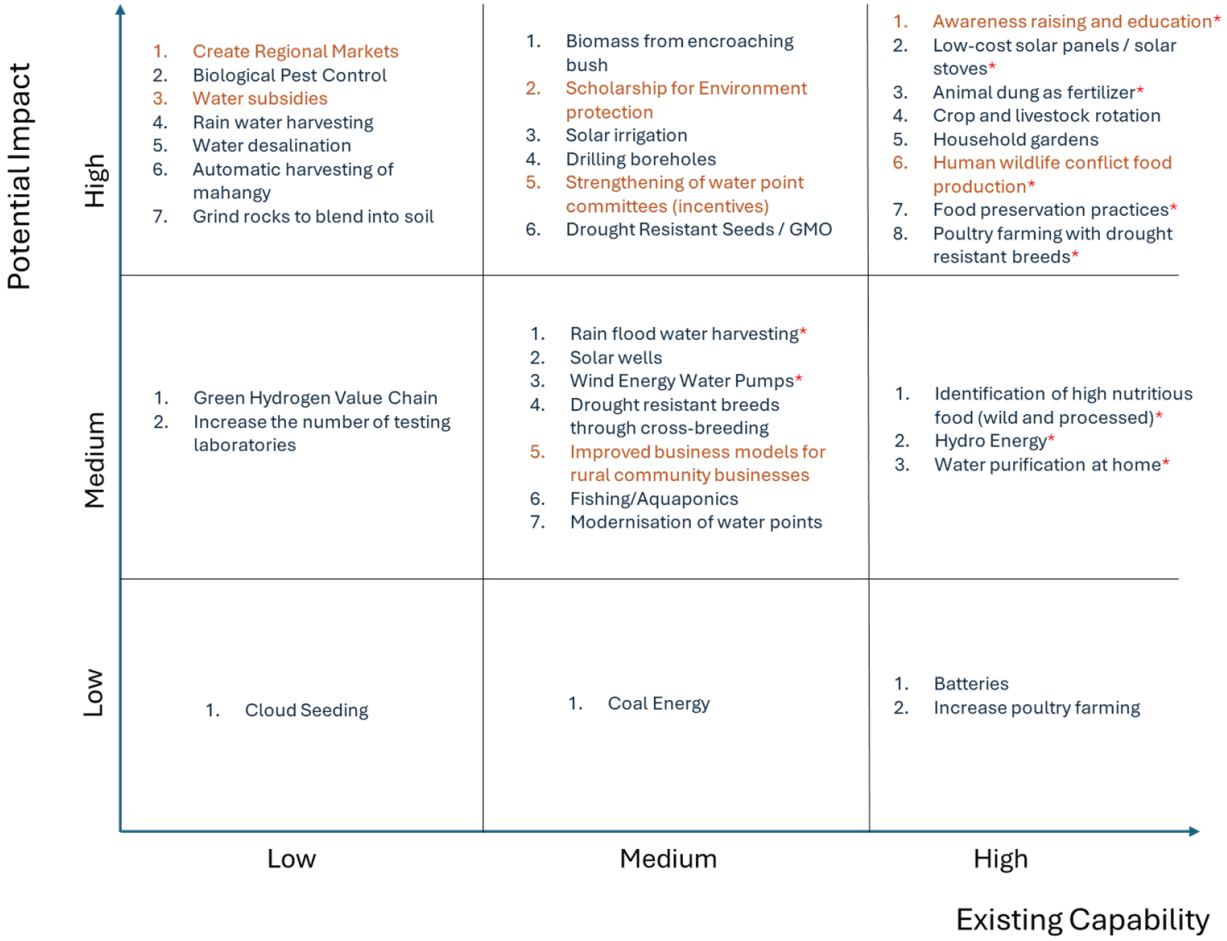
As a next steps, are participants were asked to vote (using yellow stickers) on all solutions, and to indicate with red stickers where they saw an opportunity for bringing in indigenous knowledge. The final result was reflected on in a plenary discussion.

ROUND 3. GAPS AND OPPORTUNITIES IN TERMS OF SYSTEM CAPABILITIES

As a final step, participants were also asked to reflect on gaps in the system and its capabilities to implement these solutions addressing the challenge. What ensued was a diverse and rich discussion regarding the potential role of policies and government more broadly to implement solutions. Examples included improving regulations for decentralised solar power, building hydrological capabilities in the government, establishment of a revolving fund, purchasing equipment, awareness raising, tax incentives and skills building at regional centers.

The debate painted a picture of the complex policy system impacting the challenge area and its solutions, ranging from general economic policies (taxation etc.) to sectoral policies (education, agriculture, energy). It was challenging to collect information on STI policies specifically, likely due

FIGURE 17.
PRIORITY AREA ANALYSIS



*Legend: Colours: blue = technological; red = non-technological; * is potential for indigenous knowledge). Numbers indicate priority based on group voting.*

to the limited exposure the stakeholders have had to such policies in practice. While we mitigated this by various short presentations regarding potential STI policies, and a rich key-note lecture on indigenous knowledge by Prof. Heike Winschiers-Theophilus, this issue persisted. Nevertheless, the overall experience in this participatory design of the roadmap was overwhelmingly positive, and generated rich inputs for the definition of investment areas (next section, 4.2) and policy recommendations (5.1).

3.2. OPPORTUNITY AREAS TO MOBILISE STI FOR THE CHALLENGE

The combined insights from the stakeholder workshop, desk research, interviews and data analysis allow to identify relevant STI investment areas with the potential to strengthen climate resilience of rural Namibian communities, considering the water-energy-food nexus and the potential role of indigenous knowledge:

- Broad investments around a STI-informed value-chain for **(decentralised) renewable energy**. Namibia has clear potential for both small-scale and large-scale renewable energy generation, which could immediately support local (and rural) energy needs. Within such

investment, building a STI-profile through the building of local capacity along the value chain through skill development, local innovative adaptation of business models, building research capacity, etc. could be of high importance for generating local opportunities as well as addressing energy needs.

- Further unlock the opportunities of already proven as well as promising **grassroots innovations** in the broader bioeconomy (agriculture, food, biomass for energy, nature conversation etc.) with a focus on increasing resilience to climate change. This includes a mix of high-tech agronomic research on drought-adapted crops and breeds, frugal innovations, social innovations (e.g. such as community based conservancy models *(Wenborn, Svensson, Katupa, Collinson, & Nijman, 2022)*, with a specific role for indigenous knowledge. There are opportunities to scale-up responsibly local knowledge in international value chains, with a respect for the rights of indigenous knowledge holders.

- While the policy analysis showed that Namibia's policies are relatively coherent and synergistic when it concerns addressing the challenge of climate change in rural context, in particular in the water-energy-food nexus, there is still a strong need for more **integrated approaches in policy and practice**. In policies, connections need to be built between traditional economic and investment policies, as well as between STI policies and regional councils.

- **Build and unlock national and international scientific knowledge for policy challenges**, including those in water management, agriculture and energy policy. Scientific knowledge is currently not optimally available to decision makers (public, as well as private), and a more systematic approach to science for policy could help policy makers navigate the complexities of the nexus.

- More investment in **technical skills and competences** are important, given the downward trend of students focusing on these areas, especially given the current and future needs to navigate the challenges of the water-energy-food nexus. This ranges from formal STEM-promotion at national level, to widely available (including in rural context) opportunities for **entrepreneurial youth** to be exposed to technical opportunities (e.g. in maker spaces).

It is important to note that these concern substantive areas, with the following sections discussing the STI system gaps (drivers and barriers 3.3) and potential actions (*Chapter 4*).

3.3. ANALYSIS OF MAIN DRIVERS AND BARRIERS IN TERMS OF ADDRESSING THE CHALLENGE

In order to deliver on these investment opportunities, it is important to recognise both internal and external drivers and barriers that affect any potential policy action going forward. *Table 9* presents an overview of the main identified barriers and drivers in categories of economy, funding and investment, policy and system coordination, knowledge production, and innovation, entrepreneurship & knowledge exploitation.

TABLE 9.
OVERVIEW OF DRIVERS AND BARRIERS

Barriers	Drivers
Economy, Funding, Investment ■ Limited direct funding for STI activities ■ Investment in off-shore oil exploration could risk competing with climate-resilient investment agenda's **Policy and system coordination** ■ Limited implementation capacity ■ Limited coordination in the STI system ■ Limited data availability and the use of science for policy design and implementation ■ Limited coordination of relevant investments from foreign development partners **Knowledge production** ■ Limited involvement of the private sector in R&D ■ Limited RTO/contract research **Innovation, entrepreneurship, knowledge exploitation** ■ Lack of technical/vocational skills, especially in remote areas ■ Weak exploitation of scientific research results ■ Limited entrepreneurial ecosystem, notably in rural areas	**Economy, Funding, Investment** ■ Substantial international investments in renewables (EIF, Green Hydrogen etc.) ■ (Potential) investments in resource extraction (mining, off-shore oil etc.) could provide value chain opportunities. **Policy and system coordination** ■ Strong political recognition of the challenge ■ Consistent policy mix **Knowledge Production** ■ Growing R&D staff ■ (Some) Research Infrastructure in place ■ Existing and emerging areas of research excellence linked to the unique Namibian environment (e.g. SASSCAL, research on desert ecosystems funded by the Desert Research Foundation of Namibia at Gobabeb station) **Innovation, Entrepreneurship, Knowledge exploitation** ■ Community based approaches to nature protection and conservancy (Community Conservancy Models) ■ Experience in combining traditional and 'standard' knowledge (e.g. in medicine and agriculture) ■ Significant renewable energy potential based on the country's climate, solar irradiation and land use (notably solar energy and green hydrogen) ■ Young entrepreneurial talent

Sources: Stakeholder interviews and literature

4. CONCLUSIONS AND ACTION PLAN FOR THE STI FOR SDGs ROADMAP

This section presents an action plan that outlines essential investment areas and policy instruments aimed at strengthening resilience of rural communities to climate change through STI. The actions identified are based on comprehensive inputs from stakeholders, gathered through workshops and interviews, ensuring that they are contextually relevant and feasible. ***Section 4.2*** introduces these actions by specifying proposed activities, responsibilities, expected outputs, and timing.

4.1. KEY CONCLUSIONS AND POLICY MESSAGES

Climate change is among the direst challenges for Namibia. Changing climate patterns exacerbate already challenging living and working conditions of the majority of Namibians, especially those living in the rural and remote areas. Strengthening rural resilience to changing climate conditions is one of the main development challenges of the country.

Changes in climate have systemic and interconnected impacts on society, economy and natural ecosystems that manifest themselves differently in different places. This report highlights the need to ensure that innovations developed and deployed in rural communities consider the interconnected nature of water, food and energy systems. Each of these systems have resource requirements which, at times, may be conflicting. This may happen when, for example, limited water resources are required for both food and energy production. Building climate resilience requires systemic understanding of the challenges and systemic solutions that are adapted to the local conditions. The solutions to systemic challenges need to be developed and applied carefully to use natural resources efficiently and minimise the risks of rebound effects, i.e. causing new problems elsewhere in the system as a result of implementing a solution to a problem.

Science, technology and innovation (STI) are pivotal for developing systemic knowledge, capacities and integrated solutions that help transform rural communities to become more resilient to climate change. The dedicated focus on mobilising STI for regional development and rural communities is an important dimension of STI policy.

Namibia is on the cusp of investing in the “big ticket” opportunities of green hydrogen and moving forward with the large scale resource extraction projects following the discovery of the off-shore oil fields. The promise of these developments takes the lion share of attention of politicians, policy makers and investors. Despite the narrative assuring that benefits of these large-scale projects will benefit ordinary Namibians, the projects are in their planning or demonstration stages and, for now, far from the majority of where rural communities dwell. While it is important to consider how these large developments can benefit rural communities in the future, it is key to ensure that STI policy remains open to innovation pathways which respond to local needs and build on local assets and opportunities.

Based on the desk research and discussions with Namibian stakeholder, we have highlighted several areas in which investment in STI can help rural communities. Undoubtedly there are many more untapped investment opportunities which remain to be discovered and, if relevant, scaled. Therefore,

our recommendations also focus on governance mechanisms of continuous discussion and collective discovery of localised opportunities and solutions.

This section describes broad STI policy and governance areas for the STI for SDGs roadmap in Namibia. These areas are elaborated in a proposed action plan for the STI for SDGs roadmap introduced in the following section. The proposed actions are designed to channel STI investments towards opportunity areas identified in the preceding chapters.

STRENGTHEN GOVERNANCE AND POLICY INTEGRATION TO FOSTER STI FOR RURAL CLIMATE RESILIENCE

There are many policy strategies and instruments supporting R&I with relevance for strengthening climate resilience. There is, however, insufficient collaboration and coordination across policy fields ensuring the overall directionality and coherence of instruments. The absence of "big picture" leads to the lack of awareness of "who is doing what" and may result in missed opportunities to benefit from synergies between STI policy and other policy areas. The limited - and often lack of - collaboration between donors active in Namibia adds additional challenges to align and learn between relevant investments.

Many stakeholders recognised the importance to adapt public policies and governance supporting STI to specific geographic contexts, local capabilities and needs. There is a need to develop appropriate governance mechanisms and "policy spaces" supporting inter-ministerial collaboration and broader collaboration between public, private and non-governmental actors. There is a need for "policy spaces" support developing place-based strategies that address local needs and challenges based on local capabilities and market opportunities. The governance processes should include diverse stakeholders, including business, research, NGOs and policy makers, as well as actors less represented in policy processes such as small farmers, local cooperatives, women and youth.

We propose two processes in this respect: a cross-ministerial committee led by the Prime Minister to coordinate policies and their implementation, and a multi-stakeholder forum to open discussions between the Government and the other actors. The bodies could establish dedicated groups or task forces to focus on specific policy issues, including putting forward concrete suggestions on how to integrate challenges of rural resilience and the water-energy-food nexus in the research, innovation and development policies.

NETWORK OF REGIONAL CENTRES AND MOBILE LABS TO SUPPORT REGIONAL INNOVATION ECOSYSTEMS

There are many examples of successful research projects and innovative solutions across Namibia. For example, the collaborative approach to nature conservation developed in the country is considered as one of the most successful in Africa. However, the current STI policy does not sufficiently elaborate on the territorial dimension of science, technology and innovation. As a result, many government programmes supporting research and innovation have only limited focus and outreach to the remote and rural regions.

We propose to develop a network of regional innovation centres and mobile labs to support place-based research and innovation potential, including through sharing good practices, demonstrations and development of concrete solutions to local problems. The centres will develop and scale cost-effective and sustainable solutions specifically designed for the unique challenges of Namibian regions. They will focus on creating innovations that require minimal resources and are easily adoptable by local communities, including smallholder farmers and rural entrepreneurs. The labs will leverage local materials and indigenous knowledge to design tools and processes that improve agricultural productivity, water management or food preservation. Key activities will involve, among others, collaborative workshops, prototype development, field testing, and community training sessions. The centres will also serve as incubation

centres for young innovative entrepreneurs and startups, providing them with the necessary support and infrastructure to develop and scale their ideas. This also creates infrastructure for STEM-promotion among youth through maker spaces. This network of regional and mobile labs would also be integrated with the national testing laboratory (see below).

BUILDING STRATEGIC INTELLIGENCE AND EVIDENCE BASE FOR POLICIES

There are few policy evaluations and strategic studies focused on STI policy and the role of STI in Namibia. There is a need for policy makers at national and regional level to have access to the best scientific evidence and insights in order to inform their policies, and to create a feedback loop between policy practice and evidence through monitoring & evaluation practices. This should be a continuous policy learning rather than one-off studies.

The challenges facing Namibia in the context of climate change and rural resilience, in the nexus of water, energy and food, are highly complex and interlinked. There is a need to establish and strengthen "science for policy" spaces for dialogues and collaboration processes focused on resilience of rural communities embracing the complexities of nexus. We propose setting up research collaboration network to engage research institutes and universities, research-performing NGOs and development partners, and research officers from relevant ministries and statistical office. This network could become an virtual think tank supporting evaluation studies, impact assessments and foresight studies on research and innovation activities relevant for rural resilience.

Establishing a science for policy practice in Namibia could be implemented through several interconnected activities (e.g. communities of practice) and creating specific roles within public institutions (e.g. research liaisons within departments, agencies, regional councils). As such, the whole science for policy system would be strengthened from all sides.

RESEARCH INFRASTRUCTURE: INTERNATIONALLY RECOGNISED TESTING LABORATORY

A lack of internationally recognised (with appropriate standards) research facilities for both commercial, public and research use is a limiting factor for both research and commercialisation of innovations, in particular in the areas of water and the agrifood value chains. Resources should be mobilised to establish a national testing laboratory, building on existing research infrastructures, that caters to both public and private research and innovation needs. The testing laboratory should obtain the appropriate international qualifications to allow for recognition and access to export markets for agrifood products. The national testing laboratory should be responsible for the exploitation of the 'moving laboratory' (see investment priority 3), in order to also provide access to basic testing services in rural areas

TOWARDS STRATEGIC INTERNATIONAL RESOURCE MOBILISATION

With relatively limited domestic resources for research & innovation activities, accessing international funding opportunities is particularly relevant for Namibia. Namibia is well embedded in several international research partnerships, and also has opportunities in terms of broader international economic cooperation (e.g. in the area of green hydrogen). However, more capacity and strategic focus is needed to convert these opportunities into concrete benefits for Namibia, in particular also for rural communities.

4.2 PROPOSED POLICY ACTIONS FOR THE STI FOR SDGs ROADMAP

Actions	Lead	Partners	Output	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.*
1. Cross-Ministerial Committee on Research and Innovation for Rural Resilience and Wellbeing Establish a high-level cross-ministerial committee led by the President's Office to coordinate policies and their implementation across various domains and sectors related to strengthening rural resilience to climate change, including consolidating diverse policies and actions covering all aspects of the nexus; mapping and coordinating international projects and programmes implemented with external funding (with the aim to avoid duplications, effectively transfer knowledge and technology, and identify actions and resources for scaling up successful ones); enabling cohesive, evidence-based policymaking; monitoring and evaluating policies and instruments; fostering effective inter-sectoral collaboration. The committee can form specialised working groups (or task forces) on the level of senior officials. ■ Task Force to integrate challenges of rural resilience and the water-energy-food nexus in STI and development policies, as well as those of industry and SME development perspectives ■ Task Force to strengthen collaboration with international, regional (SADC) and cross-border STI actors and initiatives focused on rural resilience and nexus ■ Task Force to develop a workable regulatory and policy criteria to ensure that foreign investments benefit local communities	Cross-Ministerial Task Force chaired by the President's office *Executive Secretariat of NCRST to act as the Secretariat of the Committee*	Relevant line ministries and public bodies.	Update of policy strategies, strategic frameworks, and investment guidelines	Short term
2. National Multi-Stakeholder Platform on Research and Innovation on Rural Resilience Government, research and education institutions, private sector, NGOs, and development partners. The platforms will aim to facilitate the identification of common problems and innovative solutions, scaling of innovations that enhance food security, environmental sustainability, resilience, and social inclusion.	NCRST	Line ministries, local governments, education institutes, NGOs, farmers and cooperatives, private sector representatives, technology providers	.Research and Innovation Agenda	Short term

Actions	Lead	Partners	Output	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.*
3. Regional Centres and Mobile Research and Innovation Labs for Rural Resilience and Wellbeing Labs will develop and scale cost-effective and sustainable solutions specifically designed for the unique challenges of Namibia. They will focus on creating innovations that require minimal resources and are easily adoptable by local communities, including smallholder farmers and rural entrepreneurs. The labs will leverage local resources and indigenous knowledge to design tools and processes that improve agricultural productivity, food preservation, and resource management. Key activities will involve e.g. collaborative workshops, prototype development, field testing or community training sessions. They will be equipped with essential technological infrastructure such as 3D printers, basic electronics toolkits, and software for design and simulation, enabling rapid prototyping and iterative development of agricultural tools and solutions. The labs will serve as incubators for young innovators and start-ups, providing them with the necessary support to develop and scale their ideas. Given the population density of Namibia, a combination of regional centres with basic facilities with a mobile -or "travelling"- labs with supporting staff and equipment (see investment area 4) providing more advanced support at regular intervals. Mobile R&I infrastructures have the advantage of being resource efficient, while also promoting knowledge dissemination and cross-fertilisation of innovation ideas between Namibia's regions. Concrete activities in the labs could include: ■ Supporting (frugal) innovation based on indigenous knowledge ■ Testing collaborative innovative business models for affordable water & electricity for local business and communities (addressing the problem of using water and electricity without payments) ■ Promoting of STEM among youth ■ Engaging local youth (incubation, scholarships, maker spaces) ■ Providing access to basic research and testing equipment.	NCRST	Regional Councils, Relevant Line Ministries, Local authorities, representatives of indigenous knowledge holders, incubators, maker spaces, youth, broader private sector, development partners	Regional R&I lab infrastructure Mobile R&I lab infrastructure	Short term soft launch, fully operational medium term
4. Research infrastructure: internationally recognised testing laboratory A lack of internationally recognised (with appropriate standards) research facilities for both commercial, public and research use is a limiting factor for both research and commercialisation of innovations, in particular in the areas of water and the agrifood value chains. Resources should be mobilised to establish a national testing laboratory, building on existing research infrastructures, that caters to both public and private research and innovation needs. The testing laboratory should obtain the appropriate international qualifications to allow for recognition and access to export markets for agrifood products. The national testing laboratory should be responsible for the exploitation of the 'moving laboratory' (see investment priority 3), in order to also provide access to basic testing services in rural areas.	NCRST	Universities, Private Sector, Relevant Line Ministries, Regional scientific partners.	Accredited testing laboratory Facility for rural access (moving lab)	Short term for accreditation Medium term for integration with mobile/regional labs

Actions	Lead	Partners	Output	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.*
5. Science for Policy The challenges facing Namibia in the context of climate change and rural resilience, in the nexus of water, energy and food, are highly complex and interlinked. There is a need for policy makers at national and regional level to have access to the best scientific evidence and insights in order to inform their policies, and to create a feedback loop between policy practice and evidence through monitoring & evaluation practices. Establishing a Science for Policy practice in Namibia could be implemented through a phased and modular approach, with multiple elements strengthening each other: ■ Research liaisons within departments, agencies, regional councils and other relevant public bodies. These should ideally be civil servants with an affinity for science. Research liaisons have the role of nurturing contact with Namibian scientists to establish a policy-research dialogue (e.g. through inviting researchers to planning meetings, having an annual latest insight from research presentation, feeding researchers with concrete ideas from policy challenges). ■ Multi-stakeholder community of practice for science liaisons, where officials can deliberate and exchange practices on how to advance the practice of science for policy in the Namibian civil service. ■ Focal points in research organisations and universities for public services that have evidence needs. ■ (Virtual) independent policy think tank with two roles: ■ Cyclical integrated monitoring, evaluation and foresight of the territorial impacts of policies. ■ Demand driven investigation of policy-relevant questions in an evidence-based manner (using national and international expertise), at request of ministries, agencies, regional councils or other relevant bodies (including parliament).	NCRST	Line ministries, authorities, universities, research institutes, international and regional scientific partners	Research Liaisons within Ministries Focal points in Universities An inter-ministerial community of practice for research liaisons A (virtual) independent think tank	Short term: focal points; community of practice, research liaisons. Short/medium term: policy think tank (can be scaled over time)

Actions	Lead	Partners	Output	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.*
6. Strategic International Resource Mobilisation With relatively limited domestic resources for research & innovation activities, accessing international funding opportunities is particularly relevant for Namibia. Namibia is well embedded in several international research partnerships, and also has opportunities in terms of broader international economic cooperation (e.g. in the area of green hydrogen). However, more capacity and strategic focus is needed to convert these opportunities into concrete benefits for Namibia, in particular also for rural communities. The following activities could be pursued to improve international resource mobilisation: ■ Set up a technical task force for resource mobilisation for R&I, including senior officials from the line ministries and the President's office. The task force should develop a strategy and implementation plan of where these resource mobilisation efforts should focus (see Recommendation 1) ■ Provide business development support to researchers and innovators in how to access international competitive funding. This could include monitoring calls, proactively linking Namibian researchers to international counterparts, technical writing supports, administrative guidance etc. This could be linked to the NCRST NCP function, but would also require more 'hands-on' support from experienced business/proposal developers. ■ Promote Namibia as a destination for internationally funded research infrastructure, such in the area of space, geo-observation, climatological research etc, given the unique opportunities of Namibia's geography (extreme climes, no light pollution). Such research infrastructure creates a substantial local spillover effect. ■ When negotiating local content requirements in international investment deals, include training and upskilling opportunities for Namibian workers, as well as involvement of Namibian researchers explicitly as priorities in the negotiation, in order to build productivity and capacity long-term, also for local populations.	Cross-Ministerial Task Force chaired by the President's office	Relevant Line Ministries, Authorities, National and International Investors, Bilateral and Multilateral Donors,	Task for resource mobilisation for R&I (linked to recommendation 1) Business development support facility for researchers and innovators Successful lobby for international research infrastructure investment Improved investment deals	Short term: Task Force, Business Development Facility Medium term: International research infrastructure investments, impact on investment deals.

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LIST OF ABBREVIATIONS

AFDB	African Development Bank
AU	African Union
CCHUB	Co-Creation Hub
DG INTPA	Directorate General for International Partnerships
EC	European Commission
EIF	Environmental Investment Fund
ESG	Environmental, Social, and Governance
EU	European Union
FAO	Food and Agriculture Organization
GAIN	Global Adaptation Index
GCF	Green Climate Fund
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
ICT	Information and Communication Technology
IOs	International Organizations
IRENA	International Renewable Energy Agency
ISICED	International Standard Classification of Education
JRC	Joint Research Centre
MHETI	Ministry of Higher Education, Technology and Innovation
NCRST	National Commission on Research, Science and Technology
NDP	National Development Plan
NEPAD	New Partnership for Africa's Development
NGHRI	Namibia Green Hydrogen Research Institute
NPD	National Planning Commission
NSTIP	National Science, Technology and Innovation Policy
NUST	Namibia University of Science and Technology
R&D	Research and Development
R&I	Research and Innovation
SADC	Southern African Development Community
SDGs	Sustainable Development Goals
STEM	Science, Technology, Engineering, and Mathematics
STI	Science, Technology, and Innovation

TVET	Technical and Vocational Education and Training
UN	United Nations

LIST OF FIGURES

LIST OF TABLES

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 18***).

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 18.
KEY COMPONENTS OF STI FOR SDGs ROADMAP

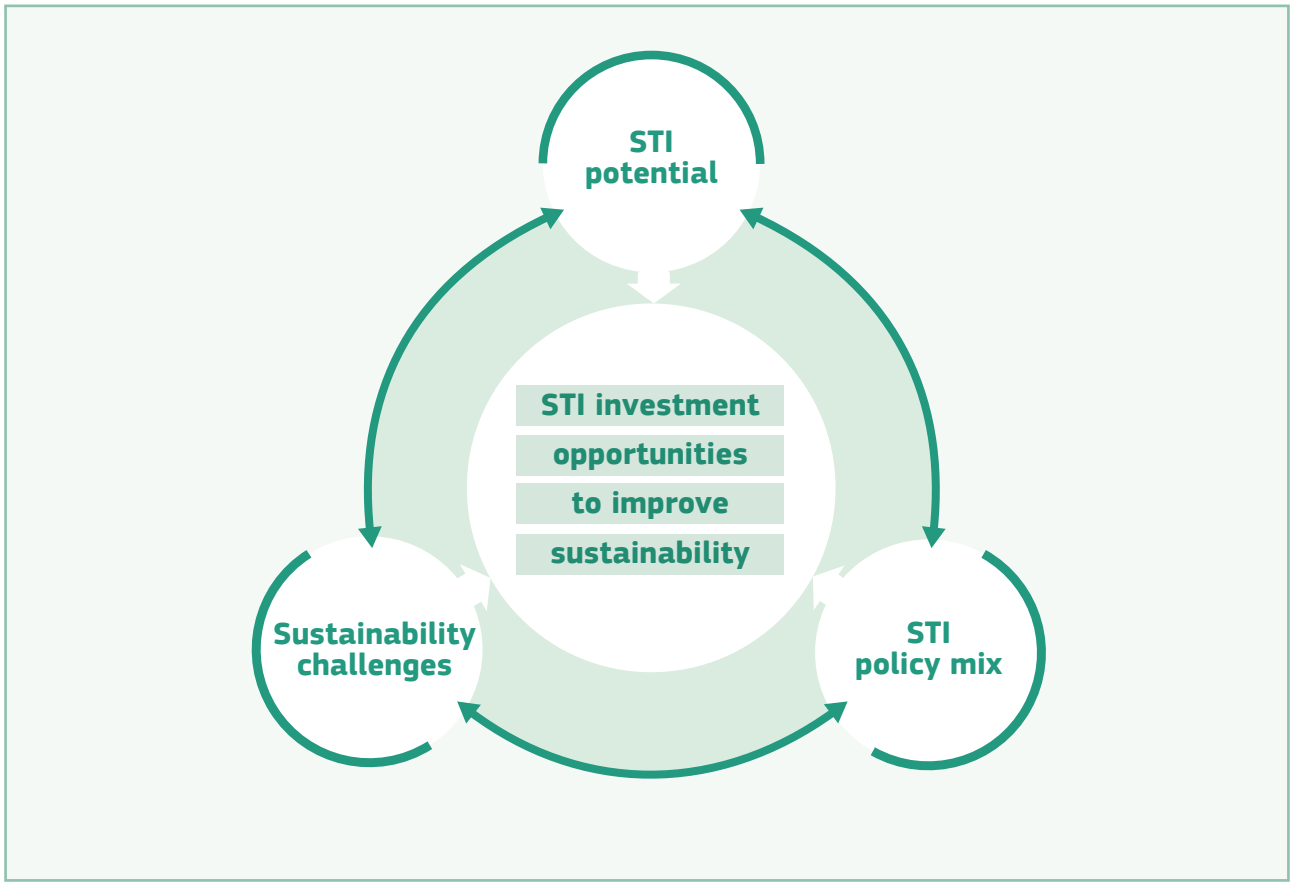

TABLE 10.
KEY COMPONENTS OF STI FOR SDGs ROADMAP

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)

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 10* 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.

I.2. COUNTRY-SPECIFIC OBSERVATIONS: NAMIBIA

SUSTAINABILITY CHALLENGE

The country team proposed to focus the roadmaps on the role of science, technology and innovation (STI) to increase resilience of rural communities to climate change, considering the localised challenges of the water-food-energy nexus and the role of indigenous knowledge.

SITUATIONAL ANALYSIS

The country report is based on the evidence sourced, see *Table 11*.

The sources of quantitative data included come from the most recent edition of the Namibia R&D Survey (launched April 2024), and from international sources such as UNESCO, World Bank, WIPO and other referenced publications.

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 the impact of the areas and the existing level capacity in the country to mobilise STI in these areas (see Figure 17). Based on the workshop materials, interviews and the desk research, the authors highlighted STI areas for investment and further development.

TABLE 11.
SOURCES OF THE QUALITATIVE DATA SUPPORTING THIS STI FOR SDGs ROADMAP

Method	Quantitative analysis
Stakeholder interviews	• 18 face-to-face interviews conducted between 25 April and 1 May 2024 • Stakeholder profiles: 6 government, 2 academia., 2 NGOs, 2 IOs and donors, 2 companies
Stakeholder workshops	• In-person stakeholder workshop (Otjiwarongo, 30 April 2024) • 50 stakeholders (25 government, 4 academia., 6 IOs and donors, 15 youth, 10 from local women's organisations)
Stakeholder survey	• Academic literature and technical reports

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