

SPONSORED BY THE



Federal Ministry
of Education
and Research



SASSCAL
GRADUATE
STUDIES
PROGRAMME

INTEGRATED WATER
RESOURCES MANAGEMENT



SASSCAL

Southern African
Science Service Centre for
Climate Change and
Adaptive Land Management

WWW.SASSCAL.ORG

SASSCAL GRADUATE STUDIES PROGRAMME: INTEGRATED WATER RESOURCES MANAGEMENT

SCIENCE PLAN 2021-2024

WINDHOEK, NAMIBIA, February 2022

HOSTED BY



NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

IN COLLABORATION WITH



ICWRGC

International Centre
for Water Resources and
Global Change

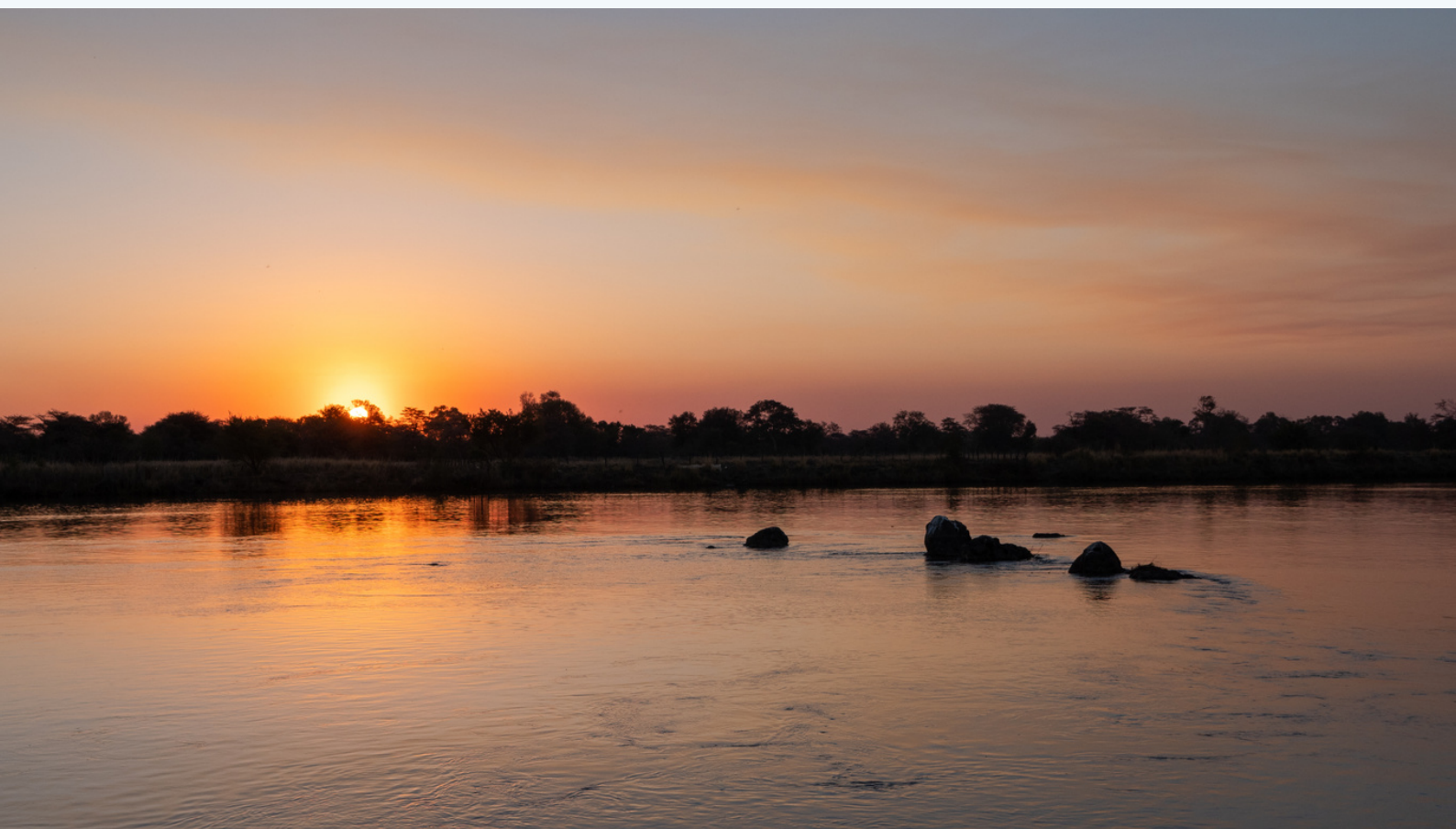


TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS.....	2
ACKNOWLEDGEMENTS.....	3
FOREWORD.....	4
PREFACE.....	5
EXECUTIVE SUMMARY.....	6
1 INTRODUCTION.....	8
1.1 SASSCAL RESEARCH PRIORITY AREAS.....	8
1.2 STRATEGIC DIRECTIONS FROM THE FIFTH REGIONAL STRATEGIC ACTION PLAN FOR THE SADC WATER SECTOR.....	8
1.3 THE SADC WATER RESEARCH AGENDA.....	9
1.4 ABOUT THE SASSCAL SGSP – IWRM.....	10
2 SGSP-IWRM FRAMEWORK.....	11
2.1 IWRM IN THE SOUTHERN AFRICAN DEVELOPMENT COMMUNITY (SADC) REGION.....	11
2.2 AIM.....	13
2.3 STRATEGIC OBJECTIVE 1: DEVELOP AND IMPLEMENT COMMON IWRM BLOCK COURSES.....	13
2.4 STRATEGIC OBJECTIVE 2: DEVELOP AND IMPLEMENT COMMON TECHNICAL BLOCK COURSES.....	14
2.5 STRATEGIC OBJECTIVE 3: ESTABLISH LEADERSHIP IN SUPPORT OF IWRM RESEARCH.....	15
2.6 STRATEGIC OBJECTIVE 4: DEVELOP AND IMPLEMENT A SGSP-IWRM MOBILITY PROGRAMME.....	15
2.7 STRATEGIC OBJECTIVE 5: DEVELOP A NEW CURRICULUM FOR A PHD IN IWRM AT NUST.....	17
3 IMPLEMENTATION STRATEGY.....	18
3.1 WORKING IN PARTNERSHIPS.....	18
3.2 MONITORING, EVALUATION AND REPORTING OF RESULTS.....	19
3.2.1 <i>Monitoring Plan</i>	19
3.2.2 <i>Evaluation Plan</i>	20
3.2.3 <i>Monitoring and Evaluation Data Reporting</i>	21
3.3 CONCLUSION.....	21

SUMMARY OF FIGURES

Figure 1: Themes under the Infrastructure for the Health, Livelihoods & Economic Development Focal Area	9
Figure 2: Themes under the Water Resource Management and Environment Focal Area.....	10
Figure 3: WEF Incentives-based Value Chain Framework.	12
Figure 4: SGSP-IWRM Theory of Change	12

LIST OF TABLES

Table 1: SGSP-IWRM thematic areas and topics	10
Table 2: Activities, Outputs and Outcomes under SO1	13
Table 3: Activities, Outputs and Outcomes under SO2	14
Table 4: Activities, Outputs and Outcomes under SO3	15
Table 5: Activities, Outputs and Outcomes under SO4	16
Table 6: Activities, Outputs and Outcomes under SO5	17
Table 7: Key Stakeholders and Functions in Implementing the SGSP-IWRM Science Plan	18
Table 8: Evaluation Questions & Monitoring Requirements.....	20

Acronyms and Abbreviations

ASAC	Academic and Scientific Advisory Committee
BMBF	German Federal Ministry of Education and Research
BfG	Federal Institute of Hydrology
ICWE	International Conference on Water and the Environment
ICWRGC	International Centre for Water Resources and Global Change
IWRM	Integrated Water Resources Management
NUST	Namibia University of Science and Technology
OADC	Open Access Data Centre
RSAP V	Fifth Regional Strategic Action Plan for the SADC Water Sector
SADC	Southern African Development Community
SASSCAL	The Southern Africa Science Service Centre for Climate Change and Adaptive Land Management
SGSP-IWRM	SASSCAL Graduate Studies Programme in Integrated Water Resources Management
SDG	Sustainable Development Goal
WEF	Water, Energy and Food

Acknowledgements

The SASSCAL Graduate Studies Programme in Integrated Water Resources Management (SGSP-IWRM) Science Plan (2022 -2024) has benefited from input, advice and comment from the Southern African Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL) Regional Secretariat, the International Centre for Water Resources and Global Change (ICWRGC) at the Federal Institute of Hydrology (BfG), and the SGSP-IWRM Academic and Scientific Advisory Committee (ASAC).

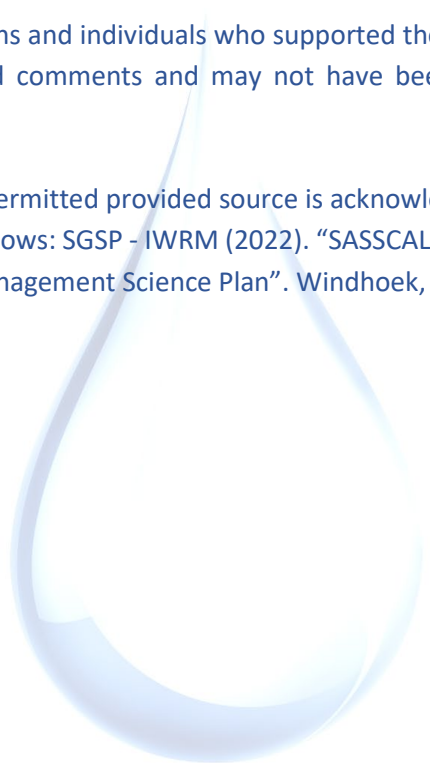
We would like to extend our deepest appreciation to the to the German Federal Ministry of Education and Research (BMBF), and the SASSCAL Regional Secretariat, for funding this innovative program.

A special thank you is extended to the Namibia University of Science and Technology (NUST) for generously hosting the SGSP-IWRM Secretariat.

The contribution of all institutions and individuals who supported the elaboration of the SGSP-IWRM Science Plan through ideas and comments and may not have been credited by name, is greatly appreciated.

© SGSP- IWRM. Reproduction permitted provided source is acknowledged.

Please reference the work as follows: SGSP - IWRM (2022). “SASSCAL Graduate Studies Programme in Integrated Water Resources Management Science Plan”. Windhoek, Namibia



Foreword

In an effort to address the capacity needs of the Southern African Development Community (SADC) water sector, the Southern African Science Service Centre for Climate Change and Adaptive Land Management established the SASSCAL Graduate Studies Programme in Integrated Water Resources Management (SGSP – IWRM) at the Namibia University of Science and Technology. The programme is implemented by NUST in partnership with the International Centre of Water Resources and Global Change based at the Institute of Hydrology in Koblenz Germany. The SGSP-IWRM is fully funded by the Federal Ministry of Education and Research (BMBF).

This SGSP-IWRM Science Plan has been formulated to serve as a roadmap for the SGSP-IWRM until 2024. The plan builds on the achievements of the first phase of SASSCAL, and is aligned to the SASSCAL 2.0 Science Plan which is geared towards ensuring SASSCAL offers scientifically sound information and knowledge related to climate change and adaptive land management.

SGSP-IWRM is the first step in a process of establishing SASSCAL Centres of Excellence in the SADC region. In SASSCAL's long-term plan, 5 Centres of excellence are planned: Centre of Excellence in Agriculture and Food Security (Angola), Centre of Excellence in Biodiversity and Ecosystem Health (Botswana), Centre of Excellence in Water Resources Management (Namibia), Centre of Excellence in Climate Services (South Africa) and Centre of Excellence in Forests and Woodland Management (Zambia). This effort is complemented by various stakeholders including regional and international collaborating institutions and universities.

Dr. Jane Olwoch
SASSCAL Regional Secretariat Executive Director

Preface

Sustainable Development Goal 6 (SDG 6) calls for the availability and sustainable management of water and sanitation for all. Failure to achieve SDG 6, compromises the attainment of many of the other SGGs, including those related to poverty reduction, food and nutrition, human health, gender equality, energy, economic growth, sustainable cities and the environment (UNDP, 2021).

The ravaging impacts of the COVID-19 pandemic in the SADC region and the world over is a reminder of the importance of access to water, sanitation and hygiene facilities, yet sadly, a significant percentage of the population in the SADC region, and the SASSCAL countries in particular are still without these basic services. Thus the establishment of the SGSP-IWRM will support the SASSCAL member countries (Angola, Botswana, Namibia, South Africa, and Angola) to achieve the 2030 Agenda for Sustainable Development through the deployment of an innovative and excellent regional collaborative education and research programme at PhD level in different specialisations under the theme Integrated Water Resource Management.

Fifteen SGSP-IWRM PhD candidates from the SASSCAL countries will be enrolled full time at NUST in four distinct PhD programmes, namely, (i) PhD in Engineering (Water and Environment), (ii) PhD in Informatics, (iii) PhD in Natural Resources Sciences, and (iv) PhD in Spatial Sciences.

The SGSP-IWRM programme includes a common block of selected courses in IWRM, a scientific mobility to Germany, seminars and conferences which will complement the research based academic programme of a 3-year study period. It is envisaged

One major output of this programme will be a new PhD in IWRM to address demands emanating from the Needs Assessment Analysis in the water sector conducted by SASSCAL in 2016/17 and confirmed by SGSP-IWRM process.

I am confident that the SGSP-IWRM Science Plan (2022-2024) will guide education and research activities undertaken under the auspices of the SGSP-IWRM. Together with the implementation plan, it will be used as a bases for the evaluation of performance against set deliverables for the SGSP-IWRM.

Dr. Anna Matros-Goreses
SGSP-IWRM ASAC Chairperson

Executive Summary

SASSCAL Graduate Studies Programme on Integrated Water Resources Management

In support of SASSCAL's research agenda and the expressed needs of the regional water sector for highly qualified professionals, SASSCAL, together with the Namibia University of Science and Technology (NUST) established the SASSCAL Graduate Studies Programme (SGSP) on Integrated Water Resources Management (IWRM) .

The SGSP-IWRM aims to improve national and regional capacity in water resources management. The programme will contribute SADC member states, and the SASSCAL countries to accelerate efforts to attain the sustainable development goals (SDGs).

SGSP-IWRM is guided by 4 broad themes namely, (i) Water and Wastewater Systems and Technology, (ii) Hydrology and Geohydrology, (iii) Water Security under Climate and Environmental Changes, and (iv) Sustainable Water, Energy and Food Security (WEF Nexus)

The SGSP-IWRM Research

The aim of the SGSP-IWRM Science Plan is to guide education and research activities undertaken under the auspices of the SGSP-IWRM. Together with the implementation plan, it will be used as a bases for the evaluation of performance against set deliverables for the SGSP-IWRM.

The goal of the SGSP-IWRM science will be achieved through the following strategic objectives and activities.

Strategic Objective 1: Develop and Implement Common IWRM Block Courses

- Develop, and offer 6 SGSP-IWRM common IWRM courses to the SGSP-IWRM PhD candidates

Strategic Objective 2: Develop and Implement Common Technical Block Courses

- Develop, and offer 6 SGSP-IWRM common technical block courses to the SGSP-IWRM PhD candidates

Strategic Objective 3: Establish Leadership in Support of IWRM research

- Recruit two post-doctoral candidates to support the students and their supervisors in conducting research in IWRM related topics
- Establish 2 Regional SASSCAL Research Chairs to drive research in Water Quantity and Water Quality sub-themes

Strategic Objective 4: Develop and implement a SGSP-IWRM Mobility Programme

- Develop and conduct online survey to assess interest in PhD in IWRM qualification in SADC
- Convene one workshop to obtain input into the PhD in IWRM programme curriculum structure
- Undertake a PhD mobility programme benchmarking study to inform the development of the SGSP-IWRM German mobility programme
- Develop and implement the SGSP-IWRM German mobility framework

Strategic Objective 5: Develop a New Curriculum for a PhD in IWRM at NUST

- Develop and conduct online survey to assess interest in PhD in IWRM qualification in SADC
- Convene one workshop to obtain input into the PhD in IWRM programme curriculum structure
- Develop the PhD in IWRM programme specification/ curriculum
- Undertake a cost benefit analysis to determine the financial viability of the programme
- Submit the PhD in IWRM curriculum for review and approval by the Programme Development Unit, Executive Director, and the Deputy Vice-Chancellor Academic programmes
- Submit the PhD in IWRM curriculum for accreditation with the Namibia Qualifications Authority

Implementation Strategy

Daily oversight for implementation of the SGSP-IWRM Science Plan will be coordinated by the SGSP-IWRM Secretariat, in collaboration with the NUST researcher and academic community, SASSCAL nodes in the five SASSCAL countries, SASSCAL Regional Secretariat's Directorates of Science and Technology, the SGSP-IWRM ASAC, the International Centre for Water Resources and Global Change (ICWRGC), the SASSCAL Research Chairs, the SGSP-IWRM Post-doctoral fellows, and the SGSP-IWRM PhD candidates.



1 Introduction

Adequate availability of clean water is indispensable for food security, energy production, health and sanitation hence key for the development of the African societies and economies. While Southern Africa experiences significant precipitation, it is highly seasonal in most countries and the distribution varies between tropical areas in the north of the region and arid and semi-arid climates in southern and central regions¹. It is important to note that the SADC region experiences both physical water scarcity and economic water scarcity (where water is physically available, however, resources to develop the resources in order to ensure access is the main limitation). Physical water scarcity in the SADC Member States is usually during the dry season with exceptions of countries in arid environments like Botswana and Namibia, which can be affected all year around.

Ensuring reliable access to water of acceptable quantity and quality in the face of increased urbanisation, a changing and unpredictable climate, and economic instability remains one of the foremost challenges and priorities of the SADC Member States. In 2016, SADC Water Division reported that 40% of the 280 million population in SADC had no access to an adequate safe drinking water supply, whilst 60% had no access to adequate sanitation services (SADC, 2016).

The SADC Water Development Framework and its supporting strategies and plans highlights that the concept of Integrated Water Resources Management (IWRM) offers solutions to deal with interlinked socio-economic, institutional, and ethical challenges by assessing and managing water resources in space and time through a transdisciplinary and multi-sectoral approach. However, currently, there is limited capacity to support a broad and integrated approach for sustainable water resources management and water security that contributes to sustainable socio-economic development in SADC.

The skills gap, coupled with the increased risks introduced by the impact of climate change is contributing to the vulnerability of the water sector, severely affecting food and energy security and socio-economic stability at household, national and regional levels. Given these challenges, the sustainable, efficient and equitable management of limited water resources has become a major priority.

1.1 SASSCAL Research Priority Areas

SASSCAL aims to improve the understanding of climate and land management change impacts on the natural and socio-economic environment in southern Africa. To achieve this, SASSCAL defined five priority research areas in the SASSCAL Science Plan 2018 – 2021, addressing a wide range of aspects of climate change and other environmental changes that affect the southern African region. The five priority research areas is centred around, (i) food security, (ii) water security, (iii) biodiversity conservation, (iv) sustainable forests and woodlands, and (v) climate service provision. Climate service is a cross-cutting topic in all SASSCAL supported research, however, the SGSP-IWRM will address the (i) food security, (ii) water security, and (v) climate service provision priority areas in particular.

1.2 Strategic Directions from the Fifth Regional Strategic Action Plan for the SADC Water Sector

The United Nations' Sustainable Development Goal 6 (SDG 6) calls Member States to ensure availability and sustainable management of water and sanitation for all. Sustainable access to water is a catalyst to the attainment of SDG 1 (No Poverty), SDG 2 (Zero Hunger), SDG 3 (Good Health and

¹ <https://www.sadc.int/themes/natural-resources/water/>

Well-being), SDG 9 (Industry, Innovation and Infrastructure), SDG 13 (Climate Action), and SDG 15 (Life on Land).

However, Climate Change threatens the attainment of this goal as SADC Member States are faced by increased uncertainty in an environment typified by spatial and temporal variability and weather extremes ranging from extended droughts and flooding (SADC, 2021).

The fifth Regional Strategic Action Plan for the SADC water sector (RSAP V) acknowledges that the COVID-19 pandemic underscores the urgent need to ensure adequate access to water, sanitation, and hygiene services in order to improve the resilience of communities for the population in all the SADC Member States.

The RSAP V contends that regional growth in the SADC region will require the ongoing development of large and small multi-purpose grey (engineering) and green (nature based) infrastructure to harness water resources to support developmental activities while also, promoting efficient use and conservation of the available water resources. Water is acknowledged as a catalyst to the development of the key sectors of the SADC Members States.

1.3 The SADC Water Research Agenda

Notions which are reflected in the SADC Water Research Agenda is that the water sector is critical to economic development of the SADC Member States, such that the benefits of related investment will lead to sustainable health and livelihoods of SADC citizens (WaterNet, 2015). In response to this challenge the SADC Water Research Agenda has two focal areas, namely, (i) Infrastructure for Health, Livelihoods and Economic Development, and (ii) Water Resource Management and Environment.

The key themes under the, “Infrastructure for Health, Livelihoods and Economic Development” focal area include, (i) development and sustainable implementation of resilient water infrastructure, (ii) innovation in affordable and appropriate technologies and innovative approaches and practices, (iii) sustainable water institutions, and the human right to water (as shown in figure 1).

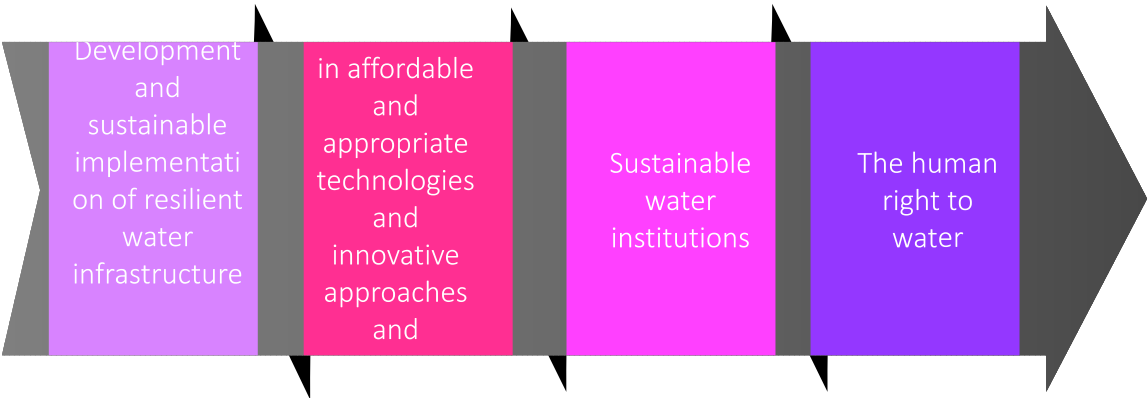


Figure 1: Themes under the Infrastructure for the Health, Livelihoods and Economic Development Focal Area

The key themes identified under the, “Water Resource Management and Environment” focal area include, (i) assessment of surface and groundwater resources, (ii) operational rules for effective water resources management, (iii) impact of urbanisation on water resources, (iv) water governance and institutional arrangements, (v) ecosystems, as well as (vi) water and land (as shown in Figure 2).

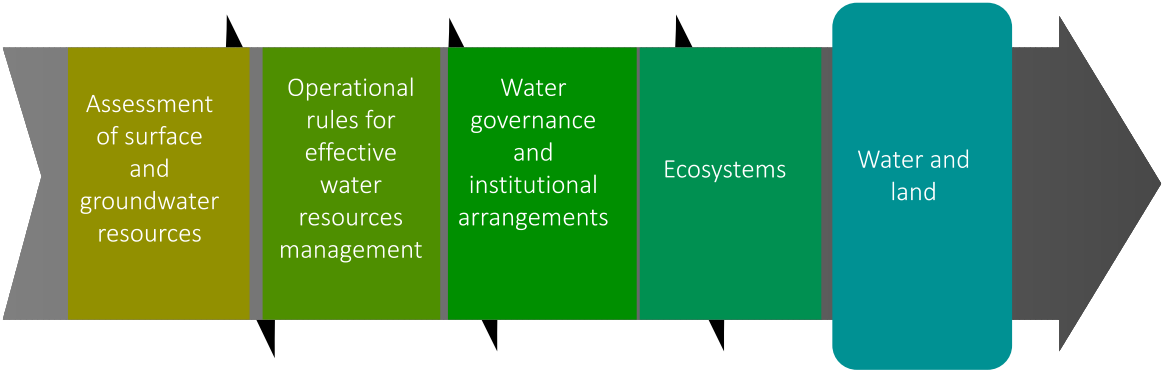


Figure 2: Themes under the Water Resource Management and Environment Focal Area

1.4 About the SASSCAL SGSP – IWRM

The SGSP-IWRM aims to improve national and regional capacity in water resources management. In addition to alignment to the SADC Water Research Agenda as well as the SASSCAL Science Plan, the programme will contribute SADC member states, and the SASSCAL countries to accelerate efforts to attain the sustainable development goals (SDGs). The programme is aligned to SDG 6 – Clean Water and Sanitation, SDG 9 – Industry, Innovation and Infrastructure, SDG 11 - Sustainable Cities and Communities, SDG 12 – Responsible Consumption and Production and SDG 13 – Climate Action, while improving the water research and innovation profile of the Southern African Region.

The section below summarises the SGSP-IWRM thematic areas and topics².

Table 1: SGSP-IWRM thematic areas and topics

Themes	Topics
1. Water and Wastewater Systems and Technology	<ul style="list-style-type: none"> – Water conservation – Water systems engineering – Development and deployment of information and communications technology applications
2. Hydrology and Geohydrology	<ul style="list-style-type: none"> – Basic and advanced hydrology – Integrated surface water/ groundwater interactions/modelling – Geohydrological, chemical, and biological process analysis – Hydrological/hydrogeological modelling and forecasting/simulations
3. Water Security under Climate and Environmental Changes	<ul style="list-style-type: none"> – Ecological assessment of water systems – Effectiveness of environmental and social impact assessment processes – Socio-economic dynamics implications – Transboundary water systems
4. Sustainable Water, Energy and Food Security (WEF Nexus)	<ul style="list-style-type: none"> – Modelling, analysis of water, and energy food nexus approaches – Risk assessments and decision support systems for WEF nexus – Investigation/analysis of agricultural and other land uses on water

2 SGSP-IWRM Framework

2.1 IWRM in the Southern African Development Community (SADC) region

The interest and uptake of the IWRM concept took off at the global level since the International Conference on Water and the Environment (ICWE) in Dublin in 1992. The Global Water Partnership's definition of IWRM is probably the most widely accepted definition. It states: 'IWRM is a process which promotes the co-ordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.' IWRM acceptance and promotion was quite early in SADC region due to several contributing factors. These include: historical political connections between the member countries; historically rooted well-established channels and connections with bilateral and multilateral donors; the success of networks such as the Global Water Partnership and WaterNet whose mandate was to promote the concept; and the fact that two-thirds of the region's population live in transboundary basins with IWRM providing a suitable hook for transboundary cooperation (Movik et al., 2016). Despite the universal appeal, IWRM has also been challenged. Molle (2008) argued that IWRM precepts such as equity and efficiency are often incompatible. Jensen (2013) has shown that IWRM is void of the politics which in fact are at the core of all critical water decisions. Giordano and Shah (2014) have argued that IWRM has now become an end in itself, in some cases undermining functioning water management systems.

Globally, the 17 Sustainable Development Goals with their 169 associated targets are demanding for holistic and integrated development. Future water resources management and development should ideally include all sectoral demands and achieve various societal objectives in a balanced way, under a wide range of plausible futures and incorporate adaptive and flexible solutions. And we need to support these solutions through enabling governance structures and policies that allow us to navigate our water resources challenges in turbulent waters (Bharati and Uhlenbrook, 2020). The IWRM framework is still arguably the only available framework for water management that tries to achieve holistic outcomes that include social equity, economic productive and environmental sustainability. Therefore, the IWRM policy is still relevant and important as there is a need to break the siloed approach to water management and development and include participatory approaches that consider the bio-physical, social and economic aspects of water.

Many of the donors as well as southern African policy-makers see IWRM as a set of principles and an approach rather than a blueprint. They also pointed out to the positive spin offs, for example, the increased cooperation on transboundary rivers in the region, the increased acceptance of interdisciplinary approaches, and generally raising the profile of water in the various countries through reform processes (Movik et al., 2016). The implementation of IWRM in the SADC region and globally will continue to evolve amid implementation challenges. The IWRM approach may need to be updated and adjusted to reflect the new challenges facing the SADC, such as climate change, food and energy security and inclusive growth. . Furthermore, investment needs to be strategic and results oriented and therefore the Water-Energy-Food (WEF) nexus approach is a “game changer” to disrupt non-productive approaches and shed new innovative direction towards achieving socio-economic impact (Matros-Goreses, 2018). Building linkages to other holistic and more recent frameworks such as the Nexus is thus pertinent. There is also research needed to consider not just synergies but also trade-offs between multiple goals and objectives.

Resource efficiency, hence, depends primarily on an overall supportive policy framework encompassing a range of different areas, including innovation, technologies, integrated resource use planning and allocation, trade and investment. A shared basic approach should be taken, taking into consideration the full spectrum of policy areas that impact the IWRM landscape (Matros-Goreses, 2018).

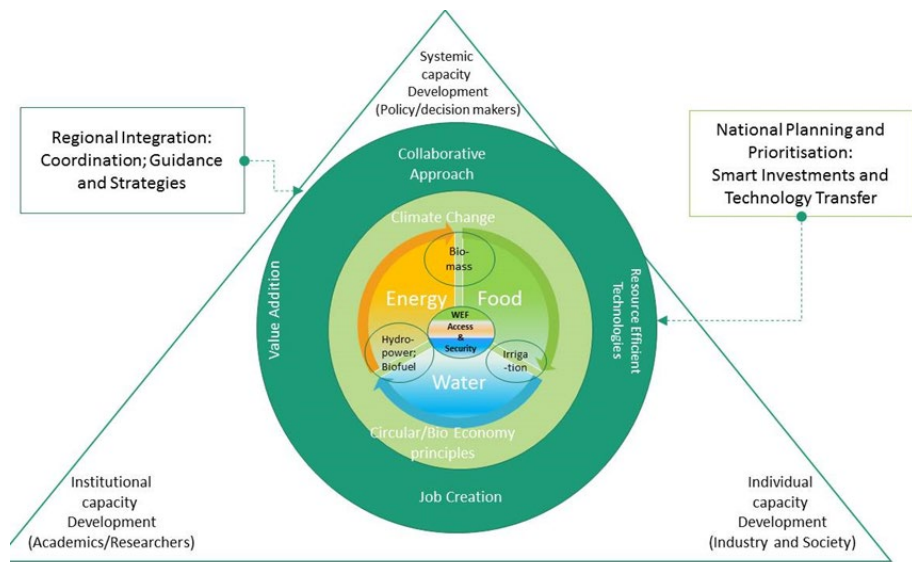


Figure 3: WEF Incentives-based Value Chain Framework. (Matros-Goreses, 2018)

To ensure ownership and successful integrated planning, the framework focuses on building the capacity of relevant stakeholders and leveraging existing efforts and knowledge. It aids evidence-based decision making processes. The capacity development and knowledge management in the framework is aimed at three levels, namely **Systemic** (also referred to as the “enabling environment”), which will involve the overall policy, economic, regulatory, and accountability frameworks within which organizations operate; **Institutional** - focusing on strengthening performance and functioning capabilities through, developing mandates, tools, guidelines, and management information systems that facilitate and catalyse organizational change. It is also concerned with strengthening the relationship between individuals in the organizational setting and their links with their environment and finally **Individual**- Involves skills and knowledge exchange via training, practices and empowerment (Matros-Goreses, 2018).

The SGSP-IWRM program will therefore critically examine the interpretations and challenges of IWRM, from global to regional to local level, with the aim of contributing to improving water policies and practices and making them locally appropriate for the SADC region.

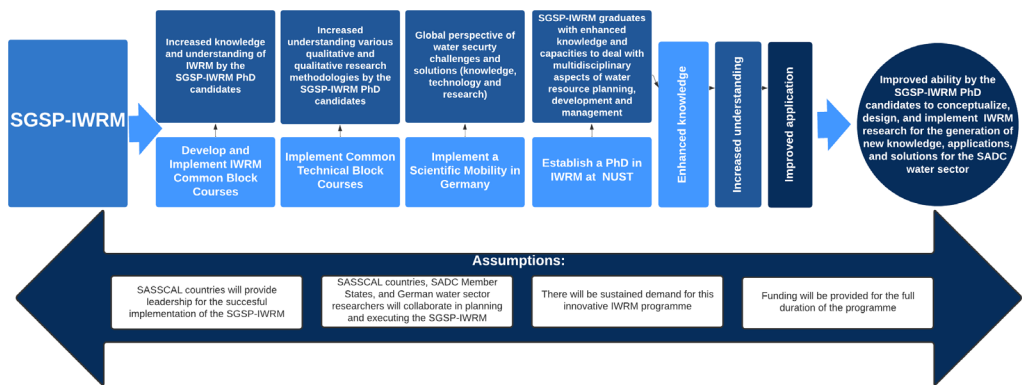


Figure 4: SGSP-IWRM Theory of Change

2.2 Aim

The aim of the SGSP-IWRM Science Plan is to guide education and research activities undertaken under the auspices of the SGSP-IWRM. Together with the implementation plan, it will be used as a bases for the evaluation of performance against set deliverables for the SGSP-IWRM.

The SGSP-IWRM Science Plan outlines a framework which informs the priority research areas that the SGSP-IWRM will address. In addition, the plan maps the research and science impact pathways of the SGSP-IWRM taking into consideration the needs of the SASSCAL countries as articulated in the IWRM capacity needs assessment for the SASSCAL countries, and related capacity needs assessments done by SADC, and related subsidiary institutions to guide research in the SADC water sector. It also provides the scientific framework for the development of a new, innovative PhD curriculum.

The goal of the SGSP-IWRM science will be achieved through the following strategic objectives and activities.

2.3 Strategic Objective 1: Develop and Implement Common IWRM Block Courses

Common introductory IWRM courses shall be offered to the SGSP-IWRM PhD students. The latest cutting edge demand based courses have been lined up to equip the SGSP-IWRM PhD candidates with appropriate knowledge and understanding of basic IWRM principles, approaches, and applications. The purpose of these courses is to introduce cross-cutting concepts and to create the basis of interlinkages between the various topics selected by candidates. The course combination and design will be the signature course that will make the SGSP internationally unique as shown below.

Table 2: Activities, Outputs and Outcomes under SO1

Key Activities	Expected Outputs	Expected Outcomes
1. Develop, and offer 6 SGSP-IWRM common IWRM courses to the SGSP-IWRM PhD candidates ³	– 6 SGSP-IWRM common courses developed and implemented	<ul style="list-style-type: none">– A working understanding of IWRM which can translate into accelerated implementation and improved water resources management by the SGSP-IWRM PhD candidates– Improved scientific quality of research and affiliated research outputs by the SGSP-IWRM PhD students– Increased scientific networking with peers participating in the SGSP-IWRM PhD students

³ Module 1: Introduction to Integrated Water Resources Management, Module 2: The Water System: Availability and Sustainable Use, Module 3: Sustainable Sanitation in a Changing World, Module 4: Water and Climate Change: Risks, Impacts, Vulnerability and Building Resilience, Module 5: Policy, Legislative, and Institutional Framework for Implementation of an IWRM Approach, Module 6: Water and Sanitation Financing

2.4 Strategic Objective 2: Develop and Implement Common Technical Block Courses

The SGSP-IWRM shall offer seminars in support of the SGSP-IWRM PhD students. This seminar series covers the philosophical approaches and research methods that are commonly used to conduct research in the IWRM field. The seminars will include the following topics:

- technical, statistical, and mathematical support
- critical thinking
- research ethics
- research design and methodology
- writing retreats, and
- supervisor training.

The seminars are designed to lay the foundation for good empirical research. Participants become acquainted with a variety of approaches to research problem conceptualization, literature review and research design. Throughout the semester, students will consult with their supervisors to develop their own research proposals. There will be presentations from scholars from NUST, the SADC Member States, and Germany. In addition, the SGSP-IWRM shall develop guidelines for supervision. These will help supervisors to respond to challenges often experienced in supervision. Thesis writing guidelines will include technical issues in writing, structuring of thesis, language and referencing.

Table 3: Activities, Outputs and Outcomes under SO2

Key Activities	Expected Outputs	Expected Outcomes
1. Develop, and offer 6 SGSP-IWRM common technical block courses to the SGSP-IWRM PhD candidates	– 6 SGSP-IWRM common technical block courses developed and implemented	<ul style="list-style-type: none">– Strengthened research design, and execution skills amongst the SGSP-IWRM PhD students– Strengthened analytical and problem-solving skills by the SGSP-IWRM PhD students– Strengthened scientific writing skills amongst the SGSP-IWRM PhD students; and– Improved scientific quality of research and affiliated research outputs by the SGSP-IWRM PhD students– Enhanced scientific quality of the SGSP-IWRM PhD students research– Increased scientific networking with peers participating in the SGSP-IWRM– Increased joint publications between the SGSP-IWRM PhD students, SADC, and German researchers in the SGSP-IWRM research topics

2.5 Strategic Objective 3: Establish Leadership in Support of IWRM Research

A regional SASSCAL Research Chairs programme shall be established and implemented under the theme: Integrated Water Resources Development and Management - Sustainable Water Security in Southern Africa. Two distinct, yet separate Research Chairs will be established focusing on 'Water Resource Quantity and Water Resource Availability' sub themes. The SASSCAL Research Chairs positions will be announced and the two SASSCAL Research Chairs will be appointed by a joint decision of NUST, the SASSCAL Scientific Advisory Committee, and the SASSCAL Regional Secretariat.

In addition to the SASSCAL Research Chairs, two post-doctoral candidates shall be appointed in order to support the students and their supervisors in conducting research. The post-doctoral researchers will be appointed by the SGSP-IWRM Academic and Scientific Advisory Committee and dedicated to advance the targeted research portfolio. The post-doctoral fellows will support the 15 SGSP-IWRM PhD-candidates in their day-to-day research activities.

Table 4: Activities, Outputs and Outcomes under SO3

Key Activities	Expected Outputs	Expected Outcomes
<ol style="list-style-type: none"> 1. Recruit two post-doctoral candidates to support the students and their supervisors in conducting research in IWRM related topics. 2. Establish 2 Regional SASSCAL Research Chairs to drive research in Water Quantity and Water Quality sub-themes 	<ul style="list-style-type: none"> – 15 SGSP-IWRM PhD students supervised and graduated – 60 research papers published in 'A' rated journals – 45 oral presentations and other conference outputs (not in published proceedings) – 45 conference proceedings – 2 authored books on water security (water quality and quantity) – 2 edited atlas- research – 10 chapter contributions in books – 18 cutting edge IWRM training courses implemented – 6 research focused guidelines developed – 36 high seminars conducted 	<ul style="list-style-type: none"> – Increased number of funded research grants that address (i) water resource quantity and availability, and (ii) water resources reliability and quality – Increased research outputs aligned to the SGSP-IWRM themes and topics – Increased number of SGSP-IWRM PhD students publishing in 'A' rated scientific journals – Increased regional and international partnerships established, and – Increased recognition of the SGSP-IWRM's research and innovation excellence, and impact.

2.6 Strategic Objective 4: Develop and implement a SGSP-IWRM Mobility Programme

The SGSP-IWRM has a uniquely designed international scientific mobility component, where the SGSP-IWRM PhD students travel to Germany to increase the transfer of knowledge, technology, research, and networking of the students. The International Centre for Water Resources and Global Change (ICWRGC) at the Federal Institute of Hydrology (BfG) in Koblenz as the German partner for the SGSP-IWRM, will identify partners involved in international water-related study programmes and research to host the SGSP-IWRM PhD students. The departure point is that the integration of the SGSP-IWRM PhD students with a multinational research and development environment will enrich the students international experience, leading to a deep, diverse, and rich cultural, academic, and research experience required in the labour market. This scientific mobility component of the SGSP, in addition to technical experience and exposure enhancement, also facilitates the promotion of 'international adaptability and cross- cultural sensitivity" desired in the global economy.

Table 5: Activities, Outputs and Outcomes under SO4

Key Activities	Expected Outputs	Expected Outcomes
<p>1. Undertake a PhD mobility programme benchmarking study to inform the development of the SGSP-IWRM German mobility programme</p> <p>2. Develop and implement the SGSP-IWRM German mobility framework</p>	<ul style="list-style-type: none"> – PhD mobility programme benchmarking study report developed – SGSP-IWRM German mobility framework developed – SGSP-IWRM German mobility programme established (15 SGSP-IWRM PhD students matched with German institutions) – 15 SGSP-IWRM PhD student learning plans developed – SGSP-IWRM German mobility framework outcomes report consolidated and shared – 15 joint publications in 'A' rated journals – 10 chapter contributions in books – 15 verbal presentations and other conference outputs (not in published proceedings) – 15 PhD fellows supervised and graduated 	<ul style="list-style-type: none"> – Increased adoption of alternative learning approaches by the SGSP-IWRM PhD students following the – Enriched international experience, and rich cultural, academic, and research experience for the SGSP-IWRM PhD students – Increased number and quality of research outputs aligned to the SGSP-IWRM themes and topics – Increased regional and international partnerships established, and – Improved scientific quality of research and affiliated research outputs by the SGSP-IWRM PhD students – Increased adoption of alternative learning approaches by the SGSP-IWRM PhD students – Enriched international experience, and rich cultural, academic, and research experience for the SGSP-IWRM PhD students – Enhanced scientific quality of the SGSP-IWRM PhD students research – Increased scientific networking with peers participating in the SGSP-IWRM PhD students – Increased joint publications between the SGSP-IWRM PhD students, SADC, and German researchers in the SGSP-IWRM research topics

2.7 Strategic Objective 5: Develop a New Curriculum for a PhD in IWRM at NUST

A new post graduate qualification in IWRM shall be developed to address demands emanating from the Needs Assessment Analysis in the water sector conducted by SASSCAL in 2016/17 and confirmed by SGSP-IWRM process. This will follow the NUST curriculum development framework after undertaking needs assessment review studies and stakeholder consultation workshops.

Table 6: Activities, Outputs and Outcomes under SO5

Key Activities	Expected Outputs	Expected Outcomes
<ol style="list-style-type: none"> 1. Develop and conduct online survey to assess interest in PhD in IWRM qualification in SADC 2. Convene one workshop to obtain input into the PhD in IWRM programme curriculum structure 3. Develop the PhD in IWRM programme specification/ curriculum 4. Undertake a cost benefit analysis to determine the financial viability of the programme 5. Submit the PhD in IWRM curriculum for review and approval by the Programme Development Unit, Executive Director, and the Deputy Vice-Chancellor Academic programmes 6. Submit the PhD in IWRM curriculum for accreditation with the Namibia Qualifications Authority 	<ul style="list-style-type: none"> – PhD in IWRM programme specification/ curriculum – PhD in IWRM programme cost benefit analysis report – PhD in IWRM Curriculum approved by NUST – PhD in IWRM Curriculum accredited by the Namibia Qualifications Authority – 	<ul style="list-style-type: none"> – Increased number of highly qualified water experts for SADC. – SGSP-IWRM graduates with enhanced knowledge and capacities to deal with multidisciplinary aspects of water resource planning, development and management.

3 Implementation Strategy

Daily oversight for implementation of the SGSP-IWRM Science Plan will be coordinated by the SGSP-IWRM Secretariat, in collaboration with the NUST researcher and academic community, SASSCAL nodes in the five SASSCAL countries, SASSCAL Regional Secretariat's Directorates of Science and Technology, ICWRGC, ASAC, SASSCAL Research Chairs, the SGSP-IWRM Post-doctoral fellows, and the SGSP-IWRM PhD students.

3.1 Working in Partnerships

The SGSP-IWRM Secretariat and governance structures will work closely with a broad array of partners in and outside the SADC region drawing on their various areas of specialisation. The SGSP-IWRM will also strengthen partnership with other graduate studies programmes in the SADC region and beyond, to benchmark progress as well as strengthen joint learning.

Within the SASSCAL countries, the SGSP-IWRM Secretariat and governance structures will work at all levels in partnership with the SASSCAL nodes, relevant government line ministries, and water centres of excellence, think tanks, and the private sector in order to achieve research and scientific excellence in IWRM.

Table 7: Key Stakeholders and Functions in Implementing the SGSP-IWRM Science Plan

Role	Function
SASSCAL RS (ED, DSTCD, DAF), NN and HCD Coordinator	<ul style="list-style-type: none"> – Strategic oversight for the successful implementation of the SGSP-IWRM programme, including the SGSP-IWRM research and Science Plan; – Ensures implementation of the SGSP-IWRM research and Science Plan is according to SASSCAL regulations, procedures and values; and – Facilitates stakeholder engagement, towards the successful execution of the SGSP-IWRM research and Science Plan.
SADC water division and its subsidiaries (Waternet, SADC groundwater management institute)	<ul style="list-style-type: none"> – Strategic directions in line with the RSAP V and the SADC Water Research Agenda – Provide oversight for the successful implementation of the SGSP-IWRM programme through participation in the Academic and Scientific Advisory Committee – Draw on the complementary strengths of the SADC subsidiary institution network to supervise research, and where appropriate provide technical input to the training activities of the Provide technical input to the Ensures implementation of the SGSP-IWRM Science Plan is according to SASSCAL regulations, procedures and values; and – Facilitates stakeholder engagement, towards the successful execution of the SGSP-IWRM Science Plan.
NUST	<ul style="list-style-type: none"> – Co-supervision of SGSP-IWRM PhD students; – Co-designing and implementation of tailor-made courses on a trainer-of-trainer basis; – Supports and facilitates the implementation of activities outlined in the SGSP-IWRM Science Plan; and – Develops and implements an effective monitoring and evaluation framework.
ICWRGC	<ul style="list-style-type: none"> – Facilitates access to (human, technical resources) at German universities and research centers. Design and coordination of scientific mobility stay in Germany; – Co-designing and implementation of tailor-made courses on a trainer-of-trainer basis.

Academic and Scientific Advisory Committee Chairperson	<ul style="list-style-type: none"> – Guides overall committee agenda and strategic direction to ensure long-term goals are achieved. Strategically guiding the implementation of the SGSP-IWRM Science Plan; and – Supports the profiling and positioning of the SGSP-IWRM science activities.
SASSCAL Research Chairs	<ul style="list-style-type: none"> – Establishes research programmes in line with the SGSP-IWRM priority research thematic areas; – Strengthen research capacity of the SGSP-IWRM PhD students; – Drive research productivity and research excellence amongst the SGSP-IWRM PhD students; – Forge and foster strategic partnerships that will grow and ensure sustainability of the SGSP-IWRM research and science portfolios; – Lead implementation of strategies to raise the profile of the SGSP-IWRM research and science activities in the SASSCAL countries, SADC region, and globally.
Post-Doctoral Researchers	<ul style="list-style-type: none"> – Supports the SASSCAL Research Chairs in coordinating research of doctoral students; – Conducts research aligned to the Chair portfolio; – Conducts training, and /or teaching accordingly; – Develops research grants in support of the SGSP-IWRM research and Science Plan; and – Contributes to research productivity through publications.
Supervisors at NUST, water institutes and centres of excellence in the SASSCAL countries and SADC region, as well as Germany	<ul style="list-style-type: none"> – Supports the SGSP-IWRM PhD students under their supervision at every stage, from design and conceptualisation of their PhD research, to data collection, analysis, presentation and publication; – Provides oversight of the SGSP-IWRM PhD students research, ensuring their students' work meets the standards of the University and the academic discipline; – Stimulates, guides, and encourages the SGSP-IWRM PhD students to achieve research excellence and recognition; – Works closely with the SASSCAL Research Chairs within a particular portfolio to ensure synergy with overall programme goals.

(Source: SGSP-IWRM funding proposal, 2020)

3.2 Monitoring, Evaluation and Reporting of Results

The SGSP-IWRM Secretariat and governance structures will carefully monitor implementation of the SGSP-IWRM Science Plan, with an emphasis on tracking not only outputs, but rather outcomes, and impact. The monthly monitoring reports will enable the SGSP-IWRM Secretariat, ASAC and the regional SASSCAL Secretariat to take corrective action where necessary as well as showcase best practices.

A mid-term evaluation shall be undertaken with the aim of assessing the continued relevance of the SGSP-IWRM Science Plan and the progress made towards achieving its planned objectives. This will allow for modifications to ensure the achievement of the overall goal and strategic objectives envisaged.

3.2.1 Monitoring Plan

The primary purpose of the monitoring plan will be to guide the ongoing collection and analysis of routine information used to both monitor the progress of implementation and to determine whether results are being achieved (Markiewicz and Patrick 2016).

The monitoring plan for the SGSP-IWRM Science Plan will therefore aid the Secretariat to:

- Produce timely and quality routine programme monitoring data,
- Provide a defined and managed data base to capture, verify, analyse, and present programme data, and
- Transfer routine data to the regional SASSCAL Secretariat and SGSP-IWRM ASAC to inform decision making.

3.2.2 Evaluation Plan

The SGSP-IWRM Science Plan evaluation plan will enable the collection and analysis of information to determine answers to formative and summative evaluation questions in order to understand whether and how the SGSP-IWRM is achieving its stated objectives and its outcomes and impacts (Markiewicz and Patrick 2016).

Kusek and Risk (2004) assert that evaluations are tools that enable accountability, inform policy formulation or revisions, as well as guide project planning, resource allocation and remedial actions where challenges have been encountered.

The key SGSP-IWRM Science Plan evaluations will answer amongst others, the following questions:

- a. What are the weaknesses of the SGSP-IWRM Science Plan?
- b. What benefits were realised from the SGSP-IWRM Science Plan?
- c. What were the underlying factors that led to success or failure of the SGSP-IWRM Science Plan?

Table 2 shows an illustration of the evaluation questions that are used to direct the monitoring and evaluation of the SGSP-IWRM Science Plan.

Table 8: Evaluation Questions & Monitoring Requirements

Evaluation questions	Monitoring requirements
1. Is the program achieving what it intended?	1. Monitoring against program goals and objectives
2. What has the program delivered?	2. Monitoring program outputs in key areas
3. What results have been achieved?	3. Monitoring short to intermediate term outcomes
4. What changes have occurred over time?	4. Monitoring changes against a baseline
5. How have funds and resources been used?	5. Financial monitoring
6. What processes have been used during program implementation?	6. Monitoring management and administrative arrangements and processes
7. What are the views of stakeholders of the progress of the program against the stated program logic?	7. Monitoring key areas such as stakeholder relationships

(Source: Markiewicz and Patrick 2016)

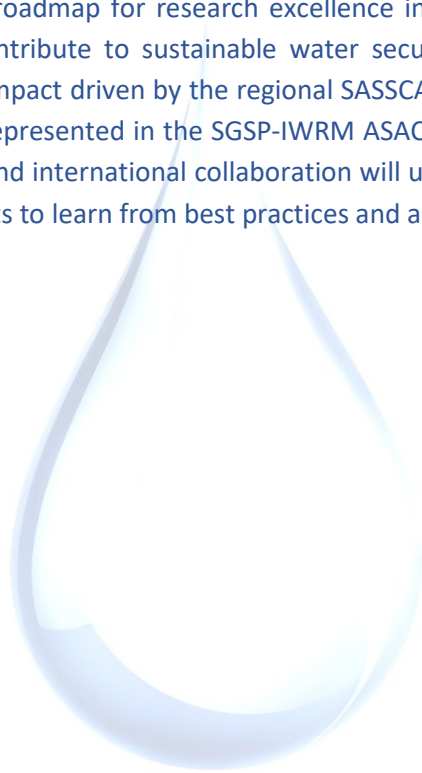
3.2.3 Monitoring and Evaluation Data Reporting

A reporting strategy is crucial for systematic and timely provision of essential information at periodic intervals to stakeholders (Munyayi, 2020). Reporting is done to deliver a message for the purposes of accountability and motivate action from all stakeholders (Welsh et al., 2005). In reporting M&E information the SGSP-IWRM Science Plan will be guided by the following practical aspects;

- Reporting shall be in a clear and understandable form;
- Reporting shall take into account the different targeted audiences' interests, expectations and preferred communication medium;
- Reported data shall also be relevant to the target audience;
- Reporting shall be in compliance with the international and national requirements;
- Reporting shall be timely and accurate.

3.3 Conclusion

This SGSP-IWRM Science Plan is a milestone for the SGSP-IWRM, the SASSCAL countries and the SADC region as it elaborates a clear roadmap for research excellence in IWRM. It is envisaged that this Science Plan will ultimately contribute to sustainable water security in southern Africa, through excellent research for societal impact driven by the regional SASSCAL Research Chairs, as well as the high level of water experts as represented in the SGSP-IWRM ASAC, and implemented by the SGSP-IWRM PhD students. Regional and international collaboration will uniquely ensure diversity, and will present the SGSP-IWRM students to learn from best practices and achieve research excellence.



References

- Bharati, L and S. Uhlenbrook. (2020). Moving from water problems to water solutions in a climate-challenged world. Rural 21. 13.03.2020 <https://www.rural21.com/english/current-issue/detail/article/moving-from-water-problems-to-water-solutions-in-a-climate-challenged-world.html>
- Giordano, Mark; Shah, Tushaar. 2014. From IWRM back to integrated water resources management. International Journal of Water Resources Development, 30(3):364-376. doi: <http://dx.doi.org/10.1080/07900627.2013.851521>
- Jensen, K. M. (2013). Viewpoint–swimming against the Current: Questioning development policy and practice. Water Alternatives, 6, 276–283.
- Markiewicz, A. & Patrick, I. (2016). Developing Monitoring and Evaluation Frameworks, Thousand Oaks, CA: Sage.
- Matros-Goreses, A. (2018). WEF Nexus Analysis. Namibia perspective. SADC Regional WEF Nexus Operational Framework. International Water Management Institute on behalf of Global Water Partnership.
- Movik, S.; Mehta, L. and Manzungu, E. 2016. The flow of IWRM in SADC: The role of regional dynamics, advocacy networks and external actors. Water Alternatives 9(3): 434-455
- Molle, F. (2008). Nirvana concepts, narratives and policy models: Insights from the water sector. Water Alternatives, 1, 131–156.
- Munyayi, R. (2020). Namibia University of Science and Technology: Research, Innovation, and Entrepreneurship Monitoring and Evaluation Guide, Windhoek, Namibia.
- SASSCAL Graduate Studies Programme in IWRM, (2020). Summary Proposal. Windhoek, Namibia
- United Nations, The United Nations World Water Development Report 2021: Valuing Water. UNESCO, Paris.
- WaterNet. (2015). SADC Research Agenda. Harare, Zimbabwe.
- Welsh, N., Schans, M. and Dethrasaving, C. (2005). Monitoring and Evaluation Systems Manual (M&E Principles). Publication of the Mekong Wetlands Biodiversity Conservation and Sustainable Use Programme