

EVALUATION OF THE AFRICAN UNION (AU) NEW PARTNERSHIP FOR AFRICA'S DEVELOPMENT (NEPAD) FLAGSHIPS PROGRAMMES

Draft Report
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A. LIST OF ABBREVIATIONS

ABI	African Biosciences Initiative
ACGI	African Collaborative Grants and Initiatives
AIMS	African Institute of Mathematical Sciences
AMI-Net	African Mathematical Institutes Network
AU	African Union
AUDA	African Union Development Agency
CSIR	Council for Scientific and Industrial Research
DHET	Department of Higher Education and Training
DSI	Department of Science and Innovation
DST	Department of Science and Technology
DVC	Deputy Vice-Chancellor
ESMT	European School of Management and Technology
KAS	Knowledge Advancement and Support
NEI	Next Einstein Initiative
NEPAD	New Partnership for Africa's Development
NRF	National Research Foundation
NSI	National System of Innovation
RISA	Research and Innovation Support and Advancement
SADC	Southern African Development Community
SANBio	Southern African Network of Biosciences
SANWATCE	Southern African Network of Water Centres of Excellence
SARChI	South African Research Chairs Initiative
SC	Steering Committee
ToR	Terms of Reference
UNESCO	United Nations Educational, Scientific and Cultural Organization

B. EXECUTIVE SUMMARY

The Department of Science and Innovation (DSI) has been supporting three African Union (AU) New Partnership for Africa's Development (NEPAD) programs. The three programs are: (i) The African Institute of Mathematical Sciences (AIMS); (ii) The Southern African Network of Biosciences (SANBio); and (iii) The Southern African Network of Water Centres of Excellence (SANWATCE). The main objective of NEPAD Flagships is to strengthen cooperation in science, technology, and innovation in Africa; building capacities and supporting initiatives of the Southern African Development Community (SADC) and the AU. The NRF commissioned the review to assess how effectively the programs have used grants to achieve their objectives, but especially how aligned these objectives were with the focus of the NRF.

The panels considered the structure of the three flagships and their place in the African and South African research landscape. They concluded that while there are similarities, primarily at the strategic level, there are significant differences at the operational level, especially between AIMS SA and the cluster of SANBio and SANWATCE. All Flagships have been created by the African Council of Ministers of Science and Technology (AMCOST). Their primary goals are aligned with the AU Agenda Flagships 2063. The final responsibility for their operation lies with the DSI. The DSI mandate is to drive the scientific agenda for the region. It is more appropriate for DSI to oversee the activities of the flagships rather than NRF, which is a funding research agency in South Africa.

The main differences between the flagships revolve around core functions, structure, governance and funding. This observation necessitated the internal splitting of the report into parts pertaining to the respective flagships. Most specific recommendations apply to particular Flagships. For instance, since AIMS, SANBio and SANWATCE have different governance structures, the suggestions for the latter concerning the structure and functioning of the Steering Committees are meaningless for AIMS. On the other hand, the recommendations for AIMS concerning the student body are not relevant to SANBio and SANWATCE.

The Panel believes that AIMS SA realized well, and in a cost-efficient way, its objectives as a NEPAD Flagship against the backdrop of a deteriorating financial situation. Also, due to the African postgraduate supervision and research contributing to South African science, AIMS is partly aligned with the NRF mandate. The main weakness of the AIMS (and, in fact, other NEPAD Flagships) model is that they are not firmly placed in any stable international or national structure and, related to this, there are too many reporting lines. In particular, the problem between NRF and AIMS SA is that NRF mainly provides short-term grants on a competitive basis, whereas AIMS (and other flagships) are facilities that require stable long-term core funding. Both AIMS Research Centre and AIMSSEC require long-term grants for meaningful functioning. The existing management structure is cost-effective, but staffing is too lean, in particular, there is a need for a Deputy Director responsible for the Research Centre. Concerning student matters, there is a lack

of student representation that could make an input into the management of AIMS and help in resolving students' grievances. The lack of regular on-site psychological counseling is considered to be a serious shortcoming. Finally, the engagement with SA institutions of higher learning and research outside the Western Cape province is too weak. There are too many other entities serving the mathematical community in South Africa with overlapping mandates, such as CoE-MaSS, NITheCS, and National Graduate Academy-MaSS.

The governance structure and the Steering Committee of SANBio performed their functions adequately. SANBio marked several significant achievements: (i) 9 products, 7 registered companies, \$17.5 M external funding in 5 years, (ii) met the HCD targets regarding the number of post-graduate students trained, (iii) youth ambassador program has been successful, (iv) SANBio mobility fund used to take students for training to partner labs. The business plan was endorsed by Ministers. Funding was adequate from external parties. SANBio moved towards impact-driven science and registered intellectual property. The success factors from commercialization create an opportunity for sustainability.

However, evidence suggested that the steering committee was not entirely constituted of people able to drive the member states to contribute financially. To generate financial contributions from member-states, SANBio requires SC members at a senior level to make decisions regarding the funding of some of the projects. Members of the committee were unable to push for more funding from the member states to ensure sustainability. SANBio requires its own resources for long-term sustainability. The steering committee is expected to be the place to resolve some of the issues. However, because the SC is not representative of all member states, it tends to reflect particular biases and interests.

Despite the lack of adequate financial resources and contributions from member states for SANWATCE, the Hub (Stellenbosch University) and the network manager were able to sustain and extend the activities of SANWATCE in line with the SADC water research agenda. Node coordinators' research was supported, wherein student training was a key component. Student ambassadors were highly complimentary of the program and the support provided. The Steering Committee was mandated to govern SANWATCE. In this regard, they did not perform their task adequately as demonstrated in the infrequency of meetings, limited participation from beyond South Africa, and lack of advisory role. There was considerable overlapping of functions among SANWATCE and WaterNet and to a lesser extent SADC GMI. Given SANWATCE's mandate within SADC, node coordinators expressed a desire for a more focused research agenda and support. Compared to the other two Flagships, there has been a lack of adequate financial support by member states for SANWATCE. This has serious negative implications on the activities of the Flagship.

In relation to the Terms of Reference (Section 6), we conclude: The performance of the Flagships in terms of their objectives was more than satisfactory. The Flagships achieved what they set out to do. In terms of return on investment, the value derived from the grants awarded to Flagships are clearly demonstrated; there is strong evidence of the Flagships using awarded grants to succeed in their programs. Without these grants, it is doubtful that the level of achievement would have been as high. The funding should be continued for these three programs and enhanced if

possible. As these are programs mandated by the AU/NEPAD and/or SADC, funding must come from all member states.

In terms of appropriate management, as a continental initiative, the Flagships are best managed by a Government Department and not a national funding agency. In this case, the DSI is more appropriate. Based on the resources provided, the achievements were more than satisfactory. The Flagships align with the NRF mandate in terms of the advancement of research and knowledge mobilization. However, the NRF should be a complementary entity that works alongside the Flagships, not act as a management instrument. For the long-term sustainability of the Flagship programs, member states must contribute core funding.

C. INTRODUCTION

The DSI has been supporting three African Union (AU) New Partnership for Africa's Development (NEPAD) programs. In 2016 the DSI engaged the National Research Foundation (NRF) to play a more proactive role in the management and monitoring of these Flagships. The African Collaborative Grants and Initiatives (ACGI) within the Knowledge Advancement and Support (KAS) Directorate of the NRF has been managing the Flagship support grants awarded to the three NEPAD programs. The three programs are:

- i. The African Institute of Mathematical Sciences (AIMS);
- ii. The Southern African Network of Biosciences (SANBio); and
- iii. The Southern African Network of Water Centres of Excellence (SANWATCE).

The three programs are in fact entities in themselves and in addition to the DSI funding through the NRF, they also source funds from elsewhere for their activities.

The main objective of NEPAD Flagships is to strengthen cooperation in science, technology and innovation in Africa; building capacities and supporting initiatives of the Southern African Development Community (SADC) and the AU. Given the current debates about the social costs and benefits of managing the NEPAD Flagships contracts within the NRF, an evaluation will be commissioned to understand the contributions of these programs and arrangements towards addressing the NRF mandate, alignment to Vision 2030 and Strategy 2025. The review will primarily assess how effectively the programs have used grants to achieve their objectives, but especially how aligned these objectives are with the focus of the NRF.

D. BACKGROUND TO THE EVALUATION PROCESS

The main purpose of the primarily retrospective evaluation was to assess the performance of three Flagship contracts that are managed by KAS so that it may provide the NRF and DSI with performance indicators for the first 5 years (end of contract) since inception. In this regard the evaluation assessed how effectively the programs have used grants to achieve the components of their program and what difference if any, the grants made. The evaluation also provided prospective recommendations on whether the Flagships align with the NRF mandate;

sustainability beyond the current contract, as well as their strategic positioning relevant to the NRF mandate in their focus areas. The evaluation report provides the NRF and DSI with a basis from which to decide the future of the individual Flagships beyond the initial 5 years of funding.

The evaluation covered the following:

- (i) The period 1 January 2016 to 31 December 2020.
- (ii) Return on investment - performance of Flagships in terms of the support received and grants awarded, in the context of the evaluation dimensions as specified in section 5.
- (iii) Management of the Flagships.
- (iv) The evaluation has provided recommendations on whether the Flagships align with the NRF mandate, sustainability beyond the current contract as well as their strategic positioning relevant to the NRF mandate in their focus areas.

E. METHODOLOGY

There were three Flagships evaluated. Two panels were constituted to conduct the evaluations. AIMS had its own panel and SANBio and SANWATCE had a combined panel. The evaluation method had three components. In this way, the components complemented each other and provided information for triangulation of the results.

1. Reading and analysis of reference material provided

Reading and analysis of relevant documents included in particular the Self-Evaluation Reports (SER) from the Flagships Principal Investigators (PIs). Below is a listing of the provided reading material considered relevant to this evaluation.

1.1 KAS

- (i) NEPAD Flagships Framework – June 2020
- (ii) Status report for the project
- (iii) A Review of DST Support Provided to the NEPAD Science and Technology Flagship Programmes, February 2013

1.2 SANWATCE

- (i) SANWATCE Award letter 2016
- (ii) SANWATCE Award letter 2018
- (iii) SANWATCE Contract between University of Stellenbosch and NRF – 2016
- (iv) SANWATCE Business Plan 2016 – 2020
- (v) SANWATCE Self-evaluation Report (SER) 2020

1.3 SANBio

- (i) Award letter
- (ii) SANBio Signed contract NRF-DSI 2016

- (iii) SANBio Business Plan 2013 – 2018
- (iv) SANBio Self-evaluation Report 2020

1.4 AIMS

- (i) AIMS Award letter
- (ii) AIMS signed contract NRF-DSI 2016
- (iii) AIMS Proposal 20151
- (iv) AIMS Self-evaluation Report 2020

1.5 Other Reference Material

- (i) NRF Vision 2030
- (ii) NRF Strategy 2025
- (iii) NRF Strategic Partnerships Strategy
- (iv) Technoscene report on Review of DST

2. Interviews

Targeted interviews (Zoom and telephone) with stakeholders/ individuals who are key to achieving the goals of the Flagships and who have a good understanding and experience of, as well as an appreciation for, the area of the Flagship were conducted by the evaluation panel.

The agenda (Annexure 1) for the interviews for SANBio and SANWATCE followed the below sequence:

- (i) 28th March 2022 (Annexure 1a)
- (ii) 29th March 2022 (Annexure 1b)
- (iii) 30th March 2022 (Annexure 1c)
- (iv) 31st March 2022 (Annexure 1d)
- (v) 1st April 2022 (Annexure 1e)
- (vi) 6th April 2022 (Annexure 1f)

The agenda for the interviews for AIMS conducted from 28th – 30th March 2020 is available in Annexure 2

Questions were submitted to the interviewees in advance (Annexure 3). The interview sessions were recorded by a scribe and the information provided by the scribe in Annexures 4 and 5 was used for the panel discussions by the SANBio/SANWATCE and AIMS committees, respectively.

Solicited and/or volunteered written submissions from some stakeholders served as input material for the panel. This option of submission was available to individuals who may have been targeted for interviews, but who are not available for the interview or prefer to make written submissions.

It should be noted that some interviewees were not available for the interviews and did not provide responses. In addition to interviews, some interviewees provided written responses (Annexure 6).

The Evaluation Panel pursued their own line of questioning during interviews, being guided by the evaluation dimensions in section 6 of ToR.

3. Panel Discussion

Subsequent to the interviews, the panels had discussions in several sessions to formulate the report (Annexure 7).

F. KEY FINDINGS

1. Differences among the Flagships

The Flagships vary in structure and function to a significant degree necessitating the recommendations to be divided in terms of specific programs and general, strategic questions. The key differences are as follows:

- **Core functions.** The main functions of AIMS SA are training postgraduate students from Africa, basic research, and teachers' enhancement (making it more similar to Waternet?). On the other hand, the primary function of SANBio & SANWATCE is to advance the bioscience research agenda and the commercialization of science. SANWATCE was intended to create a network of networks to further the SADC water research agenda in the Southern Africa region.
- **Structure.** The AIMS network consists of independent institutes across Africa, and the review focuses only on the South Africa unit, with its specific nationally oriented activities. SANBio & SANWATCE are networks of nodes in the SADC region, and the review applies to the whole network.
- **Governance.** There is an AIMS secretariat coordinating the work of all AIMS centers within the Next Einstein Initiative. However, AIMS SA is independently governed by a trust and a local council, consisting partly of the representatives of founding universities. SANBio & SANWATCE are governed by steering committees (SC) that represent the nodes in the SADC region.
- **Funding.** The funding for the AIMS core functions (postgraduate supervision) primarily comes from outside donors. The DSI contributes a few percent of the total budget, mainly used to ensure the smooth running of the facility including support for the African tutors and visiting African scientists. For SANBio and SANWATCE, DSI provides the seed funding while the rest comes from donors e.g. BioFISA in the case of SANBio, and European Commission for SANWATCE.

2. Reporting of the Hub to the National Agency - Management of the Flagships

The mandate of DSI and NRF are not completely congruent, which creates difficulties if the Flagships are moved between these two entities. The vision and mission of NRF is focused on certain key elements that may not necessarily be what the Flagships are focused on. NRF has centers of excellence, chairs, etc., however, the Flagships do not fit well within the NRF structure. Although the Flagship programs may add value to NRF, they are not aligned specifically with the NRF mandate. For instance, SANBio is focused on the commercialization of science and technology which is outside the NRF mandate. NRF's primary focus is high-level human capacity building, creation of knowledge, public awareness, etc.

NEPAD is an AU initiative at the continental level and its Flagships should be managed by appropriate governmental agencies. In South Africa, DSI should be responsible for the Flagships since it is best suited to steer the program and handle the challenges. DSI is best positioned to be able to communicate with other SADC and AU states through the African Ministers' Council on Water (AMCOW) and African Ministers of Science and Technology (AMCOST). The DSI mandate is to drive the scientific agenda for the region. It is more appropriate for DSI to oversee the activities of the Flagships than NRF, which is a funding research agency in South Africa. According to all the evidence presented by interviewees (Annexure 1a page 1-12) and supporting information, the Flagships are best placed and embedded within DSI since they have a very strong mandate to address continental challenges and facilitate collaborations.

3. SANBio

3.1 Background Information

The Southern Africa Network for Biosciences (SANBio) provides a shared research, development and innovation platform for working collaboratively to address some of Southern Africa's key biosciences issues in health, nutrition and health-related intervention areas such as agriculture and the environment. SANBio was established in 2005 under the New Partnership for Africa's Development (NEPAD), as one of five networks established under the African Biosciences Initiative (ABI) to cover the SADC region.

The SANBio network covers 12 countries – Angola, Botswana, Malawi, Mauritius, Mozambique, Namibia, Lesotho, Swaziland, Seychelles, Republic of South Africa, Zambia and Zimbabwe. Network operations are facilitated by a Secretariat, located at and supported by the Hub (the CSIR) on behalf of all the Stakeholders. There are six nodes – University of Mauritius, North West University (South Africa), University of Namibia, Bunda College of Agriculture (Malawi), University of Zambia & National Institute for Scientific and Industrial Research, and the SADC Plant Genetic Resources Centre (Zambia). The network is responsive to a Southern Africa biosciences agenda, as articulated by its key stakeholders – the Member States, SADC and the NEPAD Agency.

3.2 Evaluation

3.2.1 SANBio Governance Steering Committee (SC)

The SC played a more strategic role and succeeded in guiding the activities of the Flagship. Overall, NEPAD HOD was complimentary of the activities of SANBio. Although there were challenges, they were successfully overcome with SANBio meeting its objectives under trying circumstances including COVID.

AUDA NEPAD director agreed that funding provided by SADC member states was inadequate. (Annexure 4a page 13-15)

The SC chair indicated the following: (i) many projects were funded, (ii) SC played an oversight and advisory role, and (iii) sourced funding opportunities and approved funding. There was a lack of equal participation and commitment from member states including financially in supporting the projects. Return on investment partially realized for SANBio. The SC chair indicated that the projects were supported once-off only, and was 70% satisfied with delivery. The major problem revolved around other states' participation. (Annexure 4a, pages 16-17)

The network manager indicated that the SC comprises representation from member states working closely with AU. According to the SANBio business plan, the network manager should be supported in the secretariat by supporting staff to aid with administration. This does appear to be the case. Due to the lack of permanent positions, the secretariat has lost staff members to CSIR. (Annexure 4a page 18-22)

Despite challenges, the network has grown since 2016. Some of the highlights included: (i) 9 products, 7 registered companies, \$17.5 M external funding in 5 years, (ii) met the HCD targets with regards number of post-graduate students being trained, (iii) youth ambassador program has been successful, (iv) SANBio mobility fund used to take students for training to partner labs. The business plan was endorsed by ministers. Funding was adequate from external parties. SANBio moved towards impact-driven science and registered intellectual property

The network manager was satisfied by the support provided by CSIR including the brand and logistics support. The network manager played a central role. The network manager was overall very positive. This feedback was complemented by the node coordinators.

The Pro-Vice-Chancellor - Academic Affairs and Administration of the University of Zimbabwe was satisfied with the CSIR and promoted the project in the region (Annexure 4a page 26-27).

3.2.2 SANBio Node Coordinators

Reporting was very effective, and the Hub manager was positive about the reporting by the node coordinators. They were given the opportunity to be exposed to other projects. The model was strong, exposure to other projects allowed them to learn from each other. The Flagship had mentors and workshops on business intervention. The Hub manager organized these workshops

to bring them together. Mentors helped scientists realize how to take their products forward. Strength was in creating the university/ industry partnerships, during the earlier stage this helped scientists refine the concept and, on the business side, showing how the product could be commercialized. Overall, they had good exposure through SANBio.

Generally, there was a positive impression amongst the node coordinators. SANBio is about individuals with interesting ideas towards commercialization and not focused only on networking. It was noted that there was an uneven experience related to networking due to expectations. The expectations amongst the nodes were different. Some of the nodes' expectations were not completely realized and this influenced their performance. In some cases, the collaboration aspect did not materialize as expected. The majority of individuals' expectations were receiving funding and learning about commercialization, whereas some wanted to build a network to assist them to address problems. Several potentially marketable projects have come out of SANBio. (Annexure 1b)

3.2.3 SANBio Student Ambassadors

Student ambassadors were complimentary and happy about mobility, funding and collaborations during the completion of their projects. Node coordinators were satisfied by the various support from SANBio. There was a strong component of human capacity development and networking between/among node partners. Students were self-motivated, primarily focused on the completion of their degrees. As a result, they did not build their own network. Nevertheless, they benefited from the program by receiving funding and a qualification (Annexure 4b, pages 5-6, 18).

3.2.4 SANBIO Summary of Discussion

Responses from the node coordinators indicated they were satisfied with the support from SANBio and functioning with the nodes with regards to the interactions between the Hub and node coordinators. Responses from the students and nodes indicate they were fairly happy since their mobility, projects and prototypes were funded. Feedback from questionnaires showed they were happy with the program.

SANBio mandate was very specific and tightly coupled with the commercialization of science. SANBio facilitated network research amongst individuals. Reports showed considerable successes across the board, thus it was easier to bring interested investors to support research. However, evidence suggested that the SC was not entirely constituted of people able to drive the member states to contribute financially. To generate financial contributions from member-states requires SC members at a senior level in order to make decisions regarding the funding of some of the projects. Members on the committee were unable to push for more funding from the member states to ensure sustainability.

SANBio was well-managed and clear from the evidence provided they achieved excellent outcomes, however, there were challenges. SANBio requires its own resources for long-term sustainability. The SC is expected to be the place to resolve some of the issues, but it is not equally represented. The unequal contribution is manifest in how the SC participates.

4 SANWATCE

4.1 Background Information

In 2003, the African Ministerial Council on Science and Technology (AMCOST), decided on water science and technology (S&T) to constitute one of the main Flagship programs of the African Union/New Partnership for African Development (AU/NEPAD). Thus, in the framework of the AU/NEPAD, the leaders committed themselves to “ensure sustainable access to safe and adequate clean water supply and sanitation, especially for the poor”. The Flagship program should strengthen the continent’s capabilities to harness and apply S&T to address the challenges of securing adequate clean water as well as managing the continent’s resources.

In 2006, the African Ministers responsible for science, technology and water (AMCOST and African Ministerial Conference on Water, AMCOW) met in Cairo, Egypt. By resolution, the delegates committed to establishing an African Network of Excellence in Water Sciences and Technology Development.

Based on the foregoing, the AU/NEPAD SANWATCE is a network of higher education and research institutions conducting high-end scientific research and capacity development in water and related sectors, to achieve impact in societies. The network is a made up of 11 Centres of Excellence present in 8 SADC Member States namely:

- University of Botswana (Botswana) - Node
- University of Malawi (Malawi) - Node
- University of Mauritius (Mauritius) - Node
- Universidade Eduardo Mondlane (Mozambique) - Node
- Namibia University of Science and Technology (Namibia) – Node
- Council for Scientific and Industrial Research (South Africa) – Node
- Stellenbosch University (South Africa) – as the Hub and Node
- University of KwaZulu-Natal (South Africa) - Node
- University of Western Cape (South Africa) – Node
- University of Zambia (Zambia) - Node
- National University of Science and Technology (Zimbabwe) – Node

4.2 Evaluation

4.2.1 SANWATCE Governance Structure

According to the business plan, the SC is supposed to comprise eight members with the SC chair being the senior. The SC was expected to meet twice a year to oversee the activities of the network and evaluate the performance of the network manager and secretariat

There were concerns by members that the SC has not adequately performed its oversight role including performance evaluation of the managers, secretariat, fundraising and strategic direction.

The SC was supposed to establish a scientific advisory committee of five members from the SADC member states including influential government officials, and water organizations such as UNESCO chair or WRC to provide advice and assess projects for SC. There was no evidence to suggest that this structure exists. The governance structure appears to be an arrangement between the network manager and SADC officials. This is a serious concern to the level of commitment to the Flagship by the member states as laid out in the terms of reference.

However, the network manager should be acknowledged for contributions to try to sustain the activities despite the challenges. The network manager was instrumental in setting up collaborative partnerships which benefited several node members. (Annexure 4c, pages 1-5).

According to the DVC, hosting the Hub at Stellenbosch allowed the university to expand its research agenda and ability to raise international funding. The DVC mentioned that he will be happy to support the Hub at SU permanently (Annexure 4c, pages 6-8).

There was an overlap of roles between SANWATCE and Waternet. Several nodes indicated that there needed to be a clearer separation of function between SANWATCE and Waternet. Waternet has a clear regional mandate. SANWATCE was conceptualized at the continental level to perform similar tasks, thus there is possible duplication (Annexure 4c, pages 11-13). However, there is potential to achieve good complementarity if they had a functional SC.

From the interviews, it can be seen that the operational lines are unclear and are not focused. The majority of the node coordinators were not complimentary about the performance of the SC.

From the interviews, it seems like they are unsure who the SC is and indicated that they would like to see separate SC governance sessions to deal with strategy and operations. This could be better in terms of financing and fair contribution, strategic day-to-day operations, and sourcing of the secretariat as an entity.

Representation from the government should be at a senior level on the SC to make it more functional. A well-structured approach is required.

4.2.2 SANWATCE Funding

Seed funding (R1.1 per annum) for SANWATCE is coming from the SA government (DSI). This amount is not sufficient to sustain the projects. The Hub, Stellenbosch University has surpassed expectations in supporting the activities of SANWATCE in terms of infrastructure and human resource support.

Financial support from other member states is non-existent. All SADC member states need to provide seed funding to sustain the network, at a minimum amount of R2 million per annum per SADC member state. Further funding for research activities can be obtained by leveraging donor funding. Overdependence on EU funding reflects the limited capacity of the secretariat to leverage funding from other parts of the world.

4.2.3 SANWATCE Industry Partners and Funding Agencies

GMI signed an MOU in 2019 to cooperate on groundwater projects. SANWATCE facilitated expanding GMI networking in Africa. However, there appears to be a duplication of functions between SANWATCE and GMI. Signed MOU in 2019, but no evidence to suggest this relationship has flourished (Annexure 4c, pages 9-10).

Waternet is also a SADC subsidiary focusing on human capacity development activities by providing scholarships for students of IWRM. Waternet and SANWATCE host an annual symposium (WARFSA) to provide a platform for knowledge exchange for researchers in SADC. Waternet played a key role in an EU-funded project on the skills training aspect. The financial sustainability of Waternet depends on donor funding. It was mentioned that SANWATCE needs to do research that is more relevant for the region to attract EU funding. There should be a distinction in the role of SADC, SANWATCE and Waternet. The expectation is that SANWATCE should generate the research funds. As much as WARFSA is currently housed at SANWATCE, it needs to be revived to make any impact on the SADC water research agenda. Waternet is a teaching and training entity with a primary focus on human capacity and professional development. Waternet sees SANWATCE more like an entrepreneur, unlike GMI (Annexure 4c, pages 11-13). Waternet must focus on HCD and SANWATCE to be the research agent and focus on the water research agenda.

SADC representatives confirm that support for SANWATCE was inadequate. There are shortcomings on the part of SADC to drive the SC activities. They need better strategic and innovative ways to draw in member states' support (Annexure 4d pages 19-20).

4.2.4 Response from Node Coordinators

The key concerns raised were with regards to the performance of the SC and funding by member states was inadequate (Annexure 4d, Annexure 4f, pages 4-6).

4.2.5 Student Ambassadors

Students were highly satisfied with the support provided by SANWATCE with regards to funding, attending short courses, and workshops and facilitating networking amongst students. SANWATCE also arranged access for students to specialize equipment in partner laboratories (Annexure 4d, pages 24; Annexure 4e, pages 4-6).

5 AIMS

5.1 Background Information

African Institute for Mathematical Sciences (AIMS) was established in 2003, as a partnership project of the following 6 universities: Cambridge, Cape Town, Oxford, Paris Sud XI, Stellenbosch and Western Cape, first primarily to provide postgraduate instruction in mathematical sciences for best students from Africa. Due to SA regulations, the academic credentials for graduating students are provided by the SA partner universities, UCT, UWC and US. Originally, graduating students received a Postgraduate Diploma; it was later changed into a Structured MSc (similar to MSc by Coursework, not fully sufficient to directly progress to PhD).

Though some research activities were carried out from 2003, mostly through short-term research fellowships sponsored by the Ford Foundation, the Victor Rothschild Memorial Fund and the National Research Foundation, research commenced in earnest in 2008, when a grant secured from the Department of Science and Technology (DST) made it possible to launch of the AIMS South Africa Research Centre, situated across the street from the main AIMS building. Further, AIMS SA, through AIMSSEC, has delivered courses for mathematical teachers, together with the European School of Management and Technology (ESMT) Berlin, ran an AIMS ESMT Industry Immersion Programme supported by the German Federal Ministry for Economic Cooperation (BMZ) through the German Academic Exchange Service (DAAD) and the AIMS House of Science has provided the AIMS South Africa's public engagement activities.

The importance of AIMS was recognized by the African Ministerial Conference for Science and Technology in Dakar (Senegal) in 2005 which included it in four regional NEPAD Flagships which the Government of South Africa pledged to support through the DSI (formerly DST). At the same time, building on the model of the South African center, AIMS launched the Next Einstein Initiative (NEI) in 2008 to scale up and roll out the AIMS model across the continent. Since then, AIMS has grown into the pan-African network of similar centers in Cameroon, Ghana, Senegal and Rwanda (the center in Tanzania was closed due to the Tanzanian government having withdrawn funding but possibly will re-open). The AIMS Global Secretariat, originally operating in Cape Town, South Africa, moved to Kigali (Rwanda).

At the beginning of the assessed period (2016) AIMS and other NEPAD Flagships were handed to NRF causing certain confusion by creating dual reporting lines, to NRF and to DSI (who was the original signatory). It is important to note here that the objectives of NEPAD Flagships, being more pan-African oriented, are not necessarily aligned with NRF objectives which are oriented more towards competitively supporting South African research endeavors.

From the governance point of view, AIMS is a charitable trust registered in South Africa with trustees being Dr Rob Adam, Dr Nashima Badsha, Prof. Fritz Hahne, Prof. Loyiso Nongxa, and Prof. Daya Reddy and Prof. Neil Turok. The activities of AIMS are governed by the AIMS SA Council which includes representatives of each of the six partner universities, the Director of AIMS, a representative from the Nelson Mandela University and Prof. Turok. Detailed

management and day-to-day running of the AIMS project is done by the Executive Team, chaired by the Director of AIMS, and comprising six representatives from the three Western Cape Universities providing the accreditation for the academic activities of AIMS. On the ground, the Director of AIMS is supported by an Academic Director, dealing with the student matters, and an administrative and maintenance team.

The Panel notes that there was also an Advisory Board consisting of a broader representation of stakeholders, including the South African Mathematical Society, NRF, CSIR and other South African universities. However, it seems that it ceased to operate before 2016 (see the Annual Report 2016/2017). It is unfortunate as even though there is some collaboration, it seems that currently there are no formal links with the mathematical entities outside the Western Cape.

AIMS has been funded from a combination of different sources whose contributions have varied over the years. The South African Government funds AIMS through the Department of Higher Education and Training (Academic Programme), DST/DSI (Academic Programme, Research Programme and Post AIMS bursaries), NRF (Research Programme) and National Skills Fund (Teacher Training Academic Programme, South African Taught Masters and Teacher Training bursaries). Other sources include AIMS-NEI Bursary Funding – MasterCard Foundation (Taught Masters Programme), the Alexander Von Humboldt Foundation (German Research Chairs), AIMS-NEI Research (Research Programme), DAAD (Bursaries/Scholarships), ESMT (Industry Immersion Programme), the Oppenheimer Memorial Trust (Teacher Training Programme), IDRC and the Robert Bosch Foundation (Research Grants). It is important to emphasize that even though AIMS is a NEPAD Flagship established by the African Ministers for Science and Technology under the auspices of the African Union, no financial support from the African Union has been forthcoming. Similarly, the objectives of AIMS are aligned with that of the African Development Bank, no funds from that bank have been forthcoming.

While for the first years of the assessed period the contribution coming from the South African Government was kept at least 55% of the AIMS budget, it is noted that in 2021 this contribution decreased to 46%, mostly due to postponement of decisions concerning the National Skills Fund contribution (serving the upliftment of teachers) and a significant decrease in the DSI funding (covering some administrative salaries, the appointment of tutors and post AIMS bursaries).

5.2 Evaluation

AIMS operates within the policy context of the continental strategy of the African Union agenda 2063. It aspires to play an important role in catalyzing an education and skills revolution, as well as actively promoting science, technology, research and innovation to build knowledge, human resources, capabilities and skills for the African century. In that way, AIMS contributes to the AU agenda 2063, where the key theme is accelerating the transition of the continent to becoming more innovation-led and knowledge-based economies. More precisely, the objectives of AIMS as a NEPAD Flagship include:

- conduct and foster outstanding research and learning in the mathematical sciences thus contributing to the next generation of pan-African leaders in many spheres and the advancement of African science and academia within a multicultural environment.
- build the capacity of Africa's teachers through training programs to increase the pipeline of math and science students.

The objectives have been realized by training postgraduate students towards MSc, supporting the best of them in pursuing further academic degrees as well as preparing them for an industrial workplace environment, carrying out research in selected areas in the AIMS Research Centre, providing support to workshops and conferences, training mathematics teachers through AIMSSEC, and popularising mathematical sciences through outreach activities coordinated by the House of Science.

5.2.1 Structured MSc program

To achieve training in a multicultural environment, AIMS recruits, on a competitive basis, from among the best graduates from all African countries. In the period 2016-2020, AIMS graduated 297 students (125 females), 65 of whom are South Africans. The course curriculum differs from a typical university MSc course by offering a diversity of maths courses that include both theoretical topics but also computation, programming, data analysis and statistical methods, which are relevant to the skills of the future and are required to leverage on the opportunities that the Fourth Industrial Revolution offers. Because of this, the students do not become experts in a particular field. Some say that the AIMS program is like 'wine tasting' or a 'candy shop' for maths. However, in this way AIMS builds problem-solving skills and plays a pivotal role in enabling the students to venture into the areas of artificial intelligence, data science and machine learning. Moreover, the quality assurance is provided by the South African Qualification Authority (SAQA) approval of the program, which allows the degree to be conferred by three South African Universities. Also, the AIMS program was reviewed by the UK National Academic Recognition Information Centre (NARIC), which found that it is comparable with the UK level 7 qualification. Given that an estimated 70% of the AIMS graduates stay in Africa (<https://centres.nexteinstein.org/>), it can be stated that AIMS provides highly qualified cadres for the advancement of the continent.

All students (and most lecturers) are housed in the main building which helps in experiencing a multicultural environment and builds a bond between the students and the lecturers. However, the students' life has several problems, as described by interviewees. First, the students do not have any formal representative council contribution to the management of the center. They only nominate two representatives who communicate with the administration, which is considered insufficient (like in the case of the decrease of bursaries, discussed also later). Second, living together in a closed environment far away from home creates a lot of anxiety and there is no psychological counseling available on a permanent basis at AIMS (this is even more strongly felt by female students). Third, there are controversies about the assessment system. It is distinct from a typical university way in that the students are not given precise marks but rather assessed on overall aggregated performance so that the students do not know their results until the final results are released. Some students feel that there is no transparency on how the marking

scheme works and how collaborative work is assessed. On the one hand, the ability to work in a team is an asset but then how to distinguish free riders.

5.2.2 Industry Immersion Program.

The structured MSc offer has been enhanced recently by the Industry Immersion Programme, which here looks to develop links with industry. This program is a collaboration between AIMS and the ESMT, together with funding support from the German Federal Ministry for Economic Cooperation (BMZ) through the German Academic Exchange Service (DAAD). It provides a forum for students potentially to go into the industry, to meet with people from the industry, and become acquainted with what it takes to work in the industry, building soft skills beyond the mathematical training and then working towards being placed in an internship where the student has an opportunity to see how it all works. The industry concerned has an opportunity to develop the student and see whether that will work, which might lead to a longer-term position. The vision for the industry immersion program is for an academic institution and industry to work together, ensuring that the path across is smooth.

More than 80% of the students who have been through these immersion programs have been placed in internships. There are not many such programs in South African universities. Wits University has the Industrial Mathematics Programme and annually organizes, together with AIMS, Mathematics in Industry Study Group, which provides opportunities for students and academics to engage with real problems arising in industry.

The sustainability of this program might be possible through collaboration with the industry. There are other industry initiatives usually related to a particular question (e.g., climate science, insurance companies or government monitoring). The issue is to balance the interests of the industry with having a rigorous academic standard for the master's program. There have been some concerns in this regard with the cooperative program. Making the industry immersion program to be a certified course after MSc could be a solution.

5.2.3 Research Center

The research component of the NEPAD objectives has been realized by providing support to alumni for pursuing further research degrees, both locally at the AIMS Research Centre and various SA and international universities, and by doing high-level research at the Centre. The activities of the Centre are carried out by resident researchers, including two Alexander von Humboldt Research Chairs, one SARCHI Chair and two IDRC Junior Chairs (18 researchers worked there between 2017 and 2019) and by visiting researchers (78 visitors in that period). The resident researchers supervised 29 PhD students and published 176 research papers with the AIMS affiliation. This output firmly puts AIMS on the research map of Africa – it has been ranked as the 10th best research center in Africa (<https://research.webometrics.info/en/Africa>). Unfortunately, the von Humboldt and IDRC funding have come or is coming to the end. Such a lack of long-term stability of funding (to which we return later) and forced by it basing the research on short-term grants and ad-hoc visitors could impact the coherence of the Centre's endeavor.

5.2.4 Schools Enrichment Center

Finally, AIMS, through AIMSSEC, has been very active in further training of mathematics teachers. Through largely voluntary work of an international team (the first AIMSSEC paid staff was appointed in 2009) supported by a core local group, since 2004 AIMSECC has run thirty-five 3-month Mathematical Thinking (MT) courses for over 2500 teachers, and also 2-year courses for 250 teachers. The alumni of the residential courses keep close contact with the Centre and often return as tutors. The work of AIMSSEC helps to address an acute lack of suitably qualified mathematics teachers and hence helps in creating a pipeline of learners whose knowledge of mathematics is sufficient to pursue a degree in STEM disciplines.

5.2.5 Return on Investment

As noted before, AIMS has been funded by a combination of donor sources. The Panel's understanding is that the focus is on the grant from the DST channeled through the National Research Foundation. The requested grant was intended to cover core running costs (a portion of the director's and senior project manager's salary, and travel expenses, 33%), support for African researchers and tutors (50%), post AIMS bursaries (12%) and a workshop (5%). The percentage contribution to the AIMS budget over the assessed period changed as follows: 2016 SA Government-56% (DSI/NRF grant 9%), 2020 SA Government-59% (DSI/NRF grant 8%), 2021 SA Government-47% (DSI/NRF grant 4%). These percentage must be seen in the context of the more or less constant external contribution of circa R14 million from 2018 (with 2017 being the best year with a total of R18 million in external grants), which reduced the AIMS annual budget from about R35 million in 2016 to R27 million in 2021.

It is to be noted that fluctuation in external funding seemed to have a significant impact on the core business of AIMS as the August intakes decreased from 50 to 40 in the assessed period. The Panel was also informed about problems resulting from the decrease of the pocket money portion of the bursaries for one of the August intakes of students. The forced savings also had a negative impact on the quality of the catering at AIMS.

Also, the existing model of funding of the Research Centre, based on short-term (3 years) grants, and the fluctuations in the level of funding has a negative impact on the quality of research done at AIMS. It was frequently noted in the interviews that it was practically impossible to attract high-quality senior researchers to come to South Africa (as said by an interviewee, "Very few top people would move their families without longer-term security"). This makes the core component of the Research Centre relatively small and forces the Centre to rely on short-term visitors who, as noted by one of the interviewees, are not always of satisfactory quality.

The operation of AIMS SA seems to be quite cost-effective. As far as the Panel understands, there was no need to purchase the main building. AIMS owns all the buildings it uses. The financial and HR services are provided by Stellenbosch University. The management is lean (Director and Academic Director (dealing mostly with students' matters)). Nobody is managing

the Research Centre (which most interviewees considered a weakness). One interviewee commented on top-heavy management and bad financial practices of the AIMS network but, as far as the Panel knows, these comments were not directed at AIMS SA. Also, one interviewee stated that the salary package for the local AIMSSEC management team was relatively high.

The real asset of AIMS are local and international lecturers who do either voluntary work (AIMSSEC) or work 'at cost' (most lecturers for the MSc program). This is thanks to the 'soft power' of AIMS. The model and vision of AIMS have attracted top scientists such as Stephen Hawking and David Gross and this, in turn, created the AIMS brand bringing in excellent researchers 'who believe in the vision of AIMS, are excited by it and are willing to work towards the vision that AIMS stands for'. It is also important to mention that teaching at AIMS is oversubscribed so the selected lecturers are really among the best. If one tried to run such a selection of courses, taught at that level, on a purely commercial basis, the cost would be much, much higher.

As noted by an interviewee, *'The point is that you do not need a huge amount of money, because people who believe in the vision will find a way to make it happen.'* However, even if the academic program is delivered on a voluntary or low-cost basis by enthusiastic people, there must be a permanent and efficient support structure with a stable budget, and it is counterproductive to try to run it in a cheap way.

5.2.6 Achievements of AIMS Over the Last Five Years

AIMS SA is a pan-African Centre of Excellence and a part of a network of similar independent centers in Cameroon, Ghana, Rwanda and Senegal, coordinated by a Secretariat in Kigali. The primary objective of AIMS is to provide an MSc level education in broadly understood mathematical sciences. The number of graduates was mentioned in an earlier section. Here we emphasize that the model of AIMS is unique. As stated by one interviewee:

Because of the diversity of maths courses at AIMS, students do not become experts in a particular field. When AIMS was founded, there was criticism that the AIMS program was like 'wine tasting' for maths. But this turned out to be brilliant. The world is moving so fast that the ability to sort, filter and prioritize a large volume of information is a critical skill. There is so much information available that we have to know what to consume. AIMS students need to know how to teach themselves, how to find information, and how to judge the material received. I believe AIMS is an excellent preparation for the world we are moving into.

In addition, in recent years AIMS introduced the Industry Immersion Programme which further improves the employability of the graduates. This program depends heavily on external funding. The teaching at AIMS and subsequent students' supervision for further degrees is supported by the AIMS Research Centre, which also carries out research. The research program of the Centre is partly determined by the availability of residential researchers and visitors and partly by the

national needs and includes astronomy, mathematical biology, financial mathematics and data science. An important aspect of AIMS activities is related to teacher's training, realized by AIMSSEC. Given the sore state of high-school mathematics, teachers' support is essential for creating a sufficiently large pool of matriculants who are able to pursue mathematical intensive careers. Further, public engagement was given a higher profile by the creation of the House of Science.

The numerical data showing the performance and achievements of AIMS in the above core fields were presented earlier. Here we also note that the great achievement of AIMS was becoming a world-recognized brand in mathematical sciences. Its reputation allowed it to attract top-class international lecturers to give courses and also to participate in conferences and workshops organized at AIMS. As an example, we can mention the meeting of the International Mathematical Union organized at AIMS in February 2020.

In the next part we address the question of the alignment of AIMS with the objectives of various stakeholders.

5.2.7 Alignment of AIMS with Stakeholders

The Panel has found it challenging to place AIMS and, in general, NEPAD Flagships, in the NRF vision and strategy and also to synchronize visions of NRF and DSI. On one hand, NRF Strategy 2020-2025 states that:

'In the international environment, the NRF advances the African Union's (AU) Vision 2063 and its Science, Technology and Innovation Strategy for Africa (STISA) 2024, as well as the United Nations (UN) Sustainable Development Goals (SDGs)',

'South Africa is also signatory to a number of international treaties. As such, there are a number of international strategies that inform the work of the NRF. South Africa, and hence the NRF, has prioritized its contribution to the development of the continent and in this regard the African Union's (AU) Agenda 2063 is key'

and Priority 7 of the Medium-Term Strategic Framework (MTSF) is stated as *Better Africa and Better World*.

Also, the presentation of Mr M. Nxumalo mentions modalities such as *'Regional Flagships (support for continental Flagships programs)', 'Africa Student Exchange Programme' (to be developed with DSI), and 'South Africa as a Gateway to Africa'*.

In the conclusion of the DSI presentation we see the following points:

- *NEPAD STI Flagships continue to play a critical role in building research capacities in the region.*
- *Investment in the NEPAD Flagships will support the continent's aspirations of STISA, SDGs and Agenda 2063*
- *Increase Africa's contribution to global research output (Peer-reviewed publications, technical exchanges, conference papers, etc)*

On the other hand, the international component is practically absent from the NRF Vision 2030 and Part D of the NRF Strategy 2020-2025 states that for the purpose of measuring the performance in the *Profile of NRF-funded researchers producing research outputs* and the *Profile of NRF-funded postgraduate students who have completed their studies*, only SA citizens and permanent residents will be counted as black. There seem to be no measures to assess the pan-African aspect of both postgraduate training and research done at AIMS and hence, indeed, for the purpose of reporting, AIMS seems to be rather a liability than an asset for NRF, despite the statements about the internalization of the South African science.

AIMS SA (as well as other AIMS centers) was created as a pan-African institution. The idea was to select the best university graduates from the continent, not to discriminate based on nationality. However, it was immediately observed that the intake from South Africa was negligible. There were several reasons for this, ranging from the academic calendar following the northern hemisphere timetable, through the existence of strong competition among the South African institutions for the small pool of good postgraduate students and the fact that the AIMS degree was (and still is) in some ways formally inferior to the degree from a local university, to different work ethics (in fact, some early SA entrants did not complete the degree). AIMS has undertaken a series of interventions to address this issue by introducing the January intake, aimed mostly at SA students and hosting SA students doing specialist degrees such as Mathematical Biology. In the period under the review, there has been a stable stream of 11-13 South African graduates and between 50 and 40 (the number dropped in 2017 due to financial constraints) from other African countries. Nevertheless, the smaller amount of SA graduates has created a lot of controversies related to the question to what extent South African tax-payer should pay for the education of other African students. This is related to the dichotomy mentioned above and not precisely delineated in the NRF Strategy 2020-2025 and the position of the DSI as to how students from other African countries fit into the system. Also, several interviewees expressed very strong opinions about the lack of coherent policies toward African students even though they come to South Africa in the framework of a NEPAD Flagship Programme:

'The tension is a debate that is important to have with NRF colleagues and more broadly at the African level. It would be unfortunate to approach this kind of issue in a zero-sum way. The fact that AIMS SA has a Pan-African outlook, with students from so many African countries, detracts from the impact that it makes in SA, but aligns strongly with the SA government's vision for greater cooperation in Africa.'

'The best scenario would be finding and attracting the best, bringing them to South Africa, and then letting them go into a South African university. Using AIMS almost as a filter for finding the best talent in Africa, giving them the opportunity of coming to South Africa. The best will often go overseas for a PhD, but some of them will stay in South Africa. Even if they leave, the research networks they have developed are still valuable research connections. Building and nurturing talent and networks is probably the best scenario.'

In other words, there is a strong opinion that the funds spent on training African postgraduate students are not wasted. On the one hand, the graduates, going back to their countries, create

strong South African centered networks of influence, contributing to stronger collaboration ties favoring South Africa. On the other hand, during the time the students spend in South Africa, they contribute to the national research endeavor, and if they decide to stay in South Africa, we get highly qualified specialists who, at that level, are unlikely to take jobs away from the local population, and whose education up to the undergraduate level was paid by somebody else.

At the same time, AIMS SA (through AIMSSEC) has been engaged in addressing another critical reason for the poor representation of South African students in mathematical sciences – a small pool of sufficiently proficient high school learners. According to <https://www.timss-sa.org/wp-content/uploads/2021/07/25-years-of-TIMSS-in-South-Africa.pdf>, the 2019 national TIMSS score in mathematics was 389. Despite a significant increase of 104 points from 2011, this is still below 400 points, which represents the cut-off point for ‘a *‘low’ proficiency level (have some mathematical knowledge)*’; according to TIMSS *‘Learners who score over 400 points are more likely to progress to grade 12, succeed in the matriculation examinations and possibly pursue qualifications in science, technology, engineering and mathematics.’* Thus, the problem of low representation of South African students at AIMS should be looked at in the full context and the Panel recognizes AIMS efforts to address it in a holistic, multilayer way by running the School Enrichment Programme helping the address the available pool of school learners and by training postgraduate students.

5.2.8 Evaluation Summary

To summarise, the Panel believes that AIMS SA realized well, and in a cost-efficient way, its objectives as a NEPAD Flagship against the backdrop of a deteriorating financial situation. Nevertheless, the Panel has several suggestions for improving certain aspects of AIMS operations, and the recommendations below are based on the following identified shortcomings of both external and internal nature.

The main weakness of the AIMS (and, in fact, other NEPAD Flagships) model is that they are not firmly placed in any stable international or national structure. In the words of an interviewee, Flagships have *‘dual mandate [...], which have been established by ministerial proclamation’*. More precisely, the NEPAD Flagships realize goals aligned with the African Union Agenda 2063 which is pan-African and where national interests are taken into account only as the derivatives of the continental progress, as expressed in the Key Transformational Outcome: Integrated Africa. However, the African Union has not funded AIMS DSI (a side question is what the other NEPAD Flagships are, are they funded by African governments responsible for them and is South Africa benefiting from their work – e.g., other AIMS centers are open for South African applicants and the fact that there are very few of them is due to perceptual rather than institutional reasons). On the other hand, 40-50% of the funding has been coming from the South African Government which has mostly national transformational goals in mind (note, however, that a significant portion of the SA Government funding used to be spent on national targets (e.g., up to 2020, over R5 million from the National Skills Fund was going to the South African teachers’ upliftment program). It is

also an open question to which extent we can have prosperous South Africa without prosperous Africa.

It is also worthwhile to note that in the case of other countries, initiatives providing support to international research and student exchange (e.g., CIMPA, DAAD) are often partially supported by the respective Ministries of Foreign Affairs (or equivalents). It seems that this is not the case in South Africa.

The problem of serving many masters is exacerbated by the lack of a clear reporting structure for AIMS in South Africa. On the one hand, as far as the Panel understands, the NEPAD Flagships are the creation of the council of African Ministers responsible for Science and Technology (AMCOST) and thus, AIMS is the responsibility of DSI. On the other hand, DSI passed the administration of the Flagships to NRF, which created certain tensions as the AIMS NEPAD Flagship obligations are not aligned with NRF strategy. As was noted above, the international aspects of NRF operations are not well integrated with the local ones as the measures of the NRF performance only refer to South African citizens and permanent residents. The Panel failed to find any information on how to measure the performance of NRF in realizing the pledge from the NRF Strategy 2025:

South Africa, and hence the NRF, has prioritized its contribution to the development of the continent and in this regard the African Union's (AU) Agenda 2063 is key.

The other problem in the relations between NRF and AIMS SA is that NRF mainly provides short-term grants on a competitive basis, whereas AIMS (and other flagships) is a facility that requires stable long-term core funding to maintain its essential operational capability even through lean years. It is not a CoE or a research grant with a finite life span, which can be closed when the funding cycle ends.

Also, a piecemeal way of funding AIMS creates an impression that the funds are not spent effectively. For instance, NRF complains that it has to report on the number of funded students, while out of R3.5 million per annum transferred to AIMS, R1.250 m was spent on salaries and running costs, and R900.000 on tutors. However, this R3.5 million is not the full budget of AIMS and that portion of funding is spent on facilitating the training of a large number (over 60) students per annum funded by other means, as mentioned in the previous paragraph.

Next, we summarized the internal shortcomings of the AIMS model are related to governance and student matters.

While the existing management structure is cost-effective thanks to the administrative help provided by Stellenbosch University and the low salary bill (the NRF contribution of R 550 000.00 for the Director's salary is really cheap for such a complex job), several interviewees stated that the staffing structure of AIMS is too lean. In particular, there is a need for a Deputy Director responsible for the Research Centre the work of which, in some opinions, lacked coordination and sometimes produced research of lower-than-expected quality. The Panel shares the opinion

of most interviewees that basing the activities of the Research Centre on short-term ad-hoc grants and external funding is not conducive to deep and novel research and quality PhD supervision.

A similar comment applies to AIMSSEC funding. A substantial amount of work is done by international volunteers supported by a small local team. The funding is primarily used for the students' support. The fact that after 17 years the funding from NDF ended abruptly is incomprehensible and indicates some systemic problems of the funder.

Concerning student matters, there is a lack of meaningful student representation that could make an input into the management of AIMS. There are several issues the students are unhappy about, such as the non-transparent assessment model, balance between collaborative and individual work, quality of catering or lack of social activities, and a student council could help to alleviate them. The student interviewees also felt that the pocket money part of the bursary was too small and insufficient to buy e.g., hygienic products. Finally, the lack of regular on-site psychological counseling was considered to be a serious shortcoming of AIMS.

To conclude this section, the Panel is puzzled by the existence of several entities serving the mathematical community in South Africa with overlapping mandates: AIMS SA, CoE-MaSS, NITheCS, and National Graduate Academy-MaSS. All are funded by SA Governmental agencies, NRF and DHET. Possibly the funds could be used more efficiently if there was some coordination of these entities.

G. RECOMMENDATIONS

1. NRF-DSI

Flagship should be administered and managed by the government organization Department of Science and Innovation, South Africa

- SANBio and SANWATCE can be strategic partners of NRF, but should not be managed by the NRF.
- Being managed by NRF gives the impression that these Flagship programs are a South African initiative only.

2. SANBio

2.1 SANBio Governance

The steering committee achieved its mandate in guiding the activities of SANBio Flagship. However, to enhance the performance of the SC we recommend the following

- The SC must be composed of influential non-political appointees.
- Allowance to cover the cost of attending meetings.

CSIR satisfied its function in serving as a Hub for SANBio

- It is recommended that they continue in their role but with the provision of dedicated human capital not seconded from its other core functions

2.2 SANBio Node Coordinators

- The institutional arrangement between the Hub-node model worked well and should continue.
- The HCD and commercialization (workshop, mentoring, student support, registration of IP) aspects should continue.

2.3 SANBio Student Ambassadors

Student ambassadors worked well as recruitment mechanisms for SANBio program but were not brought on as network ambassadors, which underutilizes the potential role of Student Ambassadors in the program

- Recommend that the program be fully integrated into the SANBio program.

3. SANWATCE

3.1 SANWATCE Governance

- The SC should be composed of non-political and influential appointees.
- SC members receive an allowance to cover the cost of attending meetings.
- In support of the sustainability of the program, SADC Water Division should adopt a framework of directly supporting the entity through advocacy and participation (e.g., fundraising).
- The SC be strengthened through (i) membership drawn from the member organizations; (ii) meeting specifically as a SC twice a year; (iii) improved focus through strategic discussions.
- Stellenbosch University should continue to serve as a Hub for SANWATCE.

3.2 SANWATCE Funding

- Seed funding should be provided by all member states towards SANWATCE.
- The recommended amount is R2 million per annum.
- Further funding for research activities can also be obtained by leveraging other donor funding rather than just the EU.

3.3 SANWATCE Node coordinators

The Hub-node model is overly dependent on the initiative of the network manager. Node coordinators were also overly dependent on South African research infrastructure.

- Secretariat be resourced appropriately to take the pressure off the manager.
- There should be a fairer and improved distribution of research infrastructure amongst the nodes.
- The SADC water research agenda should be informed by the needs of the region and addressed in SANWATCE activities.

Research funding centered on post-graduate student projects, which is important; but research support for senior scholars is limited which (i) limits the capacity of SANWATCE to successfully carry out its mandated role in SADC; (ii) limits the ability to build a research network in SADC.

- A funding model should be developed for senior-level research collaboration.

3.3 Industry Partners

- The SADC water research agenda should be reviewed on a regular basis at the Waternet-WARFSA- SANWATCE symposium.
- The respective roles of SADC subsidiaries including GMI, Waternet, etc should be clarified to prevent duplication of tasks.

3.4 SANWATCE Student Ambassadors

The funding was important in HCD and complemented the teaching and training of the node coordinators.

- Research support should be continued and augmented.
- SADC member states contribute to WARFSA.

While student support was important including conference attendance their participation in the network did not extend beyond post-graduate studies

- Student ambassador arrangements should be adopted and fully integrated into the program.
- Post-graduate fellowships should be supported.

4. AIMS

4.1 General Recommendation

The AIMS NEPAD Flagship, in the form of a continental network of institutes providing postgraduate instruction in broadly understood mathematical sciences, is essential for realizing the vision of the African Union Agenda 2063 and, especially, for achieving Goals (2) and (4). The pan-African structure of AIMS is also aligned with Aspiration 2) and Goal (10). Of the Agenda. The existing model has proved to be successful by producing close to 2500 graduates from 44 African countries. Out of them, 33% of alumni are women and 70% of the alumni have remained in Africa; over 800 AIMS graduates completed PhD. The AIMS Researched Centres published over 800 scientific articles. Each national center has its own features. For instance, AIMS SA has made a significant contribution to the upliftment of mathematics teachers in South Africa.

Given these achievements, the Panel believes that it would a great waste if AIMS SA had to close or significantly changed its unique character and mode of operation. So, the Panel strongly recommends the continuation of the support to AIMS SA in its current model and is of the opinion that it would be beneficial to South Africa and to the continent if AIMS and, in particular, the AIMS Research Centre, was strengthened to become a National Centre of Mathematical Sciences whose establishment was recommended by the International Review of Mathematical Sciences Research at South African Higher Education Institutions, presented to the DST on 18/12/2008. This would make AIMS SA a leading continental research and postgraduate training center comparable to a suitable combination of the Max Planck Institute in Germany, Banff International Research Station (BIRS) for Mathematical Innovation and Discovery in Canada, Newton and Maxwell Institutes in the UK or Mathematical Institutes of National Academy of Sciences in the countries of Eastern and Central Europe or China. AIMS SA already has germs of each of these institutions under one roof. It is to be noted that in each case (apart from the Newton and Maxwell Institutes which are funded mainly by consortia of universities) is funded by the national and state/province governments.

4.2 External Matters

The Panel does not feel qualified to determine the relations between DSI and NRF concerning the funding of AIMS. This issue is solved differently in different countries – Max Planck Institutes or Mathematical Institutes of Academies of Sciences are funded directly from the state budget, governmental funding for BIRS or Newton and Maxell Instituted are channeled by the respective science funding bodies, NSERC and EPSRC). However, the Panel is of the opinion that:

- There must be a clearly defined overseeing body for NEPAD Flagships in South Africa (possibly in the form of a standing committee consisting of the stakeholders, including AU) to which the Flagship will report.
- There must be a long-term guaranteed inflation-adjusted funding that ensures the continuity of the core administrative functions of AIMS and the maintenance of resources.
- Ultimately, both the overseeing body and the funding are the responsibility of DSI as the signatory of the NEPAD Flagship agreement. The Panel does not have sufficient

information about these matters, but DSI possibly should liaise with DIRCO to ring-fence some funds for African collaboration.

- The Panel cannot provide a recommendation on whether the overseeing and funding of AIMS should be delegated to NRF – it should be a matter of bilateral negotiations and mutual consent. It could be envisaged that NRF, following the declarations on internationalization contained in the Strategy 2025, creates a directorate for international scientific collaboration and such a directorate could become a proper place to oversee the operations of AIMS.
- In any case, NRF should develop clear criteria for assessing and recognizing work done within the framework of the AU Agenda 2023 so that NEPAD Flagships will be aligned with the NRF vision.
- There must be long-term funding for the AIMS Research Centre that could attract world-class researchers on a more permanent basis. There should be a deputy director of AIMS for research, responsible for the coordination of work of different teams and aligning it with the needs of AIMS. This could be done by creating of 2-3 SARChI Chairs placed at AIMS. Also, the incentives must be found to create joint appointments shared by AIMS and South African universities and recognizing teaching at AIMS to increase the support for AIMS coming from the South African mathematical community.
 - There must be long-term funding for AIMSSEC.
 - At the same time, efforts should be made to strengthen the diversity of funding sources and securing them to ensure the sustainability of AIMS. However, the core functions of AIMS should not depend on ad-hoc funds.
 - The Research Centre should play a role in attracting funds by strengthening the fields of current interest and importance such as data science, artificial intelligence and machine learning, financial mathematics or mathematical epidemiology. Offering short or extended courses and postgraduate supervision in these fields could attract funding from industry.

4.3 Internal Matters

On the operational level, the Panel recommends that:

- Closer collaboration between AIMS SA and the South African mathematical community, that is, the universities from outside the Western Cape, South African Mathematical Society, CoE-MaSS, National Graduate Academy-MaSS, and NITheCS should be developed. This can be done by, among others, reconstituting the Advisory Committee with a broad representation of South African stakeholders.
- The interactions with industry and financial institutions, be it through the Industry Immersion Programme or otherwise, should significantly increase. Courses with strong applied flavor developed with specialists from the industrial sector should be on offer continually.
- The role of AIMSSEC to reach out to the broader community, public engagement, etc., should be strengthened.
- The model of students' representation should be revised. There should be a more substantial student representation, able to discuss with the management students' problems such as methods of assessment, social life, bursaries issues, in a meaningful

way and negotiate satisfactory solutions. Specific needs for female students should be taken care of.

- There should be a psychological student counseling provided on a regular basis.

H. CONCLUSIONS

Evaluation Dimensions

1. Performance of the Flagships in terms of its objectives.

The performance of the flagships in terms of their objectives was satisfactory. The flagships achieved what they set out to do.

2. Return on investment

2.1 The support provided to the Flagships:

In terms of return on investment, the value derived from the grants awarded to Flagships is clearly demonstrated; there is strong evidence of the Flagships using awarded grants to succeed in their programs. Without these grants, it is doubtful that the level of achievement would have been as high.

Funding should be continued for all programs and enhanced if possible, additionally, funding must come from member states. Our recommendations for Flagship support are conditional upon satisfactorily addressing our concerns regarding AIMS, SANBio and SANWATCE.

2.2 Management of the Flagships:

As a continental initiative, the Flagships are best managed by a Government Department not a national funding agency. In this case, the DSI (SA) is more appropriate.

3. Achievements of the Flagships over the past five years

Based on the resources provided, the achievements were satisfactory.

4. Sustainability of the Flagships and alignment of priority and relevance to the NRF mandate as Flagships within their areas of specialization

The Flagships align with the NRF mandate in terms of the advancement of research and knowledge mobilization. However, the NRF should be a complementary entity that works alongside the Flagships, not act as a management instrument. For the long-term sustainability of the Flagship programs, member states must contribute core funding.

I. EVALUATORS' SIGNATURES

Panel: SANBio/SANWATCE



Prof. Faizal Bux

(Convenor and SANBio/SANWATCE Panel Member)

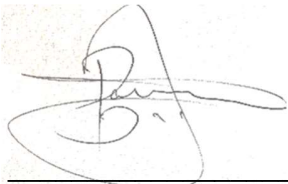
Director: Institute for Water and Wastewater Technology, Durban University of Technology
NRF-SARChI Chair in Wastewater Treatment



Prof. Larry A Swatuk

(SANBio/SANWATCE Panel Member)

University of Waterloo Professor – School of Environment, Enterprise and Development

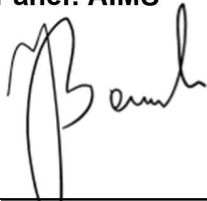


Dr Budzanani Tacheba

(SANBio/SANWATCE Panel Member)

Director of Innovation & Technology at the Botswana Innovation Hub

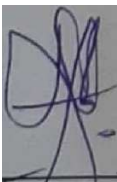
Panel: AIMS



Prof. Jacek Banasiak

(Convenor and AIMS Panel Member)

University of Pretoria - Chair Holder DST/NRF SARChI Chair in Mathematical Models and Methods in Biosciences and Bioengineering



Prof Mahouton Norbert Hounkonnou

(AIMS Panel Member)

University of Abomey-Calavi - Full Professor of Mathematics & Physics, President of the International Chair in Mathematical Physics and Applications (ICMPA-UNESCO Chair)

J. ANNEXURES

- Annexure 1: SANBio and SANWATCE Agenda
- Annexure 2: AIMS Agenda
- Annexure 3: Questions to participants
- Annexure 4: SANBio and SANWATCE scribe reports
- Annexure 5: AIMS scribe reports
- Annexure 6: Written responses
- Annexure 7: Panel discussion Agenda