

*September 2021*

**Consultancy services for the  
Mid-Term Evaluation of the  
Mathematical Sciences for  
Climate Resilience (MS4CR)  
Programme at the African  
Institute for Mathematical  
Sciences (AIMS)**



**Final Report**



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## 1 Executive summary

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This final report constitutes the final deliverable in the mid-term evaluation of the AIMS MS4CR programme (hereafter referred to as "the MTE"). As per the agreement between IDRC/GAC and the AIMS Secretariat, this external evaluation was commissioned to review and document results from the MS4CR. The evaluation is both summative and formative in nature. It covers the period 2017-2020.

The present report follows a data collection phase conducted from March to June 2021. It was drafted based on an extensive desk review, data analysis, bibliometric analysis, interviews with around 40 stakeholders, a peer review of the curricula, and a learning workshop organised September 15<sup>th</sup>.

The evaluation concludes that the AIMS MS4CR programme is highly relevant and is performing satisfactorily.

Despite problems at the programme's inception, and difficulties associated with COVID 19, most elements of the programme have started and have achieved their first results.

- The Master's level training Programme is on good track to achieve its revised targets. The teaching quality of the courses and the programme curriculum seems to be generally in line with students' expectations. The programme is nevertheless struggling to entice students who are interested in climate change.
- The Research Programme is also on track to achieve its revised targets in terms of number of researchers, although the number of women fellows is below target. The programme attracts good researchers and AIMS provides a conducive research environment. The number of peer reviewed publications exceeds the initial target set. The programme shows signs of contributing to increasing the capacity to participate in research in climate change fields, which is also the case for women researchers.
- Most of the activities under the Women in Climate Science programme are below 50% achievement rate.
- So far, the internship programme has placed 64 students into internships with relevant industry partners, on track to reach the target of 100. Both interns and employers are satisfied with the programme.

Whilst the programme has achieved concrete results, there remains room for improvement. Going forward, it is important that the programme strikes a better balance between mathematics and climate science and revisit certain aspects of the course curriculum. The programme could also benefit from greater collaboration with industry, government and non-governmental organisations for the internship programme, and with universities for the research programme, which would afford greater opportunities to exchange and increase the career prospects of alumni. A detailed set of recommendations is provided at the end of this report in Chapter 4.



## 2 Description of the methodology and study limitations

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### 2.1 Initial presentation of MS4CR Programme

Established in 2003 in Cape Town, South Africa, the African Institute for Mathematical Sciences – Next Einstein (AIMS-NEI) is a pan-African network of centres of excellence offering postgraduate education, research, and public engagement for the development of Science, Technology, Engineering and Mathematics (STEM) in Africa. AIMS-NEI recruits Africa's most talented university graduates to pursue a one-year fully funded Master's in Mathematical Sciences in a highly interactive and culturally diverse learning environment. AIMS-NEI attracts world-class lecturers and research fellows on a volunteer basis to further improve the learning experience for students. Building on the success of its first centre in South Africa, AIMS launched the Next Einstein Initiative (NEI) in 2008 to scale up and roll out the AIMS-NEI model across the continent. Six additional centres were established in Senegal (2011), Ghana (2012), Cameroon (2013), Tanzania (opened in 2014 but closed since 2020), and Rwanda (2016). As of December 2020, over 2,200 students (33% women) from 43 African countries had graduated from AIMS post-graduate programmes of whom 54 were graduates of the MS4CR programme.

The AIMS Mathematical Sciences for Climate Change Resilience (MS4CR) Programme is a CAD \$20 million initiative funded through Canada's International Development Research Centre (IDRC). The objectives of the MS4CR programme are (i) to increase the contribution of African mathematical scientists in finding solutions to climate change-related challenges in Africa through training, internships, and research and (ii) to support the consolidation of AIMS' operations across the continent through strengthening existing AIMS centres. The programme was originally to be implemented over five years (2017/2018 – 2021/2022). A time extension to the research component was agreed in 2020 for an additional year - to permit completion of planned activities postponed due to delays in hiring of the Research Chair. This component will thus end in June 2023.

The partnership between AIMS-NEI and IDRC extends beyond the MS4CR programme. The initial contribution by IDRC and GAC (CA\$ 20 million in 2010 and CA\$ 2 million in 2013) laid the foundation for AIMS to grow into the Pan-African network it is today. AIMS is also involved in a number of IDRC projects as subgrantee. Other joint activities/collaboration include the GAC-funded Skills for Employability Programme at AIMS Senegal since 2016. Note that GAC also provided CA\$2.5M<sup>1</sup> in short term funding to cover core costs in support to AIMS' cost savings and deficit reduction plan.

The MS4CR programme is composed of **five pillars**:

- **Master's Programme:** the climate science stream was to be offered at AIMS Rwanda and AIMS Tanzania within the ten-month structured AIMS Master's programme, composed of both functional courses and a three-month applied research project. Other AIMS centres (Cameroon, Ghana, Senegal and South Africa) were to offer elective courses in climate science in order to introduce the students to how mathematical sciences can be applied to climate change-related issues. However, in the course of programme implementation, modifications were brought to the programme: AIMS Tanzania did not offer the climate science stream (as the centre faced financial difficulties and was eventually closed), but

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<sup>1</sup> Date to be identified



AIMS Ghana, Cameroon, and Senegal will do so from September 2021; only AIMS Ghana and Cameroon offered the elective courses.

- **Internship Programme:** seeks to place students and alumni in internships with relevant industry partners. It also seeks to build sustainable partnerships with industry partners across and beyond Africa. In addition, some students can obtain industry experience through Mitacs “Global Links Programme<sup>2</sup>,” which involves spending six-to-eight weeks in a research or internship placement in the fields of sustainable development, engineering or renewable energy.
- **Research Programme:** provides i) research scholarships for Masters, PhD students and Post-Docs; ii) Research chairs involving resident researchers, Post-docs, PhD and Masters students; iii) Small research grants to researchers (USD 10,000 per project); iv) Research Fellowships for women (up to USD 35,000 for an innovative research project in climate change at an African host institution) and mobility grants; v) Sponsorship to Next Einstein Fellows (NEF) for NEF Global Gatherings and promotion of thought leadership in climate science through the participation of researchers to climate science panels and other pre-events organised by NEF Global Gathering.
- **Climate Science Fellowship for Women:** dedicated activities including i) Women fellowships; ii) Mobility grants for women researchers to facilitate their participation in climate science-related opportunities; iii) Publications to profile leading African women climate scientists; iv) AIMS Women in Science Climate Change Speaker Series; v) Gender Summit; vi) Other outreach activities to encourage girls to pursue further studies in mathematical sciences and climate change
- **Consolidation of AIMS network:** concerning the MS4CR, hiring an MS4CR programme manager; concerning the overall AIMS network, opening of a new AIMS centre in Francophone Africa, enhancing key internal systems (including finance, human resources, communications, fundraising, IT, gender equality, M&E and procurement).

## 2.2 Evaluation objectives and scope

### 2.2.1 Objectives of the study

The main objective of this **mid-term evaluation (MTE) is to assess the implementation and early results of the MS4CR Programme**, in accordance with the grant agreement with IDRC. It is both summative and formative in nature and takes stock of what is working, and which areas can be improved. The MTE will inform the final two years of project implementation by providing recommendations on how to best ensure that the intended objectives are met.

- The retrospective nature of the evaluation indicates that we assessed the extent to which targets are being met and identified factors that hinder or facilitate their realisation, in order to provide evidence to key stakeholders on the sustainable outcomes of the MS4CR

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<sup>2</sup> Mitacs Globalink Research Internship is a competitive initiative for international undergraduates. From May to October of each year, top-ranked applicants participate in a 12-week research internship under the supervision of Canadian university faculty members in a variety of academic disciplines, from science, engineering, and mathematics to the humanities and social sciences.



Programme. It also aimed at understanding the added value of this new form of thematically focused training in the overall landscape of AIMS activities.

- The prospective nature of the evaluation indicates that insights into potential future improvements are provided in the form of recommendations.

The MTE took stock of MS4CR programme implementation at AIMS-NEI with the aim of:

- **Assessing the progress** made towards achieving expected outcomes in each of the Programme areas and identifying any signs of early impacts
- **Identifying key factors (barriers or facilitators)** to be considered for the next phase of the Programme
- **Providing recommendations for programme implementation** going forward to ensure greater impact and the achievement of planned results.

### 2.2.2 Scope of the study

- The evaluation **exclusively concerns the MS4CR Programme at AIMS** and its five Programme areas, noting that the fifth programme component (consolidation of AIMS across all programming) is broader than the MS4CR programme, from its inception in 2017 up to December 2020. It has looked at activities undertaken at the Secretariat and the five AIMS Centres in Cameroon, Ghana, Rwanda, Senegal, and South Africa.
- The MTE focuses on the immediate outcome results, measuring the progress of the programme towards achieving the higher-level outcomes, according to the MS4CR Performance Measurement Framework as well as processes.
- Data was collected from across the AIMS network: at the level of executive and senior Management (i.e. the Secretariat), the five AIMS centres, beneficiaries including students and alumni, partners and donors.

### 2.2.3 The use of evaluation results

We understand the results of this evaluation will be fed back into the delivery of the MS4CR Programme and the continuing consolidation of AIMS, and will inform future growth in AIMS' academic, research, and industry programmes, particularly as it relates to specialised master's programmes in a thematic area or targeted research and Work-Integrated Learning programmes.

## 2.3 Our methodological approach

We conducted the MTE based on the following principles:

- A **theory-based evaluation relying on a contribution analysis**: through a logic model and theory of change analysis.
- **Prioritising learning and a collaborative approach**: the formative dimension of this evaluation is central, as its findings and recommendations will support AIMS' future development.
- **Capitalising on existing data and evidence**. The AIMS Secretariat already had various sets of data at its disposal, gathered from multiple sources (existing evaluations, annual surveys, database etc.) We built on and complemented this existing evidence base to avoid any duplication of efforts.
- **Combining qualitative and quantitative investigations**.



- **Proposing concrete and actionable recommendations.**

In Table 1 below, we present the evaluation tools.



Table 1 Evaluation tools

Evaluation tools	Sub-programme	Relevance	Effectiveness	Efficiency	Impact	Sustainability	Recommendations
<ul style="list-style-type: none"> <li>• <b>Desk analysis</b> of: Africa's policies and strategies on climate change and higher education; MS4CR programme intervention logic, Performance Measurement Framework and progress reports (technical and financial part); budget and financial documentation, use of Theory of Change</li> </ul>	<ul style="list-style-type: none"> <li>• Master's level training Programme</li> <li>• Internships Programme</li> <li>• Research Programme (Research Chairs, Small Research Grants)</li> <li>• Climate Science Fellowships for Women and funding to initiatives for young women in STEM/climate science</li> <li>• Consolidation of AIMS Network Programme</li> </ul>	✓	✓	✓	✓	✓	✓
<ul style="list-style-type: none"> <li>• <b>Virtual interviews with internal stakeholders</b> (AIMS Executive Team, Senior management, Academic Directors and relevant staff across the network, AIMS MS4CR lecturers and tutors, AIMS Research staff, AIMS MS4CR direct beneficiaries)</li> </ul>	<ul style="list-style-type: none"> <li>• Master's level training Programme</li> <li>• Internships Programme</li> <li>• Research Programme (Research Chairs, Small Research Grants)</li> <li>• Climate Science Fellowships for Women and funding to initiatives for young women in STEM/climate science</li> <li>• Consolidation of AIMS Network Programme</li> </ul>	✓	✓	✓	✓	✓	✓
<ul style="list-style-type: none"> <li>• <b>Virtual interviews with external stakeholders</b> (IDRC and GAC staff; Employers of AIMS MS4CR interns and graduates; external partners in the private sector, government, education)</li> </ul>	<ul style="list-style-type: none"> <li>• Master's level training Programme</li> <li>• Internships Programme</li> <li>• Research Programme (Research Chairs, Small Research Grants)</li> </ul>	✓	✓	✓	✓	✓	✓



	<ul style="list-style-type: none"> <li>• Climate Science Fellowships for Women and funding to initiatives for young women in STEM/climate science</li> <li>• Consolidation of AIMS Network Programme</li> </ul>						
<ul style="list-style-type: none"> <li>• Analysis of surveys and data on AIMS MS4CR students (current and alumni) across the network</li> </ul>	<ul style="list-style-type: none"> <li>• Master's level training Programme</li> <li>• Internships Programme</li> </ul>		✓		✓	✓	✓
<ul style="list-style-type: none"> <li>• Virtual focus group discussions with Master's students</li> </ul>	<ul style="list-style-type: none"> <li>• Master's level training Programme</li> <li>• Internships Programme</li> <li>• Research Programme (Research Chairs, Small Research Grants)</li> </ul>		✓		✓	✓	✓
<ul style="list-style-type: none"> <li>• Peer review of curricula</li> </ul>	<ul style="list-style-type: none"> <li>• Master's level training Programme</li> </ul>	✓					✓
<ul style="list-style-type: none"> <li>• Bibliometrics</li> </ul>	<ul style="list-style-type: none"> <li>• Research Programme (Research Chairs, Small Research Grants)</li> </ul>	✓	✓		✓		✓
<ul style="list-style-type: none"> <li>• Learning workshop</li> </ul>	<ul style="list-style-type: none"> <li>• Master's level training Programme</li> <li>• Internships Programme</li> <li>• Research Programme (Research Chairs, Small Research Grants)</li> <li>• Climate Science Fellowships for Women and funding to initiatives for young women in STEM/climate science</li> <li>• Consolidation of AIMS Network Programme</li> </ul>	✓			✓	✓	✓

## 3 Findings of the MTE

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### 3.1 The relevance of the MS4CR programme

**To what extent is the programme relevant to the development priorities of Africa, specifically in terms of higher education and research in climate change, as well as gender equality?**

- **The MS4CR overall objective of increasing the contribution of African mathematical scientists (men and women) in financing solutions to CC challenges in Africa is relevant.**

See Annex G for full details.

**Africa is one of the most vulnerable<sup>3</sup> continents** to the impacts of climate change, including climate variability and extremes<sup>4</sup>. Africa's adaptive capacity and resilience is weak in the face of projected climate impacts. Whilst knowledge of African climate trends and vulnerability has increased over the past decade, there is still a blind spot in terms of data, particularly when compared to data available in Europe and North America.

**This information gap** has led to a widening dichotomy between climate impacts that are experienced on the ground in Africa and climate impacts that are recorded and published in scientific literature. Major reports such as the Intergovernmental Panel on Climate Change (IPCC) assessments, for example, present more information regarding impacts in developed countries than for less-developed countries.

**Addressing climate change requires research, innovation and new technologies.** At the same time, regional and local technological development is necessary, **together with associated skills development.**

African leaders are faced with the challenge of developing and implementing both climate-smart and climate-resilient development strategies. Responses to mitigation and adaptation challenges must be based on the best available scientific knowledge<sup>5</sup> and much of this knowledge and **potential lies in the field of science, technology, engineering and mathematics (STEM)**. There are two relevant dimensions. First, predicting and understanding the impacts of climate change involves the use of sophisticated, quantitative mathematic models of chemical, physical and biological processes, including the integrated assessment models used for IPCC reports. Second, STEM disciplines provide the foundation for pursuing resilient, climate-smart technological opportunities. Thus, investments in both research and education specifically relevant for climate change are needed.

**Many African countries have been driving policies to enhance adaptation and mitigation, as well as to build up their internal capacities to solve the challenges faced**, including Rwanda's Green Growth and Climate Resilience-National strategy for climate change and low carbon development, Ghana's National Climate Change Master Plan, Cameroon's National Climate Change Adaptation Plan, South Africa's National Adaptation Strategy. **However, African governments do not invest substantially in research, meaning that most research is either**

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<sup>3</sup> Vulnerability is defined as the "the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes" (IPCC, 2001. Third Assessment Report).

<sup>4</sup> IPCC, 2014. Fifth Assessment Report.

<sup>5</sup> As recognised for example the jointly funded AU-EU Research & Innovation Partnership on Climate Change and Sustainable Energy (CCSE).



**donor-driven** or conducted by external consultants<sup>6</sup>. According to the United Nations University, this means that research does not always reflect national priorities, as it more likely would be if it were undertaken by national researchers. Consequently, African theories, perspectives and experiences are inadequately represented in climate research on the continent.

The United Nations Economic Commission for Africa (ECA) has recommended investing in a network for **Centres of Excellence in Science and Technology on the continent that can build a workforce to provide innovative solutions to climate change through research and development**<sup>7</sup>. Accordingly, research centres and education centres of excellence have recently been established specialising in climate change. In parallel, the ECA established the Climate Research for Development in Africa (CR4D) initiative.

**Women scientists remain substantially under-represented in higher education and in science, technology engineering and mathematics (STEM) careers**, accounting for less than 30% of researchers worldwide<sup>8</sup>. They nevertheless have a vital part to play in scientific leadership and in contributing to Africa's development and transformation by ensuring inclusive perspectives.

- **The MS4CR Programme research components are relevant to the climate change priorities of Africa.**

The Programme aims at increased research conducted by African mathematical scientists (women and men) in the field of climate science (stated in the ToC for the programme as intermediate outcome 1120) as well as increased capacity for African women to participate in research in climate fields in Africa (intermediate outcome 1140). As highlighted in the above paragraphs, this is what is needed in Africa.

The programme is intrinsically contributing to reducing the scarcity of research funding in Africa. It funds research chairs and resident researchers in climate science (CS), provides research scholarships at the Master's, PhD and postdoctoral levels, and small research grants.

### Quotes

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"Africans need to be more aware of the climate issue, to be able to analyse climate data, to create their own climate models specific to Africa" (AIMS Tutor)

"When you read the African Union strategy on climate change, they highlight the importance of education and research, the promotion of international cooperation, etc. The MS4CR Programme is a good input towards this" (AIMS Lecturer)

"It's all about getting quality students interested in climate science, and we know the benefits of that for Africa" (AIMS Tutor)

Fellowships and mobility grants are also available to women.

### Quotes

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"I applied to the programme because it was dedicated to women in STEM. Usually, grants do not take into consideration maternity leave. This programme takes into consideration this factor." (WiCCS<sup>9</sup> fellow)

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<sup>6</sup> United Nations University. Research Uptake: Strengthening Climate Change Research in Africa. <https://www.wider.unu.edu/research-uptake/strengthening-climate-change-research-africa>

<sup>7</sup> <https://www.uneca.org/acpc>

<sup>8</sup> <http://uis.unesco.org/en/topic/women-science>

<sup>9</sup> Women in Climate Change Science

“Apart from AIMS WiCCS, I do not know any similar programme focusing on women scientists in Africa”. (WiCCS fellow)

“The programme helps women climate scientists to stay in research”. (WiCCS fellow)

MS4CR researchers (Research Masters, PhDs, Post-Docs, small research grantees, Research chair, and women fellows) highlight how research undertaken under the programme covered topics that are relevant to key sectors in Africa (agriculture, fisheries, health, energy...) and explored both adaptation and mitigation strategies to climate change. Figure 1 presents the topics<sup>10</sup> of the research produced under the MS4CR research programme as classified by SCOPUS. The word cloud shows that research topics are related to climate science and climate-related challenges the continent faces in agriculture, energy, health, etc. The research papers broadly intend to understand the climate change dynamics on the continent and its impact on key socio-economic sectors and articulate mitigation measures. Research also pays special attention to particularly vulnerable regions, like the Sahel region, and rural areas.

Figure 1 Word cloud of research topics



Source: SCOPUS, SciVal topics, treated by Technopolis (retrieved 5<sup>th</sup> July, 2021)

- **The MS4CR Programme outreach components for women and girls are relevant to the priorities of Africa.**

The Programme aims to increase the visibility of African women (intermediate outcome 1150) and the interest of African girls in mathematical sciences and climate change (intermediate outcome 1160). Creating role models and raising awareness among girls on pursuing further

<sup>10</sup> Topics are unique areas of research, created using all Scopus publications from 1996 onwards.



studies in mathematical sciences and climate science is relevant to creating a new generation of women in science and increasing the pool of African scientists<sup>11</sup>.

- **While the internship component of the MS4CR Programme is relevant, the training component is not entirely adapted to the immediate needs in climate science fields.**

Concerning skills development, the Master's programme curriculum aims to provide a combination of mathematical and climate science courses. It is complemented by an internship aiming to increase the capacity of AIMS alumni (women and men) to work in climate change fields within industry, governments and non-governmental organizations (intermediate outcome 1130).

Some stakeholders (particularly AIMS tutors and employers of AIMS graduates) noted that the job market for climate scientists in Africa is still nascent and not yet fully developed. This can be expected to be the case for training programmes that are preparing for future needs and does not decrease the relevance of training climate scientists in Africa. As time goes on and African governments increasingly focus on climate change, the opportunities will increase for well-trained climate scientists in Africa, who will be needed in large numbers. An example of this can be seen in the International Labour Organization's recent launch of the "Climate Action for Jobs" initiative in Africa, to promote green jobs and support green industries<sup>12</sup>.

#### Quotes

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"I have the impression that many alumni might have difficulty in finding jobs on the workplace after graduating and might have to go into teaching afterwards" (AIMS Employer)

"I'm not sure the job opportunities exist for climate scientists today. For the average country in Africa, if someone has a climate degree, it's not as useful or perceived to be as useful compared to other fields such as engineering" (AIMS Tutor)

However, as many AIMS lecturers and tutors pointed out, while climate scientists need a good background in mathematics, this does not mean that climate scientists must be mathematicians.

#### Quotes

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"Although the MS4CR programme is definitely helping, there is an issue that a lot of the climate science is not as mathematical as we would like" (AIMS Tutor)

Hence increased access for African students to post-graduate education in mathematical sciences with a focus on climate change (intermediate outcome 1110) is not entirely what is needed in Africa: rather, what is needed is increased access to post-graduate education in climate change fields with a focus on mathematics.

### To what extent was and will be the MS4CR programme relevant to AIMS strategic priorities?

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<sup>11</sup> Gender equality is a key priority for AIMS and plays a central role in MS4CR. In the MS4CR, AIMS maintains its target of at least 30% female enrolment at all AIMS Centres. This goal is extended to all new student programming, including enrolment in the new climate science stream and participation in internships. The MS4CR also aims at increasing the interest of girls and young women in STEM and climate science, with a view to expanding the pipeline of future climate scientists, through outreach activities. See Project implementation plan, June 2017.

<sup>12</sup> [https://www.ilo.org/africa/whats-new/WCMS\\_782118/lang--en/index.htm](https://www.ilo.org/africa/whats-new/WCMS_782118/lang--en/index.htm)



- **The MS4CR components are relevant to AIMS-NEI strategic priorities.**

The MS4CR intervention logic is overall coherent with the AIMS-NEI strategic framework and the next strategic direction of AIMS covering the period 2021-2026. AIMS strategic priorities prior to 2021 (AIMS Vision 2020) are mirrored in the MS4CR programme. The main pillars of the AIMS strategic framework 2021-2026 are namely 1) Education and training; 2) Youth employment and entrepreneurship; 3) Research and innovation, and 4) Public engagement and public advocacy. The MS4CR programme fits well into these four pillars.

- **MS4CR adds value to AIMS' offerings.**

Even before the climate stream, AIMS programmes were already fairly application-oriented, with courses on subjects such as mathematics for automation and data science. All courses provide many opportunities for alumni. The essence of the added value of the climate stream is that it seems to open doors in some sectors which would not otherwise have recruited AIMS alumni, especially in the public sector.

#### Quotes

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"In the example of the Ghana Meteorological Centre the specific knowledge and competencies of the trainee (which the centre only noticed when he was already there), turned out to be useful. In the end this resulted in the Ghana centre hiring the trainee. He still works there" (AIMS staff)

### Has COVID 19 impacted the relevance of the MS4CR programme to Africa needs and to AIMS?

- **MS4CR programme relevance was not impacted by COVID 19**

Stakeholders interviewed are unanimous that COVID 19 did not reduce the relevance of the MS4CR programme (training, research, internship), but rather the implementation modalities (see next chapter). If anything, COVID 19 may even have increased the relevance of the programme, with stakeholders highlighting the links between the climate-modelling methods taught in the programme and the probabilistic methods used in pandemic modelling (e.g. similarities in running 'ensemble' models<sup>13</sup>).

## 3.2 The effectiveness of the MS4CR programme

### To what extent were programme activities implemented as intended?

- **Preparation of the Master's component activities was suboptimal.**

Various stakeholders mentioned that the MS4CR Master's component activities were implemented under significant time pressure especially at the initial stage of introducing the master's programme in climate science. Even though the freedom for Academic Directors at each AIMS centre to organise their own course programmes was not seen as inherently negative, the short timeframe for preparation and the sometimes limited experience in climate science among academic directors with a more mathematical background was suboptimal.

As such, AIMS received general mathematical applications for the master's programme and then sensitized the students on climate change during their skills-level courses to encourage them to join the Climate Science stream. The fact that AIMS does not solicit climate change

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<sup>13</sup> <https://www.nature.com/articles/d41586-020-03208-1>



applicants out right during the application stage may lead to missing out on potential and more suited students in the field.

However, students' and teachers' assessment of the courses was generally positive.

- **COVID 19 has impacted programme delivery in 2020-2021, but the AIMS network swiftly adapted to the new realities.**

Whilst COVID 19 did impact the delivery of the programme, some of these impacts were unavoidable and outside of the control of AIMS. For example, for the training and internship components it was i) difficult or impossible to fly the lecturers in; ii) there were not as many possibilities for internships and transfer to employment proved more difficult. In addition, interaction between various components of the programme were reduced or made virtual (e.g. meetings between researchers and Master students). Cooperation with (local) universities also became more difficult. The flight restrictions and lockdown measures also prevented the organisation of researchers planned visits to AIMS centres and outreach events were organised virtually.

- **The MS4CR Programme is now entering a turning point to complete planned activities**

*Master's level training Programme*

Appendix H shows the outputs of the Master's level Programme. It appears that halfway through implementation, and considering the scaling up of the climate stream course which will be implemented in four centres from September 2021, **the Master's level training Programme is on track to achieve its revised targets.**

As of December 2020, a total of 54 students have graduated from the AIMS Master's Climate Science Stream in Rwanda with half of them being women. This is on track to reach the original target of 88 graduates, which in mid-2020 was subsequently increased to a target of 174 graduates due to the growing interest in climate science courses. **The next intake of students is planned to be very ambitious<sup>14</sup> as the climate stream will be proposed in three more AIMS Centres as a measure to scale up the activities.**

Whilst an initial target had been set of offering six Climate Science Stream courses across the centres (subsequently increased to ten), at present only two cohorts have completed the courses, both at AIMS Rwanda due to the fact that AIMS Tanzania, which was supposed to host stream courses was forced to close

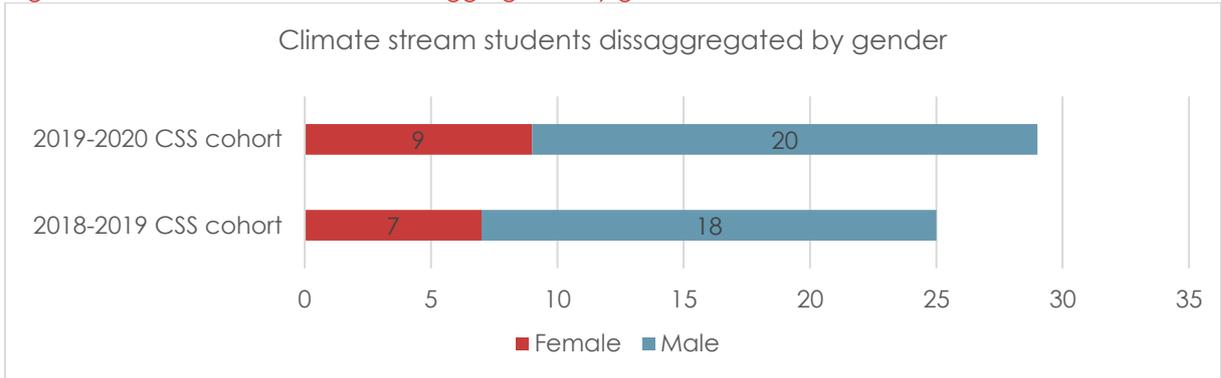
The Climate Science elective courses, initially scheduled for the 2018/2019 academic year, faced delays due to country-specific requirements and approvals. Nevertheless, AIMS Ghana and Cameroon each offered two elective climate science courses in the 2019/2020 academic year with a total enrolment of 31 students at AIMS Ghana (22 men, 9 women) and 30 students at AIMS Cameroon (19 men, 11 women), far above the 20 students envisaged in total.

The figures below break down the gender and national representations of the students per cohort.

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<sup>14</sup> Number to be obtained

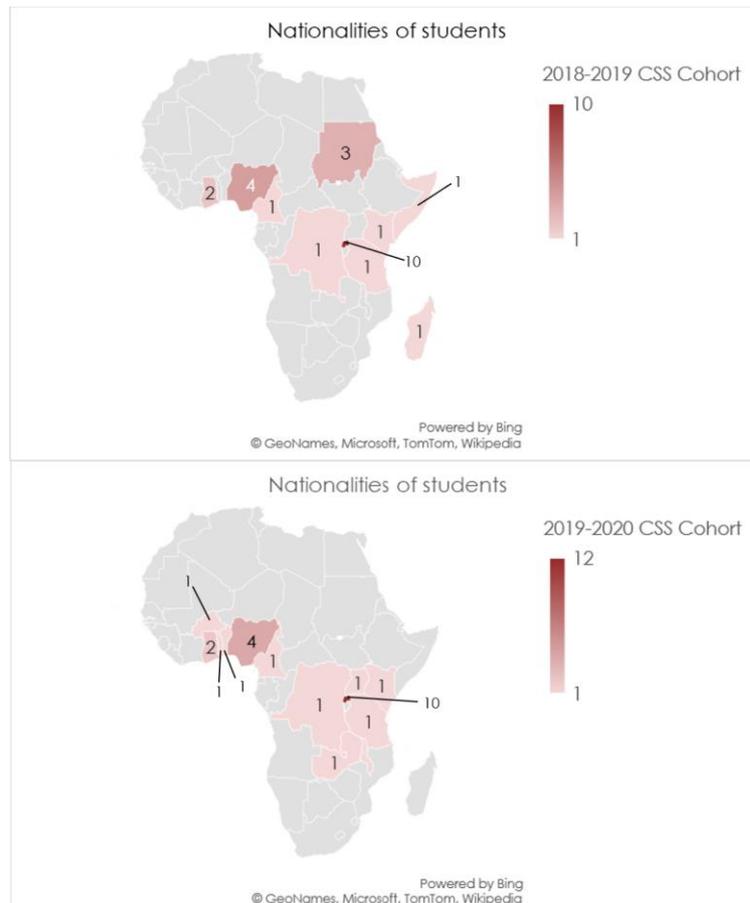
Figure 2 Climate Stream students disaggregated by gender.



Source: Climate Stream students (CSS) database.

The most represented nationality of climate stream students across both cohorts is Rwandan (41%), due to Rwanda pioneering the climate science streams over the 2018 and 2019 cohorts. This was followed by Nigerian (15%) and Ghanaian (7%) students.

Figure 3 Nationalities of the Climate Stream Students



Source: Climate Stream students (CSS) data base.



### *Research programme*

Table 4 in Appendix H shows the outputs of the Research Programme. It appears that halfway through implementation, **the programme is on track to achieve its revised targets** regarding the number of research scholarships, small research grants awarded and sponsorship of Next Einstein Forum (NEF) Fellows. The targets have already been met for the Research chairs component. **However, the number of women fellows is below target.** This is explained by the fact that it was anticipated that the candidates selected for the third call, which closed in June 2020, would start in November, but the external reviewers wanted more time. Therefore, AIMS expects seven successful candidates to begin their research in February 2021. If we count these seven new women fellows, the achievement rate increases to 65%, meaning that chances are high that the target will be achieved by June 2023. The number of mobility grants awarded to women is also below target. For now, three mobility grants were awarded to women researchers from across Africa to participate in the Gender Summit 14 in 2018. No additional mobility grants have been awarded. The delay in recruiting the research chair impacted on the process of providing mobility grants as these needed to be well coordinated by the chair. In addition, due to COVID 19, mobility grants are temporarily on hold.

**The threshold of 30% women is met for the small research grants and the Research chairs. However, this is not the case for the research scholarships.** Because most of the Research Master's students are male, due to a dearth of applications from women, **AIMS instituted an intentional policy to increase the share of female candidates.** AIMS has targeted and shortlisted eight female students who are either enrolled in or have completed the climate science stream of the AIMS Master's programme, five of whom will be recruited in March 2021. Those currently enrolled in the AIMS Master's programme will formally join the Research Master's programme upon graduation. They will be mentored during the AIMS Master's programme with a view to preparing them to complete the Research Master's programme one year after graduating. (See AIMS MS4CR 7<sup>th</sup> Technical report).

The number of peer reviewed publications in the field of climate science by December 2020 is 55<sup>15</sup> : 8 for WiCCS, 34 for AIMS Alumni, staff and researchers and 13 for Small research grantees. **This number already exceeded the target set (50 peer reviewed publications). In total, 20 of the publications were by women (36%).**

### *Women in Climate Change Science (WiCCS)*

Table 5 in Appendix H shows the achievement rate of the activities under the WiCCS programme. The programme is on track to reach its targets regarding the mobility grants, the publication series profiling African women climate science scientists and outreach activities, even if outreach activities have been put on hold because of COVID 19. The speakers' series started later and as a result few of them have been organised. All Centres were aiming to implement their respective speakers' series between January and June 2020. However, AIMS Rwanda, South Africa and Senegal were unable to hold their planned speakers' series due to the COVID 19 pandemic (See 7<sup>th</sup> Technical report). While the first event took place physically at AIMS Ghana in January 2020 (96 participants), the second, organised by AIMS Cameroon, was held virtually and gathered 26 participants. The mobility grants component is also on hold due to COVID 19.

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<sup>15</sup> We identified 3 duplicates that we deleted. It explains why the number differs from the PMF.



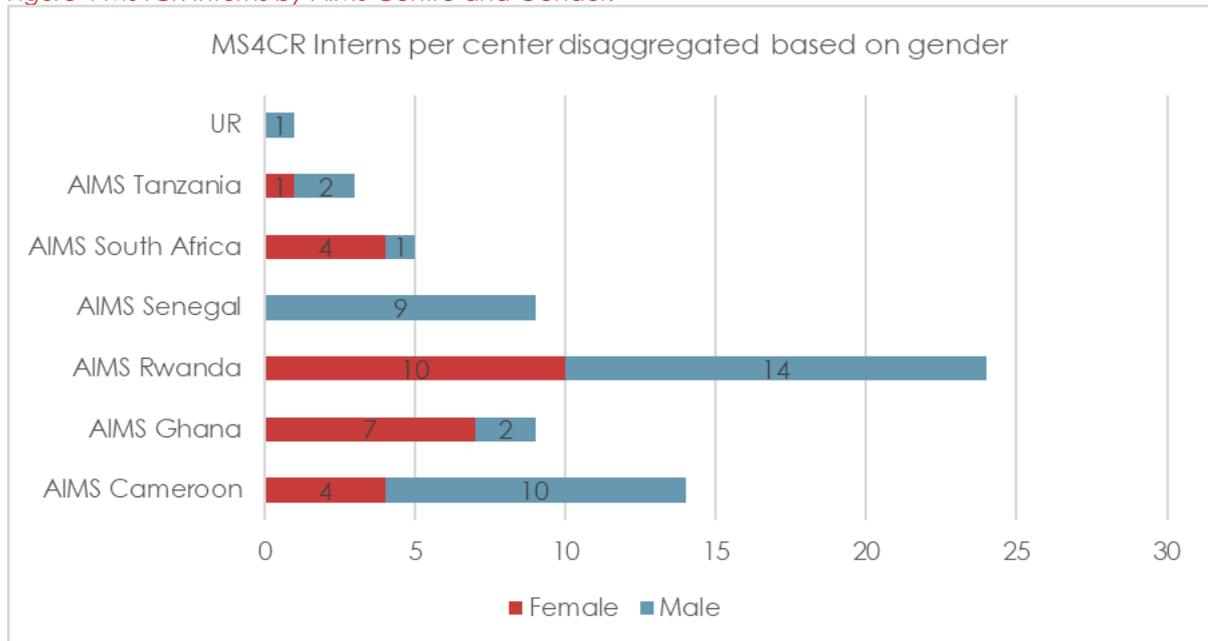
### Internship Programme

The internship programme seeks to place 100 students and alumni into internships with relevant industry partners. In addition, four postdoctoral students will obtain industry experience through Mitacs “the Global Links Programme” which involves spending six-to-eight weeks on research or internships in sustainable development, engineering or renewable energy.

So far, three cohorts of MS4CR internships have been launched. The table below shows that a total of 62 internships have been provided to students, on track to reach the target of 100 internships by June 2022, and with a better gender ratio than originally foreseen (39% compared to an objective of 30%). Internship placements have been carried out in India, Rwanda, Tanzania, Uganda and Kenya on a number of topics including energy, water, pollution, agriculture, climate information and pathogens. Whilst 11 partnerships have been formalised with organisations (73% of the target level), 7 organisations currently host interns (47% of the target).

The graphs below provide a descriptive analysis of the state of internships. It shows that the largest number of MS4CR interns are from AIMS Rwanda (24).

Figure 4 MS4CR Interns by AIMS Centre and Gender.

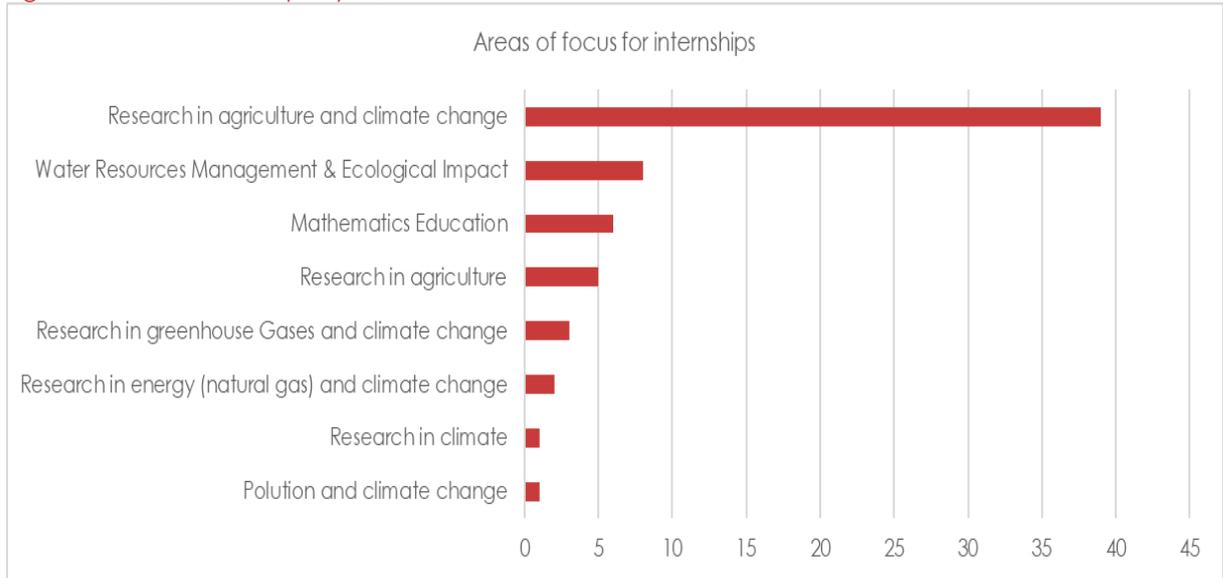


Source: AIMS-MS4C Internship Program Data, Technopolis Group

The majority of MS4CR internships are focused on agriculture and climate change (39 placements) including modelling for agronomic services, analysis of rainfall data and using AI predictions. This was followed by water resources management & ecological impact (e.g. conducting assessments of fish stocks and flood hazard assessments).



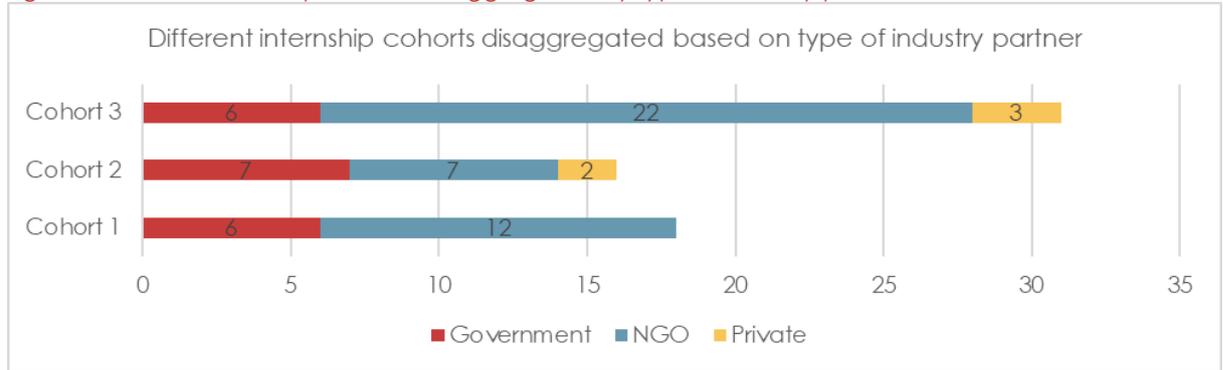
Figure 5 MS4CR Internships by Field of Focus



Source: AIMS-MS4C Internships Host Institution Data, Technopolis Group

As expected, the highest number of internship placements took place in the third cohort as the programme picked momentum and the internships offered were predominantly carried out in research institutes.

Figure 6 Different internship cohorts disaggregated by type of industry partner.



Source: AIMS-MS4C Internships Host Institution Data, Technopolis Group

### Consolidation of AIMS network

AIMS implemented many consolidation activities as shown in the table 6 in Appendix H, touching upon all its functions: governance, finances, human resources, communication and IT, procurement, fundraising, gender equality, operations, and M&E. Several trainings on the new procedures and the harassment subject were conducted.

Policies and procedures were developed from 2017 forward to improve network coordination and increase efficiency. A training plan for staff on policies and procedures has been elaborated and is under implementation.



However, concerning the creation of a new Centre in la Francophonie: even though interest was raised from the governments of Benin, Guinea and Côte d'Ivoire<sup>16</sup> to host a seventh AIMS centre and some concrete steps were notably on the way in Côte d'Ivoire, this activity was cancelled under the MS4CR programme. Indeed, IDRC/GAC required AIMS in 2019 to focus on other aspects of consolidating the AIMS network during the remaining implementation period of the IDRC grant. So did the AIMS network.

AIMS network then accelerated its **governance and operations restructuring**, following KPMG audit recommendations. Notably, it restructured the Board and designed a new chart; it introduced 23 policy chapters, 17 of which were recently approved by the Board, 6 almost completed or to be completed<sup>17</sup>; checks and balances in the financial management including new hire in the financial department, hiring of an external auditing, as well as creation of an Audit and Finance Committee of the International Governing Board<sup>18</sup>; an HR policy manual and system was elaborated and staff responsibilities clarified; a SharePoint platform was established; procurement, grants & project management<sup>19</sup>, and M&E were restructured with checks and balances strengthened. The senior team has also started implementing the KPMG recommendations.

### What results were achieved?

#### *Master's level training Programme*

**AIMS students, alumni and tutors are almost unanimous in their appreciation of the teaching quality of the courses within the MS4CR Programme.** Stakeholders acknowledge AIMS' ability to bring in high-quality lecturers from around the world, and are grateful of the opportunity to interact, learn from and network with these lecturers.

However, some interviewees stated that the **network of climate lecturers was not of the same quality** or as exhaustive as the network that was at AIMS' disposal for traditional mathematics programmes. One lecturer stated that at the beginning of the programme, there was "a panicked frenzy that [AIMS] had money to spend, and they had to spend it at once," and that those in charge of securing lecturers did not have the necessary network to find the best climate lecturers as AIMS does for pure mathematics lecturers. However, the impact of this rapid switch to securing climate lecturers was apparently more significant during the first year of the MS4CR programme: since then, AIMS' connections have increased, and other fail-stop measures such as not re-inviting bad lecturers after their course ends have worked to ensure the quality of teaching.

#### *Quotes*

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"You are taught by world-class lecturers that you never thought you would meet" (AIMS Student)

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<sup>16</sup> In Benin preparations for an MOU were made; in Guinea discussions took place, but difficulties arose in the government's mobilisation of the required finances; in Côte d'Ivoire the government had agreed to contribute up to 75% of the estimated \$20M for a period of five years and negotiations were coming to an agreement.

<sup>17</sup> HR, communication, IP, gender and inclusion, internal audit

<sup>18</sup> The Audit and Finance Committee of the International Governing Board looks at the financial management oversight; credibility; policies; budget and financial statements; financial performance; cash and payment projections; the funding reports; effectiveness of the statutory audit.

<sup>19</sup> Monitoring the spending, analysis of patterns, providing in depth report to donors



"AIMS is starting to get well known in maths, and so they're increasing their connections and their network, so that if they urgently need a lecturer for a course starting in a month's time, they can usually find someone. For climate it's not the same, they have some connections but not as many as for maths in general, and so it's more difficult to find lecturers" (AIMS Tutor)

**The programme curriculum seems to be generally in line with students' expectations**, although many said that the curriculum sometimes struggled to find a uniform standard between courses (difficulty of the course, grading standards, etc.) or a balance between each student's strengths and different background (physics, data, mathematics, economics). For most students, climate change was a new field of study, and some believed that the introductory classes provided at the beginning of the programme were not sufficient to acquire a deep enough understanding of the issue. Some tutors also stated that the curriculum was not entirely coherent and that courses did not logically follow on from each other, with the correct "building blocks".

The peer review analysis carried out on the curriculum (available in Appendix E) is positive about including both mathematical sciences and climate sciences (quite comprehensive). Nevertheless, the peer review analysis produced the following recommendations:

- **The curriculum should be revisited and adapted.** Social science aspects, including the interplay with policy (informing policy-makers), the geopolitics of climate science, and the economics of climate change, should also be considered. Cooperation with leading African and other universities could also be strengthened to achieve this.
- **The course could better integrate opportunities with government and intergovernmental policy makers as well as international NGOs.** These stakeholders could, together with some external climate scientists, be part of a programme board that offers advice on the programme, introduces what they need from climate science professionals, and provides access to a more extensive network.

### Quotes

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"Before going there, I had two objectives: to learn the skills to apply mathematics, and to identify in which field to apply mathematics. With AIMS, I managed to identify these opportunities" (AIMS Student)

"Even after the one-hour lecture at the beginning of the course on climate, students aren't really experts in climate, so they could maybe do a more intensive introduction to climate at the beginning of the course" (AIMS Tutor)

A better **balance is to be struck between the mathematic and climate aspects of the programme**. For example, certain courses are highly climate focused without any equations or mathematic aspects, whilst others have a focus on pure mathematics without any climate science: the two should be better integrated to ensure that there is a correct standard for all courses.

In terms of the programme delivery, the three-week format of courses is deemed **intense but generally manageable** by AIMS students and alumni. For AIMS lecturers, the three-week format is appreciated as it means that they can teach at AIMS while also holding a permanent contract with a university elsewhere. For students, however, the three-week courses are often not long enough to allow them to properly master a topic, even with the support they receive from tutors and lecturers. One lecturer also stated that a difficulty with having three-week courses is that the credits sometimes do not transfer over if a student wants to go on to study a PhD elsewhere, they are often obliged to take the same classes as an undergraduate student.



### Quotes

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"The timing was too short for the courses. In the first week you start to get the basics, in the second week you have assignments and then in the third week the course finishes" (AIMS Student)

"The three-week course is very short: for someone who does not have a background in that subject, it's too short to become an expert" (AIMS Student)

"The structure of the programme is very intense, but the support base of tutors/lecturers ensure that there are always things there to help you" (AIMS Tutor)

In terms of whether the programme is attracting the targeted population, **the programme is struggling to entice students who are interested in climate change**. This is in part due to structural problems (a relative lack of young people in Africa who are aware of climate issues, a job market which is perhaps not as strong for climate science graduates as it is for other fields, etc.). Feedback from tutors and students shows that **a significant share of the MS4CR cohort were persuaded to choose the climate stream even though this was not their initial choice**, particularly in the current academic year, with AIMS staff having to reach out to applicants to explain the benefits of opting for the climate stream. Whilst the decision was the students' own, and they were ultimately pleased with their choice, this shows the difficulty that the programme faces with targeting mathematics applicants interested in a career in the field of climate change.

### Quotes

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"When we arrived, we had no idea that we would do anything climate related. The management wanted some students to opt for a climate stream. At first, I wasn't very interested, but they did a seminar for us to introduce what it meant to join the climate stream, and I found that it was more of an application of the mathematics we had. I wanted to apply mathematics somehow and at the time the climate stream was there" (AIMS Student)

"For climate science, the ideal background would be someone with high skills in mathematics who wants to go into climate. However, most young people in Africa are not really aware of climate issues and the importance of climate change in Africa. Right at the beginning of the programme they do an introductory course on climate change and for most students it actually is an introduction to the subject" (AIMS Tutor)

"This year we were in dire need of people, so a lot of students were coerced into it. Given a complete choice, this year probably around 50% of the climate stream students would have naturally chosen this option, whilst the other half were coerced" (AIMS Tutor)

**The gender balance of the programme is considered good by all stakeholders**, particularly when considering the gender imbalance in STEM in general. Many of the interviewed lecturers agreed that the gender balance within the MS4CR programme was better than that at their home universities in North America and Europe. Furthermore, there were no significant differences overall in the levels of participation and academic achievement between men and women.

### Quotes

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"The gender balance at AIMS is much better than my course experiences at [home university] ...Remotely, I did not see a lot of women participating in the class, so I changed my approach a little bit to make it more accessible and saw a huge difference in terms of women participating. At AIMS, I could do this experiment, because they have the women in the room, which I can't do at [home university]" (AIMS Lecturer)

"There is a gender imbalance in science in general, and women feel discouraged. But with AIMS, I'm seeing that they've tried their best to get more women involved" (AIMS Lecturer)



“Bearing in mind its mathematics, the gender balance is pretty good at AIMS, and the weakest students have actually been male. If you took the average of boys and girls, it would probably be about the same” (AIMS Tutor)

To note, COVID-19 only slightly impacted the programme results in the sense that whilst students were exposed to the majority of the AIMS learning experience, they were not able to collaborate in-person with other students and lecturers. As recognised by several interviewees, there is a huge value in being physically present (breaking barriers, etc.), but there are also upsides to e-learning, such as reaching more people with good education, and attracting guest lecturers and other experts.

### *Research programme*

As stated in section 3.2, the research programme is on track to achieve its targets regarding the number of research scholarships, small research grants, research chairs and resident researchers, women fellowships, and peer-reviewed publications. But the number of female research masters, PhD students and post-docs for the research scholarships is still low (under 30%).

**Overall, the programme is therefore on a good course to contributing to increasing research by African mathematical scientists in climate science.** The programme has not only increased research output in terms of quantity (number of publications), but also research quality. COVID 19 has not negatively impacted the advancement of research work in a significant way, as reported by most researchers. The research plan was on track prior to COVID 19 and most data was already collected (for those needing to collect data from the field).

**The programme succeeded in attracting some of the best scientists in the climate science field.** The programme is giving African researchers the possibility to conduct high-level research in climate change science in Africa. Therefore, the programme is contributing to reducing the brain drain of African scientists, by giving incentives to return to Africa for instance. In addition, the excellent reputation of the AIMS resident climate researchers (research chair namely) is a valuable incitation for students and early career researchers, who find the opportunity to learn from and collaborate with renowned established researchers in the field. As shown by **Error! Reference source not found.**, if we take the criteria of the number of publications from 2017 to 2020, two researchers involved in the MS4CR Research programme (the Research chair and a small research grantee) are in the top 25 most active researchers in Climate in Africa over the period 2017-2020 (see Appendix D, Table ).

Secondly, **almost all the researchers involved in the MS4CR programme have a publication history.** Only one researcher of those included in the bibliometric analysis has an h-index<sup>20</sup> equal to zero. For more detail about the bibliometric analysis, see Appendix D.

According to the researchers working from AIMS centres (Post-Docs and resident researchers), **AIMS provides a conducive research environment.** Indeed, the centres offer high-quality infrastructure required to carry out climate modelling (super-computers, speed of internet

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<sup>20</sup> The h-index is an index that attempts to measure both the productivity and impact of the published work of a scientist or scholar. In Scopus, the h-index is not a static value; it is calculated live on a set of results each time you look it up. The calculation was suggested by Hirsch and it can be summed up as: “A scientist has an index  $h$  if  $h$  of his/her  $N_p$  papers has at least  $h$  citations each, and the other  $(N_p - h)$  papers have no more than  $h$  citations each.”



connection, 24-hour office facilities, etc.). Moreover, having a research team (facilitated by the existence of a research chair) is an asset since it allows fruitful collaboration and avoids “researcher solitude”. The small research grant recipients and women fellows were not able to fully visit AIMS centres as planned due to COVID. While this situation has not impacted the delivery of their research work, they believe that they would have benefited from coming to the Centres to network and build ties with peer researchers. The researchers initially applied to the programme's research opportunities because of the **AIMS' reputation for excellence and the topics covered** by the call for proposals. They all consider that the **application process for the research programme is clear, transparent and straightforward.**

### Quotes

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“AIMS is very a good environment for studying. At AIMS all things that students need are there: places to work, office where you can sit, internet.” (Research Masters student)

“AIMS is very effective for learning and teaching. There is a collaboration between students and supervisors. The place and internet connection are good.” (PhD student)

“AIMS is really an inspiring environment. A whole new world opened for me at AIMS. It is nice to have a broad training (also including e.g. Python, R, etc.). the multicultural aspect of AIMS is a plus.” (Research Masters student)

### *Climate Science Fellowship for Women*

Of the 400 girls planned to be sensitised to mathematical sciences and climate change studies, only 32 participated in outreach activities by December 2020<sup>21</sup>. Secondary school girls from Gashora Girls Academy and FAWE Girls participated in the Research Training School on Climate Sciences, held at AIMS Rwanda. COVID 19 indeed delayed the realisation of planned activities regarding gender outreach. For example, activities planned at AIMS centres and the launch of the workbook that aligned the different mathematics concepts with climate change in outreach events did not occur. **Thus, when the COVID 19 situation improves, AIMS will need to increase effort in organizing gender outreach activities, for the MS4CR programme to meet its objective of increasing the interest of African girls in mathematical sciences and climate change.**

**The MS4CR also made efforts to give visibility to African women in the field of mathematical sciences and climate change.** The programme issued 2/4 publications<sup>22</sup> profiling African women climate science scientists that featured 30/60 women researchers. In addition, 2 Gender Summits were organised and completed as planned. However, the number of women scientists attending (276) is below the initial target (750). The participation of women scientists affected by the fact that due to COVID 19, the conference initially planned to take place in person, in March 2020 was postponed and held virtually in December 2020. The virtual conference could also accommodate a relatively limited number of participants compared to the physical events.

The programme also planned to organise AIMS Women in Science Climate Change Speaker Series. Only 2 of those were able to be organised out of 15 initially planned as the COVID 19 restrictions imposed a cautious approach to organizing events.

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<sup>21</sup> Performance Management Framework, 2020.

<sup>22</sup> New Interventions for a Changing World: Celebrating African Women Scientists at the Frontlines of Climate Change.



Yet, the bibliometric analysis shows that **the programme attracted women researchers with a decent publication track record**. For instance, women researchers included in the analysis (13/20 who published) have an h-index of at least 2, except one researcher. One female resident researcher (Dr. Nana Klutse, who benefited from the WiCCS fellowship and is now a resident researcher) is particularly active. Therefore, we can assert that **the programme shows signs of its contribution to increasing capacity for African women to participate in research in climate change fields**.

### *Internships Programme*

**All of the interns interviewed felt that their internship had been useful and had prepared them for their future career**, helping them to develop their technical skills and to put their knowledge into practice, but also to develop their soft skills. Of those interviewed, internships had been carried out within diverse fields: mostly within research organisations, but also in industry, including finance and insurance companies.

#### *Quotes*

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"It was really good to move from theory to practical experience, where you can explore what's outside, the opportunities for jobs" (AIMS Intern)

"It introduces you to a network with people in different fields, and helps you to upgrade your skills" (AIMS Intern)

The vast majority of students agree or strongly agree that as a result of their time at AIMS, they have the knowledge and skills to succeed in their career.

**Employers think very highly of the MS4CR Programme and its students and graduates**. They highlighted **the AIMS format in general as a strength**, insofar as it provides a steady pool of graduates who are very diverse in terms of culture, background, nationality and language proficiency and have a "continental mind-set". Furthermore, employers can hire from different AIMS centres without having to undertake a benchmark of grades between countries, as these are more or less harmonised throughout the AIMS network.

#### *Quotes*

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"Local universities are not structured enough to provide a consistent pool of graduates that we can tap into. Geographic fragmentation is an issue – we would have to contact individual people in each university in each country... It is heavy to do this for each contact point. Where AIMS has an edge is that they provide an integrated one-stop-shop where you can source a large pool of graduates across the different campuses. This is a big asset from an industry perspective" (Employer)

The MS4CR Programme itself is deemed to be of added value, as it distinguishes MS4CR graduates from students from other universities going into the field of climate change. Employers pointed to **MS4CR graduates' and interns' proficiency in data analysis, data science, mathematical concepts, programming and modelling** as an aspect that distinguishes them from other graduates, who often come from a more environmental management background. However, some employers also said that MS4CR graduates and interns often had a **more generalised knowledge of climate science** and were often not experts in specialised topics, such as agronomy and water distribution. This matches what AIMS students themselves stated about the three-week courses not being sufficient to become an expert in climate science. Employers nevertheless feel that interns/graduates are **well-equipped with climate science theory and were quick to grasp new subjects** once being exposed to more topical



expertise which had not been part of their programme curriculum. Employers appreciate interns' ability to work at the nexus of climate, mathematics and data.

### Quotes

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"AIMS interns come with the critical tools that can really help us (data, programming languages...), a different toolset that can provide more useful and practical solutions to help us in our work" (Employer)

"The interns come in with a lot of mathematical knowledge, tools and skills. They come in with the climate science theory, which is adequate enough to work with our teams. We were impressed with the way interns can link climate, maths and data" (Employer)

"They have a unique set of skills, balancing climate policy, environmental management, skills in report writing, and then the maths side" (Employer)

### Consolidation of AIMS network

While the restructuring of key internal systems at AIMS have progressed, AIMS governance and management are more accountable than ever and display:

- **A more accountable governing structure. For example**, the new structure appears quite aligned with the UK standards of governance for higher education institution governing bodies (which is one of the world's highest):
  - *"is unambiguously and collectively accountable for institutional activities, taking all final decisions on matters of fundamental concern within its remit;*
  - *(...) protects institutional reputation by being assured that clear regulations, policies, and procedures that adhere to legislative and regulatory requirements are in place, ethical in nature, and followed;*
  - *(...) ensures institutional sustainability by working with the Executive to set the institutional mission and strategy. In addition, it needs to be assured that appropriate steps are being taken to deliver them and that there are effective systems of control and risk management;*
  - *(...) receives assurance that academic governance is effective by working with the Senate/Academic Board or equivalent as specified in its governing instruments;*
  - *(...) works with the Executive to be assured that effective control and due diligence take place in relation to institutionally significant external activities;*
  - *(...) must promote equality and diversity throughout the institution, including in relation to its own operation;*
  - *(...) must ensure that governance structures and processes are fit for purpose by referencing them against recognised standards of good practice."*

Stakeholders recognise the added value in the changes recently occurred in the Board structure and operating, and the balance between the Board members (in terms of profiles and gender). Board members come from the research & academic, traditional banking system and donor communities. There are 2 female and 4 male board members.

Name	Position
Prof. Neil Turok (Chair)	Founder of AIMS, Inaugural Higgs Chair of Theoretical Physics, University of Edinburgh, Director Emeritus of the Perimeter Institute for Theoretical Physics, Cambridge University
Mr Mohammed Gharbi	Former Vice-President and Chief of Staff at the African Development Bank
Prof Ruth Oniang'o	Past President of the Academy of Food Science and Technology, Founder and Editor in Chief of the African Journal of Food, Agriculture, Nutrition, and Development, Former Member of Parliament in Kenya, and Founder of Rural Outreach Africa
Prof Thuli Madonsela	Professor of Law and Chair in Social Justice at Stellenbosch University, and Former Public Protector of South Africa
Mr Abdel Kader Ndiaye	Vice-President of the Chamber of Commerce and Industry of Dakar, Senegal
Mr Charles O. Boamah	Former Senior Vice-President at the African Development Bank

Board members can be both sources of valuable information on the market needs for skills, and links/connections to potential AIMS funders or partners. However, the size of the Board (5 board members + one chair) appears too limited to include all communities which views could benefit to AIMS. Indeed, the non-traditional donor community such as foundations, social impact investing to quote a few are not yet represented. As an example, the African Association of Universities counts 11 members and the AfricaLics network international Board counts 17 members.

- **A revised business model which has still to be fine-tuned to achieve the objectives set in the 2021-2026 AIMS Strategic Framework.** The current overall AIMS annual budget is of approx. 14 M€, a big chunk of which comes from donor funding<sup>23</sup> and 25% of which comes from national governments contributions<sup>24</sup>. To complement these major funding sources, the AIMS alumni were to start contributing from their salaries from 2020 on, but this did not materialise. Options currently explored by AIMS are the potential of social impact investments and seed funding.
- **An enhanced coordination of the network.** AIMS is a network of several independent entities, with five core centres. A central coordination -operated by the Secretariat- is key to ensure alignment of the centres on values, academic content, and operating principles. The objective is to reach a balance in stewardship and providing support to programme teams. Developed policies and procedures are core to reaching this objective, though, their implementation is yet to be maintained through time, thanks to regular training to the staff and checks on implementation (ie. centres review). However, it appears through the different interviews conducted, that a discussion on the right level of centralisation versus devolution would be beneficial to ascertain efficiency of the AIMS model.
- **Prudent financial management**, exercised through checks and balances at Board level and at operational level including external auditing
- **Strengthened teams and gender equality**, supported by recruitments at AIMS Secretariat, clarification of roles and processes through the HR and gender policies and the HR information system.
- **Compliance with financial reporting and technical reporting requirements of donors.** According to the CFO, as of now, donors can have real time access to information.

<sup>23</sup> Main funders are Facebook, GAC, Google, IDRC, Mastercard Foundation, Carnegie Mellon and Humboldt

<sup>24</sup> Governments are contributing to infrastructures, accreditation, tax cuts for expatriates



However, when looking at the reports in detail: i) financial reports do not yet allow to measure progress against initially set budgets, revised budgets with traces of addendums and reasons for the addendums or modifications; ii) progress reports do not yet allow to understand for each period for all programmes and all activities which activities have progressed against which target, what has been changed, what has been stalled and why, and the corrective measures taken. Reports shall contain information on progress of all sub-programmes, and all activities, and even though for instance mentioning if there is no progress and why.

- **Strengthened procurement, communication and IT**

### 3.3 The efficiency of the MS4CR programme

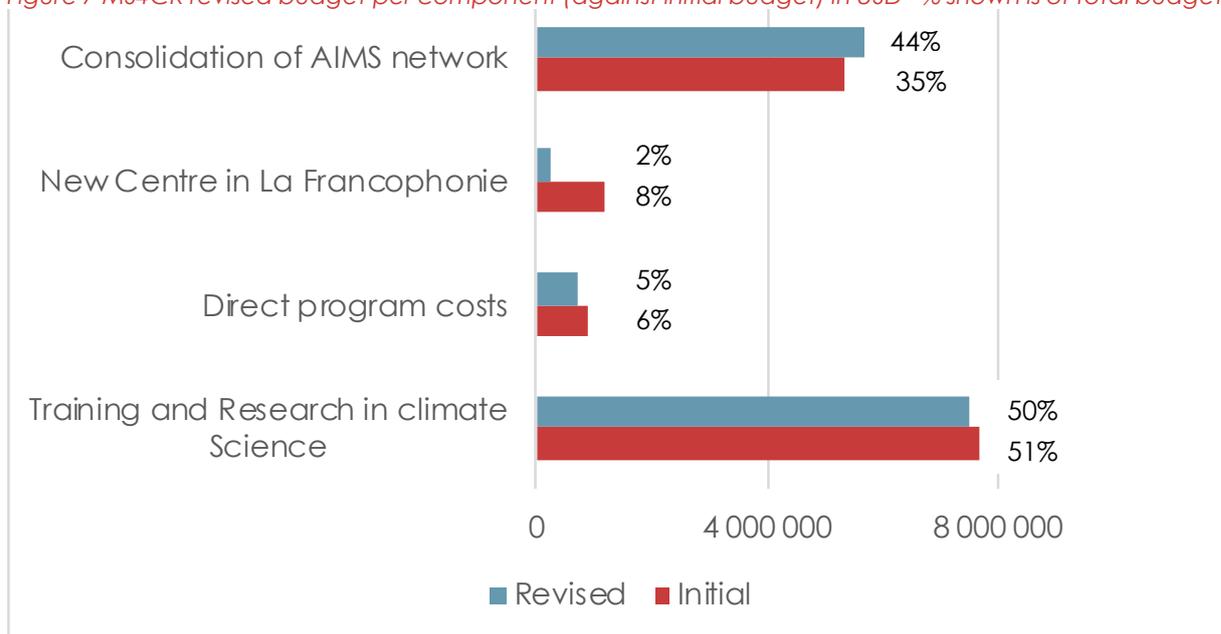
#### How adequate are the available resources to deliver the programme (human, financial, etc.)?

- **The MS4CR Programme overall budget appears to be adequate to implement planned activities**

This conclusion is drawn by looking at the initial and twice recalibrated budgets in 2019 and in 2021 (see semester reports and financial reports 2018, 2019, 2020).

Of the budget, 51% was initially devoted to training and research, 6% to direct program costs, 8% to the opening of a new centre in la Francophonie and 35% to consolidation. The level of budget devoted to consolidation even increased after re-profiling to 44% (see Figure 8). Additionally, to note is the increase in the budget of the indirect costs (see Figure 9).

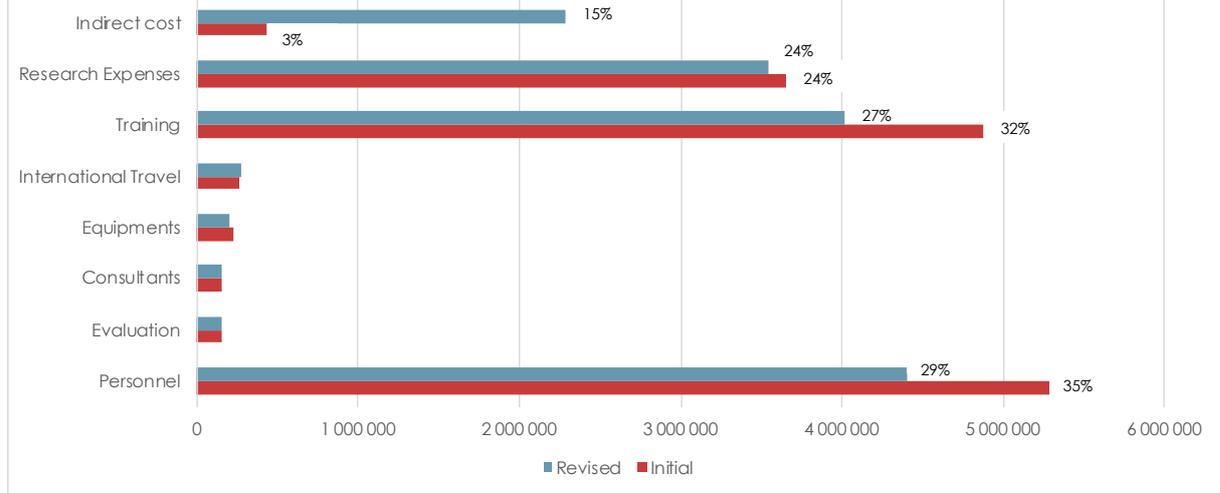
Figure 7 MS4CR revised budget per component (against initial budget) in USD - % shown is of total budget



Source: AIMS (2021), Financial reports 2018, 2019, 2020



Figure 8 MS4CR revised budget per category (against initial budget) in USD - % shown is of total budget



Source: AIMS (2021), Financial reports 2018, 2019, 2020

However, overall, GAC contribution to AIMS activities is only a proportion of the total expenses and payroll (see Figure 9 and 10). The proportion of the Secretariat costs is about 40% of overall expenses. MS4CR consolidation activities budget follows the same ratio

Figure 9 GAC contribution to AIMS overall expenses (in CAD)

Total Expenses									
Entities	July 2017- June 2018			July 2018- June 2019			July 2019- June 2020		
	Total expenses	Total charged to Gac	% Gac contribution	Total expenses	Total charged to Gac	% Gac contribution	Total expenses	Total charged to Gac	% Gac contribution
AIMS Cameroon	2 198 048		0%	2 615 282		0%	2 085 125	44 666	2%
AIMS Ghana	1 401 146		0%	1 349 418		0%	2 620 502	44 666	2%
AIMS Senegal	1 949 133		0%	1 225 000		0%	2 408 385	44 666	2%
AIMS Tanzania	682 000		0%	255 000		0%	71 000		0%
AIMS South Africa	2 953 000		0%	2 968 000		0%	2 527 000		0%
AIMS Rwanda	1 369 313	169 528	12%	1 559 221	511 450	33%	1 792 973	451 448	25%
Chapter Canada	1 117 700		0%	1 110 550		0%	863 488		0%
Chapter UK	372 567		0%	277 638		0%	246 711		0%
Chapter Germany	506 510		0%	38 132		0%	123 355		0%
Secretariat	8 571 604	1 350 656	16%	8 214 794	1 199 914	15%	10 437 277	1 688 705	16%
Total	21 121 020	1 520 184	7%	19 613 035	1 711 364	9%	23 175 816	2 274 151	10%

Source: AIMS (2021) – note that under Secretariat, Research activities are counted

Figure 10 GAC contribution to AIMS overall payroll (in CAD)

Payroll									
Entities	July 2017- June 2018			July 2018- June 2019			July 2019- June 2020		
	Total expenses	Total charged to Gac	% Gac contribution	Total expenses	Total charged to Gac	% Gac contribution	Total expenses	Total charged to Gac	% Gac contribution
AIMS Cameroon	519 401		0%	631 421		0%	498 847		0%
AIMS Ghana	402 696		0%	410 720		0%	381 648		0%
AIMS Senegal	659 401		0%	670 537		0%	589 946		0%
AIMS Tanzania	159 032		0%	123 350		0%	13 039		0%
AIMS Rwanda	328 050	69 528	21%	405 255	50 610	12%	427 027	60 631	14%
Chapter Canada	216 894	28 900	13%	172 971	14 759	9%	153 017	8 464	6%
Chapter UK	56 185		0%	4 335		0%	15 996		0%
Chapter Germany	1 198		0%	9 396		0%	16 299		0%
Secretariat	2 864 595	464 664	16%	2 768 017	628 389	23%	3 469 222	873 950	25%
Total	5 207 452	563 092	11%	5 196 001	693 758	13%	5 565 039	943 045	17%

Source: AIMS (2021)

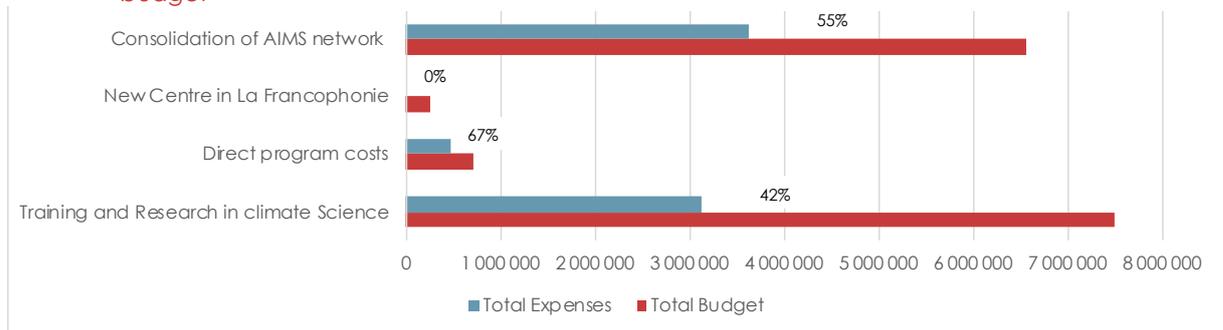
**Due to delays, difficulties in implementing the activities and savings on travel by staff, students and lecturers, the project expenses were below the available budgets. Additionally, the budget**



was re-profiled<sup>25</sup>, notably with the budget for the new centre in Francophone Africa being reallocated. This allowed AIMS to cover more student costs than otherwise, hence AIMS will finally train twice as many students in the Climate Stream (initial target of 88 moved to 174 students at least by end of 2022) within the same budget. A certain percentage of the saved funds were also reallocated to “indirect costs”

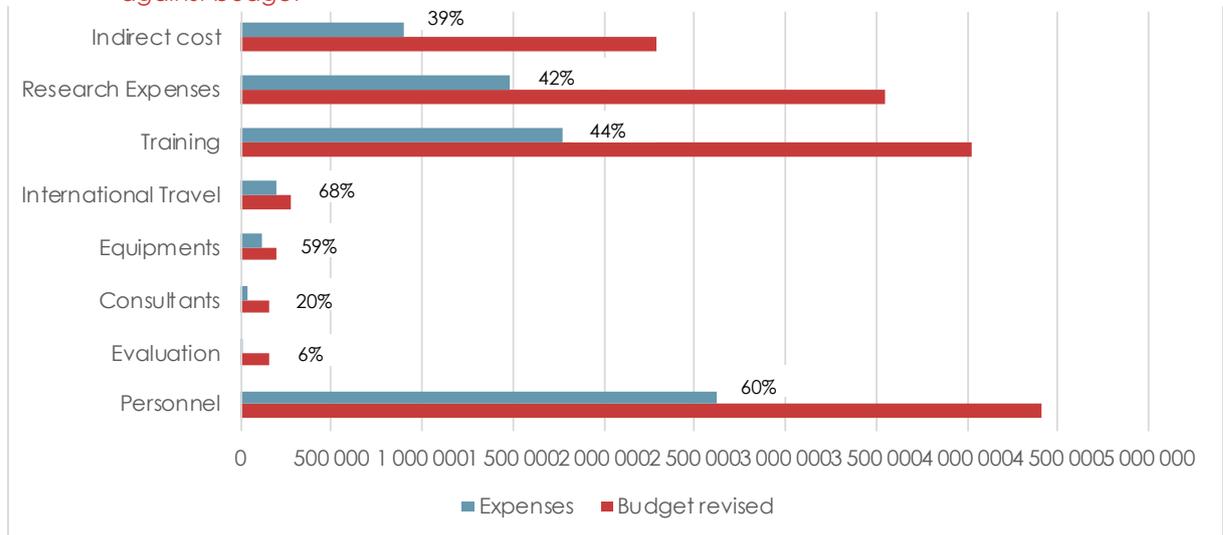
Current budget consumption on the training and research component reflects a slow start of activities (see. Figure 12 and 13), but the planned scale up of trainings (Master’s stream) in four AIMS Centres, as well as the time extension on the research component, shall see the timely use of the rest of the budget<sup>26</sup>. So far, expenses appear coherent with activities implemented and outputs obtained.

Figure 11 MS4CR expenses per programme (against budget) in USD- % shown is of expenses against budget



Source: AIMS (2021), Financial reports 2018, 2019, 2020

Figure 12 MS4CR expenses per category (against revised budget) in USD - % shown is of expenses against budget



Source: AIMS (2021), Financial reports 2018, 2019, 2020

<sup>25</sup> 2019 and 2021

<sup>26</sup> (Note that data for period 2 of budget implementation is still missing from accessible documentation but was calculated by the evaluator)



The perception among interviewed stakeholders is that, to date, the allocated budget is rather adequate to implement the MS4CR activities.

**Concerning training**, stakeholders believe that the budget is adequate, but that additional budget would result in the ability to implement more activities, such as student mobility.

**Regarding the perception of beneficiaries of the Research programme on the amount of funding**, there are mixed opinions. PhD students are satisfied with the funds attributed as part of their scholarships. It allows them to be involved full-time in their research work. The post-docs were also comfortable with their salary. In addition, post-docs mention that health insurance is not covered for them, which poses an issue. Some researchers (small research grantees), based on their research objectives, were able to complete their project because they got access to additional funding from other donors. Otherwise, they mentioned that it would have been challenging to do so.

Originally, there was a total of 36 staff positions across the AIMS network supported in part or in full by the MS4CR programme. However, some positions previously funded by MS4CR have concluded, either through termination, resignation or contract completion and there are some vacant positions to be filled (13 positions) once deemed necessary; since 2018, 6 positions were filled to ensure the smooth running of all activities and support functions,

### How appropriate are the implementation modalities and M&E mechanisms?

- **AIMS network operations and management are generally perceived by stakeholders to be of good quality, despite some difficulties at the beginning of project implementation.**

#### *Master's training programme*

The application and recruitment process of MS4CR students encountered some difficulties. In terms of applications, it was difficult to set a benchmark for applicants because of the non-standardised nature of grades between different countries. One recommendation which emerged during the interviews to resolve this problem was to put in place an entrance exam in order to set a level playing field and to ease the application process.

#### *Quotes*

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"One challenge is that students come with rather different perspectives, and you have to convince them to do the climate science stream" (AIMS Academic Director)

"For the CR stream we intend to attract students with a background/interest in programming and data related. If they are not interested in this, it will be a bit boring for them" (AIMS Academic Director)

"The students have to write an application letter and upload the transcripts of what they did in university and then they try to select the best. But this is difficult because the educational systems in Africa are very different (e.g., an A-level in Nigeria may not be better than a B-level in a different system. In French speaking countries there is more attention for mathematics, so generally the level of the graduates is higher there). We would like to organise an entrance exam and an interview (for all AIMS). This is a fairer way of selection" (AIMS Academic Director)

Teaching within the Master's level training Programme was judged to be good by students, alumni and tutors. Nevertheless, there is a perception among stakeholders that the programme was slightly rushed at the beginning of its implementation. For example, some of the lecturers and courses in the first cohort were judged to not be up-to-standard. Whilst the stakeholder feedback also shows that the management has improved with time. It points to inadequacies in management at the beginning of the programme.



## Quotes

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"One of the challenges is to attract very good lecturers. They should have enough time to come for 3 weeks." (AIMS Academic Director)

"The Academic Director is managing the programme himself. He would like to have a separate programme manager (doing the leg work), so that he can focus on the academic issues, teach or do research" (AIMS staff)

"The ideal situation is to go back to face-to-face teaching, but we should think differently and need to adapt to a more blended mode of learning. This year's climate courses have been taught in Cameroon and Senegal with the same team of lecturers. With cases of teachers 1 week remotely and 2 weeks onsite. This has been implemented and worked well" (AIMS Academic Director)

All stakeholders tend to agree that the programme is well managed, and that despite the fact that some impacts arose due to COVID-19, the programme managed to respond relatively well to these. For some lecturers, the short-term schedule planning at AIMS was difficult to get used to compared to what they were familiar with at their home universities. COVID-19 meant that some courses were taught remotely, meaning that students could not get in-person experience with their lecturers, missing out on important informal exchanges, and that tutors were required to do additional work to set up the class and offer the one-on-one interaction with the students. In general, students, lecturers and tutors alike feel that AIMS and the programme responded to these challenges in the best way possible, although some complained of internet connectivity issues.

## Quotes

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"Management is getting better. It maybe needs to be more focused on the wellbeing of researchers. They should be more in contact with researchers, the lecturers and the contacts in industry, and to create this bridge. The solution is closer to the students and their needs" (AIMS Lecturer)

"They have a system, they do a good job of implementing this system, and they communicate well. What was most difficult for me was the timing, at [home university] I already have my schedule for Spring 2022, whereas at AIMS it's a lot shorter term, and I have only just requested my schedule for September" (AIMS Lecturer)

"One of the beautiful things about AIMS is gathering people from different cultures and backgrounds and learning from each other. With COVID, this has affected the ability to reunite a wide range of people.

There's a huge difference between online and on-site meetings" (AIMS Tutor)

## Research programme

**All researchers interviewed express high satisfaction regarding project implementation and management.** In particular, they highlighted the **responsiveness of MS4CR staff** when they had requests. However, some issues still need to be tackled to ensure that resident researchers have the needed support to focus on their research work:

- Competent research support staff assisting with administrative to quickly respond (prioritise) to the research team needs
- Increased responsiveness of the IT team to handle the needs of the research team.

Finally, **the Research programme is missing a coordinator of the scientific activity carried out by each group of beneficiaries** (Research Masters, PhD students, small research grantees, women fellow, post docs, resident researchers, and research chair). The research currently undertaken appears disparate, and complementarity to strategically inform practitioners and policymakers.



### *Climate Science Fellowship for Women*

All women fellows were satisfied with programme implementation and management. The fact that it can cover for their dependents<sup>27</sup> is particularly appreciated.

### *Internships Programme*

The interns felt that the programme provided the necessary support and guidance in helping them to find their internships, and also praised the support provided by their supervisors during their internship, although some said that their supervisors were not sufficiently familiar with some of the technical questions that they had. Due to COVID, some of the internships were carried out remotely which brought a new set of challenges: Internet connectivity issues were a problem for some, and the lack of in-person exchanges sometimes an issue for alumni in the early stages of their career.

#### *Quotes*

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"AIMS really helped me to find the internship – their support was invaluable. During the internship, I had two supervisors who provided help anytime I wanted" (AIMS Intern)

"I maybe could have benefitted from more technical expertise from my supervisor. I was new in the field and so were they" (AIMS Intern)

Employers feel that the support provided during the internship in terms of communication and supervision is adequate, although they feel that the frequency of reporting to AIMS could be reduced (for example, from a monthly to a bi-monthly reporting system). Although there were some challenges due to remote working, employers felt that AIMS were partners in helping them to find solutions to these difficulties.

### *Consolidation of AIMS network*

Consolidation at AIMS means two different approaches, which are not exclusive of each other in general, but might come into conflict due to internal capacities which are not unlimited: i) restructuring and reorganisation of activities for institutional strengthening and sustainability, and ii) expansion of activities in order for AIMS to be financially viable.

Given the challenges in securing host governments' financial support for existing centres, and the overhead costs of the Secretariat, adding another centre was considered in 2018-2019 as a risk for AIMS. It appeared at that time that consolidation of the network and improvements in core operations should come first, before expanding to new host countries<sup>28</sup>.

The Programme Management Framework (PMF) is very solid and aligned to the intervention logic and *Performance Management Framework* (PMF). However, the reporting is not sufficiently clear and could be more connected to the PMF. The reporting on consolidation should be more detailed to allow for a better understanding of the efforts and achievements on this very important component. New indicators might prove necessary on this aspect.

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<sup>27</sup> Terms of Reference for Fellows [https://research.nexteinstein.org/wp-content/uploads/2020/03/ms4cr.f.tor\\_fellows.2.2020.pdf](https://research.nexteinstein.org/wp-content/uploads/2020/03/ms4cr.f.tor_fellows.2.2020.pdf)

The fellowship will cover: o transport (air/train ticket, petrol, etc.) to/from the host institution for the Fellow, up to three accompanying dependents (a spouse, two children) and an in-country nanny, at a maximum cost of USD 6,000; o transportation and accommodation to enable the Fellow to present work funded by the fellowship at one international conference (up to USD 2,000); o a living stipend for the Fellow (USD 12,000) plus a supplemental stipend for up to three accompanying dependents and nanny (up to USD 6 000); and o funding for project-related activities

<sup>28</sup> 2<sup>nd</sup> Technical progress Report, AIMS-NEI Global Secretariat. 26<sup>th</sup> August 2018. To clarify with Executive Management and IDRC



### **In what ways is/isn't the program being implemented in the most cost-effective manner possible?**

The evaluators note that, as described in programme annual reports, cost-cutting measures have been implemented, including staff lay-offs and programme down-sizing, leading to reductions of about 20-30% in operating costs across Centres and the Secretariat and allowing to double the number of students to be trained. The evaluators also note that the closure of the Tanzania Centre counts in these cost reductions.

### **Is the consolidation component an essential/ongoing component of any major training & research programme at AIMS?**

Some interviewed stakeholders mentioned that the role of Secretariat staff is key in overseeing the implementation of programmes, ensuring that these are harmonised across centres, and that key functions are centralised (policies, procedures, recruitment, curricula, training opportunities).

The MS4CR is AIMS' first experience in developing and implementing a thematic stream within a long standing Master's programme. This comes with challenges. Many stakeholders mentioned that the MS4CR implementation was not well prepared and that difficulties were experienced in the first year in terms of recruitment of the students, selection of the right tutors and lecturers, and ensuring the quality of the training. This raises questions about the role of the Secretariat in ensuring a **smooth start of a new programme**. However, it must be also recognised that AIMS central functions have gone through a restructuring since 2018, which aims to enhance the support provided to Centres and should ascertain a better start for new programmes in the future.

## **3.4 The impact of the MS4CR programme**

### **What are the early signs, if any, that immediate and higher-level outcome results have been achieved (positive/negative)?**

*On increased access for African students (women and men) to post-graduate education in mathematical sciences with a focus on climate change (outcome 1110)*

According to AIMS internal data, most MS4CR alumni choose to go into employment upon graduating (46%), followed by those choosing to pursue further studies (28%)<sup>29</sup>. Of those employed, the most common sectors are: environment and agriculture (32%), education (20%), ICT (12%), and business consulting/management (12%). Of those pursuing their studies, 60% opted for a PhD and 40% for another master's. The most common fields of study are: climate science and machine learning/AI (both on 27%). No information is available on whether alumni remained in Africa to pursue their studies or find employment.

*On increased research by African mathematical scientists (women and men) in the field of climate science (outcome 1120)*

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<sup>29</sup> Data is unavailable for 26% of graduates.



From the results on the state of completion of the MS4CR programme and current results, we can **attest to early signs of the contribution of the MS4CR programme in increasing the role African scientists (women and men) in finding solutions to climate-related issues**. This claim is evidenced both by the bibliometric analysis and qualitative data (interviews with researchers).

In total, we counted 185 citations for the 32 publications (58% of total publications peer-reviewed) referenced on SCOPUS. Overall, publications by AIMS MS4CR researchers perform well compared to similar publications. In terms of citation benchmarking<sup>30</sup>:

- 5 publications (15%) are in the top 10% most cited articles in the field.
- 12 publications (37%) are in the 30% most cited articles in their field.

Moreover, 12 publications (37%) have a Field-Weighted Citation Impact<sup>31</sup> (FWCI) higher than 1, meaning that these publications are well positioned in terms of citations according to the global average. For more detail about the bibliometric analysis, see Appendix D.

According to interviews with researchers, the programme shows early signs of impact. Furthermore, the programme has several unintended effects on researcher career, indirect capacity building, and other examples of spill over, as shown by the following quotes.

### Quotes

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"One of my publications was published in a high ranked journal and got me promoted." (Small research grantee)

"My students (masters) benefited from skill transfer and capacity building thanks to the programme. They worked on my project and got exposed to climate modelling. Most students come from rural background where doing a research masters of research is not common. The programme made a huge difference in their lives. After being involved in the project, one student is now working for a private organisation doing environmental research." (Small research grantee)

"Without the MS4CR programme, I would not have pursued a PhD in Climate science". (PhD student)

*On increased capacity of AIMS alumni (women and men) to work in climate change fields within industry, governments and non-governmental organizations (outcome 1130)*

There are not many opportunities for climate scientists in Africa outside research. They do not have difficulties in finding internships and get good feedback from the employers. The alumni are able to get jobs because of their skills in data science and data analysis, but these are only to a limited extent in the climate sector. The climate science opportunities are fairly limited (limited to research opportunities, according to respondents) and alumni are often more attracted to other sectors such as finance, a field that is increasingly attracting mathematicians especially in data analysis. Academic directors do not believe that opportunities will increase in the immediate future.

However, some lecturers said that they believed they had already witnessed an impact of the MS4CR Programme, as they are aware of **some students conducting important research in the**

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<sup>30</sup> Citation Benchmarking shows how citations received by this article compare with the average for similar articles. It takes into account: i) Date of publication; ii) Document type; iii) Disciplines associated with the source; iv) Compared articles within an 18 month window and is computed separately for each of its sources' disciplines

<sup>31</sup> Field-Weighted Citation Impact (FWCI) - the ratio of the total citations actually received by the denominator's output, and the total citations that would be expected based on the average of the subject field. i) The FWCI is the ratio of the document's citations to the average number of citations received by all similar documents over a three-year window. Each discipline makes an equal contribution to the metric, which eliminates differences in researcher citation behavior. ii) FWCI attempts to account for disciplinary differences in publication patterns; iii) FWCI of: exactly 1\* means the output performs just as expected for the global average; ii) more than 1 means that the output is more cited than expected according to the global average; iii) Less than 1 means that the output is cited less than expected according to the global average



**field of climate science since their time at AIMS, which is significant in and of itself given the recent timeframe of the programme. According to the PMF, 29 AIMS alumni are pursuing PhDs and Research Masters in climate science and 39 AIMS alumni are employed and working in the field of climate change**

*On increased capacity for African women to participate in research in climate change fields (outcome 1140)*

**Women researchers perform well** regarding their publications' impact. They publish 43% of the top 30% most cited articles in their field. 5/13 (38%) publications by women researchers have a field-citation impact higher than 1.

**Nevertheless, the number of women participating to gender outreach activities is below initial targets.**

*On increased visibility of African women in the field of mathematical sciences and climate change (outcome 1150) and increased interest of African girls in mathematical sciences and climate change (outcome 1160)*

Even though the participation of women is still low concerning research scholarships and that outreach activities have not been implemented as planned, the programme shows promising results on the research side. The Women Fellow programme is particularly successful and gives increased visibility to participating women scientists. Yet, in order to amplify this, more efforts have to be done on awareness-raising activities and outreach.

*On sustained capacity of AIMS centres to deliver high standards of training and research in advanced mathematical sciences (outcome 1210)*

As described in the previous sections, AIMS centres have ensured high standards of training and research within the MS4CR programme, despite a slow and uneven start during the first year of implementation.

*On strengthened institutional capacity of the AIMS network including sustainability (outcome 1220)*

As mentioned in the previous subchapters, there is much evidence that support the conclusion that the AIMS network is working to strengthen its institutional capacity, including the gradual implementation of KPMG audit recommendations since 2020-2021 period. Concrete effects on programme implementation as well as sustainability shall be seen in the coming years.

### **What is the anticipated impact of the programme on the contribution of mathematical scientists in finding solutions to climate change-related challenges in Africa?**

The anticipated impact of the programme on the contribution of mathematical scientists appears to be limited in industry and government, as these sectors do not presently offer a sufficient level of opportunities to graduates mainly in the short term. Prospects for impact in research appear brighter.

#### **Quotes**

"We are far from a critical mass. But they are producing more graduates than there is demand for at the moment". (AIMS Centre staff)

"From the feedback we had, AIMS alumni work on interesting projects and make a contribution" (AIMS Centre staff)



"There are also mini-contributions by researchers to global gatherings etc. However, there is no strong influence yet" (AIMS Centre staff)

### 3.5 The sustainability of the MS4CR programme

#### To what extent has AIMS received commitment from African governments and the private sector to support this programme?

**Commitments from African governments which are hosts to AIMS centres and private sector have proved difficult to mobilise**, although this is not specific to the MS4CR programme. For the MS4CR programme, no funding from the private sector has to date been sought or secured. As underlined by some interviewed stakeholders, ensuring sustainability at AIMS requires sustained investments which will be expanded within the new strategy framework (2021-2026) that is in the pipeline.

However, partnerships were established, offering lecturers, postgraduate opportunities (e.g. University of Rwanda hosts AIMS PhD, master's in research students), host institutions for interns.

#### To what extent are any early results observed in gender equality and inclusion in the programme and at AIMS likely to endure following this grant?

Early results in gender equality and inclusion at AIMS will not endure if no further investment are made. Yet, the systematic gender equality and inclusion mainstreaming across the programme, as well as the AIMS gender strategy in preparation, are showing results regarding a better inclusion of women.

#### To what extent will the thematic-focused programme model receive commitment and engagement from donors?

AIMS Centres Academic Directors point to the awareness and interest raised among national governments for a climate science thematic programme. However, AIMS do not appear to have yet engaged into finding other funders for this particular programme. Therefore, there have been no other financial commitments or engagements from donors so far, apart from that of IDRC/GAC. Conclusion and discussion, recommendations

### 3.6 Main conclusion and discussion

Overall, this MTE concludes that the AIMS MS4CR programme is performing satisfactorily. Despite problems at the programme's inception, and difficulties associated with COVID 19, most elements of the programme have started and as is indicated in the previous chapters, achieved their first results. There is however ample room for improvement.

Before we present the recommendations on how to improve the MS4CR programme going forward, we first present conclusions on the determining factors behind the success of the programme.

The strength of the AIMS model is the supply of a high-quality learning environment with intensive, focused and well-supported courses for bright students, who can focus purely on their studies (with no issues regarding their subsistence and accommodation), in a stimulating 24/7 setting with one-year courses. The mathematical methods and tools which the students learn within their courses, which cover different and not necessarily interrelated subjects, together form a toolbox that, once the students finish the programme, can be widely applied by them in all kinds of different jobs. COVID-19 has already affected two cohorts and the latter were not



able to fully benefit from the unique learning environment. In the light of some benefits to distance learning (easier access to some students or some lecturers, reduced travel costs, mutualisation of lecturers and lectures across centres), it seems important that AIMS conducts a specific reflection around the pros and cons of distance learning to strike a good balance.

Climate change is one of the world's most important drivers today, especially in Africa which is likely to be the most vulnerable continent to climate impacts. Africa should prepare for this future, and targeted education constitutes an important part of this preparation.

Whilst the MS4CR programme title targets "Climate Resilience", mathematical skills are of primary importance for climate modelling, yet many other skills are needed to achieve climate resilience, including skills in applied science, social sciences, etc. Mainstreaming all these skills in a one-year long programme appears challenging, and therefore choices must be made on the overall objective of the programme: either focus deep on the (mathematical) topic of climate modelling, or broader, with less mathematics.

A positive aspect of the MS4CR programme is the wider approach it takes, rather than just educating Master's students. The research activities in the programme offer the opportunity for AIMS to interact more strongly with the scientific world and provide a richer scientific surrounding for the students. The interactions with science (e.g. cooperation with universities and institutes, interaction between researchers and MSc students) have not been sufficiently explored so far (partly because of COVID).

The attention given to women in the programme is very important and seems to have already produced desirable effects. This is however not something that is (or should be) restricted to the MS4CR programme alone and relates to the whole of AIMS.

The internships provide students with the opportunity to apply what they have learned in practice and offers them a view on possible employers (and employers a view on possible employees).

MS4CR has been instrumental in consolidating the AIMS network. The additional finances have increased the activities in the various centres, notably strengthening the activities at the AIMS Secretariat. A new Francophonie Centre has not been achieved because of the strategic choices of the AIMS Board and IDRC to focus on strengthening existing activities.

With respect to these last two goals, the question may arise as to whether it is better to concentrate all climate change activities in one (or two) centre(s) or having all centres offering the same palette of services. Concentrating activities may lead to a more immediate achievement of a critical mass in the chosen area and may lead to increased interactions between researchers (who are currently in more than one location) and between research and (MSc) students. However, building relations with stakeholders (governments, NGOs, industry) across Africa becomes more difficult when activities are concentrated in one location.

## 3.7 Recommendations

### 3.7.1 Strategy and governance

- **Install a Programme Board for the MS4CR programme**, with stakeholders of various backgrounds (science, government, NGOs, industry) and involve them closely in improving the programme.
- **Make explicit choices about the best way to achieve synergy between the AIMS model and climate resilience**. Besides the balance between mathematics and climate change topics in the programme, the discussion within AIMS (and possibly with the newly installed



Programme Board) should also answer the question whether specific programmes within AIMS should be run in all centres or should be concentrated in one or two centres. Act according to the outcomes.

- **Carefully consider opening new Centres in light of a sustainability plan (including fundraising plan).** Consider the importance of consolidating existing activities prior to expanding. Do not mix this discussion too much with the discussion on the importance of climate resilience for AIMS.

### 3.7.2 Overall operations

- **Safeguard AIMS' reputation for excellence.** The researchers in the MS4CR programme stated they were attracted to the programme due to its excellent reputation. Maintaining this reputation is therefore essential if the research programme is to continue enrolling high-profile researchers.
- **Take adequate time and resources necessary for designing and planning** before launching any new programmes or even scaling them up. Do not rush and take up the lessons learned from the MS4CR in that matter.

### 3.7.3 Master's level training Programme

- Once the goals for the MS4CR programme are revisited (first recommendation above) **consider the balance between mathematic and climate topics in the course.**
- **Increase the length of time dedicated to the introductory course on climate at the beginning of the programme.** When students arrive at Master's programme, most are not experts in climate and would benefit from a more extensive introduction to the subject.
- **Improve the recruitment process for the Master's programme in order to attract higher-quality applicants.** Invest in a more targeted or widespread communication campaign, specifically for MS4CR so that potential applicants are made aware of the benefits of studying climate science before applying (relevance for Africa, career prospects, etc.). Consider introducing standardised entrance exams, either run separately from other AIMS courses or introduced for all programmes.
- **Consider tailoring the length of the courses according to their level of difficulty.** Although the three-week courses are important in order to attract the best lecturers from around the world, the standard three-week length can be an issue for students' learning, especially for the more difficult courses on the curriculum. A longer course time could help reinforce students' learning before they move on to a different course. This would nevertheless also be dependent on being able to secure lecturers for these longer, more difficult courses.

### 3.7.4 Research programme

- **Involve more PhD and Research Master's students in the Research Chair's team.** The interviews with some post-docs show that PhD and Master's students could be better integrated into research teams. Some PhD students have fewer links with the AIMS centres and research teams, compared to those who are AIMS Alumni.
- **Strengthen the cooperation with universities and increase the opportunity to exchange and network with other researchers.** Agreements with universities on research(ers) seem rather ad hoc at present. Structure these agreements, and build a real network of organisations instead of a network of individuals. Strengthen relations between researchers and AIMS centres, and structure the researcher alumni network.



- **Identify a coordinator of the scientific activity under the Research programme.** Currently, the research programme lacks scientific coherence to ensure that research carried out is serving a clear research agenda: research is carried out disparately without ensuring complementarity. In order to enhance the usefulness of the programme (the extent to which the research outputs inform policymakers and practitioners), it will be key to ensure that coordination is made.

#### 3.7.5 *Climate Science Fellowship for Women*

- **Pursue the Women fellow programme and expand it to include more women.** The WiCCS is highly relevant to include more women scientists in climate change. Specific sub-programme targeting women and their needs have shown to be particularly successful and could inspire other programmes at AIMS.
- **Intensify gender outreach activities.** The planned activities lagged fell behind in terms of delivery speed. AIMS needs to take strategic measures (for example exploring partnerships with other organisation active in gender, women in STEM and climate science, intensifying the organisation of virtual events).
- **Encourage WiCCS alumni to mentor young women researchers.** Women fellows we interviewed showed interest to mentor young women researchers. This could be done by creating a platform (mentorship initiative) where they can be paired with younger researchers in the programme.

#### 3.7.6 *Internships Programme*

- **Build stronger relationships with industry, government, and non-governmental organisations.** A stronger relationship between AIMS and these organisations could be mutually beneficial. For AIMS, this partnership would help to secure internships for students and to increase their network for their graduates. In return, AIMS, through the MS4CR Programme can provide capacity-building activities for these organisations, particularly those in need of upgrading or enhancing their data skills in the climate field. The afore mentioned Programme Board can play a role here.

#### 3.7.7 *Consolidation of AIMS network*

The consolidation part is not just about the MS4CR programme. Hence two recommendations concern the overall AIMS network and two others the MS4CR programme only.

- **Consider extending the size of the international governing board to include more members and from non-academic background, to enhance sustainability and better feed reflections around AIMS business model**
- **Consider carefully defining the right level of centralisation** versus decentralisation to the AIMS Centres, to ensure the right model is implemented. The ongoing exercise on the strategy framework is a good opportunity to start reflecting on this.
- **Enhance the reporting function on the programme.** Reports shall detail actions that have happened during the report period but also since the beginning of the program, to allow a better understanding of progress made, but also difficulties faced. Each of the subprogrammes activities and outcomes should be presented systematically and not only some of them, at each period.
- **Enhance the PMF consolidation component to include some more indicators, notably on the governance and business model, distinctly from other key functions.** This will allow to unpack the effort made by AIMS and reflect it better.



### 3.8 How should the thematic focus of any future specialised master's programme be determined and what might it be?

Stakeholders all stated that it would be relatively simple to replicate the structure of the MS4CR Programme if AIMS were to decide to create a new specialised master's programme. With the mathematics, physics and computing courses already in place, and by adapting the models used, stakeholders felt that potential ideas for a specialised master's programme could include:

- Mathematical biology (including epidemiology),
- Machine learning, (although already part of the MS4CR programme),
- Data science (although already part of the MS4CR programme),
- Resilience (mixing the core of the mathematics/computing side with the more economic and public policy side).

Another stakeholder felt that it could be interesting to have five different specialised master's courses, instead of one specialised programme such as the MS4CR regroups a number of different fields. In this sense, each centre would have one specialised programme (e.g. pure mathematics, data analytics, climate science, etc.).



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## Appendix B Interview List

### Interviews Conducted

Group	Interviewees	Role / Organisation
Senior Management, Secretariat AIMS	Lydie Hakizimana	CEO
	Rana Auditto	Chief Financial Officer
	Prof. Mama Foupouagnigni	Chief Academic Officer
	Prof. Wilfred Ndifon	Chief Scientific Officer
	Francis Musoke	MS4CR Programme Manager
	Kode Niane	
	Audrey Namdiero Walsh	Director of European Operations, Director of Gender Equality & Inclusion
	Karen Sutherland	Director of Monitoring & Evaluation
AIMS Academic Directors	Prof. Franck Kalala Mutombo	AIMS Senegal
	Prof. Marco A. Garuti	AIMS Cameroon
	Prof. Blaise TCHAPNDA	AIMS Rwanda
	Francis Oduro is replaced for this interview by: Dr. Prince Osei	AIMS Ghana
AIMS Research Staff	Dr. Nana Klutse	Resident Researcher
	Prof. Mouhamadou Bamba SYLLA	Climate Change Research Chair
AIMS NEF – Industry Initiative	Dr. Charles Lebon Mberi Kimpolo	Director
AIMS Lecturers	Prof. Roger Stern	
	Dr. Babatunde Abiodun	
	Dr. Mohamed Mbehou	
	Dr. Jodi Mead	
AIMS Tutors	Kossi Amouzouvi	AIMS Rwanda
	Jessica Weitbrecht	AIMS Rwanda
	Vestine Mukandayisenga	AIMS Rwanda
	Rockefeller	AIMS Cameroon
	DADEDZI Kenneth	AIMS Ghana
Research Master's in Climate Science Candidates	Jean de Dieu Munezero	
	Nasson Ntwari	
	Camelle Kabiwa	



PhD in Climate Science Candidates	Wilfried Kamdem	
	Marie Aimee Uwineza	
Post-Doctoral Fellows	Abdoelnaser Degoot	
	Moustapha Tall	
	Ndeye Yacine Barry	
MS4CR Climate Science Women Fellows	Jessica N. P. Thorn	
	N'Datchoh Evelyne Toure	
	Nana Klutse	
MS4CR Small Research Grantees	Ayansina Ayanlade	
	Innocent Muhire	
	Timothy Dube	
MS4CR Interns	Fauste NDIKUMANA	AIMS Cameroon
	Emmanuel Beker CHINEDZE	AIMS Cameroon
MS4CR Climate Science Stream / Elective Courses Alumni	Climate Science Focus Group	
	Elective Courses Focus Group	
Hosts and employers of AIMS MS4CR Interns and Graduates	Marie-Laelitia Busokeye	Director Research, Environmental Planning and Development, Rwanda Environment Management Authority
	Pearl Nkusi	Intern Supervisor, Rwanda Environment Management Authority
	Pierre C. Sibiry Traore	MANOBI-Senegal
	Ndungu Steven	ICRISAT-Mali
Donors	Ann Weston	Senior Program Specialist, Education and Science IDRC
	Mano Buckshi	Grant Administrator IDRC
	Michele Leone	IDRC regional office Dakar
	Harriet Roos	GAC

## Interviews Planned

Group	Interviewees	Role / Organisation
AIMS Research Staff	Dr. Rosita Endah Yocgo	Resident Researcher
Research institutes / partner universities covering climate change	Prof Emmanuel K. Essel	Ghana: Dean of School of Physical Sciences, University of Cape Coast



## Interviews Declined/Unreachable Interviewees

Group	Interviewees	Role / Organisation
AIMS Academic Directors	Dr. Simukai Utete	AIMS South Africa
AIMS NEF - Industry Initiative	S�raphine Kayitaramirwa	Project Coordinator
AIMS Lecturers	Dr. Bonfils Safari	
Research Master's in Climate Science Candidates	Annastazia Hema	
MS4CR Interns	Claudine KAZARHO	AIMS Rwanda
Hosts and employers of AIMS MS4CR Interns and Graduates	Gaetan Sakindi	Rwanda Energy Group
	Dr. Desire Kagabo	Research Scientist, International Centre for Tropical Agriculture, Rwanda
Government	Prof. Wilfred Gabsa	Cameroon: Secretary General, Ministry of Higher Education
	Dr Daniel Adams	South Africa: Chief Director for Basic Sciences and Infrastructure, Department of Science and Innovation
	Ama Serwaa Nerquaye-Tetteh	Ghana: Secretary General, National Commission for UNESCO
	Dr Fabien HABIMANA	Rwanda: Ministry of Education
Research institutes/partner universities covering climate change	Prof. Horace Ngomo Manga	Cameroon: Vice-chancellor of University of Buea
	Prof. Louse Warnich	South Africa: Dean of Science, Stellenbosch University
	Dr Denis Ndanguza	Rwanda: Dean of School of Science, College of Science and Technology, University of Rwanda



## Appendix D Bibliometric analysis

We received a list of 58 peer-reviewed publications. We identified 3 duplicates that we deleted. The final list therefore shows 55 publications. From this final list, we found 32 publications referenced in SCOPUS, that were considered for the bibliometric analysis. The synthesis of key bibliometric indicators is summarised in the table below.

*Table 2 Peer reviewed publications – key bibliometric indicators*

Name	Title of Publication	Year of publication	DOI	Document type	Source type	Citations	Citation benchmarking	Field - Weighted Citation Impact	h-index Scientist
Nana Ama Browne Klutse	Projected Change in Temperature and Precipitation over Africa from CMIP6.	2020	10.1007/S41748-020-00161-X	Article	Journal	32	99th percentile	12.47	8
Dr Daniel Akinyele	Evaluation of Solar PV Microgrid Deployment Sustainability in Rural Areas: A fuzzy STEEP Approach	2019	10.1109/POWERAFRICA.2019.8928904	Conference Paper	Conference Proceedings	8	98th percentile	6.72	17
Jessica N. P. Thorn	Catalyzing transformations to sustainability in mountain social-ecological systems	2019	10.1029/2018EF001024	Article	Journal	25	95th percentile	4.12	7



Dr Dube Timothy	Remote Sensing of Invasive Lantana camara (Verbenaceae) in Semiarid Savanna Rangeland Ecosystems of South Africa.	2020	10.1016/J.RAMA.2020.01.003	Article	Journal	6	93th percentile	3.5	21
Guy - Alain Lusilao-Zodi	A wireless sensor network for rainfall monitoring, using cellular network: A case for namibia	2017	10.1109/GWS.2017.8300469	Conference Paper	Conference Proceedings	7	93th percentile	3.27	3
Dr Ayansina Ayanlade	Communicating Climate Change Impacts as Manifested in Extreme Weather: A Case of Newspapers' Reports in Nigeria.	2020	10.1007/978-3-030-36875-3_20	Book Chapter	Book Series	2	87th percentile	2.07	11
Justin B. Munyakazi	Assessing the role of climate factors on malaria transmission dynamics in South Sudan	2019	10.1016/J.MBS.2019.01.002	Article	Journal	9	86th percentile	1.98	7
Getachew Mehabie Mulualem	Saprio-temporal Assessment of drought in Ethiopia and the impact of recent intense droughts	2019	10.3390/RS11151828	Article	Journal	13	86th percentile	1.87	2
Nana Ama Browne Klutse	Recent Trends in the Daily Rainfall Regime in Southern West Africa	2019	10.3390/ATMOS10120741	Article	Journal	8	83th percentile	1.76	8
Nana Ama Browne Klutse	Projected temperature increases over northern Ghana	2020	10.1007/S42452-020-3095-3	Article	Journal	4	82th percentile	1.6	8
Andree Nenkam	Assessment of the use of Participatory Integrated Climate Services for Agriculture (PICSA) approach by farmers to manage climate risk in Mali and Senegal	2018	10.1016/J.CLISER.2018.07.003	Article	Journal	18	80th percentile	1.41	1
Francis Torgbor	An investigation of the effects of PICSA on smallholder farmers' decision-making and livelihoods when implemented at large scale – The case of Northern Ghana	2019	10.1016/J.CLISER.2019.02.002	Article	Journal	10	79th percentile	1.44	1
Nana Ama Browne Klutse	Identification of Potential Drought Areas in West Africa Under Climate Change and Variability	2019	10.1007/S41748-019-00133-W	Review	Journal	8	66th percentile	0.86	8



Dr. Daniel Akinyele	Possibility of solar thermal power generation technologies in Nigeria: Challenges and policy directions (In June 2019):	2019	10.1016/J.REF.2019.02.002	Article	Journal	9	64th percentile	0.8	17
Marc Niyongendako	Solar Irradiance and Temperature Variability and Projected Trends Analysis in Burundi	2019	10.3390/CLI7060083	Article	Journal	5	62th percentile	0.75	1
Dr. Ayansina Ayanlade	Early warning climate indices for malaria and meningitis in tropical ecological zones,	2020	10.1038/S41598-020-71094-8	Article	Journal	2	60th percentile	0	11
Dzupire Nelson Christopher	A Copula based Bi-variate Model for Temperature and Rainfall Processes	2020	10.1016/J.SCIAF.2020.E00365	Article	Journal	2	60th percentile	0.45	2
Hackman Kwame Oppong	Exploring the temporal density of Landsat observations for cropland mapping: experiments from Egypt, Ethiopia, and South Africa	2018	10.1080/01431161.2018.1468115	Article	Journal	6	59th percentile	0.66	6
Athiah Winifred Ayinpogbilla	Trends and interannual variability of extreme rainfall indices over Ghana, West Africa	2020	10.1007/S00704-020-03114-6	Article	Journal	1	55th percentile	0.37	4
Dzupire Nelson Christopher	A poisson-gamma model for zero inflated rainfall data	2018	10.1155/2018/1012647	Article	Journal	3	54th percentile	0.54	2
Manalebish Debalike Asfaw	Co-existence thresholds in the dynamics of the plant–herbivore interaction with Allee effect and harvest	2018	10.1142/S1793524518500572	Article	Journal	3	50th percentile	0.46	2
Dr Daniel Akinyele	Optimal planning and electricity sharing strategy of hybrid energy system for remote communities in Nigeria,	2020	10.1016/J.SCIAF.2020.E00589	Article	Journal	0	49th percentile	0	17
Dr. Ayansina Ayanlade	Malaria and meningitis under climate change: initial assessment of climate information service in Nigeria	2020	10.1002/MET.1953	Article	Journal	0	49th percentile	0	11



Jessica N. P. Thorn	Indigenous and scientific knowledge of soil regulation services, and factors effecting decision-making in the Terai Plains of Nepal	2020	10.1007/978-3-030-51051-0_3	Conference Paper	Book Series	0	49th percentile	0	7
Chama Abdoukadi	Responses of humpback whales to a changing climate in the Southern Hemisphere: Priorities for research efforts	2020	10.1111/MAEC.12616	Article	Journal	0	49th percentile	0	4
Francis Torgbor	Envisioning Change in the Statistics-Education Climate.	2020	N/A	Article	Journal	0	49th percentile	0	1
Francis Torgbor	The spatial correlation structure of rainfall at the local scale over southern Ghana	2020	10.1016/J.EJRH.2020.100720	Article	Journal	0	49th percentile	0	1
Bright Silas Edem Aboh	Satellite imagery analysis for Land Use, Land Use Change and Forestry: A pilot study in Kigali, Rwanda	2020	10.1145/3378393.3402268	Conference Paper	Conference Proceedings	0	49th percentile	0	0
Manalebish Debalike Asfaw	Effects of temperature and rainfall in plant–herbivore interactions at different altitude	2019	10.1016/J.ECOLMOD.EL.2019.05.011	Article	Journal	2	40th percentile	0.23	2
Manalebish Debalike Asfaw	Effects of temperature and rainfall in plant+//0A4v/9AID//QCT-herbivore interactions at different altitude	2019	10.1016/J.ECOLMOD.EL.2019.05.011	Article	Journal	2	40th percentile	0.23	2
Fadoua el moustaid	A Mathematical Modeling Approach to The Cort-Fitness Hypothesis	2019	10.1093/iob/obz019	Article	Journal	0	33th percentile	0	4
Manalebish Debalike Asfaw	Stochastic plant–herbivore interaction model with Allee effect	2019	10.1007/S00285-019-01425-5	Article	Journal	0	33th percentile	0	2



Source: SCOPUS, Technopolis (retrieved July 5<sup>th</sup> 2021)

Table 2 Top 25 Researchers publishing in topic related to climate in Africa from 2017-2021

Researcher	Number of publications	Researcher	Number of publications
1. Mabhaudhi, T.	35	2. Vicente-Serrano, S.M.	24
3. Simane, B.	34	4. Vincent, K.	24
5. Dougill, A.J.	32	6. Vondou, D.A.	24
7. Fitchett, J.M.	31	8. McKechnie, A.E.	23
9. Abiodun, B.J	30	10. Modi, A.T.	23
11. Wright, C.Y.	29	12. Mutanga, O.	23
13. Merbold, L.	28	14. Ongoma, V.	23
15. Nhamo, G.	28	16. Ouazar, D.	23
17. Shahid, S.	28	18. Sylla, M.B. <sup>32</sup>	23
19. Dube, T. <sup>33</sup>	26	20. Butterbach-Bahl, K.	22
21. Lwasa, S.	26	22. Domínguez-Castro, F.	22
23. Malhi, Y.	26	24. Emetere, M.E.	25
25. Zougmore, R.B.	25		

Source: SCOPUS, treated by Technopolis (retrieved 6<sup>th</sup> July 2021)

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<sup>32</sup> Climate Science Research Chair

<sup>33</sup> Small research grantee.



## Appendix E Peer review analysis

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The Climate Science Curriculum was sent to six renowned professors in Climate Science/Climate science education. Three answers were received, of which two were rather elaborate (and the other one was stating the lack of attention for climate mitigation and adaptation, the expertise of the professor involved).

### Absence of Resilience in the Specification

The programme, especially as it relates to physical climate science, is very comprehensive — a real climate science curriculum. However, it can be asked: What are the critical elements of climate science that a mathematician needs to know to make the connection with climate scientists?

It would be good to have more explicit mention of how the mathematical sciences can make a contribution to, not just to the assessment of, but to the building of climate resilience. Resilience is signalled in the programmes title but absent throughout the specification.

The specification talks about data collection, analysis and modelling techniques and how this can assist prediction of climate change and determine impacts in Africa. The resilience component is not defined, explained or reflected in the outline of the course. Integrating a resilience component (including mitigation and adaptation) to the existing outline will give a competitive edge to the course and build capabilities amongst the students that will increase their employability prospects.

### Competences and Capabilities listed

There is no question that mathematics (and the physics that it describes) is the basis for the flavour of climate science that leads to being able to make predictions and projections. The most basic elements that every such climate scientist has to have a sense for are the differential equations that (describe the laws of physics that) climate models are based on, and the statistical methods that are used, for example, to compare observations and model simulations. Making the offering around Machine Learning/Artificial Intelligence explicit would be timely, given the current interest and increasing application of these techniques to modelling and analysis in climate science

Missing from the comprehensive list of scientifically based competences are skills and capabilities associated with informing policy contexts be they national, regional or international. If the students are to aspire to be more than data collection and processing professionals they need to develop the competencies to inform policy as well as make recommendations to relevant bodies not just generate academic papers or communicate effectively to their scientific peers.

The course needs to integrate opportunities where government and intergovernmental policy makers as well as international NGOs speak about what they need from climate scientist professionals. Experiences to undertake internships or specific assignments that mirror real life tasks in these contexts are needed.

Equally participation in regional climate forums (non-scientific or mathematical) is important so that they understand the language, needs and concerns of those with a non-scientific background engaged in this agenda.

Following on from this the ability to work in interdisciplinary teams is critical. This means lining up with other MA students not undertaking a mathematical or science degree and engaging in



an assignment that will not result in an academic paper but in expert advice or recommendations to stakeholders involved in climate governance. The latter will help not only implement their learnings associated with this component of the course but also help them understand the realities of policy and change making as well as the complexity of making tangible recommendations in order to inform these processes.

Attaining the above requires setting assignments and criteria for assessment that recognizes application of expert knowledge and abilities to engage in, and inform, real life situations in the non-academic world. Pedagogical approaches and assignments should be set so that students can investigate these areas themselves and present their learnings and positions in a reflective diary or perhaps a presentation or videoclip. The latter should be assessed by non-mathematical or climate science experts who prioritise other capabilities.

Academic mobility or internships could also assist with the further development of these skills. The programme is mostly silent on the pedagogical approaches to the adopted which have a significant influence on how the depth of the learning and competences acquired by the students.

### Being an Effective Climate Scientist

Following on from what has been said previously, it is important the course offers students the opportunity to learn about the geopolitics of climate science; the economics of climate change and the ethical considerations in climate science. These shape and influence climate science decisions and are also important when seeking funds for climate science. Graduates of the programme will be engaged in seeking funding and reporting progress to donors and agencies. The course should also prepare them for these responsibilities.

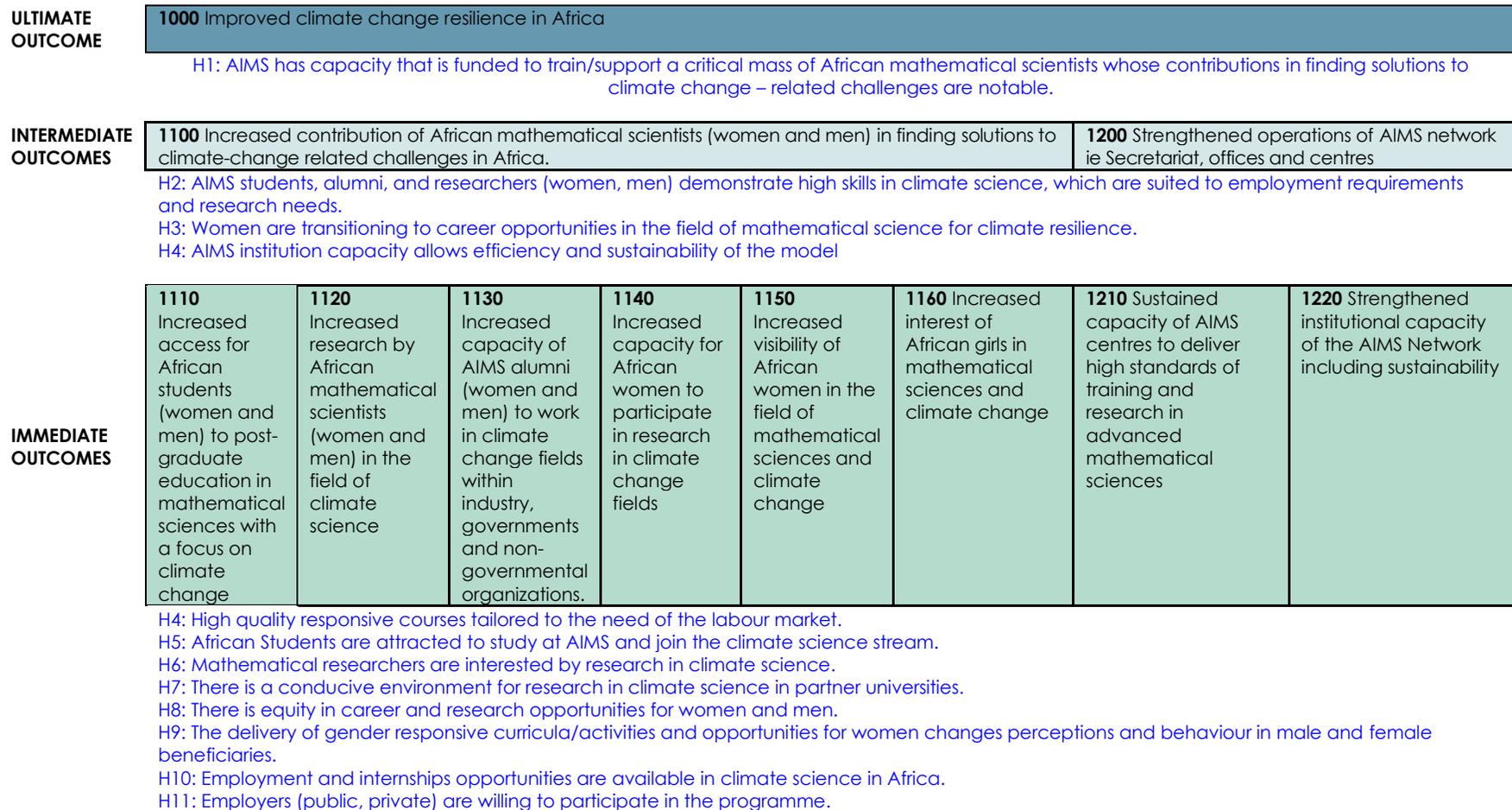
### Programme Board

Highly recommended is the constitution of a programme board which will include not only academic experts in the field of climate science but also government agencies across Africa that employ or call upon climate scientists in policy making. Equally, key individuals from regional and international NGOs and intergovernmental agencies that are monitoring targets and progress in this area as well as educators with a specialisation in sustainable development in higher education. The latter are important in ensuring the programme not prepares students to contribute the science of climate change but also the communication and application of the science in key decision-making forums. The development of key competences in communication and stakeholder engagement are essential to the effectiveness of professionals in this area.



## Appendix F MS4CR Theory of change

Figure 9 Theory of Change MS4CR Programme





H12: Stakeholders are committed and engaged to support the evolution of the MS4CR Programme.

H13: Staff are well equipped to support the delivery of the programme.

H14: Well-functioning systems and operations at AIMS.

**OUTPUTS**

<p><b>1111 A</b> Climate Science Stream at AIMS Rwanda, AIMS Senegal, AIMS Cameroon, and AIMS Ghana are created</p> <p><b>1112 A</b> climate science course option is offered at AIMS Ghana and AIMS Cameroun</p>	<p><b>1121 AIMS</b> Research Chair and Resident Researchers in Climate Science (CS) program is created</p> <p><b>1122 AIMS</b> Research Scholarships in climate science is created for Master's, PhD and Post-doc students working under the AIMS Research Chair in CS</p> <p><b>1123</b> The Next Einstein Forum promotes climate change research (by women and men)</p> <p><b>1124</b> Small research grants</p>	<p><b>1131 A</b> successful internship program is created to secure placements for AIMS alumni (women and men) in industry, governments and non-governmental organizations in the field of climate change</p>	<p><b>1141 A</b> climate science fellowship program for women is created</p> <p><b>1142</b> Mobility grants are provided to women researchers to facilitate participation in climate science-related opportunities</p>	<p><b>1151</b> Publications to profile leading African women climate scientists are produced</p> <p><b>1152 AIMS</b> Women in Science (AIMSWIS) Climate Change Speaker Series is created</p> <p><b>1153</b> Gender Summit-Africa is delivered</p>	<p><b>1161</b> Girls are targeted and encouraged to pursue further studies in mathematical sciences and climate change</p>	<p><b>1211</b> African graduate students (women and men) are trained in advanced mathematical sciences at the post-graduate level.</p>	<p><b>1221</b> Key internal systems (including finance, human resources, communications, fundraising, IT, gender equality, M&amp;E and procurement) are "in place"<sup>34</sup></p> <p><b>1222</b> Additional program staff are hired to support AIMS Network</p> <p>Additional (consultant proposal): Governance, business model and consolidation is adapted</p>
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<sup>34</sup> Original: "strengthened"; phrased by the consultant as an output



	program in CS is created							
<b>ACTIVITIES</b>	<p><b>1111.1</b> Design the curriculum for the Climate Science Stream at AIMS-Rwanda, Senegal, Ghana, and Cameroon</p> <p><b>1111.2</b> Recruit lecturers with expertise in climate change</p> <p><b>1111.3</b> Recruit students into climate science stream</p> <p><b>1112.1</b> Recruit lecturers to offer climate science course options at AIMS Ghana and Cameroon</p>	<p><b>1121.1</b> Launch call to recruit Research Chair and Resident Researchers in CS</p> <p><b>1121.2</b> Recruit Research Chair and Resident Researchers in CS</p> <p><b>1122.1</b> Launch calls to provide AIMS Research Scholarships in climate science to Master's, PhD and Post-doc students (women and men) working under the AIMS Research Chair in CS</p> <p><b>1123.1</b> Identify and connect with existing communities of practice on CS</p>	<p><b>1131.1</b> Develop partnerships with industry, government and non-governmental organizations in the field of climate change</p> <p><b>1131.2</b> Train AIMS students in transferable skills for the workplace prior to their internship placements</p> <p><b>1131.3</b> Follow up with interns and host organizations during and after internships to gather feedback on the strengths and weakness of the placement in order to further improve the internship</p>	<p><b>1141.1</b> Design climate science fellowship program for women</p> <p><b>1141.2</b> Launch call for applications to select climate science fellows</p> <p><b>1142.1</b> Identify early-career women scientists requiring mobility grants to facilitate participation in climate science-related opportunities</p>	<p><b>1151.1</b> Identify leading African women climate scientists within the AIMS network to profile</p> <p><b>1151.2</b> Launch a call to identify leading African women climate scientists outside of the AIMS network to profile</p> <p><b>1152.1</b> Design AIMS Women in Science (AIMSWIS) Climate Change Speaker series</p> <p><b>1152.2</b> Recruit experts to deliver Speaker series</p> <p><b>1153.1</b> Design Gender Summit-Africa</p>	<p><b>1161.1</b> Organize public outreach events aimed to inspire girls and boys to pursue further studies in mathematical sciences and climate change</p>	<p><b>1211.1</b> Recruit African graduate students (women and men) to AIMS centres</p> <p><b>1211.2</b> Provide students with AIMS bursaries towards the study of mathematical sciences</p>	<p><b>1231.1</b> Review and update AIMS key internal systems</p> <p><b>1231.2</b> Clarify roles and responsibilities of AIMS departments and staff</p> <p><b>1231.3</b> Train AIMS staff on internal policies and procedures</p> <p><b>1231.4</b> Network consolidation (advancement, communication, governance, capital assets)</p> <p><b>1231.5</b> Peer review of AIMS centres</p> <p><b>1232.1</b> Recruit MS4CR program manager</p> <p><b>1232.2</b> Consolidate Secretariat staff</p>



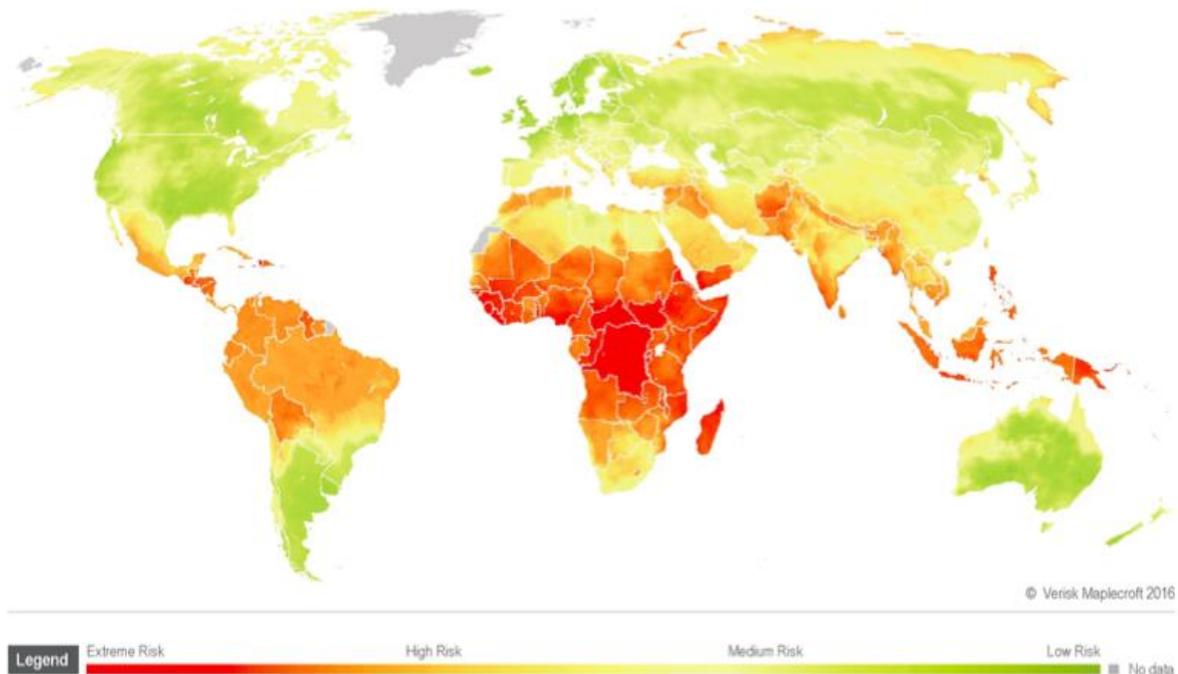
	<p><b>1123.2</b> Launch calls to recruit NEF fellows in climate science (for women and men)</p> <p><b>1123.3</b> Recruit NEF Fellows in CS</p> <p><b>1123.4</b> Organize panel in fields related to climate science at NEF Global Gathering</p> <p><b>1123.5</b> Reach-out to expert to organize pre-events in fields related to climate science at NEF Global Gathering</p> <p><b>1124.1</b> Launch call for small research grants in CS (women and men)</p>	program going forward					
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Source: MS4CR Programme Logic Model, AIMS (April 2020), Adapted by Technopolis (February 2021)

## Appendix G: The burden of Climate Change in Africa

**Africa is one of the most vulnerable<sup>35</sup> continents** to the impacts of climate change, including climate variability and extremes<sup>36</sup>. Climate impacts in the form of increasing temperatures, rising sea levels, changing precipitation patterns and more frequent extreme weather events such as droughts and floods will increasingly threaten Africans' livelihoods and security. These impacts are likely to be felt in the form of water crises, food insecurity, infectious diseases, and direct loss of human lives<sup>37</sup>. Sea-level rise will endanger coastal cities, particularly those close to important river deltas such as the Niger and Nile Delta regions. Agriculture is extremely sensitive to changes in temperatures and rainfall, and these changes will impact food security and access to food on the continent. Climate-sensitive diseases including malaria and cholera are also projected to spread to regions where they are not currently present as a result of warming temperatures.

Figure 10 Global climate change vulnerability index



Source: Verisk Maplecroft, 2016.

Across the continent, there is a strong economic dependence on climate-related activities, resulting in a heightened vulnerability of important economic sectors and substantial economic impacts on the line. This climate vulnerability is aggravated by other compounding developmental factors, such as weak economies and institutions, complex and poorly developed governance structures, limited access to capital, and endemic poverty. These

<sup>35</sup> Vulnerability is defined as the "the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes" (IPCC, 2001. Third Assessment Report).

<sup>36</sup> IPCC, 2014. Fifth Assessment Report.

<sup>37</sup> State of the Climate in Africa, World Meteorological Organisation, WMO No 1253, 2019

factors combined have in turn weakened Africa's adaptive capacity and resilience in the face of projected climate impacts.

The African Union's (AU) African Climate Change strategy confirms that Africa “will bear the greatest brunt and suffer the worst devastating effects” of climate change. Forecasts from climate modelling indicate that Africa is the most vulnerable region for the impacts of climate change under all climate scenarios for average global warming above 1.5 degrees Celsius.<sup>38</sup> According to the AU, the expected impacts of climate change in Africa include the following:

	<p><b>Agriculture and food security:</b> Prolonged droughts, flooding and loss of arable land due to desertification and soil erosion are reducing agricultural yields and causing crop failure and loss of livestock, endangering rural and pastoralist populations, as well as urban food security.</p>
	<p><b>Health:</b> Climate change induced natural disasters and scarcity in safe drinking water due to droughts leading to spread of communicable diseases in Africa, exacerbated by poor sanitation.</p>
	<p><b>Forced migration:</b> Droughts and floods have led to forced/induced displacements in many parts of Africa. Extreme weather conditions and shifts in climate and degradation of ecosystems threaten livelihoods and erode human security, causing forced migration and population displacement. It can then also threaten political and economic security and lead to conflicts as people struggle for access to basic resources.</p>
	<p><b>Energy:</b> Extreme weather events damage energy infrastructure, such as hydropower generation and electricity transmission. Climate change exacerbates deforestation, which in turn contributes further to GHG emissions.</p>

Source: Treated by Technopolis Group, 2020

Whilst knowledge of African climate trends and vulnerability has increased over the past decade, there is still a blind spot in terms of data, particularly when compared to data available in Europe and North America. This lack of climate data and scientific studies on the subject means that there is a large degree of uncertainty regarding projected climate impacts in Africa, particularly when predicting impacts in a country, sub-region or at the local level<sup>39</sup>. In turn, this uncertainty constrains governments' decision-making to reduce vulnerability, build resilience, and plan and implement adaptation strategies.

**This information gap** has led to a widening dichotomy between climate impacts that are experienced on the ground in Africa and climate impacts that are recorded and published in scientific literature. Major reports such as the Intergovernmental Panel on Climate Change (IPCC) assessments, for example, present more information regarding impacts in developed countries than for less-developed countries.

**This problematic lack of research** can be attributed to several causes, some of which are structural or historical in nature. Climate data is based on long-term observations of weather patterns, where there is a relative lack of long-term climate observation infrastructure in Africa<sup>40</sup>. This factor is compounded by a lack of funding, capacity, technology, and human resources for African scientists and researchers to undertake and monitor front-line research and publish their findings. African researchers are generally excluded from access to critical

<sup>38</sup> <https://www.afdb.org/en/cop25/climate-change-africa>

<sup>39</sup> The Science of Climate Change in Africa: Impacts and Adaptation, Gordon Conawy,

<sup>40</sup> IPCC, 2014.



data recorded by national meteorological institutions because of the high costs involved, which hinders their ability to research climate impacts<sup>41</sup>.

**In general, African governments do not invest substantially in research, meaning that most research is either donor-driven** or conducted by external consultants<sup>42</sup>. Because of this, research is rarely mainstreamed into national development policy or based on national priorities, as it more likely would be if it were undertaken by national researchers. Consequently, African theories, perspectives and experiences are inadequately represented in climate research on the continent.

#### *African policies on Climate Change*

African leaders are faced with the challenge of developing and implementing both climate-smart and climate-resilient development strategies. These strategies need to address the implications of ongoing and anticipated changes in climate while also shifting to cleaner energy sources and avoid locking-in to the technologies of yesterday. In this regard, the AU has put forth the African Climate Change Strategy to provide regional economic communities, member countries and other stakeholders with strategic guidance to address climate change challenges. The African Development Bank (AfDB) has developed a Pilot Program for Climate Resilience (PPCR) to demonstrate ways in which developing countries can make climate risk and resilience a part of their core development planning, while building on the National Adaptation Programs of Action<sup>43</sup>.

**A major component of African strategies to address climate change involves research, innovation and new technologies.** The African Union and the European Union set out a roadmap for a Research & Innovation Partnership on Climate Change and Sustainable Energy in 2017. The UNFCCC and, in particular, the Green Climate Fund provide a mechanism by which African countries can gain facilitated access to technologies developed elsewhere. At the same time, regional and local technological development is necessary, **together with associated skills development.** Based on the African Union climate strategy, technology transfer has been stressed on both adaptation (with technologies related to dealing with impacts of desertification, drought-resistant crop varieties and early-warning systems) and mitigation aspects (technologies related to low-carbon sustainable development)<sup>44</sup>.

**At the national level, many African countries have also been driving diverse policies to enhance adaptation and mitigation, as well as build up capacities internally to solve the challenges faced.** Some of such strategies include: National Plan of Adaptations to Climate Change of Togo; National Policy on Climate Change for Namibia; National Adaptation Strategy and Plan of Action of Climate Change for Nigeria; Mauritania's National Adaptation Programme of Action to Climate Change (NAPA); Rwanda Green Growth and Climate Resilience-National strategy for climate change and low carbon development; Guinea-Bissau National programme of action of adaptation to climate changes; Benin's Low carbon and climate change resilient development strategy 2016–2025.

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<sup>41</sup> Nordling, L. 2019. "Scientists Struggle to Access Africa's Historical Climate Data," *Nature*, 574: 605-606.

<sup>42</sup> United Nations University. Research Uptake: Strengthening Climate Change Research in Africa. <https://www.wider.unu.edu/research-uptake/strengthening-climate-change-research-africa>

<sup>43</sup> <https://www.afdb.org/en/topics-and-sectors/initiatives-partnerships/climate-investment-funds-cif/strategic-climate-fund/pilot-program-for-climate-resilience-ppcr>

<sup>44</sup> African Strategy on Climate Change, African Union, May 2014

*Mathematical sciences and Climate Change*

**Responses to mitigation and adaptation challenges must be based on the best available scientific knowledge<sup>45</sup>** and much of this knowledge and potential lies in the field of science, technology, engineering and mathematics (STEM). There are two relevant dimensions. First, predicting and understanding the impacts of climate change involves the use of sophisticated, quantitative mathematic models of chemical, physical and biological processes, including the integrated assessment models used for IPCC reports. Indeed, sufficient expertise in this area is required in order to participate on an equal basis in international negotiations (e.g. UNFCCC). Furthermore, it is important to ensure that such modelling efforts reflect sufficient and proportionate attention to the African region, in terms of the robustness of data and mechanisms modelled and geographical granularity. Second, STEM disciplines provide the foundation for pursuing resilient, climate-smart technological opportunities. Thus, investments in both research and education specifically relevant for climate change are needed.

Climate change provides mathematical scientists with a broad range of challenging research problems whose solutions could have a large societal impact<sup>46</sup>. The figure below shows some of the dimensions in which mathematics for climate science can be engaged.



The United Nations Economic Commission for Africa (ECA) has recommended investing in a network for **Centres of Excellence in Science and Technology in the continent that can build a workforce to provide innovative solutions to climate change through research and development.**

Accordingly, research centres and education centres of excellence have recently been established specialising on climate change, including but not limited to: the African Centre of Excellence for Climate Smart Agriculture and Biodiversity Conservation (ACESABC); the ARUA Centre of Excellence in Climate and Development (ARUA-CD); the African Climate and Development Initiative (ACDI) at the University of Cape Town; the Institute for Climate Change

<sup>45</sup> As recognised for example the jointly funded AU-EU Research & Innovation Partnership on Climate Change and Sustainable Energy (CCSE).

<sup>46</sup> Mathematics of Climate change A new discipline for uncertain century, Dana Mackenzie MSRI, 2007



Adaptation (ICCA) at the University of Nairobi; The Institute for Environment and Sanitation Studies at the University of Ghana, etc.

In parallel, the ECA established the Climate Research for Development in Africa (CR4D) initiative, to create “a multi-institutional and multi-stakeholder collaborative platform that mobilizes expertise and resources to facilitate use-inspired climate science research that informs climate change policy and sustainable development planning in Africa”<sup>47</sup>. The intention is to develop Regional Climate Research Partnerships that involve diverse expertise from the natural, biophysical and social sciences to design research that translates into appropriate and actionable information for policy and sustainable development planning.

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<sup>47</sup> <https://www.uneca.org/cr4d>



## Appendix H Outputs from MS4CR – December 2020

Table 3 Achievement of the Master's level training Programme - Outputs

Activity	Baseline	Initial targets <sup>48</sup>	Revised targets <sup>49</sup>	Current status (Dec.2020) <sup>50</sup>	Achievement rate <sup>51,52</sup>	Gender ratio <sup>53</sup>
Climate Science Stream (number of offerings)	0	<ul style="list-style-type: none"> <li>3 (AIMS Rwanda)</li> <li>3 (AIMS Tanzania)</li> </ul>	<ul style="list-style-type: none"> <li>4 (AIMS Rwanda)</li> <li>2 (AIMS Cameroon)</li> <li>2 (AIMS Ghana)</li> <li>2 (AIMS Senegal)</li> </ul>	<ul style="list-style-type: none"> <li>2 (AIMS Rwanda)</li> </ul>	20%	
Climate Science Stream (graduates)	0	<ul style="list-style-type: none"> <li>88 graduates (34% F)</li> </ul>	<ul style="list-style-type: none"> <li>174 graduates (30% F)</li> </ul>	<ul style="list-style-type: none"> <li>54 (38M, 16F)</li> </ul>	31%	50%
Climate Science course options (offerings)ie electives?	0	<ul style="list-style-type: none"> <li>5 centres (AIMS Cameroon, AIMS Ghana, AIMS Senegal, AIMS South Africa, new centre in francophone country)</li> </ul>	<ul style="list-style-type: none"> <li>2 centres (AIMS Cameroon, AIMS Ghana)</li> </ul>	<ul style="list-style-type: none"> <li>2</li> </ul>	100%	
Climate Science course options (graduates)	0	<ul style="list-style-type: none"> <li>105 graduates</li> </ul>	<ul style="list-style-type: none"> <li>20 (10 per centre)</li> </ul>	<ul style="list-style-type: none"> <li>61 (41M, 20F)</li> </ul>	305%	33%

Source AIMS MS4CR Performance Management Framework (Dec. 2020) and 7<sup>th</sup> Technical report

<sup>48</sup> From implementation plan, June 2017

<sup>49</sup> From implementation plan, June 2017

<sup>50</sup> From Performance Measurement Framework, July 2021

<sup>51</sup> Key: Red – Achievement rate < 50%, Orange – Achievement rate > =50%, Green – Achievement rate >=100%.

<sup>52</sup> Achievement rate is calculated against revised target.

<sup>53</sup> Key: Red – Gender ratio < Target threshold (30%), Green – Gender ratio >= Target threshold (30%).



Table 4 Achievement of the Research Programme - Outputs

Activity	Baseline	Initial target <sup>54</sup>	Revised target <sup>55</sup>	Current status (Dec.2020)	Achievement rate <sup>56,57</sup>	Gender ratio <sup>58</sup>
Research scholarships	0	<ul style="list-style-type: none"> <li>Total: 50</li> </ul>	<ul style="list-style-type: none"> <li>Total: 45</li> </ul>	<ul style="list-style-type: none"> <li>Total: 30 (24M, 6F)</li> </ul>	66%	20%
Research masters	0	<ul style="list-style-type: none"> <li>20 Masters</li> </ul>	<ul style="list-style-type: none"> <li>Masters: 18</li> </ul>	<ul style="list-style-type: none"> <li>Masters: 11 (9M, 2F)</li> </ul>	61%	18%
PhD students	0	<ul style="list-style-type: none"> <li>14 PhDs</li> </ul>	<ul style="list-style-type: none"> <li>PhD: 13</li> </ul>	<ul style="list-style-type: none"> <li>PhD: 12 (9M, 3F)</li> </ul>	92%	25%
Post-Docs	0	<ul style="list-style-type: none"> <li>16 post-Docs</li> </ul>	<ul style="list-style-type: none"> <li>Post-doc: 14</li> </ul>	<ul style="list-style-type: none"> <li>Post-doc: 7 (6M, 1F)</li> </ul>	50%	14%
Research chairs	0	<ul style="list-style-type: none"> <li>3 chairs</li> </ul>	<ul style="list-style-type: none"> <li>1 Research Chair</li> <li>3 Resident Researchers</li> </ul>	<ul style="list-style-type: none"> <li>1 research chair</li> <li>3 resident researchers (1M, 2F)</li> </ul>	<ul style="list-style-type: none"> <li>100%</li> <li>100%</li> </ul>	66%
Small research grants	0	<ul style="list-style-type: none"> <li>16 grantees</li> </ul>	<ul style="list-style-type: none"> <li>4 calls for proposal (1 per year)</li> <li>16 grantees</li> </ul>	<ul style="list-style-type: none"> <li>2 calls launched</li> <li>10 (6M, 4F)</li> </ul>	<ul style="list-style-type: none"> <li>50%</li> <li>62%</li> </ul>	40%
Climate science Fellowship for women	0	<ul style="list-style-type: none"> <li>20 grantees</li> </ul>	<ul style="list-style-type: none"> <li>4 calls for proposal (1 per year)</li> </ul>	<ul style="list-style-type: none"> <li>3 calls launched</li> </ul>	<ul style="list-style-type: none"> <li>75%</li> </ul>	
			<ul style="list-style-type: none"> <li>20 fellows</li> </ul>	<ul style="list-style-type: none"> <li>6 fellows</li> </ul>	<ul style="list-style-type: none"> <li>30%</li> </ul>	
Mobility grants for women	0	<ul style="list-style-type: none"> <li>10 grants awarded</li> </ul>	<ul style="list-style-type: none"> <li>10 grants awarded</li> </ul>	<ul style="list-style-type: none"> <li>6 grants awarded</li> </ul>	60%	
NEF Fellows in field related to climate science (women and men)	0	<ul style="list-style-type: none"> <li>8 fellows</li> <li>10 panellists in NEF Global Gatherings</li> <li>40 participants</li> </ul>	<ul style="list-style-type: none"> <li>5 fellows supported</li> </ul>	<ul style="list-style-type: none"> <li>5 fellows</li> </ul>	<ul style="list-style-type: none"> <li>100%</li> </ul>	
			<ul style="list-style-type: none"> <li>10 panellists in NEF Global Gatherings</li> </ul>	<ul style="list-style-type: none"> <li>22 panellists in NEF Global Gatherings</li> </ul>	<ul style="list-style-type: none"> <li>220%</li> </ul>	

<sup>54</sup> From implementation plan, June 2017

<sup>55</sup> From Performance Measurement Framework, July 2021

<sup>56</sup> Key: Red – Achievement rate < 50%, Orange – Achievement rate > =50%, Green – Achievement rate >=100%.

<sup>57</sup> Achievement rate is calculated against revised target.

<sup>58</sup> Key: Red – Gender ratio < Target threshold (30%), Green – Gender ratio >= Target threshold (30%).

Activity	Baseline	Initial target <sup>54</sup>	Revised target <sup>55</sup>	Current status (Dec.2020)	Achievement rate <sup>56,57</sup>	Gender ratio <sup>58</sup>
		supported to attend pre-events				
	<ul style="list-style-type: none"> <li>40 participants supported to attend pre-events</li> </ul>		<ul style="list-style-type: none"> <li>22 participants supported to attend pre-events<sup>59</sup></li> </ul>	<ul style="list-style-type: none"> <li>55%</li> </ul>		
	<ul style="list-style-type: none"> <li>15 Alumni supported to attend NEF GG</li> </ul>		<ul style="list-style-type: none"> <li>14 Alumni supported to attend NEF GG</li> </ul>	<ul style="list-style-type: none"> <li>93%</li> </ul>		

Source AIMS MS4CR Performance Management Framework (Dec. 2020) and 7<sup>th</sup> Technical report

Table 5 Achievement of the WiCCs programme - Outputs

Activity	Baseline	Initial target <sup>60</sup>	Revised target <sup>61</sup>	Current status (Dec.2020)	Achievement rate <sup>62,63</sup>
Fellowship for women	0	<ul style="list-style-type: none"> <li>20 grantees</li> </ul>	<ul style="list-style-type: none"> <li>4 calls for proposal (1 per year)</li> </ul>	<ul style="list-style-type: none"> <li>3 calls launched</li> </ul>	<ul style="list-style-type: none"> <li>75%</li> </ul>
			<ul style="list-style-type: none"> <li>20 grantees</li> </ul>	<ul style="list-style-type: none"> <li>6 fellows</li> </ul>	<ul style="list-style-type: none"> <li>30%</li> </ul>
Mobility grants	0	<ul style="list-style-type: none"> <li>10 grants awarded</li> </ul>	<ul style="list-style-type: none"> <li>10 grants awarded</li> </ul>	<ul style="list-style-type: none"> <li>6 grants awarded</li> </ul>	<ul style="list-style-type: none"> <li>60%</li> </ul>
Publications profiling African women climate science scientists	0	<ul style="list-style-type: none"> <li>4 issues of the publication</li> </ul>	<ul style="list-style-type: none"> <li>4 issues of the publication</li> </ul>	<ul style="list-style-type: none"> <li>2 issues of the publication</li> </ul>	<ul style="list-style-type: none"> <li>50%</li> </ul>
			<ul style="list-style-type: none"> <li>60 women researchers profiled (15 per issue)</li> </ul>	<ul style="list-style-type: none"> <li>30 women researchers profiled</li> </ul>	<ul style="list-style-type: none"> <li>50%</li> </ul>
AIMS Women in Science Climate Change	0	<ul style="list-style-type: none"> <li>24 series organised</li> </ul>	<ul style="list-style-type: none"> <li>15 series organised (3 per centre)</li> </ul>	<ul style="list-style-type: none"> <li>2 series organised</li> </ul>	<ul style="list-style-type: none"> <li>13%</li> </ul>

<sup>59</sup> The exact number of NEF Fellows who featured in the virtual NEF GG, 2020, from 8-10 December 2020 not included because not yet available.

<sup>60</sup> From implementation plan, June 2017

<sup>61</sup> From PFM, February 2021

<sup>62</sup> Key: Key: Red – Achievement rate < 50%, Orange – Achievement rate > =50%, Green – Achievement rate >=100%.

<sup>63</sup> Achievement rate is calculated against revised target.



Activity	Baseline	Initial target <sup>60</sup>	Revised target <sup>61</sup>	Current status (Dec.2020)	Achievement rate <sup>62,63</sup>
Speaker Series (AIMSWIS)			<ul style="list-style-type: none"> <li>600 attendees (30 per event)</li> </ul>	<ul style="list-style-type: none"> <li>122 attendees (45F, 77M)</li> </ul>	<ul style="list-style-type: none"> <li>20%</li> </ul>
Gender summit	0		<ul style="list-style-type: none"> <li>2 Gender summits organised</li> </ul>	<ul style="list-style-type: none"> <li>2 Gender summits organised</li> </ul>	<ul style="list-style-type: none"> <li>100%</li> </ul>
			<ul style="list-style-type: none"> <li>750 women scientists attendees</li> </ul>	<ul style="list-style-type: none"> <li>276 women scientists attendees</li> </ul>	<ul style="list-style-type: none"> <li>37%</li> </ul>
Other outreach activities	0		<ul style="list-style-type: none"> <li>4 outreach activities</li> </ul>	<ul style="list-style-type: none"> <li>3 outreach activities organised</li> </ul>	<ul style="list-style-type: none"> <li>75%</li> </ul>

Source AIMS MS4CR Programme Management Framework (Dec. 2020) and 7<sup>th</sup> Technical report

Table 6 Achievement of the Master's level training Programme - Outputs

Activity	Baseline	Target <sup>64</sup>	Current status (Dec.2020)	Achievement rate <sup>65</sup>	Gender ratio <sup>66</sup>
Internships provided	0	<ul style="list-style-type: none"> <li>100 (30% F)</li> </ul>	<ul style="list-style-type: none"> <li>62 (38M, 24F)</li> </ul>	62%	39%
Organisations hosting interns	0	<ul style="list-style-type: none"> <li>15</li> </ul>	<ul style="list-style-type: none"> <li>7</li> </ul>	47%	
Internship partnerships formalised with organisations	0	<ul style="list-style-type: none"> <li>15</li> </ul>	<ul style="list-style-type: none"> <li>11</li> </ul>	73%	

Source AIMS MS4CR Performance Management Framework (Dec. 2020) and 7<sup>th</sup> Technical report

Table 7 Achievement of the Consolidation Programme - Outputs

Functions	Actions
<b>Governance</b>	<p><b>AIMS International Governing Board Charter</b> (operational principles) was approved by the Board in February 2021. The following changes have been introduced:</p> <ul style="list-style-type: none"> <li>Replace practice of silent approval with more practical and prudent approval practice</li> <li>Include calendar of board activities</li> <li>Make provision for annual general meeting</li> <li>Introduce annual evaluation of the board and its committees</li> <li>CEO expenses must be pre-approved by the Board or AFC and AFC must take a stock of CEO expenses on a quarterly basis</li> </ul>

<sup>64</sup> From Performance Measurement Framework, February 2021

<sup>65</sup> Key: Green- Above 100%, Orange – Above 50%, Red – Below 50%.

<sup>66</sup> Key: Green- Above 30%, Red – Below 30%.

	<ul style="list-style-type: none"> <li>- Appointments: CEO must be appointed by the Board; appointments of CFO, CSO, CAO and Centre Presidents must be pre-approved by the Board; and appointment of International Auditor must be done by a committee, including all members of the AFD</li> </ul> <p><b>Expansion of the AIMS International Governing Board</b>, making it more effective. A new Board member was added, Mr. Charles Boamah, Ex- senior Vice President and Chief Financial Officer of the African Development Bank. He is now the Chair of the re-established Audit and Finance Committee. Board is expected to add two more members towards the later part of 2021.</p> <p>AIMS started undertaking a profound <b>restructuring and reorganization process</b> to ensure more streamlined operations and increased efficiency and effectiveness, and contracted KPMG to conduct an internal audit to assess the existing structure, operations, and policies.</p> <p><b>Revised organisational structure of the Board</b>, to reduce PCEO span of control, align with strategy, and eliminate role ambiguity. All policy chapters were revised in February 2021 to include:</p> <ul style="list-style-type: none"> <li>- All requests initiated by CEO and all exceptions to the policy must be pre-approved by AFC</li> <li>- Delegation of authorities must be pre-approved</li> <li>- Reference to the position titles is changed, e.g., PCEO to CEO, VPO-CFO to CFO, etc.,</li> <li>- Non-compliance and repercussions are clearly defined in each policy chapter</li> </ul> <p><b>AIMS 2021-2026 Strategic Framework</b> designed early 2021.</p>
<p><b>Finance</b></p>	<p>A total of <b>11 new finance policies</b> were finalized and approved by the AIMS International Governing Board in July 2019. These are: Accounting and Financial Reporting; Financial Management and Authorization; Budget and Resources Allocation; Banking and Cash Management; Investment; Reserves; Borrowings; Audit and Compliance; Grants and Project Management; Information Technology; and Information and Records Management.</p> <p><b>ACCPAC</b> (financial system) was upgraded to support timely closure of books of accounts and to enable system-based reconciliation of inter-company accounts between the entities. The</p> <p>AIMS International Governing Board includes a schedule of activities to be undertaken by the <b>Audit and Finance Committee</b> of the Board.</p> <p><b>Financial reports vetting process</b> was put in place: the Chief Finance Officer now vets financial reports to donors before their submission. An online platform was created to help streamline centre-level planning and reporting.</p> <p><b>Financial statements</b> of all entities are regularly audited including the consolidated financial statements of the network.</p> <p>AIMS is in the process of <b>hiring an internal auditor</b> towards improving due diligence and offering financial oversight.</p> <p>A section was added on mapping Stellenbosch University Accounting coding structure with AIMS accounting structure</p>
<p><b>Human resources and hiring of program staff</b></p>	<p>December 2018, <b>a dedicated MS4CR programme Manager</b> was hired.</p> <p>In 2019, <b>a Director for Programme Delivery and Reporting</b> was hired.</p> <p>In the first half of 2020, AIMS laid off nine employees and dismissed four employees due to misconduct.</p> <p>In the second half of 2020, hiring took place for a: <b>Chief Academic Officer</b> of the AIMS Network; <b>Global Network &amp; Centre President</b>, AIMS Cameroon; <b>Chief Scientific Officer</b> for the AIMS Global Network, replacement of <b>AIMS Global Network CEO</b>; Secretariat based <b>Director of HR</b></p> <p>December 2020, Employee Handbook was converted into HR policy manual with specific policy chapters:</p> <ul style="list-style-type: none"> <li>- Recruitment, selection and staff on-boarding</li> <li>- Staff welfare and remuneration</li> <li>- Pay administration</li> <li>- Performance management</li> <li>- Training and development</li> </ul>

	<ul style="list-style-type: none"> <li>- Staff conduct</li> <li>- Organisational structure and reporting relationships</li> <li>- Working hours, and accountability hours worked</li> <li>- Compensation with equitable grading and salary structure</li> <li>- Organisational culture and audit</li> <li>- Code of conduct and professional Ethics</li> <li>- Conflict of interest</li> <li>- Disciplinary procedures</li> <li>- Termination of employment</li> </ul> <p><b>HR information system</b> launched April 2021.</p>
<b>Communication and IT</b>	<p>The <b>AIMS SharePoint platform</b> was established June 2020, providing an online collaborative platform for AIMS staff to share and manage information and knowledge. It is intended to promote collaboration across the network by sharing financial/procurement documents, policies/guidelines/procedures/templates, academic materials/reports etc.</p> <p>AIMS intend to hire a <b>software developer</b>, that will support the setup of the electronic climate science information service and facilitate converting research results into public goods.</p>
<b>Procurement</b>	<p>AIMS adopted a <b>new procurement manual</b>, setting out the procedures, processes and guidelines for the procurement of goods and services across the network, aiming at greater efficiency and effectiveness in service delivery. The following are enforced:</p> <ul style="list-style-type: none"> <li>- All purchases between USD 15,000 and USD 150,000 must be jointly approved by the CEO and CFO and verification by Internal Auditor</li> <li>- In case of higher value purchases, no formal or informal commitments should ever be made without the approval of the AFC</li> <li>- Legal review of contracts above USD 150 K</li> <li>- Internal Auditor must review all purchases above USD 150K before it is sent to AFC for approval</li> <li>- Provision for pre-qualification exercise to identify competent service provider</li> </ul> <p><b>Training on the new procurement process</b> was delivered on several occasions to staff.</p>
<b>Fundraising</b>	<p><b>Continuous engagement with Host country governments</b> was carried out to obtain their financial contributions as agreed in the country MoUs.</p> <p><b>Other options have been pursued</b> with Foundations, high-tech companies or social enterprises, and paid summer courses.</p> <p>A <b>High-Level Advisory Council (HiLAC)</b> was established at AIMS to help mobilise significant long-term funding for the network and a <b>Donor Committee</b> to provide a convening forum for AIMS' major donors.</p>
<b>Gender equality</b>	<p><b>AIMS Gender Equality &amp; Inclusion Policy and Strategy</b> was drafted and validated in 2020; AIMS is the process of appointing a gender officer responsible for mainstreaming gender across the network.</p> <p>The <b>position</b> will be placed under the CEO office according to the new organigram.</p>
<b>Operations and M&amp;E mechanisms</b>	<p>A <b>Risk Management Committee</b> was created and a <b>Risk Management Plan</b> was approved by the Board in July 2019. The Committee is mandated to develop a Corporate Risk Profile and a Risk Management Policy and Procedures. The Committee is also tasked with providing risk management training to AIMS employees. The Committee was expected to deliver on all aspects by June 2020;</p> <p>An <b>AIMS at a Glance</b> document was produced (organizational fact sheet for every AIMS entity) It includes an overview of all entities –budget, activities, list of employees, main cost elements, and status of regulatory compliances.</p> <p>The <b>AIMS Environmental Policy</b> was drafted by the Skills for Employability programme at AIMS Senegal, supported by Global Affairs Canada.</p> <p><b>Grants and project Management Policy and Procedures</b> have been enhanced:</p>



	<ul style="list-style-type: none"><li>- Donor financial reports must be approved by the Internal Auditor</li><li>- Include guidelines on reallocation of resources and all reallocation of resources must be pre-approved by the AFC, both in case of restricted and unrestricted grants</li><li>- For restricted Budgeted expenditures, AFC approval in advance must be obtained for over-expenditure</li><li>- Donor approval should be mandatory for expenditures beyond budget, in accordance with the grant conditions</li></ul> <p><b>Travel policy</b> was introduced:</p> <ul style="list-style-type: none"><li>- Emphasise that the travel should be the last option after exploring virtual means of meeting</li><li>- All employees, irrespective of their level, must submit back to office or trip report</li><li>- CEO travel must be preapproved by the AFC</li><li>- CEO travel expenses must be approved by the AFC</li><li>- CEO should not approve any exception to travel policy</li></ul> <p>The <b>M&amp;E component</b> will be placed under the CEO office according to the new organigram.</p>
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Source AIMS MS4CR 1<sup>st</sup> to 7<sup>th</sup> Technical reports (2017 – March 2021) and KPMG Review of AIMS policies and procedures – recommendations and Action Plan – Status Report Apr 30, 2021



## Appendix I: Portraits – Success stories

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### **Nana Ama Browne Klutse, AIMS MS4CR Women in Climate Science Fellow, AIMS Resident Researcher in Climate Science**

**Dr. Nana Ama Browne Klutse holds a PhD in Climatology from the University of Cape Town, South Africa. Her research focuses on climate modelling, climate impact assessments on society** (health, energy, and gender). She has worked on both national and international projects and consultancies including the climate and health project in Ghana and the ongoing global CORDEX experiment.

Following her PhD in the field of Climate Modelling, Dr. Klutse was looking to pursue a career in research. **She responded to the AIMS MS4CR Women Fellowship call attracted by the possibility to conduct her work in a convenient research environment** that offers adequate infrastructure (high performance computer, speed internet connectivity), data availability and networking/collaboration with reputed climate scientists.

During her Climate Change Science Fellowship, hosted at the Department of Environmental and Geographical Science at the University of Cape Town, South Africa, Dr. Klutse investigated the dynamics of extreme climate in Africa and the impact of extreme climate under global warming.

She has also co-authored a good number of journal article publications and academic books. **Dr. Klutse published in the high-impact journal** the Environmental Research Letters in May 2018 on Potential impact of 1.5°C and 2°C global warming on consecutive dry (CDD) and wet days (CWD) over West Africa. Her article revealed that enhanced warming results in a reduction in mean rainfall across the region. The article concludes that the difference in impacts between 1.5°C and 2°C warming on the projected changes imply that if we fail to meet the threshold of 1.5°C or 2°C, it will have an impact on consecutive dry and wet days over West Africa.

Following this fellowship, she returned to AIMS Ghana to teach and deliver seminars. She then applied to a resident research position with AIMS in 2020. **She is now working at AIMS, under the Climate Science research Chair.**

Her teachings at AIMS include the following topics: General Physics, Cloud Physics, Atmospheric Physics, Climate dynamics of Africa, Regional Climate modelling. She also supervises students' research in Ghana and abroad at Masters and PhD levels. She also serves as an external examiner for universities in Ghana.

**Dr. Klutse has received several awards** and was celebrated as a female icon on Intellectual Property Day 2018, a programme by the Registrar General's Department to honour successful women in Ghana.



**Timothy DUBE, AIMS MS4CR Small Research Grantee**

**Prof Timothy Dube is a rated researcher with an interest in GIS science and Earth Observation (EO) applications in environmental & water resources management.** His research is inclined towards the use of cutting-edge satellite data & mathematical modelling in tracking the impacts of climate change on water resources and the environment. Two of his recent projects are "The Global Monitoring for Environment and Security, an initiative of the European Union & the European Space Agency & African Union project focusing on water resource management in Southern Africa". He has been involved in intensive EO training and capacity building across different institutions of higher learning and research in Southern Africa.

Currently, he serves in the African Association of Remote Sensing of the Environment & WaterNet as a technical board member. His engagement with EO technology applications is not only restricted to research in Africa but also involves collaborations with various EO experts from European institutions, promoting EO knowledge and skills transfer to enhance policy formulation & decision making to promote Economic Development in the SADC & Africa.

Prof. Dube has participated in the TIGERBridge African Water and Climate Change Phase 1 Project, commissioned by the European Space Agency - Water for Agriculture (2016-2017) as the leading Principal Investigator for Africa. He is also the recipient of the UWC 2019 DVC Research and Innovation- Research and Recognition Award and received a grant from AIMS in Climate Change Science to carry out research on the Mediterranean's bounding desert-type biomes of the Greater Cape Floristic Region, a global hotspot of biodiversity.

**He was attracted to AIMS through their activities on social media** mainly their Twitter account when he found the opportunity for a research grant in 2018. He submitted a proposal to model the impact of climate change on water resources to address the water challenges in the Western Cape from 2017 to 2019. **His project thus aligned with the Ministry of water resources interest to shift to ground water in this context of water shortage.** Prof. Dube received a grant of USD 10,000, under the AIMS MS4CR Small research grant to carry out his research project from which he shared the findings with various Departments in the South Africa including the biodiversity Institutes. His research results were used by policy makers and contributed to the reflections to address water shortage in arid environments.

**Prof. Dube also used the MS4CR – funded project to involve his Masters students and therefore develop their capacities.** He exposed his students to modelling, making a huge difference in their training. Today one of them secured a research position in a private organisation thanks to his mastery of climate modelling.

Prof. Dube was recently appointed as a member of the South African Alien Species Risk Analysis Review Panel (ASRARP) – a subsidiary of the BioSecurity directorate of the Department of Environment, Fisheries and Forestry. (2020-2023). Also, in May 2020, he was appointed as one of the United Nations Global Risk Assessment Framework (GRAF) Vulnerability and Exposure Working Group Member working on a typology and classification of the drivers and indicators of exposure and vulnerability for understanding risk.



**Donatien Wilfried Kuissi Kamdem, AIMS Ghana Alumnus from 2016/2017, AIMS MS4CR PhD Scholarship recipient**

**Donatien Wilfried Kuissi Kamdem is an AIMS Ghana Alumnus** from 2016/2017. Wilfried completed his M.Phil in Mathematics at the University of Cape Coast, Ghana, and holds a Master in Mathematics and Economics and a B.Sc in Mathematics and Applications both from the University of Douala, Cameroon.

**Wilfried benefits from a PhD Research scholarship under the MS4CR programme.** He is being supervised by Prof. Olivier Menoukeu Pamen, German Research Chair in Mathematics and its application at AIMS Ghana and he is registered at the University of Rwanda. He has also benefited from several research visits at the Humboldt University Berlin through the support of the German Academic Exchange Service, DAAD.

**Wilfried credits AIMS in strengthening his mathematical and programming skills and raising its interest in statistics.** He also gained hands-on experience statistical and programming software (Python, R, etc.)

Today **Wilfried's broad research interests include stochastic optimal control, optimal stopping, mathematical finance, climate and green finance, and theoretical machine learning** (reinforcement learning). He uses his knowledge to work on a **fair price for climate insurances in Africa**. His goal is to design a strategy for countries to negotiate fair prices for farmers to include climate insurance in their framework. His research is not yet completed however the results will help solve a prominent problem in the agricultural sector by helping farmers limit their losses due to climate/environmental issues (droughts or floods).



## Emmanuel Beker Chinedze, AIMS Alumnus, AIMS MS4CR Internship Programme beneficiary

Emmanuel Beker Chinedze is from the village of the Western region of Cameroon called Baleng. He grew up in a family with limited financial resources. Growing up in a location without electricity, the conditions were scarce, but Emmanuel was able to attend school for the first time at the age of 6. Afterwards, Emmanuel then went on with his studies until 2015 when he graduated with a bachelor's degree in Mathematics and computer science, mathematics option followed with a Master's degree in fundamental mathematics.

Unfortunately, the lack of financial resources caused the cease of his academical curriculum forcing him to start looking for scholarship opportunities to pursue his studies. This is how Emmanuel came across AIMS and applied for a cooperative Master's in industrial mathematics at the AIMS Cameroon centre and received a full scholarship.

According to Emmanuel, his experience at AIMS gave sense to his career and life goals. **The programme allowed him to understand Mathematics not just as an accumulation of knowledge but as a set of tools to solve problems affecting his direct environment**, a catalyst for a better world.

He graduated with a cooperative master's degree in industrial mathematics on February 21, 2020 and was **selected for the MSC4R internship programme launched by AIMS**. His project was on AI reducing basis risk in smallholder crop index insurance at the ICRISAT / agCelerant-Senegal in Dakar. This working experience deepened Emmanuel's mathematical knowledge combining them with data analysis that he plans to use to empower industries growth.

**Today Emmanuel feels that the MS4CR internship programme built a strong foundation for him to be able to address challenging problems hands-on. He considers that AIMS was the first step helping him move from academia to the industry.** The internship helped him gain invaluable practical and problem-solving skills through the help of his mentors and peers in the programme. Emmanuel was able to find a focus in his career plans which he directed towards finance and entrepreneurship. Emmanuel was able to continue on with his studies and he is currently a 2021 BAUM TENPERS fellow (scholarship programme, located in the US), a predoctoral training for PhD in mathematical economy and finance in the world class universities in the domains.