



Climate & Development
Knowledge Network



Key messages

- Climate change research is multifaceted and scientists should engage with non-scientific communities to ensure the relevance and use of their research findings.
- This means climate change scientists must have a range of competencies, including competency in a specialised area as a base for their expertise, as well as interdisciplinary competencies that enable them to work with people in other disciplines and to situate their research in the broader context.
- Capacity in the individual is built up through iterative and reflexive learning across a person's career trajectory; such learning is often fragmented and ad hoc in African contexts.
- There has been little analysis or evaluation of past scientific capacity development (SCD) initiatives and programmes to determine which factors enable successful outcomes. A context–mechanisms–outcomes evaluation framework is a useful analysis tool.
- There is a need to shift incentive structures, develop infrastructure and support a mix of SCD that covers the full spectrum of competencies that climate scientists need.
- To be robust, SCD systems across diverse African contexts must have supportive elements at the level of the individual, the institution and the broader enabling system.

About FCFA

Future Climate for Africa (FCFA) aims to generate fundamentally new climate science focused on Africa, and to ensure that this science has an impact on human development across the continent.

www.futureclimateafrica.org

Barriers and opportunities for scientific capacity development on climate change in Africa

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Introduction

Africa is one of the most vulnerable continents to climate change and climate variability, a situation aggravated by limited expertise and resources for climate science.¹ Developing Africa's scientific capacity is crucial for forecasting and preparing for the impacts of climate change, steering adaptation and mitigation, and supporting African negotiators.

While the importance of capacity development for climate change science and research in Africa is increasingly recognised, there have been few reflections on past capacity-development interventions and their impacts.² Such reflections could help to understand which capacity-development approaches are most effective in Africa.

A study was undertaken to advance our understanding of scientific capacity development (SCD) on climate change in Africa. The study helped to inform the capacity-development strategy of the Future Climate for Africa (FCFA) programme. Findings from a literature review, online survey and evaluations of case study SCD initiatives (based on in-depth interviews with 28 participants and seven organisers from delivery institutions) highlighted barriers and opportunities for robust SCD systems in diverse African contexts. A summary of the methods used can be found in Table 2 at the end of this brief.

Important concepts for scientific capacity-building on climate

Climate change is a multifaceted area of research. It encompasses earth system science as well as fields related to vulnerability, impacts, mitigation and adaptation (drawing from the

biophysical, as well as social, economic, engineering and other sciences). Scientists working in this multifaceted area of study need to have their own specialised area of expertise, but they also need to have interdisciplinary knowledge and competencies to help them collaborate with their peers from the same, similar or different disciplines.

Competency: “a functionally linked complex of knowledge, skills, and attitudes that enable successful task performance and problem solving”³

Climate change research also needs to be situated within a broader societal context. This means working with non-scientists to ensure that research is accessible and relevant to policy and practice, to enhance its use and impact. Climate change capacity development thus needs to take into account the way that new knowledge is created, and how it is used and applied by different groups of people, for different purposes. Capacity development can address the needs for specific skills or competencies that are required by people in different roles and professions.

Capacity development takes place at three levels: the individual, the institution and the broader enabling system. Factors at these three levels interact to enhance or undermine SCD. The climate capacity development needs of individuals, institutions and regions are shaped by a number of contextual factors, such as access to information and communications technology (ICT) infrastructure, historical legacy, economic priorities, socio-political conditions, geography and climate drivers.

Broadly speaking, there are some common trends constraining SCD in Africa.⁴ These include the following.

- The reliance on international donor funding for research influences research priorities and can lead to inadequate continuity from one project to the next.
- In general, institutional capacity for climate change science is weak.
- There is very little apparent cross-institutional networking and

knowledge-sharing around SCD programmes and initiatives.

- There is insufficient ‘critical mass’ but rather ‘pockets’ of expertise, and relatively few dedicated, formal learning programmes for climate change.
- Opportunities to develop and transition from formal education to a working specialist are often poorly coordinated and ad hoc across a person’s career.

Short-term SCD initiatives may fill knowledge or capacity gaps for an individual, but longer-term capacity-development strategies that build institutional capacity are needed.

Evaluating contexts, mechanisms and outcomes of SCD initiatives in Africa

To understand more about how positive SCD outcomes are achieved, the authors analysed six case study initiatives (see Table 2) and programmes using a context–mechanisms–outcomes (CMO) evaluation framework. A CMO framework is similar to a standard logical framework (logframe) used for evaluation, but it allows for more contextual variables than just programme inputs to be considered. This is an important addition to the logframe, as African contexts are very diverse. Furthermore, the inclusion of ‘mechanisms’ rather than ‘activities’ provides for stronger conceptual framing, as mechanisms encompass a rationale for a designed outcome.

The CMO framework makes the assumption that the ‘contexts’ (including

inputs, motivations and enabling environments) of the SCD case studies partly determine the ‘mechanisms’ (i.e. approaches, design, delivery mode and processes) of the activity (see Figure 1). Differences in mechanisms can lead to different outcomes, for both the institution and the individual. The outcomes for the individual are also partly determined by his or her own contextual and social background.

Opportunities for SCD for climate change in Africa

The concepts and issues outlined earlier provide a general overview of the needs and current state of SCD systems in Africa. These concepts and issues can be used to imagine ideal or robust SCD systems for climate change in Africa (see Figure 2). An institution delivering an SCD initiative or programme should contribute to such a robust system by striving towards positive learning and career outcomes for their participants or beneficiaries.

A CMO evaluation of six SCD initiatives in Africa highlighted the following nine factors that operate together to help achieve positive learning and career outcomes (the absence of which may act as a barrier to success). These are best practice ‘elements’ that an ideal SCD initiative or programme should contain, as they foster learning and facilitate career advancement.

1. **Adequate funding.** When individuals lack sufficient resources to pay for their own education, individual development pathways can be constrained, while institutional funding shortages can constrain the scope or effectiveness of activities.
2. **Human resources.** At the institutional level, the management or coordination of funds and activities – and having expertise present and available – are important.

Figure 1. Applying a CMO evaluation framework

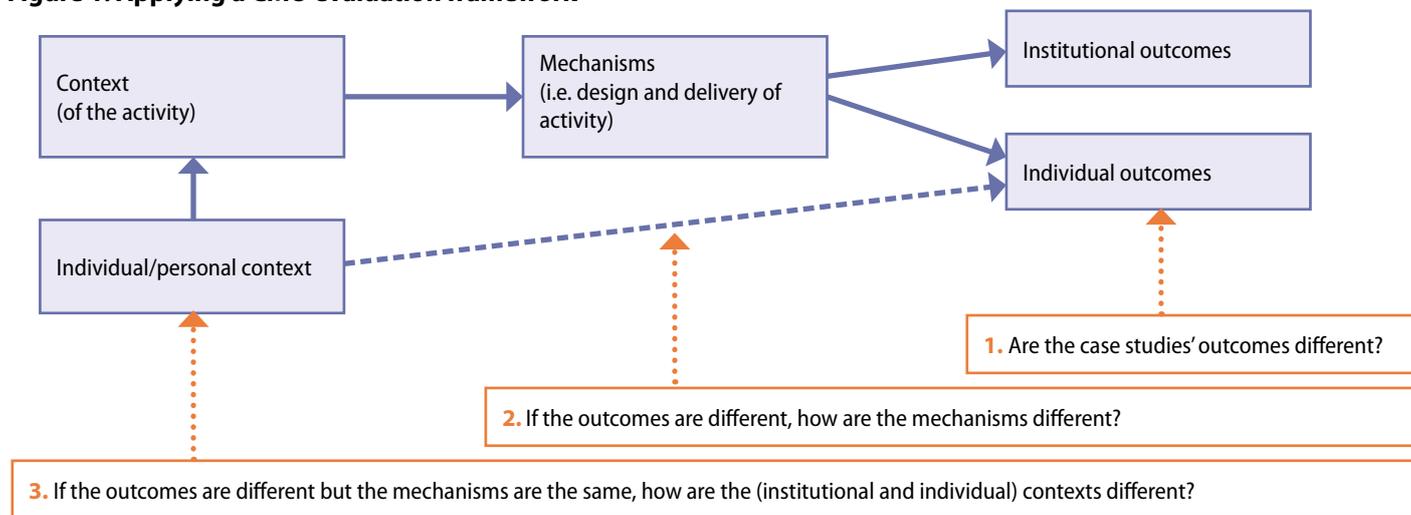


Table 1. Simplified indicators for a CMO evaluation framework for analysing SCD initiatives and programmes in different African contexts

	Context	Mechanisms	Outcomes
Institutional	Purpose and motivation	Design and content of the initiative/programme	Changes to the institution's capacity
	Inputs and funder(s)	Recruitment process	New partnerships between established and emerging African institutions/scientists
	Target participants	Institutional partnerships	Extent of engagement with decision-makers
	Location	Motivation for content	Extent of advanced frontiers of knowledge
	Other systems factors (e.g. political, legal)	Processes for continuity between SCD programmes, and for evaluation	As above
Individual	Disciplinary background	Interaction/engagement	New/improved specialist competencies
	Career stage and educational background	Motivation and interest	Research generation/new outputs
	Other personal factors (e.g. cultural, financial)	Values and interest/commitment	Career advancement, new research collaborations

3. **Infrastructural or computing capacity.** Computing resources and internet are important at the institutional or systems (regional) level, and data and climate information systems must be functional at the systems level.

have an existing 'base' of technical or discipline-specific skills, particularly analytical skills, on which to build interdisciplinary competencies. A degree of specialisation is essential to advance scientific knowledge and understanding.

and channels that enable relevant information to transfer reflexively between relevant participants and stakeholders.

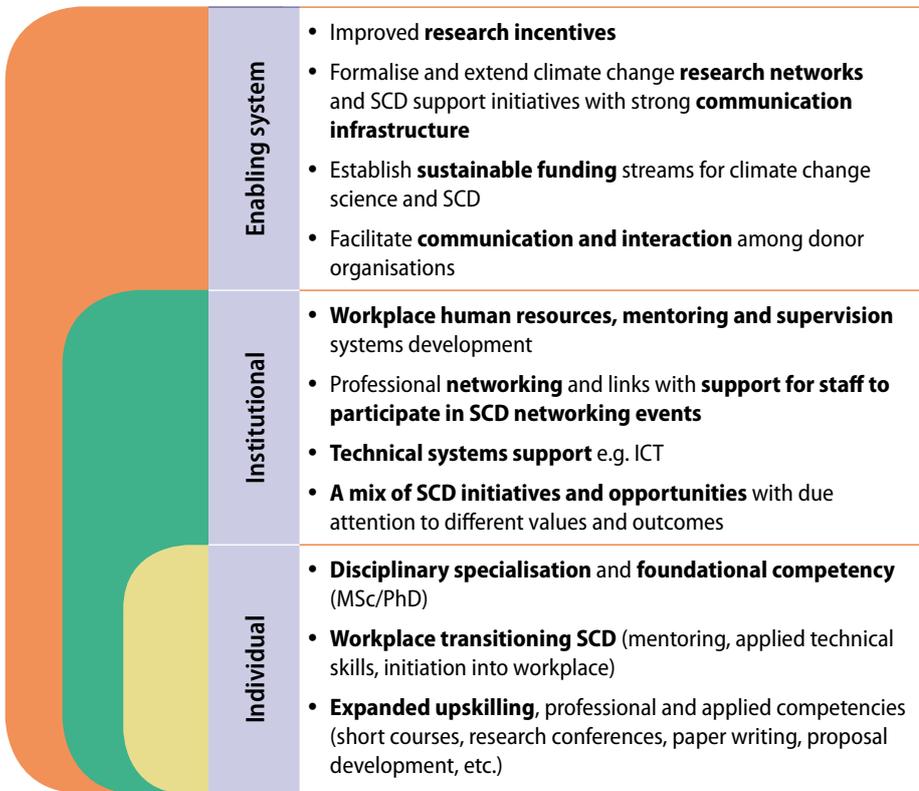
4. **Baseline skills of participants.** At the individual level, it is important to

5. **Supportive platforms for communication.** This refers to tools

6. **Supportive academic professional interactions.** Peer-to-peer support, professional networks and senior supervision or mentoring can provide guidance, stimulate new ideas and



Figure 2. A robust SCD system with supportive elements across three scales



ways of thinking, and facilitate new collaborations.

7. An ethic of collaboration.

Commitment and value at the individual and institutional levels can facilitate peer-to-peer, cross-disciplinary, cross-institutional and/or cross-border collaboration.

8. Integrative reflexive approaches.

It is important to involve participants and/or stakeholders across the full research or capacity-development process to understand their existing resources and competencies, and identify gaps and needs.

9. Autonomy to practice and pursue opportunity.

At the individual level, it is important to have room to apply or practice skills, build confidence and address one's own skill shortages. At

the institutional level, this can mean capacity to pursue new areas and create a legacy.

A full package of support that simultaneously builds individual and institutional capacity is the ideal objective for an SCD initiative. This is especially the case if this full package is situated within a longer-term, reflexive and more systemic framework for SCD. Such a package should comprise initiatives that consider the best practice 'elements' identified earlier as far as possible. Significant organisational, coordination and leadership resources are required to implement an SCD initiative or programme, without which effectiveness and significant outcomes are likely to be compromised.

Where possible, SCD initiatives and programmes should seek to link up to

and learn from other SCD programmes within a systems-oriented, networked framework. As climate change research is an emerging field of practice, collaboration and reflexive engagement among institutions delivering SCD programmes is critical to the success of expanding climate-science capacity in Africa.

Recommendations

In order to develop robust SCD systems across diverse African contexts, support and coordination are needed between institutions delivering climate change SCD in Africa and the broader, systems level. Such enabling support can come from: i) delivery institutions, such as multi-year research programmes; ii) support institutions; or iii) research policy and funding institutions. Recommendations for each of these types of institutions are outlined below.

Recommendations for multi-year, multi-team research projects

- Senior programme leaders should ensure that they understand and respond to the competency levels and needs of participating early-career researchers. A number of components could support this: a needs assessment of early-career researchers at the start of the programme; a dedicated SCD officer to coordinate ongoing reflective interaction between the different research teams; a dedicated stream of funding to support emerging needs; and a platform for peer-to-peer support and communication where researchers can share, review and critique research.
- Synergies with other relevant programmes should be enhanced through collaboration and coordination; for example, through shared SCD initiatives or research.

Recommendations for support institutions

- Universities could consider how students may benefit from integrated competencies in curriculum reviews and in supporting students to transition from university to work.
- Training organisations, such as START, and convening member-based organisations, such as the African Academy of Sciences (that coordinates the Climate Impact Research Capacity and Leadership Enhancement programme), should build in stronger monitoring and evaluation processes so that more rigorous learning, reflection and improvement of SCD can take place. A platform for SCD networking, with regular meetings to exchange experiences and emerging best practices, could significantly enhance the capacities of institutions involved in SCD, and create a shared understanding of the importance of SCD for building climate-resilient societies in Africa.

“The overall message is viewing capacity-building not as a simple training workshop but a comprehensive package of support systems in place, making use of participants themselves as contributors.”

– Director of the Assessments of Impacts and Adaptations to Climate Change programme

- Cross-institutional mentoring and professional exchange programmes must be supported, especially where computing capacity can be shared (e.g. access to the ‘supercomputers’ at well-resourced institutions).
- Inter-sectoral engagement and knowledge co-production must be supported.

Recommendations for research funding and policy institutions

- Research funding institutions could develop sustainable funding systems and broker national and international partnerships to develop climate sciences in Africa.
- Better incentive systems for climate sciences and SCD could enhance outputs.
- Priority needs to be given to climate capacity development for PhD students through bursary programmes, and for academics at regional universities who will provide important ongoing supervision as well as development of the academic field.
- Climate sciences and climate change SCD should be included in national human resources and human capacity-development planning and policies.
- Give attention to the funding and supply of technical equipment and computing competency for climate change research.

Concluding remarks

The recommendations outlined here were derived from a study focused on realising the FCFA’s primary capacity-development objective: developing the individual capacity of climate scientists, and the necessary supporting institutional capacity. Institutions within a robust SCD system in turn need support from the broader enabling system to deliver multifaceted capacity-building that addresses the range of competencies that climate change scientists need to advance their careers and integrate their research into practice.

A later study will need to address in more detail the secondary capacity-development objective of FCFA, namely that of developing the capacity of climate information users, decision-makers and other stakeholders, including communities.

A summary of the methodologies used in the SCD study that informed this policy brief is provided in Table 2 on page 6. A full report on this study will be available on the FCFA website (www.futureclimateafrica.org).

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Table 2. Methodologies used in the FCFA scientific capacity development study

Method	Components
Literature review	<ul style="list-style-type: none"> • Review of educational and pedagogical literature relating to environmental education, education for sustainable development and climate change education. • Review of grey literature consisting largely of reports from large climate change initiatives in Africa. • Compilation of 12 case studies using online searches, reports (when available) and contributions (either written correspondence or short, informal interviews) from key informants, such as past participants or organisers of the activity.
Database of SCD initiatives	<ul style="list-style-type: none"> • Compilation of a database of SCD initiatives, programmes and activities relevant to climate change in Africa; entries were primarily focused on developing capacity at the individual level, though the database also contained regional projects and communities of practice which could constitute institutional capacity development.
Survey	<ul style="list-style-type: none"> • Analysis of results from an online survey about career trajectories and competencies that was circulated to climate change researchers and practitioners working in Africa.
In-depth evaluation of selected case studies	<ul style="list-style-type: none"> • In-depth interviews with participants and organisers from six different SCD initiatives: <ul style="list-style-type: none"> • The Applied Centre for Climate and Earth System Science (ACCESS) Global Change Scholars programme: a multi-university, undergraduate programme in South Africa. • The African Climate Change Fellowship Programme (ACCFP): a six- to 12-month multinational African fellowship programme with exchanges. • Assessments of Impacts and Adaptations to Climate Change (AIACC): a multifaceted five-year donor-funded multi-team research programme, with in-project skill-building of researchers. • Agricultural Model Intercomparison and Improvement Project (AgMIP) workshop: an introductory four-day training workshop at the start of a multinational community of practice. • Climate Systems Analysis Group (CSAG) Winter School: a two-week winter school for mid-level, mid-career practitioners. • Africa Climate Science Research Partnership (CSR-1) Fellowships: a year-long fellowship programme, with mentoring exchanges between African and UK institutions, and with a broader research programme.

Endnotes

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