Policy Brief 19

WISER
Weather and Climate Information Services for Africa

May 2019

MAKING EVERY DOLLAR COUNT:

how investing in climate information pays dividends for the key socioeconomic sectors of Africa

A new framework – the first of its kind – developed by the African Climate Policy Centre can provide Governments of climate dependent countries with clear social and economic returns for investing in climate information services

KEY POINTS

- Until now, there has been limited evidence available that demonstrates the tangible benefits of investing in climate information services.
- The African Climate Policy Centre has developed a new framework that can be used to compare the socioeconomic benefits generated by investing in climate information services with the costs of investment. It can be applied across key sectors of Africa and customized by country.
- The framework shows that the socioeconomic benefits generated from higher quality climate information services far outweigh the costs of investing in such services. In addition, the cost of investing in climate information services is minimal compared with the significant costs incurred if countries fail to invest sufficiently in them.
- By showing the value for money of investing in climate investment services, the analysis conducted using the framework provides a clear incentive for Governments to invest in such services.

Social and economic welfare in Africa is intrinsically linked to the health of climate-dependent sectors, from agriculture to aviation, fishing to forestry, transportation to tourism. As the impacts of extremes in climate change and variability – such as floods, droughts and tropical cyclones – deepen, countries need clear strategies that safeguard affected sectors against losses from climate shocks and stresses while supporting economic growth. Governments, businesses and communities must be able to adapt to climate variability in order to mitigate the threats of climate change, while at the same time seizing opportunities for adapting to the changing climate.

One such strategy includes investments to improve the capacity of human resources and upgrading the technical equipment necessary to generate high-quality weather and climate information and prediction services. In addition, benefits can be realised by building the capacity of end users to apply such information and services, and by assessing the socioeconomic benefits that result from using high-quality information to mitigate climate impacts.

With improved networks for forecasting rainfall and temperature data, government health ministries can provide reliable advice on mosquito-borne diseases. In addition, planning departments can use current and future trends to climate-proof vital infrastructure, such as housing, office buildings, roads, railways, bridges and dams. Furthermore, farmers can protect and maximize yields by adjusting harvesting schedules or crop choices if they know, for example, when adverse weather and climate events will occur, how much rain will fall or when the rainy season will start. Better information can bolster business: more accurate information on sunshine hours can help energy entrepreneurs assess the potential for solar energy to strengthen a country's power provision. In addition, better wind outlook data can be used to deter-

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mine if an investment in wind energy would bring better returns.

From the grassroots to Government, high-quality information can inform evidence-based decisions to minimize climate damage and protect socioeconomic gains. The World Bank estimates that upgrading weather and climate observation in developing countries annually saves 23,000 lives, avoids $2 billion in assets lost due to natural disasters and results in up to $30 billion of additional economic benefits annually.[1]

However, when making investment decisions, African Governments do not always use good quality climate information; they also tend not to commit enough resources to generate, disseminate and apply better information. The use of insufficient or outdated observational equipment results in weather stations producing data that are weak and patchy. In addition, insufficient spending on human resource development results in countries lacking the technical expertise to prepare and communicate data and information in a way that is easily applicable by users.

1 Stéphane Hallegatte, "A cost effective solution to reduce disaster losses in developing countries: hydro-meteorological services, early warning and evacuation", Policy Research Working Paper, No. 6056 (Washington, D.C., World Bank, 2012).

There are numerous reasons for the low uptake of high-quality climate information, but one point is clear: the implications of Africa not having the capacity to generate and apply best possible climate information services are extremely detrimental to the continent's social and economic well-being.

New framework provides the hard evidence Governments require

While the case for investing in climate information services may seem compelling, in the past, evidence that demonstrates the tangible benefits has been limited. To commit funds from national budgets, Governments need to know the likely returns – and that the benefits will outweigh the costs of investment.

The African Climate Policy Centre of the Economic Commission for Africa under the Weather Information and Climate Services programme has made significant efforts towards filling this gap with a framework that uses climate information to simulate the impacts of climate variability and change and assess the socioeconomic benefits. The framework then compares these benefits with the costs of investing in available information, or of producing higher quality climate information services. The framework can be applied across sectors that are key to the continent's socioeconomic development and can be customized by country.

A more accurate picture

The Weather Information and Climate Services framework is distinct from conventional models in several ways. It can be used to simulate the impacts of climate variability and change on key sectors and enables users of the framework to extract the social, environmental and economic implications, such as gross domestic product (GDP) and job creation, which is a significant advancement. The framework provides Governments with information about extreme events – for example, costs incurred by storms or drought – based on experience.

Governments typically view such events in isolation and fail to see them as part of the broader picture: the accumulation of climate impacts and how they affect extrabudgetary expenditure for reconstruction. They tend to overlook the need to invest in and apply climate information services for socioeconomic benefits that can advance development and increase the overall resilience of the economy against climate change impacts. The framework makes it possible to quantify in monetary terms the impacts of climate change and separate them from other factors, such as population growth, that can put a strain on key sectors.

The framework can be used to assess four key aspects:

a. Climate damage without interventions or investing in climate investment services;
b. Required investments in interventions that can mitigate the impacts of extreme events;
c. Avoided costs and damages from implementing such interventions;
d. Added benefits, such as maintained employment and production, and the added labour income and GDP that results.

Conventional models tend to take a narrow sector-by-sector focus. The new framework uses a systemic approach, which links sectors and enables a holistic view of the social, economic and environmental implications within and across all sectors. Recognition of this interdependence enables an analysis of intervention effectiveness across sectors. This nexus approach makes it possible to identify synergies across the sectors, which can result in more cost-effective, streamlined investments.

The model provides information about where, and to what extent, investing in climate investment services can bring benefits. It helps identify tangible benefits, including jobs, tons of production and energy generated, and provides information on their economic value. The results generated by the model can be used to encourage investment in climate information services, depending on the amount of damages avoided and the investment required. Accordingly, the model provides an objective assessment of the return on investment of interventions in terms of added production and avoided damages.

The framework in practice: the costs of climate impacts and benefits of interventions

To date, the framework has provided simulations of climate impacts for the disaster risk reduction, agriculture, energy and water sectors. The latter three sectors and customizations for Cameroon, Mozambique and Uganda are discussed in this policy brief.

More volatile rainfall patterns caused by climate variability, higher variability of rainfall are simulated (an increase of 0.5 per cent per year), leading to more floods and droughts. Section A contains a summary of the socioeconomic impact of this simulation. Section B contains the socioeconomic benefits of interventions for adapting to the impacts of climate change and improving the resilience of communities.

A. The costs of climate impacts

Agriculture: yields suffer, gross domestic product drops and employment falls

With the potential to secure food for the growing population and to power economic growth, agriculture is central to development in Africa. In its Agenda 2063: The Africa We Want, the African Union points to the sector's potential to help realize socioeconomic gains and drive sustainable development. However, climate variability – most notably erratic rainfall patterns – affects agricultural productivity and threatens this vision.

Under the framework, agricultural production is calculated using the amount of productive farmland and the yield per hectare, which depends on water availability. Climate impacts are most visible in Mozambique, which is particularly affected by the variation in rainfall, owing to severe water shortages

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experienced during the dry season when most of the land is not irrigated.

Projections for the period up to 2050 indicate that agricultural production in Mozambique will decline by approximately 26 per cent because of water shortages experienced during the dry season. In addition, agricultural production will decrease by up to 4 per cent in Cameroon and 2 per cent in Uganda (figure I). Although the figures for Cameroon and Uganda are relatively low compared with Mozambique, they are still significant when considering the local impact on nutrition.

Under the framework, the reduction in production can be measured in pure economic terms. Agriculture GDP is projected to decline by an average of 24 per cent ($6.2 billion) in Mozambique, 14 per cent ($14.9 billion) in Cameroon and 12 per cent ($9.9 billion) in Uganda (figure II).

Figure I: Reductions in agricultural productivity based on projected decrease in precipitation (Percentage)

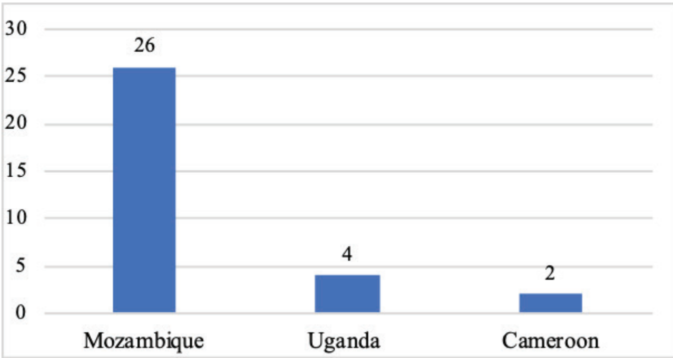

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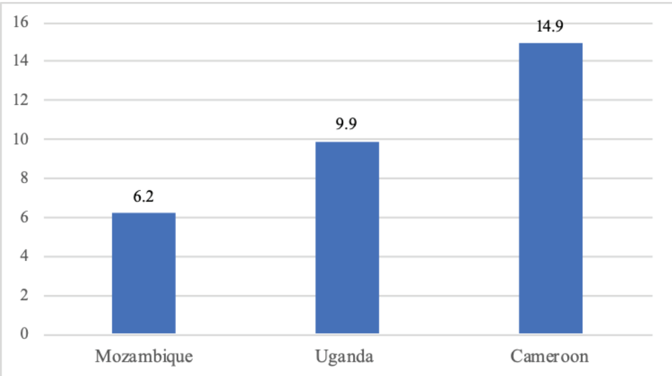
Figure II: Projected climate impacts on agricultural gross domestic product by 2050 (Billions of United States dollars)



Reduced productivity has direct social implications, putting employment in the sector at risk. In Mozambique, approximately 42 per cent of jobs in agriculture are threatened, leaving around 1.26 million jobs vulnerable by 2050. Employment in the agricultural sectors of Cameroon and Uganda will be reduced by just under 3 per cent each.

Water resources dry up

Water is at the heart of social and economic growth and is the primary medium through which Africans will experience the impacts of climate change.

Climate variability and change exposes millions to increased water stress, as clean and reliable water sources come under pressure. The framework gives a projection on the impact of rainfall variability and evapotranspiration on water resources, while the uncertainty of water supply is highlighted.

The water balance in Mozambique is projected to decrease by almost 70 per cent from an average shortage of 5.98 billion m3 in 2018 to 10.1 billion m3 annually until 2050.

The water balance – an indication of a surplus or scarcity of water at any given point in time – will decline in all three countries. In Mozambique, water shortages almost double, with the water balance decreasing by 68.8 per cent from a shortage of 5.98 billion m^3 in 2018 to 10.1 billion m^3 annually until 2050. The water balance in Uganda will decline by 5 billion m^3 by 2050, reaching approximately 4.3 billion m^3 per year. In Cameroon the water balance will decrease by 6.6 billion m^3 by 2050 – a decline of 30 per cent compared with 2018.

Energy sectors lose power

Reliable, affordable energy is the driver of wealth creation and enhances human well-being – from lighting to cooling to transportation to cooking. Energy supply underpins many aspects of modern life, such as water consumption, access to goods and services, and land use. Energy access for all is a cornerstone to achieving the Sustainable Development Goals.

Changes in temperature, precipitation, sea level, and the frequency and severity of extreme events all affect how much energy is produced, delivered and consumed. The model can be used to simulate the impacts of increased rainfall variability and higher temperatures. It shows the amount needed by countries to compensate for the impacts on power generation. For example, Mozambique is projected to need an additional 25 MW of capacity, the cost of which ranges between $25 million and $50 million. Cameroon and Uganda will require 16 MW and 4 MW, respectively.

Damages to power generation capacity also incur significant cost. By 2050, Cameroon is projected to require a cumulative investment of 10.49 trillion CFA francs; Uganda, 47.66 trillion Uganda shillings; and Mozambique, 221.1 billion metical.

B. . Proactive investments to adapt, stimulate growth and avoid future climate damage

As demonstrated above, by comparing climate change simulations to a baseline simulation without climate change impacts, the framework shows heavy implications for the agriculture, water and energy sectors.

In the next stage of the analysis, climate investment services are used to assess and implement interventions that mitigate the social and economic vulnerabilities created by climate change on the three sectors.

The following interventions are considered:

- For the agriculture sector, the framework can be used to assess whether a transition towards organic farming practices increases resilience. Organic agriculture, or climate smart agricultural practices, have been proven to reduce the impacts of climate change, leading to more reliable agricultural production, in particular for small-scale farmers.

- For the energy sector, the framework can be used to simulate whether decentralized renewable energy reduces the threats to power generation. Power generation from renewable energy is less susceptible to water scarcity or temperature increases, which are projected to increase due to climate change. The transition to renewable energy is assumed to contribute towards an increased and more reliable provision of energy.

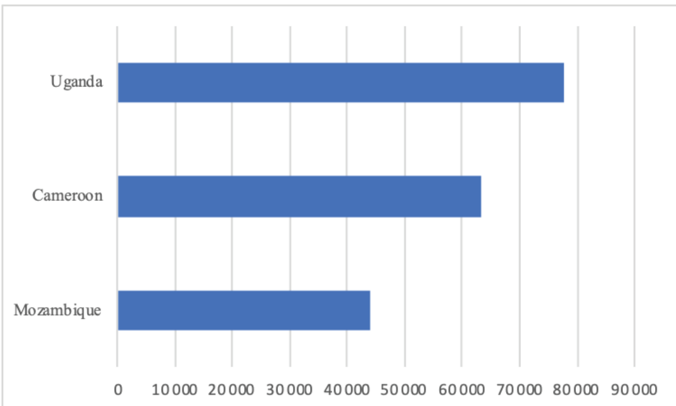
- Drip irrigation is deployed to increase water security. More efficient irrigation infrastructure for agriculture production reduces the total water demand from the sector, which makes water available to sustain a higher amount of productive farmland through dry periods.

Organic farming: yields rise, jobs increase

The transition towards organic farming is projected to increase the productivity of the agriculture sector considerably, increasing annual agricultural production by an average of 5 per cent. The greatest gains are projected in Cameroon where total production will increase by 3.12 million tons in 2050. Increases for Uganda and Mozambique are projected at 1.59 million and 0.86 million tons, respectively. In terms of translating yields into money, the agriculture GDP of Cameroon will increase by 114.7 billion CFA francs over 30 years; the increase for Uganda and Mozambique during the same period will be 13.74 trillion Uganda shillings and 133 billion metical, respectively.

In addition to the economic benefits, organic farming helps boost employment in all three countries: 63,410 additional jobs in Cameroon; 77,770 in Uganda; and 44,080 in Mozambique (figure III).

Figure III: Projected job increases as a result of organic farming in the period 2018 to 2050

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Renewable energy powers growth

The transition towards renewable energy increases the resilience of the power generation sector in the face of climate change impacts and adverse climate events. Between 2018 and 2050, the increase in that resilience is projected to result in a cumulative additional power generation of 24.9 million MWh in Mozambique, 4.1 million MWh in Cameroon and 3.5 million MWh in Uganda.

Renewable energy creates a total of 245 more electricity hours per year

Electricity generation is projected to increase by between 1.5 and 2.8 per cent if adaptation measures are implemented. An increase of 2.8 per cent in electricity generation corresponds to a value of up to 245 additional hours (or approximately 10 days) of electricity availability per year.[2]

Drip irrigation yields water savings

Projections for the water sector indicate that introducing efficient drip irrigation can significantly reduce water consumption and boost productivity. The most significant savings can be achieved in Mozambique, where introducing drip irrigation yields cumulative water savings of 27.9 trillion m^3 over a 30-year period. During the same period, the projected cumulative water savings in Uganda and Cameroon will average 7.26 trillion m^3 and 1.54 trillion m^3, respectively. If water savings are used to irrigate additional cropland, the total amount of cropland could be increased by between 12.8 and 14.4 per cent. Assuming the same amount of water is used, when water efficiency increases, the number of hectares irrigated will also increase.

Nexus approach: summary of findings

- Using climate information to simulate climate impacts has significant socioeconomic implications for the agriculture, water and energy sectors across the three country customizations. Agriculture GDP, for example, is projected to decline by between 12.1 and 16.7 per cent by 2050.

- The socioeconomic benefits framework can be used to analyse climate impacts and show the potential for avoiding costs through extreme weather events in monetary terms, such as avoiding the costs of damage when countries decentralize their power generation capacity.

2 The number of hours is calculated based on the total hours of production per year (8,760) and the increase in production compared with the climate scenario without adaptation measures (+2.8 per cent). Therefore, 8,760 h per year × 0.028 = 245.28 h per year.

- The socioeconomic benefits framework can be used to show the potential for generating socioeconomic benefits of investing in adaptation interventions: organic farming, drip irrigation and renewable energy. From an economic perspective, results from the three countries show improved GDP growth; from a social perspective, interventions can lead to job creation. Climate information services can be used to identify areas where investment in interventions for climate change adaptation are most needed and yield the highest socioeconomic returns.

- Social and economic benefits of robust climate information services far outweigh the costs of investing in them; at the same time, the cost of investing in climate information services is minimal compared with the significant costs incurred if countries fail to invest in them.

- By showing the value for money of investing in climate information services, the framework analysis provides a clear incentive for Governments to make such investments.

Policy recommendations

- Increase investment in human resources and in developing equipment for the collection, processing, dissemination and use of climate information services, such as early warning systems. Such an approach would give decision makers a strong foundation for improved planning and more timely intervention.

- Develop the capacity of meteorological departments to generate and disseminate climate information services across weather- and climate-sensitive sectors, including agriculture, health, water and energy. Meteorological departments require the following:

    - The right infrastructure to generate climate information services;

    - Competent staff to correctly analyse and prepare that information for end users;

    - Personnel and infrastructure to disseminate this information to the end user;

    - Access to end users that know how to use the information to improve their own production in the face of climate change.

- Require the preparation of integrated economic analysis – that is, cost-benefit analysis that includes economic, social and environmental outcomes.

About ACPC

The African Climate Policy Centre (ACPC) is a hub for demand-led knowledge on climate change in Africa. It addresses the need for greatly improved climate information for Africa and strengthening the use of such information for decision making, by improving analytical capacity, knowledge management and dissemination activities.

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