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WISER
Weather and Climate Information Services for Africa

The economic case for climate information services

If African nations are to avoid losses from climate shocks and stresses, or reap the potential benefits from changing climatic patterns, governments need accurate, timely and accessible climate information services. A new framework developed by the African Climate Policy Centre will enable governments to weigh up the economic and social benefits of climate information services against the costs of investment to improve generation and use of these services.

KEY POINTS

- Across Africa, insufficient investment in climate information services means these services are often not fit for purpose.
- But before investing in climate information services, policymakers need to know the likely economic returns of their investment.
- ACPC has developed a Socio-economic Benefits framework that assesses the economic and social benefits of climate information services compared to investment costs.
- Following development of the framework, the next stage will be customisation for specific sectors starting with agriculture and disaster risk reduction.

The Paris Agreement sets out that average global warming must reach no more than 2˚C if the world is to avoid dangerous and irreversible climate change. Yet Africa is already experiencing devastating effects; extreme weather events are increasing at an alarming rate while temperature and rainfall patterns become ever more erratic. And with the world already locked into high levels of emissions, the most severe impacts of climate change are expected to be felt in decades to come.

These changes in climate cause loss of life, damage property, affect productivity and threaten Africa's longer-term development and efforts to reduce poverty.

However, shifting climate patterns can – if nations are ready to be proactive and forward thinking – present opportunities for resilient and inclusive growth.

While there is still much uncertainty about how Africa's climate will respond to global greenhouse emissions in the future, one thing is clear: if nations are to avoid losses from climate shocks and stresses, or reap the potential benefits from changing climatic patterns, governments need accurate, timely and accessible climate information services (CIS).

But in many countries across the continent, CIS are not fit for purpose. Inadequate investment has led to National Meteorological and Hydrological Services (NMHSs) with weak observational networks. Information about climate-related events, trends, forecasts and projections is sparse and requiring significant improvement. Lack of spending on human resource means the people needed to analyse, manage, prepare and communicate data and

ACPC African Climate Policy Centre
United Nations Economic Commission for Africa

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information in a way that is meaningful for different end users are few, and among those in post, capacity is low.

Without clarity on what information exists, whether it is accurate, how to access it, or how to apply it, governments are failing to incorporate climate information into crucial investment and planning decisions.

The socio-economic benefits of climate information

To get the reliable, credible data and information needed to strengthen decision-making, governments urgently need to invest in CIS. But before policymakers can dedicate national budgets to this sector, they first need to be convinced of the likely economic returns of their investment; they need know that the benefits will outweigh the costs. This calls for methods that can translate the benefits of climate information into monetary terms.

A strong economic case for CIS can also justify diverting spend away from key sectors such as primary education, health, transport and social housing – where needs are widely perceived to be more pressing and policy makers are often under pressure to respond in shorter timeframes.

The social and economic benefits of climate information can be split into two broad areas: avoiding losses and harnessing opportunities for growth.

The costs of climate variability and climate change…

The macro-economic impacts of climate variability and climate change can be projected in terms of GDP. For example, according to the 'Economic Vulnerability and Disaster Risk Assessment in Malawi and Mozambique',[1] during a 1-in-25 year drought (an RP25 drought), as experienced in Malawi in 1991-92, GDP contracted by as much as 10.4 per cent. This had knock-on effects for the country's poverty levels: on average, droughts cause a 1.3 per cent increase in poverty, but during the Malawi RP25 drought, this rose to almost 17 per cent – equivalent to an additional 2.1 million people falling below the poverty line.

In general, policy makers do not factor droughts and floods into planning – despite their considerable adverse impact on GDP: for instance, droughts cause GDP to contract by nearly 2 per cent on an annual basis which, over decades, leads to significant economic losses.[2]

According to 'A Review of Droughts on the African Continent: a Geospatial and Long-term Perspective',[3] nearly 300 drought events were reported across Africa between 1900 and 2013, killing approximately 850 000 people and affecting over 36 million. The total economic damages were estimated at $3 billion.

... and how CIS can curb losses

Post-harvest losses continue to threaten Africa's food security. The majority of farming practices rely on rain-fed agriculture, and with precise information – for example from Early Warning Systems - on changing rainfall patterns caused by extreme weather events such as, drought, floods, and storm surges, farmers can adjust planting and harvesting times, adapt their choice of crop and fertiliser, or change their weeding regimes. Farmers may also take early action to prevent infestation from crop pests and diseases that can thrive in excess moisture, high temperatures or extreme humidity.

With the right information to avoid costly damage to yields, countries can evade the knock-on effects of hunger and malnutrition; lower yields can push up the price of crops and threaten jobs and it is often the poorest, vulnerable groups – particularly women and children – whose lives and livelihoods are most affected.

With the right information to avoid costly damage to yields, countries can evade the knock-on effects of hunger and malnutrition

Nowcasting comprises a detailed description of current weather along with forecasts of up to six hours ahead, making it a powerful service for warnings of hazardous, high-impact weather including tropical cyclones, thunderstorms and tornados. Nowcasting is a useful tool in preventing or minimizing damage from extreme weather such as storms thereby minimizing the costs of damage to infrastructure. For example, if a road is secured in advance of heavy rainfalls, the costs of road repair can be avoided. Critical business assets can also be protected: with accurate, real-time information of when a flood or tropical storm will hit, factories can ensure critical equipment is moved to safer, higher ground. In rural communities, women can take emergency measures to prepare for climate-related floods by using sandbags or other devices to act as a barrier to prevent damage to their homes. Meanwhile, businesses can take measures to avoid supply chain disruption for example if flooding and landslides caused by heavy rain are likely to block crucial roads to markets.

Nowcasting is a powerful service for warnings of hazardous, high-impact weather

Longer-range climate predictions are crucial for projecting rainfall patterns over the longer term. In Southern Africa, the close association between regional droughts in 1982/3, 1991/2 and 1994/5 and El Niño events provided the impetus for developing regional long-lead or seasonal forecasting. By 1997/98 a formal process for consensus-based long-lead forecasting had emerged, managed through the Southern African Climatic Outlook Forum (SARCOF), and involving national meteorological agencies from all Southern African Development Community (SADC) countries.[4] This was pioneered as part of a wider global initiative to strengthen regional climatic forecasting. It has been up-scaled globally as Regional Climatic Outlook Forums (RCOFs) which act as nodes of the Global Framework of Climate Services (GFCS).

RCOFs provide broad outlooks of rainfall patterns six months in advance. Country-specific forecasts can alert international and national agencies and civil society to the need for precautionary measures to safeguard food security and water supplies, and reduce the cost of potentially financially destabilising crisis measures.

However, decision makers do not always factor these forecasts into the planning process. For instance, the 2015/16 SARCOF seasonal climate prediction warned of impending drought in SADC, and the report was generated and disseminated six months before the drought hit. Yet no action was taken to avert disaster from the forecasted drought. Consequently, SADC Heads of State and governments were forced to make an international appeal of $3 billion for food and non-food aid, with the costs of food escalating by the time the appeal was launched. Dwindling pastures led to the SADC region losing almost 650 000 cattle. Damage costs could have been substantially decreased if early action had been taken, such as procuring grain before prices escalated or destocking before pastures depleted to the level that caused the decimation of livestock.

Long-term predictions, within climate change paradigm, are also crucial for helping to guide the billions of dollars Africa invests in major infrastructure every year – such as power stations, roads, reservoirs and irrigation canals. Without well-informed decisions on how to climate-proof big infrastructure, precious budgetary resources may be wasted and the continent's development efforts severely undermined. If climate risks are not factored into the design of new infrastructure, the expected benefits may not be sustained in the future.

Limiting the human cost of climate change: CIS to save lives and protect livelihoods

Access to precise, real-time information can save lives and help build resilience among climate-

Counting the costs of the Mozambique flood of 2000: a preliminary assessment of damage

Preliminary damage assessments following the 2000 Mozambique flood totalled $273 million in direct costs and $428 million in optimal-standard reconstruction cost. Estimates that factor in that some data is uncertain and some assumptions are untested (e.g. direct losses to housing and private property, direct losses to traders, and indirect losses due to damaged roads) have been more conservative.

Second, costs to the public sector were estimated at $135 million in direct costs. This includes costs in health ($15.7 million), education ($18.7 million), government buildings and their contents ($5.2 million), water and sanitation ($12.0 million), energy ($13.1 million), roads ($47.0 million), railways ($7.3 million), and agriculture infrastructure ($16.4 million). Indirect costs to the government in these sectors total $13 to $14million. There were marginal losses in other sectors (less than $500,000), although losses in the power sector ($2.4 million) and the railway sector ($10.7 million) were significant.

Third, costs to the private sector were estimated at US$130 million in direct costs, including housing and private property ($29.1 million), agriculture ($41.5 million), livestock ($7.9 million), fisheries ($8.5million), industry ($25.7 million), trade ($15.7 million) and tourism ($2.0 million). Indirect losses in these sectors also fell to the private sector and are estimated to be significant - at around $190 million. The indirect costs of damage to the roads network was estimated to be about $30 million and these fell to the private sector as well.

Fourth, costs for the relief effort were understated, since they only accounted for the costs associated with providing basic services, and excluded rehabilitation and reconstruction costs. The estimated $64.8 million, was therefore significantly less than the $160.5 million that the government indicated to be the gross requirement for the emergency response in its most recent international appeal, launched in collaboration with the UN and issued in March 2000. Items such as road repair, building repair and the provision of goods and services that are provided to restore livelihoods are included as direct costs of the disaster rather than relief costs, though some of these items were included in the appeal. At the same time, with the exception of food aid, there was no attempt to capture extraordinary relief costs (e.g. for family reunification and emergency e.g. air-borne rescue operations). These would significantly add to the total.

Fifth, estimates of reconstruction costs were highly preliminary, as specialists have only just begun to identify and cost up effective risk-reducing strategies for sectoral activities in the affected areas. Moreover, the decision of whether to rebuild to improved standards could only be determined by assessing the exposure of the relevant asset to catastrophic losses and the economic impacts of these losses. This called for informed speculation on the probability of severe flooding on the affected flood plains or exposure to other hazards in the future.
Based of death and damage tolls from floods in 1970 and 1977, it is clear that flooding in these areas periodically reaches magnitudes that are sufficient to cause extensive damage and loss of life. Every effort must be made to reduce the human costs of these events, and to incorporate loss exposure levels into standard model projections to obtain a realistic view of an asset's probable returns and insurance needs.

Source: Republic of Mozambique A Preliminary Assessment of Damage from the Flood and Cyclone Emergency of February-March 2000, World Bank, 2000

vulnerable communities. On the Lake Victoria Basin, for example, an estimated 5000 people from the local fishing community lose their lives each year due to thunderstorms. Climate change is causing these storms to become increasingly severe and erratic. But with more accurate weather forecasts, disseminated via communication systems such as radio and wireless telephone, fishermen and women are alerted to impending storms. Lives are saved and injuries averted. Avoiding disaster also prevents damage to or loss of critical assets including boats and fishing equipment.

Access to precise, real-time information can save lives and help build resilience among climate-vulnerable communities

With the right information, humanitarian agencies can have time to prepare for floods, droughts, heatwaves, wild fires, storms, landslides and other climate hazards. In the case of torrential downpours, agencies know the levels of extreme rainfall that triggers flash floods. With warnings of incoming storms, they can monitor this threshold, and put plans in

IN NUMBERS: Regional Inter-Agency Standing Committee (RIASCO) response plan for the El Niño-induced drought in Southern Africa

Key statistics:

- Drought: Worst in 35 years (La Niña probability = 76%)
- Agricultural output: 15% below 5 year average
- Livestock deaths: 634 000
- People affected: 32m (total population 236m)
- Cholera cases: 39 000

RIASCO funding:

- $1.2bn requested, 237m received

Creation date: 20 Jul 2016

Key statistic source: total Food insecure (SADC data); SADC & UN Country Response Plan
RIASCO funding source: RIASCO

place to support communities while alerting citizens when to take action.

Seizing opportunities: the value of climate information

Hydro-meteorological hazards, typically droughts or floods, wreak havoc on socio-economic development particularly among the most climate vulnerable of communities. Lives are lost and economic damage can cause GDP to contract. During the droughts of the early 1990s and more recently in 2015/16 over Southern Africa, huge amounts of food and non-food goods were imported at enormous cost to governments. Similarly, tropical cyclone Eline in 2000 resulted in huge loss of life and costly damage to infrastructure such as roads and bridges, some of which are still in disrepair nearly two decades later.

On the other hand, climate variability can bring more favourable conditions to communities, for example through well distributed seasonal rains, both temporally and spatially.

This can lead to healthier agricultural production which can serve not only to feed a burgeoning population but to drive a prosperous export market, and in doing so, bolster economic growth.

Ability to avert disasters from hydro meteorological hazards using current CIS, such as seasonal climate prediction, prepares communities to adapt to climate change challenges.

While climate information and services can help avert danger and avoid costs from the associated damage, significant opportunities can also emerge. Openly available high-quality climate information can drive productivity; savings made from averting risk and avoiding damage can be reinvested into more resilient economic activities.

Timely, accurate climate information on seasonal weather patterns (e.g. heat waves, cold spells, droughts) can inform farmers which crops are most likely to thrive in the coming growing season. Farmers can decide which crops to grow and in what quantity, or which crop inputs (fertilizers, pesticides, fungicides) will support maximum yield.

In the case of crop production, changes in temperature and rainfall can have varying effects on yields: while historically high productivity of certain crops in a particular region may decline, other crops in that same region may thrive. Likewise, regions that in the past have seen poor yields may become more productive as climatic factors change. With the right information, different types of crops can be planted leading to higher yields which in turn leads to more trade, more food, more jobs – benefitting the wider population.

Openly available high-quality climate information can drive productivity; savings made from averting risk and avoiding damage can be reinvested into more resilient economic activities

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Additionally, it has been amply demonstrated that disaster risk management, water resource management, hydropower generation, health, tourism and other sectors are sensitive to climate variability and climate change. All this these sectors will benefit immensely from applying climate information and prediction services. For instance, using CIS, strategies for cost-effectively combatting epidemiological diseases such as malaria and cholera can be better formulated: spraying of potential hotspots of malaria, or procuring medicines can be done ahead of time which will help minimise fatalities. CIS will lead to better planning and executing of hydropower generation and reservoir management. If a drought is foreseen power utilities can implement more controlled load-shedding. If flooding rains are predicted, water may be released so that risks of flooding communities around river basins are averted. Opportunities for avoiding cost can be significant, allowing such savings to help grow the economy as well as enabling communities to thrive.

CIS can also significantly contribute to the rational use of the environment. For example, CIS can provide prediction of conditions that generate and spread wild fires. Therefore CIS has a role to play in minimizing risk to lives and property.

Money talks: a framework to translate benefits into money

The African Climate Policy Centre (ACPC) of the United Nations Economic Commission for Africa (UNECA) under the Weather Information and Climate Services (WISER) programme has developed a framework that assesses the economic and social benefits of CIS compared to the costs of investments.

The framework will essentially build a business case for ongoing investment in CIS by showing the impacts of integrating climate information into the policy and resource allocation process. By turning the outcomes of CIS investment into monetary terms, the framework illustrates whether the benefits of policies outweigh the amount of money invested in them. In this way, it is easier for policy makers to justify current and future investment in CIS.

The Socio-economic Benefits (SEB) Framework presents the steps required for the effective identification and use of indicators to support a sectoral and integrated analysis of SEB in CIS. The steps presented are largely more relevant to climate vulnerability assessment, while others are more useful for adaptation and policy formulation/assessment. The steps that lead to the implementation of an integrated Cost Benefit Analysis (CBA), where social, economic

EXPLAINER: the distinction between natural climate variability and climate change

In essence, climate variability looks at changes that occur within smaller timeframes, such as a month, a season, or a year. Climate change considers changes that occur over a longer period of time, typically over decades or longer.

A key difference between climate variability and change is in persistence of 'anomalous' conditions – when events that used to be rare occur more frequently, or vice-versa. In statistical terms, the curve of the frequency distribution representing the probability of specific meteorological events changes. The curve may be modified either in amplitude, shifted about a new mean, or both.

Care must be taken not to confuse variability with change. Climatologically speaking, many regions of the world experience greater variability than others. In some parts of the world, or in any region for certain time periods or parts of the year, the variability can be weak (i.e. there is not much difference in the conditions within that time period). In other places or time periods, the conditions can swing across a large range, from freezing to very warm, or from very wet to very dry and exhibit strong variability.

A certain amount of this is understood and accepted, instinctively, by the people in a region. What is 'normal' for one location in terms of the frequency of precipitation events with high variability could be 'abnormal' for another location with low variability. Thus, any single event, such as a severe tropical cyclone, cannot be attributed to human-induced climate change.

An event or sequence of events occurs that has never been witnessed before (or recorded before), such as the exceptional hurricane season in the Atlantic in 2005. Yet even that could be part of natural climate variability. If such a season does not recur within the next 30 years. Reflecting back, this may be marked as an exceptional year, but not a harbinger of change. Only a persistent series of unusual events taken in the context of regional climate parameters can suggest that a potential change in climate has occurred.

and environmental impacts – as well as policy outcomes – are considered.

CBA considers three main analytical components: investment, avoided costs and added benefits. The integrated CBA includes the economic valuation of environmental consequences.

By turning the outcomes of CIS investment into monetary terms, the framework illustrates whether the benefits of policies outweigh the amount of money invested in them.

Indicators[5] when used to effectively inform decision making, are designed to support the initial and final stages of the development planning process, namely issue identification (stage 1), strategy/policy formulation and assessment (stage 2), and strategy/policy monitoring and evaluation (stage 5) (UNEP, 2014).[6] Decision-making (stage 3) is the point in time when a particular policy recommendation is adopted, based on the comparison of different policy options that were developed under stage 2. Finally, the role of indicators in policy implementation (stage 4), is mainly exercised through monitoring and evaluation (stage 5), when the actual impacts of development plans are monitored both during and after implementation.

Cross-sectoral causal descriptive models can incorporate several of the methods mentioned above, from historical observations to simulation of future scenarios. These models, based on the Systems Thinking and System Dynamics methodology, have been traditionally used to support planning exercises at various levels with the analysis of "what if" scenarios, for instance in the context of climate adaptation.

The key features include horizontal integration (i.e. a variety of sectors interconnected with one another) and a fairly aggregated level of detail for each sector. The former allows the inclusion into the model social, economic and environmental indicators; the latter indicates that this approach does not substitute others, instead it complements existing – and more detailed – sectoral modelling efforts with a more comprehensive framework of analysis. As a result, these models can be used to simulate alternative scenarios of action and inaction, using several weather indicators as input and providing insights on both the identification and anticipation of vulnerabilities and the identification and evaluation of interventions to improve resilience to climate change (e.g. based on forecasts of SEB).

Having a shared understanding is crucial for solving problems that influence several sectors or areas of influence which are normal in complex systems. Since the process involves broad stakeholder participation all the parties involved need a shared understanding of the factors that generate the problem and those that could lead to a solution to effectively implement successful private-public partnerships. As such, the solution should not be imposed on the system, but should emerge from it. In other words, interventions should be designed to make the system start working in our favour, to solve the problem, rather than generating it.

Looking ahead: framework customisation by sector

Following development of the framework, the next stage is customising it for specific sectors, starting with agriculture and disaster risk reduction. This tailoring of the framework will facilitate closer examination of the economic benefit of applying CIS at sector level. This will enable decision makers to make better informed strategies for averting climate-induced disasters; or taking advantage of favourable climatic conditions to help grow their economies.

Agriculture

Here, customisation will be designed so CIS products can be tailored and applied to agriculture, leading to better productivity. This may include enabling use of appropriate seed varieties, containing infestation of pest and diseases, managing agricultural operations, e.g. scheduling weeding and application of fertilizers and hiring of temporary staff for specific tasks necessary to improve productivity.

Disaster Risk Reduction

The model output will provide a basis for integrating CIS into disaster risk reduction. This will involve developing and disseminating climate information and prediction products that enable the tracking of hydro-meteorological hazards ahead of time. This will contribute to enabling Disaster Risk Managers capacitated in applying CIS to put in place measures to avert potential weather- and climate-induced disasters. The process will also map out patterns of hydro-meteorological disasters into the future. This will enable planners to invest resources in the areas that are currently more susceptible to flooding and droughts so that, for instance, roads, bridges, dams and housing structures are designed to be as climate proof as possible.

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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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