Macroeconomics and Climate Adaptation

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KEY MESSAGES

- **Even if the Paris Climate Agreement goals are achieved, the economic costs of climate change in Africa are projected to be large. It is likely that Africa will experience higher relative impacts (as a percentage of GDP) than most other world regions,** even though it is less responsible (whether historically or in the present day) for global greenhouse gas emissions than other major regions of the world. If the Paris Climate Agreement goals are missed, the economic costs will be very significant in Africa, and potentially catastrophic in some sub-regions. It is likely that these impacts will be unevenly distributed within countries, affecting the vulnerable the most.
- **Climate change will affect near-term development and poverty reduction, as well as long-term growth for the continent.** Most analyses show significant economic costs over the next few decades (i.e., several percent of GDP per year), rising significantly for high-warming scenarios in the longer term (to more than 5 percent and plausibly more than 10 percent for some countries).
- **Climate change is a major macroeconomic risk and is likely to affect the public finances of most African countries.** Recent findings indicate that climate change could reduce the sovereign credit ratings of African countries, increasing the cost of borrowing/cost of capital. It could also increase the level of uninsured assets and contingent liabilities, and negatively affect foreign investment. The impacts of climate change on public finances, combined with the need to finance adaptation, could add pressure to debt levels in Africa. Financial market anticipation of these various impacts could bring forward climate-related economic costs in Africa.
- **The level of climate change in Africa in the next 20 years is already locked in, and these impacts can only be reduced with adaptation. Africa needs to scale up adaptation now.**

More positively, adaptation can reduce the near-term economic costs of climate change very cost-effectively, and many early interventions have high benefit-to-cost (BCR) ratios. The existing estimate shows that BCRs are mostly above 2:1 (i.e., a dollar invested generates double this in terms of economic benefits), and often above 5:1. Furthermore, many adaptation measures have important environmental co-benefits, and some can address other drivers of vulnerability in terms of poverty reduction, especially in low-income countries.

INTRODUCTION

While Africa has enjoyed high levels of economic growth over the last decade, it still experiences high economic losses from climate-related variability and extreme events, such as major floods, droughts and storms.[1] In fact, it is the region with the highest vulnerability to such events globally.[2] These events have major macroeconomic consequences. Several studies have found that climate shocks reduce economic (GDP) growth,[3,4,5] especially for low-income countries. To put this another way, the strong growth rates experienced in Africa over the last decade would have been even higher if climate shocks had been better managed; a failure to manage these events has led to foregone growth. While current climate-related extremes are often the result of natural climate variability, there is strong evidence that these events are increasing,[6,7] and that climate change is playing an increasing role in extreme event frequency and/or intensity, as reported in recent attribution analyses in Africa for major droughts.[8,9]Africa already has a large existing adaptation deficit.[10]

Looking to the future, climate change will exacerbate these existing impacts, and create new risks even in the near term. In the long term, it will lead to potentially very high future economic costs, though the level of these impacts will depend on global mitigation agreements and their implementation. The Paris Agreement of 2015[11] set the goal of limiting average global temperature rise to well below 2°C above pre-industrial levels and of pursuing efforts to limit it to 1.5°C. However, greenhouse gas emissions (GHG) are still increasing globally, and recent analysis indicates the world is not on track to achieve the Paris goals.[12,13,14] More positively, international action on climate mitigation is gathering pace. A series of recent announcements indicate greater global ambition on mitigation, with countries committing to achieving net-zero emissions goals by mid-century. This will help limit future warming, though net-zero goals have not yet been translated into announced policy action internationally.

This chapter provides a deep dive into the economics of climate change impacts in Africa. It presents the findings of recent analyses on the potential economic costs of climate change in Africa, as well as recent evidence on the potential macroeconomic risks of climate change. The chapter then considers the potential economic benefits of adaptation, and summarises the potential costs and benefits of adaptation interventions in Africa. Based on this analysis, it provides a number of key messages and policy recommendations.

The Economic Costs of Climate Change in Africa

There is a small but established literature on the economic costs of climate change, going back several decades. This uses models to estimate the potential economic costs of climate change, either as aggregate values (an equivalent percentage of GDP) or as a social cost of carbon (the marginal cost of a tonne of additional carbon emitted, i.e., $/tCO2). The earlier analyses[15] used a small subset of models to generate these estimates. In recent years, the number of models and approaches has expanded (see Box 1). This provides a larger evidence base to sample, but it has also increased the range of values reported.

This chapter reviews the latest analytical estimates in the academic and grey literature on the aggregate economic costs of climate change in Africa, covering global, regional and country studies.[16] It is stressed that assessing the impacts of climate change on societal welfare (the economic cost[17]) is extremely challenging, as discussed in Box 1. Any estimates can only be considered indicative and should be treated with caution.

> **The dangerous divergence in economic fortunes between the rich and the poor, in countries and across the globe ... is the most important race to win because only when we come together as people we can fight the climate crisis. This requires the wealthy countries to fulfil their pledge of $100 billion per year, it requires adaptation to be put on equal footing with mitigation as we fund action, and it requires all of us to do our part."**
>
> **Kristalina Georgieva, Managing Director, International Monetary Fund**
> High-Level Dialogue "An adaptation acceleration imperative for COP26", September, 2021

The challenges involved, and the wide range of reported values, make it very difficult to report central estimates of the future economic costs in Africa with confidence. However, there are many common insights that these various studies provide, and our analysis based on an extensive literature review identifies **robust findings from the evidence.** These findings are presented on page 37.

Box 1: Modelling the Economic Costs of Climate Change


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Estimating the economic costs of climate change is difficult. This is because of the complexity of trying to assess and monetize the impacts of climate change for multiple hazards (both slow-onset factors and changes in the frequency and intensity of extreme events), for all sectors (market and non-market), and for all countries globally, over long timespans. These challenges are compounded by high uncertainty, firstly over future emission scenarios and mitigation levels, and secondly from the climate modeling projections, as the climate response to any given emission scenario varies significantly across different models. Beyond this, there are challenges and uncertainties in estimating the physical impacts (including damage functions) of climate change, and in the valuation of these changes, as well as the impacts on the economy including feedbacks. This is compounded by other changing factors (notably socioeconomic change) which affect vulnerability and adaptive capacity, and can increase (or decrease) climate impacts.

Most of the earlier literature on the economic costs of climate change was produced by a small number of Integrated Assessment Models (IAMs). More recently, additional approaches have been developed, which include the use of computable general equilibrium (CGE) models and econometric (statistical) studies. This has led to more studies, but it has also increased the range of published estimates. The reasons for the large differences are partly due to the methods used. They also vary due to the inputs used (e.g., scenarios and climate model projections) and the coverage of impacts.

It is emphasized that all studies are partial, in that they include only a subset of the economic costs of climate change. There are also differences in the model outputs, because of the nature of the models used. For example, some studies (econometric and CGE models) only include market damages, while others, such as IAMs, include some non-market impacts (health, ecosystems). A further issue is the lack of empirical evidence on climate change impacts and economic costs at higher temperatures, and thus whether there will be a step-change in impacts. There is also a further set of potential risks from the risk of large-scale, non-linear global discontinuities, often called tipping points.[18] The inclusion of these events gives greater weight to ambitious mitigation scenarios.

Finally, the results of any study are affected by the assumptions made. This includes aggregating assumptions, notably on whether and how to add up or adjust effects in different regions and time periods, including positive and negative values, and for risk and equity/inequality aversion. When expressing economic costs as a social cost of carbon or in present value terms, there is a further issue around the appropriate discount rate to use.


Photo: Fearless on Four Wheels/iStock

Even if the Paris Agreement Goals are achieved, the economic costs of climate change in Africa are likely to be very high, and impacts in Africa are projected to be greater (as a percentage of GDP) than in other world regions.

We find that recent modeling studies generally report higher economic costs from climate change than earlier studies, including for the impacts in Africa. The early literature, as summarised in several reviews,[19,20,21] generally reports low economic costs from climate change, with a 1 to 2 percent welfare-equivalent income loss globally, expressed as a percentage of income, for 2–3°C of warming. These estimates were primarily based on IAM results.

Studies undertaken since the IPCC AR5 (2014) generally report much higher estimates of the economic costs of climate change at the global level, particularly in Africa. This reflects more negative findings in the climate science (e.g., higher levels of sea-level rise as projected in the IPCC SROCC[22]), as well as the greater coverage of climate impacts, including extreme events. These higher values are seen in updates to existing IAMs,[23,24] as well as studies that update the functions in Integrated Assessment Models.[25] Higher costs are also often reported by alternative modelling approaches, with generally higher values from computable general equilibrium (CGE) models[26] and from econometric studies that consider the effects of climate change impacts on growth rates as well as output, noting that these studies can lead to higher long-term impacts because of compounding effects over time.[27,28,29]

A second robust finding that emerges from our work is that the relative distribution of climate change impacts will not occur evenly across the world. The absolute costs of climate change are influenced by the size of regional and national economies, and thus the proportion of global total damages in Africa is low. However, the relative cost of climate change reveals a different picture. All studies project much higher relative economic impacts in Africa and Asia, as a percentage of GDP, than in other world regions. For example, the OECD analysis reports that the relative economic costs of climate change in sub-Saharan Africa could be double the global average. Other studies find even higher ratios than this for Africa.[30,31] The reason for this is that Africa, and especially the Least Developed Countries in the continent, are particularly affected by climate change in relative terms[32] as they have climate-sensitive economies (with agriculture being a more important sector), they are often close to climate thresholds (e.g., for outdoor labor productivity efficiency or crop tolerance levels), and they have lower adaptive capacity.[33]

This means that even if the Paris Goals are achieved, the economic costs of climate change in Africa are projected to be large, and it is likely that **Africa will experience higher relative impacts than most other world regions, even though it is the least responsible for global GHG emissions.** If the Paris goals are not met, then the economic costs in Africa could be extremely large and climate change will fundamentally affect development and growth objectives for the African continent.

Our GCA analysis finds that there is less consensus on the exact size of the economic costs of climate change in Africa and on which regions and specific countries in Africa will be most affected, though most studies report significant economic costs over the next few decades (at several percent of GDP per year), rising significantly (to more than 5 percent and plausibly more than 10 percent for some countries) for high-warming scenarios in the longer term.

There are now a reasonable number of global, regional and national studies that present results for the economic costs of climate change in Africa. Our review finds that they report a very wide range of results. This range is influenced by the future scenarios, i.e., whether the world is on a 2°C or 4°C pathway by the end of the century relative to pre-industrial temperature levels (captured by consideration of different Representative Concentration Pathways or RCPs). They also vary with the climate model projections for a given scenario, i.e., across the ensemble of climate model projections. There are also major differences in which sectors and impacts are included, including market and non-market sectors, and whether wider economic effects (e.g. trade) are included. Because of this wide variation in results and the parameters of coverage of different studies, it is not possible to present definitive results, at least with confidence (see Box 2). Nonetheless, useful insights do emerge from our review.

Box 2. Estimates of the Economic Costs of Climate Change in Africa from the Literature

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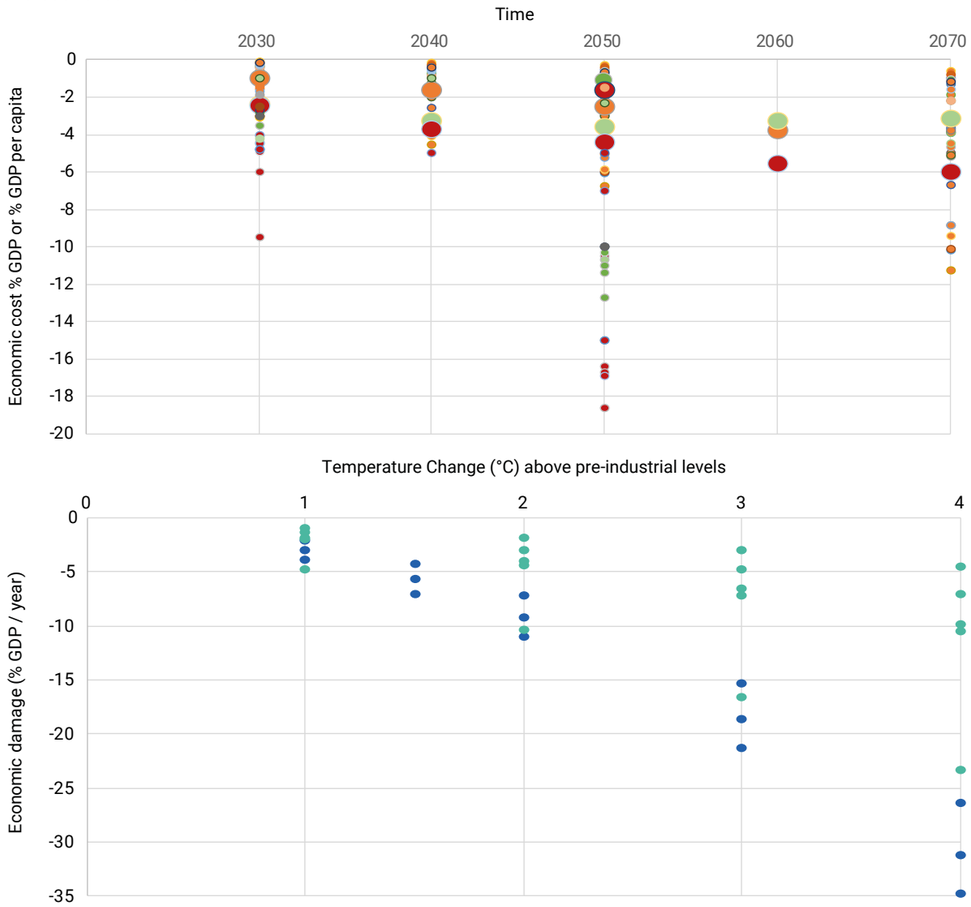
As highlighted in the main text, there is a wide range of reported values in the literature on the economic costs of climate change globally and in Africa. These are reported in a forthcoming Supplementary Research Paper. These reflect the scenarios considered, i.e., low- or high-emission pathways, the sectors and impacts considered, and the type of study or model used (for example, integrated assessment, CGEs, or econometric studies). There is also a wide range of values from the consideration of uncertainty, whether from climate model projections, impact assumptions, or monetary valuation. Summary values can be presented in terms of the impact over time (for different scenarios, e.g., RCP2.6, RCP4.5) or for different global warming levels (e.g., 2°C, 3°C) though as results are normally the sum of climate and socioeconomic change, it is stressed that time matters.

A consideration of different studies provides an illustration of the size of reported estimates. Many integrated assessment models estimate lower values. For example, De Bruin and Ayuba (2020)[34] report damages in Africa of 1.1% to 1.6% of GDP per year by 2050, and 0.6% to 2.8% by 2100, for RCP2.6 and RCP8.5 scenarios respectively. Many CGE studies report higher values than these. For example, the Bosello et al., (2021) estimates GDP losses for Africa of 3%, 4.5% and 6% per year for RCPs 2.6, 4.5 and 6.0 respectively by 2060. Kompas et al. (2018)[35] report values for a selection of African countries at between 0.3% and 6.7% by 2050 for a 3°C scenario per year, rising to 0.6% to 11% of GDP by 2070, but also report much higher damages for 4°C outcomes, especially for African LDCs (up to 27% of GDP). Many econometric studies present high estimates. AfDB (2019)[36] and Baarsch et al. (2020)[37] estimate losses at 0.6% to 3.6% of per capita GDP even by 2030, rising to 5% to 10% by 2050 for low- and high-warming scenarios, and report that some of the most affected countries in Africa could lose up to 15% of GDP by 2050. However, Kahn et al. (2019)[38] report lower values, with estimates of 0.1% to 4.2 % loss of GDP per capita for individual African countries in an RCP8.5 scenario in 2050, rising to 0.2% to 12.6 % by 2100, but lower and even positive values for RCP2.6.

A selection of recent results are presented in the figure below. Mostly, they indicate important economic costs in Africa in the short term (e.g. 1–5 percent of GDP per year), but rising significantly over later decades, especially for high-warming scenarios[39] (to more than 5 percent and in some studies and countries to more than 10 percent per year). Under the latter high-warming pathways, the economic costs projected from many studies would have extremely severe consequences in Africa.

There are also large differences in the relative impacts projected in different regions and countries in Africa, which means it is unclear where economic costs will be greatest. For example, Kompas et al. (2018)[40] identify highest economic costs as a percentage of GDP in western Africa; Baasch et al. (2020) identify the highest impacts in western and eastern African countries; ADAPTCost (2010)[41] in northern Africa; and Kahn et al. (2019)[42] in southern Africa. These differences often emerge from different methods (e.g., econometric versus IAMs), and depend in part on the sectors covered (e.g., econometric studies omit sea-level rise). The studies also show different relative impacts by sector. Some studies show highest impacts for the coastal impacts, others for health, and others for agriculture. It is also worth noting that study results also vary with the consideration of socioeconomic scenarios,

Figures 1 and 2: Selection of economic study findings over time for increasing temperature levels for regions and countries in Africa



Source: Authors

Data shown are from a series of recent studies, for low (green), medium (orange) and high (red) warming scenarios, including World Bank (2010),[43] OECD (2015),[44] Kompas et al. (2018),[45] Baarsch et al. (2020),[46] AfDB (2020),[47] Bosello et al., (2021),[48] De Bruin et al. (2020),[49] and include regional studies for Africa and country studies. Small circles represent country studies, large circles represent regional studies. Studies are plotted on the same scale, but they report slightly different metrics (e.g., % of GDP, gross damages [including non-market impacts] as an equivalent % of GDP, % GDP per capita).

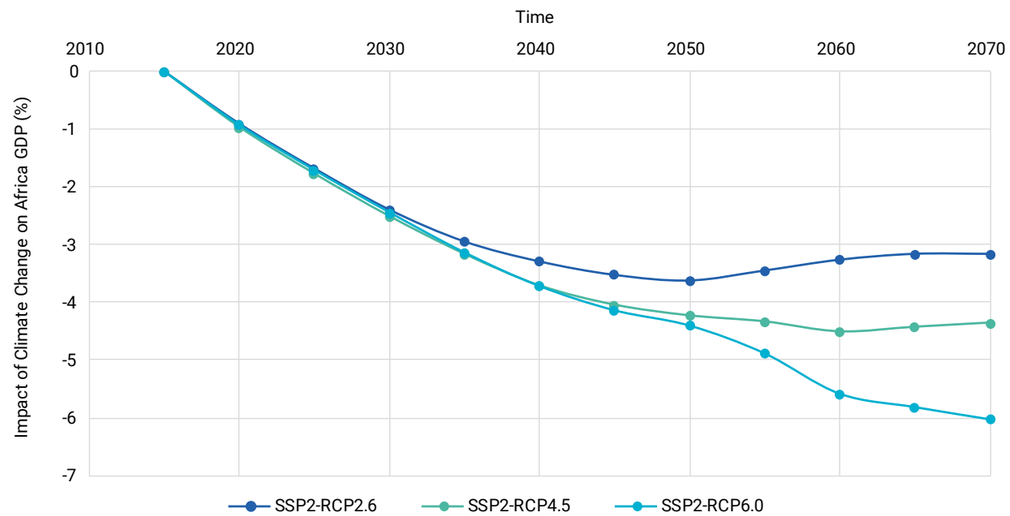
and which scenarios are included, as well as the assumptions on development trends and vulnerability over time. That is, factoring in development trends can reduce the climate impact in some sectors or regions.[50]

Our GCA analysis of the results also provides another key insight. **Only adaptation can reduce the economic costs of climate change in Africa over the next 20 years. Africa needs to scale up adaptation now.**

International mitigation policy is the only way to avoid the economic costs of high warming pathways, i.e., above 2°C relative to pre-industrial levels. Given the extremely high impacts in Africa from such scenarios (see Figure 2), the need for early and ambitious global mitigation action is paramount. Without this, Africa will suffer extremely high impacts, as seen in the figure above, that would be likely to reverse recent economic and development gains. In such a case, climate change will mean it will take longer for the LDCs and LICs in Africa to achieve middle-income status. The impact of climate change on growth by mid-century could be equivalent to almost a lost decade of economic growth.[51]

However, while ambitious mitigation will provide huge benefits by avoiding these high warming scenarios and the associated economic costs, the benefits of these policies have a relatively limited impact in the short term. Mitigation primarily has benefits after 2040, due to the inertia in the temperature response to GHG concentrations.[52] Even under ambitious mitigation scenarios, therefore, there will be high economic costs for Africa. This can be seen in Figure 3. This presents the projected changes in economic costs for Africa for a number of different scenarios (RCPs) and shows that they only diverge significantly after 2040,[53,54] because the economic costs follow the temperature (and wider climate change) projections. Economic costs diverge strongly after 2040, but this means there are still significant economic costs for Africa in the next 20 years. This finding is critical. To put this another way, **the level of climate change in the next 20 years for Africa is already locked in, and these impacts can only be reduced by adaptation.**

Figure 3. Estimates of the economic cost of climate change for Africa for different climate scenarios over time



Source: Bosello et al., (2021)[48]


Photo: subman/iStock

Climate change will affect public finances: it is now considered a financial and a macroeconomic risk. There is a need to consider climate change in public financial management.

Our GCA analysis shows that climate change is now recognized as a financial risk,[62,63] including by many of the world's central banks, including in Africa,[64] and by International Finance Institutions.[65] These financial risks include physical climate risks from the changing climate, i.e., the climate risks outlined by the models above.[66] In line with the economic cost estimates above, these physical climate risks have the potential to be large in Africa, especially as they compound other issues of lower economic diversification, less climate-resilient public infrastructure, and lower capital market flexibility compared to other world regions.

Severe weather and climate shocks (natural disasters) are already the second-most frequent source of contingent liabilities in emerging markets, and they can be a direct cause of sovereign defaults from their impact on government finances and economic growth.[67] For example, Hurricane Ivan in 2004, which resulted in damages of over 200 percent of GDP, was the direct cause of Grenada's subsequent debt restructuring. Further hurricanes in 2003 and 2004, which damaged the agricultural sector, were contributing factors in the Dominican Republic's debt restructuring in 2005.

The vulnerability of countries worldwide to existing climate shocks is already correlated with sovereign credit ratings.[68,69] These issues are more important for developing countries, including in Africa and especially sub-Saharan Africa, as they are driven by the greater importance of agricultural GDP (a climate-sensitive sector), the quality of infrastructure, and the level of institutional strength. Indeed, one study,[70] albeit somewhat controversial, reports that climate risks are already reflected in ratings for the vulnerable countries, and have led to an increase of approximately 10 percent on interest costs on government debt, in turn putting upward pressure on interest rates.

As highlighted in the Finance chapter of this report, African nations already face low sovereign credit ratings from the three major credit rating agencies or CRAs (Moody's, Standard & Poor's, and Fitch). Looking forward, rating agencies,[71, 72] expect climate change to be a global mega-trend impacting sovereign creditworthiness. For example, these look at the impact that climate change could feed through to sovereign creditworthiness on economic performance (e.g., growth prospects), fiscal performance (public finances as tax revenues, additional government budget for disaster recovery, reconstruction), and external performance (e.g., exports of agricultural products for foreign currency). The higher projected economic costs of climate change in Africa than in other world regions, therefore poses a disproportionate financial risk to the region. However, the size of these climate risks is uncertain (see earlier discussion on economic costs, (Figures 1 & 2), and thus the potential impacts on public finances are subject to the same caveats as identified in the economic section above.

A number of studies have investigated these issues and assessed the potential impact of climate change on sovereign ratings globally, including Moody's (2016),[73] ICBS and SOAS (2018);[74] Volz et al. (2020),[75] IMF (2020),[76] CFA (2020),[77] Klusak et al. (2021).[78] The detailed review is presented in the forthcoming Supplementary Research Paper.

In summary, we conclude that climate change is likely to affect sovereign ratings globally and in Africa. This is due to the potentially negative effects of climate change on the criteria that are used by rating agencies, which center on economic, fiscal and institutional strength, as well as other factors such as monetary flexibility, international investment position, event risk and others, noting that the exact factors vary with each agency.

The analyses of climate change and sovereign ratings identify multiple transmission channels through which physical climate risks could affect these criteria, and thereby the ratings. These include direct effects from rising hazards (event risk), but just as importantly, a broader set of pathways. These include the potential for climate change to reduce government revenues and increase government expenditure, reduce external performance (exports), increase contingent liabilities, increase external vulnerability, damage infrastructure assets and services, increase social costs, increase government debt levels, and reduce economic growth. This combination will lead to elevated macro-financial risks and Africa has been identified as one of the potentially most vulnerable regions.[79]

Analyzing these pathways is challenging, not least because of the wide range of reported impacts (as illustrated by Box 2 and Figure 2). There is high confidence that countries in Africa could face potential risks, but the exact size of the impacts remains difficult to predict with confidence.

The limited studies to date that look at sovereign risk have used a simpler approach where susceptibility is assessed in terms of exposure and resilience, rather than from analysis of economic impacts, with many existing studies using the ND-GAINS index[80] to assess these two components. These studies show relatively large impacts in vulnerable countries internationally, in terms of basis points or rating notch downgrades, and all show disproportionately high impacts on sovereign ratings in Africa.[81] As a result, climate change is anticipated to increase the cost of government borrowing and the cost of capital of climate-vulnerable countries in Africa, though these findings should be interpreted with caution with regard to the size of the effects.

A further insight of our analysis is that climate change could affect the public finances of countries by increasing government expenditure and public debt, as well as by reducing government revenues, all of which affect fiscal stability. Again, the size of these impacts will be influenced by the level of economic impacts that occur. Climate change[82] will also affect the affordability of insurance in higher-risk countries, not least because there is strong evidence of rising hazard levels from climate change. This could therefore increase the level of uninsured assets. Climate change is also projected to influence the private sector, from potential risks to assets and higher operating costs (by raising insurance costs, increasing supply chain disruption, increasing operating costs/ losses), and potentially lower revenues, affecting cash flow and subsequent company performance (profit and loss, balance sheet values).[83,84] This will influence expected rates of return for investors, and could affect international investment attractiveness and thus flows into perceived high-risk countries.

Our GCA analysis looked at some early assessments that examine the risks to the financial sector and equities. For instance, one study,[85,86] estimated very large climate impacts in terms of the 'expected value at risk' of global financial assets, albeit in the long term. Another report assessed the potential impacts on financial markets and equities,[87] considering the potential effects on asset classes and return

expectations, and concluded that climate change risks could impact investment returns for emerging market equities, especially in the most affected sectors, such as agriculture. Another study[88] estimates that that under more extreme climate scenarios, short-term shifts in market sentiment could lead to economic shocks and losses in equity investment portfolio value, with some areas such as real estate and infrastructure assets identified as key concerns due to the high physical climate risks. Overall, these studies highlight the potential risks. Given the size of the economic costs projected for Africa (Figures 1 and 2), these are anticipated to be important for the continent, but the size and speed of these risks remains uncertain.

Interestingly, and worryingly, awareness of these financial impacts could circulate through markets before the actual climate change of impacts occur, because of market anticipation of future impacts.[89] Climate-related financial disclosure, as encouraged by the Task Force on Climate-Related Financial Disclosures (TCFD), could therefore be detrimental for high-risk areas, including Africa. As markets start to price in climate risks, commercial banks, insurers and investors might be more cautious, or even withdraw from particularly vulnerable regions or countries.

Climate change will have disproportionally more impact on the poorest and most vulnerable in Africa, and could increase the number of people in poverty.

As well as differences between regions, the impacts of climate change will have marked distributional variations within groups in society. Climate change is projected to affect the poorest and most vulnerable most in relative terms (as a percentage of income) as those with lowest incomes have higher vulnerability and lower adaptive capacity.[90] There is also likely to be a strong distributional contrast between urban and rural areas, with a general expectation that larger relative impacts will occur for rural agricultural livelihoods. Climate-related shocks already keep people in, or drag them back into, poverty; they affect the poorest the most due to their greater exposure and vulnerability, but also because they have fewer resources. Climate change is also projected to increase these impacts globally, affecting economic growth and poverty reduction targets. This could result in an increase of 122 million people globally living in extreme poverty by 2030[91] of which the highest relative proportion, up to 43 million by 2030, are in sub-Saharan Africa.[92] Even if development is rapid, inclusive and climate-informed, up to 12 million people could be pushed into poverty in this region. Considering the economic consequences, climate change can increase inequalities between countries in Africa (delaying convergence by approximately 10 years in terms of the Gini index). It could widen the inequality gap within countries.

THE ECONOMIC BENEFITS OF ADAPTATION

Because it is challenging to estimate the economic costs of climate change, it follows that it is also challenging to estimate the economic benefits of adaptation in reducing these costs. Therefore, many of the same challenges that were highlighted in Box 1 apply for our analysis on the economic benefits of adaptation. However, there are also additional challenges in estimating the effectiveness of adaptation as well as its costs.

Proactive planned adaptation is difficult to do in practice, because of the uncertainty around future warming scenarios and climate model projections. Long-term modeling studies therefore do not reflect the reality of early adaptation decision-making. A further issue is whether the adaptation deficit is included in the estimated design and costs of adaptation. This deficit relates to the adverse impacts of current climate variability and extremes. Many African countries have a considerable adaptation deficit today, above the level that might be considered economically efficient. While this adaptation deficit is not caused primarily by climate change, future adaptation will be less effective (and/or will involve higher costs) if it is not first addressed.

As a consequence, any aggregate estimates of the economic benefits or costs of adaptation, at the African or national level, need to be treated with caution. Nevertheless, as with the discussion above, there are many insights that the studies from the literature provide. In this analysis, we have conducted a detailed literature review to identify robust findings from the evidence. These are presented below.

Adaptation can reduce the economic costs of climate change in Africa very effectively. A number of the economic studies of climate change assessed for this report (described in the section above) also include analysis of adaptation. Indeed, there are a growing number of global, regional and country studies that consider evidence evidence for Africa. These find that adaptation can reduce the economic costs of climate change very significantly and cost-effectively for both low- and high-warming pathways. It is noted, however, that adaptation will cost more under high-warming scenarios and there

Photo: Sean Pavone/iStock

There has been a very considering strengthening of ambition in adaptation. Adaptation really is coming of age. Countries are ready for new ambitions on adaptation, and they are ready for much scaled up financing on adaptation, too."

Ban Ki-moon, GCA Board Chair & 8th UN Secretary-General
High-Level Dialogue "An adaptation acceleration imperative for COP26", September, 2021

may be significant limits to adaptation for high-warming pathways. It is also highlighted that Africa will still face high residual costs after adaptation, and that these levels will be greater under high-warming scenarios. Adaptation should therefore be seen as a complement to mitigation, not a substitute.[93]

For example, the African Development Bank reports high economic benefits from adaptation, as well as potential benefits for macroeconomic stability.[94] This study draws on an African-specific IAM to look at the economic benefits (and costs) of adaptation, and it indicates the relatively high levels of damage that can be reduced by adaptation in Africa (26–63 percent) under an optimal framework, though this still involves considerable investment, reported at 0.3 to 0.6 percent of GDP by 2050.[95] The effectiveness of adaptation is confirmed by country studies of impacts and adaptation in Africa, including Uganda,[96] Ethiopia, Ghana, Mozambique and others.[97]

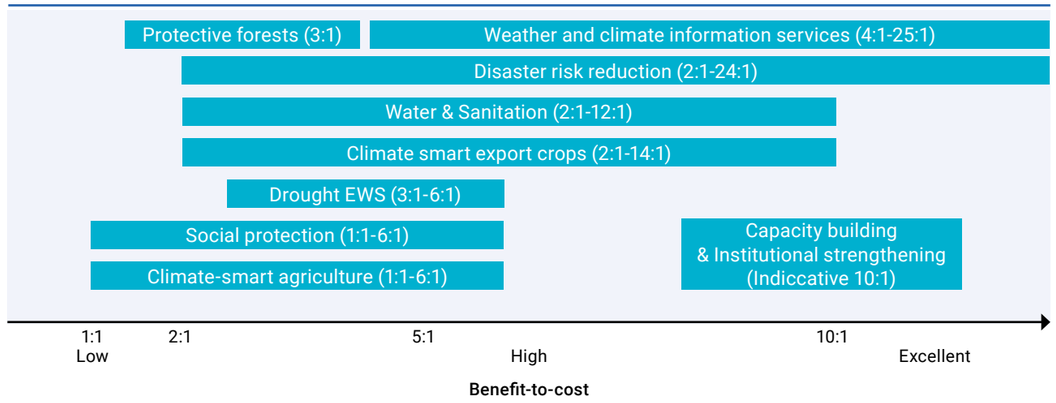
Dropping down to the sector level, adaptation is very effective in reducing the economic costs of climate change in Africa. There are several findings that consider coastal regions and sea-level rise for Africa or African countries and report on the very high benefits of adaptation, and low residual damage after adaptation.[98,99,100] These indicate climate impacts could be reduced by more than an order of magnitude with adaptation, and that such investment is relatively modest (though it will be more important in GDP terms in low-income countries). In many cases, coastal adaptation has high benefit-to-cost ratios[101] but not in all cases. Similar findings are found for river flood adaptation,[102] and these report that adaptation will lead to large decreases in future damages (as a percentage of GDP) in Africa (as well as other world regions), and with positive net present values in many parts of the continent. Recent studies also report similar positive findings on reducing the water gap (the gap between demand and supply), including for Africa,[103] and for adaptation for the main agricultural crops.[104]

Based on this review, we conclude that while adaptation is found to be highly beneficial, the amount of adaptation (and the cost) depends on the decision framework used, as well as the level of warming. The decision on how much adaptation to undertake involves trade-offs, because reducing residual damages to very low levels involves more adaptation and higher costs, and is therefore not optimal from an economic perspective (noting countries do not reduce current weather and climate-related impacts down to zero today). These are policy decisions, and will depend on the approach taken to setting policy (economic efficiency, acceptable levels of risk) as well as risk tolerance/preferences and even ethical choices, especially where the decisions involve risks of fatalities.

Early adaptation has high benefit-to-cost ratios In economic appraisal, options are usually considered using cost-benefit analysis. This assesses a policy, program, or project by estimating the economic benefits it produces over time, and compares these to the costs (capital, operating and maintenance costs) over time from a societal perspective, adjusting values in different time periods using discount rates. The results are usually expressed as the Net Present Value (NPV) or the benefit-to-cost ratio (BCR). An option that generates a BCR greater than one has a net positive economic effect.

While adaptation is context- and site-specific, there is growing evidence, including from GCA, that shows that early adaptation delivers high BCR ratios.[105,106,107,108] We have reviewed the information on adaptation economic studies in the academic and grey literature, **focusing on information for Africa specifically**, to identify the potential benefit-to-cost ratios for adaptation. This has focused in particular on short-term interventions, i.e., no- and low-regret

Figure 4. Adaptation benefit-to-cost ratios for a selection of options from africa-specific studies



Source: Authors

Note: The figure shows the indicative benefit-to-cost ratios and ranges for several adaptation measures. It is based on the evidence review undertaken for this report. It is stressed that BCRs of adaptation measures are highly site- and context-specific and there is future uncertainty about the scale of climate change. Actual BCRs will depend on all these factors.

interventions. The findings of the BCRs reported are summarised in Figure 4. The detailed review is presented in the Supplementary Research Paper.

This demonstrates that investing in adaptation generally leads to positive economic benefits. As shown in the figure, BCRs are mostly above 2:1 (i.e., a dollar invested generates double this in terms of economic benefits), and often above 5:1, which is high. Furthermore, many adaptation measures have important environmental co-benefits, and some, such as adaptive social protection, can address other drivers of vulnerability in terms of poverty reduction, especially in low-income countries.

Our review identifies several interventions that generate large, positive returns for a range of different climate hazards, across multiple sectors. These high returns are due, in part, to the existing adaptation deficit in Africa. Adaptation can deliver high economic benefits immediately by reducing losses or enhancing gains associated with the current climate (and extremes), as well as enhancing resilience to future climate change. However, as well as options that deliver adaptation, there is a need for capacity building. Capacity building has a high BCR (as shown in Figure 4) as it improves the efficiency and effectiveness of adaptation delivery.[109] Adaptation is also a core part of the COVID green recovery. The literature reports that a "good" green recovery has several key characteristics, including that investments can be made quickly ("shovel-ready"); that they are labor-intensive in the short-term and have high economic multipliers; and that they can contribute to the productive asset base.[110,111] Many adaptation measures perform well on these criteria. They include measures that target climate and disaster resilience (including nature-based solutions). There is an opportunity to include these adaptation investment opportunities in post-COVID-19 stimulus packages, as discussed in the COVID Recovery chapter of this report.

We conclude that there is a strong case to act now in a number of key areas. Delaying adaptation will increase costs.

Given the long timescales involved in climate change, it is not necessary to do everything now. However, in some areas it is important to act early. Delaying adaptation in these cases will make it much harder to tackle future climate risks and may make large future costs inevitable, as opportunities for building resilience could decline with time.[112] At the same time, there are some decisions and actions that can be delayed. A key issue is to distinguish what action is urgent, and what can be done later as part of an adaptive management approach. There are three areas where early action is needed and can be justified in economic terms.[113]

- First, Africa already experiences large economic costs from climate extremes today, and these are growing. There are therefore large net **economic benefits today** from reducing these with low- and no-regret actions such as weather and climate information services and climate-smart agriculture. These have high benefit-to-cost ratios, as shown in the figure above. While there is growing recognition of these options, there is a need to promote and share experience on the most promising ones to help scale up these early interventions.
- Second, in some areas there is a potentially large economic cost from delaying action. This involves decisions or investments (or a lack of decisions) that involve lock-in risks or path dependency, i.e., which could lead to very large future costs that will be costly to address later or are irreversible. There is often a one-off opportunity to avoid these risks now. A good example is with infrastructure or urban development, because of the long timespans involved. Infrastructure built over the next five years in Africa will operate under a very different climate to today. If future climate risks are not considered in infrastructure design, climate change could cause asset damage or failure, and affect operating costs and/or revenues.[114] Integrating climate resilience into infrastructure when it is designed and built therefore makes sense, and should have positive benefit-to-cost ratios (potentially of 4:1[115]). However, due to climate uncertainty, it is challenging to design climate-resilient infrastructure (and address other lock-in risks), and more support is needed for countries in Africa. The Transport and Energy chapter and the Urban Development chapter review in further detail this challenge.
- Finally, there are some extremely low-cost preparatory actions that can be taken to improve future decisions, effectively providing option values.[116] This involves developing adaptive management plans, especially for decisions that have long lead times or involve major but uncertain future change. Again, while these approaches have significant benefits, they can be challenging to deliver in practice.[117] So there is a need to build awareness and capacity for such adaptive management in Africa.

It is stressed that at the country level, all three of these priorities are needed, and this requires portfolios of interventions, since there is some emerging evidence that portfolios can deliver higher economic benefits than individual options alone.

We also found that while adaptation is beneficial, there are barriers and constraints that stop it from happening. There is a role for government and economic decision-makers to consider these and create the enabling environment for adaptation.

While Figure 4 shows the potential benefits of adaptive action, there are a range of barriers and constraints that make adaptation difficult in practice.[118] These various barriers can make it difficult to take action, even when it is clear that action is needed, and it would lead to economic benefits.

These constraints can include physical and ecological limits, technological limits, financial barriers, information and cognitive barriers, and social and cultural barriers. However, it is also important to consider these barriers from an economic perspective. The barriers to adaptation include market and policy failures, and there is a role for government (and economic and planning ministries) to consider these.[119]

One of the most common barriers to adaptation identified in this report is the issue of uncertainty.[120] The presence of uncertainty around future climate change translates into imperfect information, which is a market failure,[121] or information asymmetry, which acts as a barrier to adaptation by both public authorities and the private sector (individuals and firms). When public or private actors have inaccurate, incomplete or uncertain information they are unable to make the most appropriate adaptation decisions, or in some cases any decision at all.

There are also a range of other economic barriers to adaptation which include a range of market failures, or factors that prevent the private sector from delivering socially efficient adaptation and therefore justify government intervention.[122] A major economic barrier for adaptation concerns public goods and externalities. Many adaptation actions have public-goods or non-market dimensions that the private sector is unlikely to invest in (e.g., large-scale flood defenses). To put it another way, by acting rationally in their own interest, private companies will base their adaptation decisions on private costs and benefits, not those that are best from a societal perspective. It is a generally accepted role of government to address externalities, and thus there is a role to help deliver adaptation with a focus on public goods.

There are also potential barriers around misaligned incentives, where the costs of adaptation fall on certain individuals while the benefits accrue to others.

The market structures in place, whether monopoly, oligopoly or perfect competition, shape the incentives and affect the investment decisions on climate change adaptation, and may incentivize adaptation, and/or lead to over- or under-adaptation due to distortions.[123] The availability of finance is also an obvious and important constraint to adaptation, though this is discussed in greater detail in the Finance chapter.

Our GCA analysis also identified a set of policy, institutional and governance barriers to adaptation.[124] Policy constraints may arise when a regulation or a policy creates a barrier to effective adaptation. Policy barriers can also arise when there are conflicting or competing policy objectives, or a lack of clarity.

“With our partners, we intend to mobilize $25 billion in financing for the success of the Africa Adaptation Acceleration Program. It is time for developed countries to meet their promise of providing $100 billion annually for climate finance. And a greater share of this should go to climate adaptation.”

Dr. Akinwumi A. Adesina, President of the African Development Bank
Leader’s Dialogue on the Africa Covid-Climate Emergency, April, 2021

Photo: bennymarty/iStock

As adaptation is a fairly new theme in policy and development decision-making, the existing structures and/or the regulatory policy framework are often poorly aligned to its objectives. As an example, development objectives may not take into account the vulnerability of assets and people to climatic risks. Governance barriers occur when there is ineffective institutional decision-making and/or implementation of adaptation. These can constrain action, creating challenges or slow planning and implementation. There are often institutional barriers: for example the lack of a clear mandate and responsibility, or of coordination and resources. This is a particular problem for adaptation, which frequently involves cross-cutting themes, and thus multiple actors and institutions with different objectives, jurisdictional authority and levels of power and resources. There is often a lack of coordination (or clear leadership or mandate), as well as (internal) competition for resources and policy control, that can all act to make adaptation harder to deliver. These institutional aspects may be compounded by the problem of competing priorities, and the need to address short-term priorities (rather than long-term climate risks), inherent in political and medium-term (5-year) planning cycles which are commonly used in Africa.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What is clear is that effective adaptation will require a clear consideration of the role for government intervention—as in all areas of public policy—and that there is a need to integrate economic thinking and relevant line ministries in these decisions. This also requires consideration of the appropriate case for government intervention to address the barriers above, i.e., to establish what the case for government intervention is, as well as to design appropriate action to address these barriers and create the enabling environment for adaptation.[125]

Adaptation needs to be designed to reach the most vulnerable As highlighted above, the impacts of climate change are likely to have strong distributional variations, with particularly high relative impacts for low-income groups and those with the most vulnerability. Accordingly, adaptation interventions may reduce or reinforce these inequalities, because they may redistribute or create new vulnerability.[126] For example, adaptation may be undertaken by some households and private sector actors, notably those who have access to resources. However, such action is unlikely to benefit (or be taken up by) the poorest. As highlighted above, without appropriate signals, the private sector might not undertake the most appropriate level of adaptation, and might even increase the vulnerability of others or the system as a whole. Furthermore, there are additional challenges for implementing adaptation for the most vulnerable that makes it more challenging for public and private actors. For example, it is simpler to work on adaptation for a single major infrastructure project than it is to target tens of thousands of individual farm smallholders, even if the latter are highly vulnerable.

We found that there is therefore a danger that adaptation could increase inequality. Following from the section above, there is a role for government to put in place the right signals or conditions to ensure adaptation is fair and equitable, and that it also benefits the most vulnerable. This requires distributional considerations (and targeting) when planning and implementing adaptation. It may also include specific targeting of adaptation to the most vulnerable, e.g., with targeted policies such as adaptive social protection, noting these have been shown to have high economic benefits.[127]

Several key messages emerge from our analysis:

- Even if the Paris Goals are achieved of limiting temperature rise to well below 2°C above pre-industrial levels, it is likely that Africa will experience higher relative economic costs (as a percentage of GDP) from climate change than most other world regions, even though it is less responsible, both historically and in the present day, than other major world regions for global GHG emissions.
- If the Paris Goals are missed, these economic costs will be very significant in Africa, and potentially catastrophic for development and poverty reduction, as well as long-term growth for the African continent.
- There is less agreement on the exact size of the economic costs of climate change in Africa, and on which regions and specific countries in Africa will be most affected in economic terms. Most studies report significant economic costs over the next few decades (several % of GDP per year), rising significantly for high-warming scenarios in the longer term (to more than 5 percent and plausibly more than 10 percent for some countries).
- A further insight is that impacts will also be unevenly distributed within countries, and climate change is likely (in relative terms) to affect the vulnerable the most.
- Climate change is a major macroeconomic risk and is projected to affect governments and public finances.
- Recent studies indicate that climate change could reduce the sovereign credit ratings of African countries, increase the cost of borrowing/cost of capital, and increase the level of uninsured assets and contingent liabilities. The impacts of climate change on public finances, combined with the need to finance adaptation, could add pressure to debt levels in Africa.
- These same trends could affect the profitability of companies in Africa, and could affect their attractiveness for foreign investment.
- Financial market anticipation of these various impacts on the public and private sector could exacerbate and bring forward climate-related economic costs in Africa.


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- The level of climate change in the next 20 years is already largely locked in, and the potential impacts of these changes can only be reduced with adaptation. Global mitigation action is critical, but it will primarily reduce impacts from mid-century onwards. Thus Africa needs to scale up adaptation now.
- More positively, adaptation can reduce the near-term economic costs of climate change very cost-effectively. A literature review undertaken for this report finds many early adaptation options have high benefit-to-cost ratios. This includes investing in capacity building, as this improves the effectiveness of delivery.
- It is also important to prioritize early adaptation, and there is growing evidence that portfolios of interventions can deliver higher economic benefits than individual options alone.
- However, important barriers to adaptation exist, and these require targeted interventions by governments for effective adaptation, and the management of distributional considerations to ensure benefits reach the most vulnerable.

In response to these challenges, our analysis identifies several policy recommendations and potential solutions.

POLICY RECOMMENDATIONS

There is a need to integrate climate change in public financial management, as well as more fully into development policy and budgetary cycles. This involves moving beyond national adaptation plans to integrate climate change in national and sector development planning. This needs a stronger lead from economic and financial ministries (in coordination with sector ministries), combined with greater understanding, coordination and management of climate risks across sectors. Countries will increasingly need to demonstrate they are managing climate risks to reassure financial markets and investors, but they will need support to do this. IFIs and bilateral donors can help governments improve climate risk financial management.

Delivering this will mean more direct integration of climate change risks and adaptation budgeting in public financial management, and into development planning and budgeting cycles. Clearly, this starts with countries assessing the risks of climate change to the economy and on public finances. This information then needs to cascade into the integration (mainstreaming) of climate change adaptation in long-term country visions (e.g., for 2040 or 2050) and medium-term (5-year) plans, as well as more generally in macroeconomic forecasts and planning. This needs to happen in the relevant ministries, notably finance ministries. For example, the Helsinki Principles,[128] from the Coalition of Finance Ministers for Climate Action, includes six common principles, including the need to take climate change and the need for Paris alignment into account in macroeconomic policy, fiscal planning, budgeting, public investment management, and procurement practices.

There have been positive examples of such action internationally, though there is a need to scale up. This includes Climate Public Finance Tracking (Climate Budget Tagging),[129] which allows countries to identify how much of the government budget is currently being spent on adaptation (and mitigation) activities and creates a climate mainstreaming cascade across subsequent development planning and budgeting processes. Several countries have undertaken such exercises, including in Africa (e.g., in Tanzania, Uganda and Ethiopia – see insert on this topic). It also includes initiatives such as the UNDP Poverty-Environment Action for Sustainable Development Goals initiative, which has sought to integrate climate into development planning, with pilots conducted in Malawi, Mozambique and Rwanda. These approaches have important advantages, as they can leverage funding of underlying development budgets, and can nudge national and sector development plans along climate-smart pathways. However, there is still work to do to translate these approaches into systematic input to inform future plans and budgets.[130] These issues also need to be integrated in national development support and financing from development partners and International Finance Institutions, for example in country partnership programs.

More broadly, there is an opportunity for greater participation of African central banks in the network for greening financial systems.[131] This could extend to integrate climate-related financial risks in macro-and micro-prudential supervision and even to integrate climate risk/resilience into developing-country financial policy and regulation.[132]

There also needs to be more action to reduce climate risks. While this will require investing in adaptation (see next point), there is also a need to improve structural and financial resilience more generally. This might include enhancing economic diversification and policy management, fiscal buffers, insurance schemes, etc., to help the public finances with the challenge of climate change in particular and economic development in general.[133] It might also include innovative financing instruments linked to climate change to reduce the debt burdens in the case of catastrophic events.[134]

Given the impacts of climate change will be uneven, there will be a need to support more vulnerable regions and countries in particular. Across all of these areas, there will be a need to communicate that action is being taken and that risks are being addressed with credit agencies, financial markets and investors. Communication with these stakeholders would benefit from support from development partners, multilateral development banks, and International Finance Institutions.

Underpinning all of this is the need for better access to high-quality historic, current and projected future climate data—and investment in the training and support needed to interpret this data and include it in public financial management and development planning. There is some evidence on the success factors for such adaptation mainstreaming.[135,136] These include the presence of a high-level champion, the involvement of strong ministries (notably Finance), and the availability of climate finance and technical assistance. Supportive policy frameworks (and commitments) can also help push forward the

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process of mainstreaming, as can the presence of coordination mechanisms across government that support mainstreaming goals, and information and tools. Such activities could be supported by DPs and IFIs through technical assistance and funding (e.g., policy-based lending), as well as from country-to-country sharing of practice. There is also likely to be a role for such partners to help provide macroeconomic support and innovative solutions to help particularly vulnerable countries directly.

Given the potentially large impact of climate change on countries' public finances and macroeconomic implications, there will need to be a rapid scale-up of adaptation in the next 20 years in Africa. It is important to strengthen the consideration of climate adaptation upstream (at a more strategic level in government policy and strategy, as well as MDBs), as well as to develop pipelines of bankable projects, considering both climate-proofing of planned development (e.g., resilient infrastructure), but also targeted adaptation projects (e.g., flood defenses).

This chapter shows the strong economic case for adaptation-positive benefit-to-cost ratios. However, a core challenge now is to scale up adaptation. To date, much of the focus has been downstream, at the level of individual projects, and there is a need to move the debate and analysis upstream—for example, to incorporate climate risks in early-stage planning of national infrastructure, rather than when it is being built. There are good examples of such action internationally and in Africa. For example, in Ghana, the GCA catalyzed a joint initiative between the Ministry of Environment, Science, Technology and Innovation, UNOPS, UN Environment and the University of Oxford's Environmental Change Institute to explore the performance of Ghana's energy, water and transportation system under climate change, and to identify actions at both the system-level and asset level that can help improve the resilience of national infrastructure.

There is also a need to develop investable project pipelines and facilitate the integration into the mainstream planning and investment pipelines of the country, for example by climate-proofing infrastructure. This may be supported by other activities, for example developing standards and codes that embed climate resilience at national level, or providing guidance for the integration of climate risks into public-private partnerships.

Clearly, this will require an increase in the financing of adaptation, which will in turn lead to issues for public finances, e.g., on debt levels and sustainability. These are discussed in the Finance chapter of this report, including external finance for many LDCs. However, delivering this in practice will also require institutional support and capacity building, and technical assistance, information and guidance.

There is an important role for governments to identify the strategic economic case for action, and to consider where and how best to intervene to create the enabling environment for adaptation, as well as to ensure it is effective, efficient and equitable. There is a need to integrate economic thinking when designing adaptation strategies and policies, i.e., to consider market and policy failures and where it is appropriate for government to act, and to design strategy and policy accordingly. This will require analysis of these issues by governments, and involve relevant ministries and expertise, and the translation of these into strategy, policy and development. As well as efficiency and effectiveness, there will be a need to design interventions to ensure the most vulnerable are not left behind, and to ensure there is the capacity to deliver. Many countries will require support to do this.

Looking forward, it will be useful to identify some metrics to measure the issues above, so as to allow changes in these metrics to be considered in subsequent versions of this report. This might center on the number of medium-term national development plans in Africa that have integrated climate adaptation, as well as the status of climate risks on credit risks of African countries. It might also assess the progress on addressing distributional issues in adaptation policy and programming.

Mainstreaming adaptation in national planning and finance

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With African economies projected to lose an average of 3.2 percent of annual GDP between 2021-2050 due to climate change, adaptation and climate resilience has to become an integral part of national planning and budgeting. This insert highlights efforts to mainstream climate change in national planning and finance in five countries in Africa.

Ethiopia

Ethiopia launched the Climate Resilient Green Economy (CRGE) Initiative in 2011 to pursue the triple goals of economic growth, net-zero emissions, and resilience. Its five main elements include:

1. The CRGE Strategy
2. iPlan, an integrated planning process for CRGE sector investment plans
3. CRGE units in line ministries and in regional states
4. A national monitoring, reporting, and verification (MRV) system
5. A CRGE Facility to mobilise, access, and blend climate finance

Ethiopia estimates that an investment of US$ 150 billion will be needed over 2010-2030 to implement the Strategy, which the Planning and Development Commission has integrated into the country's second Growth and Transformation Plan and Ten-Year Development Plan. Climate change is a central pillar of the Ten-Year Development Plan, which reflects the submissions of different sectors. Ethiopia has also taken steps to mainstream climate change in subsequent three-year plans and in planning at the '*woreda*' or district level.[137]

In 2013, the Ministry of Finance established a dedicated CRGE Unit and Secretariat to drive the climate change integration agenda, with technical guidance from the Environment, Forest, and Climate Change Commission (EFCCC).

Each ministry now has an independent climate finance unit that reports through the CRGE Unit to the CRGE Secretariat.[138]

The Ministry of Finance introduced a Fiscal Risk Statement in 2019, and is currently working on quantifying the risks associated with droughts and floods, two key climate-related hazards in the country. The Ministry of Finance is also in the process of strengthening public investment management (PIM) from a climate and environment perspective; and developing a consolidated climate budget tagging and tracking system, with a pilot expected to be ready in late 2021.

Finally, Ethiopia plans to be the first country in Africa to pilot the Public Expenditure and Financial Accountability (PEFA) climate module, with an assessment of its performance planned for 2021. There are also ongoing discussions to establish a domestically financed climate fund proposed by the Ministry of Finance, which is expected to get 0.5 percent of the annual budget to restore degraded land and fund afforestation and reforestation.[139]

Uganda

The priority of Uganda's Nationally Determined Contribution (NDC), which is based on a 2015 National Climate Change Policy, is to reduce the climate-change vulnerability of its population, environment, and economy by promoting adaptation in agriculture, livestock, forestry, and infrastructure. The NDC emphasizes human settlements, social infrastructure, transport, water, energy, health, and disaster risk management. Sustainable land management and climate-smart agriculture will be scaled up to increase resilience at the grassroots level.[140]

The Ministry of Finance, Planning and Economic Development (MOFPED), the National Planning Authority (NPA), and the Ministry of Water and Environment's Climate Change Department are currently spearheading the NDC implementation and revision. This arrangement has encouraged the revision process to span across sectors and include multiple stakeholders that include national, sub-national, and non-government entities.

The tripartite group has also led efforts to mainstream climate change into national planning and budgetary processes.[141]

Uganda has mainstreamed climate change in Uganda Vision 2040,[142] and climate change is one of the strategic programs in the Third National Development Plan (NDP III) 2021-2025.[143]

Climate change has also been identified in Budget Call Circulars as a key crosscutting issue since the 2017-2018 financial year. MOFPED's first fiscal risk statement for 2019-2020 featured climate change as a driver of extreme weather that endangers economic growth and social welfare, with potentially significant consequences for the national budget through unplanned or emergency spending. Since then, climate change has been qualitatively featured in annual fiscal risk statements.[144]

In 2018, MOFPED and the NPA partnered with the World Bank to develop a paper on natural capital accounting and a country-adjusted macroeconomic report. This provided quantitative estimates for NDP III to consider the contribution of natural assets to the economy, and incorporate risks to natural resources from climate change.[145] In the same year, MOFPED introduced climate budget tagging, with support from the World Bank for a climate budget tagging manual. It was piloted in four ministries and four local governments, but its implementation was delayed, partly due to the COVID-19 pandemic and limited dedicated administrative capacity.

Uganda has mainstreamed climate change in its well-established performance-based budgeting system. In the last three years, PIM has become a focal point of public financial management reform in the country, leading to the creation of a draft national PIM policy. Finally, Uganda is in the process of drafting a National Climate Change Bill to support implementation of the National Climate Change Policy. The passage of the Bill will ensure that procurement standards include climate change factors, and will roll out the budget tagging methodology.[146]

Kenya

Kenya's NDC aims to ensure a climate-resilient society by mainstreaming adaptation into its medium-term plans and Country Integrated Development Plans (CIDP); and by implementing adaptation measures. The Climate Change Act of 2016 mandated the establishment of Climate Change Units in all counties and ministries to mainstream climate change activities within planning and budgeting.[147] A National Climate Change Fund was launched in the 2018-2019 financial year, and County Climate Change Funds (CCCF) have been piloted in five counties.[148] Kenya has also recognized climate change as a risk to the country's development in Kenya Vision 2030, launched in 2008.

The National Action Plan (NAP) for 2015-2030 and the National Climate Change Action Plan (2018-2022) further detail the government's climate change ambitions, while the National Climate Change Framework Policy (2018) provides an explicit commitment to integrate climate change considerations into planning, budgeting, implementation, and decision-making at the national and county levels, and across all economic sectors. Finally, the National Climate Finance Policy (2018) promotes the establishment of legal, institutional, and reporting frameworks to access and manage climate finance.[149]

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The CIDP embraced decentralization and enlisted the Council of Governors and county governments to establish the CCCF. The CCCFs are managed by county authorities, and receive funds from the national budget, donors, and international climate funds. They provide financial support to counties to propose, prioritize, and implement adaptation measures, including for local efforts to mainstream climate adaptation, and gather data on local risks, hazards, vulnerabilities, and adaptation measures.[150]

Kenya has also introduced various plans, policies, and interventions to integrate climate change into the national budgetary system. For example, the 2020 Budget Call Circular outlines priority mitigation and adaptation interventions and details Kenya's system of climate budget tagging. The country also has a separate system for reporting disaster-related expenditures by ministries, departments, and agencies. The national Budget Policy Statement (equivalent to a budget speech) recognizes the need to reduce exposure to climate-related risks and disasters, and consequent impacts on the budget and economy. Over time, this has led to the establishment of the Disaster Risk Financing Strategy, which proposes financing options to reduce the impact of primary disaster risks. Kenya had sovereign insurance for drought but ended it because of its cost, reflecting the inability of governments in Africa to overcome the barrier of high upfront costs for climate risk insurance. The country was also a member of the African Risk Capacity's risk insurance pool until 2017.

Kenya's PIM program incorporates climate risk, and in 2015, all ministries, departments, and agencies were required by law to evaluate the effects of climate change on programs and activities. Finally, Kenya is considering issuing a green bond. Despite Kenya's efforts to mainstream climate adaptation, inadequate social inclusion has limited the impact of its resilience-building efforts.[151]

Rwanda

Rwanda's Ministry of Agriculture has placed adaptation at the center of its plans to boost the productivity of coffee and tea production — the country's primary export industries — as global temperatures rise.[152] In 2011, Rwanda launched a Green Growth and Climate Resilience Strategy (GGCRS) that set out actions and priorities on climate change adaptation and mitigation, including how these would be mainstreamed into economic planning.

GGCRS is now being revised to include a carbon neutral target by 2050. The strategy has 14 programs of action as a basis for strategic and sectoral programs. These include the NDC, *Vision 2050*, the National Strategy for Transformation, sectoral policies, sectoral strategic plans, the Strategic Programme for Climate Resilience (SPCR), and Sustainable Energy for All (2015-2030).[153] A National Environment and Climate Change Policy that aims to achieve a climate-resilient nation with a clean and healthy environment was enacted in 2019.

Most of Rwanda's interventions in climate budgeting and finance have focused on budget preparation processes. For example, Rwanda starts its budget process with a review of fiscal risks, as required under the East African Community Monetary Union. This is a new process, launched in 2020-2021, and led by the Ministry of Finance and Economic Planning's Macroeconomic Department. Climate change has featured in Rwanda's budget guidelines since 2011, championed by the Ministry of Environment, along with climate budget tagging. The tagging process is not built into the Integrated Financial Management Information System, but is a standalone exercise conducted annually by the Ministry of Finance and Economic Planning and the Ministry of Environment. Climate change is also usually featured in the Minister of Finance's annual budget presentation.[154]

Rwanda has a National Fund for Environment – FONERWA – financed entirely from national budgetary sources and managed by the Ministry of Finance and Economic Planning. FONERWA finances elements that are not normally covered by the budget, including unforeseen climate-related emergencies like floods and drought.

Finally, Rwanda is in the process of developing green procurement guidelines, and introducing environmental standards into PIM. It is also considering revenue measures, developing a post-COVID-19 green economic recovery plan, and the introduction of a climate change budget statement from 2021-2022. The country has expressed interest in receiving support from the Collaborative Instruments for Ambitious Climate Action workstream of the UN Framework Convention on Climate Change, to explore the adoption of carbon pricing instruments.[155]

Kenya has also introduced various plans, policies, and interventions to integrate climate change into the national budgetary system. For example, the 2020 Budget Call Circular outlines priority mitigation and adaptation interventions and details Kenya's system of climate budget tagging.

South Africa

South Africa's NDC includes plans to develop an integrated National Climate Change Adaptation Strategy and Plan and operationalize it as part of implementing the National Climate Change Response Policy (NCCRP); and to integrate climate change in national development, subnational, and sector policy frameworks for 2020-2030, including the National Development Plan Vision 2030. The NCCRP highlights the government's commitment *"to mainstream climate change response into the fiscal budgetary process and so integrate the climate change response programs at national, provincial and local government levels"*.[156]

Most of South Africa's interventions on climate budgeting and finance have been initiated at the local government level. For example, local governments are required by the Built Environment Performance Plans to consider climate risks in investment planning. Johannesburg and Cape Town have also issued green bonds.

In 2010, South Africa introduced the Renewable Energy Independent Power Producer procurement program to address regular power shortages, and over-reliance on a single state-owned electricity provider, Eskom

In September 2020, the National Treasury partnered with World Bank to develop a climate budget tagging system. As a result, the 2020-2021 Medium-Term Expenditure Framework submission guidelines mentioned climate change for the first time, requiring provinces to consider climate risks in their budgets.

In October 2020, South Africa's post-COVID-19 economic recovery plan committed to various green stimulus measures, such as re-prioritizing planned investments in renewable energy, increasing investments to energy and water efficiency of buildings, and developing the forestry sector.

South Africa is also in the process of developing various plans to extend climate-related public finance management reforms, introducing climate-relevant fiscal instruments through an Environmental Fiscal Policy Paper, and tabling a climate change Bill in the national legislature.[157]

Conclusions

While significant strides have been made in integrating climate adaptation and resilience into long-term planning, standard macroeconomic 'fixes' may not ensure stability in an era of climate shocks. Systematic climate risk management for policies and projects is essential, for which better climate data, tools and resilience planning efforts are necessary.

Efficient and prepared government institutions matter, as do sectoral and cross-sectoral climate-centered policies and investment. Governments must continue to enable and reinforce climate-informed macro-level analysis through research on whole-of-economy modeling of climate impacts, debt sustainability analysis, public expenditure reviews, and poverty diagnostics.

Greater internal coherence is key to stronger climate action, with a clear recognition that development outcomes hinge on the management of climate risk across sectors and levels of government. Robust ownership of climate action (rather than simply a compliance response) follows more easily from greater internal coherence, and can speed up adaptation and resilience efforts.

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Viewpoint:
Reshaping the relationship between science and policy for informed adaptation action

Lessons from the Future Climate for Africa program

SouthSouthNorth

Future Climate for Africa (FCFA) is a research and development program in which more than 200 researchers worked to improve the global understanding of Africa's climate and to bring climate information into the policy-making process. Through targeted engagements with key institutions and decision makers on specific adaptation problems in 16 pilot studies across 13 countries in Sub-Saharan Africa, the program has supported the integration of climate information into 13 national and local policies, plans and investments and delivered 14 tools to support the uptake and use of climate information.

FCFA consisted of one pan-Africa research consortium, Improving Model Processes For African Climate (IMPALA), and four regional research consortia.[158] In order to influence policy, planning and investments within the context of each pilot study, co-production was used as a guiding principle for engagement. Co-production refers to the process of "bringing together different knowledge sources and experiences to jointly develop new and combined knowledge [that] is better able to support specific decision-making contexts."[159] In the case of FCFA, co-production led to researchers tailoring climate information to decision makers' needs to be better fit to inform adaptation planning, policy and investments.

Within FCFA, co-production was not only important to delivering relevant and useful climate information, but was crucial to bridging the divide between researchers, practitioners and decision makers. Each pilot project had its own co-production process, but they all utilized six common building blocks: (1) identify key actors, (2) build common ground, (3) co-explore need, (4) co-design solutions, (5) co-deliver solutions and (6) evaluate. This process helped to facilitate shared learning between all groups involved and strengthened relationships by building trust, creating shared goals and generating co-ownership of research. In-person meetings and regular virtual check-ins played a key role in maintaining these relationships while helping decision makers to engage in the research process, thus improving their receptivity to climate information. When key decision makers and stakeholders were asked in annual surveys[160] whether their engagement with FCFA had improved their appreciation of climate information and risks in decision-making, 100 percent of respondents stated they had an improved appreciation, with 75 percent of respondents noting significant improvements in their appreciation for information on climate risks (Figure 1).


Source: Authors

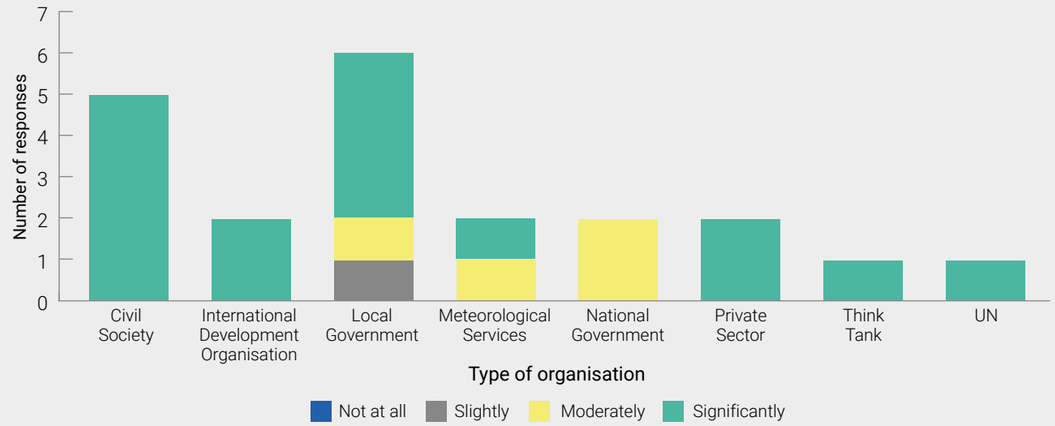

Source: Authors

Co-production was also beneficial in building the capacity of all involved. The interdisciplinary and co-production approaches employed by FCFA, in some cases, were the first instance in which climate scientists were able to directly interact with decision makers regarding climate research. Interviews with 12 partner researchers within the AMMA-2050 showed that 11 of these researchers felt their capacity to deliver climate information for decision-making had been partially or completely improved during the program.[161]

Bridging the gap between academia and policy and planning spaces was particularly important in helping these different actors to understand decision-making and bureaucratic processes and in shaping research outputs. For example, the embedded research approach adopted by FRACTAL placed researchers from local universities within local councils in southern Africa so they could develop a deep understanding of local government processes to tailor research towards their needs while strengthening relationships and institutional networks between local councils, universities and civil society. One example of these strengthened networks is the multi-stakeholder Lusaka Water Security Initiative (LuWSI), wherein the University of Zambia and the Lusaka City Council entered into an agreement to work together on water insecurity issues within the city.[162]

In other cases, co-production helped to build the capacity of climate scientists to co-explore user needs and develop information that was relevant to the decision-making context. For example the Ci4Tea project co-produced a range of climate metrics (i.e. climate variables specific to tea plants) that were particularly relevant for tea growers in Kenya and Malawi. Research results showed that tea farmers experienced regional differences in the climate sensitivities of crops (including heat wave frequencies, number of cold nights, number of rainy days and duration of dry spells) and that increasing temperature and rainfall variability requires prioritization of adaptations such as irrigation and climate-smart agriculture practices.[163]

Figure 1: Improved appreciation of climate risks



Working closely with decision-makers to understand their climate information needs also led to new knowledge on how climate information is packaged and communicated. While climate scientists and researchers often present decision-makers with complex data that has various levels of uncertainty, decision makers often only require high-level messaging. This realization led to the production of climate risk narratives. These narratives combine climate information with other data on the local socio-economic and environmental context to provide decision makers with a range of potential future scenarios. These narratives were found to be beneficial to both helping scientists to understand decision makers' needs and providing decision makers with a starting point to plan for the impacts of climate change.[164] For example, in Windhoek, Namibia, the climate risk narratives developed by the FRACTAL project were used as a reference point in the development of the Integrated Climate Change Strategy and Action Plan.

While FCFA's approach has helped to improve the capacity of researchers to produce user-relevant information, including decision makers and key stakeholders in the process also improved their capacity to use climate information. Key informant interviews with stakeholders that engaged with the AMMA-2050 indicated that 79 percent of decision makers felt the project supported the integration of climate information into decision making and planning.[165] One respondent highlighted the significant achievements made through co-production, saying, "[AMMA-2050] managed to achieve more understanding in one workshop than I have managed to achieve in the 20 years I've been doing this job."[166] This engagement not only improved decision makers' understanding of climate information but also increased demand for climate information.[167] For example, in the City of Ouagadougou, Burkina Faso, consultants working for the public sector in the city (Agence d'Etudes d'Ingénierie et de Maîtise d'oeuvre (AEIM) and Agence Municipale des Grands Travaux) requested intensity-duration-frequency (IDF) information from the project to inform road and drainage plans being developed for the city.

FCFA's collaborative and interdisciplinary approach was able to make significant headway in both the scientific understanding of Africa's climate and in approaches to support the integration of climate information into decision-making. While the full impact of the program will only be evident in years to come, it was able to create valuable networks and approaches that can be applied to future projects and programs to continue to support adaptation across the continent.


Source: Authors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