BRIDGING THE GAP – MOBILISING SOURCES

Africa's Adaptation Gap 2

TECHNICAL REPORT

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Foreword

In the midst of accelerating international climate negotiations, expected to culminate in a new agreement by December 2015, this second, Africa's Adaptation Gap Report provides a timely analysis of Africa's future in a climate-changing world, and with it, the continent's increasingly urgent adaptation needs. But it also provides an inspiring menu of options to address those needs internationally, regionally and domestically.

While the first Africa Adaptation Gap Report demonstrated how delaying action would result in exponentially rising costs down the road, the second report now turns to possible solutions to respond to this urgency.

Past global emissions already commit Africa to adaptation costs of USD 7-15 billion per year by 2020. So far, roughly USD 1-2 bn a year has been flowing to Africa for adaptation, through a variety of sources.

The report builds on the UNEP 2014 emissions gap report that showed global emission-reduction efforts are not yet at the level of what is required to put the world on track to hold global warming below 2°C. By 2050, Africa's adaptation costs could rise to USD 50 billion per year for a scenario holding global warming below 2°C, and up to USD 100 billion per year by 2050, if the world does not manage to turn away from the current path that could lead to more than 4°C warming by 2100.

To take a step back: this is not just a question of money, millions of people and their livelihoods are at stake. Africa's population would be at an increasing risk of undernourishment due to increasing food demand and the detrimental effects of climate change on agriculture on the continent. A warming of 2˚C globally would put over 50% of the African continent's population at risk of undernourishment. Yet, right now, we are heading to 4˚C of warming.

The report findings show that sea level could rise by a metre above present-day levels, putting millions of people at risk of flooding in the large coastal cities across the continent. These are the striking impacts of climate change risk reversing Africa's economic and development gains.

While not completely eliminating the risks, effective adaptation can reduce Africa's vulnerability to hundreds of thousands of people, rather than millions. Rising to the challenge and addressing the systemic harm that climate change may cause to Africa development prospects warrants leaving no stone unturned in exploring opportunities for supporting adaptation actions and measures in Africa.

The report findings show that even if the explored avenues for revenue generation were implemented across Africa, only a maximum of USD 3 billion per year would be raised by 2020. However, rapidly rising adaptation costs would exceed these potential revenues raised through levies as early as 2020. A steep and rapid increase in adaptation funding from developed to developing countries is therefore urgently needed to close the adaptation-funding gap that the continent faces.

Based on the analyses contained in this report, policy makers can consider how all options at international, regional and national levels can complement each other. All of these done together can protect Africa from much of the harm that even very stringent global mitigation alone cannot prevent.

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Key Messages

Africa is the continent where a rapidly changing climate will deviate from "normal" earlier than across any other continent, making adaptation a matter of utmost urgency

- Africa is beginning to experience annual-mean temperatures consistently higher than any temperature experienced locally in history. This is already happening in Central Africa and is projected to cover the entire continent in the next two to three decades – earlier across Africa than any other continent.
- Warming projections under medium scenarios indicate that extensive areas of Africa will exceed 2°C by the last 2 decades of this century relative to the late 20th century mean annual temperature. Under a high warming pathway ("over 4°C world"), that exceedance could occur by mid-century across much of Africa and reach between 3°C and 6°C by the end of the century.
- By 2100, sea level rise along the Indian and Atlantic Ocean coastlines is projected to be around 80 cm above 2000 in an over 4˚C world (compared to the global mean of roughly 70 cm), but there are chances it could be much worse. Particularly high numbers of people would be risk of flooding in the coastal cities of Mozambique, Tanzania, Cameroon, Egypt, Senegal and Morocco.
- Climate changes directly affect food security, water availability, flooding risk, urban areas, health and other sectors.

Africa's adaptation costs could rise to USD 50 billion/year by 2050 in a below 2˚C world

- Costs could double to USD 100 billion/year by 2050 under a scenario that has the world warming more than 4˚C warming by 2100[1]
- The first Africa adaptation gap report (2013) noted already that past (global) emissions commit Africa to adaptation costs of USD 7-15 billion/year by 2020
- In the yet longer term, and relative to Africa's (growing) GDP, adaptation costs could rise to as much as 6% of African GDP by 2100 in an over 4˚C world, but in a below 2˚C world these would be less than 1% of GDP.
- Even if all cost-effective adaptation is realised, Africa will still suffer large "residual" damages, which are estimated to be double the adaptation costs in the period 2030-2050.
- Africa and the international community will need to find ways to cope with these residual damages, under any scenario of global mitigation and local adaptation efforts.

A steep increase in adaptation funding from developed to developing countries would contribute significantly in closing the adaptation-funding gap

- The climate change challenge exceeds the capacity of the continent to respond to projected damages and impacts through domestic resources, even if the base to raise additional funding is broadened. Scaled-up international support for African countries is therefore critical.
- Current levels of international funding are not sufficient.
- While international financial flows for adaptation have increased, and could bridge the deepening adaptation gap by 2020, disbursements need to continue to grow rapidly post 2020 to keep pace with warming, and even faster if global mitigation fails to put the world on a pathway to hold warming below 1.5 and 2°C by 2100
- Scaling up international climate finance under the UNFCCC may by itself lead to sufficient funding for adaptation in Africa, but even here, actual implementation can only reach its full potential if complemented by comprehensive and effective national and regional policy planning, capacity-building and governance.

1 Note that costs in the 2013 Africa's adaptation gap technical report were reported in constant 2005 USD, while this report expresses costs in constant 2012 USD for easier comparison with other existing studies.

Since it is in countries' own direct interest to address the profound harm that climate change may cause to their development prospects, it is also in their interests to explore every opportunity for financing adaptation within their own jurisdiction

- To address the multiple challenges of adaptation in Africa, there will be no silver bullet that can solve all the funding and implementation issues faced by African countries. Addressing these challenges will require the deployment of complementary measures at the international, continental and national levels
- Results of the report suggest that a great deal still needs to be done, including the promotion of an effective enabling framework for private sector participation in adaptation activities

In the context of the current UNFCCC negotiations towards the post-2015 agreement, the findings in this report suggest:

1. The best insurance against potentially catastrophic impacts of climate change and unmanageable adaptation and (residual) damage costs in Africa is effective and ambitious mitigation action leading to deep global emission reductions;
2. Cancun climate finance commitments need to be met by 2020, the historical imbalance between adaptation and mitigation in the allocation of resources needs to be corrected, and ease of access ('modalities') for African countries needs to be improved. Adequate (large-scale, rapidly increasing) and predictable funding must be mobilised for the subsequent periods;
3. The potential and the feasibility of mobilising untapped international, regional and domestic sources should be explored further

Warming projections under medium scenarios indicate that extensive areas of Africa will exceed 2°C by the last 2 decades of this century relative to the late 20th century mean annual temperature. Under a high warming pathway ("over 4°C world"), that exceedance could occur by mid-century across much of Africa and reach between 3°C and 6°C by the end of the century

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Executive Summary

Climate change represents a clear and present danger to the development prospects of Africa. African countries are going to have to adapt to protect their peoples from the harsh impacts of climate change and to ensure that they are not derailed from their current development pathways.

Developed country Parties to the Climate Convention committed to "assist the developing country Parties that are particularly vulnerable to the adverse effects of climate change in meeting costs of adaptation to those adverse effects." (UNFCCC Articles 4.3 and 4.4)

The first edition of Africa's Adaptation Gap Technical report (AAGr1) in 2013 provided an overview of the most relevant impacts of climate change in different sectors across Africa, as well as cost estimates for adaptation.

This report (2015 AAGr2) is directed towards exploring the extent to which African countries can contribute to closing the adaptation gap, in order to better understand the gap in the resources that will be needed and, thereby, the likely extent to which international climate finance must be urgently raised, leveraged and deployed in service of Africa's pressing adaptation needs.

Given the increasing severity of the adaptation challenge posed by climate change to Africa, no stone should be left unturned in looking for solutions for closing the adaptation gap, for two major reasons: firstly, the case for international solutions is even stronger if national and regional options are considered and evaluated; secondly, it is in the interest of African nations and their stakeholders at all levels to hedge against the possibility that the funding provided through the Green Climate Fund and other channels is insufficient or ineffective.

Building on the report's findings, and relating to the current negotiations towards the post-2015 agreement context under the UNFCCC, African policymakers may consider the three following findings:

1. The best insurance against potentially catastrophic impacts of climate change and unmanageable adaptation and (residual) damage costs in Africa is effective and ambitious mitigation action that leads to deep global emission reductions;
2. Cancun climate finance commitments need to be met by 2020, the historical imbalance between adaptation and mitigation in the allocation of resources needs to be corrected, and ease of access ('modalities') for African countries needs to be improved. Adequate (large-scale, rapidly increasing) and predictable funding must be mobilised for the subsequent periods;
3. The potential for - and the feasibility of - mobilising untapped international, regional and domestic sources should be explored further.

An update on climate impacts shows increased urgency

- Africa is beginning to experience annual-mean temperatures higher than any locally experienced in history. This is already happening in Central Africa and is projected to cover the entire continent in the next two to three decades; earlier across Africa than any other continent.
- Warming projections under medium scenarios indicate that, by the last two decades of this century, extensive areas of Africa will exceed 2°C relative to the late 20th century mean annual temperature. Under a high warming pathway ("over 4°C world"), that exceedance could occur by mid-century across much of Africa and reach between 3°C and 6°C by the end of the century.
- Combined with changes in water availability, for example, this will likely have a severe impact on agriculture. 97% of sub-Saharan agricultural systems are rain-fed, and 60% of the labour force relies on agriculture.
- Sea level rise is generally higher along Africa's coastlines than the global average, particularly along the Indian and Atlantic Oceans. Sea levels are projected to rise at least 40cm above 2000 by 2100 in a below-2˚C scenario (close to 1.5°C), and to 80cm in an over-4˚C scenario (compared to roughly 70cm globally). There are chances it could be much worse, with a 15% chance of 100cm sea-level rise above 2000 by 2100 and a considerable 5% chance of a rise exceeding 130 cm by 2100.
- Particularly high numbers of people are at risk of flooding in the coastal cities of Mozambique, Tanzania, Cameroon, Egypt, Senegal and Morocco.

Estimated adaptation costs point to a very rapid divergence between globally low and high warming scenarios

- The first Africa's adaptation gap report (2013) stressed already that past (global) emissions commit Africa to adaptation costs of USD 7-15 billion/year by 2020.
- This second report estimates that adaptation costs could rise to about **USD50bn/year[2] by 2050** for a scenario holding warming below 2°C.
- The estimated costs double to about **USD100bn/year by 2050** for a scenario reaching over 4°C by 2100.
- In the longer term, and relative to Africa's (growing) GDP, adaptation costs could rise to as much as **6% of African GDP by 2100** in an over 4˚C world, but in a below 2˚C world, these would be less than **1% of GDP.**

Adaptation cannot prevent all damages: residual damages will always remain and are large

- In a more general sense, the IPCC's recent Fifth Assessment Report (AR5) noted that even after implementation of potential adaptation options, residual risks remain for many sectors in Africa.
- This, second Africa Adaptation Gap report confirms this in a more specific sense: even if all cost-effective adaptation is realised, Africa will still suffer large "residual" damages, which are estimated to be double the adaptation costs in the period 2030-2050.
- Africa and the international community will need to find ways to cope with these residual damages, under any scenario of global mitigation and local adaptation efforts.

Current international funding falls short and must be scaled up rapidly

- The climate change challenge exceeds the capacity of the African continent to respond to projected damages and impacts through domestic resources, even if the base to raise additional funding is broadened. Scaled-up international support for African countries is therefore critical.
- Current levels of international funding are not sufficient. So far, while difficult to estimate, roughly USD$1-2bn a year is flowing to Africa for adaptation, through a variety of sources.
- A steep increase in adaptation funding from developed to developing countries would contribute significantly to closing the adaptation-funding gap. Therefore, increased adaptation funding disbursements – in line with the USD100-billion target as agreed by the Parties at the UNFCCC conferences in Copenhagen in 2009 and Cancun in 2010 - could result in bridging the deepening adaptation gap by 2020.
- Such disbursements subsequently need to continue to grow rapidly to keep pace with warming, and most rapidly if global mitigation fails to put the world on a pathway to hold warming below 1.5 and 2°C by 2100.
- Recent positive developments in the operationalisation of the Green Climate Fund are of critical importance for adaptation financing in Africa. The GCF initial capitalisation was completed in December 2014, with pledges amounting to around USD10.2bn. The GCF Board has decided that 50% of its portfolio should be allocated to adaptation and, in turn, that 50% should go to particularly vulnerable developing countries including Least Developed Countries (LDCs), Small Island Developing States (SIDS) and Africa.

The report's approach: African case studies on adaptation

This report has taken the approach of exploring the additional options and opportunities that may exist in Africa through **four country case studies** – representing a reasonably diverse sample of the great variety of countries and economies to be found within Africa (Ethiopia, Ghana, South Africa and Togo).

- Each of these case studies explores aspects of the adaptation response and, in particular, the scope for domestic adaptation financing, in terms of the increased domestic adaptation resources that could be generated through economic growth and tax reform, through adaptation-specific taxes and fees, and through regulation and market-making aimed at eliciting greater private investment.
- The conceptually-simple calculations this report presents are primarily intended to be illustrative of the limits and potential for adaptation financing from domestic sources in a context where strong growth is assumed and tax reforms are successfully achieved.
- The evidence suggests that African countries are already committing some resources of their own to adaptation efforts and that there are opportunities for doing more that can be considered and debated across the continent, with lessons to learn and share.

2 Note that costs in the 2013 Africa's adaptation gap technical report were reported in constant 2005 USD, while this report expresses costs in constant 2012 USD for easier comparison with other existing studies.

Options for sources of adaptation funds – international, national, continental

As the report shows, there are a lot of adaptation options, measures and sources that countries can mobilise and implement from the national level to the international level to limit the deepening of the adaptation gap under any level of global mitigation. The report assesses:

- Options at the international level – scaling up countries' commitments and channelling through the Green Climate Fund and other channels
- Options at the national level – resources from national budget
- Options at the continental level – levies

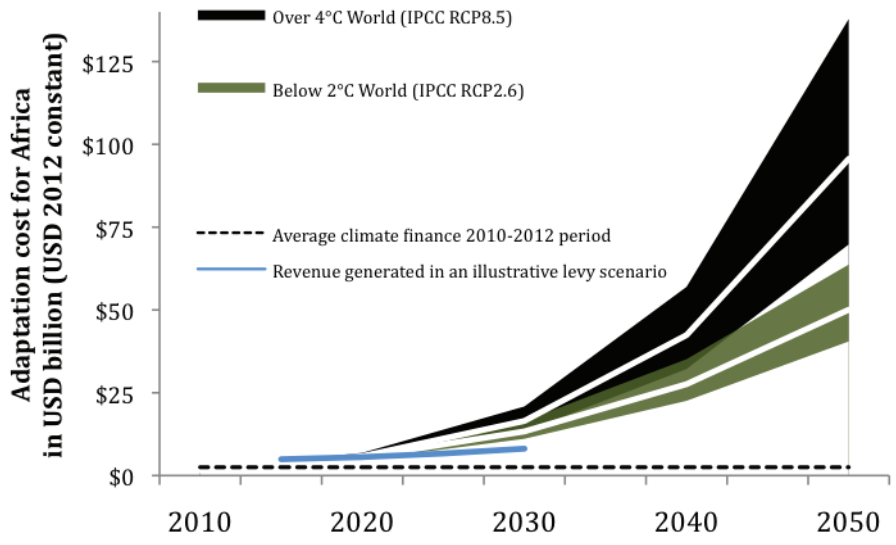
Scaling up international climate finance under the UNFCCC may, by itself, lead to sufficient funding for adaptation in Africa, but - even in this case - actual implementation can only reach its full potential if complemented by comprehensive and effective national and regional policy planning, capacity-building, readiness and governance.

To address the multiple challenges of adaptation in Africa, there will be no single solution that solves all the funding and implementation issues African countries face. Addressing these challenges will require the deployment of measures at the international, continental and national levels.

A levy on transactions to pay for adaptation?

This report assesses, amongst other complementary options, the potential effects of a **levy applied on transactions.**

Building upon similar international experiences in both developed and developing countries, and political as well as economic analyses**, a levy on transactions in Africa is explored in four sectors: extractive industries, financial and banking transactions (including remittances), international trade and transportation (including exports) and tourism.** The estimated revenue shows that ***even if*** such regional revenues were generated by the application of these levies, however, adaptation costs would exceed the revenue generation capacity as early as 2020.



Current and projected adaptation costs for Africa far exceed average climate finance over the 2010-2012 period. Addressing this urgent lack of funding will require the deployment of complementary measures at the international, continental and national levels. Even if for example a levy were regionally applied on transactions to raise revenue for adaptation costs which would already exceed the revenue generation capacity by 2020. Only a steep increase in adaptation funding from developed to developing countries will contribute to closing the adaptation-funding gap in Africa

GCF process likely to be highly competitive

The GCF's Governing Instrument requires that funding should be allocated to 'paradigm-shifting' projects and programs

Countries that can show that they have given full and reasoned consideration to the adaptation measures and associated costs of meeting the impacts of climate change in their country will likely be better placed to put together proposals with a high probability of approval.

In turn, without being a conditionality, there is a growing appreciation of the need for beneficiary countries to have explored opportunities for funding adaptation costs from within their own resources, whether in terms of existing public expenditure or possible reforms or re-allocations.

Hence, being able to identify such existing expenditure - and the possible space for further national fiscal commitment to meeting some adaptation costs - is likely to add even greater credibility to countries that submit proposals to international climate funds.

This starting point is not advanced in any way to detract - or depart - from the over-riding principle that should govern international climate finance, which is that developed countries have an obligation under the Climate Convention to fund the necessary efforts that must be made for the developing world to adapt to climate change.

Leave no stone unturned

As it is in countries' own direct interest to address the profound harm that climate change may cause to their economic sustainable development prospects, it is also in their interests to leave no stone unturned in exploring opportunities for financing adaptation that are within their own sovereign realm. International climate finance is unlikely, by itself, to be able to meet the whole bill for adaptation.

Governance-related issues: region-wide levies disbursed multilaterally

The analysis in this report points to a number of governance-related issues that can be classified under two main headings: continental and domestic. The continental governance dimension arises particularly under the first of the three options for implementing the levies discussed in Section 5: where levies are raised on the basis of a continent-wide or regional agreement and collected as well as disbursed through a multilateral vehicle.

- This vehicle would have to be provided with specific revenue-raising powers across all countries, and a decision-making framework for the disbursement of the funds it collects. In particular, a multilateral vehicle would facilitate deploying a portion of funds raised by levies in more developed or resource-rich African countries to support adaptation investment in the continent's least developed and most vulnerable countries. Consequently, such a vehicle would likely need to demonstrate the following characteristics:
    - Political legitimacy.
    - Robust allocation and investment framework.
    - Strong fiduciary and administrative capacity.
- Domestic governance-related issues are arguably relevant, not only irrespective of which levy implementation modality is involved, but also if no such continental levies are envisaged and countries focus instead on domestic resource mobilisation opportunities. Among the key dimensions of this are:
    - The quality and perceptions of fiscal governance.
    - Inter-governmental fiscal relations and decentralisation.
    - Private sector finance.

The policy effort and supporting framework for encouraging private sector funding of adaptation activities can be significantly enhanced. In particular, a basic assessment of country frameworks for promoting private sector climate change adaptation in the four case study countries revealed that many components thereof are either absent or in the early stages of development.

1. Introduction

Human influences over the past decades to centuries have resulted in discernable anthropogenic climate changes and impacts, in particular the emission of greenhouse gases. The recent Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC) has assessed these changes globally and for the African continent. Changes in weather-related extremes, sea level, crop yields and health have been observed and attributed to human influences. These and other impacts are bound to become more severe, as historic emissions and those projected by trends in development and policies commit the world to climate changes beyond today's over the coming decades.

UNEP's 2014 emissions gap report compared global mitigation efforts to what is required to put the world on track for holding warming below 2°C, relative to pre-industrial levels. While that report showed there is a gap between what is pledged, in terms of emission reductions, and what is required for below 2°C, the same report also showed the gap is somewhat larger if an estimate is taken into account of how far certain countries are still removed from implementing climate policies sufficient to reach the pledged emission reductions, let alone to fully close the 'emissions gap'. This report builds on such information and assesses impacts and adaptation needs in Africa for a range of future global emission pathways.

In 2013, Africa's Adaptation Gap Technical report (AAGr1), noted that projections of climate change lead to an increasing gap between current funding for adaptation measures in Africa and what is needed to reduce rapidly rising climate-change damages across the continent. Examples of such projected damages mentioned in that report are diminished agricultural and fishery productivity and human health undermined by the risks associated with extreme weather events and an increased incidence of transmittable diseases and under-nutrition.

A strong appeal can be made to the international community to deal with adaptation costs worldwide in a balanced manner, in agreement with the principles of the Climate Convention (UNFCCC). Indeed the Green Climate Fund established by the UNFCCC is expected to become the main instrument to finance adaptation measures in much of the developing world. With the initial resource mobilization process of the Fund being completed at the end of November 2014, the GCF is scheduled to start programing resources in the second half of 2015. In the Cancún Agreements of 2010, UNFCCC Parties committed to mobilize USD 100 billion for both mitigation and adaptation in developing countries, from both public and private funding sources. Given the rapidly rising adaptation needs as estimated in AAGr1, as well as in UNEP's 2014 global Adaptation Gap report, capitalization and operationalization of the GCF is extremely urgent.

UNEP's 2014 global Adaptation Gap report explored many conceptual issues related to adaptation, while AAGr1 assessed impacts, damages and adaptation options in a large range of sectors for Africa. Taking these reports as a starting point, the AAGr2 will conduct a more in depth study for Africa through a number of continental-scale and country-case studies. Given the growing adaptation challenges, there are two reasons why no stone should be left unturned in looking for solutions for closing the adaptation gap. Firstly, the case for international solutions is stronger if national and regional options are well evaluated. Secondly, it is in the interest of Africa nations and its stakeholders on all levels to hedge against the possibility that funding provided through GCF and other channels is insufficient or not effective enough.

Chapter 2 updates the 2013 report by discussing the main climate and impacts scenario projections in the context of AR5, as well as the estimates for damage and adaptation costs. The main framing for the latter is the growing regional adaptation gap between funding and needs, even in low-emission scenarios, and the difference in this regional gap between scenarios of weak and stronger efforts of global emissions reductions.

Chapters 3 to 5 assess the wide range of options for triggering the resources needed for closing the adaptation gap. While chapter 3 assesses international climate finance including the GCF and other bilateral and multilateral channels, chapter 4 reports on the conclusions of four detailed country case studies of government practice and planning. The approach taken by this study is to explore the options and opportunities that may exist in Africa through these four country case studies – each of which explore aspects of the adaptation response. The scope of the AAGr2 did not allow for a comprehensive, continental assessment. While four countries cannot be adequately representative of a continent as large and complex as Africa, the four countries chosen do offer both regional and developmental variety and 'spread', and a sufficiently diverse sample of the challenges and opportunities in Africa. In selecting Ethiopia, Ghana, South Africa and Togo as the countries for the case studies, the research team took into account a number of factors, including: regional considerations (there is one East African country, one from Southern Africa, one from West Africa and another from West/Central Africa [Togo] that also happens to be Francophone) and developmental status – the sample extends from a middle-sized economy (South Africa) to an LDC (Togo), with two emerging/fast-growing economies (Ghana and Ethiopia), as well as where the research team had their own researchers, and/or alternative capacity and local contacts.

Ideally, a further research study should now extend the range and depth of the assessment of what it happening around the continent and the full extent of the opportunities and constraints that exist. A further study ought to cover other significant (and in the context of the exploration of opportunities for regional levies, oil-producing) African economies such as Nigeria and Angola, as well as a larger sample of LDCs. Such a study would inevitably require substantial resourcing, but on the basis of the findings that we have been able to extrapolate from the sample of four country case studies, this would represent a valuable investment.

Chapter 5 explores a set of hypothetical scenarios of levies on international transactions across Africa as another potential source of revenue for adaptation finance. Finally, chapter 6 contains a set of discussions, conclusions and recommendations, leading to the idea that national and regional actions and policies are required for enabling any effective adaptation measures, but by themselves would still be grossly insufficient, so that a rapid scaling up of international climate finance remains the only option that could meet the challenges of Africa's growing adaptation needs, particularly if global mitigation action remains inadequate.

A degratated Mangrove area in Mozambique

Photo Credits: CCDARE

2 Update on climate impacts, adaptation costs and damages for Africa

The first edition of Africa's Adaptation Gap technical report of 2013 (Schaeffer et al. 2013) provided an overview of most relevant impacts in different sectors across Africa, as well as cost estimates for adaptation. Major findings were:

- Extreme weather events including droughts, floods and heat waves are likely to become both more frequent and more severe.
- At warming exceeding 3°C globally, virtually all of the present maize, millet, and sorghum cropping areas across Africa could become unviable. However, even a warming approaching 2°C will lead to a substantial increase in the proportion of under-nourished people in sub-Saharan Africa.
- Human health will be undermined by the risks associated with extreme weather events and an increased incidence of transmittable diseases and under-nutrition.
- Those African populations that are already most vulnerable to climatic variability, such as the poor inhabitants of informal settlements, will become even more vulnerable.

In April 2014 the Intergovernmental Panel on Climate Change published its Fifth Assessment Report (AR5) on climate change impacts and adaptation (IPCC 2014), a joint effort of hundreds of scientists worldwide to assess and summarize the full body of scientific literature submitted before February 2013 and accepted for publication before September 2013.

The focus of the 2015 AAGr2 report is not on impacts. Merely for illustration, the first section of this chapter provides a brief update of the findings in AAGr1 and AR5, as well as a few findings from literature yet more recent than included in both these reports.

The second section of this chapter provides an update of adaptation cost estimates for Africa since 2013, and in addition illustrates the important issue of considerable remaining damages, even after adaptation measures were implemented, as well as risks, in terms of cost estimates for lower and upper ends of uncertainties in climate projections.

2.1 Brief update on climate and impacts projections

2.1.1 Scenario framework and emergence of warming signals

Working Group I of IPCC assessed in its contribution to AR5 four scenarios of changes in the Earth's heat balance, caused by human intervention, in particular the emission of greenhouse gases. The highest of these Representative Concentration Pathways (RCP) is a business-as-usual scenario (Riahi et al. 2011) with a continued high reliance on coal in energy supply, medium economic growth and population increase consistent with the recent medium projections of the UN[3]. Greenhouse-gas emissions in this scenario are on the high side of the range of business-as-usual (BAU) non-mitigation scenarios found in literature and assessed by Working Group III (Clarke et al. 2014). This leads to a global-mean temperature increase of 4.8°C [3.5 to 6°C] by 2100 above pre-industrial levels[4] when neglecting uncertainty in the response of the global carbon cycle, and about 5°C [3.5 to 7°C] by 2100 if that is included. The large library of non-mitigation scenarios assessed by Working Group III of IPCC (Clarke et al. 2014) leads to a range of warming of roughly 2.5 to 7.8°C by 2100 (including climate and carbon-cycle uncertainty).

3 http://esa.un.org/wpp/

4 For model runs neglecting carbon-cycle uncertainty, WGI AR5 (IPCC 2013)reported projected warming for the period 2081-2100 of 2.8-4.2°C above 1986-2005, with the mean estimate in WGI AR5 figure 12.5 of 3.7°C, while noting warming in 1986-2005 was observed to be about 0.6°C above the period 1850-1900, the best proxy for "preindustrial" levels. AR5 figure 12.5 shows 0.3°C warming per decade for the low-end of the uncertainty range by the end of the century, 0.5°C for the mean and 0.6°C for the high end, implying 4.8 [3.5-6] °C above preindustrial by 2100. AR5 further shows that if carbon-cycle uncertainty is included, the estimate on the high side in particular increases. With 2081-2100 warming of 3.9 [2.5-5.6] °C above 1986-2005, this case likewise leads to 5 [3.4-6.8] °C above preindustrial by 2100.

As a scenario framing for this report, including for the adaptation and damage costs estimates in the second section of this chapter, Figure 1 shows global-mean temperature increases projected for the highest and lowest RCP scenarios. In this report RCP8.5 is referred to as an "Over 4°C World" and RCP2.6 as a "Below 2°C World". The latter leads to impacts, damages and adaptation costs slightly above a scenario that peaks at a comparable warming level, but leads to a more rapid decrease in warming and likely below 1.5°C by 2100 ("1.5°C World"). These scenarios from the scenario literature can be compared to two policy scenarios that are based on estimates of the aggregate effects of national-level "current policy" projections and of "current pledges", the latter referring to proposals by countries to reduce emissions in the context of the international climate negotiations, if these were effectively implemented and would fully deliver the emission reductions pledged.

Warming in the low and high warming scenarios starts to diverge in the 2030s. The divergence grows rapidly over the century and there is not only a very large difference in warming by 2100, but there is also a "commitment" to a yet larger longer-term divergence, given that the lowest scenario leads to stabilized or declining warming, while the high scenarios show a high rate of warming throughout the century and beyond 2100.

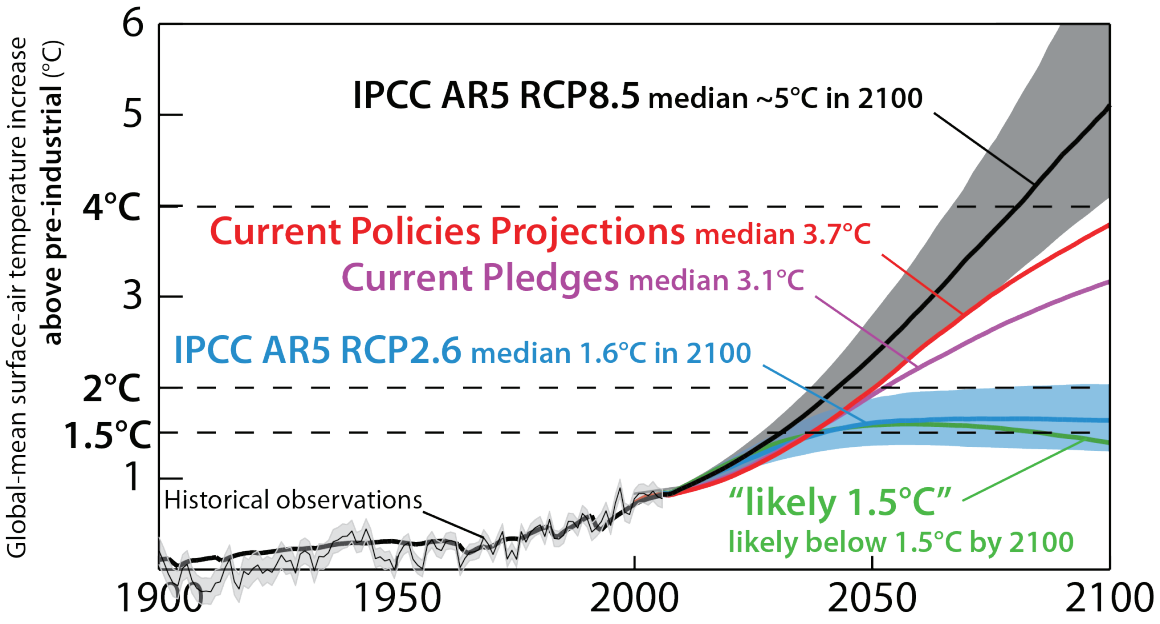


Figure 1- Projections for global-mean surface-air temperature increase, showing the scenarios assessed in this report. Lines indicate median estimates and colored areas uncertainty ranges driven by climate-system, as well as carbon-cycle processes (only shown for RCPs for clarity). Methods as in Schellnhuber et al (2014).

In terms of geographical patterns, observed and projected warming is generally larger over land areas than the oceans, and stronger towards the poles. Hence, over land in the tropics and subtropics projected warming is higher than over oceans, but smaller than in high latitudes. Warming projections under medium scenarios indicate that extensive areas of Africa will exceed 2°C by the last 2 decades of this century relative to the late 20th century mean annual temperature. Under a high warming pathway ("over 4°C world"), that exceedance could occur by mid-century across much of Africa and reach between 3°C and 6°C by the end of the century (IPCC 2014).

However, as shown in AAGr 1, warming in the tropics and subtropics is projected to be higher when expressed relative to local natural year-to-year fluctuations in temperatures. In other words, in the tropics and subtropics climate change will sooner move climate outside of what can be considered as "normal" local circumstances. This is indeed consistent with observations, which show that the warming trend in some tropical regions, including parts of Africa, has already emerged out of the "noise" of local natural variations (Mahlstein et al. 2011; Diffenbaugh and Scherer 2011; Mahlstein et al. 2012; IPCC 2013; Coumou and Robinson 2013).

An early emergence of climate change in the tropics and subtropics is also very clear in climate projections (Mahlstein et al. 2011; Diffenbaugh and Scherer 2011; Hawkins and Sutton 2012; Coumou and Robinson 2013; Mora et al. 2013; Hawkins et al. 2014). Figure - 2 shows the approximate year when a climate-change signal clearly emerges, with "emergence" defined here very strictly as the year after which ***all*** subsequent annual-mean temperatures lie above any historical local precedent (Hawkins et al. 2014). At low latitudes, climate change generally creates an unprecedented climate earliest; in the 2020s for equatorial regions and in the 2030s for most of the rest of Africa. This early time by which climate consistently ventures out of what has occurred historically, earlier across Africa than any other continent, implies urgent adaptation needs across Africa.

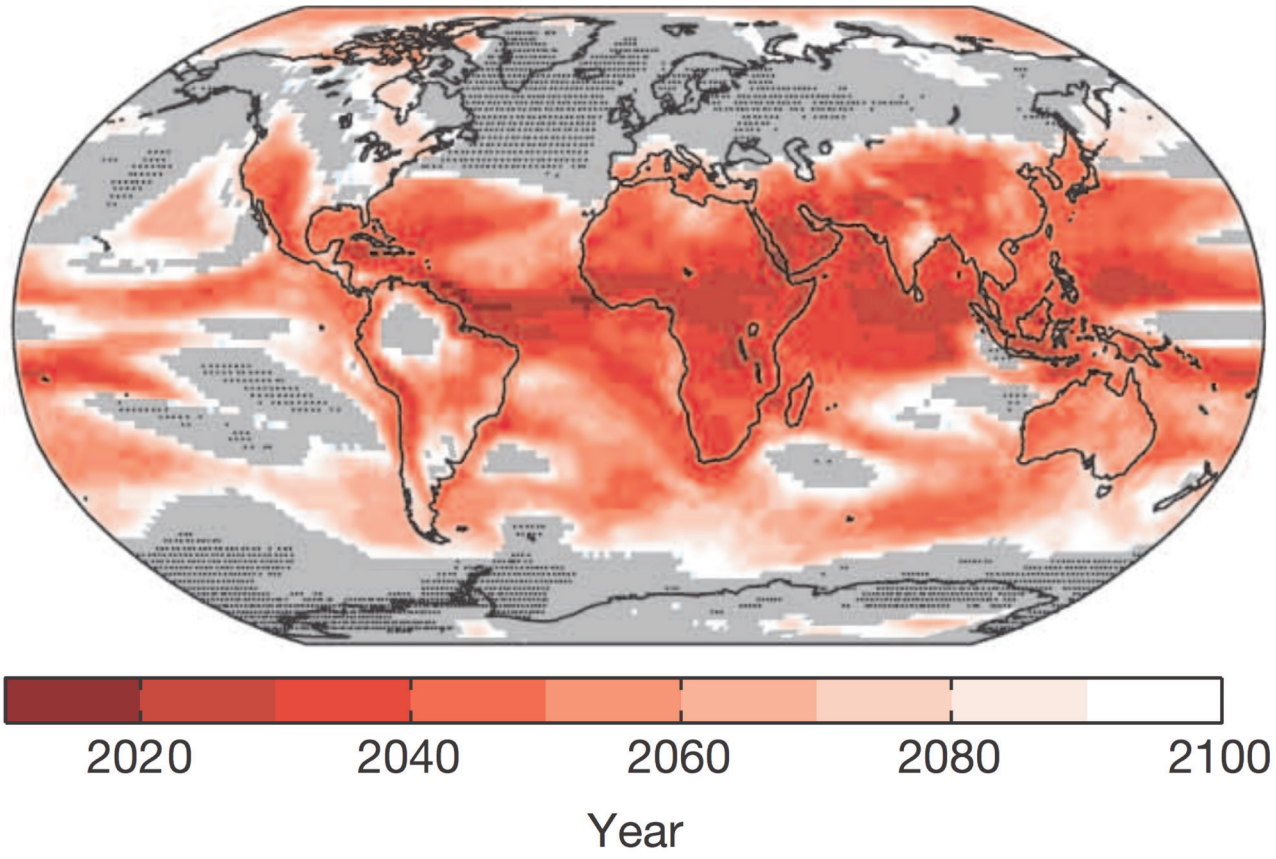


Figure 2 - Year after which annual-mean temperatures consistently lies above any historical local annual mean, based on median estimated from 30 simulations of climate model CSIRO Mk3.6. Grey regions show where more than half the simulations emerge after 2100 and hence no median emergence value can be determined (28% by area). Stippling indicates where all members show emergence beyond 2100 (8% by area). Source: (Hawkins et al. 2014).

2.1.2 Sea-level rise

Like other climate changes, even a slow-responding climate-change aspect such as sea-level rise shows a distinct geographical pattern In this case, with relatively high sea-level rise at low latitudes (in the tropics) and below-average sea-level rise at higher latitudes, caused by changes in the gravitational pull of the (melting) ice sheets, ocean currents and wind patterns, as also shown in AAGr1. Figure 3 shows updated sea-level rise projections consistent with those of AR5, as explained in detail in the World Bank's Turn Down the Heat 3 report (Schellnhuber 2014). Along the Indian and Atlantic Oceans' coastlines, projected sea-level rise is significantly above the global mean. In the no-mitigation scenario along the Indian and Atlantic Oceans' coastlines, this leads to a 15% chance of 100 cm sea-level rise above 2000 by 2100 and a considerable 5% chance of a rise that exceeds 40 cm shortly after 2050, and 130 cm by 2100. Considerable sea-level rise is projected even for a "below 2°C World". However, the projections show that emissions reductions that lead to a "below 2°C World" will also lower projected sea-level rise by 2100 by more than half, compared to a "over 4°C World". Table 1 shows that sea-level rise is generally comparable between individual cities in Africa that are located along the same ocean-basin coastline.

Estimates of risk to people rise rapidly with further warming and without adaptation. By the time a sea-level rise of around 40cm is reached (shortly after 2050 for Africa's Indian and Atlantics Oceans' coastlines) the number of people at risk of flooding (Brown et al. 2011) rises to particularly high levels in Mozambique (5 million), Tanzania (2 million), Cameroon (2 million), Egypt (1 million), Senegal (0.5 million) and Morocco (0.5 million). In all cases, adaptation is assessed as potentially highly effective. Although considerable risk remains for Mozambique and Tanzania even after full implementation of adaptation measures, the number of people at risk of flooding can be strongly reduced even there, to hundreds of thousands, not millions. This example shows that effective adaptation can reduce the risk to people enormously, which strengthens the case for investments in adaptation measures, without which the risks rise to very high levels.

Applying the same methodology for projecting sea-level rise as in this report, Schellnhuber et al (2014) explain that it is important to note that large uncertainties remain in predicting future sea-level rise and, in particular, the contribution from potentially unstable regions of marine ice in Antarctica (Church et al. 2013). The results in this report incorporate the direct effect of Southern Ocean warming on ice-shelf basal melting and related ice stream acceleration in Antarctica. As in the IPCC AR5, however, they do not include amplifying feedbacks responsible for marine ice sheet instability. The lower and upper bounds of sea-level projections here can be interpreted as ***likely*** ranges, with a considerable remaining risk of higher sea-level rise.

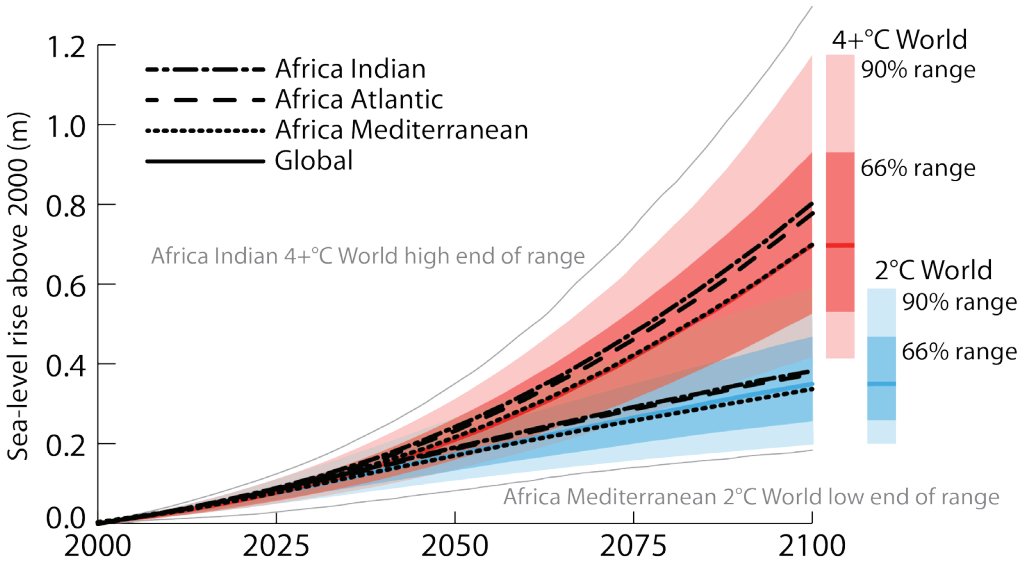


Figure 3 - Sea-level rise projections for highest (RCP8.5 – over 4°C) and lowest (RCP2.6 – below 2°C) scenario assessed in this report. Shaded areas indicate uncertainty ranges in the global-mean projections around the median. Black lines indicate median projections typical for respectively Mediterranean, Atlantic Ocean and Indian Ocean coastlines of the African continent. Finally the thin grey lines indicate respectively the high end of the range (95th percentile) for the high scenario representative of the Indian Ocean coastline and the low end of the range (5th percentile) for the low scenario representative of the Mediterranean coastline, to illustrate the maximum and minimum assessed risk levels. Methods as in Schellnhuber et al (2014).

Table 1. Sea-level rise projections by 2100 for a range of cities along the African coastlines. The range in square brackets indicates the uncertainty range ±1 standard deviation around the median. Methods as in Schellnhuber et al (2014).

City	SLR 2100 RCP8.5 scenario (m above 2000)	SLR 2100 1.5°C scenario (m above 2000)
Mediterranean		
Alexandria	0.70 [0.51 0.94]	0.34 [0.24 0.46]
Cairo	0.70 [0.51 0.94]	0.34 [0.24 0.46]
Atlantic Ocean		
Abidjan	0.78 [0.60 1.02]	0.37 [0.27 0.50]
Accra	0.79 [0.60 1.03]	0.37 [0.27 0.50]
Capetown	0.80 [0.62 1.05]	0.38 [0.28 0.52]
Casablanca	0.73 [0.57 0.97]	0.35 [0.25 0.47]
Dakar	0.77 [0.58 1.01]	0.37 [0.27 0.50]
Douala	0.79 [0.60 1.03]	0.37 [0.27 0.50]
Freetown	0.78 [0.59 1.03]	0.38 [0.27 0.51]
Banjul	0.77 [0.58 1.01]	0.37 [0.27 0.50]
Lagos	0.78 [0.60 1.02]	0.37 [0.27 0.50]
Libreville	0.80 [0.61 1.04]	0.38 [0.28 0.51]
Lome	0.78 [0.60 1.03]	0.37 [0.27 0.50]
Indian Ocean		
Dar Es Salaam	0.80 [0.63 1.06]	0.38 [0.28 0.51]
Durban	0.79 [0.61 1.05]	0.38 [0.28 0.51]
Maputo	0.81 [0.62 1.07]	0.39 [0.28 0.52]
Port Louis	0.78 [0.59 1.04]	0.39 [0.28 0.52]
Victoria	0.84 [0.65 1.10]	0.39 [0.29 0.53]

2.1.3 Agriculture

As has been recognized even since the previous IPCC Fourth Assessment Report (Schneider et al. 2007), agriculture is one of the key sectors of vulnerability for Africa, among others due to expected population growth and the fact that currently 97% of total cropland in Sub-Saharan Africa is rain-fed (Calzadilla et al. 2009) and 60% of the labor force is involved in the agricultural sector (Schellnhuber et al. 2013).

IPCC AR5 notes: "Climate change will interact with non-climate drivers and stressors to exacerbate vulnerability of agricultural systems, particularly in semi-arid areas (*high confidence*). Increasing temperatures and changes in precipitation are very likely to reduce cereal crop productivity. This will have strong adverse effects on food security. New evidence is also emerging that high-value perennial crops could also be adversely affected by temperature rise (*medium confidence)*. Pest, weed, and disease pressure on crops and livestock is expected to increase as a result of climate change combined with other factors (*low confidence)*. Moreover, new challenges to food security are emerging as a result of strong urbanization trends on the continent and increasingly globalized food chains, which require better understanding of the multi-stressor context of food and livelihood security in both urban and rural contexts in Africa." (IPCC 2014)

Unfortunately, AR5 does not provide an overall assessment of food security and (changes in) agricultural yields for Africa for different levels of warming. Table 2 shows information from AR5 Table Box 7-1, with additional data extracted from the underlying papers not included in AR5. Overall this overview confirms the assessment in AAGr1 of a large risk to African food production, leading to reductions in yields of major cereals of around 10% by the 2050s at around 2°C of global warming. A possible exception is East Africa, where increased precipitation might lead to higher yields. However, as discussed in (Schellnhuber et al. 2013) projections of increased precipitation in this region in the global climate models, used for agriculture assessments, might be overestimates, since this strong increase in precipitation is generally not reproduced by high-resolution regional climate models.

More recent studies also find large risks to agriculture from climate change, including in Africa. Particularly important is the perspective in (Lobell and Tebaldi 2014) who noted that, while many agriculture assessments are focused on identifying the long-term risk of large negative effects of climate change on food productions and security, food demand growth will be particularly large over the next few decades and hence near-term trends of increased agricultural production need to keep pace. However, (Lobell and Tebaldi 2014) found that further warming implies a roughly 1 in 4 chance for maize and 1 in 6 chance for wheat that observed 10% yield increase per decade would be slashed by half globally, with the implication of driving up global food prices as increases in crop yields fail to keep pace with population growth.

(Dawson et al. 2014) found about 50% of world population would be at risk of undernourishment under increasing demand and climate change by 2050 (~2°C warming globally), compared to about 30% as a result of socio-economic changes alone. Without adaptation, this would apply particularly to most countries in Africa, with over 50% of population at risk generally in Sahel countries, the Maghreb, North and South Sudan, Ethiopia and Mid to Southern Africa. The model applied in this study adopts the dietary energy provision-based methodology (Food and Agriculture Organisation – FAO), derived from the principle that food deprivation is based on a comparison of usual food consumption expressed in terms of dietary energy (calories) with minimum energy requirement norms and a function of future scenarios of climate, population and social-economic changes.

Table 2. Changes in crop yields under a range of climate change scenarios. Extension of table in IPCC AR5 WGII box 7-1 with data from underlying studies.

Region	Crop yield change in %	Scenario decade (global warming above preindustrial)	Source
All regions	Wheat: –17% Maize: –5% Sorghum: –15% Millet: –10%	2050 (~2°C)	(Knox et al. 2012)
All regions	Maize: –24 ± 19%	2090 (~5°C)	(Thornton et al. 2011)
West Africa	Maize: –7%	2050 (~2°C)	(Knox et al. 2012)
Sahel	Maize: –13% Millet: –11%	2050 (~2°C)	(Ben Mohamed 2011)
Sahel	Millet: –20% Millet: –40%	(~2°C) (~3°C)	(Ben Mohamed 2011)
Central Africa	Maize: –13%	2050 (~2°C)	(Knox et al. 2012)
East Africa	Maize: –3% to +15% Beans:–2 to +22% Maize: –9% to +18% Beans: –18 to +24%	2030 (~1.5°C) 2030 (~1.5°C) 2050 (~2°C) 2050 (~2°C)	(Thornton et al. 2011)
Southern Africa	Maize: –11%	2050 (~2°C)	(Knox et al. 2012)

2.1.4 Health

AAGr1 noted that the rate of undernourishment in the Sub-Saharan African population would increase by 25-90% with a warming of 1.2-1.9°C by 2050 compared to the present (Lloyd et al. 2011). Undernutrition can place people at risk of other health conditions including child stunting, which in turn results in reduced cognitive development and poor health into adulthood.

AR5 stated: "Evidence is growing that highland areas, especially in East Africa, could experience increased malaria epidemics due to climate change (*medium evidence, very high agreement*). The strong seasonality of meningococcal meningitis and associations with weather and climate variability suggest the disease burden could be negatively affected by climate change (*medium evidence, high agreement*). The frequency of leishmaniasis epidemics in sub-Saharan Africa is changing, with spatial spread to peri-urban areas and to adjacent geographic regions, with possible contributions from changing rainfall patterns (*low confidence*). Climate change is projected to increase the burden of malnutrition (*medium confidence*), with the highest toll expected in children." (IPCC 2014)

2.1.5 Other sectors

Although the sectors above are major sectors of interest for Africa's development, with considerable representation in AR5, projected impacts are not confined to these sectors. Key impacts in other sectors as assessed in AAGR1 are:

- Ecosystem ranges will potentially shift rapidly as warming increases, with a risk of loss of biodiversity as species may be unable to migrate to keep pace. Accelerated woody plant encroachment could limit grazing options for both wildlife and animal stock.
- The tourism sector could be affected through factors such as extreme summertime temperatures, loss of biodiversity and natural attractions, and damage to infrastructure as a result of extreme weather events.
- Disruptions to energy supply could occur as changes in river runoff and increased temperatures affect hydroelectric dams and the cooling systems of thermoelectric power plants.
- In many cases, urban areas are particularly exposed to a number of risks associated with climate change, including sea-level rise, storm surges and extreme heat events. Informal settlements are highly vulnerable to flooding and the poor urban populations have been found to be the most vulnerable to elevated food prices following disruptions to agricultural production.

2.1.6 Adaptation potential and limits

Adaptation measures can be very effective in reducing damages from climate change to lives and livelihoods. AAGr1 assessed a range of adaptation measures to reduce impacts, including those updated above. AR5 (IPCC 2014) noted that five "common principles for adaptation and building adaptive capacity can be distilled:

1. supporting autonomous adaptation through a policy that recognizes the multiple-stressor nature of vulnerable livelihoods;
2. increasing attention to the cultural, ethical, and rights considerations of adaptation by increasing the participation of women, youth, and poor and vulnerable people in adaptation policy and implementation;
3. combining "soft path" options and flexible and iterative learning approaches with technological and infrastructural approaches and blending scientific, local, and indigenous knowledge when developing adaptation strategies;
4. focusing on building resilience and implementing low-regrets adaptation with development synergies, in the face of future climate and socioeconomic uncertainties; and
5. building adaptive management and social and institutional learning into adaptation processes at all levels."

Many of these elements can be strengthened by building and developing accountability mechanisms and tools (e.g. operational accountability, strategic accountability, constitutional accountability), thereby enhancing the sustainability of the system of solutions.

However, AR5 also noted that, while adaptation can reduce risks, considerable risks remain even after adaptation for many regions and sectors. In particular, AR5 summarized its risk assessment in a set of diagrams, of which Figure 4 is an example. This confirms assessments of remaining risks in terms of "residual damage" costs in e.g. (Schaeffer et al. 2014). The next section updates AAGr1 calculations of adaptation costs for Africa and includes an assessment of residual damage costs.

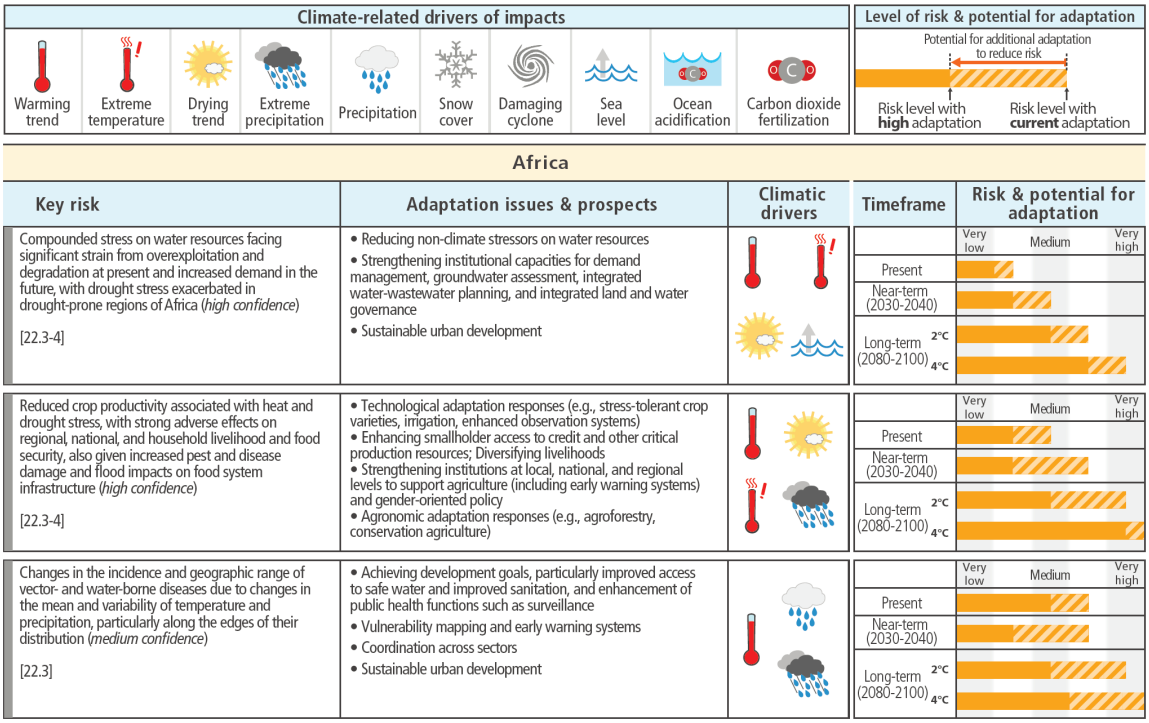


Figure 4 - Example of climate-change risk assessment under current conditions, near-term changes and long-term pathways reaching 2, resp. 4°C global warming above preindustrial (see "Timeframe" column). The orange bars indicate the remaining risk level after achieving of a hypothetical highly adapted state, representing the potential for adaptation, but also its limitations, as considerable risk remains. However, the risk is generally higher without additional adaptation (hatched bars). Source: Assessment Box SPM.2 Table 1 of WGII AR5.

2.2 Damage and Adaptation cost projections

Estimating future damage and adaptation costs remains a difficult task due to among others the large amount of uncertainties involved. Nonetheless several studies have attempted to approximate adaptation costs, focusing both on the short term (Stern 2006; Oxfam 2007; UNDP 2007; World Bank 2010b) and the long term (de Bruin et al. 2009; Hof et al. 2010). Estimating adaptation costs in the long run necessitates the use of Integrated Assessment Models (IAMs). IAMs are aggregated top down models, which enable the study of interactions between climate change and the economy in the long run. As climate change damages and hence adaptation costs increase exponentially over time, including long-term estimates of adaptation costs are essential. In this section a regional IAM (AD-RICE) is used to study the development of adaptation costs in Africa over time. This model has been applied in previous studies (UNEP 2013, UNEP 2014). For a detailed description of the model please refer to UNEP 2013, the following paragraph only briefly introduces the methodology behind the model.

The AD-RICE model (de Bruin 2011) is based on the RICE model (Nordhaus 2011), but explicitly includes the role of adaptation in climate change policy. Based on impact literature AD-RICE calibrates the costs and benefits of three forms of adaptation namely autonomous adaptation, anticipatory adaptation and sea-level rise adaptation. Autonomous adaptation describes adaptation where the benefits of adaptation are felt immediately, i.e. the use of air-conditioning or the changing of crop planting times. This form of adaptation is often considered ***private*** due to the relative low costs of these adaptation options, the absence of upfront investments and the private nature of the benefits. Anticipatory adaptation refers to adaptation where investments are made to reduce climate change damages in the future, i.e. investments in irrigation infrastructure. This form of adaptation is considered ***public*** due to large scale investments needed and the public nature of the benefits. Sea level rise adaptation is a special form of anticipatory adaptation, where seawalls are built to reduce damages caused by sea level rise.

Figure 5 shows the estimated adaptation costs for Africa over the next century for several mitigation scenarios (2012 USD billions). What differs in these estimates compared to 2013 AAGr1, is the estimated temperature change and sea level rise for the different scenarios. From the figure two main results can be inferred, firstly adaptation costs rise steeply over time and secondly the level of adaptation costs will differ greatly between mitigation scenarios, with the difference emerging in the 2030s. By the 2050s, adaptation costs in an "over 4°C World" pathway rise to double the levels in a "below 2°C World" pathway. Note the 1.5°C scenario is very close to the below-2°C scenario, which is due to warming in the latter scenario being much closer to 1.5°C than to 2°C - see also Figure 1 and Table 3

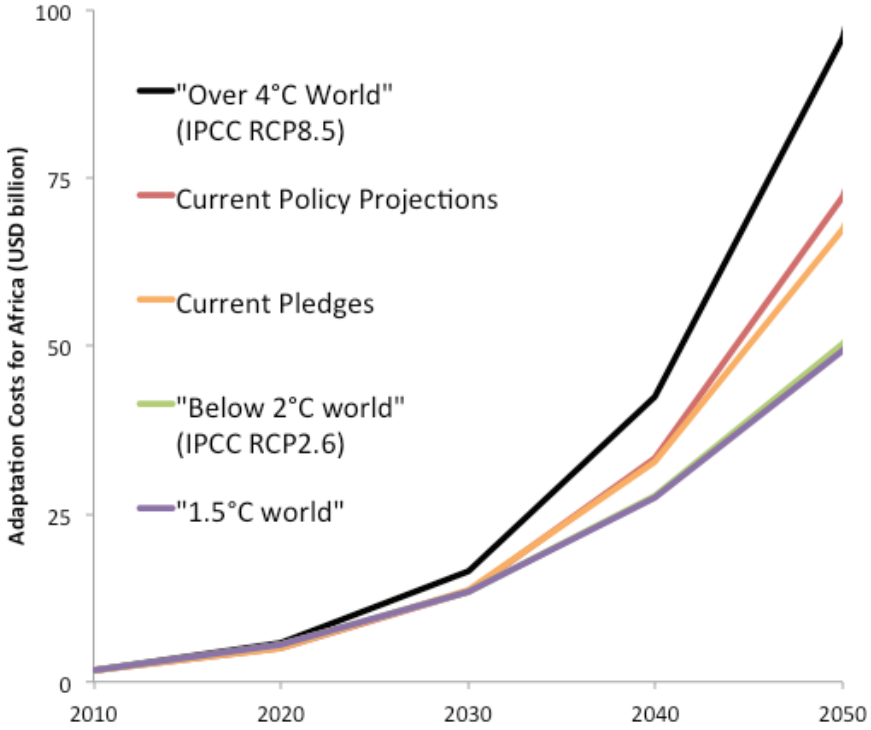


Figure 5 - Total adaptation costs for Africa for all sectors in USD 2012 billion over time. Source: own calculations using the AD-RICE model.

Table 3: Global climate-change indicator projections and total adaptation costs for Africa for all sectors in USD 2012 billion over time (rounded to nearest 5). Source: own calculations.

	"Below 2°C World"	Current Pledges	Current Policy Projections	"Above 4°C World"
Global climate-change indicators:				
Warming 2050 (°C)	1.6	1.9	2.0	2.3
Warming 2100 (°C)	1.6	3.1	3.7	5.1
Sea-level rise 2050 (cm)	17	18	18	21
Sea-level rise 2100 (m)	36	51	56	70
Adaptation costs in USD 2012 billion:				
2020	5	5	5	5
2030	15	15	15	15
2040	30	35	35	45
2050	50	65	70	95

Figure 6 shows the adaptation costs as a percentage of GDP. Adaptation costs for Africa exceed 3.5% of GDP in the "Over 4°C world" scenario by the end of the 21st century, and about half that for the Current Policy Projections and Current pledges scenarios. In the "Below 2°C world" and "1.5°C world" adaptation costs reach under 1%. This reflects the immense positive effect of mitigation policies on adaptation costs.

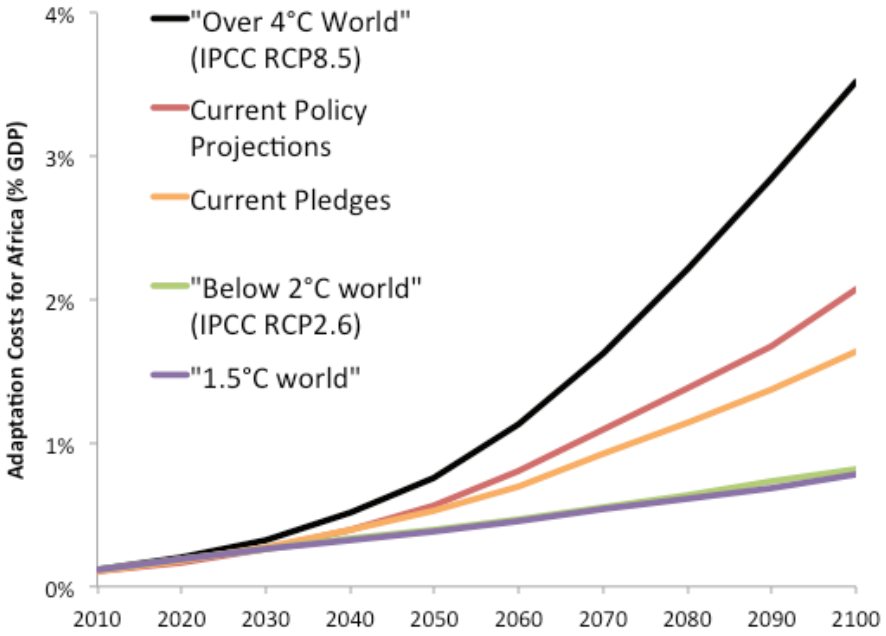


Figure 6 - Total adaptation costs for Africa for all sectors as a percentage of Africa's GDP over time. Source: own calculations using the AD-RICE model.

In Figure 5 and Figure 6 adaptation costs are presented in association with the median value of temperature in each mitigation scenario. To better understand the role that uncertainty plays, in Figure 7 the adaptation costs are displayed for the temperature range (16th to 84th percentile) as well as the median value, highlighting the uncertainty induced by climate sensitivity. Figure 7 focuses on two mitigation scenarios ("Below 2°C world" and "Over 4°C world"). The figure clearly shows how dependent the results are on uncertainty and should be interpreted with this in mind.

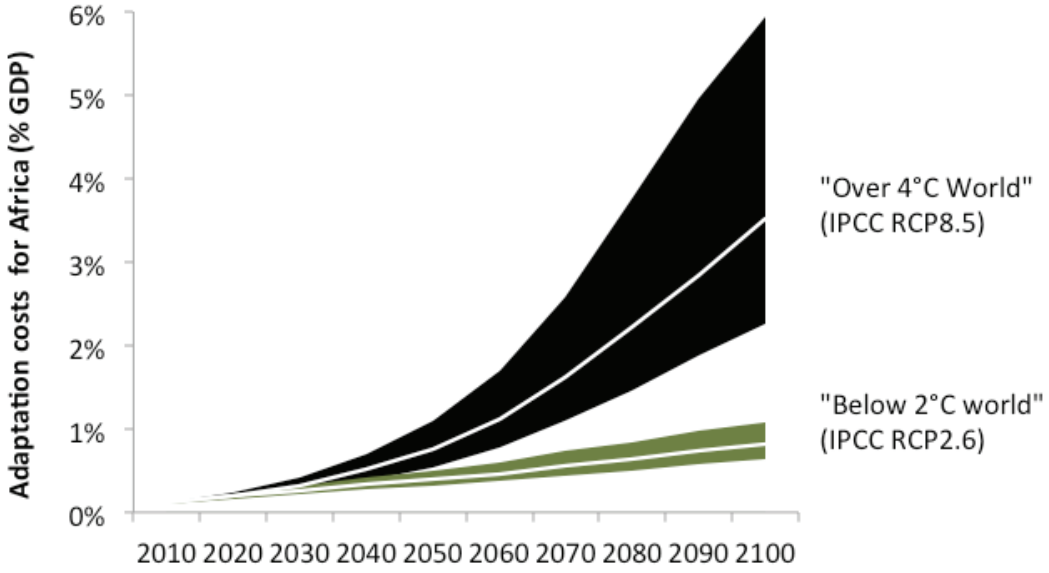


Figure 7 - Total adaptation costs for Africa for all sectors as a percentage of Africa's GDP over time for median and 90-precent uncertainty range of climate projections. Source: own calculations using the AD-RICE model.

Figure 8 shows the long-term composition of annual adaptation costs (distinguishing between autonomous, anticipatory and sea level rise) for 2100 for the various mitigation scenarios. Sea-level rise adaptation costs are relatively constant across scenarios due to the large inertia in the ocean and ice sheets, but since total costs are much lower in low-emission scenarios, sea-level rise comprise a relatively much larger fraction of total costs. Secondly, we see that anticipatory adaptation costs are much higher than autonomous adaptation costs. As temperature increases, so does the share of anticipatory and reactive adaptation, though the increase in the share of anticipatory adaptation is much more striking.

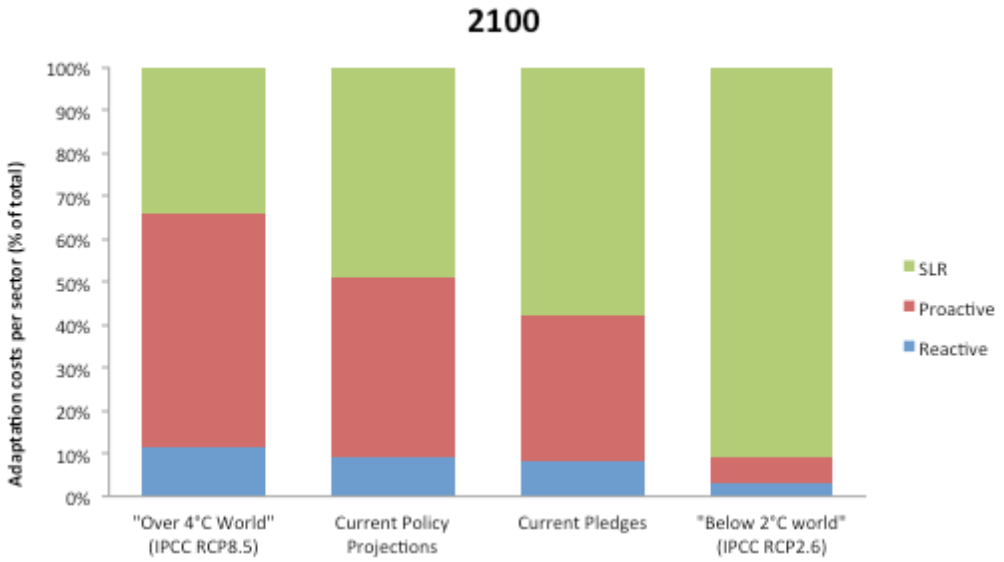


Figure 8 - Total annual adaptation costs for Africa decomposed in autonomous adaptation costs, anticipatory adaptation costs and sea-level rise adaptation costs for the year 2100. Source: own calculations using the AD-RICE model.

The AD-RICE model sets adaptation at a level where adaptation costs and residual damages are minimized, i.e. adaptation costs and benefits are equalized at the margin. This results in what in this modelling context can be called the optimal level of adaptation (lowest overall costs). It is hence important to consider the resulting residual damages of the mitigation scenarios and how they relate to adaptation costs. Figure 9 presents both adaptation costs and residual damages between 2010 and 2050 for the "Below 2°C world" and "Over 4°C world" scenarios. The figure shows that even with optimal adaptation residual damages will be large. Residual damages are more than twice as large as adaptation costs, though the relative size of adaptation costs increase slightly over time. Again, the main divergence between mitigation scenarios takes off by the 2030s.

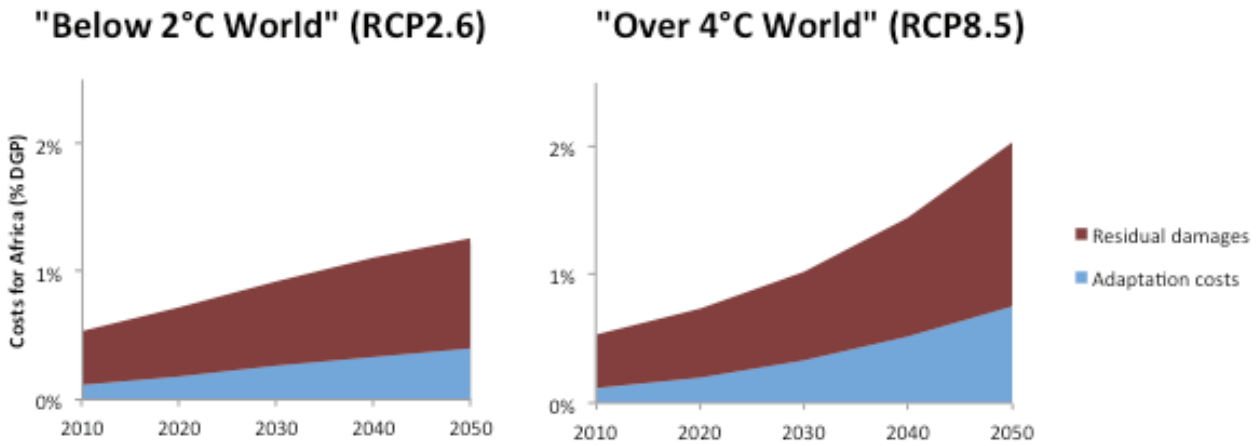


Figure 9 - Adaptation costs and residual damages for Africa for all sectors as a percentage of Africa's GDP over time. Source: own calculations using the AD-RICE model.

Comparing different estimates of adaptation costs is problematic as different studies use different methodologies, consider different impacts, use a different time frame and have a different focus (long term vs. short term). However, at least for context it is useful to compare the AD-RICE estimates to other adaptation costs estimates. Figure 10 presents the static global adaptation estimates (World Bank 2006, Stern 2007, Oxfam 2007, UNDP 2007 and UNFCC 2007), which are mentioned in AR5 along with the dynamic AD-RICE estimates. The AD-RICE estimates are for the Current Policy Projections scenario, which is most consistent with the assumed climate change scenarios of the static studies. The AD-RICE estimates seem consistent with the static estimates, albeit that they are near the higher end of the static estimate ranges.

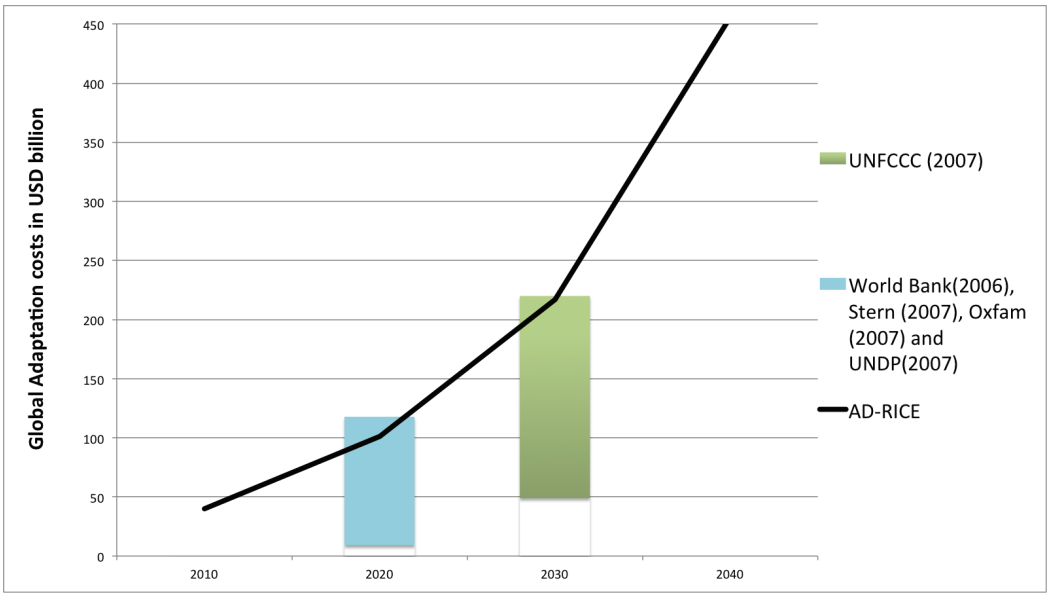


Figure 10 - Global adaptation cost estimates from various sources over time in USD 2005 billion. Source: own calculations using the AD-RICE model, World Bank 2006, Stern 2007, Oxfam 2007, UNDP 2007 and UNFCC 2007.

Figure 11 compares the estimates of adaptation costs for Africa from 2020 to 2050 for AD-RICE and the World Bank (2010a) study[5]. The adaptation costs are divided into sea-level rise costs and other sectors. In the short run AD-RICE has similar sea-level rise adaptation cost estimates to the World Bank study. In the long run, however, AD-RICE adaptation costs increase at a rapid rate surpassing those of the World Bank 2010a, where the World Bank estimates these at 6.2 USD billion annually in 2050 whereas AD-RICE estimates these at 34 USD billion annually. This can partly be explained by the methodology, where in the long run the AD-RICE model assumes more rapidly increasing damages, economic growth and hence steeply increasing adaptation costs. Indeed, costs of adaptation to sea-level rise are expected to grow not only with sea-level rise itself, but also with GDP in the AD-RICE model, i.e. at a rate of almost 7% annually in 2010 in Africa, decreasing over time to a level of 3.5% annually in 2050.

Concerning adaptation costs in other sectors, the World Bank has higher estimates in earlier periods than AD-RICE (and the other static estimates mentioned before). However, the AD-RICE estimates are higher by 2050.

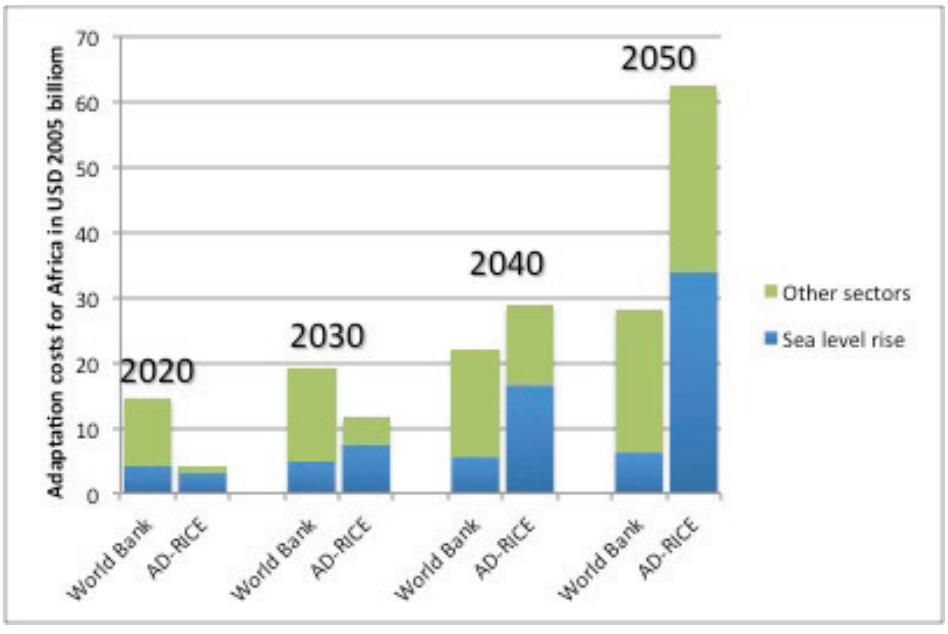


Figure 11 - Adaptation costs for Africa in USD 2005 billion for 2020-2050 as estimated by AD-RICE and World Bank 2010a. Source: own calculations using the AD-RICE model and World Bank 2010a

5 Due to differences in regional aggregation between World Bank 2010a and AD-RICE, a perfect comparison of Africa's adaptation cost estimates is not possible. The best comparison possible is between the total of the regions Sub-Saharan Africa, and North Africa and the Middle East in World Bank (2010a) and Africa in AD-RICE. For this comparison the policy reference scenario in AD-RICE is used, as over the comparison period projected warming in this scenario most closely matches that of the SRES A2 scenario on which the World Bank (2010a) estimates are based.

3. Update international finance - comparison with costs

3.1 Funding available globally for adaptation

Under the United Nations Framework Convention on Climate Change (UNFCCC) developed countries have made a commitment to assist developing country Parties that are particularly vulnerable to the adverse effects of climate change in meeting the cost of adaptation to those adverse effects (Article 4.4). A vehicle for the provision of financial resources to developing countries is the financial mechanism of the Convention, which is currently operated by the Global Environment Facility (GEF) and the Green Climate Fund (GCF).

As stipulated in Article 11.5, developed countries may also provide financial resources related to the implementation of the Convention through bilateral, regional or multilateral channels. Historically, the majority of funding has been delivered through these vehicles.

The international efforts to make the provision of financial resources more effective received a significant boost through the adoption of the Cancun Agreements at the 16th session of the Conference of the Parties (COP) to the UNFCCC in December 2010. These agreements inter alia established the Green Climate Fund (GCF), which is supposed to become the major vehicle for climate finance in the coming years. Parties in particular agreed that a significant share of new multilateral funding for adaptation should flow through the GCF.

Another main feature of the Cancun Agreements was the formal recognition of the commitment made by developed countries at COP 15[6] to a goal of mobilizing jointly USD 100 billion per year by 2020 to address the needs of developing countries, including funding for adaptation. Funding provided in relation to this commitment will come from a wide variety of sources, public and private, bilateral and multilateral, including alternative sources, the latter inter alia referring to emission reduction policies that at the same time can generate public financial resources such as a carbon tax or emission trading schemes.

The notion that the USD 100 billion commitment includes a wide variety of sources indicates that the scope of climate finance will continue to expand in the coming years towards not only narrowly looking at financial transfers from developed to developing countries but also more broadly on the redirection of global public and private investment flows towards low carbon and climate resilient development pathways. This renewed broader approach reflects a growing understanding that an effective policy response to climate change will need to include measures targeted at catalysing investments from all actors including institutional and private investors. At the same time this approach also poses new challenges for tracking and validating the mobilization of financial resources as methodologies for accounting of non-public investment flows are still at the early stage of development. This is especially true for adaptation finance, which currently is provided primarily in the form of official development assistance. These challenges and the fact that the USD 100 billion commitment does not include milestones or mid-term-targets towards 2020 makes it difficult to estimate expected levels of climate finance flows for the short and medium term (i.e. for the period 2014-2020). This follows a period where developed countries reported annually on the progress in fulfilling their commitment of providing USD 30 billion to developing countries over 2010-2012. This political commitment was made at COP 15 in December 2009 (the so-called "Fast-Start Finance" commitment). The relatively short lifespan of the commitment and annual reporting by developed countries increased transparency and predictability of the delivery of finance during this period. Over the three years, developed countries have reported the provision of USD 39.6 billion as pledged, allocated and implemented Fast Start Finance. This includes USD 36.2 billion in public finance and USD 3.4 billion in mobilised private finance (Japan) (Fallasch and De Marez 2013).

6 The outcome of COP 15, in 2009, was a political declaration called the "Copenhagen Accord" which has no legal status, as it was not adopted by the COP. Some of the commitments made in the Copenhagen Accord have been formally included one year later in the Cancun Agreements adopted at COP 16.

3.1.1 Aid flows for adaptation, globally and in Africa

It is estimated that public adaptation-related finance reached a volume of USD 24.7 billion (range: USD 23-26 billion) in 2012/13 of which 88 per cent, or US$22.0 billion, was invested in non-OECD countries (USD 22.0 billion) (Buchner et al., 2014).

These figures include aid flows in form of Official Development Assistance (ODA) as well as other funding streams originating from developed and developing country governments, multilateral climate funds and Development Finance Institutions (DFIs). In 2013 on average a total of USD 11.9 billion and USD 4.3 billion of these flows was allocated to Sub-Saharan Africa and the MENA region respectively (Buchner et al., 2014).

In the following section we focus on bilateral ODA flows from developed to developing countries as reported under the creditor reporting system of the OECD Development Assistance Committee (DAC).

The Development Assistance Committee (DAC) of the Organization for Economic Cooperation and Development (OECD) is monitoring aid by theme, using policy markers that donors can use to indicate for each aid activity what objectives it targets. For climate change, the OECD DAC monitors both mitigation and adaptation flows.

Using the OECD DAC database, we estimated the funding disbursed globally and in Africa for climate change adaptation through bilateral and multilateral channels for the period 2010-2012 (Table 4). Under the OECD DAC methodology, aid activities can serve multiple objectives and individual projects can be reported under the mitigation and adaptation markers simultaneously.

Table 4. Aid flows for adaptation over the period 2010-2012 based on (OECD.Stat 2014)

Geographical scale of aid flows	Policy objective	2010 (USD million)	2011 (USD million)	2012 (USD million)
Global adaptation aid flows	Principal	$2,683.21	$2,069.43	$2,680.29
	Significant	$5,770.97	$6,449.79	$7,420.88
Africa adaptation aid flows	Principal	$742.87	$615.94	$885.57
	Significant	$1,509.02	$1,789.11	$2,083.15

When accounting for climate aid flows, the OECD distinguishes between projects that have a principle and significant climate policy objective. Aid activities are marked with a principle policy objective, when promoting the objectives of the UNFCCC is one of the principle reasons for undertaking the project or programme. Activities marked "significant" have other prime objectives but have been formulated or adjusted to help meet climate concerns (OECD 2011). For these projects only an unspecified share of the funding contributes to adaptation. In terms of coverage, the database on climate change adaptation currently extends to flows provided as official development assistance (ODA) and other official flows (OOF), the latter consisting of non-concessional development flows. Exploratory work is underway on tracking non-concessional private flows and other instruments such as guarantees.

Furthermore, the OECD database does not cover all aid flows to climate change adaptation activities. Most notably, data for contributions by the United States are currently not available in the reporting system. These flows could be potentially significant as the US in its first Biennial Report[7] to the UNFCCC reported the provision of USD 555 million in 2011 and USD 393 million in 2012 respectively for adaptation activities in developing countries (U.S. Department of State 2014). Scope and methodology of the Biennial Reports however are not comparable to those applied by the OECD DAC. While the OECD DAC applies a common methodology for all countries in accounting for climate aid flows, in the Biennial Reports each country can decide at its discretion what type of flows it reports. The spectrum of flows reported in the Biennial Reports is therefore wider than of flows reported under the OECD. The above numbers for the US therefore need to be interpreted with caution when compared to numbers reported by the OECD and are for reference only. The remainder of this report is based on figures provided by the OECD DAC as they have a higher degree of granularity. Especially, funding reported in the Biennial Reports is not broken down by region, therefore no aggregate figures for support provided to Africa can be extracted from these reports.

The OECD DAC figures show that the level of global aid flows that have a principle adaptation policy objective has been stagnating over the past three years with a drop in flows observable in 2011. This drop is consistent with an overall drop in official development assistance experienced in 2011 due to pressure on aid levels in major donor countries because of continuing tight budgets in these countries. As Figure 12 shows, the share of flows with principle adaptation objectives directed towards Africa has increased slightly over the period 2010-2012 reaching approximately a third of the global adaptation aid flows in 2012.

At the same time, adaptation flows with a significant objective have been increasing over 2010-2012, both globally and in Africa, indicating that adaptation is increasingly becoming an important topic for projects that have other principle development objectives.

7 As part of the reporting system under the UNFCCC developed countries are requested to submit biennial reports on inter alia their GHG inventories, mitigation actions and financial, technical and capacity building support provided. These reports complement the existing system of National Communications and national inventory reports.

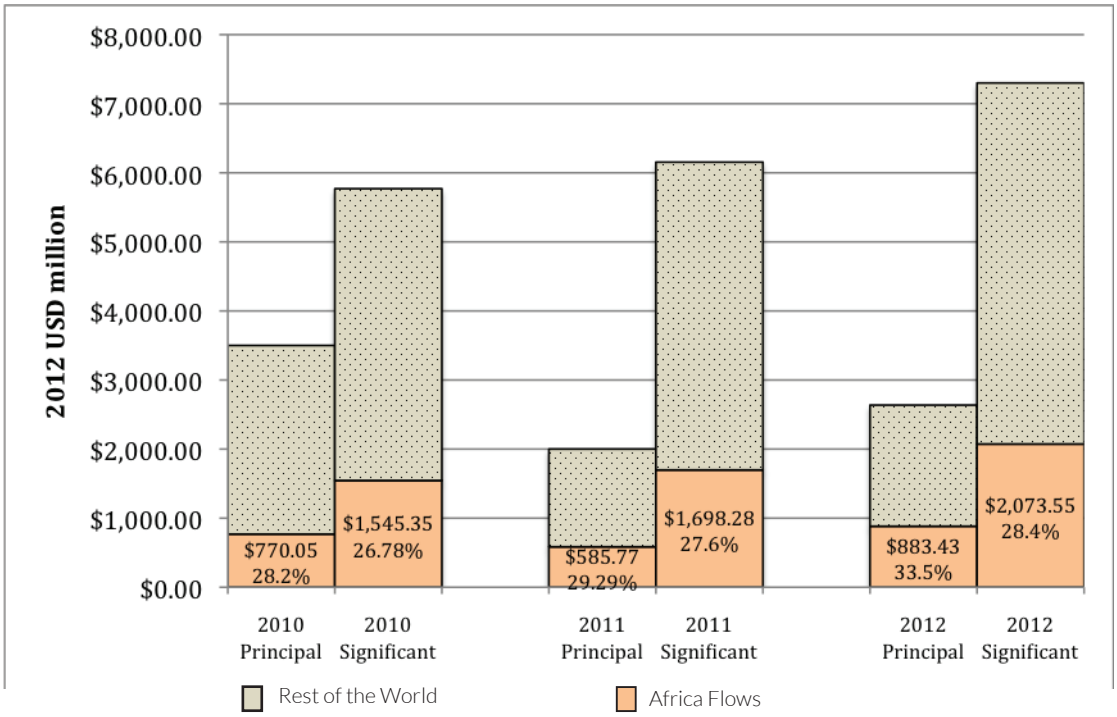


Figure 12 - Development of adaptation aid flows over the period 2010-2012 based on (OECD.Stat 2014)

3.1.2 Available multilateral funding for climate change in Africa and globally

As part of its response to the climate change challenge, the international community established a number of multilateral funds to serve as vehicles for the provision of financial resources to assist developing countries in the implementation of their commitments under the UNFCCC (Figure 14). These include the two Operating Entities of the financial mechanism of the Convention – the Global Environment Facility (GEF) and more recently the Green Climate Fund (GCF) – as well as three special purpose funds, namely the Kyoto Protocol Adaptation Fund (AF), the Least Developed Country Fund (LDCF), and the Special Climate Change Fund (SCCF). In terms of size and scope another important set of funds located outside the UNFCCC are the Climate Investment Funds (CIFs) that are administered by the World Bank and use the Multilateral Development Banks (MDBs) for programme and project implementation. The CIFs have a sunset clause stipulating that they will conclude their operations once a new financial architecture becomes effective under the UNFCCC (World Bank 2008).

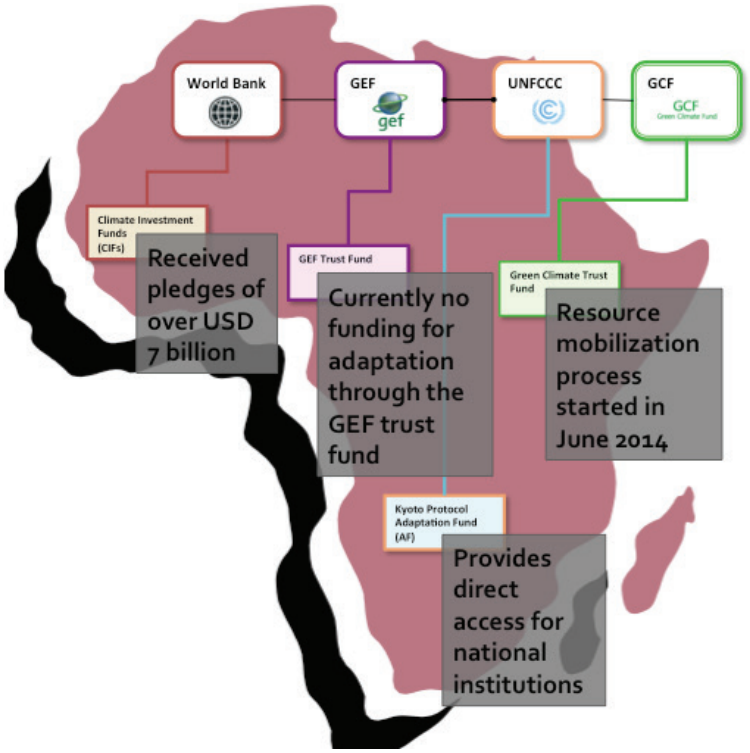


Figure 13 - Review of the main multilateral climate funds operating in Africa and their interlinkages

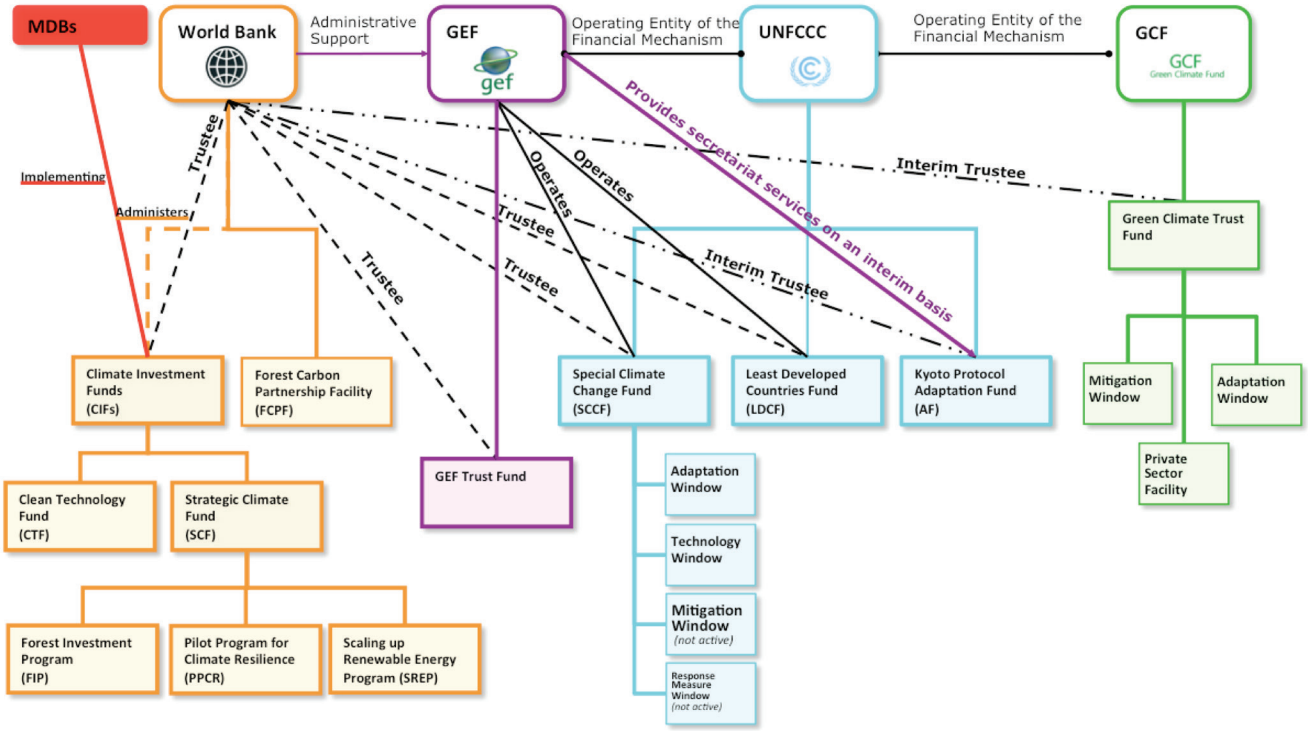


Figure 14 - Overview of multilateral climate funds (adapted from (Fallasch et al. 2010)*)*

Scope, focus and access modalities vary for these various funds depending on their specific mandates and governance systems. The main source for adaptation finance under the UNFCCC is currently the adaptation window of the SCCF. However the current size of this fund does not correspond to the demand by developing countries for adaptation finance (GEF 2011). In addition, the LDCF provides funding to least developed countries (LDCs) for the formulation and implementation of National Adaptation Plans of Action (NAPAs), National Adaptation Plans (NAPs) and other elements of the LDC work programme under the UNFCCC. Both, the SCCF and LDCF, are sourced by voluntary contributions by developed countries and are operated by the Global Environment Facility (GEF). Access to SCCF and LDCF funding is provided through those implementing entities that are accredited with the GEF[8].

8 Asian Development Bank (ADB), African Development Bank (AfDB), Conservation International (CI), European Bank for Reconstruction and Development (EBRD), Food and Agriculture Organizaton of the United Nations (FAO), Inter-American Development Bank (IADB), International Fund for Agricultural Development (IFAD), United Nations Development Programme (UNDP), United Nations Environment Programme (UNEP), United Nations Industrial Development Organization (UNIDO), The World Bank (WB)

Developing countries that are Parties to the Kyoto Protocol can also access adaptation resources through the Protocol's Adaptation Fund. The mandate of the Fund is to finance concrete adaptation projects and programmes in developing countries that are particularly vulnerable to climate change. In an attempt to strengthen country ownership of its programmes and projects, the Adaptation Fund has implemented a new modality through which countries can access multilateral resources directly via their national or regional institutions once these have been accredited with the Fund. The Fund has initially been primarily sourced through a two per cent levy applied on the monetization of Certified Emission Reductions (CERs) from the Clean Development Mechanism (CDM). More recently, the Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol (CMP) decided to extend the two per cent levy to the first international transfers of Assigned Amount Units (AAUs) and the issuance of Emission Reduction Units (ERUs) for joint implementation projects under the Kyoto Protocol. Due to the low level of mitigation ambition that resulted in the collapse of CER prices, the revenues that can be raised through these levies have declined sharply in the past years and the Adaptation Fund now mainly relies on voluntary contributions by developed countries[9]. Under an ambitious mitigation regime, these levies would have however a significant revenue potential (UNEP 2014). The UN Secretary General's High Level Advisory Group on Climate Change Finance (AGF) for example estimates that a 2 per cent levy on carbon offsets could raise up to USD 3 billion annually under mitigation targets that correspond roughly to an emission pathway that limits global warming to 2-2.5°C above pre-industrial levels (High-level Advisory Group on Climate Change Financing 2010). A more stringent mitigation regime consistent with a long-term global temperature goal of 1.5°C, as currently considered by the UNFCCC in its review of the global temperature goal would further increase the revenue potential of such a levy.

Table 5. Overview of multilateral funds providing resources for adaptation

Fund	Established by	Total pledges, contributions and revenue earned since inception	Total cumulative funding approvals towards projects and programs[10]	Cumulative Cash Transfers to recipients	Funds available to support funding decisions	Access Modalities
GCF	UNFCCC	USD 10,193.3	n/a	n/a	n/a	Through accredited national, regional and multilateral implementing entities and intermediaries
Adaptation Fund[11]	UNFCCC-KP	USD 414.7	USD 226.1	USD 99.5	USD 150.7	Through accredited national, regional and multilateral implementing entities
SCCF[12]	UNFCCC	USD 348.5	USD 271.3	USD 118.5	USD 15.67	Through implementing entities accredited with the GEF
LDCF[13]	UNFCCC	USD 916.5	USD 804.3	USD 197.21	USD 33.56	Through implementing entities accredited with the GEF
PPCR[14]	World Bank/ MDBs	USD 1,148.0	USD 787.0	USD 236.0	USD 182.0	Through MDBs

All numbers in USD million

Table 5 summarizes pledges and contributions received as well as, in the case of the Adaptation Fund, revenues earned, since their inception. With pledges of USD 1,148 million the Pilot Programme for Climate Resilience (PPCR), which is hosted under the Climate Investment Funds, has been the largest multilateral source of adaptation funding to date. It is followed by the LDCF, whose resources are exclusively available for least developed countries. With USD 407.88 and 348.5 million respectively the Adaptation Fund and SCCF received less than half of the resources that have been pledged to the LDCF. The resources that these funds have available to support new funding decisions are considerably smaller. Under the LDCF and SCCF for example only USD 33.56 and USD 15.67 million respectively are available to fund additional projects since funding decisions have been made for the majority of the pledges they received. Cumulative cash transfers since inception for each of the Funds up to now are below USD 200 million. Due to their complexity, many projects and programmes of these funds have a long-term horizon leading to increasing disbursements over their lifespan. Under the PPCR, the majority of disbursements is for example scheduled to occur between 2015 and 2019 reaching annual levels of up to USD 222.6 million in 2016 (CIFs, 2014). The numbers however show that the provision of multilateral adaptation finance needs to be scaled-up significantly if it is to make a substantial contribution to the USD 100 billion commitment.

9 In 2010, the Adaptation Fund generated around USD 100.22 million through the sale of a total of 5,985,000 CERs. In 2013 the sale of 3,742,303 CERs generated only USD 1.8 million in revenues for the Fund.

10 Does not include agency fees and administrative budgets

11 Data based on AF Financial Report including financial information as of 30 June 2014

12 Data based on SCCF Financial Report including financial information as of 30 September 2014

13 Data based on LDCF Financial Report including financial information as of 30 September 2014

14 Data based on PPCR Financial Report including financial information as of 30 September 2014

A new channel for the delivery of scaled-up adaptation finance is the Green Climate Fund (GCF) that was established by the UNFCCC in 2010. By decision 1/CP.16 countries agreed that a significant share of new multilateral funding for adaptation should flow through the GCF. Paragraph 50 of the GCF Governing Instrument stipulates that the Board will balance the allocation of resources between adaptation and mitigation activities under the Fund. The Board is also required to take into account the urgent and immediate needs of developing countries that are particularly vulnerable to the adverse effects of climate change including LDCs, SIDS and African States, using minimum allocation floors for these countries as appropriate (Paragraph 52 GCF Governing Instrument).

By decision B.06/06 the Board of the GCF gave effect to these provisions, deciding that the fund will aim for a 50:50 balance between mitigation and adaptation over time, as well as a floor of fifty per cent of the adaptation allocation for particularly vulnerable countries, including LDCs, SIDS and African States (Figure 15).

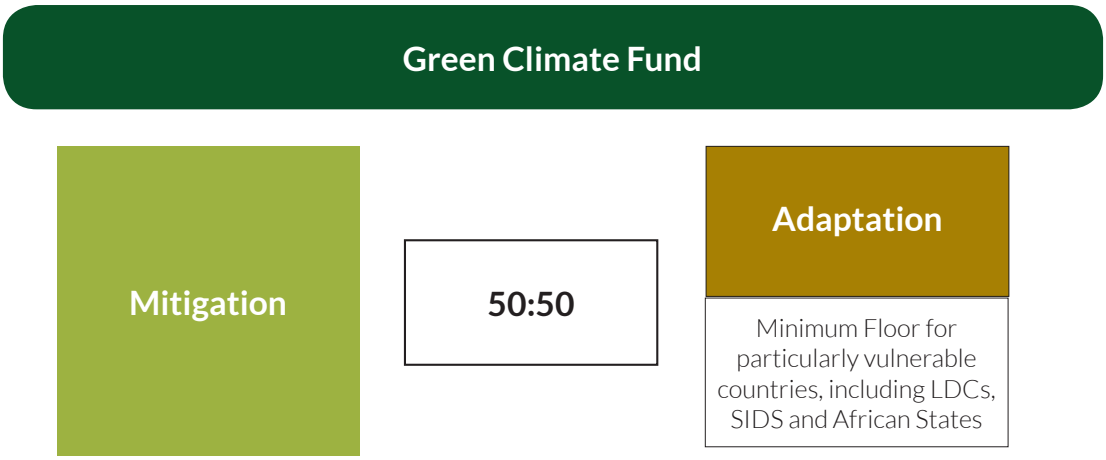
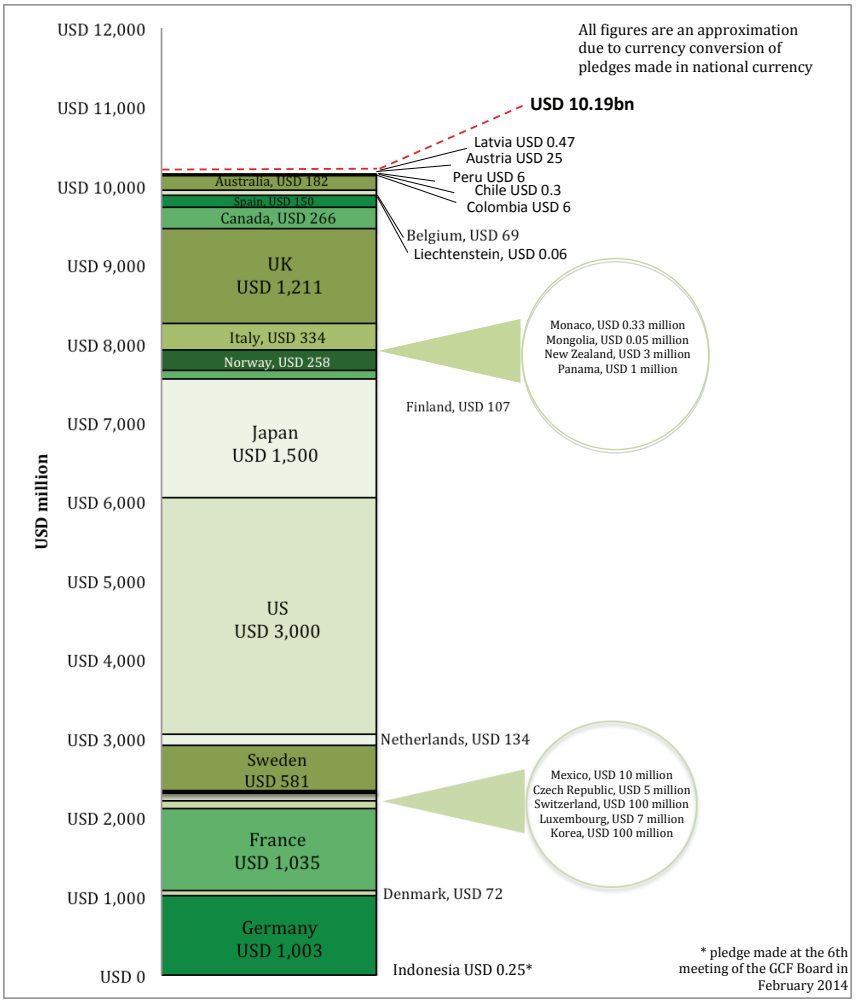


Figure 15 - Allocation Framework of the GCF

At a high-level pledging conference for the GCF on 20 November 2014 in Berlin, Germany 21 countries pledged contributions of USD 9.3bn to the Fund, making it the largest multilateral climate fund in the current climate finance architecture. Through further pledges total contributions to the Fund, reached USD 10.19 billion by the end of 2014. If the Fund will achieve its allocation targets a total of USD 5 billion could become available for adaptation through the GCF in the coming four years of which USD 2.5 billion would be reserved for particularly vulnerable countries.

Flooding in Kenyan village

Photo Credits: CCDARE



The GCF will be accessible through national, regional and international implementing entities and intermediaries building on the experience of the direct access modality piloted by the Adaptation Fund. Institutions interested to work with the GCF have to go through an accreditation process, which will screen their capacities to comply with the Fund's fiduciary standards and environmental and social safeguards. These standards and safeguards are designed to ensure that institutions have appropriate systems in place to manage GCF funding prudentially and to minimize any potential environmental and social impacts of activities supported by the Fund. The accreditation process of the Adaptation Fund has been perceived as challenging by many institutions from developing countries, which was reflected in the initially low success rate of applications (Brown et al. 2010). Over time the accreditation process became more established (Trujillo and Nakhooda 2013) and today 16 national and 4 regional institutions from developing countries are accredited with the Adaptation Fund including 7 national and 1 regional implementing entity from Africa (Table 6). At the same time, countries that successfully completed the accreditation process highlighted that it had a positive impact on building organisational development and improvements that otherwise may not have occurred (Bugler and Rivard 2012; SPREP 2014).

Table 6. National and Regional Implementing Entities in Africa that are accredited with the Adaptation Fund (as of August 2014).

National Implementing Entities	Country
National Environment Fund	Benin
National Environment Management Authority (NEMA)	Kenya
Agency for Agricultural Development	Morocco
Desert Research Foundation of Namibia (DRFN)	Namibia
Ministry of Natural Resources (MINIRENA)	Rwanda
Centre de Suivi Ecologique	Senegal
South African National Biodiversity Institute	South Africa
Regional Implementing Entities	**Based in**
West African Development Bank (BOAD)	Togo

Building on the experiences of the Adaptation Fund, the GCF Board agreed on developing a fit-for-purpose accreditation approach that matches the nature, scale and risk of proposed activities to the application of the initial fiduciary standards and environmental and social safeguards (Decision B.07/02). This novel approach to accreditation can provide additional flexibility to institutions to build their capacities gradually by focussing initially on activities that are less risky from a financial management and environmental perspective. This can be especially important for institutions seeking international support for small-scale adaptation activities. The current climate finance architecture did not fully accommodate the needs of these actors resulting in a bias towards larger scale infrastructure projects risking missing the catalytic effect of pilot projects and innovative approaches (Polycarp et al. 2013).

Further channels of international adaptation finance are the multilateral development banks (MDBs). Since 2011 seven MDBs[15] have been reporting annually on adaptation finance provided. The MDBs are using a different reporting methodology than the OECD, which is not differentiating between principle and significant policy objectives of funded activities. Instead reporting is limited to those activities that are clearly linked to the climate vulnerability context. Funding is tracked at the sub-project or project component level where possible. Reports cover the MDBs' own resources as well as a range of external resources that are managed by them. These resources might also be reported to the OECD DAC by the contributor country. In 2012 the MDBs provided approximately USD 5.9 billion in adaptation finance. Out of this figure USD 1.8 billion has been directed to Sub-Saharan Africa (Table 7 & Figure 16a).

Table 7. Multilateral development bank adaptation Finance globally and for Africa for the period 2011-2012 based on (MDBs 2012; MDBs 2013)

Geographical scale		2011 (USD million)	2012 (USD million)	2013 (USD million)
Global MDB Adaptation Finance	MDB Resources	$4,176.00	$5,586.00	$4,438
	External Resources	$344.00	$370.00	$388
Sub-Saharan Africa MDB Adaptation Finance	MDB Resources	n/a	$1,657.00	$843
	External Resources	n/a	$179.00	$109

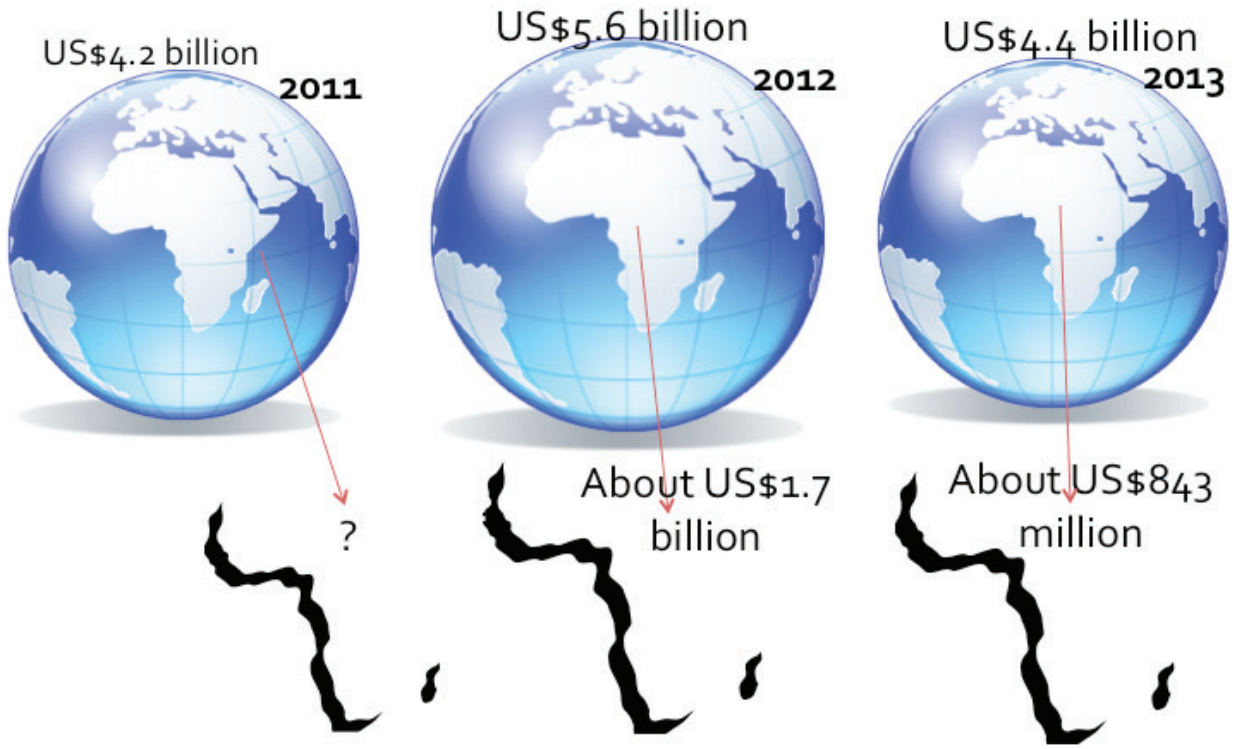


Figure 16a - Multilateral development bank adaptation finance globally and for Africa for the period 2011-2013 based on (MDBs 2012; MDBs 2013)

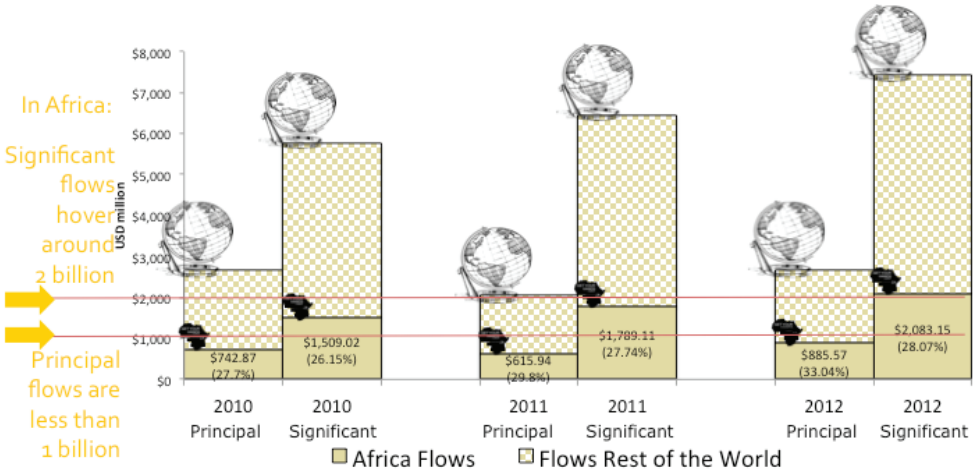
15 African Development Bank (AfDB), Asian Development Bank (ADB) European Bank for Reconstruction and Development (ERBD), European Investment Bank (EIB), Inter-American Development Bank (IADB), World Bank (WB) and International Finance Cooperation (IFC).

3.1.3 Private sector adaptation flows in Africa and globally

Sub-national actors, such as local governments and the private sector, are increasingly recognized as critical for adapting to the adverse effects of climate change, as they are instrumental in promoting adaptation of communities, households, and civil society as well as in managing risk information and financing (IPCC 2014). There are various sources of international private finance flows for climate change. These can for example include foreign direct investment (FDI), carbon markets, resources channelled through a private climate fund, loans and guarantees provided through export credit agencies and investment banks, the international capital markets through green bonds and other financial instruments or financing vehicles that mix public and private resources. However, currently no systematic tracking of these flows from private investors exists (Clapp et al. 2012). Challenges for accounting private sector flows include reluctance of private actors to reveal or share information on their investments for confidentiality reasons (Buchner et al. 2011; Montmasseon-Clair 2013; Tirpak et al. 2014), difficulties in identifying those investments that are mobilized by government intervention and not part of existing flows (Atteridge 2009), potential double counting of carbon market flows (Roberts et al. 2010) and a lack of a common understanding what is meant by private finance ((Stadelmann et al. 2011)). Work to overcome persistent data, knowledge and methodological gaps in tracking private climate finance is inter alia underway through a research collaborative initiated by the OECD and comprising key international finance and research institutions. Also the UNFCCC Standing Committee on Finance (SCF) is looking into some of these issues in the context of its first biennial assessment and overview of financial flows. In addition, initial studies have explored methodologies for accounting private sector flows mobilized by an individual country. (Stadelmann and Michaelowa 2013) for example, using top-down and bottom-up approaches, estimate that Switzerland mobilizes between CHF 0.2 and 2.7 billion in private finance annually for mitigation and adaptation activities in developing countries. Similarly, (Cloete et al. 2011) estimate that the amount of private equity funds available for climate finance in South Africa is USD 0.3-0.5 billion based on data of the Development Bank of South Africa (DBSA) collecting publically available information on climate finance flows in the country.

Achieving greater clarity on private climate finance flows will become critical in the context of assessing progress towards fulfilling the USD 100 billion commitment. It will also help to better understand current private investment flows and to identify leverage points for making these investments climate proof.

3.2 The near-term adaptation funding Gap



Principal: objective of activities is to promote the objectives of the UNFCCC

Significant: activities have different prime objectives, but are formulated or adjusted to also meet climate concerns

Development of adaptation aid flows over the period 2010-2012 based on (OECD Stat, 2014)

Figure 16b - OECD Data on Adaptation Finance Globally and in Africa

Following up from the 2013 Africa's Adaptation Gap, this section of the 2015 report provides an update of the adaptation-funding gap. It indicates the difference or gap between, on the one hand, the funding available and, on the other hand, the costs of adaptation in the same timeframe. This gap is shown to grow rapidly with emissions and hence warming and impacts, for example in two different emission scenarios, one leading to a "below 2°C World" and another one leading to an "above 4°C World", with adaptation costs and hence the gap growing much more rapidly in the latter case from the 2030s onwards, as section 2.2 showed.

The average of the funding disbursed during the 2010-2012 period by OECD countries in Africa for adaptation (section 3.1) using the OECD DAC database amounts to up to USD2.5 billion per year (USD 2012 constant value). However, only 750 USD billion per year on average was labelled as "principal" in terms of the primary purpose of the funding benefiting adaptation. The adaptation benefit of the remaining "significant" adaptation funding is hard to establish. As Figure shows, the current level of funding for adaptation of between 750 and 2,500 USD Million per year, if it is not already insufficient, will shortly become insufficient to meet Africa's adaptation needs, irrespective of emission scenario. Thus, the funding gap for Africa is projected to quickly deepen throughout the 2010-2020 period. This scenario underlines that in the absence of clear commitments and disbursements to scale-up funding for adaptation in Africa within the next years, African countries are projected to face severe challenges with regards to adapting to the impacts of climate change.

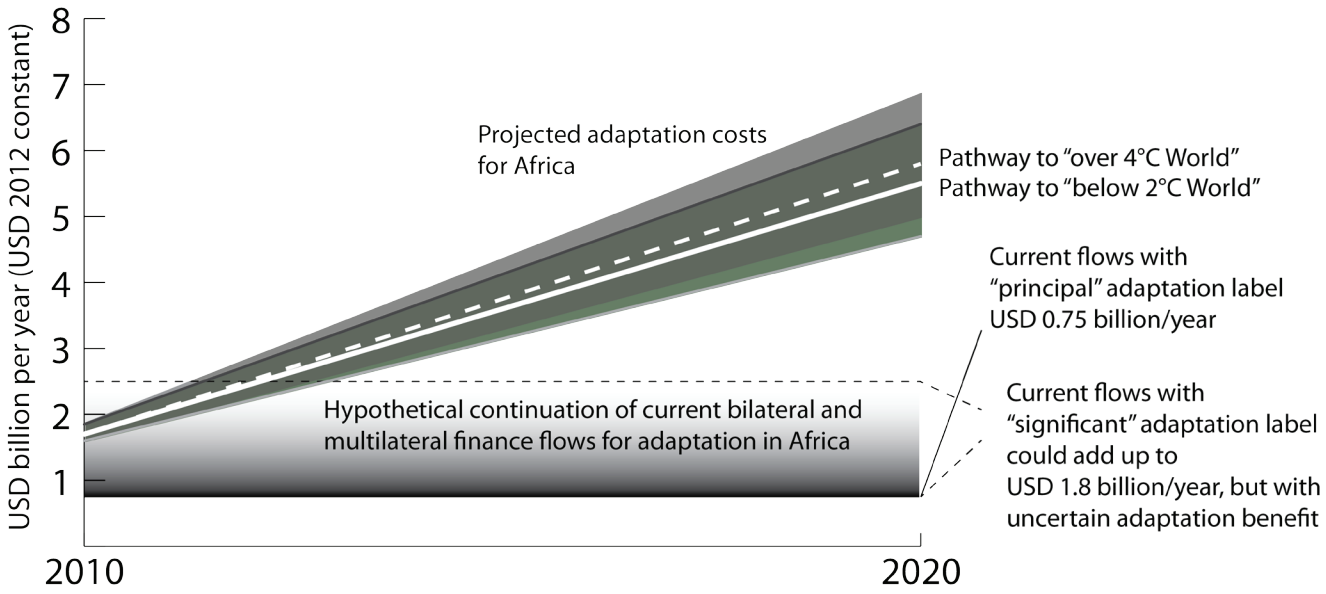


Figure 16c - Costs of adaptation in Africa from 2010-2020 in the "below 2°C" and "above 4°C" world scenarios, compared to the current funding available during the period 2010-2012, hypothetically continued at same level through 2020. Sources: Author's calculations based on AD-RICE 2012 model outputs, and section 3.1; all the dollar values are expressed here in constant US dollar 2012.

Whereas there is considerable uncertainty in estimates of past and current funding for adaptation in Africa (see 2013 AAGr1 and section 3.1), there is obviously a yet higher uncertainty concerning the future funds to be disbursed. In particular, there is no established methodology to interpret the USD100-billion-by-2020 commitment of the Cancun Agreements. Among others, as discussed in section 3.1, it is unclear how much will be mobilized from public and how much from private sources, what the accounting "rules" would be to the real adaptation benefits, what would be additional to existing investment flows (versus what would be a redirecting or relabeling of such flows), or how much of the USD 100 billion will flow through the GCF. Only for funding through the GCF does the agreed rule apply of a 50:50 split in finance directed towards adaptation and mitigation.

Imagining for simplicity that an upper limit of adaptation funding would result from applying the 50:50 rule to the whole USD 100 billion per year, instead of just the GCF part, and also assuming adaptation funding in Africa were to comprise the same share of total adaptation funding in developing countries as under bilateral and multilateral flows over the past few years, this would amount to almost USD 15 billion by 2020. This would catch up for a large part of the "lost opportunity" to invest in adaptation over the pre-2020 period implied by Figure 16c , and – if continued – also make a significant annual contribution post-2020.

If however, over the whole of the USD 100 billion a share of adaptation in Africa were to flow merely equal to the share of adaptation in Africa of overall climate finance today, this would amount to only USD 6 billion per year. This would barely cover annual adaptation costs for Africa by 2020, would not make up for the pre-2020 gap, and would immediately fall short of further rising annual adaptation costs post-2020, unless it were to grow by 10% per year just to keep pace with rapidly increasing adaptation costs in the 2030s as estimated in section 2.2.

4. Exploring country-wide solutions

The purpose of the four country studies included in the report is to assess, in some detail, the extent to which untapped domestic financing could provide an additional source of adaptation finance for African countries. Potential domestic finance estimates are compared, where available, to estimates of adaptation costs. The countries for which this question is explored are Ethiopia, Ghana, South Africa and Togo. As noted in the Introduction, four countries cannot be adequately representative of a continent as large and complex as Africa. However, the four countries chosen do offer both regional and developmental variety and 'spread', and a sufficiently diverse sample of the challenges and opportunities in Africa. In selecting Ethiopia, Ghana, South Africa and Togo as the countries for the case studies, the research team took into account a number of factors, including: regional considerations (there is one East African country, one from Southern Africa, one from West Africa and another from West/Central Africa [Togo] that also happens to be Francophone) and developmental status – the sample extends from a middle-sized economy (South Africa) to an LDC (Togo), with two emerging/fast-growing economies (Ghana and Ethiopia), as well as where the research team had their own researchers, and/or alternative capacity and local contacts. The full country studies are included in Part II of the Report. Selected results are presented here.

Domestic resource mobilization for adaptation includes both public and private additional resources, and our interest is thus both on matters of tax and other public revenue options and on how to elicit greater private sector adaptation investment. Implicit in the approach taken to domestic adaptation possibilities are the following evaluative principles:

- ***Flexibility:*** climate impacts are uncertain and the revenue requirement is unlikely to escalate in a simple linear manner; flexibility means resources are available when needed but are not kept aside before they are required
- ***Realism:*** estimates of the resource potential of various options should be factual rather than wishful; potential new measures should be assessed carefully against the administrative and technical capacity that exists, as well as the governance context in which they are to be deployed
- ***Seek out low hanging fruit:*** additional revenue measures should themselves be considered in terms of the cost of the measure vs the likely additional revenue; cost should not only refer here to tax administrative costs but also to broader social costs; simpler solutions should be preferred to more complex ones if they are likely to deliver the same outcome
- ***Equitability:*** the burden of revenue measures should fall to a greater extent on those with higher ability to pay, ie progressivity; might well include provisions for poor households; equitability includes limiting exemptions for particular groups, firms etc which have historically eroded tax bases on the continent (REFS)
- ***Efficiency:*** minimize deadweight losses, and other costs to the economy; watch out for nuisance taxes; distinguish between what is easy to tax (eg exports) and what makes sense to tax (eg wealthy residents)
- ***Diversity of sources:*** A range of revenue options will serve to spread risk, retain flexibility, and minimize deadweight losses, since a mix will enable lower rates for a particular measure than would be the case if a single measure were exclusively relied on.

We consider the scope of possible domestic adaptation finance by looking firstly at additional resources generated through higher growth coupled with enhanced tax reforms. As aspects of growth and tax reform we also discuss debt management, increased tax effort, and longer-term changes in the tax mix. For each country, estimates of current illicit financial flows (IFFs) are also presented. We then consider the scope of tax expenditures in the included countries. This analysis then presents an indication of additional revenue that might be available for allocation through the general budget-making process.

In addition, we present some indicative estimates for the potential earmarking of some existing and possible taxes as a contribution to domestic adaptation finance. Finally, we consider the current enabling framework for private sector adaptation investment. For each country, we note some aspects of the general investment environment, before considering the framework for adaptation investment against a range of indicators.

Table 8 provides key country indicators that are discussed further below and in more detail in the country studies themselves.

Table 8. Selected Country Indicators

Country	1) Gov. Revenue: % of GDP	2) Tax Mix: % from Int'l Trade	3) Tax Expend. Rel. to GDP	4) Est. IFFs Rel. to GDP	5) Revenue Scenarios	6) Public Debt Stock Rel. to GDP	7) Indicative Earmarking Potential
ETHIOPIA	12.5% (2012/13)	50% (2014/15)	4% (2013/14)	9.7%	3 provided	33.6% (2012)	USD 35m current
GHANA	23.9% (2013)	17.3%	2.1% (2014)	1.1%	3 Provided	52.8% (2013)	USD 105m in 2020
SOUTH AFRICA	25.3% (2012/13)	5% (2014)	4% (2011/12)	3.4%	3 Provided	40% (2014)	USD 155m current
TOGO	18.2% (2012)	17% (2013)	1.3% (2013)	66%	3 Provided	45% (2012)	USD 18m in 2025

4.1 Growth and Tax Reform Scenarios

The country studies include one upper middle income country (South Africa) where growth has stagnated and prospects for a higher growth trajectory are uncertain; one country that has recently attained middle income status (Ghana), where growth is realistically expected to remain high (in excess of 8%) over the next decade; and two low income countries (Ethiopia and Togo). Ethiopia has recently experienced exceptionally high growth rates (in excess of 10%) with a realistic prospect of maintaining such growth. Togo has experienced, in particular since 2009, a moderate economic recovery after a period of crisis which saw GDP per capita decline by 17% between 1997 and 2002; growth between 2010 and 2013 has averaged 5.1%.

In the country studies we provide three growth and tax as share of GDP scenarios for each country. In each case, we compare a mildly pessimistic or 'baseline' growth and tax share scenario with a moderately optimistic and an optimistic scenario for the period up to 2029/30. The difference in revenues available to the state in each case are regarded as 'additional' revenues, some of which could then be made available for domestic adaptation measures. Table 9 provides the additional resources available in the moderately optimistic scenario when 2% of such additional resources are allocated to adaptation.

Table 9. Scope for Adaptation Finance from Moderately Optimistic Growth and Tax Take Scenarios, 2% of Additional Resources Allocated to Adaptation, $US Million

	2019/20	2024/25	2029/30	Baseline Scenario (Present to 2029/30)	Moderately Optimistic Scenario (Present to 2029/30)
Ethiopia	44	149	248	Real growth averages 8% and the tax share of GDP remains constant at 12%	Real growth averages 9% up to 2030 and the tax share increases linearly to 15% by 2019/20 and to 17% by 2023/24
Ghana	45	124	233	Real growth averages 7% and the tax share of GDP remains constant at 23%	Real growth averages 8.5% up to 2030 and the tax share increases linearly to 24% by 2019/20 and to 25% by 2023/24
South Africa	338	603	961	Real growth averages 2% and the tax share of GDP remains 25% up to 2029/30	Real growth averages 3% up to the end of 2016/17, before increasing linearly to 4.5% by 2018/19, at which point this rate is maintained up to 2029/30, with the tax share increasing linearly to 27% by 2017/18 and to 28% by 2019/20
Togo	4.4	11.5	18.2	Real growth averages 5 % up to 2030 and the tax share of GDP remains constant at 18% to 2029/30	Real growth averages 6.5 % up to 2030 and the tax share increases to 20 % by 2019/20 and to 22% by 2023/24, at which point it remains constant

As we note in the country studies themselves, it is difficult to compare such additional resources generated to adaptation cost estimates, since these tend at present to be quite general, and sensitive to assumptions, at the country level. We suggest, however, that for Ghana and Ethiopia, the allocation of additional resources beyond the baseline at 2%, and even 5%, is unlikely to meet climate adaptation costs over this period. This conclusion would of course be even more applicable to the baseline scenario, where resources available are even less. This conclusion suggests that, for Ghana and Ethiopia, support for public adaptation projects will continue to be required, and careful consideration will have to be given to involving the private sector to also help fill the gap. In the case of Togo, there can be little doubt that additional domestic resources becoming available for adaptation are extremely limited and pale in comparison to the challenge.

In the case of South Africa, the more optimistic scenarios generate resources that might be able to address adaptation costs, though the South African economy is in effect a stagnating one and we suspect the likelihood of attaining even the moderately optimistic scenario is smaller than for Ghana and Ethiopia.

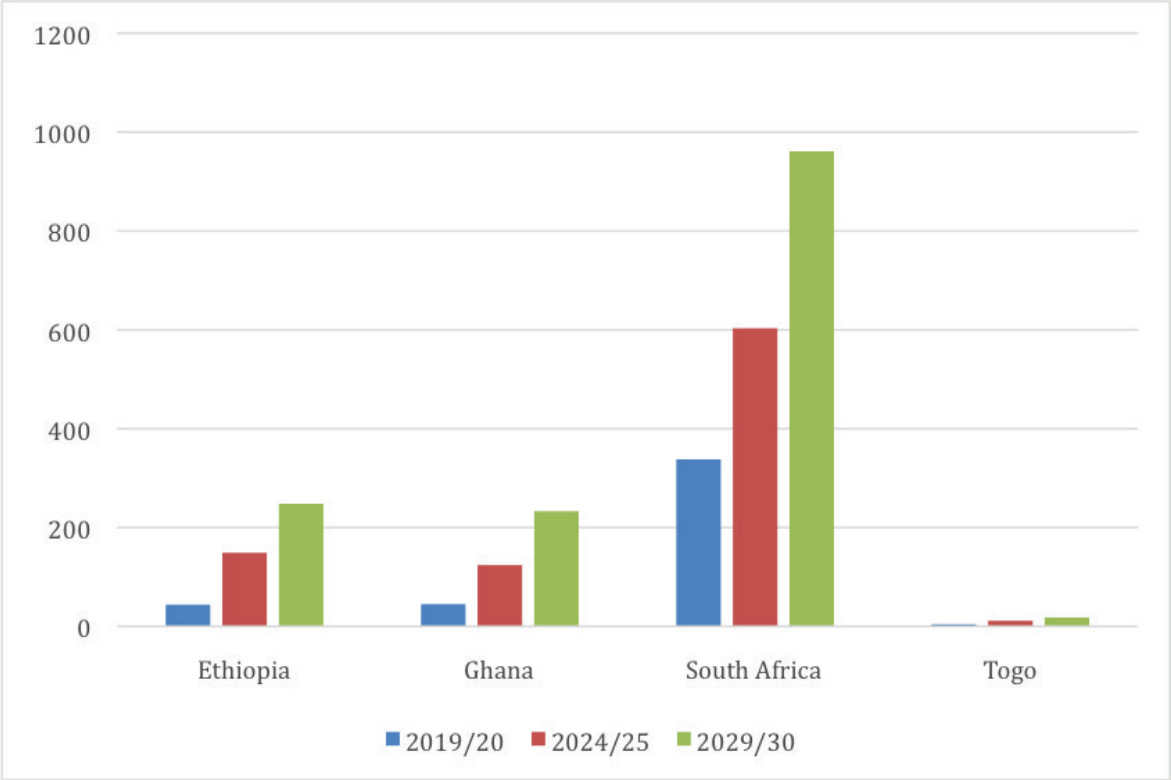


Figure 17 - Moderately Optimistic Growth and Tax Scenarios: Domestic Adaptation Resources at 2% of Additional Resources Allocated to Adaptation, 2019/20, 2024/25, 2029/30

4.2 Public Debt

Although none of the countries included here is facing a 'debt trap' in the narrower sense of the word, careful consideration will have to be given to debt management over the medium- and longer-term, not only as an important aspect of macro-economic management, but also to ensure there is adequate medium-term fiscal space for adaptation expenditure.

In South Africa and Ghana, there is little doubt that debt will have crowding out implications for other expenditure: in SA debt servicing since 2008 has been the fastest increasing expenditure item in the budget; in Ghana even successful 'fiscal consolidation' would see debt stabilize at a fairly high 52% of GDP, whilst the failure to control expenditures and enhance revenue could be disastrous.

In the case of Ethiopia, debt has increased quite rapidly again since the HIPC and MDRI completion points in 2004 and 2006, from 24.6% of GDP in 2006/07 to 33.6% of GDP for 2011/12.

A similar picture emerges in Togo, where debt has increased quite rapidly in recent years following on what are in all likelihood unsustainably high budget deficits; the cash-basis over-all deficit for Togo doubled from 2011 to 2012, to a value of 7.2 % of GDP in 2012.

Although the fiscal circumstances of the four countries differ significantly as regards aggregate resource amounts and growth prospects, the adaptation challenge must be considered for all of them in the light of sustainable debt management.

4.3 The Tax Mix and Tax Effort

All four countries finance domestic public expenditure from own sources to a significant or virtually exclusive degree, with Togo having the largest share of grants in total revenue, at around 18%.

South Africa and Ghana score well in tax effort,[16] whilst in the case of Ethiopia there would appear to be room for improvement. Togo is very close to the average tax effort value.

For Ghana, Togo and Ethiopia, the medium- and longer-term will require further shifts away from a reliance on trade taxes and measures to ensure that continued strong growth generates additional fiscal resources. For Ethiopia, in particular, the higher growth rates over the last decade have not been accompanied by shifts in the tax mix aimed at increasing the tax take as a share of GDP, which remains low and appears to have declined, and the strong reliance on trade tax revenue has created incentives for more aggressive tax avoidance.

For Ghana the challenge will be to fill the gap as donor funding dwindles in the wake of attaining middle income status, and moreover to do this in a context defined by high expectations around the developmental potential of oil revenues and, as discussed below, increases in illicit financial flows (IFFs).

Both Ghana and Ethiopia are embarked on processes of tax administration reform and modernization which may help ensure that the tax take remains strong, whilst in the case of Togo an important initial step will be the establishment of a national revenue authority.

4.4 Illicit Financial Flows

The last few years have seen a growing awareness of the resource losses to developing countries as a result of illicit financial flows, with many such flows motivated by efforts to reduce the personal and corporate tax burden.

Table 10: 2002-2011 Average IFFs for 7 African Countries as Share of GDP

	Average Annual IFFs 2002-2011 ($US Million)	Average IFF as Share of GDP (%), 2002/2011
Egypt	3,588	2.9%
Ethiopia	2,024	9.7%
Nigeria	14,227	7.9%
South Africa	10,073	3.4%
Sudan	2,610	4.9%
Ghana	316	1.1%
Togo	1,847	65.9%

In absolute amounts, South Africa is the second-largest victim of IFFs in Africa, after Nigeria, with an annual average of more than $US 10 billion per year for the period 2002-2011. Egypt and Sudan are respectively the third and fourth largest victims in absolute amounts. However, taking IFFs relative to the scope of economic activity, both Ethiopia and Togo suffer larger IFF losses, with IFFs comprising an estimated average of 9.7% of Ethiopian GDP for 2002-2011 and an extremely high 65.9% for Togo. Though Ghana's result may appear more encouraging, there is a significant difference in IFF estimates before and after 2007 for Ghana; thus, the annual average for 2007-2011 is $US 633, more than double the 2002-2011 average, or 2.1% of GDP for the more recent period. These estimates suggest that the problem of IFFs for Ghana has escalated significantly since the discovery of oil reserves and the consequent wave of investment and production in extraction and related industries.

Clearly, the potential resources lost as a result of IFFs are substantial and would go some way to address adaptation financing. In the South African country study we cite more detailed research that suggests that trade mispricing abuse alone (that is one, albeit a central, component of IFFs) may have cost the country up to 6% of tax revenue on average for the period 2001-2010.

IFFs are a problem of international taxation, and require internationally coordinated measures. However, this does not mean that revenue gains cannot be achieved through targeted domestic measures which go some way to reducing the asymmetry between revenue agencies and tax evaders and avoiders, such as establishing a transfer pricing unit that is adequately capacitated within the revenue authority, addressing obvious loopholes in the tax code, entering into information sharing agreements with other jurisdictions, and selectively targeting companies for more detailed tax audits based on risk profiles.

4.5 Tax Expenditures

All four countries make use of tax expenditures to further a range of investment and equity objectives, with tax expenditure constituting a significant loss of potential revenue, from 2.1% of GDP for Ghana to 4% for South Africa and Ethiopia and 1.7% for Togo. Unfortunately, available data did not allow us to gain a nuanced sense of the mix of tax expenditures by country, with the exception of South Africa, which has been providing estimates of tax expenditures on various activities since 2011.

We note two aspects of the question, however. Firstly, for both Ghana and Ethiopia, the use of tax expenditures such as tax exemptions and related investment incentives has come in for a fair amount of criticism. In Ghana, a review of the entire exemptions regime was announced in the 2013 Budget, which referred specifically to the need to reduce their scope and eliminate abuses. For Ethiopia, Abay (2010) regards the abuse of exemptions as one of the main reasons for Ethiopia's low tax effort, and the Ethiopian government refers in its Growth and Transformation Plan to efforts " to improve the tax base and bring new business into the tax net, particularly where they were beneficiaries of tax incentives (tax holidays)".

16 Actual tax collected as a share of potential tax collection estimates.

It is vital, then, that tax exemptions be 'rationalized' (that is that their social costs and benefits converge to a larger extent), not only because of lost revenue, but also because there may be scope for using tax exemptions in the medium-term to support adaptation investment. This, however, can only be considered if and when the exemption regime is more insulated from abuse.

Notwithstanding concerns around abuse, and as we discuss in the South Africa study, adaptation-related tax expenditures might include a tax credit on adaptation expenditures which are additional to business as usual expenditures, differential accelerated depreciation allowances between climate proofed and non-climate proofed assets, as well as favourable tax treatment of country-specific adaptation R&D.

4.6 Earmarking

The earmarking of particular revenue sources can have a number of effects on the overall tax burden, which will depend on whether already existing revenue sources are used, new tax instruments are introduced, or whether a new instrument is accompanied by offsetting reductions in other taxes. From an adaptation perspective, then, the argument in favour of earmarking may in some instances be associated with the attempt to increase the overall tax burden in order to secure more resources for adaptation, and in other instances primarily with the intention to insulate revenue for adaptation from other expenditure claims.

The country studies focus primarily on the latter option, that is the assigning of particular existing revenue sources to adaptation financing, and derive from the assumption that there should be a fairly credible link between the revenue source and the adaptation use, that is, essentially, that an initial approach to domestic adaptation financing should tax environmental 'bads' in order to finance adaptation.

In the case of **Ghana**, we consider the following earmarking options:

- Reserving 12.5% of the Annual Budget Funding Amount from Petroleum Revenues for adaptation.
- Reserving 10% of revenue from five smaller-scale revenue instruments for the Ghana Green Fund for adaptation (From other consultants'' report)
- Reserving 5% of VAT gains through the recent rate increase for adaptation, via an adaptation requirement in the proposed Ghanaian infrastructure fund

The combined revenue effect of these measures is estimated to generate around $US 105 million in 2020, a significant though far from full share of Ghanaian adaptation cost estimates.

In the case of **Ethiopia,** we consider the revenue potential of existing taxes on vehicle and petroleum related trade and VAT revenues, and provide estimates where 5% and 10% of such revenues are earmarked for adaptation. The 5% earmarking option would generate around 17% of the $US 200 million required at the present time to implement the CRGE additional measures, and the 10% option around 35%.

For **South Africa**, we argue that some portion of carbon tax revenues should be set aside for adaptation, but note the current uncertainties around the likely revenue to come from this tax. We consider, therefore, existing South African 'environmental levies' as follows: we assign 5% of the existing electricity levy revenues to adaptation, and 25% of the Air Passenger Tax, the Plastic Bags Levy, the Incandescent Light Bulb Levy, and the Motor Vehicle CO2 Emissions Tax. This generates annual adaptation resources of around R 1.7 billion or $US 150 million.

In the case of **Togo,** we raise doubts about the extent to which earmarking could currently constitute a source of adaptation finance, given the general low economic base and the challenges of establishing infrastructure and sectoral growth across the economy. We consider, however, the potential of phasing out the current oil price support, which in 2013 amounted to an estimated 2% of GDP. Whilst noting that fiscal space created through such phasing out would primarily need to be allocated to deficit reduction, we present indicative allocations where 10% and 20% of a conservative estimate of additional revenue is allocated to adaptation. The 10% option provides around 18.5 million USD in 2025.

The analysis suggests that domestic contributions to adaptation through earmarking can be significant for some countries, though highly unlikely to be adequate given available adaptation cost estimates, with the possible exception of South Africa.

4.7 Funds and Facilities

Ghana, Ethiopia and South Africa have introduced some form of fund or facility to attract and coordinate climate spending. However, at this point it seems too early to draw any conclusions about their performance.

South Africa has a Green Fund. However, it is virtually exclusively oriented towards mitigation; it was initially capitalized from the budget and has provided finance for a number of mitigation-related projects.

Ghana has a proposed Green Fund. Although it has yet to be established , a revenue-earmarking approach for its capitalization has been explicitly considered.

Ethiopia has a Climate Resilient Green Economy (CRGE) facility, but we were unable to determine how operational it is at this date. There is, however, a highly detailed 'facility manual'.

In the case of Togo no climate-dedicated fund is currently in existence or close to being established.

4.8 The Private Sector

We consider the enabling framework for promoting private sector adaptation investment in each of the four countries by applying a range of indicators pertaining to:

- Availability and access to information
- Institutional Arrangements
- Policies
- Economic Incentives
- Communication, technology and knowledge

In each case, as far as data allows, response options are classified as 'largely in place', 'under development', or 'absent'. A "/' signifies an incomplete response.

For all four countries, results suggest that a great deal still needs to be done to promote an effective enabling framework. Table 11 summarises the results.

Table 11. Private Sector Adaptation Promotion: Indicators by Country

		Ethiopia	Ghana	South Africa	Togo
Data and Information	Are business-relevant climate/ hydrological historical information and projections (in appropriate temporal and spatial resolution) available and easy to access?	Absent	Under development	Under development	Absent
	Are decision-support tools that help understand climate risks and identify potential adaptation actions available and accessible?	Absent	Under development	Under development	Under development
Institutional Arrangements	Is there an operational climate change coordination body that includes government, private sector, CSO/NGO and/or academic representatives?	Absent	Absent	Absent	Absent
Policies	Do building codes and infrastructure design standards take into account anticipated climate variability (or even existing variability)?	Absent	Under development	Under development	Absent
	Do local zoning regulations seek to avoid development in areas that are particularly vulnerable to climate change and/or critical for maintaining resilience?	Absent	Under development	Under development	Under development
	Do national/local permitting regulations require that environmental impact assessments be conducted? Are strategic environmental assessments mandatory for new policies and programmes?	Under development	Largely in place	Largely in place	Largely in place
	Are companies required to disclose climate change risks in their communication with shareholders, bondholders and other stakeholders	Absent	Absent	Under development	Absent

		Ethiopia	Ghana	South Africa	Togo
Economic Incentives	Do administered prices for water and energy seek to take into account anticipated rising costs of providing these services under greater weather extremes (or even reflect current full financial costs)? Are regulated utilities allowed to offer differentiated tariff/ service options that provide customer choices on security of supply and cost?	Absent	Absent	Absent	Absent
	Are there specific public and/or private financing instruments available to support climate change adaptation by the private sector? Are there microfinance programmes for SMEs and smallholders (e.g. microloans for drought-resistant crops, for water/ energy efficiency technology or small-scale renewable energy solutions)?	Under development	Absent	Absent	Absent
	Are there any markets where environmental entitlements or allocations for resources under pressure from climate change can be traded? (e.g. for water or biodiversity).	Absent	Absent	Absent	Absent
	Are insurance or financial risk management products that transfer climate-related risks available?	Under development	Under development	/	Under development
Communication, technology and knowledge	What is the market penetration of information and communication technologies? (e.g. internet and mobile cellular). Are these technologies being used to provide applications that support climate change adaptation? (e.g. climate information and extreme events forecasts)	Absent	/	Under development	/
	Are technologies or processes that support climate change adaptation promoted/marketed by the private sector? (e.g. water-efficient irrigation, conservation agriculture, or drought-resistant crops).	Under development	Under development	Under development	Absent

We note in the country studies themselves that for all four countries emphasis is placed on the role of the private sector in driving investment and generating high economic growth. In some cases, furthermore, a strong role is also envisaged for the private sector in adaptation investment. However, the results of the adaptation framework survey suggest that currently very little is being done, in concrete terms, to elicit private adaptation.

5. Exploring continent-wide solutions: levies on transactions for adaptation in Africa

Designing and implementing adaptation in Africa faces a critical funding gap from bilateral and multilateral international channels and as the majority of the countries of the continent is in the category of the Least Developed Countries, alternative innovative ways to raise funds for adaptation need to be explored in complement of an increase of the financial commitments from developed countries and big emitters for adaptation.

The current report outlines that the current funding available from international multilateral and bilateral sources is not sufficient to meet the current and future needs for adaptation (see chapters 2 and 3 of this report, Schaeffer et al. (2013) and Mekonnen (2014)). In addition to the limited amount of international funding for adaptation, chapter 4 highlights that African governments' spending and financial capacity are not sufficient either to meet the needs. This limited national financial capacity is not projected to significantly change in the next few years as high level of debt, limited fiscal systems and dependency on foreign aid constrain governments' ability to increase funding for adaptation (see chapter 4). Alternative ways for raising funds may then become necessary to meet Africa's adaptation challenge.

Including in these alternative ways to finance the adaptation gap in Africa, this report investigates the potential effects of a levy to be applied on transactions. By 2020 and 2030, African countries will need between 10 and 20 billion dollars to meet their adaptation funding needs, the first section of this chapter inquires in which sectors a levy could be applied and how much funds could be raised thanks to its implementation. As African countries are projected to see high increase in economic growth in the coming years and decades (African Development Bank 2011), the subsequent section also studies whether a levy could hinder or slow down current and future economic development prospects.

5.1 The potential of applying levies to transactions

5.1.1 Which sectors could be concerned

In the following section, the sectors that could potentially be concerned by the levies are analysed and examples from other levy initiatives in similar sectors highlighted as references. The second subsection estimates how much could be raised from 2013 until 2030 thanks to the application of the levies in the different sectors. Finally, based on these estimates and projections, the interest of applying a levy in these different sectors is considered according to three core principles: cost efficiency, equitable participation and collectability.

Building upon similar international experiences and political as well as economic analysis, a levy on transactions in Africa could be instigated in the four sectors: extractive industries, financial and banking transactions, international trade and transportation (including exports) and tourism.

5.1.1.1 Extractive industries

Rents coming from extractive industries represent a major source of revenues to African countries. In addition to coal (World Bank 2014a), natural gas (World Bank 2014b) and oil (World Bank 2014c), these report estimates also incorporate the revenues generated by mineral extraction including tin, gold, lead, zinc, iron, copper, nickel, silver, bauxite, and phosphate (World Bank 2014d). Together oil, natural gas, coal and mineral generated USD400 billion of rents[17] in 2012. Oil rents is the major bulk of these revenues with about USD 303 billion in 2012, followed by mineral rents at USD49 billion, natural gas rents at USD32 billion and coal rents at USD12 billion. The overall amount of rents from extractive industries in Africa is unevenly distributed between countries. For example, Nigeria generates about 37 per cent of the total rents in Africa, while the majority of the countries have very little resources coming from oil, natural gas, coal or mineral rents[18] and some others have no resources coming from this sector[19] (in Figure 17, the

17 Following World Bank's definition, rents are calculated as being the difference between the value of the production at world price and their total costs of production.

18 Uganda, Benin, Central African Republic, Rwanda, Liberia, Burundi, Niger, Sierra Leone, Kenya, Togo, Madagascar, Namibia, Senegal, Eritrea, Ethiopia, Botswana, Mozambique, Zimbabwe, Guinea, Mali, Burkina Faso, Mauritania, Cote d'Ivoire, Cameroon, Tanzania, Tunisia, Chad, Zambia, Morocco

19 Cabo Verde, Comoros, Djibouti, The Gambia, Guinea-Bissau, Lesotho, Libya, Malawi, Mauritius, Sao Tome and Principe, Seychelles, Somalia, South Sudan, Swaziland. It is worth mentioning that Libya and South Sudan are listed in the countries with no rents from extractive industries in 2012, despite significant resources. This absence of rents could be explained by the interruption of oil and gas extraction due to the civil war in Libya and instability in South Sudan during the same period.

others label include both countries with limited rents and no rent). The respective country' shares of the total extractive industry rents generated in Africa for 2012 are displayed in the following Figure 18.

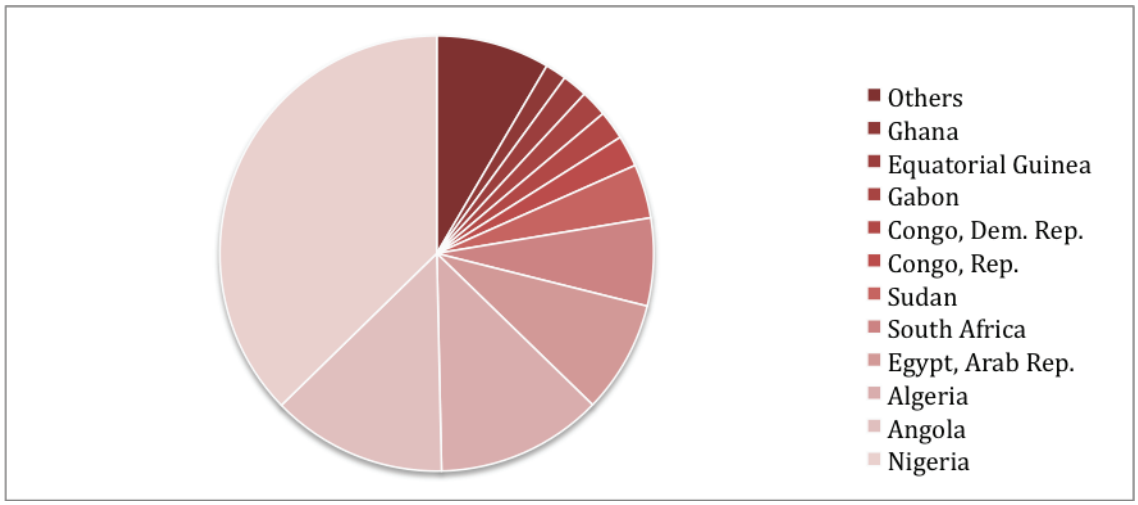


Figure 18 - Total extractive industries rents in 2012, including oil, natural gas, coal and mineral rents for African countries. Data sources: World Bank, 2014a, 2014b, 2014c, 2014d, 2014e; authors' calculations.

There are a limited number of countries, which established a levy to generate funds for social purposes (Hujo 2013). According to Hujo (2013), Norway, Bolivia, Chile, Botswana and Indonesia have established funds or mechanisms to allocate a share of the rent generated by extractive industries for social purposes, such as pension funds, educational programmes or cash transfer programmes. The most relevant for Africa examples of levy on extractive industries' rents in developing and developed countries are:

Norway Government Pension Fund (Norway): Established in 1990 by the Norwegian Parliament, the fund manages the revenues from oil extracted in the country. The primary use of the fund is to cover the cost of the pension for retired people. In addition, every year, a share of the revenues of the fund is allocated to the Norwegian government budget. For example, for the 2014 fiscal budget the Norwegian Parliament voted the allocation of NOK139 billion to the Government budget to cover the "non-oil deficit", which corresponds to about 10 per cent of total government expenditures (Norwegian Ministry of Finance 2013). Taxation on oil products and activities in Norway is particularly high. Net profits are taxed with a high marginal tax rate of 78 per cent, which consists of an additional 50 per cent Special Tax on income from petroleum production and pipeline transportation activities in addition to 28 per cent income tax (Jansen and Bjerke 2012).

"Renta Dignidad" programme (Bolivia): The programme is financed through direct hydrocarbons tax on oil and gas rents at a rate of 32 per cent in addition to a special tax on hydrocarbons and derivatives (Fuentes et al. 2013). This direct tax is the highest of all the Latin American countries. However, since oil and gas extraction activities in the country have recently been nationalised, the tax on the profits of oil companies is the lowest in the region at only 25 per cent, when most countries tax oil companies profits at 50 per cent (Fuentes et al. 2013). "Renta Dignidad", which was launched in 2008 is a non-contributory pension benefits all people above 60. The scheme is partially financed by the tax on hydrocarbons and contributed to reduce extreme poverty by 5.8 per cent between 2007 and 2009 (Gonzales 2011).

Levy on mineral extraction in Botswana: above 40 per cent of the resources of the social insurance and social assistance programmes are dependent on mineral and ores revenues (Hinojosa et al. 2010). According to the World Trade Organisation, mineral taxation in Botswana has contributed to "improve basic infrastructure, such as transportation, and social services, such as health and education" (World Trade Organisation 2009). Furthermore, government revenues from taxes on mineral extraction, which is the main source of receipts significantly increased over the last years. In 2007-2008, these revenues are composed at 77 per cent from the dividends from companies the governments hold shares and at 21 per cent from diamond mining royalties(World Trade Organisation 2009).

As these few examples illustrate, developed and developing countries have already put in place levy to raise funds for social purposes. The existence of these examples shows that applying a levy on extractive industry rents and profits is feasible and that levied funds are collectable. Furthermore, instigating a levy on extractive industry activities neither hampers the development of the sector (diamond extraction keeps increasing in Botswana for example) nor the socioeconomic development of the countries (Norway is the country with the highest Human Development Index of the planet).

5.1.1.2 Financial and banking transactions

At the opposite of extractive industries' transactions, financial and banking transactions are very multiform and multipolar. There are indeed both domestic and international transactions occurring in Africa, for example foreign investors acquiring stocks on African stock exchanges and Africa-based businesses reimbursing their loans to banks located in Africa. There is a wide diversity of operations and transactions as well as a wide diversity of operators, which could be potentially targeted when applying a levy on financial and banking transactions in Africa.

Under the banking and financial transactions in Africa, the present study integrates for the financial transactions: stocks traded (World Bank 2014f); portfolio investment, transaction in equity securities and debt securities (World Bank 2014g); portfolio equity, net inflows from equity securities other than those recorded as direct investment and including shares, stocks and depository receipts (World Bank 2014h), and for the banking transactions: total debt service from private non-guaranteed long-term debt from bonds (World Bank 2014i), total debt service from private non-guaranteed long-term commercial bank loans from private banks and other private financial institutions (World Bank 2014j) and personal remittances (World Bank 2014k). In 2012, the total value of the financial and banking transactions as listed above was about USD457 billion, with traded stocks representing the majority of the transactions at about USD344 billion. South Africa alone represents 71 percent of the transactions on the continent. The majority of these financial transactions are channelled through the most active African stock exchange, the Johannesburg Stock Exchange (JSE).

Figure 19 displays the total amount of banking and financial transactions in Africa for 2012. Only values are displayed for the following countries: Kenya, Zimbabwe, Tunisia, Morocco, Mauritius, Egypt, Nigeria and South Africa, the label others includes the rest of the African countries.

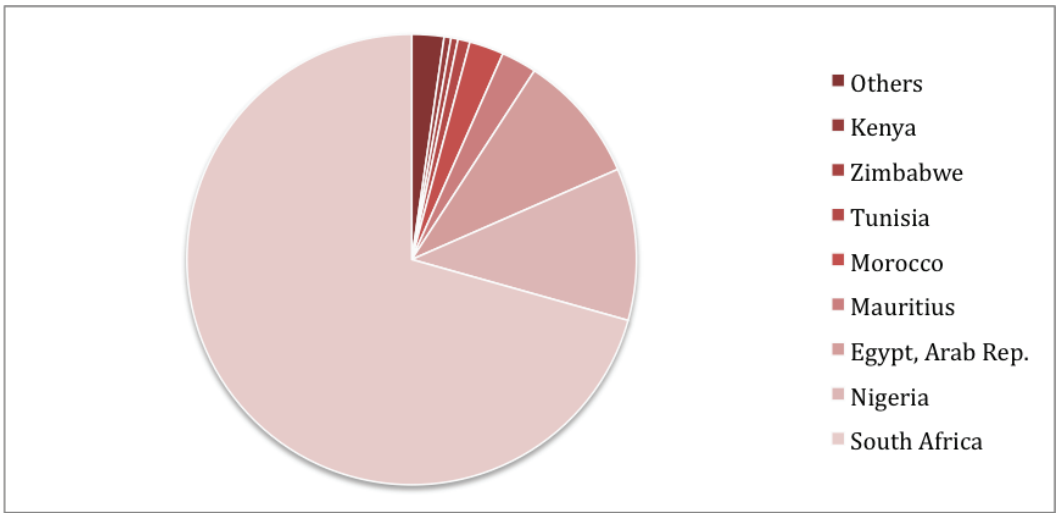


Figure 19 - Total financial and banking transactions in 2012 in African countries. Data sources: (World Bank 2014f; World Bank 2014g; World Bank 2014h; World Bank 2014i; World Bank 2014j; World Bank 2014k)*; authors' calculations.*

Building on J.M. Keynes' idea of a "substantial government transfer tax on all financial transactions" (Keynes 1936), the Nobel Prize award J. Tobin proposed the application of a levy on currency transactions in 1972 during his inaugural lectures at Princeton University (Tobin 1974). The proposal was described as "an internationally uniform tax on all spot conversions of one currency into another, proportional to the size of the transaction" (Tobin 1978). Recently, economists and advocacy organizations have revitalized the debate of a financial transaction whose objective would be to raise funds for dedicated purposes. However, for James Tobin the main goal was to put "sand in the wheels" of the financial transactions of the already over-efficient international financial vehicles (Tobin 1996) without impeding the trade of goods and services between countries and economic operators and a minimal interference in the efficient allocation of capital (Tobin 1996).

Beyond this academic proposal, only a few countries have established a financial transaction tax. According to the International Monetary Fund (IMF), as of 2011 only two countries, Turkey and Brazil had put in place a tax on foreign exchanges (Matheson 2011). However, 14 countries have instigated taxes on equity, with the majority of them being emerging economies: Brazil, China, India, Indonesia, South Africa, South Korea, Turkey, Hong Kong, Singapore and Taiwan as well as three developed countries: Italy, United States of America, United Kingdom and Switzerland (Matheson 2011). More recently, the European Commission at the request of 11 member countries tabled a proposal for a Council directive to established a financial transaction tax in these countries (European Commission 2013). At the Finance Ministers European Council of May 6th 2014, they "noted the intention of participating countries to work on a progressive implementation of the FTT, focusing initially on the taxation of shares and certain derivatives. The first steps would be implemented at the latest on 1 January 2016" (Council of the European Union 2014).

Personal remittances are counted in the scope of the banking and financial transactions on which a levy could be applied. Generating funds from remittances by the application of a very low levy will contribute to the implementation of one of the decisions of the L'Aquila G8 final declaration, which encourages the "improved use of remittances" as well as the "enhancement of cooperation between national and international organisations" (G8 2009). Furthermore, thanks to the very low value of the levy, most likely well below 0.1 per cent, its application may not hinder current global efforts to lower the overall costs of remittances, as at present sending remittances costs on average 8.14 per cent of the amount sent (World Bank 2014l).

5.1.1.3 International trade and transportation, including tourism

The final sector on which a transaction levy could be applied to generate funds for adaptation in Africa is international transportation including tourism. African countries are increasingly integrated in international trade for imports and exports and therefore, the volume of goods transported via maritime and air freight is constantly increasing. Similarly, the expenditures of international tourists have also increased during the last decade. Under international transportation are included the number of air passengers carried per year (World Bank 2014m), the number of containers transported via African ports (World Bank 2014n) and air freight (World Bank

2014o); for tourism, it only includes the expenditures of international tourists (World Bank 2014p). At the exception of the number of containers being transported, South Africa has the highest number of air transport passenger, the highest freight transported and tourism-related expenditures. The following Figure 20 figure displays the main countries for the four elements identified above.

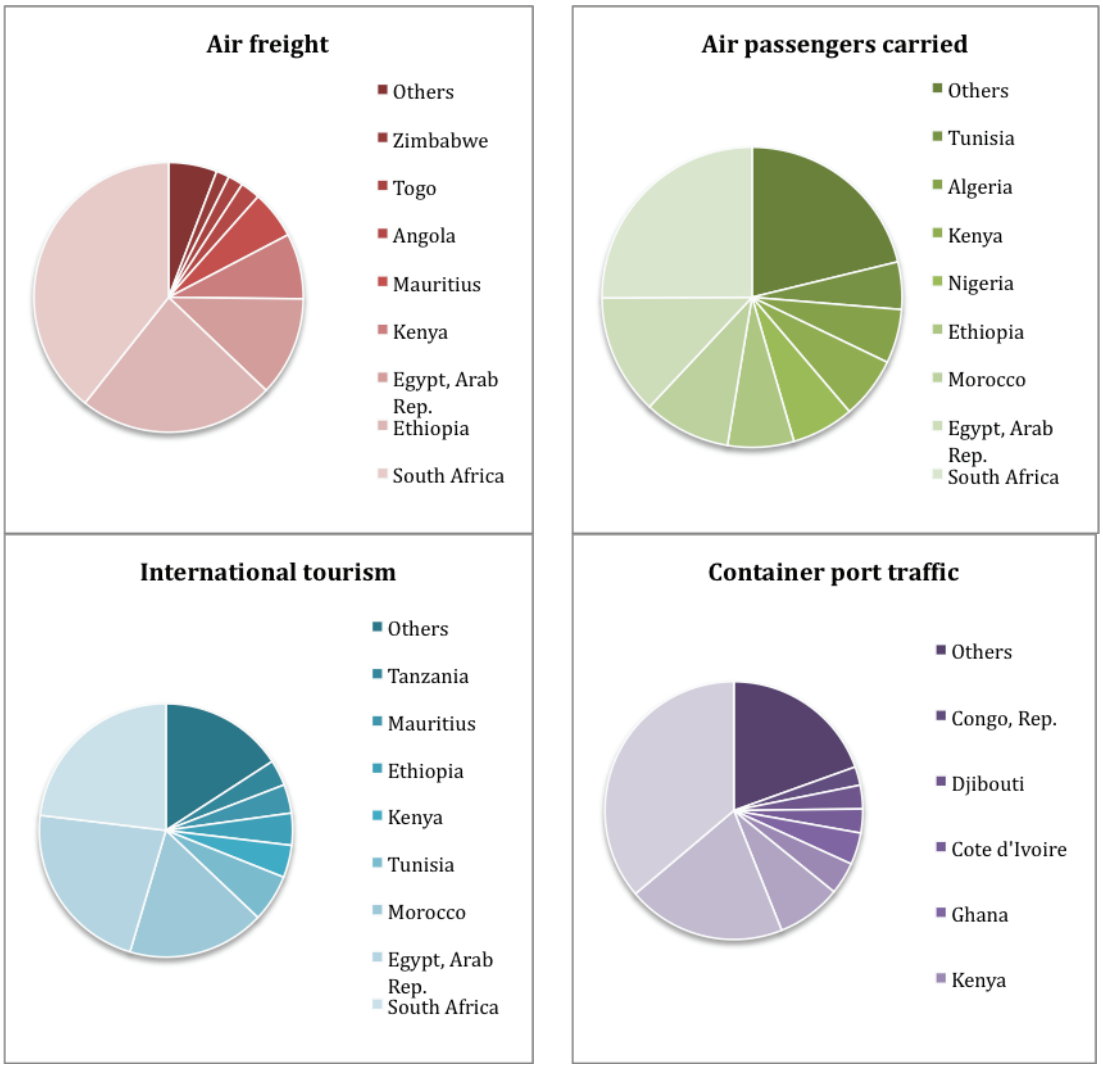


Figure 20 - International transportation and tourism in Africa in 2012. Sources: (World Bank 2014m; World Bank 2014n; World Bank 2014o; World Bank 2014p)

A levy on aviation and shipping has been in several occasions proposed at the United Nations Framework Convention on Climate Change (UNFCCC) and other international fora as a means to fund climate change actions in developing countries. The Least Developed Countries (LDC) group has been championing in this area for several years. Maldives on behalf of the LDCs put forward a submission proposing to establish an International Air Passenger Adaptation Levy (IAPAL) based on the model of the French "Leading Group" solidarity levy to combat HIV/AIDS (Maldives on behalf of the Group of Least Developed Countries 2008). Similarly, the International Monetary Fund and the World Bank also proposed the idea of establishing market-based instruments for international aviation and shipping as a source of climate finance at the request of the G20 countries. According to their estimates, by 2020, by applying a USD 25 per tonne of CO_2 USD12 billion and USD26 billion could be raised from international aviation and shipping, respectively (International Monetary Fund & World Bank 2011).

Some countries have already implemented such a levy on air passenger. The Leading group on Innovative Financing for Development founded in 2006 by France and Brazil now gather 64 countries. The "flagship initiative" of the leading group is the establishment of a solidarity contribution on airline tickets. Since its inception, the contribution has raised about USD1.25 billion (Leading Group 2014). The levy applied ranges from USD1 to USD4 for the economy class and from USD10 to USD40 for the business and first class for intra-European and international flights, respectively (International Monetary Fund & World Bank 2011).

5.1.2 Estimating the amount potentially raised from the levies

5.1.2.1 Defining the value of the levy: a benchmark approach

As the present study is not prescriptive and only proposes scenarios for the application of a levy on a set of transactions, as analysed above, the following section proposes different values for the levy to be applied.

Three scenarios are developed for this analysis: A high levy scenario, including a high relative levy on transactions and a high nominal value; A medium levy scenario; A low levy scenario. Defining the value of the levies is a complex exercise, which requires economic sensitivity and high-level political agreement. Therefore, the values used for this study are based on existing initiatives and policies already in place in developed and developing countries or based on scientific literature in the absence of already implemented levy in some sectors or subsectors. The table (Table 12) summarizes the values taken by the levies in the different scenarios.

Financial and banking transactions:

The value for the relative levy in the high scenario is derived from James Tobin's currency transaction tax (Tobin 1996), which was proposed at 0.2 per cent of the transaction of currencies. The possibility of instigating a levy on financial transactions was also integrated in the report of the High-level Advisory Group on Climate Change Financing. In the report published in 2010 at the request of the United Nations Secretary General, the authors proposed the establishment of the financial transaction tax whose rate could be between 0.01 and 0.001 per cent (High-level Advisory Group on Climate Change Financing 2010). Based on these, the rates for the levy in the three different scenarios take the following values: 0.2, 0.001 per cent in the high and low levy scenarios, respectively and 0.01 per cent in the medium levy scenario as the average of the values taken in the high and low levy scenarios.

Transportation activities and tourism transactions:

- **Nominal levy on maritime freight:**

Fees for importing and exporting 20-foot containers (the metrics used for maritime freight) largely fluctuate between African countries; for example the total amount of fees, excluding government taxes, for importing a container fluctuate between USD577 in Sao Tome and Principe and USD9285 in South Sudan, with an average cost of USD2560. This cost includes all the fees associated with completing the procedures to export or import the goods (World Bank 2014q). The application of a nominal levy on the export or import of container would primarily affect countries where fees are low. For the application of a levy on maritime freight, the study uses the following values: USD50, USD30 and USD20 for the high, medium and low levy scenarios respectively. On average, the levy would contribute to increase the average export fees paid in African countries by 1.10 per cent, 1.70 per cent and 2.80 per cent in the low, medium and high levy scenarios respectively. If such a levy would be applied in Africa, export fees per container in Sao Tome and Principe would increase between 3.50 per cent and 8.70 per cent.

- **Nominal levy on air passenger and freight:**

For the levy on air passenger, the values for the levy used in this study refer to the "flagship initiative" of the Leading Group on innovative financing. Therefore, USD1, USD4 and USD10, respectively for the low, medium and high levy scenarios, which correspond to the levy for the economy and business class tickets are taken as reference for the implementation of a levy in African countries.

For the levy on freight, in the absence of similar experiences and scientific publications on this specific sector, the levy assigned for this is calculated so that the total amount generated from this sector is equivalent to the amount of the funding raised by the instigation of a levy in the maritime freight sector. Therefore, for the low levy scenario, the levy value is USD0.14 per metric tons times kilometers traveled and USD0.21 and USD0.36 for the medium and high levy scenarios.

Table 12: Levy values used in the different scenarios and for the different sectors

Values relative to the total fees paid to export a container, between 1.10% and 2.80% of the current fees in average

Total amount generated equivalent to amount levied in the maritime sector

Levy value Scenario	Relative levy	Levy on container	Levy on air passenger	Levy on air freight
High levy	0.2%	USD50.00	USD10.00	USD0.36 per ton
Medium levy	0.1005%	USD30.00	USD4.00	USD0.21 per ton
Low levy	0.001%	USD20.00	USD1.00	USD0.14 per ton

Similar to values used in the High-Level AGF (2010) and Tobin's work

Similar to values used by the Leading Group on innovative financing

The IMF and the World Bank proposed another approach to levy funds from the air and maritime sectors through the application of market mechanisms application to GHG emissions similar to a carbon tax. A levy of USD25 per ton of CO2 on these sectors could generate USD26 billion in the maritime sector and USD12 billion in the aviation sector globally by 2020 (International Monetary Fund & World Bank 2011). Similar approach based on sectoral GHG emissions could also be implemented in Africa to generate funding for adaptation, but was not addressed in this study due to the limited data availability for these sectors in Africa.

5.1.2.2 Estimates and projections of amount levied from 2013 to 2030

By applying these values for the levy in the different scenarios and sectors, between USD0.30 and USD4.77 billion could have been leveraged in 2012 in Africa for adaptation. The following table (Table 13) presents the breakdown by sectors in the different scenarios and the total amount generated thanks to the application of the levy. The values in Table 13 and subsequent calculations slightly overestimate the funding to be potentially generated thanks to the application of the levies. Indeed, applying levies leads to an increase in final consumer price leading to a potential decrease of the demand for the levied services or products. As estimates of the elasticity of the demand for all these products and services are not available for Africa, the calculations do not include them. As a matter of comparison, the High-level Advisory Group on Climate Change Financing (2010) used an elasticity of demand ranging 6 and 21 per cent when estimating the funding to be generated from the financial transaction tax.

Table 13: Funds generated by the application of the levy in the different scenarios

Scenario / Amount	Low levy	Medium levy	High levy
Extractive industries	$3.988.224	$400.816.492	$797.644.759
Banking and financial	$4.576.698	$459.958.106	$915.339.515
Tourism	$484.958	$48.738.279	$96.991.600
Maritime freight	$111.242.821	$444.971.284	$1.112.428.210
Air passenger	$72.535.001	$290.140.004	$725.350.011
Air freight	$111.880.317	$447.521.269	$1.118.803.173
Total	$304.708.019	$2.092.145.434	$4.766.557.267

Sources: World Bank Development Indicators, authors' calculations.

As chapter 2 shows, the needs for adaptation are significantly going to increase in the coming decades in both the 2-degree and 4-degree worlds. The funds to be potentially generated from the levy are also expected to increase with the projected economic and demographic growth in Africa, as well as the development of banking services and the better connections of the African continent to commercial air and maritime routes. Furthermore, the African Development Bank projects that continent-wide African GDP is going to increase by 4.9 per cent between 2010 and 2020 and 6.2 per cent during the subsequent decade (African Development Bank 2011). To estimate the funds to be potentially generated from the levy in Africa, the projected economic growth rate is applied in the three scenarios (low, medium and high levy) for the years 2015, 2020, 2025 and 2030. By 2030 funds generated by the application of a levy on transactions in Africa would range between USD0.82 billion and USD12.75 billion. The estimates are displayed in Table 14 and compared in the following Figure 21. Figure 21 illustrates the rapidly diverging potential of the levy scenarios owing to their respective nominal and relatives levy values.

Table 14: Estimates of funds generated in the three levy scenarios for the years 2015, 2020, 2025 and 2030 based on African Development Bank's economic growth projections.

Scenario/ Year	Growth during period (AfDB)	Low levy	Medium Levy	High Levy
2015	4,90%	$351.730.758	$2.415.006.675	$5.502.135.478
2020	4,90%	$446.773.894	$3.067.579.144	$6.988.898.298
2025	6,20%	$603.545.995	$4.143.986.769	$9.441.289.277
2030	6,20%	$815.329.125	$5.598.103.761	$12.754.219.536

Sources: African Development Bank, 2011 and authors' calculations

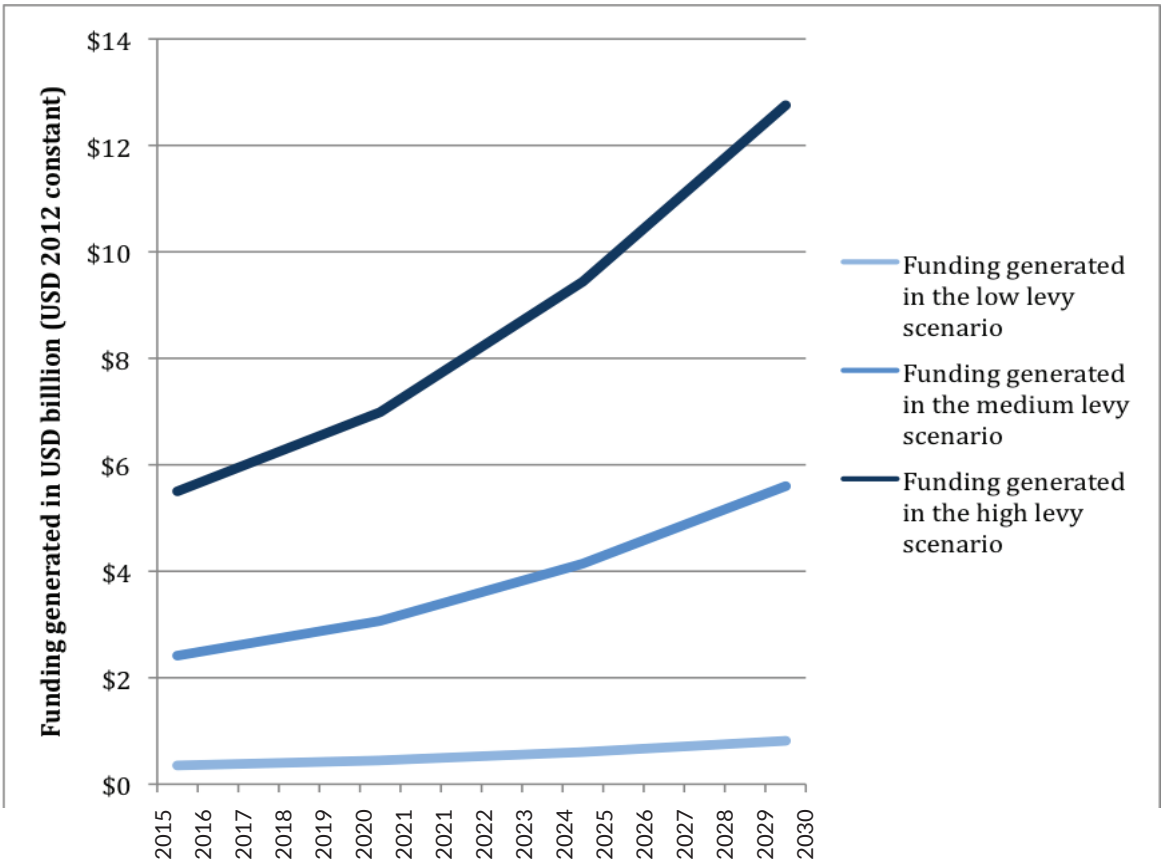


Figure 21 - Funds generated in the three levy scenarios for the years 2015, 2020, 2025 and 2030 based on African Development Bank's economic growth projections.

Sources: African Development Bank, 2011 and authors' calculations

The following Figure 22 illustrates the effects of the levies on the adaptation finance needs in Africa. The adaptation finance needs for the period 2012-2030 are compared to the funding potentially mobilised in the medium levy scenario in addition to the current funding made available by developed country Parties in the period 2010-2012. The figure reveals that in the case that the funding committed by developed countries remains constant over the 2012-2030 period then even applying a medium levy scenario would not be sufficient to meet the needs for adaptation of African countries. This highlights the potential limitations of the levy approach, which is projected not to be sufficient to meet rapidly increasing adaptation needs. Indeed, assuming a full implementation of the medium levy scenario by 2015, funds mobilised through levies would only contribute to bridge the adaptation gap up to 2020, by which time the growth of adaptation needs already outgrows the revenues in this levies scenario.

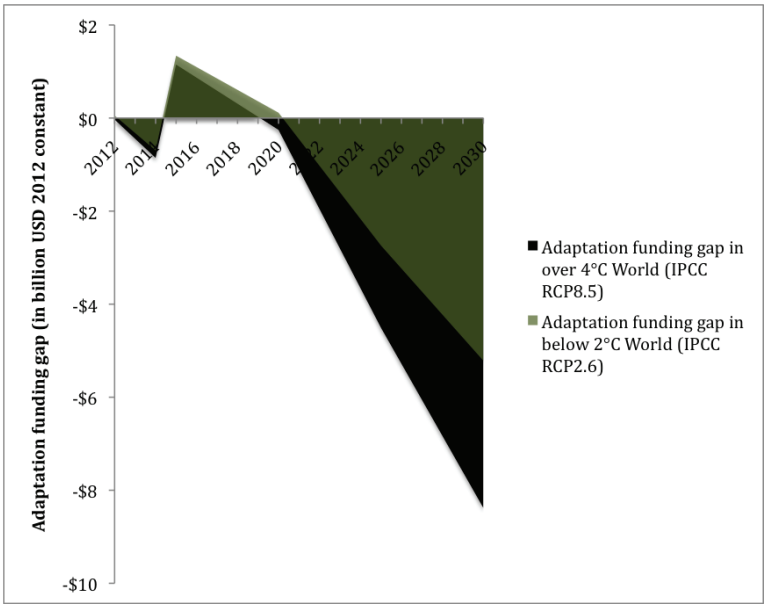


Figure 22 - Adaptation funding gap comparing the adaptation finance needs in the over 4°C World and in the below 2°C World and the current funding available in the 2010-2012 period and the funding mobilised in the medium levy scenario

Sources: authors' calculations and AD-RICE model 2012

5.1.2.3 Country breakdown

Depending on the structure of the economy of the African countries, some are expected to contribute more than others –an equitable repartition of the burden based on current capacity is a core requirement for the implementation of the levies. Countries such as South Africa, Egypt or Nigeria, which are the strongest economies of the continent, in terms of GDP, are therefore likely to contribute more in absolute terms than smaller and less developed countries. In absolute terms countries with its intense financial activity and active stock exchange (South Africa), its high revenues from mineral or fossil-fuel extraction (Nigeria and Algeria) or with its vigorous air and maritime freight activities (Egypt) are the main absolute contributors to the levy. The following graph displays the amount of funding generated by country relative to the total amount of funding generated thanks to the application of a levy. The following graph only displays the share for countries[20] with a contribution above 0.2 per cent of the total levied amount (see list of countries not included in the graph in the footnote).

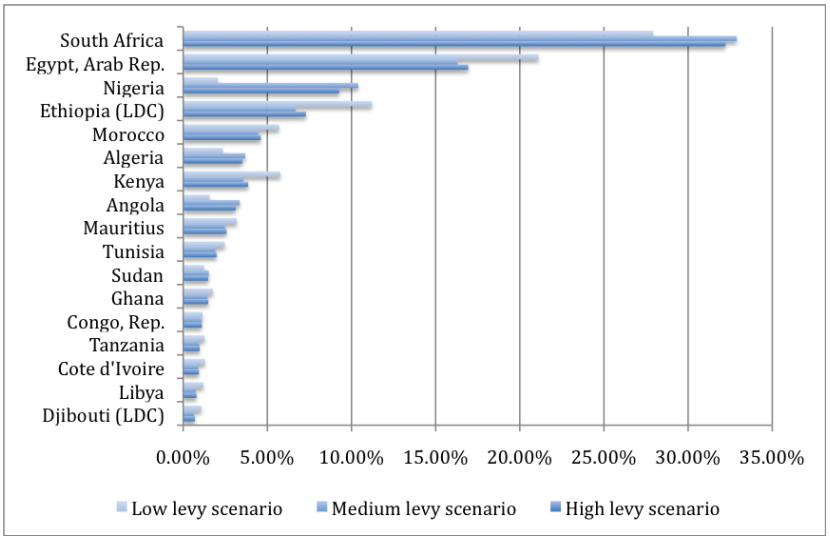


Figure 23 - Relative amount of funding generated by country relative to the total amount of funding generated by the application of a levy, in the low, medium and high levy scenarios. Least Developed Countries are mentioned in brackets.

The analysis of the share of funding levied by country highlights that the strongest economies of the continent, namely South Africa, Egypt and Nigeria would be the main contributors to the amount of funding levied continent-wide. With a contribution between USD34 and USD347 million (low and high levy scenario, respectively), Ethiopia scores particularly high, despite its LDC status. Two factors can explain the high contribution of Ethiopia: first, it displays a high country GDP (not high GDP per capita) and second, three sectors: air freight, air passenger transportation and tourism, which are included in the basis for the levy are particularly important in Ethiopia compared to other African countries.

The overall levied amount by country also needs to be put in perspective with the current economic capacity of the countries. Therefore, the following graph highlights that the main relative contributors are not the biggest economies of the continent. In light of this, a relative cap on the contribution given by a given country could be put in place in order to limit the relative amount of funding levied from a specific country.

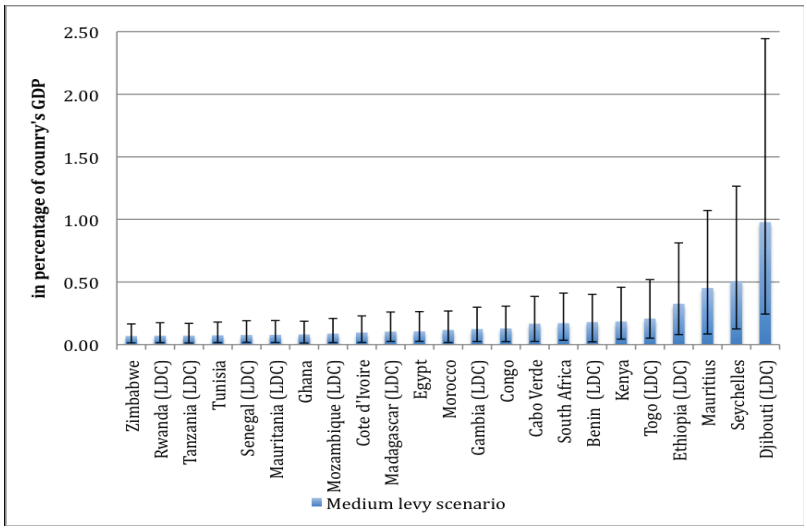


Figure 24 - Amount levied compared to country's GDP. The blue column represents the medium value and the two error bars represents the low and high levy scenarios. Least Developed Countries are mentioned in brackets.

20 Comoros, Guinea-Bissau, South Sudan, Central African Republic, Sao Tome and Principe, Liberia, Swaziland, Burundi, Malawi, Sierra Leone, Eritrea, Lesotho, Niger, Guinea, Gambia, Somalia, Mali, Burkina Faso, Botswana, Uganda, Cabo Verde, Chad

5.1.3 Application of the principles to the sectors and levies

By the application of the levies on the four sectors: banking and financial transactions, extractive industries, international freight transportation and international passengers transportation including tourism, up to USD12 billion could be generated by 2030. The implementation of these levies should consider three core principles: 1- cost efficiency, the amount of funding levied should be higher than the cost implied by the implementation of the levy; 2- equitable participation from all countries, all African countries could equitably participate in raising funds for adaptation according to their capacities; 3- traceability and collectability, for a levy to be applied, the transactions have to be traceable and an operating entity either public or private to be able to collect the amount targeted by the levy.

5.1.3.1 Cost efficiency:

Implementing the levies in the different African countries, collecting the funding generated by their application and transferring the amount raised to a specific regional fund and national fund for adaptation involves a number of transactions and policies, which all come at a cost. For some African countries, more especially Least Developed Countries, in which fiscal administration still have limited capacity (Christians 2009), the application of a levy could be particularly expensive. In an optimal implementation of the levies, these should therefore only be applied to countries where the amount of funding raised by the application of the levies exceeds the cost of implementing them. As a consequence, a floor amount could be established below which the levy is not being applied in a specific sector or country. The floor amount is to be defined on a country by country and on a sectoral basis.

In the absence of available data on the development of the fiscal administration in the different countries and the cost of establishing and collecting the levies, the floor price is hypothetically defined at USD1 million for the total amount of funding to be generated by the application of the levies. This floor price at USD1 million is used as a proxy to simplify the calculations.

5.1.3.2 Equitable participation:

The objective of applying levies on transactions in Africa is to generate additional funding for adaptation to climate change on the continent. The application of such levies should not lead to unequitable situations in which some countries are overburdened due to the application of the levies. Similarly to the application of a floor amount generated in the countries, a cap could also be applied. The cap, which could be expressed as percentage of the GDP of the country would therefore limit the amount generated from a specific sector. Its application would be particularly relevant for countries such as Mauritius, the Seychelles and Djibouti for which the amount generated by the levies would be higher than 0.5 per cent of country's GDP in the medium scenario.

Another aspect to be investigated when assessing the issue of equitable participation is the situation of the African Least Developed Countries, which could be exempted from contributing to the levy for adaptation. However, to avoid competition distortion between countries induced by the non-participation of the LDCs, the funding generated by the application of the levies in LDCs could be directly compensated.

When both the principles of cost efficiency (floor at USD 1 million) and equitable participation (cap equivalent to 0.5 per cent of the GDP) are applied, the amount generated by the application of the levies is USD 4.660 billion in the high levy scenario (compared to USD 4.766 when principles are not applied), USD 2.088 billion in the medium levy scenario (compared to USD 2.092 billion) and USD 0.299 billion in the low levy scenario (compared to USD 0.304 billion).

5.1.3.3 Traceability and collectability:

This criterion only relates to the "feasibility of implementation" of the levies on the transactions (High-level Advisory Group on Climate Change Financing 2010). The application of this criterion led to the selection of the four sectors for this research, namely: international transportation, banking and financial transactions including remittances, tourism and extractive industries on which levies have already been applied either in Africa or in other countries (see section 5.1.1).

Only three guiding principles are used for this report while the Advisory Group of climate change Financing had mentioned seven criteria: efficiency, equity, incidence, practicality, reliability, additionality and acceptability. The AGF principles of efficiency and reliability are addressed under cost efficiency, the principles of equity and incidence under the principle of equitable participation and the principle of practicality under the principle of traceability and collectability. Additionality is not addressed in this report as the application of the levies is by definition additional to the current funding for adaptation received by African countries. The AGF principle of acceptability is partially addressed under the criterion on traceability by identifying similar levies applied either in Africa or in other countries (see section 5.1.1).

5.2 Would a levy hinder economic development in Africa?

Applying a levy on economic transactions will generate funding for adaptation in Africa and may also lead to the negative consequences induced by several mechanisms such as competition distortions, increase in price, decrease in demand, etc. Analyzing the four sectors where the levies could be applied, the following section assesses the levies under three categories: compensable negative effects, limited effects and positive effects.

5.2.1 Negative effects and options for compensation

The main mechanism that could lead to negative effects could be summarised as follows: the application of the levy leads to price increase paid by consumers of goods and services, as a consequence the demand is expected to decrease. This decrease in demand then itself leads to various consequences depending on the sectors, which are discussed here. Two sectors might be affected in priority: the transportation and the banking sectors.

Applying a levy on the transportation sector could lead to competition distortion as the levy would increase the price of transporting goods and passengers in Africa. However, this negative effect could be offset by applying the levy not only to African companies involved in the transportation business, but by applying it to all the transportation companies operating in Africa. Therefore, distortion would be limited, as all the operators would be equally affected by the same additional charge.

The opportunity of applying a levy on banking transactions (not including remittances) has to be carefully considered by decision-makers as this could lead to a non-proportional increase of the interest rates and overall costs of the loans purchased in Africa and therefore increasing the cost of the principal repayment and interest payment. As, generally speaking, the banking sector is currently underdeveloped in Africa, interest rates are very high and competition is very low between banking and financial operators, applying a levy on these already costly services may potentially hinder the development of the private sector and investments. Furthermore, the amount of funding that could be potentially levied on this sector is currently low compared to the financial transactions in Africa, even though it could be expected that with current economic development more people will have access to bank services and products. However, this effect is particularly complex to estimate and would require a specific macroeconomic modelling assessment.

5.2.2 Limited socioeconomic effects

The application of a levy on transactions affects demand as well as supply of services and goods, as the overall costs of production may increase as a consequence. The increase in production costs, even by very limited amount between 0.2 and 0.001 per cent, could potentially put at risk business activities in very competitive sectors, or in sectors where benefits are very low. In the sectors analysed in this study, tourism and extractive industries could fit in this category. However, existing literature and economic modelling show that the consequences in these sectors may actually be limited.

As the levy on extractive industry transactions would be applied on "rents" (or benefits) of the extractive industry, the negative effects on the production are very likely to be limited. Indeed, a company with production costs higher than the value of its production would not be affected to the application of the levy. Otto et al. (2006) have estimated that a fluctuation of the types and values of the royalties paid by extractive companies only affect the internal rate of the return of the mining activities potentially leading to a decrease of several percentage points in the model used, without affecting the overall financial viability of the economic activities. The different royalties scenarios used by the authors integrate values, which are significantly higher than the highest levy used for this report of 0.2 per cent. Based on this example, it is expected the application of a levy may have very limited consequences of the sector.

Several taxes and charges are already applied in the tourism sector, for example "departure tax", "hotel room tax", etc. The nominal value of the levy applied in this sector would very limited, and hence may have very limited consequences on demand for touristic goods and services in Africa. The World Bank and the International Monetary Fund also estimated that the application of a tax on carbon would have very limited consequences on developing countries as the potential of these countries can still be significantly developed and taxes are already applied (International Monetary Fund & World Bank 2011).

5.2.3 Positive socioeconomic effects

The application of levies could also lead to the generation of positive socioeconomic consequences. These primarily concern three sectors: the financial transactions, the transportation sector and the extractive industries.

Originally, economists considered the application of a levy on the financial transactions in order to limit speculation on the financial markets and therefore to limit excessive liquidity in markets and overshooting of asset prices - especially exchange rates and interest rates (Tobin 1978; Schulmeister et al. 2008). African financial markets may not be yet exposed to this kind of financial risks (over-liquidity for example) however an early application of such a levy could limit future excessive speculation on African markets.

In the transportation sector, the application of the levy could lead to energy efficiency and carbon intensity gains by the main transportation operators as they would try to compensate the consequences of the levy. If the levy were applied on greenhouse gas emissions, this would lead to rapid and significant emission reductions. The World Bank and IMF estimated that the application of a carbon tax of USD25 per tonne could lead to a global emissions reductions of about 2-3 per cent for the aviation sector by 2020 when emission from developing countries are excluded and 5 per cent over the medium term for the maritime sector (International Monetary Fund & World Bank 2011).

The application of the levy on extractive industries transactions would foster the distributional effect of the benefits of this industry in Africa.

Remittance transaction is a sector that needs to be addressed with a specific care as the instigation of a levy on these transactions could have both a limited negative effects and a potentially beneficial one. However, it seems rather unlikely that applying a levy of maximum 0.2 per cent on remittance transactions would have a significant effect on the number and amount of transactions and therefore on the amount of remittances received in Africa. Two potential effects are foreseeable; first, the overall amount of remittance being channelled towards Africa will be reduced by an amount equal to the percentage of the levy (from 0.2 to 0.001%). which is particularly small compared to current 8.14 per cent average cost of remittances (World Bank 2014l). The second potential effect relates to the price elasticity of the demand, which is very unlikely to be affected by such a low levy. The levy may therefore not affect the gross amount channelled to the countries, only the net amount would be reduced by a very low percentage (equal to the levy applied). Furthermore, applying a levy on remittances may generate beneficial distributional effects on African economics. As remittances may have a limited effect on economic growth, and only benefit sending households in Africa Clemens & Mckenzie (2014), using a very low share of these transactions would have a positive effect on African economies' resilience.

The potential positive and negative consequences of the application of the levies however need to be thoroughly analysed, especially their interlinkages and potential interactions. In this regard, only a careful and robust macroeconomic modelling exercise would properly assess the potential negative and positive direct and indirect consequences of the application of the levies.

5.3 How could the funds be generated and how could countries access available funding?

There are different options how the levies discussed above can be implemented in practice. These options differ in the scope of levy application and cooperation between different states. Broadly, three options can be considered for the application of a levy:

1. Levies are applied on the basis of an continent-wide or regional agreement and are collected and disbursed through a multilateral vehicle such as an African Adaptation Fund
2. Levies are applied unilateral and are collected and disbursed through domestic legislation and institutions
3. Levies are applied on the basis of a continent-wide or regional agreement but are collected and disbursed through national legislation and institutions. Each of the options have inherent advantages and disadvantages that are discussed in the following sections of this chapter.

5.3.1 Levies applied on the basis of a continent-wide or regional agreement collected and disbursed through a multilateral body

Under this option countries would negotiate the application of the levy under a multilateral agreement. Each participant to the agreement would commit to apply the levies to its national sectors. As part of the agreement countries would set up a financial vehicle that would collect the proceeds of the levies. The agreement would also need include provisions how the proceeds collected from the levies will be distributed using an allocation formula for example based on vulnerability of countries and their adaptation needs. Examples for the collection of a levy based on a multilateral agreement are the International Oil Pollution Compensation Funds (IOPC Funds). The International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage created the Funds and their function is to provide compensation for oil pollution damage caused by tankers (Ganten 1983) (Mason 2003). The IOPC Funds are financed by levies on certain types of oil carried by sea. The levies are paid by the entities, which receive oil after sea transport, and normally not by States. By levying the recipient of the oil, the Convention assures that the oil industry contributes to the compensation for damage caused by the maritime transport of oil (Ganten 1983). The Funds are governed by executive committees that take policy decisions concerning the admissibility of claims for compensation for oil pollution damage. The Fund's assembly elects the 15 members of the executive committee on an annual basis.

The advantage of applying levies on a multilateral basis is that it minimizes distortional effects of these levies because no country can gain a competitive advantage over their neighbours by not applying the levy. The aversion of sectors to the introduction of a levy might be smaller if it is applied on a multilateral basis. A multilateral solution also would enable more affluent African countries to help support adaptation in the continent's poorest and most vulnerable states.

On the other hand this option requires a comprehensive negotiation process and subsequent ratification of the multilateral levy agreement, which could be time and resource intensive.

There are existing vehicles that could be used in principle to disburse the proceeds of the levy such as the AfDB Africa Climate Change Fund and the NEPAD Climate Change Fund. However this would require an arrangement between the vehicle and the multilateral agreement on the modalities for collecting and disbursing the resources collected through the levy.

5.3.2 Levies are applied unilateral and are collected and disbursed through domestic legislation and institutions

The Kenyan railway development levy that was enacted in the budget year 2013/2014 could be mentioned as an example of a levy that is applied unilaterally and collected and disbursed through domestic legislation. The government of Kenya introduced the 1.5 percent levy on all goods that are imported in the country for home use through the Finance Bill of 2013 by amending Section 117A. The purpose of this levy is to mobilize funds for construction of a railway network from Mombasa to Nairobi to help facilitate the transportation of goods. Furthermore, it was decided to establish a Railway development levy Fund in which these levies will be

paid. This Fund is to be "established, managed and administered in accordance with the Public Financial Management Act, 2012 and regulations made under that Act" (Kenya 2013).

The Transport Ministry of Kenya had expected to collect Ksh 13.5 billion in 2013/2014 and Ksh 22 billion over 2014/2015 from this railway development levy (Wangalwa 2014). The money needed to build the Standard Gauge Railway is Ksh 327 billion in which the government is supposed to raise 10% of this amount with the remaining budget to be covered from the Chinese Concessional Loan as per the agreement between the Kenyan government and the Exim Bank of China. The newly introduced levy raised Ksh 10 billion in the first six months after it was being put in place and by exceeding its target. Besides, the government plans to continue this levy beyond the specific railway development and cover costs of land acquisition and commuter railway (Kamau 2014).

When the levy was first introduced, there were complaints from different business communities in Kenya and also other neighboring countries such as the Kenyan oil dealers and Uganda Manufactures Association (UMA). The reason for their opposition towards this levy was that it will have implication on transportation costs that will be passed onto consumers, increase costs for local manufacturers, higher prices for imports and the fact that it was being implemented only in Kenya (Muwanga 2013).

Moreover, the levy faced another challenge from the East African Community (EAC) with the Council of Ministers contesting it for the reason that it contradicts EAC's common market protocol and issued a directive. The EAC directed the government of Kenya to halt this levy system on goods that are imported from the EAC member countries. This is in line with Article 10 of the EAC Customs Union Protocol that internal tariffs and other charges must be removed on trades among member states (EAC Secretariat, 2004). Due to these complaints the Customs and Excise Act allows a refund for levies that were collected from EAC member countries if they submit an application for a refund (Okulo 2014). When levies of this kind are being applied careful measures must be taken not to contradict with existing agreements since it will have implication on trade and/or partnership with other countries.

Even though the government of Kenya has exceeded its target of collecting the 10% i.e. Ksh 32.7 billion needed for the railway development it has a plan to continue collecting the 1.5% levy to meet other obligations. Once EAC member countries apply for refund the levy that was raised will decrease dramatically and would have to continue raising funds from this levy for the railway development. However, this kind of innovative financing scheme could be a good example for other African countries as it has shown that domestic finance could be raised for a specific purpose and be sustained by allocating it for a national plan. With all its challenges levies such as this could be promoted to raise funds for building a climate resilient infrastructure among other climate adaptation actions. As the Kenyan case shows, applying a levy unilaterally bears the risk that countries will be pressured by affected stakeholders and neighbouring countries to lower the levy or abandon it altogether for competitive reasons.

5.3.3 Levies are applied on the basis of a continent-wide or regional agreement but are collected and disbursed through national legislation and institutions

In this case, the 1.5 percent infrastructure levy of the East African Customs Union could be taken as one example that is applied in a regional level and collected and disbursed through national legislation. The Protocol for the establishment of the East African Community Customs Union was signed in 2004 by three countries (Tanzania, Uganda and Kenya) and later signed by Rwanda and Burundi in 2008 and started its application in 2009. The main objective of this Union was to facilitate intra-regional trade, enhance investment, promote efficiency in production and economic development in the community (EAC 2014).

The Council of Ministers of the East African Customs Union came to an agreement to introduce a 1.5 percent levy on all imports to the EAC member countries to raise funds for regional infrastructure development to come to force on July 1, 2014 (EAC Gazette, 2014). This infrastructure levy is similar to that of the Kenyan railway development levy as explained in the previous section. While Uganda, Rwanda and Kenya agreed to it Tanzania could not announce a specific time frame when it will start implementing it. However even though Kenya has agreed in principle it asked to be exempted from this programme as it will be duplicating the country's railway development levy. Kenya proposed to enact this levy not before 2017 after extending its railway development levy (Scola Kamau 2014).

After this regional infrastructure levy comes to force, it will be difficult for Kenya to continue to apply its national railway development levy. Besides, participating in the regional levy will not benefit Kenya as it will lose the financial resources that it was collecting from the existing railway development levy. The other argument has been the fact that EAC member countries have other agreements with other regional trading blocs such as the COMESA (Common Market for Eastern and Southern Africa) and SADC (Southern Africa Development Community). This will make the application of this levy complex as some countries that are non- EAC will have to be exempted as per their existing agreements with member countries. Domestic collection of the levy will also not enable the implementation of an inter-continental solidarity transfer element where levy proceeds are channelled to those countries particular vulnerable to climate change and having the greatest needs.

Nevertheless, this regional levy has a potential to raise large amount of money and could be replicated in other regions of the continent to mobilize domestic finances that could be directed towards climate resilient infrastructure development.

6. Discussion and conclusions: mobilising the potentials

6.1 Main conclusions

This report provides an overview of the current and future needs for adaptation and options to meet these needs using different policy measures at the international, continental and national levels. From the analyses at these different scales, four key conclusions can be extracted:

1. **The current level of funding available from both international and domestic sources for adaptation in Africa is insufficient to meet current and projected needs,**
2. **Emissions pathways and therefore mitigation at the global level plays a central role in limiting the overall costs of adaptation in Africa,**
3. **Several policy measures from the national to the regional level could be put in place to generate higher level of funding, however none of them may individually meet all the needs for adaptation in Africa**
4. **Scaling up international climate finance under the UNFCCC may by itself lead to sufficient funding for adaptation in Africa, but even in this case actual implementation can only reach its full potential if complemented by comprehensive and effective national and regional policy planning and governance.**

6.1.1 Adaptation funding gap

The report highlights that **current and projected funding mobilised by the application of levies for adaptation in Africa from both domestic and international sources is and will increasingly be insufficient to address adaptation needs** in all the climate-change scenarios studied.

The gap between resources mobilised for adaptation and future adaptation needs is projected to deepen rapidly as global mean temperature increases. In both the "below 2°C" and "over 4°C" world scenarios[21] there is an adaptation gap, even when current funding for adaptation is supplemented by explorative scenarios of regional levies. This gap is apparent by 2015 for the lowest levy scenario and starting in 2030 and 2025 for the highest levy scenario in the "below 2°C" and "over 4°C" worlds, respectively. In Figure 25, only the potential funding generated by the application of the high levy scenario (blue line) could contribute to meet adaptation needs up to 2025, while constituting a annual burden on African economies. However, even if regional revenues were generated at the levels of the highest levy scenario, and even if these were to keep pace with further economic growth, the adaptation costs in the "over 4°C World" scenario quickly exceed the potential funding generated from the 2020s onwards. In the "below 2°C World" scenario, adaptation needs would exceed generation capacity of this highest levy scenario after 2030. In the low and medium levy scenario, adaptation costs would exceed the levy generation capacity even earlier, from about 2020 in the medium levy scenario and 2015 in the low levy scenario.

21 Global emission scenarios that lead to warming globally increasing from today's levels to these specified levels by 2100, relative to pre-industrial levels

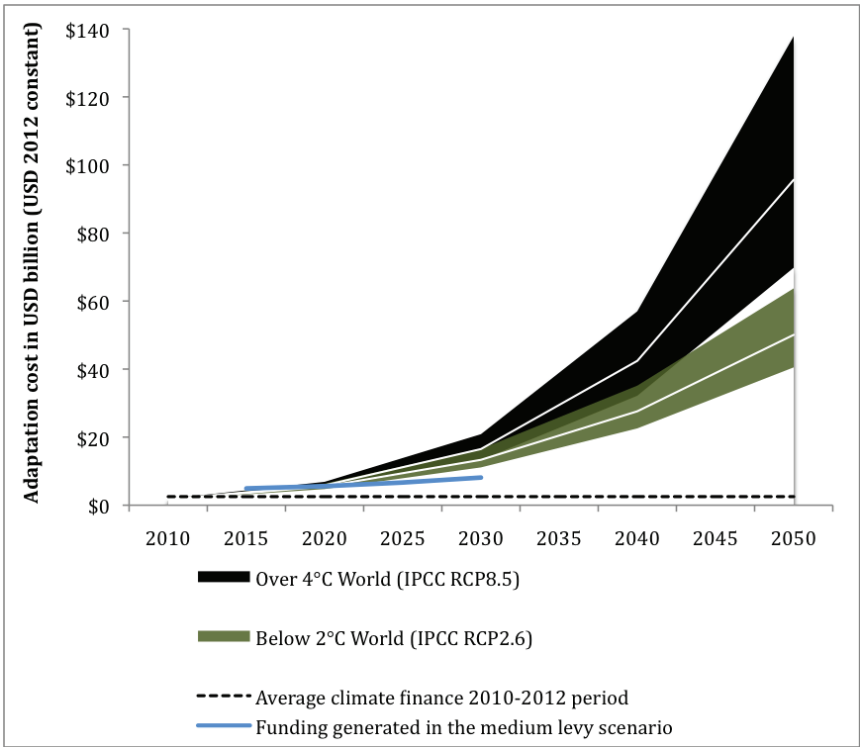


Figure 25 – Adaptation costs from 2010 to 2030 in Africa using the AD-RICE mode compared to the funding potentially generated in the three levy scenarios (low, medium and high) and the average climate finance available during the 2010-2012 period. Sources: author's calculations; see chapter 2 for details on adaptation costs, chapter 3 for climate finance details and chapter 5 for details on levies. All values harmonized here to constant USD 2012 value.

When adaptation funding from international sources (here channelled from OECD to African countries) is kept at the level of the 2010-2012 period, it clearly appears that even if additional funding were generated from regional levies, the total will fall far short to meet Africa's adaptation needs. In other words, this report plainly underlines that even if African countries were to focus on domestically funded adaptation, this would not be sufficient to meet Africa's overall adaptation cost challenge.

Only a steep increase in adaptation funding from developed to developing countries will contribute to closing the adaptation-funding gap. Therefore, increased adaptation funding disbursements – at least – in line with the USD100-billion target as agreed by the Parties at the UNFCCC in Copenhagen in 2009 and Cancun in 2010 could result in bridging the deepening adaptation gap by 2020. Such disbursements subsequently need to continue to grow rapidly to keep pace with warming, most rapidly if global mitigation fails to put the world on a pathway to hold warming below 1.5 and 2°C by 2100.

6.1.2 Emission-dependent adaptation gap

Chapter 2 of this report illustrates the severity and the depth of the gap is strongly temperature-pathway dependant. **The rate of increase of the adaptation needs is projected to be significantly higher in a scenario leading to an "over 4°C World" than in a "below 2°C World" scenario**. Figure 26 illustrates the differences in adaptation needs between the scenarios used in this report. It compares the costs of the adaptation against the scenario with the lowest emissions and associated adaptation cost, i.e. the 1.5°C world scenario, which in the 2nd half of the century remains just a bit under the "below 2°C World" scenario in terms of warming and hence impacts and damages, although the scenarios are virtually identical up to the 2050s. In both the 1.5°C and "below 2°C World" scenarios, the African adaptation gap grows to roughly USD50 billion per year by 2050 (Figure 25). However, by that time, the emission-dependant part of the adaptation gap in the "over 4°C World" scenario leads to an ***additional*** burden of USD50 billion per year (Figure 26). Hence, **under socio-economically feasible global mitigation that holds warming below 2°C, future climate change is estimated to commit Africa to USD50 billion per year in adaptation costs by 2050, which doubles to USD100 billion per year, if global mitigation fails to deliver at all.** A final set of scenarios assessed in this report illustrates that if current pledges by individual countries worldwide to reduce emissions in the coming decades were fully implemented and effective, the emission-dependant part of the adaptation gap reduces to USD25 billion per year by 2050, leading to a total of USD75 billion per year in Africa adaptation costs by 2050.

It is important to realize that adaptation, **even if all cost-effective adaptation potential is used, will still leave large "residual" damages for Africa, estimated here as about double the adaptation costs in the period 2030-2050. Therefore, even if international climate finance and national-level implementation achieves the full potential of adapting to anthropogenic climate change, Africa and the international community will need to find ways to cope with the residual damages, lest it further undermines Africa's development and its adaptation efforts.**

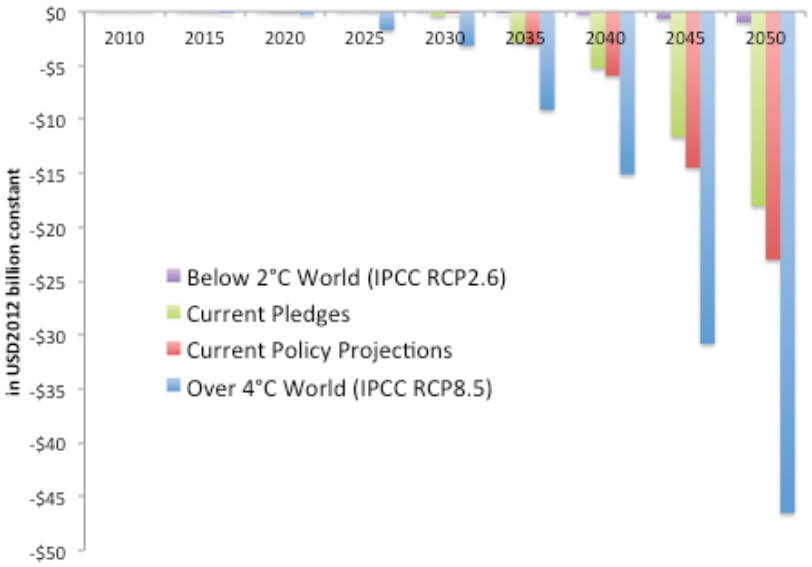


Figure 26 – Emission-pathway dependent adaptation gap; annual adaptation cost in different temperature scenarios relative to the costs of adaptation in a "1.5°C World" scenario for the period 2010-2050. Sources: authors' calculations; see chapter 2 for details on adaptation costs and scenarios. All values harmonized here to constant USD 2012 value.

The calculations in this report only point out the adaptation gap for individual years. When the difference in the gaps between the "over 4°C World" and the 1.5/"below 2°C World" scenarios for individual years are aggregated the difference exceeds one trillion dollars as early as the 2060s.

Overall, it becomes clear that ensuring through a global agreement applicable to all Parties that mitigation commitments are in line with maintaining global mean temperature increase well below 2°C is a core condition to guarantee the manageability and feasibility of adaptation in Africa in the coming century, irrespective of the sources of adaptation funding.

6.1.3 Lessons from exploring a broad range of solutions at national level

As the report shows, there are a lot of adaptation options, measures and sources countries can mobilise and implement from the national level to the international level to limit the deepening of the adaptation gap under any level of global mitigation. The report assessed:

- Options at the international level – scaling up countries' commitments and channelling through the GCF
- Options at the national level – resources from national budget
- Options at the continental level – levies

The international climate finance landscape is changing in significant ways and new opportunities are on the horizon, especially the Green Climate Fund (GCF). The GCF has entered a promising period of capitalization. Since the GCF's board has decided that 50% of funds allocated should be allocated and, in turn, that 50% should go to Least Developed Countries (LDCs), these developments are of particular importance for many African countries.

The process for applying for grants from the GCF is likely to be highly competitive. The GCF's governing instrument requires that funding should be allocated to 'paradigm-shifting' projects. Countries that can show that they have given full and reasoned consideration to the adaptation needs and costs of meeting the impact of climate change in their country will likely be better placed to put together proposals with a high probability of approval. In turn, there is a growing appreciation of the need for beneficiary countries to have explored opportunities for funding adaptation costs from within their own resources, whether in terms of existing public expenditure or possible reforms or re-allocations.

Hence, being able to identify such existing expenditure and the possible space for further national fiscal commitment to meeting some adaptation costs is likely to add even greater credibility to countries that bid for GCF funding. This starting point is not advanced in any way to detract from, or depart from, the over-riding principle that should govern international climate finance, which is that the developed world has a responsibility to fund the necessary efforts that must be made to adapt to climate change in the developing world. But since it is in countries' own direct interest to address the profound harm that climate change may cause to their economic development prospects, it is also in their interests to leave no stone unturned in exploring opportunities for financing adaptation that are within their own sovereign realm. Besides, international climate finance is unlikely, by itself, to be able to meet the whole bill for adaptation.

To address the multiple challenges of adaptation in Africa there will be no single solution to solving all the funding and implementation issues faced by African countries. Addressing these challenges will require the deployment of complementary measures at the international, continental and national levels.

The evidence suggests that African countries are already committing some resources of their own to adaptation efforts and, moreover, that there are plentiful opportunities for doing more that can be considered and debated across the continent, with lessons to learn and share. It is difficult to compare such additional resources generated to adaptation cost estimates, since these tend at present to be quite general, and sensitive to assumptions, at the country level. We suggest, however, that for Ghana and Ethiopia, the allocation of additional resources beyond the baseline at 2%, and even 5%, is unlikely to meet climate adaptation costs through 2030. This conclusion would of course be even more applicable to the baseline scenario, where resources available are even less. This conclusion suggests that, for Ghana and Ethiopia, support for public adaptation projects will continue to be required, and careful consideration will have to be given to involving the private sector to also help fill the gap. In the case of Togo, there can be little doubt that additional domestic resources becoming available for adaptation are extremely limited and pale in comparison to the challenge. In the case of South Africa, the more optimistic scenarios generate resources that might be able to address adaptation costs, though the South African economy is in effect a stagnating one and we suspect the likelihood of attaining even the moderately optimistic scenario is smaller than for Ghana and Ethiopia.

Ghana, like Ethiopia and South Africa, is already financing the major part of its public spending from own sources. However, an emerging challenge emanates from these successes. The attainment of lower middle-income country status has implications for Ghana's access to concessional finance, as well as the extent of donor support it is likely to receive in the future. For South Africa, the issue of 'domestic resource mobilization' for adaptation is less a matter of absolute resource availability and more a matter of planning and partnership in a potentially fractious policy-making context seeking to address escalating competing claims on public resources.

The Ethiopian government views building climate resilience as a domestic priority requiring domestic finance and has already established a facility for the pooling of revenue for its vision of a climate resilient green middle income economy by 2025. The challenge Ethiopia faces is to ensure that it's high growth is maintained and that it is translated into substantially increased domestic resource mobilization, which includes both higher savings and, critically, increases in tax revenue as the result of effective tax reforms. For Ethiopia, the domestic adaptation finance challenge is inseparable from the broader challenge of increased domestic resource mobilization, accompanied in at least the short- and medium-term by continued international support. Over the next decade, a major challenge for Ethiopia will be to combine effective capacity building at sub-national level within an overall finance framework which continues to pursue equity and national objectives and carefully considers not only the distribution of revenue between jurisdictions on the same level of government, but also the vertical division of federal revenue.

Although the fiscal circumstances of countries differ significantly as regards aggregate resource amounts and growth prospects, the adaptation challenge must be considered for all of them in the light of sustainable debt management. In this regard, a fundamental issue that Ghana will have to grapple with is the costs and benefits of aggressive debt repayment vs. accelerated adaptation. Difficult decisions will have to be made about the best use of additional fiscal resources that become available: these decisions will in essence concern timing issues as regards debt, adaptation financing, and immediate growth and poverty alleviation measures.

Domestic contributions to adaptation through earmarking can be significant for some countries, though highly unlikely to be adequate given available adaptation cost estimates, with the possible exception of South Africa. For example, a 5% earmarking option that is discussed in the Ethiopia case study, on the illustrative tax bases given, could generate around 17% of the $US200 million required at the present time to implement its ***Climate Resilient Green Economy (CRGE).***

Adaptation-related tax expenditures are another option. These might include a tax credit on adaptation expenditures that are additional to business-as-usual expenditures, differential accelerated depreciation allowances between climate proofed and non-climate proofed assets, as well as favourable tax treatment of country-specific adaptation R&D.

There are different options already in practice for 'institutionalizing' domestic resource mobilization. In terms of institutional arrangements for adaptation – and funds and specialized facilities, especially – South Africa has a Green Fund, which however is virtually exclusively oriented towards mitigation; Ghana has a proposed Green Fund which however has not been established yet and which explicitly considers a revenue earmarking approach as one form of capitalization; and, Ethiopia has a Climate Resilient Green Economy (CRGE) facility though it has not been possible to determine how operational it is at this point.

The question of subsidies is one that the study suggests deserves attention and should not be ignored. Eliminating or reducing subsidies may not only create new fiscal space but can at the same time help shift priorities as well as public resources away from carbon intensive parts of the economy. Togo, for example, provides a large fiscal subsidy to maintain domestic fuel prices. The gradual phasing out of this subsidy is desirable, and is recommended in the 2013 IMF Section IV Consultation and supported by the Togolese authorities. The concern in regard to the current oil subsidies is not only their size in relation to GDP and the Togolese budget, but also their tendency in recent years to exceed the estimates in the approved budget. However, the phasing out of the support will have to negotiate a complex political economy and to do so with little real credibility, given recent trends. Secondly, were such a phasing out to occur successfully, persuasive arguments would exist for firstly initiating a 'fiscal adjustment', that is using the additional revenue mainly as a means of providing for smaller budget deficits for a given set of expenditure commitments. On the other hand, earmarking a fairly small share of estimated additional revenue to adaptation need not compromise such fiscal adjustment and might constitute a viable initial financing source in a resource-constrained context. Again drawing from the Togo case study, taking a fairly low oil price support as share of GDP value of 1% (the actual average for 2011-2013 is 2%), and assuming that the fuel-intensity of growth remains constant and growth averages 6.5% up to 2025, the study provides indicative estimates of resources made available if 10% and 20% of the subsidy elimination savings are allocated to adaptation for a period of ten years, namely, USD18m at 10% and USD30m by 2025 respectively.

For all four countries, results suggest that a great deal still needs to be done to promote an effective enabling framework for private sector participation in adaptation activities. Togo generally scores quite low in assessments of the general business environment and many of the initiatives intended to improve the enabling environment represent 'work in progress'. A similar situation pertains in Ethiopia, which, considering the extent to which the country framework currently promotes private sector

investment in adaptation, means that much still needs to be done in this regard. In Ghana, to date, there has been little private sector involvement in climate change related activities where a social benefit component is an explicit part of project intention. It is safe to conclude that at present there is not a significant policy effort to harness private sector finance for activities that have both private and social adaptation benefits. South Africa has a large private sector, including a sophisticated financial sector, both of which hold considerable resource mobilization potential for climate finance. Given a fairly evolved system of tax expenditures in South Africa, there might be scope for considering the use of tax incentives to generate private adaptation measures up to an efficient level, on the assumption that a sub-efficient autonomous adaptation response would otherwise occur. Such measures might include a tax credit on adaptation expenditures that are additional to business as usual expenditures, as well as differential accelerated depreciation allowances between climate proofed and non-climate proofed assets. At present, however, key challenges in the establishment of an enabling framework for eliciting greater private sector investment in climate change include insufficient awareness of the challenge within the private sector, and concerns around the coherence of government policy in regard to South Africa's response.

6.2 Recommendations

Building on the conclusions in the previous sections, and relating to the current negotiations towards the post-2015 agreement context at the UNFCCC, African policymakers may consider the three following findings:

1. The best insurance against potentially catastrophic impacts of climate change and unmanageable adaptation and (residual) damage costs in Africa is deep and ambitious global mitigation action
2. Cancun climate finance commitments need to be met by 2020. Adequate (large-scale, increasing) and predictable funding must be mobilised for the subsequent periods
3. The potential and feasibility of mobilising untapped domestic and regional sources should be explored further

6.2.1 Mitigation as the best insurance against deepening adaptation gaps

As the series of UNEP emissions gap reports have highlighted, closing the emissions gap is economically and technically feasible. Therefore, ensuring that developed countries and major emitters take strong mitigation commitments and actions are highly recommended as a requirement to keep adaptation and damage costs at the lowest level possible. This may imply for the ongoing negotiations:

- A high level of mitigation ambition and commitment anchored in the 2015 agreement is a core requirement to ensure a limited adaptation gap in Africa
- Although not analysed in this report, this would imply that the Intended Nationally Determined Contribution (INDC) process at the UNFCCC should ensure through a transparent review process that aggregated contributions are consistent with keeping global mean temperature well below 2°C

6.2.2 Scaled-up funding to be mobilised by 2020 and beyond

Scaling up current funding for adaptation in Africa is a core requirement to meet current and future African needs during the pre-2020 period and beyond, as the adaptation gap is rapidly deepening. Furthermore, assuming the USD100-billion commitment by 2020, the allocation of the mobilised funding resources has to be realised in a balanced manner taking into consideration the needs of each developing country regions and the most optimal allocation between adaptation and mitigation.

- The Green Climate Fund plays and will play a central role in channelling resources being made available by pledging Parties;
- Developed country Parties are solicited to meet their commitment to mobilise USD100 billion by 2020. An appropriate monitoring system of these commitments also needs to be established to make current commitments and disbursements more transparent and comparable and properly monitor the adaptation benefits;
- With the current negotiations under the ADP for the post-2015 agreement, the AGN is recommended to start investigating options and measures to fund adaptation after 2020 taking into considering adaptation needs with regards to the emissions gap pathways, and the potentials of different funding-mobilisation options;
- In investigating the potentials of different funding-mobilisation options, particular attention could be given to mobilise large-scale funding from innovative sources, such as for example the assessment of the potential of the sources as proposed by the High Level Advisory Group on Climate Change Financing in the UNEP Adaptation Gap (chapter 3).

6.2.3 Mobilising untapped potentials

In addition to the urgent and rapid scaling up of the mobilised funding by developed countries for adaptation actions in developing countries, other sources and potentials can be explored. The report explored three potential options for complementing adaptation funding channelled by developed countries towards developing countries: the increased role of the private sector, additional domestic budgetary resources in African countries, and finally funding mobilised by the continental application of levies on transactions.

- The policy effort and supporting framework for encouraging private sector funding of adaptation activities can be significantly enhanced. In particular, a basic assessment of country frameworks for promoting private sector climate change adaptation in the four case study countries revealed that many components thereof are either absent or in the early stages of development.

- Tax collection and tax culture on the one hand, and enhancing the budget process and outcomes on the other hand can be improved. The country studies noted that fiscal reform efforts and rationalizing tax expenditures would help create much-needed fiscal space for funding adaptation in the medium to longer term. Included here are domestic measures targeted at reducing IFFs, for example establishing an effective transfer pricing unit within the revenue authority to reduce the capacity asymmetry between revenue agencies and tax evaders/avoiders, addressing obvious loopholes in the tax code, entering into information sharing agreements with other jurisdictions, and selectively targeting companies for more detailed tax audits based on risk profiles. A consistent and credible budget process under which outcomes remain broadly in line with budget approvals would then complement the above tax reform efforts, and facilitate allocation of fiscal resources to adaptation – whether by apportioning general budgetary resources or earmarking specific taxes.
- Inter-governmental fiscal relations and decentralisation. Implementation capacity for capital spending is a constraint in numerous countries. Sub-national level capacity-building holds potential for easing such constraints – particularly with regard to adaptation investments.
- Explore levies on transactions with a progressive scaling up of the values of the levies in sectors least economically sensitive and least exposed to international competition, as such levies could generate several billion dollars per year of predictable funding

In conclusion, there are a few over-arching points that should be noted. First of all, it is important to recognise that there will be little or no appetite for regional funds or instruments such as those explored in this report, if the necessary and appropriate governance systems are not in place. Transparency is essential - and not just in the technical sense of ensuring an adequate information flow, and full access to the scientific and other knowledge that underpins the rationale and legitimacy of such revenue-raising innovation, but in terms of permitting national and regional stakeholders to engage properly in the process of both establishing such mechanisms and in determining the allocation of the new resources for adaptation that are created.

Second, it is certainly important to recognise that the decisions that governments take in relation to policies that impact on GHG emissions and pollution, and on mitigation generally, as well as in relation to budget allocation towards adaptation capacity and activities, are highly political and so the ability of public institutions to fully grasp the significance of their decisions, and the socio-economic and environmental implications of those decisions in the light of what is 'required by science' (or what the data is telling us), is an important consideration, as is the leadership required to take bold and innovative decisions.

Thirdly, the question of what happens next and how to get the ball rolling must be considered. Much depends on the political reaction to the ideas explored in the study. And in this regard it is also important to recognise that there is clearly a profound relationship between creating the necessary political will in Africa to seriously consider the resource-raising reforms considered in AAGr2, and, on the other hand, the effectiveness of the UNFCCC process, and the GCF in particular, to marshal sufficient new resources from the developed world to meaningfully, and therefore credibly, contribute to meeting Africa's adaptation needs. Hence, the Paris COP will be an inevitably important part of the journey. But in the meantime there is probably a strong case for a group of interested and willing African stakeholders to meet to specifically consider the ideas and approach presented here and to see if a strong and sufficiently representative consensus can be found on the continent as to the way ahead, to ensure that Africa maximises the opportunities that exist to ensure that there are sufficient resources available to meet its adaptation needs.

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Figures

Tables

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