
Short Summary of Literature Review Findings

GCAP and Vivid Economics

This synthesis summarises the findings from Phase 1 – the literature review - of the project ‘Economics, Political Economy and Behavioural Science of Accounting for Long-term Climate in Decision Making Today’. The project has been commissioned by the Future Climate For Africa (FCFA) programme, which is advancing scientific understanding of sub-Saharan African (SSA) climate on decadal timescales and promoting the use and uptake of climate information in long-term climate-resilient development strategies. The aims of the project are to analyse and identify the types of development decisions that should be actively accounting for future (10 years+) climate in decisions taken today, and to advance quantitative evidence on this to help inform decisions made by development practitioners in Africa.

**TASK 1: IDENTIFICATION OF LONG-LIVED POLICIES AND INVESTMENTS**

The review has first explored a number of evidence lines to identify where and how long-lived polices, plans and investments are being made across sub-Saharan Africa and where these will shape vulnerability.

**A) Review of key focus areas**

The study has first identified the potential areas of interest for the study – and FCFA more broadly. This indicates that in the 5 to 40 year period of interest, the most important areas for consideration are likely to be:

- Infrastructure, including water, irrigation and flood protection infrastructure, but also energy and transport infrastructure;
- Planning, especially urban, natural resource (water) and coastal planning,
- Forestry and agricultural land-use, the latter including key export crops; and
- Natural and semi-natural ecosystem management.

The importance of these areas is due to their long-life time (e.g. in the case of major infrastructure or forestry) or the long-lived nature of decisions (e.g. planning): the typical timescales involved for these two areas are set out in the figure below. However, an additional category of future large-scale and irreversible impacts has also been identified, which requires long-term climate information for early action, particularly for biodiversity and ecosystem services.
However, in these cases, the most important impacts of climate change are likely to arise in the future, towards mid-century. The benefits of adapting to these future changes will accumulate and be realised over long time horizons, while the costs may be incurred in the short-term. This type of cost and benefit profile is often difficult to justify when using the social discount rates conventionally used in developing countries, which are typically 10-12%. In practical terms, this means that the limited resources available in these countries should be spent elsewhere (i.e. to give more immediate social benefits) and it gives much greater preference to no-regret adaptation options as these produce immediate economic benefits. However, there are some cases where medium to long-term investments can be justified. These include:

- Where the costs of overdesign are low, or where it is possible to include flexibility or robustness into at low cost;
- Where the future costs of climate change and the benefits of adaptation are extremely high (when there are major shocks or indirect effects, such as from failure of critical infrastructure, or where path dependency locks in future large impacts);
- When there are early benefits associated with longer-term adaptation options;
- When there is a value of information, i.e. for early action to provide learning;
- Where there are high costs to delay, or very long decision time-frames.

**Implications for the RCPs**

The current focus of adaptation in SSA is on addressing the current adaptation deficit, investing in decisions that reduce the impacts of current climate variability whilst also building resilience for the future. These types of intervention do not require the (detailed) use of medium- to long-term climate information. The interventions that do require this information include:

- The use of future climate information for climate risk screening, to reduce the impacts of future climate change on investments (especially infrastructure) with long life-times, i.e. to reduce risks of climate change affecting the asset value or performance.
- The use of future climate information to assist decision makers in cases where there is path dependency and the risk of lock-in, to minimise the risk that current actions will lead to increased levels of vulnerability (maladaptation) in the future (especially for planning).
- To identify potential long-term challenges, which could lead to major impacts in the future (2050s), and for which early programmes of research and monitoring – as well as iterative
plans – are needed now to start the process of learning and allow improved decisions in the future.

However, it is stressed that some – but not all – of the above categories warrant the implementation of early adaptation and thus the short-term use of long-term information. For example while major hydropower schemes might justify climate risk screening, smaller hydropower plants may not. Similarly, while the siting of new roads might warrant careful consideration, which would benefit from future information, the lifetime of paving surfaces is too short to warrant long-term protection.

**B) Identification of Key Stakeholders and Policy Entry Points**

The study has identified the types of policy decisions that could incorporate medium-long-term climate information, as these are critical in looking at the practical uses of FCFA. In the adaptation context – in Sub-Saharan Africa – this is centred on mainstreaming, i.e. the integration of adaptation into existing development planning processes (and sectors) and the inclusion in programme and project safeguard and screening processes. A critical issue for advancing mainstreaming is the identification of relevant entry points, i.e. steps in the existing policy cycle where climate information could be used to inform decisions. The entry points for mainstreaming in national strategic planning policy in developing countries are summarised below.

<table>
<thead>
<tr>
<th>Planning level</th>
<th>Entry point</th>
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</table>
| National government and cross sector ministries -Ministry of Finance -Planning Commission | - National development vision (long-term)  
- Poverty reduction strategy  
- National development plan (e.g. 5 year )  
- National budget allocation process or review |
| Sector ministries -e.g. Agriculture, Energy | - Sector development plans  
- Sector master plans  
- Sector budgets |
| Subnational authorities -District government | - Decentralisation plans  
- District plans  
- Subnational budgets |
| Programme and Project investment -National ministries -Finance providers (e.g. multi-lateral development banks, development partners) | - Strategic environmental assessment  
- Project design  
- Climate risk screening and safeguards systems  
- Environmental impact assessment |

Source: Adapted from UNDP/UNEP (2011), Mainstreaming Climate Change Adaptation into Development Planning: A Guide for Practitioners, UNDP-UNEP Poverty-Environment Initiative, Kenya

**Implications for the RCPs**

The table above summarises the potential users of medium-long term climate information, and the decisions in which this information could be used. The left hand column identifies key stakeholder (policy makers). As an example, this can include national government (key ministries) but also the development partners/multi-lateral banks (e.g. World Bank, African Development Bank). The right hand column identifies the types of policy processes where
climate change information could be used, i.e. in the process of national economic development planning or sector development plans/master plans, or in the project cycle for major infrastructure projects. To advance practical case studies for this study – and FCFA more widely – these stakeholders and types of applications should be targeted.

C) Capital investments
While some capital investments today might appear vulnerable to future climate, the capital stock may depreciate so fast that its economic lifetime is relatively short. This is a particular problem in the African context, where capital depreciates faster than in the OECD. Nonetheless, decisions on assets taken over the next few years will determine the character of capital stock for the next couple of decades.

The review has analysed the potential infrastructure investment in future years in Africa. Looking across the indicators of infrastructure intensity as a whole, Nigeria appears to have the highest absolute investment needs in Sub-Saharan Africa. Ethiopia and the DRC also score highly on a wide range of indicators. The key drivers for this are the large size of population and land area. However, these countries typically perform poorly when looking at the enabling environment for infrastructure investment.

Two particular intensity indicators that give a different perspective are the share of land equipped for irrigation and hydropower production relative to potential. For both, only a small subset of countries is likely to experience any significant investment in the future. While the DRC still has the highest investment needs for irrigation and Ethiopia for hydropower, other countries such as Angola, Mozambique and Zambia also require a substantial amount. These three countries scored moderately on both the investment climate indicators and the quality of governance indicator suggesting that a moderate level of investment in infrastructure in these sectors is likely.
Implications for the RCPs

Where there is a) regional FCFA focus, or a b) country case study, it would be useful to consider those a) countries b) sectors where future capital intensity is likely to be greatest, as these will represent the highest priorities for the use of climate information for adaptation.

**TASK 2: PRACTICAL EXAMPLES OF LONG-TERM DECISIONS**

**A) Evidence base on Costs and Benefits**

The study has reviewed the evidence base on the costs and benefits of adaptation in Africa. This has expanded considerably in recent years, due to a large number of global and country level initiatives on the economics of adaptation, and also sectoral studies that apply existing options to new contexts or locations. The coverage of studies is shown below.

![National and sub-national level adaptation cost studies in Africa](image)

Source: ECONADAPT, 2015.

Implications for the RCPs

There is a large base of existing studies that may provide some useful baseline information for the FCFA study teams on economic impacts and costs of adaptation. However, some caution is needed in using these studies, as most are based on scenario-based impact assessment, and therefore do not consider decision making under uncertainty.

**B) Decision Making Under Uncertainty**

The recent literature (e.g. as summarised in the IPCC 5th Assessment Report) has started to move away from current methods of decision-support (for appraisal) to new approaches which are targeted to addressing uncertainty in medium to long-term decisions. These are summarised below.
**Decision Support Tools for Adaptation**

There are also a set of examples of these applications, including some examples in Africa.

<table>
<thead>
<tr>
<th>Tool</th>
<th>Published Example Applications</th>
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<tbody>
<tr>
<td>Cost-Benefit Analysis</td>
<td>AIAACC (2006). This South African study examined the benefits and costs of avoiding climate change damages through structural and institutional options for increasing water supply in the Berg River Basin in the Western Cape Province. The UBA (2012) project applied cost-benefit analysis to consider 28 adaptation options for Germany.</td>
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<tr>
<td>Cost-Effectiveness Analysis</td>
<td>Boyd et al (2006) undertook a detailed application of cost-effectiveness for water resource zones and the adaptation response to address household water deficits in the UK. Tainio et al. (2013) investigated the cost-effectiveness of adaptation options that could maintain the biodiversity of Finnish semi-natural grasslands under a changing climate.</td>
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<tr>
<td>Multi-criteria analysis</td>
<td>Van Ierland et al. (2007) (De Bruin et al. 2009) applied MCA to assess adaptation options for the Netherlands as part of the Routeplanner national study. This used a qualitative MCA, which included various adaptation criteria. A quantitative MCA was used in the Thames Estuary 2100 project (EA, 2009: 2011) as part of a broader study looking at future coastal flood defences for London. The MCA was used to include qualitative criteria (environment, heritage, etc.) alongside formal economic cost-benefit analysis.</td>
</tr>
<tr>
<td><strong>Real Options Analysis</strong></td>
<td><strong>Robust Decision Making</strong></td>
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**Implications for the RCPs**

The use of climate information in medium to long-term adaptation decisions is changing, with greater focus away from standard techniques to new approaches.

These new methods require different types of climate information – and also more interpretation of climate projections.

It is important for FCFA teams to be aware of these new methods – and the climate data needs associated with these new approaches– as this will influence end-user needs. The table above summarises the methods and some indicative information on climate information needs.
Attributes and Application of Decision Support Methods for Adaptation

<table>
<thead>
<tr>
<th>Decision-Support Tool</th>
<th>Strengths</th>
<th>Climate and other information</th>
<th>Applicability</th>
<th>Potential use</th>
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<tbody>
<tr>
<td>Cost-Benefit Analysis</td>
<td>Well known and widely applied.</td>
<td>Individual scenario and climate model outputs. Baseline damage costs from scenario-based IA.</td>
<td>Most useful when climate risk probabilities known and sensitivity small.</td>
<td>To identify low and no regret options (short-term) in market sectors. As a decision support tool within ICRM</td>
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<tr>
<td>Cost-Effectiveness Analysis</td>
<td>Analysis of benefits in non-monetary terms.</td>
<td>Scenario and climate model outputs and often baseline damage costs. Effectiveness as reduction in impacts (unit / total).</td>
<td>As above, but for non-monetary sectors (e.g. ecosystems) and where social objective (e.g. acceptable risks of flooding).</td>
<td>As above, but for market and non-market sectors.</td>
</tr>
<tr>
<td>Multi-Criteria Analysis</td>
<td>Analysis of costs and benefits in non-monetary terms.</td>
<td>Scenario and climate model outputs Analysis of uncertainty level</td>
<td>Where mix of quantitative and qualitative data. Can include uncertainty performance as a criteria</td>
<td>As above, but also use for scoping options (policy level). Can complement other tools and capture qualitative aspects.</td>
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<tr>
<td>Iterative Risk Assessment Frameworks</td>
<td>Iterative analysis, monitoring, evaluation and learning.</td>
<td>Sets of scenario and climate model outputs, but flexible. Threshold levels for risks.</td>
<td>Useful where long-term and uncertain challenges, especially when clear risk thresholds.</td>
<td>For appraisal over medium-long-term. Also applicable as a framework at policy level.</td>
</tr>
<tr>
<td>Real Options Analysis</td>
<td>Value of flexibility, information.</td>
<td>Probability or probabilistic assumptions for climate (multiple scenarios). Decision points.</td>
<td>Large irreversible decisions, where information on climate risk probabilities.</td>
<td>Economic analysis of major capital investment decisions. Analysis of flexibility within major projects.</td>
</tr>
<tr>
<td>Robust Decision Making</td>
<td>Robustness rather than optimisation.</td>
<td>Multi-model scenario and climate model outputs (more the better). Formal approach requires uncertainty information for all parameters.</td>
<td>When large uncertainty. Can use a mix of quantitative and qualitative information.</td>
<td>Identifying low and no regret options and robust decisions for investments with long life-times.</td>
</tr>
<tr>
<td>Portfolio Analysis</td>
<td>Analysis of portfolios rather than individual options</td>
<td>Probability or probabilistic assumptions for climate (multiple scenarios). Variance and covariance of each option.</td>
<td>When number of complementary adaptation actions and good information.</td>
<td>Project based analysis of future combinations. Designing portfolio mixes as part of iterative pathways.</td>
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One further issue that has emerged is that these new decision techniques are often complex and time intensive to use. There is therefore a need for light-touch and pragmatic versions of these methods – especially for application in SSA.

**TASK 3 BARRIERS TO LONG-TERM DECISIONS**

Barriers or constraints to adaptation are factors that make it harder to plan and implement adaptation actions. Barriers will make adaptation less efficient or less effective. Alternatively, it may require changes that lead to missed opportunities or higher costs.

The study has reviewed the literature on barriers to adaptation. It has also undertaken a further more detailed review in relation to behavioral economics. Finally, it has drawn up an initial table of how the barriers might affect the medium to long-term adaptation decisions identified
in previous sections. The main barriers to socially efficient adaptation are market failures, policy failures, governance failures and behavioral barriers.

Market failures can occur e.g. due to lack of information, the presence of externalities and public goods, information asymmetry and misaligned incentives. Economic theory applied to adaptation, as well as empirical observations, indicate that such actions will not receive appropriate levels of private investment. For example, under different market structures (monopoly, oligopoly or perfect competition), the ability of investors to reap the benefits of adaptation will vary, and therefore also their incentives to invest in it.

Policy failures occur when conflicting policy objectives co-exist (which is often) and there are not appropriate mechanisms for addressing these trade-offs, and when the current structure of institutions and regulatory policies is poorly aligned to account for adaptation objectives. For example, urban development objectives may not take into account the vulnerability of assets and human systems to climatic stresses. Also, when policies result in market distortions (e.g. price or income subsidies), people will under- or over-adapt depending on how their adaptation choices will translate into income changes.

Governance failures refer to ineffective institutional decision-making processes. Adaptation typically requires multiple actors and institutions with different objectives, jurisdictional authority and levels of power and resources. The complexities of governance networks can indeed constrain adaptation. Overlapping mandates of government entities tend to create conflicts and slow adaptive responses. Further, lengthy bureaucratic processes and lack of transparency are an impediment to fiscal planning and access to finance, particularly relevant for developing countries. Poor - or lack of - leadership, lack of a clear mandate, and the short-term political cycle can also represent barriers to effective decision-making. Corruption within institutions also undermines adaptation efforts.

Behavioural barriers are concerned with the observed inability of individuals to take what appear to be rational decisions (i.e. to maximize their net benefits or utilities) and with their cognitive limitation in attempting to achieve their goals. This limitation manifests itself as inertia, procrastination, and the use of time-inconsistent discounting. Social values and beliefs can also support or hamper adaptation, in so far as they frame how societies develop rules and institutions to govern risk, and to manage social change and the allocation of scarce resources.

Further, individuals, institutions and the natural environment will clearly adapt within the boundaries of their adaptive capacity, and physical and biological constraints. Gender, age, education, access to infrastructure and finance, and access to markets and technology are all elements that determine the adaptive capacity of social systems. Natural systems’ ability to adapt will be possible within certain climatic thresholds, and can be hampered by other non-climatic stresses, and the presence of physical barriers (e.g. the lack of corridors for species migration).

**Implications for the RCPs**

In moving from a technical assessment to the practical use of climate information, it will be useful for the FCFA teams to consider the various barriers to the use of this information, and for adaptation decision making in the medium-long-term more generally. Further work on identifying the most relevant barriers for different areas is underway.