

CTI PFAN Background Paper on Adaptation

An introduction to adaptation
in view of developing a private financing approach for
adaptation related projects using the CTI PFAN model



Authors: Thaven Naidoo, Kemal Vaz & Lynne Byaba

Glossary / List of Abbreviations & Acronyms

ADB	Asian Development Bank	MW/MW hr	Megawatt / Megawatt hour
AfDB	African Development Bank	NAPA	National Adaptation Programme of Actions
AFD	Agence Française de Développement	NGO	Non-Governmental Organisation
BoM	Bank of Mozambique	ODA	Overseas Development Assistance
C	Centigrade	PPP	Public Private Partnership
CDM	Clean Development Mechanism	RE	Renewable Energy
CE	Clean Energy	RFP	Request for Proposals
CO₂	Carbon Dioxide	RSA / SA	South Africa
COP	Conference of the Parties	SPCR	Special Program on Climate Resilience of the World Bank
CTI	Climate Technology Initiative	UNEP	United Nations Environment Programme
CTI PFAN	Climate Technology Initiative Private Financing Advisory Network	UNDP	United Nations Development Programme
EE	Energy Efficiency	UNFCCC	United Nations Framework Convention on Climate Change
EGTT	Expert Group on Technology Transfer (now defunct)	UNIDO	United Nations Industrial Development Organisation
EMP	Environmental Management Plan	USD	United States Dollars
ESIA	Environment & Social Impact Assessment	USAID	United States Agency for International Development
EU	European Union	W2E	Waste to Energy
GDP	Gross Domestic Product		
GEF	Global Environment Facility		
GHG	Green House Gas		
Ha	Hectare		
IDA	International Development Agency		
IPP	Independent Power Producer		
IPCC	International Panel on Climate Change		
IRR	Internal Rate of Return		
JI	Joint Implementation		
JICA	Japanese International Cooperation Assistance		
KfW	Kreditanstalt fuer Wiederaufbau		
LDC	Least Developed Country		
MDB	Multilateral Development Bank		
MDG	Millennium Development Goals		
MSW	Municipal Solid Waste		

CONTENTS

Executive Summary – Separate Document

Glossary

1. Introduction	4
2. UNFCCC, Adaptation & Mitigation	7
3. Defining Adaptation	9
3.1. Current Definitions of Adaptation.....	9
In this connection, a number of established definitions were reviewed to serve as reference points in developing and working towards a definition for CTI PFAN:	9
3.2. Considerations for CTI PFAN Definition	10
4. The Need for Private Sector Financing	12
4.1. Current Sources of Financing.....	13
4.2. Opportunity for Innovation	15
4.3. Leveraging of Public Resources with Private Finance	17
4.4. Public Private Partnerships.....	17
5. The Enabling Environment (Barriers to Private Sector Finance)	19
5.1. Sector Roles & Responsibilities.....	20
5.2. National Adaptation Plans of Action	21
6. Target Sectors Project Development & Financing Activity	22
6.1. Agriculture.....	22
6.2. Energy / Access to Energy	26
6.3. Tourism	28
6.4. Water	30
7. Cross Cutting Sectors & Coping Mechanisms	33
7.1. Urban Development.....	33
7.2. Coping Mechanisms – Micro-Finance	35
7.3. Coping Mechanisms – Insurance / Micro-Insurance	37
7.4. Adaptation Products & Services	39
8. A Regional Approach	41
9. Risk Analysis of Adaptation Projects	44
9.1. Risk Mitigation Strategies & Instruments.....	45
10. Additional Considerations	46
10.1. Data, Models & Indicators	46
10.2. Adaptation & Development Planning	46
10.3. Integration with Disaster Risk Management.....	47
10.4. Top-Down / Bottom-Up Community Engagement.....	48
11. Concluding Remarks & Next Steps	49

ANNEXES – Separate Document

1. Introduction

This Background Paper is conceived as an introduction to adaptation to climate change (adaptation) in relation to private sector financing. It is intended primarily for adaptation beginners and the uninitiated - those people who have had little or no contact with the UNFCCC process or who have been primarily involved in other aspects of climate change; it is particularly targeted at private sector investors and financiers. The paper constitutes the first step of a programme of work engaged by CTI PFAN, which aims to establish a methodology for facilitating private sector investment and finance in adaptation related projects in developing countries, based on the CTI PFAN model, which is already operating successfully to raise investment and financing for technology transfer projects in the sphere of Mitigation.

This programme of work includes the following steps and activities:

- i. **Preparation of a Background Paper** (this paper) which is intended as an introduction to adaptation for non-experts and to set the framework for the adaptation Stream activity with the specific objectives of
 - a. identifying the main issues, barriers and opportunities with respect to the financing of adaptation projects;
 - b. identifying other stakeholders and parties to accompany the work; and
 - c. preparing the terms of reference for the Exploratory Workshop.
- ii. **Distribution of this Background Paper** to key stakeholders involved in work on adaptation, including project developers of adaptation projects, potential investors and financiers, developing country government institutions and agencies, multilateral and international organisations, NGOs and others.
- iii. **Exploratory Workshop**, where a group of invited stakeholders will help address some of the issues raised by the Background Paper and further develop and elaborate the ideas arising from it. A number of project developers will be invited to present their projects to the workshop with the aim of using them as test / case studies for on-going work – to demonstrate the practicalities of financing adaptation projects and to familiarise participants with the challenges and issues. It is hoped that the participants at the workshop will be able to identify and agree core areas of focus for targeting CTI PFAN activity on adaptation and to set out the terms of reference for future project identification and development during the pilot phase. The workshop will provide the launch platform for the pilot programme of CTI PFAN to start work with adaptation projects. This workshop is scheduled to take place on 18th – 19th April 2012 in Nairobi.
- iv. **A Pilot Programme** will commence immediately after the Exploratory Workshop and will seek to identify between 4 – 8 adaptation-related projects with the potential for private sector financing. The selected projects will receive coaching and mentoring on project development and financial structuring in preparation for introductions to investors and financiers and

ensuing financing negotiations. The advice and support will be provided by PFAN Consultants and will be coordinated with the potential investment community to facilitate financing opportunities and to maximise the learning potential of all involved parties.

- v. **2nd Workshop**, where the outcomes and experiences of the Pilot Programme will be reported to the same / similar stakeholders, and used as a basis to design a fully-fledged programme of activity to facilitate the financing of adaptation projects in the private sector.
- vi. **A Recommendation Paper** which will document and review the work performed including summaries of the findings of the Workshops, the outcomes of the Pilot Programme and will also outline the design of the dedicated adaptation Financing Activity.
- vii. **Launch of a fully-fledged adaptation Activity**, subsequent to the second workshop, in accordance with the Recommendation Paper. It is expected (but does not need to be the case) in the long term that this activity will be organised as an on-going discrete activity of CTI PFAN.

The ultimate objective of this process is to establish a CTI PFAN network and project development activity, dedicated to connecting private sector investment and financing to adaptation projects.

The geographic focus of this study and initial activity will be Sub-Saharan Africa (SSA), where the model will be first piloted and further refined. There are a number of reasons behind this choice. SSA is particularly vulnerable to climate change (see Annex VIII) and as such rich in adaptation investment opportunities (especially in the agri-business sector). The region is also expected to be particularly challenging, having a generally low starting adaptive capacity and a high incidence of Least Developed Countries, which present challenges not encountered to the same extent elsewhere in other developing world regions. Accordingly, assuming the approach works in SSA, it should be easier to replicate and scale-up globally. Also, a large proportion of recent and current multi-lateral and bi-lateral financing is being targeted towards Africa (see Section 4), which should make it easier to integrate with and leverage off existing activities and lessons learned. However, the process is flexible and will remain open to projects, activities, participants and learning inputs from other regions and countries, especially those which have demonstrated success and can provide guidance and assistance in further developing the model. If the pilot activity is a success it is intended to expand and replicate it through other regions.

This background paper provides a foundation for understanding the context of required adaptation activities and forms the basis of a discussion with key stakeholders, which will occur through a series of workshops, to establish and refine the format and approach of the intended CTI PFAN activity, with the intention of identifying more clearly the most viable opportunities and the most appropriate uses of the CTI PFAN methodology, and how it might need to be adjusted in relation to adaptation. It is hoped that the key issues can be identified so as to provide a foundation for supporting the key actors, already engaged in adaptation, as well as create the opportunity to bring in additional and new players.

The paper's main authors are Thaven Naidoo, Kemal Vaz of Verde Azul and Lynne Byaba of PPL; the Paper has been extensively reviewed by Peter Storey (PPL), Daniele Guidi (Ecosoluzioni), Ilaria Firmian (IFAD), Elmer Holt (Vice Chair of the CTI Executive Committee and CTI PFAN Manager) as well as USAID's Global Climate Change team in Washington DC.

The paper is primarily based on review of existing literature and prior reports as well as on primary data, collected through interviews with a wide range of stakeholders involved in adaptation activities, including relevant government departments and agencies, donor countries and organisations, project developers of adaptation projects, private sector companies and financial institutions. The authors would like to extend their sincere thanks to all those, too numerous to mention individually, who participated in the interviews and contributed to this study, as well as to CTI and USAID for sponsoring the study and providing valuable guidance on its composition and contents.

For further background and context please see Annex I: *Background to CTI PFAN*.

2. UNFCCC, Adaptation & Mitigation

As awareness of the potential for climate change grew in the early 1990's, a process under the UN General Assembly was established to create a framework to tackle the issues at a global level, which led to the creation and adoption of the United Nations Framework Convention on Climate Change (UNFCCC).

Under the UNFCCC, *mitigation* is the process of preventing climate change (or at least slowing it down or limiting the change to acceptable levels), principally by reducing the emission of greenhouse gases (GHG, which include CO₂, Methane & Nitrous Oxide) and moving to a low carbon economy. While there are many definitions of *adaptation*, it is essentially the process of having to adapt to changes in a given environment (lifestyle) caused by a permanent change in the prevailing climate (increase / reduction in temperature; increase / decrease in rainfall; shift in seasons etc).

For the purposes of supporting mitigation efforts, two mechanisms, the Clean Development Mechanism (CDM) and Joint Implementation (JI), developed and instigated under the aegis of the UNFCCC, allow developed countries to off-set their GHG emissions by trading. These programmes were essentially designed to promote the development and implementation of emission reduction projects in developing countries through the creation of a new financing stream generated by the sale of emissions reductions from the developing country projects to the developed countries.

In mitigation there is an existing emissions profile that can be independently verified and changing that profile is supported through additional funding in the form of the CDM, with a market-related value for the emission reductions based on a per ton carbon value. This creates a distinct advantage for investment opportunities by the private sector as there is a base metric – the quantity of carbon-ton emissions and the value of that carbon. In many cases, reducing the emissions involves the use of a technology in which investors could invest directly, either as technology license holders or in terms of physical plant or equipment. These activities lend themselves to the kinds of financing arrangements that are familiar in project and capital equipment financing arrangements.

Mitigation efforts alone are unlikely to keep climate change to a manageable and supportable level in most countries - especially developing countries. The currently projected changes in climate could have major consequences for Africa, with the potential for large scale, irreversible impacts, making adaptation strategies an important complement to existing mitigation efforts. Efforts to create enhanced anticipatory adaptive capacity will require additional financial resources. These efforts need to be supported by more accurate data and additional research on appropriate, cost-effective adaptive actions, and the development of market based mechanisms to stimulate more private sector involvement, which will likely require considerable support in the establishment of an appropriate enabling environment through institutional and regulatory change and the dismantling of related barriers, and in the strengthening of the capacity of communities and organizations.

Identifying the responsibility for adaptation activities is not always clear and many adaptation actions require local participation, with most of the benefits accruing locally. Not many adaptation activities involve either physical equipment, technology or tradable commodities to which investors can readily attach ownership value or derive returns. Increasingly, however, new approaches to adaptation are seeking to develop instruments which offer opportunities for private sector finance. The following table illustrates the difference between mitigation and adaptation strategies by comparing their scope and impact.

	Mitigation	Adaptation
Benefitting systems	All systems	Selected systems
Scale of intervention	Global	Local to regional
Life time of intervention	Centuries	Years to centuries
Lead time to impact	Decades	Immediate to decades
Effectiveness	Certain, in terms of emission reduction, less certain in terms of damage reduction	Generally less certain (especially where local knowledge of likely climate-related changes is weak)
Ancillary benefits	Sometimes	Mostly
Polluter pays	Typically yes	Not necessarily
Payer benefits	Only a little	Almost fully
Administrative scale/ implementing body	(Mainly) national government/ international negotiation	(Mainly) local managers/ authorities/ households/ communities
Sectors involved	Primarily energy and transport in high-income nations and energy and forestry in low/middle income nations	Potentially all
Monitoring	Relatively easy	More difficult

Figure 1: Table showing the key differences between Mitigation and Adaptation (Stockholm Environment Institute)

It is generally accepted that developing countries will experience some of the worst impacts of climate change while being among the least responsible for the causes and the least capable of dealing with the effects (see Figure 2 below). Adaptation to climate change remains a major challenge for many, if not all, developing countries. It is now generally accepted that even the most stringent mitigation efforts would not avoid further impacts of climate change in the next few decades. This makes adaptation essential, particularly in addressing near and medium term impacts. Notwithstanding this, mitigation and adaptation are seen as interdependent, non-competing, and equally vital strategies for dealing organically with climate change. Adaptation needs to be integrated into good development practice so that development and adaptation actions become mutually reinforcing.

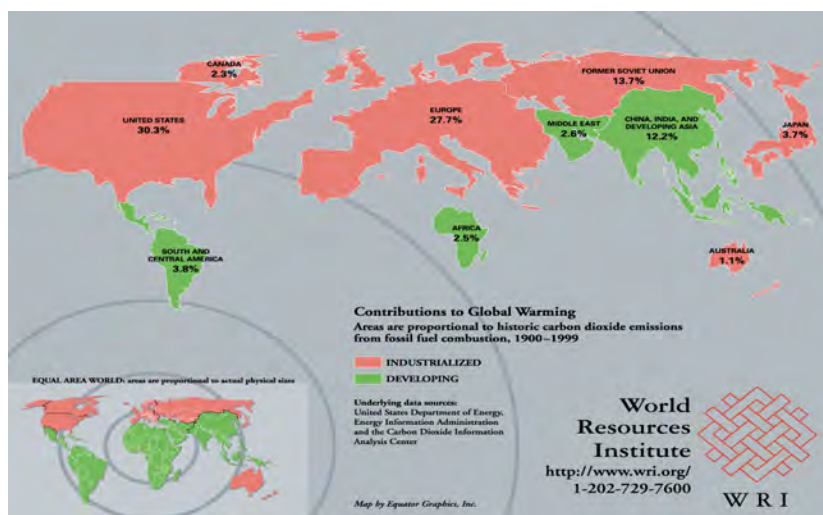


Figure 2: Graphic showing the contribution to carbon dioxide emissions, with land areas proportional to 1900-1999 fossil fuel combustion. Africa has contributed only 2.5% yet has 15% of the world population.

3. Defining Adaptation

Adaptation is . . . ***“adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.” (IPCC)***

For the purposes of its envisaged activity CTI PFAN needs a working definition of adaptation. The definition will facilitate the focusing of resources through enhanced identification and selection of activities and projects which can be supported by private sector investment and finance. It is anticipated that one of the outputs of the Exploratory Workshop will be such a working definition. This is not intended as an attempt to redefine adaptation, but as a common foundation on which future activities and work can be based. Importantly, the definition must be closely aligned with existing thinking and work on adaptation and be workable for the purposes of the intended CTI PFAN financing activity.

3.1. Current Definitions of Adaptation

In this connection, a number of established definitions were reviewed to serve as reference points in developing and working towards a definition for CTI PFAN:

- i. *“Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderate harm or exploit beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptation” (IPCC TAR, 2001 a).*
- ii. *“Practical steps to protect countries and communities from the likely disruption and damage that will result from effects of climate change. For example, flood walls should be built and in numerous cases it is probably advisable to move human settlements out of flood plains and other low-lying areas...” (Website of the UNFCCC Secretariat).*
- iii. *“A process by which, strategies to moderate, cope with and take advantage of the consequences of climatic events are enhanced, developed, and implemented.” (UNDP, 2005).*
- iv. *“The process or outcome of a process that leads to a reduction in harm or risk of harm, or realisation of benefits associated with climate variability and climate change.” (UK Climate Impact Programme - UKCIP, 2003).*
- v. *Adaptation projects are development projects that help decrease the vulnerability of populations, infrastructures and ecosystems to current and future impacts of climate change. (Agence Française de Développement - AFD). For further focus this definition is complemented by a precise typology of projects that can contribute to the objective; the typology is available on the AFD website.*

- vi. Adaptation projects “are projects which are intended primarily as measures taken specifically in anticipation of climate change.” (European Investment Bank - EIB). The EIB lists examples of eligible projects which include flood control, drought management and measures to increase climate resilience.
- vii. Adaptation activities are defined as “reducing the vulnerability of human or natural systems to the impacts of climate change and climate-related risks, by maintaining or increasing adaptive capacity and resilience. This encompasses a range of activities including information and knowledge generation, capacity development, planning and the implementation of climate change adaptation actions.” (OECD Development Assistance Committee – Rio Marker). This definition, introduced in 2009, is in the meantime used by a number of bilateral development institutions and banks in framing their respective definitions for adaptation.
- viii. For USAID adaptation activities need to be targeted at “building adaptive capacity in regions and countries affected by the negative impacts of climate change” and adaptation investments “must have the explicit objective of assisting developing countries to reduce the vulnerability of human or natural systems to the impacts of climate change and climate-related risk”. The USAID definition is complemented by illustrative examples and a set of indicators which seek to quantify the impact of the activity / investment. Further details on the USAID adaptation approach is provided in Annex II.

3.2. Considerations for CTI PFAN Definition

These definitions show that there are differences in scope, application and interpretation for what constitutes adaptation. The definitions differ in their approach (adjustment / steps / process / outcome / building adaptive capacity), the actors (natural and human systems / countries or communities), impetus (actual or expected stimuli / disruption and damage / moderation or coping or taking advantage of / reduction of harm) and in the anticipated outcomes. Key words can be interpreted differently by various stakeholders and both time and subject references aim for different goals. Expectations from adaptation as an outcome might be much higher than expectations from it as a process. Some stakeholders (e.g., community-based adaptation practitioners) may want to use a more technical interpretation of the term (the one closer to the UNFCCC definition), while others (e.g., adaptation policymakers) may choose a broader definition that emphasizes the institutional / policy side of adaptation.

The IPCC provides a broad definition, distinguishing various types of adaptation (e.g., anticipatory, reactive, public, planned adaptation, etc.) and focuses not only on technical adaptation measures but also on institutional responses, and it includes adaptation of natural systems not just human. It suggests measures to be put in place where damage has occurred as well as where damage is expected. In this connection it should be kept in mind that adaptation can be carried out in response to or in anticipation of changes in climatic conditions.

The definition must also be able to account for gradual as well as dramatic change, and should include an increase in adaptive capacity. The need for immediate

responses to imminent impacts and extreme events compared to longer term responses to predicted impacts need to be taken into account.

The definition needs to be broad and flexible enough to include ecological, technological and behavioural aspects of adaptation, so as to enhance and focus project identification and resource allocation. Including sustainable development within the terms of the definition, would allow a focus both on reducing emissions and on the vulnerability of populations to climate variability and change. These varied interpretations could have differing financial implications. Funding aspirations and evaluation of achieved results would also vary accordingly.

The CTI PFAN definition developed from the Exploratory Workshop will need to have some or all of the following characteristics:

- i. Allow inclusion of the projects that are best suited for private sector engagement in investment and finance;
- ii. Help in the selection of the projects as a screening mechanism;
- iii. May have to include both projects and processes;
- iv. Incorporate new ways of thinking about adaptation;
- v. Allow adaptation activities to become mainstream rather than remain a local issue or activity;
- vi. Allow the inclusion of mitigation activities that have adaptation co-benefits, and vice versa;
- vii. Include increasing adaptive capacity;
- viii. Have indicators / monitoring plans for measurement of effectiveness; and
- ix. Account for adaptation as a dynamic social process that involves collective action;
- x. Incorporate and consider the USAID and UNFCCC / IPCC and OECD DAC definitions.

It is further proposed that the CTI PFAN definition should seek to define eligible adaptation projects rather than adaptation itself. Accordingly, and based on the above considerations, the following draft definition is proposed for further consideration by the Workshop

“adaptation projects are projects which help reduce the vulnerability of populations, infrastructures, ecosystems, human or natural systems to the current and future impacts of climate change and climate-related risks and which help increase or maintain adaptive capacity and resilience in the targeted regions and countries of project implementation.”

It is suggested that a list of exemplary projects and activities be developed to complement this definition. This list should be illustrative rather than exhaustive and could be developed and agreed by the Workshop.

4. The Need for Private Sector Financing

The prevailing uncertainty around the full scale of the impact of climate change and the extent of measures required to create adequate resilience creates difficulty in estimating the funding required by developing countries for adaptation. This lack of precision is compounded by the following factors:

- Current estimates on adaptation costs are limited and fragmented, with equity considerations (the distribution of costs and benefits) poorly addressed;
- There are few cross-sector studies that look at cumulative effects and the wider macro-economic consequences of impacts or adaptation;
- Most estimates work on the assumption that adaptation is a gradual process, with very little attention given to more abrupt changes in average conditions and changes in the frequency and magnitude of extreme events;
- The cost-benefits of adaptation options need to account for multiple factors making it difficult for decision-makers to compare between alternative adaptation options and to consider potential trade-offs;
- Different bodies use differing climate models and different date ranges to project estimates of the required investments;

The following table, which provides an overview of some of the more authoritative data, illustrates the level of uncertainty and the range of projections which start at USD 4 - 37 billion of annual incremental investment in the years 2010 – 2015 according to the 2006 Stern Review and range up to USD 200 – 400 billion by 2020 according to the G77 and China.

Adaptation costs (\$bn per annum)	2010-2012	2010-2015	2010-2020	2020	2030
European Commission (2009)				13-30	
World Bank (2006)		9-41			
Stern Review (2006)		4-37			
UNDP HDR (2007)		83-105			
UNFCCC (2007)					28-67
World Bank EACC (2010)					70-100
Project Catalyst (2009)			13-25		
G77 & China				200-400	
African Group (2009)				>67	
Oxfam (2007)	>50				
IIED (2009)	Costs estimated to be 2 or 3 times higher than UNFCC figures				

Figure 3: Estimates on the costs of adaptation, excluding the underlying assumptions, taken from *Climate Funds Update*: <http://www.climatefundsupdate.org/resources/estimated-costs-climate-change>

4.1. Current Sources of Financing

The five main multi-lateral adaptation finance instruments that have disbursed funds to-date are:

- **The Least Developed Countries Fund (LDCF)** administered by the Global Environment Facility (GEF), supports the preparation and the implementation of National adaptation Programmes of Action (NAPAs), and has disbursed \$142 million since 2002. All Least Developed Countries are eligible for support.
- **The Special Climate Change Fund (SCCF)**, also administered by the GEF on behalf of the UNFCCC supports long-term adaptation measures that increase the resilience of national development sectors to the impacts of climate change.
- **The Strategic Priority on adaptation (SPA)** was a three-year pilot programme of the GEF that supported pilot and demonstration projects to show how adaptation planning and assessment can be practically translated into full-scale projects.
- **The Pilot Program for Climate Resilience (PPCR)**, one of the sub funds / activities of the Climate Investment Funds (CIF) and administered by the World Bank is targeted at integrating climate resilience into national development planning
- **The Adaptation Fund (AF)**, established under the Framework Convention and operational since 2009. It is a multilateral adaptation finance mechanism that allows developing countries direct access to its resources, which come from a 2% levy on certified emission reductions under the Clean Development Mechanism (CDM).

Annex IV contains a table which provides an overview of some of the main climate funds and financing instruments currently operational. In the main these are general climate facilities or alternatively they are focussed on specific areas and sectors (eg forestry) but many of them include elements for adaptation activities and some, including those above, are purely focussed on adaptation.

There are also a large number of ODA funds and bi-lateral activities (such as Japan's Cool Earth Partnership, AFD, JICA, KfW, EIB, NEFCO,) which directly or indirectly address adaptation to Climate Change.

According to a 2010 UNEP study (Bilateral Finance Institutions & Climate Change) which included figures for the activities of 5 major bilateral ODAs (AFD, JICA, EIB, KfW & NEFCO) the total amount of bi-lateral finance made available to adaptation activities in 2009 amounted to just under USD 4 billion, which represented a 31% year on year increase over 2008 (ca USD 3 billion) and which was distributed by region, sector and financial instrument as shown by the following charts:

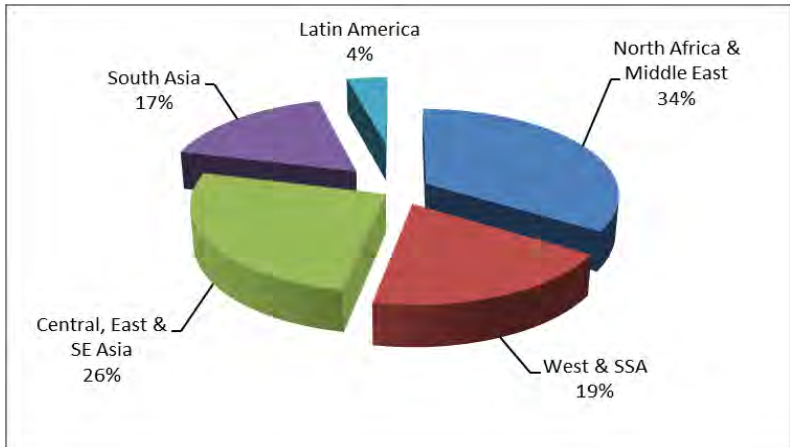


Figure 4: Regional Distribution of BFI Financial Flows to adaptation in 2009 (UNEP – Bilateral Finance Institutions & Climate Change)

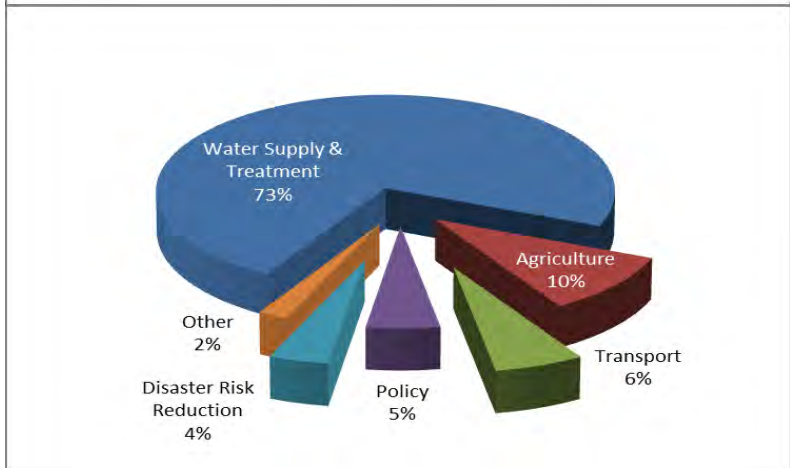


Figure 5: Sectorial Distribution of BFI Financial Flows to adaptation in 2009 (Source: UNEP – Bilateral Finance Institutions & Climate Change)

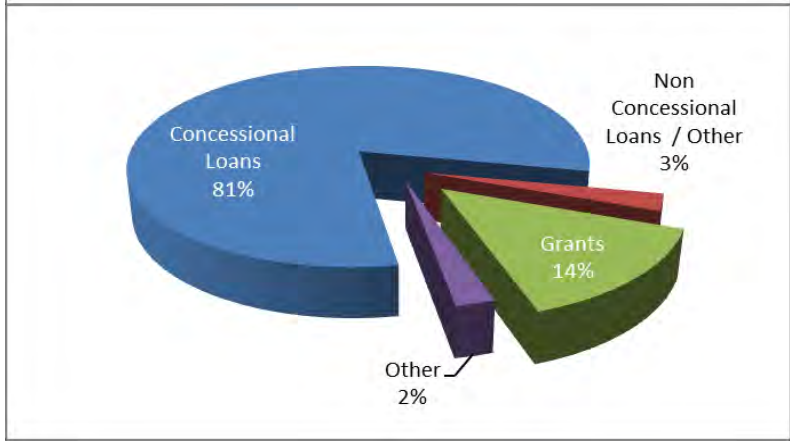
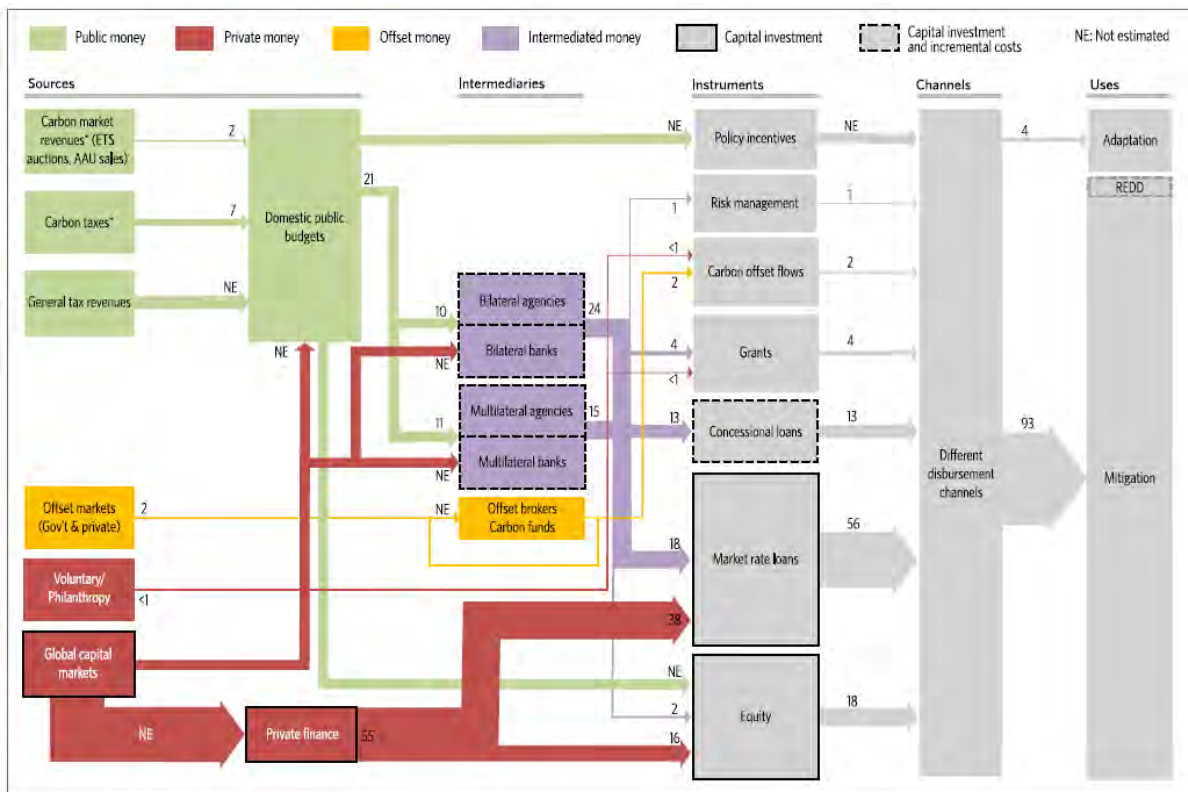


Figure 6: Distribution of BFI Financial Flows by Instrument type to adaptation in 2009 (Source: UNEP – Bilateral Finance Institutions & Climate Change)

While these amounts and the above charts are not in any way intended as a fully comprehensive summary of all the financial flows to adaptation they are believed to give a representative picture of the sort of financing that is already available and its prime uses. What, however, is very clear is that the available financing from the public sector (multi-lateral and bi-lateral sources combined) is but a small fraction of even the most optimistic / benign scenarios for adaptation requirements. In addition the major focus of the private sector to date has been on supporting mitigation activities rather than adaptation activities.

Evidence suggests that the lower the economic development of a country, the lower the share of private sector investment in the financial flows directed toward climate change; this holds across both mitigation and adaptation activities. Between 1998

and 2000, approximately 92% of financial flows relating to climate change (mitigation & adaptation activities) to least-developed countries came from multilateral and bilateral donor sources. Direct investment made up the remainder. Other low-income, lower- and upper-middle-income and high-income countries all receive larger shares of direct private investment. The majority of climate finance (USD 93 billion out of USD 97 billion) is used for mitigation measures mainly investments in renewable energy. Adaptation funding amounts to only USD 4.4 billion, mostly in the form of incremental cost payments.



Source: Climate Policy Initiative (CPI)

Figure 7: Graphic showing the various current sources of finance and their disbursement mechanisms, in USD Billions for 2009 / 2010

4.2. Opportunity for Innovation

While the private sector is already an important source of climate finance, most of it is directed towards Mitigation activities. For example, multilateral and bilateral development banks can issue generic bonds as a means of raising private finance from capital markets, some of which is then used to support projects that deliver climate change outcomes. There are other ways in which private finance can support adaptation - debt can be used as an enabling instrument for both publicly and privately initiated adaptation, including direct project lending and special credit lines to local finance institutions. However to reach the poor and those most in need of adaptation funding, finance may need to be delivered in new ways, including through microfinance products.

Financing / discounting of public pledges is one way in which private finance could support adaptation by enabling pledges of future adaptation funding from donor countries to be converted into immediate available funds for immediate distribution to developing countries. This approach was piloted in public health by the International Finance Facility for Immunization (IFFIm), where private finance was raised through the issue of bonds, which were backed by the long term pledges, for immunization programs of donor governments; as the bonds mature the pledges are used to repay the investors. Making pledged finance available earlier would be especially beneficial where rapid implementation is critical, but could also be used for capacity building to facilitate more effective adaptation responses.

Another innovation is value capture instruments which can raise capital through specific taxes and can be front-end loaded by raising capital against future income. It is also possible to develop new kinds of insurance products that can be re-insured or pooled / spread over large geographical areas to reduce individual insurers' exposure to co-variate risks. Catastrophe bonds are an alternative to reinsurance; they pass risk on to private investors who may be prepared for these kinds of risks based on their earning potential, especially when they are pooled across multiple locations.

A number of proposals have been made for bonds guaranteed by OECD country governments to be issued to private sector investors to generate funds for climate change activities. In principle, bonds guaranteed by OECD governments offer an attractive way to raise large sums from capital markets for climate and adaptation financing. However, it will not be possible to raise significant sums unless the risk-return characteristics of 'climate bonds' are competitive with those of 'normal' bonds. A further concern about climate bonds would be the verification and validation of the underlying projects and actions which they finance.

Social impact bonds provide capital for investment in measures that can reduce associated risks of other investments, making these other investments possible, such as the building of sea walls to off-set the risk to low lying urban housing developments in coastal cities. The Great Barrier Reef Foundation issued a bond to raise funding for research on how to make coral reefs more resilient and protect income streams of tourism operators and fishermen – this recognizes the importance of natural infrastructure in addition to built infrastructure such as sea walls. These instruments could have a role to play in urban adaptation to climate finance by pooling resources across many cities and millions of buildings.

Multilateral and bilateral development finance institutions could establish mechanisms, which support private sector companies and institutions in both developed and developing countries to facilitate the establishment of large-scale infrastructure or private equity funds targeted at investment in climate change adaptation activities and projects. These envisaged support mechanisms could be structured, drawing on existing models and emerging experience of using various debt and equity structures in conjunction with targeted export credit guarantees and political risk insurance to help buy down political and regulatory risk (e.g. against policy change). Such support will need to be accessible to specific funds and other composite investor groups (such as pension funds and fund managers) as well as individual projects.

4.3. Leveraging of Public Resources with Private Finance

Conditions in some developing countries may present political risks which can only be partially mitigated through improved government policies – including for instance small market size, inherent market volatility, political instability, lack of agricultural security - and accordingly will need to blend public and private finance in order to achieve acceptable risk–return profiles. Typically such public sector support would come in the form of grants, concessional loans and guarantees.

Public resources can be used to leverage additional private capital flows by assuming systemic, political and development risks that private sector investors cannot bear, (such as filling data gaps) thereby allowing the private sector to focus on the construction, delivery, implementation and operational risks with which it is comfortable. Typically leverage factors range between 1:2 and 1:5 (for each USD 1 of public sector finance between USD 2 – 5 of private finance are mobilized). Generally speaking the leverage factor can be increased over time as familiarity experience and comfort with specific risk factors grow. In this connection it is likely that pure / stand-alone private sector financing activity will generally reach only the subset of developing countries in which investment risks are generally considered sufficiently low.

One of the attractions of the PFAN financing approach is that it has been able to buy down development and transaction risk for investors in such a way as to mobilise relatively large quantities of private finance in relation to the public sector inputs. PFAN's leverage ratio across its global mitigation activities is in the region of 1:100, i.e. for every \$ 1 of donor funding made available to CTI PFAN, private sector financing of at least USD 100 is generated. While it is somewhat unlikely that this impressive rate can be achieved for adaptation projects, it is hoped that using the same or a similar approach will facilitate significant quantities of private sector finance to be mobilized in relation to the public sector inputs.

4.4. Public Private Partnerships

Public Private Partnerships (PPPs) have typically been used to finance large scale, capital intensive projects, where there is a high level of political and regulatory risk involved. Those areas related to climate change where PPPs have already been successfully deployed include waste management, transport, water & sanitation, and energy infrastructure. It is envisaged that this mechanism could also be usefully applied to adaptation projects. By spreading the risks between taxpayers and investors in ways that draw on the strengths of each sector, these partnerships provide a sound win-win approach. Each area of risk is managed by and allocated to those parties most able to deal with them. Increasingly, PPP arrangements are being trialled in the agriculture sector, and experiments show that integrating adaptive management is possible and can bring about sustainable agriculture value chains that respond to markets (for instance by giving value to indigenous climate resilient crops by re-introducing their use) as well as to the need of reducing local farmers' and ecosystems vulnerability.

Generally speaking the private sector parties assume the risks related to technology, construction, delivery, operations and the public entities manage the political, regulatory, environmental and public involvement process and sometimes elements of the market risk (particularly in new / under developed markets). The private risks are financed and supported by private equity capital; the public risks by public resources and funding. Models used for PPPs in the infrastructure and health sectors included private entities made up of participants with vested interest in working together to provide core competencies in operations, technology, funding and technical expertise.

In adaptation there is an opportunity for multi-sector participant-driven approaches, which could include technology providers (clean energy, agribusiness, water, tourism infrastructure and equipment), operators, financiers and insurers, national and sub-national governments, as well as local communities. Funding sources could include banks, private equity firms and pension fund managers as well as multilateral and bilateral donor resources where appropriate. While the PPP model shows great potential for financing adaptation projects, it also requires, more so even than for other financing models, a mix of the enabling environment (political, regulatory and legal) and appropriate incentives (regulatory, fiscal and commercial) to achieve the necessary alignment of interests across the involved parties and sectors.

5. The Enabling Environment (Barriers to Private Sector Finance)

Private sector funding requires that strong, stable, transparent, coherent and credible long-term national policies are in place and backed up by appropriate enacted regulation (commercial, legal, environmental, energy and other sectors) and incentives (which can be of a fiscal, regulatory or commercial nature) and market governance structures (i.e. in agribusiness, commodity exchanges, intermediary institutions, or associations of small producers). These provide a foundation for investment. Efforts to secure an attractive enabling environment are critical to stimulating climate and adaptation investment in emerging markets and developing countries.

Public resources and policy instruments are needed to correct market failure. Another area of public intervention is to improve the capacity and credibility of public (and to a lesser extent private) institutions and governance mechanisms so as to reduce risks and pave the way for private financing, including new businesses.

Many adaptation actions have the characteristics of a public good; for example, many residents will enjoy the benefits of coastal protection and all farmers can benefit from better weather forecasting. Traditionally the financing of such public goods has been seen and accepted to be the realm of the public sector. For governments, the challenge of involving the private sector in adaptation finance is threefold:

- Getting private players to understand and act upon the need to adapt;
- Sharing the cost of adapting public infrastructure (user charges, energy, water, agricultural extension services, roads);
- Leveraging private funds for adaptation.

Many African economies are already reforming various sectors, introducing policies, national objectives and regulation for resilient commercial and agricultural activity, for sustainable transport and for energy security and environmental protection. This has been an integral part of a new climate change and development paradigm that shifts the focus away from sole emphasis on supporting technology demonstration projects to establishing a more conducive environment and institutional milieu for promoting greater private sector investment in environmentally and climate friendly technologies and practices.

The efficiency of market operations and the availability of private investment depend on adequate provision of information. However, information on the current and future impacts of climate change is scarce, especially in the less-developed world, where resources for investigating such issues are limited. Without this information, the types of adaptation measures that would be beneficial, and the costs and benefits of investing in adaptation, cannot be determined reliably.

The finance sector has little experience in identifying and targeting climate adaptation. To maximize the benefits of climate-focused investments, new mechanisms such as the current CTI PFAN adaptation stream are required in partnership with major investors to develop practical screening tools to help identify, develop and implement worthwhile adaptation activities and projects that might be appropriate for private sector investment.

The barriers to adaptation projects include low awareness, lack of capacity to interpret and apply climate and weather information to planning and decision-making, lack of coordination between government agencies, lack of integration of climate change aspects into existing legislation and planning processes (e.g. building codes), insufficient enforcement of relevant existing regulations, uncertainties over land tenure regimes, poor environmental practices, and insufficient resources. Lowering these barriers will allow for increased action on adaptation.

5.1. Sector Roles & Responsibilities

Climate change is an issue that no government can address in isolation, and will depend on organisations, businesses and communities across Africa accepting responsibility and acting in an integrated and concerted way to prepare for a changing climate. Institutions, processes and instruments, such as special climate bonds, grants and ODA need to be balanced with private sector interests to provide the appropriate project structure for measurable and tangible returns for all parties. Broadly speaking the following roles have been identified for the respective main players:

Role of Government:

- To provide clear leadership in promoting a sustainable approach to climate change adaptation;
- To provide clear advice and guidance, helping sectors across society to better understand their role in addressing climate change and ensuring easy access to necessary information and tools;
- To establish clear and appropriate policy and a regulatory and institutional environment which enables, incentivises and supports adaptive actions;
- To establish and / or facilitate governance mechanisms, especially in rural areas, appropriate to promote the growth of “green enterprises” and value chains relevant for their adaptation to climate change contribution.
- To establish clear and binding emissions reduction commitments and related other targets
- To raise and provide sufficient funding for those vital actions which are not capable of being financed through private sector capital;

Role of the Public Sector Agencies:

- To develop research and pilot / demonstrate appropriate / effective adaptation measures and responses;

- To provide guidance, services and tertiary support and technical assistance services for the delivery of adaptation measures;
- To inform the understanding of risks and opportunities;
- To enhance public finance mechanisms needed to incentivise and scale-up private sector investment for climate solutions

Role of the Private Sector

- To raise and provide funding for those actions which are capable of being financed through private sector capital. Debt, in particular, can be used as an enabling instrument for both publicly and privately initiated adaptation, including direct project lending and credit lines to local finance institutions. In addition microfinance is seen as playing a vital role in poor (rural and remote) communities where public infrastructure is lacking and difficult to establish;
- To innovate, expand and exploit the markets for the provision of oriented goods, finance and services that can contribute to climate resilience;
- Innovation, development, commercialisation and deployment of new technologies;
- To monitor climate risks and plan adaptation response through the design and provision of disaster risk management and financing vehicles.
- To identify and assist in overcoming barriers to investment in low carbon, mitigation financing and technology transfer;
- Encourage and facilitate more climate conscious purchasing decisions by consumers.

5.2. National Adaptation Plans of Action

Since 2001 many LDCs, including those in SSA, have been preparing National Adaptation Programmes of Action (**NAPAs**), which identify priority activities that respond to their urgent and immediate adaptation needs. These plans take into account the limited adaptive capacity inherent in many LDCs and recognise that further delay in implementation of the activities proposed through NAPAs could increase vulnerability or lead to increased costs at a later stage.

Where they have been completed the NAPAs provide a good overview of country specific adaptation requirements and indicate the sorts of projects and activities that could usefully contribute to reinforcing adaptive capacity.

Further information on the role of NAPAs is provided in Annex IV and Annex V and VI provide an overview of the SSA countries which have completed NAPA and a country by country schedule of priority NAPA actions in SSA together with estimated costs.

6. Target Sectors Project Development & Financing Activity

The following sections identify and examine some of the potential sectors and projects at which the proposed CTI PFAN Adaptation Project Development & Financing Facility may most usefully and viably be targeted. These sectors have been selected based on an analysis of the expected climate impacts in Africa as well as on an assessment of commercial viability. In this connection please refer to Annex VIII for a graphical overview of anticipated climate impacts on Africa.

Broadly speaking we have selected those sectors which are both vulnerable to climate change and which have perceived potential to generate and support opportunities which might be attractive and available for private sector financing approaches. Among the features we have looked for are:

- the likely availability of fungible assets (physical property, intellectual property, tangible and non-tangible);
- the provision of services for which there is a ready market demand and capacity to pay (albeit at low levels);
- the generation of cash revenues which may be used to service investment and financing;
- the existence of un-serviced markets for basic infrastructure and utilities;
- the potential for the development of new business models based on new or existing technologies, which have the ability to leap frog or replace traditional technologies and systems;
- the likely development of new technologies and business models which incorporate or facilitate elements of the other criteria

In addition we have identified a number of cross cutting sectors and coping mechanisms which hold potential for identifying, structuring and implementing adaptation projects and which are dealt with in Section 7.

After each of the sector sections we provide a summary table of examples and recent projects to illustrate the sort of projects that might be available for a private sector financing approach. Annex IX includes a case study of a regional approach to an adaptation Project in the agriculture sector and Annex VII provides further case studies and project examples in overview.

6.1. Agriculture

The five main climate change related drivers, temperature, precipitation, sea level rise, atmospheric carbon and extreme events will have multiple impacts on agriculture, including an increase in the incidence of pest attacks, limited availability of water, increased drought periods, lower productivity and higher costs for livestock production, reduced soil fertility and soil moisture, and changes in vector borne diseases that impact the availability of human resources for agricultural production.

Agriculture accounts for about 30% of the GDP of non-oil exporting African countries, with 70% of populations dependent on the sector. It is a sector that will be severely impacted by climate change, with growing evidence that there are many regions where crops are close to their maximum tolerance and yields are projected to decrease with any increase in temperature. Agricultural productivity needs to increase to be able to accommodate growing populations and food demand. A large portion of farmland in SSA is managed by smallholder farmers, most of whom (79%) are located far from towns and markets for their crops (World Bank 2009). Smallholders will find it increasingly difficult to access markets as well as maintain food security. An adaptation investment strategy in agriculture in the Sub-Saharan region should therefore consider both:

- the need to set up value chain approaches that include smallholders, linking them to markets; and
- the fact that properly managed chains can and should leverage on the skill and productivity of smallholder labour (generally higher than hired labour in large estates).

An important pre-condition for smallholder-inclusive investments, value-forging chains with climate adaptation appeal, is to tackle the land tenure regime uncertainties that are so diffused in Sub-Saharan Africa. Small farmers, as well as the agri-business chain actors downstream, are naturally reluctant to invest in new farming projects and adaptation technologies / techniques if either the customary land rights or modern land property mechanisms are not fully recognized and protected by the national legislation and associated regulatory frameworks.

Hotter and longer dry periods and shorter and more intense wet seasons will lead to water management issues and consequent impacts on agriculture and forestry, often exacerbated by other human activities which can lead to an increase in desertification, decrease in forest cover and soil degradation. Cereals in particular are susceptible to drought, and yields from rain-fed agriculture could drop by as much as 50%, reversing progress in the Millennium Development Goals and leaving over 75 million Africans affected by hunger and malnutrition and 250 million facing water stress as a direct result of climate change over the next 20 years.

If smallholder managed agriculture is to take advantage of the associated new business / product development, there is growing consensus that one of the main changes towards adaptive management will need to take place through “sustainable intensification” (Godfray et Al., 2010), a concept which synthesizes new packages of sustainable farming practices, protocols and technologies directed to reduce inputs in agri-food chains while intensifying the yield.

Adapting African agriculture to climate change should not be limited to on-farm activities and should include off-farm activities that influence its adaptive capacity and household food security. Economic diversification is becoming increasingly important as an adaptation strategy, to decrease reliance on climate-vulnerable economic sectors. More diversified livelihood strategies can lead to enhanced incomes and can diminish the risk for poor people whose livelihoods are largely based on natural resources. African agriculture already suffers from low productivity and even small changes in current agricultural practices and systems could

positively transform the sector. The opportunity for innovation in both farming and post-harvest practices and technologies, towards integrating adaptation goals, is particularly significant in many SSA regions. Modern science-based knowledge can blend with a wealth of local traditional knowledge and be implemented by smallholders in a context of intelligent natural resources management, biodiversity conservation and business models that support sustainable value chains (Guidi, 2011).

There are many possible adaptation interventions that offer opportunities for private sector investment and financing engagement. The following is a non-inclusive list subdivided into some of the main aspects of adaptation interventions. It is followed by a table with some referenced examples.

Efficient Natural Resource Management Opportunities:

- Rainwater management and harvesting especially in rain-fed agriculture;
- Efficient water use in irrigation (i.e. micro-sprayer or drip irrigation systems);
- Productive use of agricultural waste (W2E, biomass, biogas and bio-fuels applications; bio-fertilizers and animal feed) for both substitution and increasing input availability;
- Livestock adaptation strategies (i.e. integrated crop-livestock systems production adjustments, breeding strategies, changes in livestock/herd composition, provision of shade and water, etc.);
- Inland and coastal fishery adaptation strategies (recycle water used for fish culture to moderate swings between drought and flood, use flooded and saline areas no longer suitable for crops to cultivate fish, diversification, etc).

Agricultural Technology and Practices Opportunities:

- Adapting agricultural practices including intercropping, use of different (eg drought resistant) seed strains, different crop rotations;
- Use of hydroponic crop systems and greenhouses;
- Adoption of conservation agriculture methods (modern agronomics, blended with no-tillage, soil cover management, intercropping and other techniques)
- Seed and crop management;
- Use of renewable energy inputs into farming and processing to diversify farm incomes;
- Conversion to agro-forestry;
- Pest and disease management changes in both farming and livestock systems that account for climate change influences;
- Climate monitoring and early warning systems;
- Crop research and improvement aimed at building resilience to climate change;

Post-Harvest and Off-Farm Opportunities:

- Off-farm diversification (i.e. biomass waste into new products)
- Market value chain development (infrastructure and services);
- Agricultural product improvement and local agro-processing;
- Post-harvest and logistics systems (i.e. climate resilient storage, cold chains)
- Climate improved, efficient agro-processing techniques and technologies.
- Marketing and commercialization infrastructure for climate resilient export crops (i.e. rooibos tea).

Rural Infrastructure Opportunities:

- Water storage systems
- Communication services for weather events and market prices;
- Insurance, including weather indices, area yield insurance, or traditional crop indemnity insurance;
- Science based training and agricultural extension services that promote adaptive practices.
- Provision and management of improved strategic harvest (grain) reserves;
- ICT based solutions for adaptation agri-business (i.e. GIS, internet based trading platforms; risk management services).

In addition to the listed opportunities, there seems to be a novel niche market opportunity for those activities that refer to “ecosystem services”. An example is the launching of social enterprise ventures leveraging on voluntary carbon markets, investing the carbon revenues in agro-forestry initiatives with high adaptation value added. An example is the payment for watershed services: upstream watershed protection services (soil and water conservation practices including tree planting, that result in reduced soil erosion and low sediment load in the river) typically benefit downstream stakeholders, including drinking water companies, bottling companies and hydro-electric companies. In some cases, these beneficiaries can compensate upstream land managers for the provision of these services. Examples include the Green water credit approach in Kenya (see <http://greenwatercredits.info/>), also the CARE/WWF project in Tanzania Equitable Payments for Watershed services (EPWS) and also ICRAF/PRESA activities in Sasumua Watershed Kenya (see <http://presa.worldagroforestry.org/where-we-work/kenya-sasumua/>)

Adaptation Investment Target	Type of Intervention	Reference
Pastoral community development in Ethiopia	Early warning system	IFAD, 2010
Farmer communities affected by crop spoilage in China	Index-based weather insurance service	IFAD, 2010
Mixed farming of maize and mucuna (leguminous crop) in Ghana	Conservation agriculture technologies and methods	FAO, 2008
Allanblackia tree and the commercialization of its multipurpose oil through local value chains in Tanzania and Ghana	Agro-forestry	Unilever – Novella project
Promoting a value chain approach to adaptation in agriculture in Ghana. Contribute to the reduction of climate-induced risks to the achievement of food security and income generation objectives for the rural communities in Ghana, by focusing on the improvement and adaptation of the cassava value chain in pilot areas of the country. The innovative aspect of this project is the promotion of a self-sustaining and virtuous circle in the cassava sub sector that fosters adaptation to climate change for food security and development along the value chain and takes advantage of the use of an environmentally-friendly technology that can be easily operated by the local population	Off-farm diversification (i.e. biomass waste into new products)	SCCF (IFAD) 2011
Voluntary carbon markets financed farming adaptation investments (fuel woodlot planting, agro-forestry) in Uganda	Adoption on farming practices in the context of adaptation and smallholder farming resilience	Plan Vivo and Ecotrust (local NGO)
Contribute to the reduction of climate-induced risks to the achievement of food security and income	Off-farm diversification – Value chain approach to adaptation	Special Climate Change Fund (SCCF)

generation objectives for the rural communities in Ghana.		project
Reduce vulnerability of coastal communities in Tanzania	Diversification (commercial seaweed farming, aquaculture, development of value added seaweed products)	World Bank, Marine and Coastal Environment Management Project (MACEMP)
Relieve pressure on marine resources and reduce vulnerability of small scale fishers in Republic of Mauritius	Increase the incomes of small-scale fishers through the use of fish aggregating devices (FADs) to attract fish in deeper seas and capacity building to support fishers' rural enterprises	IFAD - Rural Diversification Programme in the Republic of Mauritius

Figure 8: Examples of Adaptation targets and the kinds of interventions

In addition Annex VII provides 3 case studies of agricultural projects which were developed and implemented principally from adaptation motivations.

6.2. Energy / Access to Energy

Seasonal weather patterns, weather variability, and extreme events can affect the production and supply of energy, impact transmission capacity, disrupt oil and gas production, and impact the integrity of transmission pipelines and power distribution networks.

Poverty and the weakness of SSA's energy systems are linked, despite the region having significant energy resources. The outlook beyond 2015 for access to modern energy services remains bleak. While electricity services are in decline, nearly one billion people in SSA will still rely on traditional biomass energy by 2030. Climate impacts cross the entire energy supply chain and has effects on energy resource endowment, infrastructure, and transportation.

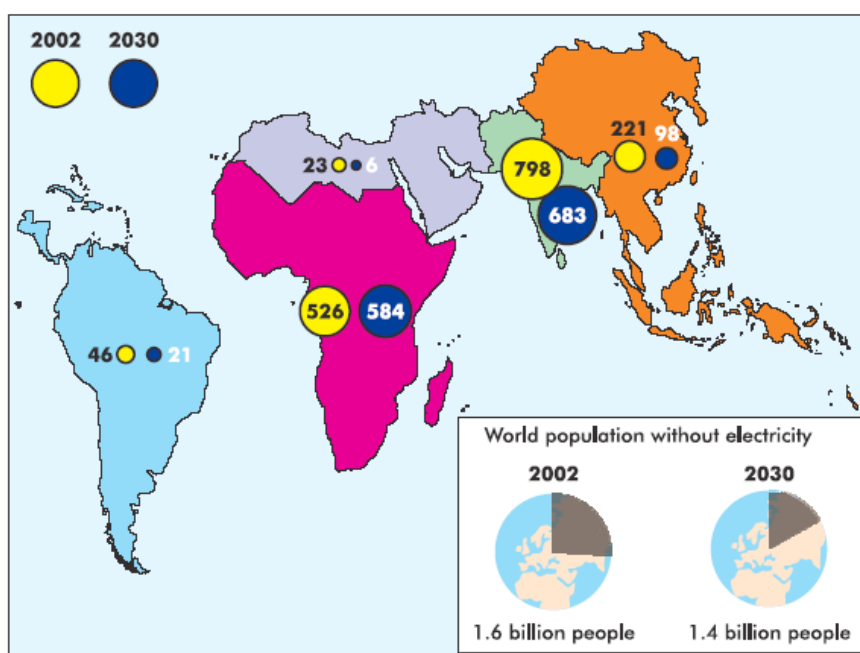


Figure 9: Map showing access to electricity in 2002 & 2030. Africa is the only region in the world where there will be more people without access to electricity in 2030.

A key response option is the adoption of mature renewable energy technologies that provide multiple benefits. Renewable energy options such as geothermal, small hydro, biomass cogeneration, solar and wind are candidates for development and attractive options for investment since the resources are widely available, especially in the eastern region of SSA, and provide additional developmental benefits such as job creation and reduction of oil import bills.

There are many examples of the adoption of renewable energy through mitigation funding. Finding the appropriate energy projects that can include aspects of adaptation can create opportunities for including these projects in the current process for adaptation funding. Projects which might be available for this approach could include:

- Improved carbonisation of fuel wood and other biomass for production of more efficient charcoal and biomass briquettes as income diversification strategies;
- Promotion of bio-fuel value chains with drought-resistant species (i.e., *Jatropha*);
- Deployment of off-grid hybrid systems using combinations of solar, wind and hydro to shield from dependence on one renewable resource which may be impacted by climate change;
- Use of renewables as inputs into agriculture, improving climate resilience of farming practice into post-harvest and local agro-processing, allowing reduced crop spoilage; E.g., renewable energy for cold chain storage or irrigation systems

Pilot projects of various scales are already under way or in the planning stages in many parts of the world to establish smallholder plantations of biofuel species such as *Jatropha curcas* for job creation, poverty alleviation, and restoration of degraded land. *Jatropha curcas* is a fast-growing, drought-resistant shrub and can tolerate marginal, nutrient-poor soils and arid conditions. Because it is unpalatable to livestock, it has been widely used in rural communities in Africa as a hedge or 'living fence' around crops.

An example is *Mali Biocarburant* (see <http://www.malibiocarburant.com/malibio/>) which is one of the first biodiesel producers in West Africa. It is a private company that works with small farmers, who are in turn shareholders of the Company. The group supports Mali bio-fuel farmers in the cultivation of *Jatropha* associated with food crops¹, combining energy security and food security. Producing, processing and marketing biodiesel locally, Mali Biofuels SA contributes to the development of the local economy and reducing poverty through additional income for farmers. A pilot biogas plant has also been established on site in Koulikoro, in partnership with research organizations, to use the waste obtained after the pressing of the *Jatropha* seeds to produce electricity for the surrounding rural areas.

Further examples are provided in the table on the following page.

¹ Mali Biocarburant set up a program associating drought resistant maize with *Jatropha*. This maize is intended for the personal use of farmers, and the sale by producers in the private sector

Adaptation investment target	Type of intervention	Reference
Set up of food cum energy value chains, with farmer co-owned jatropha oil production	Climate resilient energy crop	Malibiocarburant website
Water scarcity affected communities in Sudan	Fluxinos solar pumps have been fitted to existing open wells as part of a pilot programme to demonstrate the benefits of using solar energy; these have been financed by the Government of Italy (Labour saving technology for women)	http://www.fluxinos.it/it/pompe_solari.htm

Figure 10: Table showing examples of energy related projects in Africa

6.3. Tourism

Tourism has the potential to lift people out of poverty through the employment and entrepreneurial opportunities it provides, and the recognition of tourism's role in poverty alleviation has made it a substantial component of the international development and trade agenda (Hall & Coles 2008a, b).

Climate is an important asset (or liability) for tourism. It is a determinant for location suitability in a wide range of tourist activities, is a driver for global seasonality in tourism demand, and has an important influence on operating costs (heating-cooling space, snowmaking, irrigation, food and water supply, and insurance costs). Changes to climate have considerable implications for competitive relationships between destinations and therefore the profitability of the enterprise and / or a complete market. There are also indirect impacts due to climate change, as environmental conditions will have effects on tourism (change in water levels, availability, diversity loss, reduced landscape aesthetic, agriculture production, erosion, floods, increased vector borne diseases, accessibility of tourism sites).

The dynamic nature of the tourism industry and its ability to cope with a range of shocks suggests a relatively high adaptive capacity overall (UNWTO-UNEP-WMO 2008), however, the capacity to adapt varies between the components of the tourism value chain (sometimes described as sub-sectors of the industry) e.g. tourists, tourism service suppliers, destination communities, tour operators subsectors of the tourism industry (Elsasser & Bürki 2002, Gossling & Hall 2006c, Scott 2006, Becken & Hay 2007). Tourists have the greatest adaptive capacity with relative freedom to avoid destinations impacted by climate change. Tourism service providers and operators (and employees) who are tied to specific destinations have less adaptive capacity. Large tour operators, who do not own the infrastructure, are in a better

position to adapt to changes at destinations because they can respond to clients demands and provide information to influence clients' travel choices. Destination communities and tourism operators with large investments in immobile capital assets (e.g., hotel, resort complex, marina, or casino) have the least adaptive capacity. The information requirements, policy changes and investments that are required for effective adaptation by tourism destinations require decades to implement in some cases, and so there is a need for rapid action for destinations predicted to be among those impacted by mid-century (UNWTO-UNEP-WMO 2008).

The tourism sector will have to adapt its operations to climate zones world-wide. As Figure 12 illustrates, a diverse range of technological, managerial, policy and behavioral adaptation measures can be proposed for implementation by tourism stakeholders to deal with climate variability and change. Climate adaptation measures are rarely undertaken in isolation, but commonly involve multiple adaptations that are specific to the destination's climate and its tourism products. The location-specific nature of climate adaptation creates a complex mix of adaptations being practiced in the tourism sector across the globe. Figure 8 furthermore indicates the level of complexity that accompanies the implementation of adaptation activities with all actions needing to be synchronized and integrated; unless a majority of the activities are taken care of, the rate of failure is high.

Type of adaptation	Tourism Operators/ Businesses	Tourism Industry Associations	Governments and Communities	Financial Sector (investors/ insurance)
Technical	Rainwater collection and water recycling systems	Develop websites with practical information on adaptation measures	-Reservoirs, dams, and Water treatment plants - Fee structures for water consumption	-Provide information material to customers -Standards (requiring the insured to disclose what they do to protect their assets and manage liabilities related to climate change)
	Cyclone-proof building design and structure	Develop websites with practical information on adaptation measures and standards	Weather forecasting and early warning systems	-Provide insurance policy and premiums that reflect clients' investment (or lack thereof) in adaptation/risk reduction measure
Managerial	Water conservation plans	-Water condition reports through media	-Impact management plans (e.g., 'Draught Response plan or Coral Bleaching Response Plan')	-Adjust insurance premiums or not renew insurance policies for high-risk clients;
	-Low season closures	- Use of short-term seasonal forecasts for the planning of marketing activities	-Business subsidies (e.g., energy costs)	-Restrict lending to high risk business operations
	Product and market diversification	Use of short-term seasonal forecasts for the planning of marketing activities	Business subsidies (e.g., or energy costs)	
	Regional diversification in business operations Redirect clients away from impacted destinations	Training programmes On climate change adaptation. Encourage adaptive environmental management with firms (via certification)	Business subsidies (e.g., insurance or energy costs)	
Policy	Hurricane/Cyclones/Floods interruption Guarantees	-Coordinated political lobbying for GHG emission reductions and	-Coastal management plans and set back requirements	Consideration of climate change in credit risk and project Finance assessments

	Comply with Standards	adaptation mainstreaming - Seek funding to implement adaptation projects	-Building design standards (e.g., for hurricane force winds)	
Education	Climate change education for employees and guests	-Public education campaign	-Campaigns on the dangers of UV radiation / Water Conversation	- Educate / inform potential and existing customers

Figure 11: Table showing the various adaptation sectors and options in the tourism sector

Possible adaptation measures / projects would involve both actions on supply and demand, such as:

- Infrastructure improvements: e.g., rainwater collectors, increasing storage tank capacity, converting toilets to saltwater supply, and adding powered desalination capacity;
- Water conservation: including the application of water-saving devices and guest and employee education, revised landscaping practices and limited use of pools;
- Sustainability planning (e.g., considering long-term weather forecasts);
- Recycling programmes: use of grey water for irrigation and / or toilet supply; recycling of organic and biomass waste;
- Promotion of rural tourism as a way to diversify livelihoods for those involved in climate-vulnerable activities such as rain-fed agriculture;

The **greening of tourism** (which involves efficiency improvements in energy water and waste system, see above) is expected to reinforce the employment potential of the sector with increased local hiring and sourcing and significant opportunities in tourism oriented towards local culture and the natural environment. Investment in cultural heritage is among the most significant and usually profitable investments a society or tourism sector can make. Traditional mass tourism has reached a stage of steady growth, in contrast eco-tourism, nature, heritage cultural etc. are expected to grow rapidly over the next two decades (source: UNEP Green Economy Report).

Annex VII provides a case study example (Nr 4) of a regional tourism project which was motivated principally in response to adaptation needs.

6.4. Water

“Observational records and climate projections provide abundant evidence that freshwater resources are vulnerable and have the potential to be strongly impacted by climate change, with wide-ranging consequences for human societies and ecosystems.” (IPCC: Climate Change and Water, 2008).

The anticipated wide ranging changes to the water cycle and related resources as a result of climate change is predicted to significantly affect water availability, and the required adaptation options will have to balance reduced availability of freshwater with increasing demand driven by population growth and increased levels and intensity of agricultural and industrial activity. Water usage has doubled in the last

fifty years and is expected to rise by a further 25% over the next 20 years. Existing challenges of water quality, scarcity and unsustainable supply will be compounded by longer dry periods, higher temperatures and droughts which will require additional irrigation for agricultural production, and increased demand by farm animals due to the higher temperatures. In addition, the shifting diets of urbanized middle class towards higher meat protein content, is a significant driver of higher water intensity in farming for the production of forage and other animal feed.

The lack of water is a constraint to development and it is only in the humid tropical zones in Central and West Africa that abundant water is available. Water availability is highly variable, both seasonally and within countries. By 2025 as many as 230 million people in Africa are predicted to be facing water scarcity and twice that number will be living in countries that are “water-stressed”.

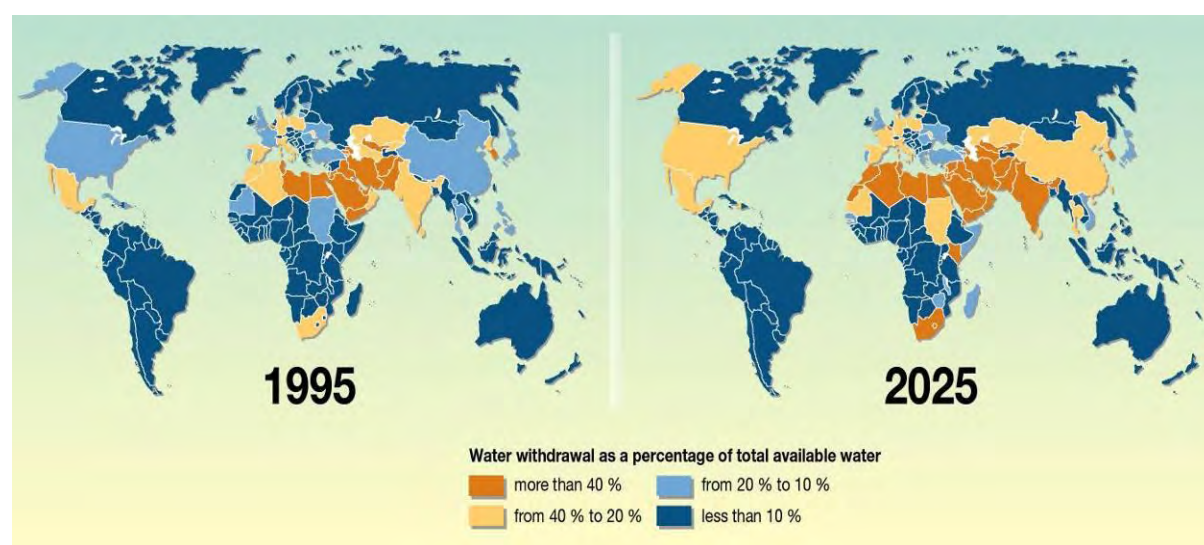


Figure 12: Map showing freshwater stress in 1995 and scarcity in 2025. Eastern Africa is already experiencing water scarcity, and South Africa which has a highly productive agricultural sector will face increased water shortages that will have a major impact on its agricultural productivity

New water infrastructure and behavioural changes around the use of water can ensure greater equity in water access and availability for both agriculture in rural areas and industry and domestic use in urban areas. The potential for adaptation actions include both supply and demand side measures and provide significant opportunities for private sector investment which can also take advantage of linkages with energy production, agriculture and food security. Practical water-related adaptations with multiple benefits, all of which can build resilience for smallholder farmers, especially in drought-prone areas include for instance:

- Aquifer recharge and ground-water use
- Building of dams and reservoirs and other storage capacity;
- Desalination;
- Rainwater harvesting;
- Floodplain restoration;
- Water usage efficiencies through recycling and treatment of grey water, reduction of loss in distribution and storage systems etc;
- Hydro energy generation;

- Localised irrigation systems through manufacturing of bottom of pyramid water management products (such as the locally manufactured and affordable drip irrigation kits by IDE) and water saving farming techniques (eg hydroponics);

The following table summarises some recent project examples:

Adaptation Investment Target	Type of Intervention	Reference
Communities vulnerable to climate change in Jordan	Innovative and efficient water-use technology (Dupont): dRHS Irrigation Technology	SCCF project - http://www.thegef.org/gef/sites/thegef.org/files/documents/document/6-17-2011%20%20ID4036%20%20Council%20Letter..pdf
Vulnerable horticulture production systems of the Sudano-Sahel area	Low-pressure drip irrigation and commercial production system (African Market Garden (AMG)) that brings to the poor farmers of Africa all the advantages of drip irrigation at a fraction of its costs.	ICRISAT - http://test1.icrisat.org/wca/project6.htm
Enhanced water productivity in rural livelihoods	Sustainable water management - Multiple use water services (MUS)	IWMI http://www.iwmi.cgiar.org/Publications/IWMI_Research_Reports/PDF/pub098/RR98.aspx

Figure 13: Table showing examples of water-related adaptation projects

This sector in particular will require a change in thinking from the regulatory and institutional perspective to support the development of new business and delivery models for the establishment and maintenance of infrastructure and the provision of water and related utility services through innovative PPP's and private investment structures.

The Africa Water Atlas provides a comprehensive overview of Africa's water resources and challenges. It is downloadable at: http://na.unep.net/atlas/africaWater/downloads/africa_water_atlas.pdf.

Annex IX includes a detailed case study of a regional adaptation approach, recently developed and implemented in Northern Mozambique, which includes activities and sub-projects which encompass all the sectors highlighted in this section 6, namely agriculture, access to energy, tourism and water.

7. Cross Cutting Sectors & Coping Mechanisms

In addition to the sectors identified above a number of cross cutting themes and coping mechanisms have been identified which are believed to show high propensity for facilitating and supporting the identification, structuring and implementation of adaptation projects. Furthermore we investigate the idea of “Adaptation Products & Services”, a concept which is gaining ground in some circles as a way to focus adaptation activity and in particular to mobilise private sector financing particularly in concert with micro-finance.

7.1. Urban Development

City authorities are one of the focal points of adaptation planning, financing and decision making, and will increasingly be required to incorporate climate change adaptation and disaster risk reduction into medium and long-term municipal planning, but are challenged by constrained financial, technical and human capacities. The degree to which urban areas deal with these challenges depends on the entire urban system, from planning processes, technical and institutional capacity to the degree to which urban residents are included in decision-making through bottom-up processes.

Many of the world’s fastest-growing cities are in Africa, and urbanization creates enormous potential for adaptation to climate change through the per-capita reduction in costs based on the high population density of these cities, and their potential to leverage transformative technologies (as has been the case with the adoption of mobile phone technology). Both public and private interventions in African cities could lead to concrete adaptation measures that improve the lives of a larger percentage of African urban dwellers.

Currently, most private sector finance is concentrated on the provision of infrastructure for which private enterprises can most easily charge – for instance in telecommunications and electricity. These are also forms of infrastructure where the costs of reaching customers and of controlling their access are relatively low. The types of infrastructure that most often need investment for increased adaptive capacity – water and sanitation, drainage systems, waste management, ports, roads, railways – have higher relative capital and operating costs and as a result tend to receive lower private sector priority. All these areas either already generate revenues or have the potential to do so which could be structured as cash flow to service investment capital and debt.

The substantial costs of addressing the deficiencies in infrastructure and services for “slums” and informal settlements and supporting better-quality housing for low-income urban dwellers remains a challenge. The total costs represent hundreds of billions of dollars and are far more than international agencies can provide. Communities in poorer cities have inadequate and inequitable access to basic urban infrastructure which further constrains their adaptive capacity. Adaptation measures that can mediate poverty and impacts of climate change which have been tested in

urban settings include: domestic energy briquettes from waste, productive greening and urban agriculture, household level rainwater harvesting, recycling, and nutrient recycling from waste.

Private investments in urban infrastructure are often concentrated in wealthier nations in wealthier regions; sub-Saharan Africa and the least developed nations, which most need such investments, get the lowest proportion of these investments. The supply of finance is dependent on the degree to which proposals for adaptation measures are standardized and the predictability of their financial performance as well as the sequencing of the planned interventions, especially in cases where the pipeline of projects create opportunities for bundling portfolios of measures or for pooling investment demand through the creation of secondary financial instruments, such as value capture instruments, insurance or re-insurance, catastrophe bonds, social impact bonds or through the securitization of structured finance. As illustrated by Figure 15 on the demand side there is a greater need for uniformity in the manner in which projects are presented and on the supply side there is greater need for customization of the financial solution.

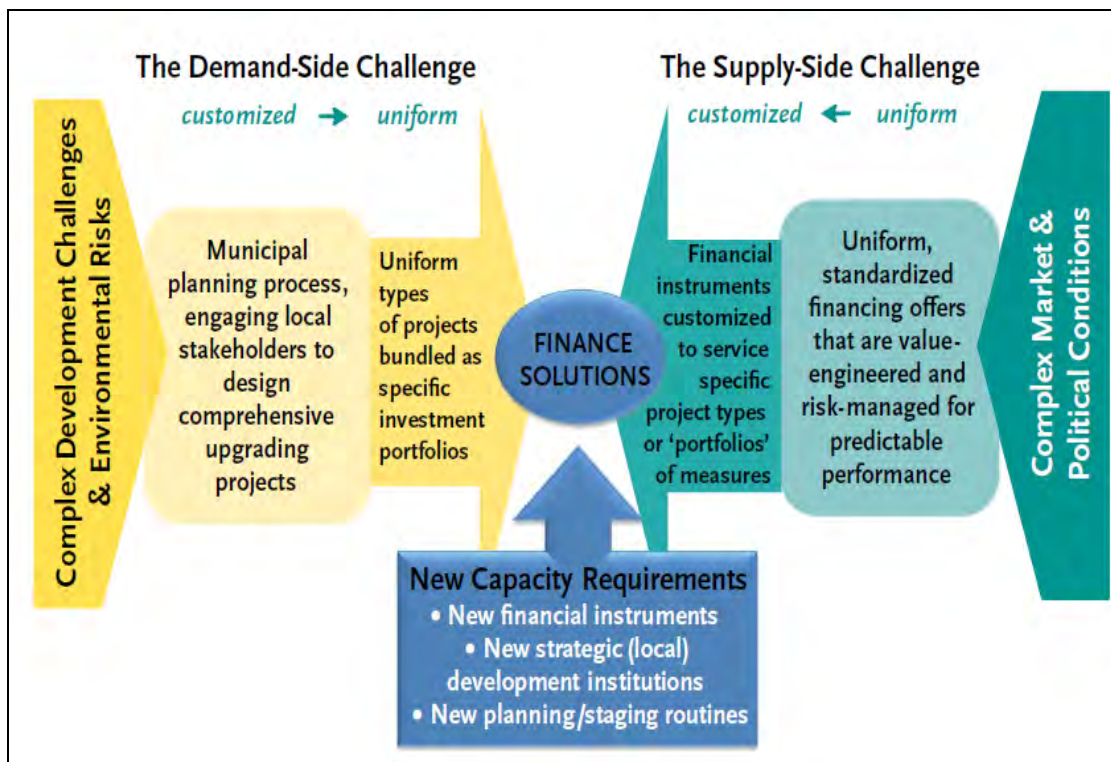


Figure 14: Graphic showing the push and pull factors in packaging urban projects for financing.

There has been limited progress in most nations in improving and extending provision for water and sanitation within urban populations and despite international donor support for privatization, expansion of provision of services and increases in capital investment have been limited. Generally, the cities with the best-managed provision for water and sanitation are those with the greatest capacity for adaptation. Good provision for water and sanitation is not only about infrastructure – it is also about local capacity to make appropriate choices in regard to the technology used and the institutional forms for building and managing it. Water scarcity is rarely the

main reason why provision for water is inadequate in cities, as many African cities have little or no overall shortage of freshwater resources; instead case studies show that these are often more the result of poor management than of water scarcity. Again, the issue of appropriate governance institutions and mechanisms to manage the natural resources comes up as a priority focus, under which appropriate business models can be identified and tested.

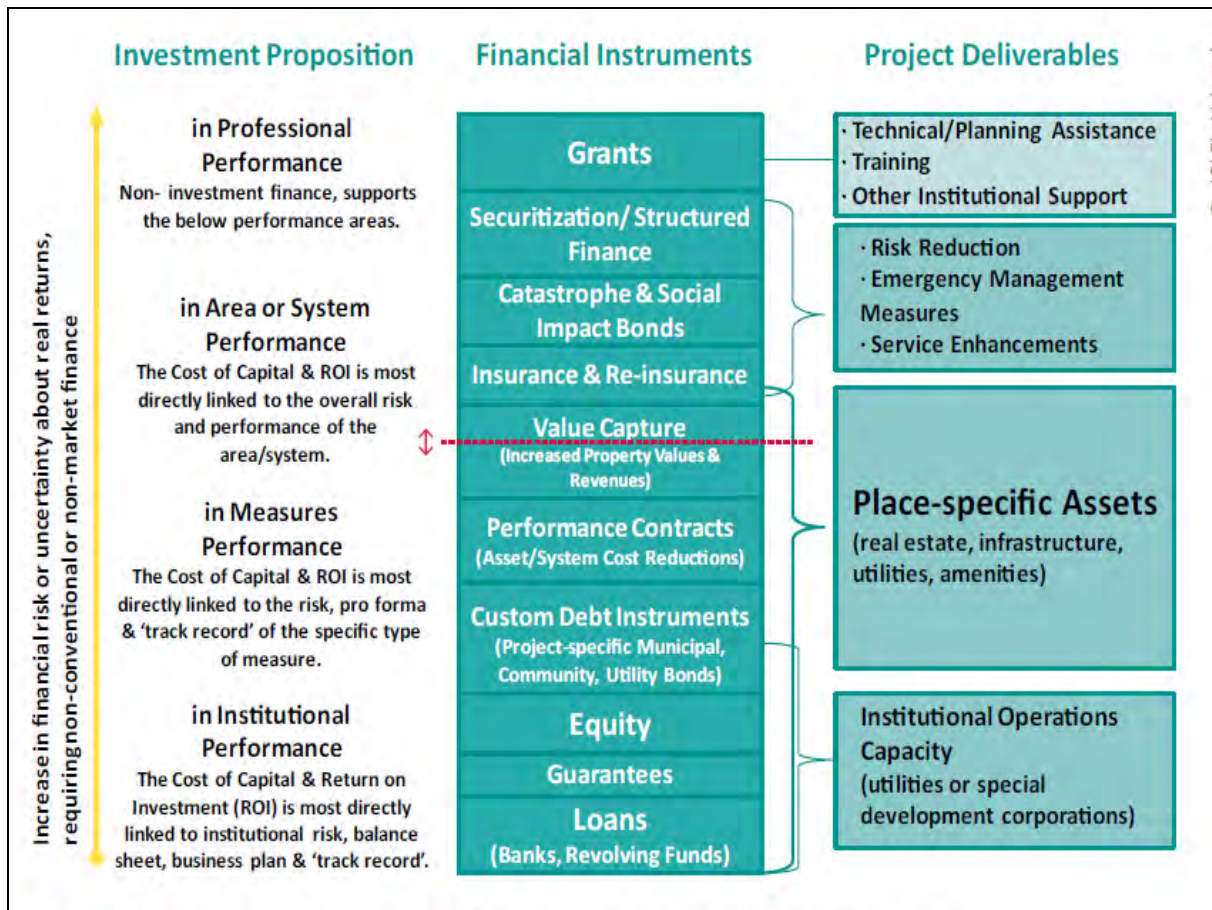


Figure 15: Graphic which shows the suitability of various financing instruments for different types of urban projects, and their risk profiling. The greatest uncertainty is in institutional performance.

7.2. Coping Mechanisms – Micro-Finance

In the space of just three decades, microfinance and climate change science have generated broad social movements grounded in the belief that these processes have the capacity to radically transform life around the world. Ironically, while in their most optimistic expressions, the proponents of microfinance imagine cutting global poverty in half within a few years, scientists have identified the same population of desperately poor as among the first people who will confront the negative impacts of climate change. Specifically, the IPCC has identified developing countries as more vulnerable to climate change damages and argues that ‘this condition is most extreme among the poorest people’ (IPCC 2001: 227). It is still to be proven that microfinance could be a good tool to move people out of poverty and many say that microfinance was not intended to serve the very poorest of the poor, but the ‘economically active poor’ and represents only one (sometimes minor) strategy for

poverty reduction. Many of the world's poor are already vulnerable to climate risk due to factors such as settlement on marginal lands, high dependence on climate-sensitive livelihoods, and limited access to or availability of resources to respond to shocks and stresses (ADB *et al.* 2003).

Climate change will amplify, modify or introduce new types of threats, which may affect natural and human systems independently or in combination with other determinants to alter productivity, diversity and functioning of ecosystems and livelihoods (IISD *et al.* 2003b). If people do not have the resources to deal with today's stresses, then they are unlikely to be able to deal with the additional stresses associated with climate change, a condition known as the 'adaptation deficit' (Burton 2004). Adaptation to climate change must start with reducing this deficit. Climate change has in effect introduced greater uncertainty into development decision-making, extended the decision-making timeframe, and further emphasized the potential trade-offs between short-term development gains and longer-term socioeconomic transformation, particularly among the world's poor.

Microfinance has the potential to help the world's poor and most vulnerable populations adapt to climate change by providing poor individuals and households with a means of accumulating and managing the assets and capabilities needed to become less susceptible to shocks and stresses and / or cope with their impacts. The logic here is simple – the more assets and capabilities people have, the less vulnerable they are and the more resilient to climate change. Of course, some assets and capabilities will be better suited to promoting climate change adaptation than others, and the optimal mix needs to be determined at the community or household level.

The inherent characteristics of microfinance make it an attractive vehicle for facilitating adaptation. MFI's already have pre-existing networks to access the poor – especially women – who are particularly vulnerable to climate change. The nature of microfinance lending (high volume, limited value loans) is consistent with the required adaptation actions that will ultimately consist of thousands of decentralised actions by individuals, households and communities, as they integrate climate risks in their activities.

Microcredit activities will need to consider structural changes to support adaptation:

- technical design of existing projects;
- financing modalities;
- activities that are not currently part of existing microcredit portfolios (including specifically access to energy and other utility services).

According to Daley-Harris *et al.* (2002, 26 and 37), 970 programmes in SSA offer micro-credit services reaching roughly over 8.4 million people in 2006, out of which 48 percent are women in the bottom 50 percent of the population living below their country's poverty line. In SSA, 27 countries have developed specific regulatory frameworks for microfinance while in 15 countries microfinance falls under general financial sector regulations (CGAP 2008).

7.3. Coping Mechanisms – Insurance / Micro-Insurance

Together Africa and Asia (excluding Japan) account for less than 7% of the world insurance market; in 2002 only 1.1% of natural disasters in Africa were insured. These statistics, which underline the underinsured nature and resulting vulnerability of African markets to extreme events and disaster, reveal both the scale of opportunity and the overall challenge for the insurance industry in Africa. Development of viable climate related insurance products and markets for Africa, particularly for coastal and rural communities and sectors such as tourism and agriculture, is viewed as being a vital component of the adaptive response.

Insurance is seen as a key instrument to strengthen financial resilience to external shocks and provides a tried and tested way of spreading and transferring risk. Additionally, it may provide incentives for risk reduction and preventative behaviour, while engaging the private sector in providing more adaptation finance. Insurance can also unlock access to credit where financial institutions are hesitant to lend to poor clients who are highly exposed to climatic risks; with the additional credit, households can then invest in inputs that will reduce their vulnerability and increase their productivity.

The development of climate related insurance products can be expected to significantly contribute to efforts to identify and quantify risk and estimate potential losses / exposure due to climate related events and risks. More exact risk identification and quantification can result in more equitable pricing of insurance, helping to reduce insurance premiums and make them more affordable. Rates may also reflect risk reduction measures, such as implementation of hazard plans, forecasting and warning systems, undertaken at various scales.

Widespread insurance cover has been generally confined to developed countries where consumers, businesses and industry have in the past been able to pay for premiums and had access to a range of insurance products. The opportunity exists to create public private partnerships to bring new kinds of creative financial instruments to developing countries where the costs of coping with a rising tide of full scale, climate-linked, natural disasters could outstrip current levels of humanitarian aid. Insurance can improve adaptive capacity by providing beneficiaries buffer capacity against climate impacts thereby breaking the poverty spiral.

An example of the new kinds of insurance is the Swiss Re and partners “weather derivative” insurance in Ethiopia:

Swiss Re is currently collaborating with Oxfam, the Ethiopian government, a local non-governmental organization, and other partners through the Horn of Africa Risk Transfer for adaptation (HARITA) project, which provides weather index insurance for smallholder rain-fed farmers in Ethiopia. Around 85 percent of all Ethiopians depend on agriculture for their livelihoods, and they are some of the poorest farmers in the world. Their harvests and incomes are already threatened by drought, which will be exacerbated by climate change. To address this problem,

Swiss Re and its partners developed a risk management package that enables farmers participating in a government social safety net scheme to pay for weather risk insurance premiums by contributing their own labour to community projects that reduce risk, including irrigation, soil improvement and composting. In the event of a seasonal drought, insurance payouts triggered automatically by low rainfall enable HARITA farmers to afford the seeds and inputs necessary to plant in the following season, without having to sell off productive assets to survive. Since the launch of the project in 2008, participation in the insurance scheme has rapidly increased, from an initial 200 households in the first year to 1,300 households in 2010. Many of these rural households are led by women. In Ethiopia, Swiss Re has pursued an opportunity to create business value in the long term while assisting those most vulnerable to climate change. Only about 0.4 percent of Ethiopia's population of around 90 million has insurance, so the HARITA project also serves as an important step toward developing Ethiopia's nascent insurance market. The project reached its goal for 2010/11 by providing insurance for 13,000 households.

Adapting for a Green Economy: Companies, Communities and Climate Change. A Caring for Climate Report. 2011, UN Global Compact, UN Environment Programme, Oxfam and the World Resources Institute

The insurance pays out money to farmers based not on the crop they lost but on pre-defined weather (rainfall / temperature) benchmarks. Such index-based weather insurance can be at the household level (in terms of micro-insurance) or at larger spatial scales like national (referred to as macro-insurance). This insurance approach reduces the time it takes to acquire sufficient emergency relief funds, thereby pre-empting the need to provide emergency food and reducing the threat of starvation in the wake of an extreme weather event or disaster (eg drought). The likely developmental impact of the safety net provided by such insurance is that farmers can retain their productive assets even after the event has occurred and are thus able to continue / restart production. According to WFP (2005), an appeal usually takes four to five months to access funds for emergency aid. By this time, farmers would have sold their productive assets making them unable to cultivate their farms in a following season. This cycle appears to have perpetuated their dependency on aid. A similar initiative is under development in Mozambique where the micro insurance broker Guy Carpenter LLC is developing an indexed insurance scheme to provide climate risk insurance to agricultural small holders in Mozambique. The development work is being funded by IFC but the aim is to develop a commercially viable product.

Index-based insurance has two advantages over traditional indemnity insurance: index insurance insures for a specific event or risk, such as rainfall deficits, so there is no need for costly in-field assessment of damage because weather data directly trigger payouts. Index insurance also addresses two problems associated with traditional crop insurance:

- **moral hazard:** a situation in which farmer practices cannot be observed so that a farmer may let a crop die in order to get an insurance payout; and
- **adverse selection:** referring to a situation in which insurance is priced based on the risks of the entire population but only the most vulnerable farmers purchase insurance (Osgood et al. 2007). Since no measurement of actual loss is required, rapid payments can be realised with index-based products. Further, micro-insurance loan package bundle as used in Malawi has *advantage over micro-credit*. Since farmers pay their premiums upfront, the micro-insurance organisations are guaranteed their income, in contrast to micro-credit loans where high default in repayment by farmers during widespread droughts have been experienced (e. g. in Kenya).

In addition the following issues need to be taken into account and factored in to the development of insurance actions and products for adaptation:

- **Affordability:** micro-insurance needs to be affordable to low-income clients. Disaster insurance premiums include the costs of handling many small contracts, distributing the product often to remote areas, as well as assuring sufficient capital to cover dependent claims. These elements combine to make insurance more costly than the purchaser's expected losses from the insured events. Thus, a major dilemma is to offer premiums that can be paid by the very poor in high risk areas (USAID report 2009).
- **Financial viability:** without sufficient back-up capital through reserves or reinsurance and / or sufficient geographic diversification, the payment of claims may be jeopardized and thus the viability and credibility of the micro-insurance programme. The science underlying the models and risk estimates must be independent, verifiable and viewed as reliable by insurers, reinsurers, investors and donors. Where there is a high degree of ambiguity with the risk estimates of extreme events or impacts of climate change, international donors may need to provide incentives for private sector involvement in such schemes (USAID report 2009).
- **Decreasing Insurability:** in the longer-term as the magnitude of damages from climate change increases, the insurability decreases. UNEP's Finance Initiative reports that by 2025, insurers may withdraw from some markets as the risks become too high for the available premium pool. CERES, a US-based NGO, has identified a growing move by insurers to reduce coverage in coastal zones. Accordingly opportunities exist to further the use of alternative risk transfer products, such as bonds, which pass the risk onto investors in the capital markets rather than to reinsurers (USAID report 2009).

7.4. Adaptation Products & Services

Particular potential is seen for private sector investment in adaptation areas in new businesses, which seek to deliver vital products and services to the bottom of the

pyramid rural and urban poor through innovative delivery methods and business models, often using microfinance and / or micro-insurance as a conduit or intermediary to support the delivery and distribution chains. The key hereby is to reduce capital and upfront costs to levels which cease to present entry barriers to the poor and thereby to develop revenue charging / generation models, which closely replicate existing spending patterns and coincide with weekly or monthly purchasing power of the target populations.

Examples of potential projects and actions which would lend themselves to this approach are:

- Production and distribution of fuel efficient cook stoves and efficient fuel therefore. One possible model is for example to give the stoves away and generate income by the sale of fuel to avoid upfront capital cost (which is often a barrier to purchase) and replicate existing spending patterns on kerosene, candles and batteries;
- Packaging of off-grid electricity generation and consumer equipment (lighting etc) in a utility model (sometimes called lease-purchase models) whereby consumers pay for units (hours / days / weeks) of electricity supply and lighting rather than invest in ownership of the capital intensive equipment;
- Hire - purchase, lease purchase, rental and utility models for the acquisition of vital domestic infrastructure (lighting, heating & cooking equipment), whereby the service is effectively commoditised, packaged in a utility offering and paid for in affordable increments (eg by the hour, kWhr or other appropriate measurable unit);
- Provision of community based crop processing, storage and marketing systems on a co-operative model for communities of small holder farmers and small agri-processing businesses. This area includes the creation and use of virtual market making systems for buyers and sellers of crops / products, brokerage networks and pricing systems, sometimes even based on barter transactions rather than money transactions;

These approaches often require (or lead to) innovative uses of existing technologies and innovative, highly focused product development techniques and lean manufacturing systems to be able to create a product (or service) which is seen as adding value and desirable and which performs under the specific local conditions and is deliverable at an affordable price. Manufacture and production of the product or service is performed through frugal engineering and / or commoditised mass manufacturing techniques, using locally available raw materials and skills; delivery, management and control of these products and services are often facilitated by special software and payment systems, now increasingly delivered over sophisticated 2nd and 3rd generation mobile ICT networks, which are now near universally available even in remote areas of SSA and other developing country regions. These are commodity or utility type service businesses which are driven by volume and which notwithstanding the low purchasing power of the target markets

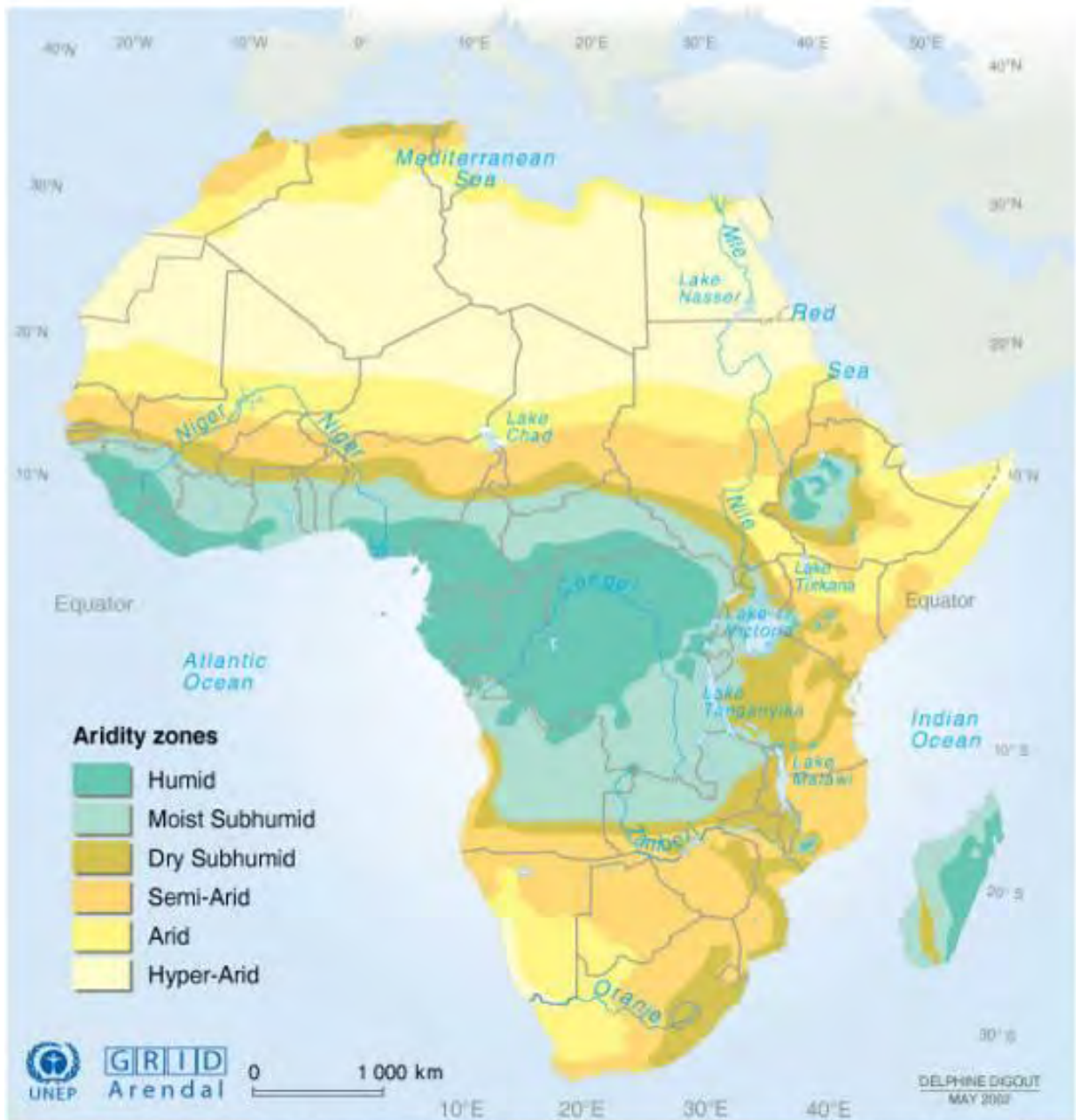
have the ability to generate interesting returns through sheer force of numbers provided you can get the product to market and collect appropriate revenue. Examples of these business models include Barefoot Power (www.barefootpower.com) in Africa and Sunlabob (www.sunlabob.com) in Asia for the distribution of solar powered lighting systems and Inyenyeri (www.inyenyeri.org) in Rwanda for the distribution of efficient cookstoves and MPAIS (Market Place for Agricultural and Information Services), a virtual marketplace and brokerage system in Uganda aimed at small scale agriculture (www.nida.or.ug).

8. A Regional Approach

A regional approach to the CTI PFAN adaptation activity makes sense as many of the climate impacts will be regional: as can be seen from Figures 16 and 17 (graphics on aridity zones) – the various identified demarcation zones for aridity and humidity have a high degree of consistency within each of the sub-regions of SSA. This may serve to facilitate the scale-up of effective adaptation measures at the regional level and in locations where they are most needed, and where some experience, skills and infrastructure have already been developed and deployed in the proof of concept at the local level. Additionally, this approach can reduce management and administration costs for both CTI PFAN and implementing partners and project developers. A regional approach may also allow differentiation in terms of project identification and development and resource allocation: for example, the focus in West Africa could be on agro-forestry conversion whereas in Southern Africa the focus could be improved water management and seed varieties.

See on the following pages:

Figures 16 & 17: Maps showing the regional dimensions of projected climate impacts for aridity and rainfall in Africa

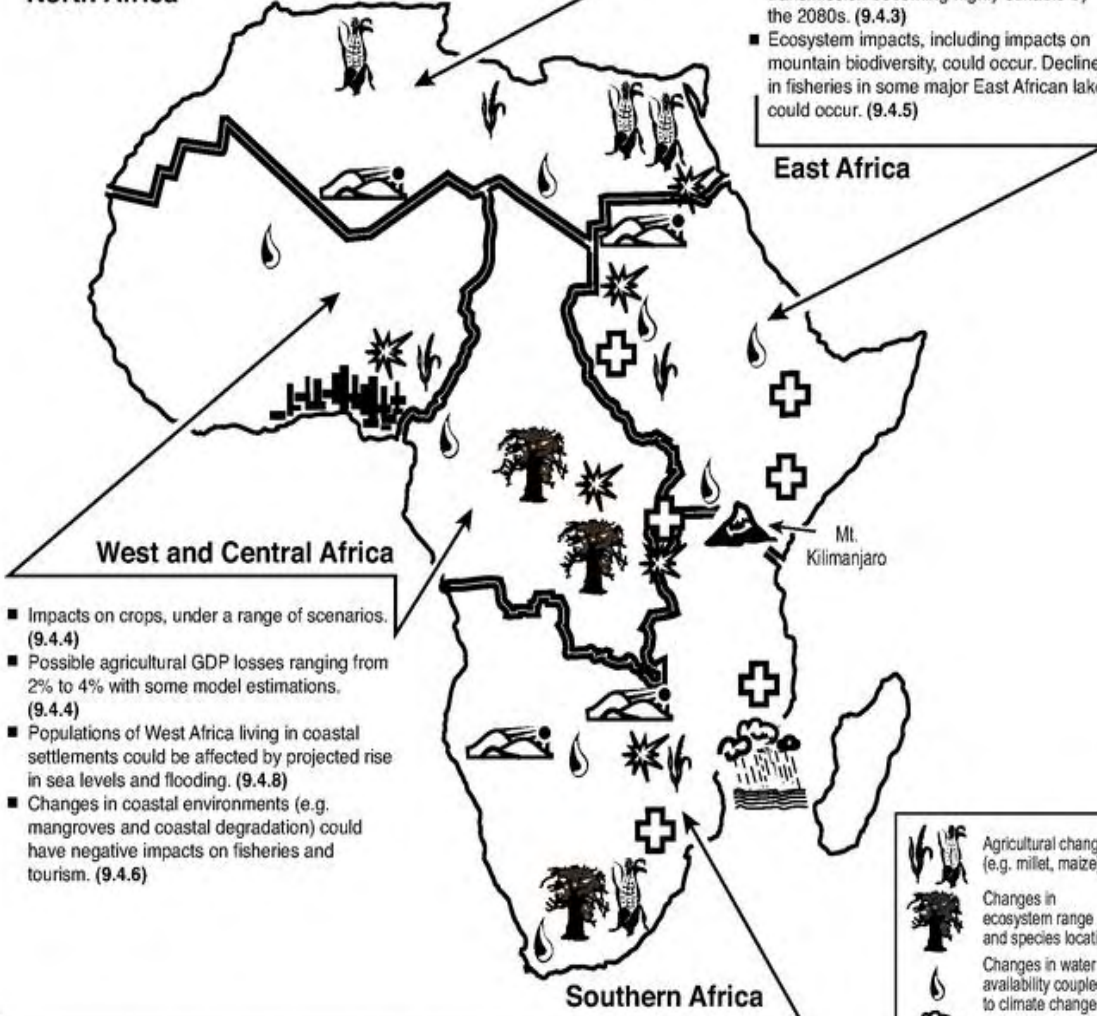


Source: World Meteorological Organization (WMO), United Nations Environment Programme (UNEP), *Climate Change 2001: Impacts, Adaptation, and Vulnerability*, Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC).

- Climate change could decrease mixed rain-fed and semi-arid systems, particularly the length of the growing period, e.g. on the margins of the Sahel. (9.4.4)
- Some assessments show increased water stress and possible runoff decreases in parts of North Africa by 2050. While climate change should be considered in any future negotiations to share Nile water, the role of water basin management is also key. (9.4.1)

- Rainfall is likely to increase in some parts of East Africa, according to some projections, resulting in various hydrological outcomes. (9.4.1)
- Previously malaria-free highland areas in Ethiopia, Kenya, Rwanda and Burundi could experience modest changes to stable malaria by the 2050s, with conditions for transmission becoming highly suitable by the 2080s. (9.4.3)
- Ecosystem impacts, including impacts on mountain biodiversity, could occur. Declines in fisheries in some major East African lakes could occur. (9.4.5)

North Africa



- Impacts on crops, under a range of scenarios. (9.4.4)
- Possible agricultural GDP losses ranging from 2% to 4% with some model estimations. (9.4.4)
- Populations of West Africa living in coastal settlements could be affected by projected rise in sea levels and flooding. (9.4.8)
- Changes in coastal environments (e.g. mangroves and coastal degradation) could have negative impacts on fisheries and tourism. (9.4.6)

- Assessments of water availability, including water stress and water drainage, show that parts of southern Africa are highly vulnerable to climate variability and change. Possible heightened water stress in some river basins. (9.4.3)
- Southward expansion of the transmission zone of malaria may likely occur. (9.4.3)
- By 2099, dune fields may become highly dynamic, from northern South Africa to Angola and Zambia. (9.4.5)
- Some biomes, for example the Fynbos and Succulent Karoo in southern Africa, are likely to be the most vulnerable ecosystems to projected climate changes, whilst the savanna is argued to be more resilient. (9.4.5)
- Food security, already a humanitarian crisis in the region, is likely to be further aggravated by climate variability and change, aggravated by HIV/AIDs, poor governance and poor adaptation. (9.4.4) (9.6.1)

	Agricultural changes (e.g. millet, maize)
	Changes in ecosystem range and species location
	Changes in water availability coupled to climate change
	Possible changes in rainfall and storms
	Desert dune shifts
	Sea-level rise and possible flooding in megacities
	Changes in health possibly linked to climate change
	Conflict zones

9. Risk Analysis of Adaptation Projects

One of the key understandings that transpired from the work leading up to the initial establishment of CTI PFAN was the importance of risk analysis to private sector investors and financiers; day to day experience from CTI PFAN's existing operations and dealings with investors further reinforce the principle that sound risk analysis and mitigation strategies are indispensable. Regardless of the sort of project, the ability to understand and analyse risk in a transparent and coherent fashion, reduce, manage and / or share it where possible, and put a commensurate value on it is key to the investment decision.

There is no reason to suspect that this will be different for adaptation projects. Project developers will need to demonstrate that their development and implementation risks have been identified and mitigated, where possible, and offer a commensurate risk premium for the assumption of those remaining risks in order to secure required investment / financing. Although adaptation projects may entail different risks from Mitigation related projects there is nothing to suggest that the analysis and treatment of these risks from an Investor's standpoint will be in any way different.

Risk is often analysed with respect to the following broad categories which include the following main project risks by way of illustration without any claim on being fully exhaustive / comprehensive.

- **Project Risks:** construction risk; performance risk; resource risk (supply risk of project inputs); technology risks; counterparty risks (especially of key suppliers, off-takers / customers or contractors); integration risks (especially for complex multifaceted projects where multiple technologies are deployed or multiple systems need to be coordinated) ; environmental liability risks; climate / weather risk; skills availability;
- **Market Risks:** exchange rate risk; interest rate risk; economic risks linked to the performance of the economy – eg inflation, deflation; price volatility of key inputs and outputs.
- **Political Risks:** change of policy and regulation / change of tariff structures / validity and enforceability of contracts / risk of political unrest, civil upheaval or disruption / permitting and licensing risks / exchange controls and repatriation of profits;

As can be seen these risks are often interconnected and overlapping. For many of them mitigation strategies are established and readily available: especially for market risks (eg hedging strategies) and for some project risks (eg performance bonds; turn-key lump-sum contracting; guarantees; insurance). It is important, however, to recognize that few projects can expect to successfully manage or mitigate all risk elements; it is therefore all the more important to understand the potential impact on a project / business of those risks which cannot be effectively handed-off to other parties, shared or mitigated.

While adaptation projects can be expected to be analysed according to the same general risk categories and criteria as other projects it is nonetheless possible that adaptation projects expose investors to new areas of risks that they are less used to and / or reveal a heightened susceptibility to a particular form or category of risk: it is conceivable, for instance, that political risk may play an increased role in the analysis of adaptation projects, because of the developmental aspect of many adaptation initiatives and because of the interconnection between public infrastructure and adaptation, in which case political insurance instruments will be key in developing and implementing risk mitigation strategies. It is also likely that many investors will be relatively unfamiliar with specific project and operational risks arising from adaptation projects simply through lack of direct experience. In the short term this lack of familiarity will likely need to be compensated with increased risk premiums, until more experience is gained and reliable data is available on performance norms and criteria for monitoring and control as well as pricing purposes.

These aspects will be further addressed through the test cases investigated at the Exploratory Workshop and through the pilot. From the outset however it is not expected that the investing community will have a fundamentally different approach to the project and risk analysis to that which we see for other projects and to which we have already been exposed under the existing CTI PFAN programme. This means the main criteria will be the ability to earn a commensurate commercial return for the risk engaged.

As with the main CTI PFAN programme an intimate understanding of risk appetites of different investors and their return criteria, together with their constitutional limitations and requirements (ie target investment amounts, maximum and minimum maturity periods, exit criteria etc) will be key to successfully structuring projects for investment and mobilising financing for them.

9.1. Risk Mitigation Strategies & Instruments

The following three examples are ways that private sector finance risk can be reduced. Additional risk reduction instruments will be necessary over time to increase private sector engagement.

- **Partial Risk Guarantees (PRGs)**; PRG's are cover against the risk of a government (or State-Owned Entities) failing to perform contractual obligations with respect to a private project.
- **Multilateral Investment Guarantee Agency (MIGA)** is a member of the World Bank Group which provides guarantees against non-commercial risks and can be used to facilitate foreign direct investments in greener infrastructure projects in Africa. Risks covered include host-country political risks such as regulatory decisions by government that could affect project operations.
- **Public Finance** can be used for country risk guarantee schemes could help re-direct private finance towards countries that currently do not receive significant private flows.

10. Additional Considerations

10.1. Data, Models & Indicators

There is a need for more detailed information and indicators which can account for and show the impacts of climate change in the context of local conditions. Most of the existing climate models use macro scales which are too large, and there are variances in the sources of data and inputs. These data need to be integrated with socio-economic data and the outputs should include analyses across a range of sectors and indicators for effective use by policymakers and stakeholders.

Furthermore as commented elsewhere the different models produce different results, making them questionable / unreliable for the purposes of designing local adaptation activities. There is clearly a role for private sector engagement in the development of improved data collection systems, the capture of data itself as well as in the development and use of climate modelling systems, which can help improve decision making.

10.2. Adaptation & Development Planning

Adaptation is a process that takes place through development, and is essential to support existing development priorities including poverty eradication, food security, access to energy, and health. Vulnerability to climate change rarely emerges in isolation and by the same measure the success of adaptation activities rely heavily on the success of other development activities. On the one hand the mainstreaming of adaptation into all development makes sense because both contribute to human physical and economic security but, on the other hand, creates a tension in terms of the need for dedicated adaptation funds and funding mechanisms.

Examples of the link between climate change, adaptation and development include the following:

- Climate change poses a risk to development progress and deliverables achieved to date;
- Climate change poses a risk to future development objectives;
- Development can lead to concrete adaptations and to improved adaptive capacity;
- Development activities can be maladaptive if they increase the exposure of populations and economic assets to climate risk or reduce adaptive capacity.

A review of over 100 projects by the World Resources Institute, “Weathering the Storm: Options for Framing adaptation and Development” found that in practice there is little difference between adaptation initiatives and what can be considered good development. The difference lies more in the definition of the problem, the development angle from which it is approached and the setting of priorities than in

the implementation of the solutions. The study presents adaptation as a continuum, ranging from more narrowly defined activities aimed specifically at addressing impacts of climate change, to building response capacity and addressing the drivers of vulnerability.

Adaptation needs to be integrated into all the processes of policy formulation, planning, program management, project design and project implementation across multiple agencies responsible for human and economic development, finance, agriculture, forestry, land use, land conservation, biodiversity conservation, water, energy, public health, transportation, housing, disaster management and other sectors and activities. In addition, dedicated programs that focus on climate change risks and adaptation may be necessary where risks and impacts lie beyond the scope and vision of ongoing development activities. For example, the migration of transboundary resources, the salinization of coastal groundwater, or melting glaciers. These risks require dedicated attention to improve the information, coordination and response options available.

10.3. Integration with Disaster Risk Management

Promoting climate-responsive risk management imposes special ways of doing business for the private sector to promote risk-responsive business practices, including business continuity planning and processes, adopting partnership approaches, contributing to communities in enhanced social responsibility initiatives, and, preventing secondary disasters.

Adaptation is necessary but is not a sufficient condition for enhancing resilience. Attention to building the strength of the human and ecological systems to withstand shocks, to re-organize when buffeted by stresses, and to maintain previous states, calls for the integration of climate change adaptation with disaster risk management. National authorities recognize the need to develop and strengthen institutions required to build resilience to hazards. Political commitment to disaster risk reduction is increasing, with countries throughout Africa (and in other developing countries) developing and establishing national platforms for promoting disaster risk reduction to protect vulnerable populations. These strategies could include early warning procedures and relief reserves for natural disasters such as floods or droughts that are forecast to increase in frequency and magnitude.

In hazard assessment and reduction, the monitoring and surveillance of hazards such as through GIS systems offer opportunities for private sector involvement. Climate-proofing infrastructure, including utilizing development opportunities during reconstruction after major disasters offers another opportunity for private business involvement in adaptive management. Some risk mitigation activities constitute sustainable business opportunities in their own right. Disaster response planning, traditionally regarded as the main source of private sector involvement in disaster management, offers opportunities in several areas, including food production and transportation, post-disaster construction and retrofitting of infrastructure.

10.4. Top-Down / Bottom-Up Community Engagement

Modelling and scenario analysis provide a top-down approach that provides sound information on the bio-physical aspects of impacts, generally at the macro level. Such top-down approach can be effectively complemented by a bottom-up approach that recognizes and builds upon local level coping strategies and indigenous knowledge systems, and the capacity and coping range of communities and local institutions in responding to climate change. Both methodologies need to be linked to promote integrated adaptation assessments. This combined approach helps to incorporate the human and economic dimensions of communities, particularly their livelihood aspects and inter-sectorial linkages. There is a large body of knowledge and experience within local communities on coping with climatic variability based on available resources and past experience. Local coping strategies are an important element of planning for adaptation. Traditional knowledge, alone or blended with modern exogenous knowledge, can help to provide efficient, appropriate and time-tested ways of supporting adaptation and is useful in developing specific strategies and implementing policy.

11. Concluding Remarks & Next Steps

From our findings it is apparent that there are many different variants and interpretations of adaptation and how it is addressed in practice. Adaptation means different things to different people, albeit there are common underlying objectives. Often the differences are a function of geography and arising specific vulnerability. While these differences are for the most part subtle, the nuances of definition can present a real challenge for a programme of work such as is conceived by CTI PFAN. It also makes it difficult to “package and present” adaptation in a way that is readily accessible to the investment and financing communities which we are trying to more closely engage.

Accordingly it will be important to agree on a workable definition that is broad enough in scope, to encompass as many activities as possible, but still focussed enough to be meaningful and facilitate project identification as well as reporting and verification. The draft definition provided in this paper is a first attempt in that direction and it is expected that the workshop will be able to build on the foundation provided.

Other key findings of this study can be summarised in overview as follows:

- In financial terms the adaptation challenge is dauntingly large (and will probably get bigger). It is clear that public sector resources will not suffice to fully address the requirement and that private sector financing will be necessary to complement public sector efforts. Given the scope and areas of adaptation measures it remains less clear how private sector funds can be effectively mobilised and channelled, although the volume of financing required could be manageable by the private sector if appropriate mechanisms and channels were available.
- There are apparently few adaptation measures and activities that will be fully commercial and in their own right attractive investment targets for private capital. Against this background it is likely that innovative risk allocation models and public – private blending mechanisms will need to be developed to leverage the use of public resources by private funding. Public Private Partnerships and variants thereof can be expected to play an important role in creating these mechanisms and models.
- The majority of funding currently flowing into adaptation is currently from the public sector. There is a need for a radical awareness change and significant capacity building efforts within the private sector to help investors, financiers and potential entrepreneurs understand, realise and exploit the opportunities provided by adaptation in the same way as they have since done in some Mitigation areas, specifically for example clean and renewable energy which in the meantime has developed into a mainstream investment activity in many countries.
- A parallel capacity building effort continues to be required in the public sector to embed adaptation thinking and approaches in all development activities.

It is anticipated that CTI PFAN can contribute to this transformation, principally by identifying and supporting the further development of those projects and activities which offer the most potential for private sector investment. Bottom up demonstration and real life implementation of adaptation measures using private capital can be expected to establish the investment community's acceptance that adaptation represents real investment and commercial opportunity and to build and reinforce their capacity to understand and manage the related risks, such that overtime private Financing of some adaptation activities becomes mainstream. Those sectors which currently appear to offer the most promise in this connection are:

- Agriculture (agri-business & agri-processing)
- Water & Sanitation
- Energy & Energy Access
- Tourism

In addition a number of cross cutting issues and coping mechanisms appear to provide frameworks which will help focus project identification and development activity. The coping mechanisms include principally micro-finance and micro-insurance which often facilitate the packaging and delivery of adaptation Products and Services (resilient crop varieties and other agricultural inputs, solar lighting kits for the rural poor, etc) and which are delivered through innovative business models, targeted specifically at the rural poor in areas of high vulnerability. A further cross cutting issue is urban development (which is driven by the accelerating urbanisation of many SSA countries) and which encompasses development sectors such as transport, waste, energy, water and other infrastructure as well as buildings (energy efficiency and green construction methods) which can also be expected to present opportunities for private investment.

It is proposed that these identified sectors and areas are targeted through a regional approach to leverage and exploit the geographical drivers identified and mentioned above, thereby potentially accelerating the outreach and impact of the programme and optimising the deployment of resources. Further refinement of this approach can be made through work on the case studies and the pilot.

Following the distribution and review of this paper the next step in the development process will be to analyse, discuss test and refine the above findings through the Exploratory Workshop and the Pilot. To achieve the maximum benefits from this process it is recommended that the Workshop should focus its attention on real life projects to the extent possible and that these projects be carried through into the pilot. Some potential case study / pilot projects have already been identified in this respect but further projects are solicited. This approach will further facilitate the smooth transition to the pilot phase which will follow on from the Workshop.

Project proposals can be made in any form but should include information on the following areas:

- A full description of the project (What? Where? How? Who?) – specifically include what climate change stress it responds to (this is how you know it is adaptation)

- Regulatory and market setting / framework
- Its rationale as an adaptation project and its envisaged adaptive impact
- Project development status (what has been done what remains to be done)
- An overview (to the extent possible) of the accruing commercial, financial and developmental benefits

Anybody wishing to participate in the Pilot Programme should register their interest with Thaven Naidoo, CTI PFAN Africa Adaptation Coordinator (adaptation@cti-pfan.net). A limited number of supported participations are available and requests will be considered on merit by CTI and CTI PFAN management.
