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GUIDEBOOK:
MOBILISING PRIVATE SECTOR FINANCE FOR CLIMATE CHANGE ADAPTATION

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March 2019

PREFACE

The “Guidebook: Mobilising Private Sector Finance for Climate Change Adaptation ” is a joint effort of Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH and Bankers Institute of Rural Development (BIRD).

As part of Indo-German Technical Cooperation on Climate Change and funded by German Federal Ministry of Economic Cooperation and Development (BMZ), GIZ India is implementing “Climate Change Adaptation in Rural Areas in India” (CCA-RAI) project in partnership with the Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India. The programme intends to integrate climate adaptation measures into the national and state development and strengthen the capacities of key actors for financing, planning, implementing and monitoring of climate change adaptation measures.

Bankers Institute of Rural Development (BIRD), an autonomous institution promoted by National Bank for Agriculture and Rural Development (NABARD), the apex financial institution in the area of Agriculture and Rural development in India is involved in training, research and capacity building in the field of rural development and financing. NABARD being the National Implementing Entity (NIE) for three important funding arrangements--Adaptation Fund (AF), National Adaptation Fund for Climate Change (NAFCC) and Green Climate Fund (GCF) aims to channelise national, international and private finance for adaptation and mitigation activities in India. Keeping in view the need for focused attention on capacity development on climate finance among the stakeholders, NABARD has taken the lead in establishing the Centre for Climate Change at BIRD, Lucknow. The centre is supported by BMZ funded Indo-German Cooperation Project on Center of Excellence on Climate Finance.

This guidebook has been prepared considering the market conditions and regulatory landscape prevailing during development of the document. With growing focus on private sector participation in climate change adaptation it is expected that new mechanisms might develop which may not be present in the document. Accordingly, the key objective of the guidebook is **“To facilitate preparation of adaptation project proposals and to provide guidance on alternate funding options with focus on private sector”**. The guidebook provides guidance in requisite tools and methodologies required for develop¬ing bankable adaptation projects along with information on alternate funding sources and investment models available to the private sector to mobilise funds for climate change adaptation. While the guidebook serves as a comprehensive source of information for planning an adaptation project, it is recommended that project proponent also take in to account the recent developments in the area of planning an adaptation project. It is envisaged that users of this guidebook will continually add their learning to further enrich this document and help keep the document relevant to future project proponents interested in developing climate change adaptation projects in India.

CONTENTS

Executive Summary

The manifestation of climate change i.e. a climate shock or stress, may lead to adverse effects which have direct and indirect impact on human beings and its surrounding ecosystem. Climate change adaptation interventions lead to adjustment in natural or human systems which help in responding to such manifestations or their effects. These interventions moderate the harm arising from climate change or exploits the beneficial opportunities. Traditionally adaptation interventions have been financed by the public sources and rarely taken up by the private sector. This phenomenon is explained by the "Development-Adaptation Continuum" which represents a spectrum from 'pure' development activities on the one hand to very explicit adaptation measures on the other.

As we move from pure development interventions in the left to pure adaptation interventions in the right, we observe a reduction in clearly identifiable revenue streams. The lack of explicit revenue opportunities in adaptation projects, thus reduces the propensity of the private sector in funding adaptation interventions. Apart from this inherent nature of adaptation project, the private sector also faces multiple problems such as low *bankability* of adaptation projects, lack of standardised methodology amongst lenders to appraise adaptation projects, limited access to information to design and develop adaptation projects, limited capability in developing inclusive business model and issues with the political economy.

Considering the scale of investment required for adaptation, it is imperative to increase participation of private sector and not leave the entire burden of investment on the public sector. The guidebook aims to achieve this objective by providing guidance in requisite tools and methodologies required for developing bankable adaptation projects along with information on alternate funding sources and investment models available to the private sector to mobilise funds for climate change adaptation.

The guidebook has been structured according to the three-stage approach generally followed in the development process of any climate change adaptation project viz. designing a climate change adaptation project, securing project funding, and project implementation. The genesis of any climate change adaptation project will be from a problem perception. This perception needs to be elaborated by means of a problem tree and validated by means of a climate risk assessment. Once the core problem, issues and the effect have been identified, a solution tree needs to be developed to identify the solutions. Pertinent to the adaptation context, these solutions can be clustered in to structural or non-structural projects. While structural projects involve development of physical infrastructure, non-structural projects involve use of knowledge, practice or agreement (like policies, laws, training, institutional strengthening, and technical assistance) to address a particular adaptation issue. The

projects thus identified, need to be tested for technical and financial feasibility (in case of structural projects) or socio-economic feasibility (in case of non-structural projects).

During the feasibility assessment of project options, an operating model need to be identified to the extent possible. A notable example of self-sustaining operating model is the Umbrella Programme for Natural Resource Management (UPNRM), a joint effort by National Bank for Agriculture and Rural Development (NABARD), KfW Group and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). The initiative, discussed in detail in the guidebook, promotes environmentally sustainable growth by encouraging private investments that are pro-poor. A defining feature of this project is the "Credit Plus" facility under which projects and businesses are provided loans with integral grant. Similar examples of self-sustaining models across various categories of adaptation projects are provided to give guidance to project proponents referring to this guidebook. The feasible solutions need to be prioritised to ascertain the sequence in which these projects need to be undertaken. As with any conventional project, a detailed project report (DPR) need to be prepared to proceed to the next stage i.e. financing. Pertinent to a structural project, climate resilient design standards need to be integrated in the DPR to ensure that a robust technical design is adopted.

THE GUIDEBOOK AIMS TO PROVIDE GUIDANCE IN REQUISITE TOOLS AND METHODOLOGIES REQUIRED FOR DEVELOPING BANKABLE ADAPTATION PROJECTS ALONG WITH INFORMATION ON ALTERNATE FUNDING SOURCES AND INVESTMENT MODELS AVAILABLE TO THE PRIVATE SECTOR TO MOBILISE FUNDS FOR CLIMATE CHANGE ADAPTATION.

A list of key requirements are provided in the guidebook for financing an adaptation project:

KEY REQUIREMENT FOR FINANCING AN ADAPTATION PROJECT

Sound project design: Solution development should be based on sound project design principles that take into account the specific needs of a climate change adaptation project

Stakeholder involvement: Ensure a comprehensive problem identification process has been undertaken and a robust solution has been developed through participation of all relevant stakeholders.

Sound governance and risk management framework: In order to ensure that project progress meets the expected standards, project governance structure needs to be well defined and comprehensive monitoring and evaluation (M&E) and risk management plans should be in place.

Monetising climate risks and benefits through economic internal rate of return (EIRR): Determine a quantitative value of the risks arising due to climate change and the benefits, including socio-economic benefits, to be realised by undertaking the project.

Appropriate finance mix: Based on the risk profile of the project and funds available with the project proponent i.e. its financial risk exposure, the appropriate debt to equity ratio should be determined.

High impact quotient: Develop a compelling value proposition for financing agency through devising of a clear revenue stream, by providing an enhanced brand value or by exhibiting a coherent alignment with the focus areas of the financing agency.

In order to secure funds for the project, the guidebook prescribes the selection of an appropriate funding source as well as a funding mechanism. There is a diverse range of sources available for financing a bankable adaptation project, wherein the guidebook provides key information required to understand the requirements and limitations of these sources. Examples of such sources range from crowdfunding, central/state government funds/schemes, capital market instruments, non-profit organisations/funds, private sector and financial institutions (FIs) and bilateral/multilateral funding agencies.

Apart from the case of self-financing, most of the aforementioned funding sources have seen to be reluctant to fund projects alone, even though feasibility has been established. This necessitates securing of funds from multiple sources and adopting an appropriate structuring of the funds to ensure risk normalisation. The guidebook provides guidance to the project proponents in the appropriate mechanism by which risk is normalised either by sharing the risk or increasing risk coverage viz. blended finance, partial risk sharing facilities (PRSF), insurance products. These concepts are discussed in the guidebook citing examples of their application. As the last stage of project planning, a brief introduction to project procurement is also present in the guidebook to assist the project proponent in procuring the requisite goods, services and works using appropriate procurement standards and guidelines.

This guidebook has been prepared taking into account the market conditions and regulatory landscape which were prevailing during its development period. With growing focus on private sector participation in climate change adaptation it is expected that new mechanisms might develop which may not be present in the document. While the guidebook serves as a comprehensive source of information for planning an adaptation project, it is recommended that project proponent also take in to account the recent developments in the area of planning an adaptation project. It is envisaged that users of this guidebook will continually add their learning to further enrich this document and help keep the document relevant to future project proponents interested in developing climate change adaptation projects in India.

Introduction to this Guidebook

2.1 Need for Climate Change Adaptation Projects

The adverse effects of climate change manifests either in the form of climate shock or stress (also referred to as slow-onset events). Climate shock refers to events which occur due to sudden changes in climatic conditions viz. cyclones, floods etc. usually causing widespread loss of lives and damage to property. Stress on the other hand, represents conditions that arise due to persistent change in climatic conditions usually leading to harmful health conditions. According to a synthesis paper prepared by the Secretariat of United Nations Framework Convention on Climate Change (UNFCCC)[1], climate change is leading to increased incidence of infectious diseases, including water-borne ones; lengthens disease transmission season, expands geographical range of many diseases like malaria and dengue among other health issues.

Apart from direct effects of climate change, indirect consequence of climate change can also have detrimental effects on human beings. For example, incidence of drought not only leads to loss of lives, but crop production gets adversely affected, leading to loss of livelihood of farmers. Repeated floods lead to soil degradation, thereby contributing to reduced crop production. Research[2] has shown that increase in temperature due to climate change will increase crop failure as well as decrease nutritional value of the crops that survive, leading to an extreme event of malnutrition eventually. Hence, adaptation to climate change can only be achieved if human beings and their surroundings, i.e. the ecosystem[3] (human beings, plant life (flora), animal (fauna) and other inorganic natural resources) can be made resistant to climate shocks and stress.

According to Inter-Governmental Panel on Climate Change Assessment Report 4 (AR4)[4] adaptation is defined as adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.

Hence, for any climate change adaptation project, the intended impact would be to increase resilience of the target beneficiaries. Outcomes would be the results of the project activities which result in realisation of the intended impact. For example, for a project which aims to improve livelihood of vulnerable farmers by introducing climate resilient seeds, outcomes, on the other hand, would be area provided with improved irrigation techniques, area with surface water storage capacity, farm productivity increase etc. Impact would be measured on the basis of number of farmers benefitted, increase in farmer income/living standards, and improvement in ecological balance due to lower water withdrawal.

The following table provides sectors of climate change adaptation based on various actors being affected and elements being safeguarded:

<table>
<tr><th rowspan="2">Outcomes of climate change</th><th colspan="4">Sectors of Climate Change Adaptation</th></tr>
<tr><th>Human Beings</th><th>Flora</th><th>Fauna</th><th>Natural Resources</th></tr>
<tr><td>Climate Shock</td><td>Disaster Risk Management</td><td rowspan="2">Agriculture and Agro-Forestry</td><td>Biodiversity protection</td><td>Soil and land protection</td></tr>
<tr><td>Climatic Stress</td><td>Public Health Management</td><td>Livestock Management</td><td>Integrated water resource management</td></tr>
</table>

A brief description of some key areas, significant from climate change adaptation perspective, is given below:

1. **Climate induced Disaster Risk Management:** Measures aimed at assessing, reducing and, managing the impact of new or existing risk from disasters caused due to climate change, e.g., early warning systems, construction of cyclone shelters, construction of flood ways, dams to prevent flooding, etc.
2. **Public Health Management:** Measures which help improve human ability to withstand climatic stress, e.g., undertaking anti-malaria drives in areas where mosquitoes are now breeding due to increasingly warmer climate, increasing focus on rehydration methods in heat islands, etc.
3. **Agriculture and agro-forestry:** Measures which help agricultural crops and other flora (especially that of forests) to adapt to the adverse impact of climate change and safeguard associated livelihoods, e.g., development of climate resilient seeds which can grow with limited quantity of water.
4. **Biodiversity protection:** Measures which help protect the fauna from climatic shocks and stresses, e.g., developing preventive measures to restrict spread of wild fires in forest areas susceptible to dry weather coupled with high temperatures.
5. **Livestock Management:** Measures which help domesticated/commercial grade livestock withstand climate shock and stress, e.g., constructing humidity and temperature controlled poultry yards.
6. **Soil and land protection:** Measures which prevent the degradation of fertile soil cover either due to climate shocks like floods, droughts or due to sustained climate stress like high temperatures, e.g., reduction of desertification through sustainable land and ecosystem management (SLEM)[5] approach.
7. **Integrated water resource management:** Measures to ensure that water is efficiently used and adequately conserved and stored to resist shocks like droughts and climatic stress, e.g., rain water harvesting.

The Inter-Governmental Panel on Climate Change (IPCC) also proposes that adaptation activities, regardless of what element is being made more resilient, should focus on how actively stakeholders in power are pursing it. To that effect, adaptation activities may be categorised either as:

1. **Reactive or anticipatory:** Reactive adaptation takes place after the initial impact of climatic shocks have taken place. Anticipatory adaptation takes place before impacts become apparent. In natural systems, there are is no anticipatory adaptation.
2. **Planned or autonomous:** Planned adaptation is consequence of deliberate policy action, based on the awareness that conditions have changed or are expected to change and that some form of action, whose outcome can be monitored through a closed but dynamic feedback loop, is required to maintain a desired state. Autonomous adaptation involves changes that systems will undergo in response to changing climate irrespective of any policy, plan or decision.

From both forms of classification, it emerges that any adaptation project has two crucial components – what is being protected, and how soon are the protective measures being undertaken.

2.2 Challenges in Financing Adaptation Projects

Currently, adaptation finance is being mobilised primarily from public sources such as National Adaptation Fund for Climate Change (NAFCC), international funding sources, development finance institutions etc. For understanding the underlying reason behind such a phenomenon, the concept of "Development-Adaptation Continuum" has often been referred[6]. The continuum represents a spectrum from 'pure' development activities on the one hand to very explicit adaptation measures on the other. At one end of the continuum (say left), the most vulnerability-oriented adaptation efforts overlap almost completely with traditional development practice, where activities take little or no account of specific impacts associated with climate change. At the opposite end of the spectrum (say right), activities are designed to target distinct climate change impacts, and fall outside the realm of development as traditionally defined. In between lies a broad spectrum of activities with varying degree of emphasis on vulnerability and impacts.

As one moves from the left to right, clearly identifiable revenue streams reduce and hence, funding of such projects are typically avoided by the private sector. This explains *additionality* of an adaptation project, i.e., irrespective of its development quotient, whether a project having clear adaptation benefits would have been implemented in a business-as-usual situation or not. If not, then such projects are termed *additional*. While *additional* projects are supposedly be financed from public funds, there is a scarcity of such funds due to other competing priorities in developing countries. This implies that scaling up of adaptation efforts would require significant contribution from multilateral concessional finance and private sector funds. Under appropriate conditions, public funds can and should play the catalysing role in attracting various forms of private sector funding into a climate adaptation project.

2.3 Challenges in mobilising Private Sector Funding for Climate Change Adaptation

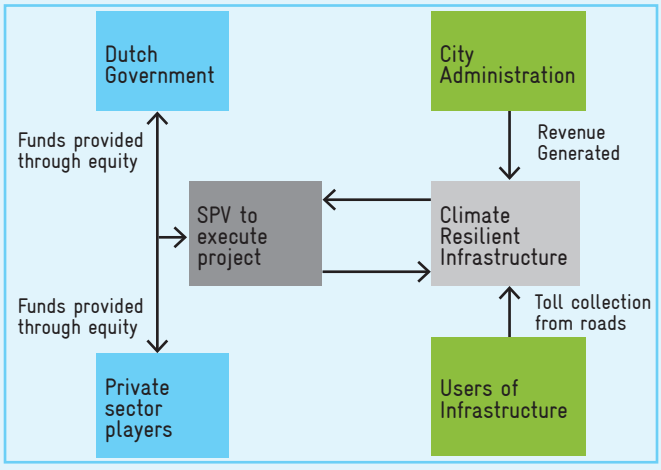
It is estimated that India needs over USD 1 trillion from 2015 to 2030 to adapt to adverse impacts of climate change[7], which impacts the lives of around 800 million people. In order to fund initiatives, the spending would have to reach USD 360 billion by 2030. In 2015-16, India established the National Adaptation Fund for Climate Change (NAFCC), a fund dedicated for financing adaptation activities. However, budgetary allocation for 2017-18 is INR 1.1 billion[8] only (USD 150 million), i.e., only 0.0057% of its GDP. While there are national level development programs and schemes which have adaptation co-benefits as their outcomes, they are still inadequate to address the entire gamut of future adaptation needs in India. In order to match the scale of funding, public funds should act as a catalyst to draw private sector funding and unlock additional funds thereof to mainstream adaptation initiatives in India.

Although private sector provides a massive opportunity in terms of unlocking funds for adaptation projects, this potential is yet to be realised due to various issues. These issues are given below:

1. **Low bankability of projects:** Investments in, for example, irrigation equipment, water-efficient technologies, stress-resilient crops or infrastructure improvements that could help to strengthen climate resilience, may provide potential business opportunities to private sector players. However, benefits associated with such climate-resilient investments may only manifest over longer time frames, and the extent of these benefits is dependent on uncertain climate impacts. While government/donor agencies consider Economic Internal Rate of Return (EIRR) for adaptation projects, private agencies normally adopt Internal Rate of Return (IRR)/ Return on Investment (ROI) for their investments. Hence, while government/ donor agencies may consider worthwhile, a simplistic IRR-based assessment increases the perception of risk in the eyes of private sector. To improve bankability, higher risk coverage/ insurance is necessitated which would require public sector intervention for cost recovery. The interventions can be in the form of establishing market mechanisms (like water tariff in case of irrigation equipment technologies) or by developing risk sharing/coverage mechanism.

EXAMPLE OF IMPROVED BANKABILITY OF ADAPTATION PROJECTS THROUGH PUBLIC SECTOR INTERVENTION

A coastal development project in Jakarta, Indonesia[9] exhibits the role that risk coverage from public sector can play in bringing in private sector participation for adaptation project. This project involves the construction of a Giant Sea Wall with an estimated of cost USD 40 billion, with a 20 year construction period and construction of 17 artificial islands with homes and office space. Sale of home/office space, through public private partnership (PPP) mode, was expected to help recover a large share of the investment costs. While risks from climate-originated and ocean-based hazards were reduced, private sector envisaged a risk of selling home/office areas on artificial islands. In order to reduce the risk of the private sector actors, the city administration guaranteed to buy back the islets from the construction companies. In addition, advance payments of USD 13.8 billion were committed by the Dutch Government, through an SPV it was a part of, to initiate the project.



2. **Lack of standardised methodology amongst lenders to appraise adaptation projects:** Financial institutions are reluctant to lend to investments in adaptation projects, often due to incomplete information or higher perceived risks because of the lack of track record, borrowers' inadequate collateral, or lack of capacity of financial institutions in appraising and financing non-traditional technologies or initiatives. In most cases, the appraisal processes are unable to capture the bankability or cost recovery and/or future cost-avoidance potential of a project.

EXAMPLE OF LIMITED CAPACITY OF BANKS IN APPRISING ADAPTATION PROJECTS

A coffee-processing company in Rwanda10 was getting increasingly affected by climate change impacts and multiple initiatives to reduce the vulnerability of the company were implemented. These initiatives included a mix of smaller actions and relatively larger structural measures, a combination of which required considerable capital. For example, smaller actions included planting shady trees across the coffee plantations, applying organic pesticides and including new pest-resistant coffee plant varieties. The structural initiatives included installation of a renewable/biomass fuel-powered dryer. The company, was however, unable to obtain a bank loan for these operations due to lack of adequate capacity of financial institution in appraising the initiative. Since, there was a clear impact of climate change on the business operations, the company was compelled to fund the initiatives from its working capital. However, in cases where the impacts are indirect, such a scenario would lead to complete avoidance of adaptation initiatives.

3. **Limited access to information to design and develop a climate-adaptation projects:** Private sector players have limited access to investment-relevant and usable data, information, and tools to integrate considerations of long-term climate trends and impacts into site/ value chain/ supply chain-specific business decision-making. In absence of such very crucial and credible and authentic data/estimates about future climatic impact, the technical ability and expertise to identify, conceptualise and design climate-resilient projects and explore appropriate financing for those projects remain grossly handicapped.

EXAMPLE OF CHALLENGES CAUSED TO LIMITED ACCESS TO INFORMATION AND EXPERTISE

In 2012, micro-insurance broker Guy Carpenter LLC11 and the insurance companies Hollard and EMOSE launched a satellite-based weather index insurance in Mozambique, which covers cotton and maize farmers against risks of drought, low temperatures and excess rainfall. It also enables them to access the capital they need to invest in inputs and production to improve crop yield and food security. The biggest challenge in implementing the insurance product was the lack of data on historical exposure and crop yield, which increased uncertainty around product design. Disseminating technical information regarding the product to smallholder farmers was also identified as a challenge. This barrier was overcome only when a multi-stakeholder approach was implemented taking all actors, invested in agricultural risk management, into consideration for design of the project. The resultant design possessed mitigation or avoidance potential for a variety of cross-sectoral risks and it was acknowledged that Guy Carpenter LLC alone would not have been able to foresee or quantify, on a probabilistic scale, all such risk factors.

4. **Lack of financial incentives to drive adaptation:** Other than where their direct business operations or supply chain are affected, private actors lack an incentive to finance public adaptation activities (for example, investments in a healthy watershed, or a storm-resilient coastline). Such activities often do not involve a market rate of return on investment and much of the benefit may accrue to other actors, including individuals and other firms, instead of rewarding only the party that made the investment. Furthermore and in most cases, companies do not yet have the tools to calculate the direct and indirect benefit they receive from operating in a more resilient community and hence, are not aware of the financial benefit received by implementing the project. Hence, any involvement is usually a reaction to business losses with a direct bearing on climate change.

5. **Limited capability in developing an inclusive business model for climate change adaptation initiative:** Climate mitigation projects usually present opportunities wherein private sector

can directly invest and business benefits are often realised due to clearly associated revenue stream. While adaptation projects can also open up large market opportunities, these are not easily discernible. For example, a coastal embankment by itself has a strong adaptation component but no clear revenue stream. However, if this embankment is co-modelled as a tourism destination, the local economy and revenue streams that are likely to develop would probably recover capital expenditure. The core issue, hence, lies in the design and delivery of a project. This often requires the private sector to design some innovative value proposition which could offer climate adaptation benefits while multiplying economic incentives for larger stakeholders.

EXAMPLE OF LIMITED PRIVATE SECTOR PARTICIPATION DUE TO LACK OF ESTABLISHED MARKET

In 1999, malaria was killing nearly one to two million people a year and pipeline for new antimalarial drugs was virtually empty, since possibility of profit in antimalarial drug development was considered too low to attract pharmaceutical investment. The Medicines for Malaria Venture (MMV)12, a not-for-profit 'Product Development Partnership' was setup by Governments of Netherlands and Switzerland, UK Department for International Development, The World Bank and Rockefeller Foundation to discover, develop and deliver safe and effective anti-malarial agents. What started as an initiative by public bodies, MMV now has considerable private sector participation and includes 28 pharmaceutical companies, 13 biotech companies, 56 universities, 38 research institutes, 72 clinical sites apart from 50 government agencies. This provides a clear example where enterprise development support has helped open up a new market for private sector participation.

Such projects may also be developed on a platform-basis where a single donor-driven SPV conceptualises a large eco-tourism project and attracts institutional non-equity investments at fixed returns for project development and operations.

6. **Political economy issues:** Investors interested in adaptation financing are also concerned about uncertain political environment, where stability and assurance of a continued green growth agenda might be absent. For example, in India, the National Adaptation Fund for Climate Change (NAFCC) has witnessed a drop in fund allocation from INR 1.3 billion in 2015-16 to INR 1.1 billion in 2017-18[13]. Similarly allocation for Climate Change Action Plan has reduced from INR 1.4 billion in 2015-16 to INR 0.4 billion in 2017-1814. Since private sector participation in climate change adaptation projects is still limited, support from government institutions is essential to support existing levels of participation and stimulate the future levels of participation of private sector. Such reductions in allocations sends a signal to investors of declining government interests in climate change action. Also, potential finance for adaptation projects is often confronted with government policy instruments like subsidies and tariff which favour environment-unfriendly practices. In such cases, driving private sector participation in adaptation initiatives becomes even more difficult.

EXAMPLE OF DETRIMENTAL EFFECT OF GOVERNMENT POLICIES ON POTENTIAL ADAPTATION INITIATIVE

In Bangladesh15, the water price is not determined by the market, but fixed at a lower level by the government. Because water has such a low price, businesses are hardly incentivised to increase water efficiency. It was only when a pilot project was undertaken under IFC's Cleaner Production project, was there any private sector participation. The grant investment of USD 100,000 under this project helped DBL Group, one of Bangladesh's largest garment and textile conglomerates upgraded equipment and fixed insulation and leaks in order to conserve water. The initiative led to savings for the group amounting to USD 500,000 in year one. A water tariff in this case would have provided adequate incentive to the private players to pursue water conservation initiatives independently.

2.4 Brief Literature Review on Developing and Financing Adaptation Projects

Several toolkits and guidance material exist on the topic of adaptation project development and financing. A synopsis of these documents are presented below:

ADAPTATION PROJECT DEVELOPMENT

a. Guide to Project Design Document Preparation for EU-GIZ Adapting to Climate Change and Sustainable Energy (ACSE) Programme (EU-GIZ)[16]: The document serves as a guide to project proponents preparing proposals seeking funding under the ACSE programme and the structure of the document is aligned to the project proposal template. Pertinent to the current context, the document provides a logical flow for project design and contains a robust risk management process.

b. Designing Climate Change Adaptation Initiatives: A UNDP Toolkit for Practitioners[17]: It provides step-by-step guidance, adequately supported with requisite tools and techniques, on planning and designing an adaptation initiative. The guidebook draws from the experiences of country-led UNDP supported initiatives in developing countries.

c. Guide to Climate Adaptation Project Preparation (USAID)[18]: The guidebook contains the tools, techniques and guidance notes which will help project proponents prepare a climate change adaptation project proposal. It aims to address the capacity gaps observed during the USAID Adapt Asia-Pacific project implemented across Asia and the Pacific.

d. GCF Proposal Toolkit (CKND & Acclimatise)[19]: The guidebook provides extensive guidance on the requirements for developing a Green Climate Fund (GCF)[20] funding proposal for climate change mitigation and adaptation projects. It provides insight on the GCF project cycle, its strategic areas, project proposal template and other related information. Pertinent to the current subject, the guidebook provides the step-wise tools and techniques required for designing a climate change project. The tools techniques can be adequately adopted for both mitigation and adaptation projects.

e. Identifying adaptation options (UKCIP)[21]: The guidebook provides specific information on how to identify and select adaptation options that can be used to respond to climate risks.

f. Integrating Climate Change Adaptation in Project Development (EUFIWACC)[22]: The document provides general guidelines that need to be taken into consideration while designing an adaptation project viz. assessment scoping, project planning, analysing and explaining risks, costs and benefits. Developed by technical experts collaborating in EUFIWACC with substantial experience in designing and implementing adaptation projects globally, these guidelines serve as a tool to the potential project proponent to help assess whether the process being chosen will help effectively achieve the adaptation objective.

ADAPTATION FINANCING

a. Demystifying Adaptation Finance for the Private Sector (BMZ-UNEP-GIZ)23: The report focuses on barriers inhibiting private financial flows for adaptation and how these barriers can be removed by public intervention. It does so by analysing a sample of 28 global case studies on adaptation to climate change by private sector actors. Pertinent to the current subject, the report provides multiple case studies related to private sector finance in climate change adaptation projects.

b. **Mobilising Adaptation Finance in Developing Countries (CICERO)[24]:** This report examines barriers to stimulating adaptation finance within the context of different policies, instruments and approaches currently being implemented. It contains innovations related to adaptation finance and policy initiatives to stimulate increased adaptation finance.

c. **Private Investment, Market mechanisms and climate change adaptation: Options for closing the Adaptation Financing Gap (DNV KEMA)[25]:** A concept brief highlighting key challenges to effective adaptation investment and providing short menu of solutions that might potentially play a part in raising required funds. Pertinent to the current subject, the document contains innovative financing mechanism like catastrophe bonds.

d. **Emerging solutions to drive private investment in climate resilience (CPI - Ministry of Infrastructure and Water Management, Government of Netherlands)[26]:** This working paper provides emerging insights from the experience of seven development finance institutions (DFIs) in driving private sector investment in climate resilience. In particular, it looks at the tools and approaches designed by these DFIs to address pre-investment and investment stage barriers holding back private investment in measures that would enhance the resilience of infrastructure, water intensive industries and agriculture.

e. **Estimating Mobilised Private Finance for Adaptation: Exploring Data and Methods (CPI - OECD)[27]:** The document, prepared under the Organisation for Economic Co-operation and Development (OECD) hosted research collaborative on tracking private sector climate finance, aims to understand private finance for climate change adaptation by developing and evaluating a range of methodological options to estimate private finance mobilised for climate action in developing countries.

f. **Adaptation finance by private fund for private investment (Standing Committee on Finance, UNFCCC)[28]:** The document provides a detailed information on climate insurance as an instrument for increasing private sector participation in climate change adaptation sphere. Specific examples of Weather Index based insurance being used for agriculture in Thailand has been provided to demonstrate real life application of the concept.

g. **Private Sector Engagement in Climate Change Adaptation (GEF)[29]:** It is a note developed to inform the Least Developed Countries Fund (LDCF) and the Special Climate Change Fund (SCCF) council of the opportunities for the private sector to a play a greater role in climate change adaptation. It contains examples of insurance and reinsurance products as well as actions taken by international organisations in supporting private sector investment in climate change adaptation.

h. **Adaptation Private Sector Initiative (PSI) of UNFCCC[30]:** It provides a database on the private sector participation in the climate change adaptation sphere.

i. **Navigating a New Climate (UNEP and Acclimatise)[31]:** The document contains the methodology adopted, the results and lessons learnt by 16 of the world's leading banks (coordinated by UNEP Finance Initiative) in applying a scenario based approach for estimating impact of climate change on their corporate lending portfolios. This report has helped provide an alternate credit risk mechanism specifically for agriculture, real estate and energy sectors.

While the literature mentioned above provides substantial information on designing an adaptation project as well as means of increasing private sector participation in such projects, they have been developed for specific contexts and lack India specific considerations. This guidebook aims to build on this existing knowledge and add specific focus on innovative private sector involvement mechanisms or financing structures taking into account the existing scenario of awareness regarding climate change adaptation in India. The potential project proponents in India require wider awareness and capacity building for development of new and innovative adaptation projects at scale that can be supported through private sector financing.

The value proposition of this guidebook is to present a step-by-step approach which incorporates the globally accepted concepts, tools and techniques for designing a bankable adaptation project and integrates them in a seamless fashion with the means and modalities to attract 'private sector financing' in such projects. The case studies and evidences (contained in ☐), provide an authentic perspective of multiple issues identified in its various sections and clearly exhibits the significance of the concept being discussed. It has been aimed to pool in Indian examples as much as possible to impress upon the reader, how concepts, developed in the global level, can be adopted to suit the Indian context as well.

2.5 Objectives of this Guidebook

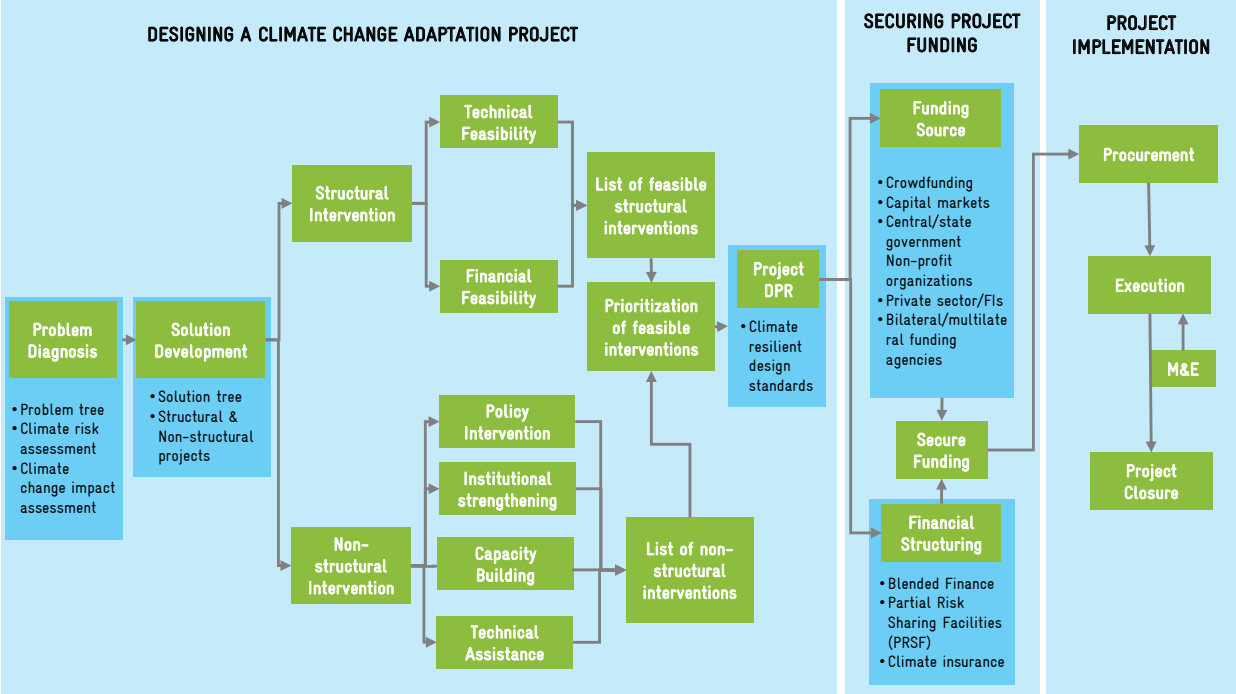
In the previous sections we have discussed the various technical and structural (policy and regulatory) issues related to designing a bankable climate change adaptation project as well as the issues causing limited participation of private sector in climate change adaptation. The scope of the guidebook, does not cover the structural issues which require policy and regulatory changes for the development of the adaptation project market. The objective of the guidebook is to provide solutions to the technical issues which can be addressed through adequate capacity building of the project proponents and other relevant stakeholders. These technical issues are specific to the diverse group of stakeholders involved in designing, planning, implementing and financing a climate change adaptation project. The benefit that the guidebook aims to provide to each of these group of stakeholders is given below:

- Support government/non-government entities involved with designing adaptation projects in developing bankable climate adaptation projects while manoeuvring around the several pitfalls listed above. The guidebook provides an established framework for designing an adaptation project, as elaborated in Section 3.
- Support governments at various levels to build capacities of relevant stakeholders on developing adaptation projects through alternate funding sources. Section 4.1 provides the guiding factors and principles to be adopted for seeking funds for each particular source, thereby helping design capacity building initiatives around it.
- Support Adaptation Fund National Implementing Entities (NIEs), GCF Accredited Entities (AEs) and similar government/non-government entities or organisations in appraising project proposals that seeks private sector engagement – quantifying adaptation benefits, return on investment, institutional/legal/ policy framework. The key requirements for apprising each specific areas of project design of an adaptation project is provided under the sub-sections of Section 3.
- Equip potential project developers and proponents, both from the public and private sector, with tools for developing climate change adaptation projects in a way which ingrains conventional business philosophies adopted during project development. Reference to these tools have been provided in various sub-sections under Section 3, which deals with designing an adaptation project.
- Helping private sector organisations as well as government entities choose from an available mix of instruments and investment models to mobilise funding in projects with climate adaptation benefits as given in Sections 4.1 and 4.2.

2.6 Structure of the Guidebook

This guidebook has been drafted to resemble the typical three-stage approach which any adaptation project development process would follow. The flowchart given below provides the flow of activities from the project design to the implementation stage. For each activity, concepts perti-

nent to climate change adaptation is provided in boxes marked in☐. These concepts have been discussed in detail in the relevant section of the guidebook.



Each succeeding chapter of this guidebook details out the procedure proposed for project proponents to adopt while conceptualising and/or developing adaptation projects. At relevant sections, the guidebook consists of anecdotal references and best practices observed both in India and also globally.

Stages of Project Development	Role of each stage
Problem Identification	What is/are the issue(s) that need(s) to be addressed?
Solution Development	What are the options to resolve the problem and what will be the scope of these options?
Feasibility Assessment and Prioritising Options	What are the options whose benefits outweigh the costs? What will be the order of execution of these options?
Detailing the Project	What are the technical, financial, statutory and other requirements for executing the prioritised project? What would be the project's operational model?
Project Financing	Who will be providing financial resources to execute the project and what will this mechanism be?
Procurement	What are the products and services that need to be procured for executing the project and what will be the corresponding mechanism for procurement?

While the first four sections have been brought together in Chapter 3 - *Designing a Climate Change Adaptation Project*, the remaining sections on financing and procurement have been discussed in detail in Chapters 4 & 5 respectively. Across these three chapters, key takeaways envisaged from this guidebook are:

1. **Methodology to appraise adaptation projects:** Banks' appraisal process has been elaborated and guidance on how to develop a bankable case for the financial institutions to fund the project is provided under sub-section "Identify potential financing sources" under Section 4.1.1.

2. **Reference to globally recognised tools and knowledge sources for undertaking technical assessments:** The methodology described in the guidebook provides a roadmap for planning and executing adaptation projects as well as requisite tools that can be implemented and knowledge sources that can be referred to bridge the information gap. Throughout the description of the methodology, areas where engagement of experts are required have also been pointed out to bridge the gap on expertise requirement.

3. **Deep dive into assessment of loss and damage avoided by climate shocks and stress:** The guidebook provides tools for project proponents to monetise the loss avoided by undertaking an adaptation initiative. This will help the proponent visualise the scale of impact and hence, provide the incentive to undertake an adaptation project.

4. **Structuring adaptation projects:** An effort has been made across the guidebook to apprise the project proponent of various options for generating revenue from adaptation projects. Such options are discussed in Section 3.2.7 of the guidebook. Developing such revenue options has the potential of developing new markets for adaptation products and services.

There are certain issues, more structural in nature, which require policy and regulatory changes for the development of the adaptation project market. Addressing these issues is beyond the scope of this document.

Designing a Climate Change Adaptation Project

3.1 Problem Identification

TASKS

- Formulate Problem Perception
- Establish core problem, its causes and effects
- Validation of causes through preliminary data
- Establish whether project can be classified as an adaptation project
- Identify climate risk and validate Problem Tree
- Climate change impact assessment

TOOLS/KNOWLEDGE SOURCES

- Problem tree
- Climate Risk Assessment study

The project initiators/proponents need to create a statement which encapsulates the problem that they wish to get investigated. This statement will be considered as the problem perception and like a perception, this statement will be an empirical conclusion based on general observation. Ideally, the project perception should include the basic issue and the geographical region where this issue has been observed. A project perception statement will be like - *Shortage of food in X Region of State Y*.

3.1.1 ESTABLISH CORE PROBLEM, ITS CAUSE, AND EFFECTS

The "Problem Tree" technique is used to establish the "Problem Perception" statement – core problem, its causes and effects. This step is a key ingredient to the success of the project since failure to realise the complexity of the problem, including direct and indirect causes/drivers can lead to flawed project design, subsequently leading to failure of achieving the intended objectives.

The Problem Tree helps to identify key constraints to be addressed through the project by mapping out the problem and, gathering data and evidences on its causes and effects[32] – the trunk representing the problem, the roots representing the causes and the branches representing the effects. Being a demand responsive approach which involves the participation of the affected population in the decision making, problem tree approach helps in identifying the most pressing concerns of the stakeholders.

Creating a Problem Tree should ideally be undertaken as a participatory group event using visual techniques, such as flipcharts or colour cards, in which identified stakeholders can write their individual problem statements.

It is recommended to have a small focus group comprising the affected people along with subject matter experts, government and non-government organisations including NGOs, philanthropic organisations and private sector enterprises who are functioning in the project area. The supply chain or workforce of such private sector entities may be adversely affected due to observed problem perception, hence the significance of their presence. Mobilisation of these wide array of stakeholders is expected to happen through initial sensitisation activities undertaken by the local government agency, optionally, in collaboration with an NGO.

This will help bring together all the relevant stakeholders who are likely to get affected by climate change in the given region and leverage their individual competencies to ensure all possible causes and effects of the main problem is identified.

At heart of the exercise is the discussion, debate and dialogue that is generated as factors are arranged and re-arranged, often forming sub-dividing roots and branches. It is imperative that the opinions of the stakeholders are recorded and analysed by the group to ensure that all possible

parameters are recorded. A few questions to periodically provide direction to the discussions are given below:

a. Does this represent the reality? Are the economic, political and socio-cultural dimensions to the problem considered?

b. Which causes and consequences are getting better, which are getting worse and which are staying the same?

c. What are the most serious consequences? Which are of most concern? Which criteria are important?

d. Have considerations for gender and other forms of social inclusion been captured? How do the results vary with and without such consideration?

e. What are the evidences which substantiate the statement being made?

f. Has an agreement been reached on the decisions taken?

The development of the Problem Tree starts with the identification of the core problem i.e. trunk, followed by the effects of this problem i.e. roots and subsequently the effects i.e. branches. A brief description of these steps are given below[33,34,35]:

a. **Identification of core problem:** The exercise begins with the group listing negative statements that describe the situation being analysed. Negative statements should be backed by empirical evidence or observation. For example, a statement like "Productivity has decreased" can be substantiated by an empirical statement like "In the last 3 years, production from a unit area of land has gone down from X metric tonne to 0.8X metric tonne." Once people agree that most of the important issues have been identified, the negative statements that have some similarities or common links need to be identified. Looking for similarities and links among the statements should help identify a core problem (or problems).

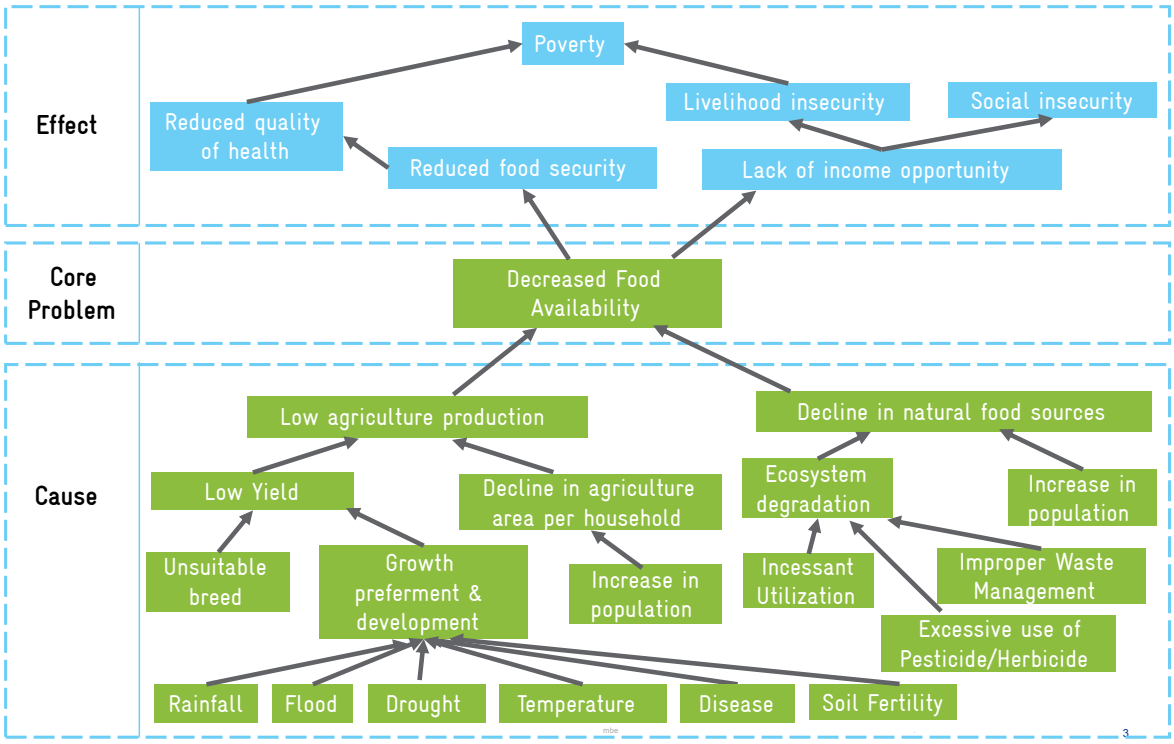
b. **Identification of causes and effects:** The other negative statements put forward by the group needs to be examined. These statements may be causes that lead to the core problem or effects that stem from the core problem. All the statements need to be clarified and placed on the appropriate classification (cause or effect). Any statement which remains unclear after clarification needs to be discarded.

c. **Finishing the construction of the tree:** The process of arranging the causes and effects at the root and the branches respectively needs to be continued, noting their relationships to each other. The goal here is to provide a relatively simple road map of how one event leads to another, which leads to another, and finally to the core problem that has been identified. In most cases, the group will note that reality is very complicated since relationships between causes and effects can go both ways and most problems do not follow a simple, linear progression.

   While it is important to identify these interactions, the most important links need to be noted. A cluttered Problem Tree will not be a useful tool and hence a balance needs to be established wherein there is enough detail to provide useful information yet it is simple enough to clearly establish the main links between problems. Hence, it is advised that the causes should be arranged up to a maximum of three levels. If there are any causes that may come up in the discussion that go beyond the stipulated levels, they need to be integrated into the third level causes.

d. **Verifying logic of tree:** In order to check the logic of the Problem Tree, the group starts from the level of the causes and working up to the effects. Each problem or group of problems should logically lead to the next. In case of any disruption in the flow of logic, clarification with the group should be undertaken to establish the logic. Once this logic of the entire tree has been established, the problem tree can be deemed to be complete.

An illustrative example of a Problem Tree working on the core problem of decreased food availability is given below[36]:



Once the Problem Tree is established, the evidences for each of the statements provided by the participants shall be verified by comparing with the available historical data. This validation will help substantiate the empirical statements made by the participant, thereby making the Problem Tree more robust and transparent.

The causes identified above will be analysed to establish:

- whether a majority (i.e. more than 50%) of them can be directly related to climate change,
- which form of adaptation measure (one or more of the six types identified in Chapter 1) would be relevant

NEED FOR DEVELOPING A PROBLEM TREE

Development of a NAFCC project[37] on creating climate resilient livelihood for vulnerable groups around Kaziranga National Park (KNP), provides a classic example of how developing, problem trees through consultative process can provide information pertinent to local needs.

Assam's economy is largely agrarian and 86% of its rural population is dependent on agriculture and allied activities (like fisheries and forests) which together contribute 34% of the gross domestic product of the state. Agriculture in Assam is a water intensive sector - 81% of the water withdrawn from the available sources is for irrigation.

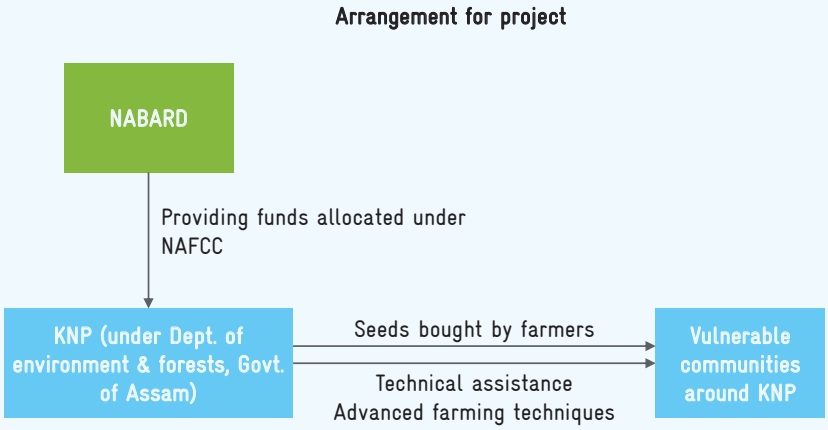
Due to climate change, decrease in annual rainfall and increased extreme rainfall events have caused flash floods, severely impacting agricultural production. High run offs during these extreme rainfall events also cause siltation in surface water bodies thereby reducing their water holding capacity. Further, flash floods also affect the rate of ground water recharge, hence affecting access to potable water, as well as causing several landslide events due to soil liquefaction. These landslides cause damage to housing structures, further reducing the coping capacity of affected population to the crisis. Based on estimates made by Government of Assam, the state loses 80,000 hectares of fertile land every year during flood. If the existing

trend continues, climate change will negatively impact the water resources sector by increasing freshwater scarcity, which is already a problem for Assam in the summer. The predicted increase in average temperature and decrease in the number of rainy days due to climate change will further stress water resources. This problem is compounded by high levels of groundwater extraction, which can be expected to continue, given Assam's growing population and reliance on agriculture.

The issues discussed above were magnified on the outskirts of ecologically sensitive zone of Kaziranga National Park where agriculture activities were undertaken. In order to understand the impact and root causes of these issues as well as devise requisite solutions, local level consultation had to be undertaken with the concerned stakeholders i.e. farmers, local administration, national park administration as well as with sectoral experts. Developing a Problem Tree provided the ideal tool for comprehending the multi-stakeholder perspective of the issue.

A socio-economic survey of the existing 33 EDC (Eco Development Committee) villages in KNP by WWF indicates that 85% of the families living in these EDCs are marginal and landless. These communities have limited capacity to adapt to climate change related vulnerability. Many families in these EDCs lack minimal facilities like safe drinking water, sanitation, health facilities. These communities rely on the 300-odd waterbodies, rivulets and streams of KNP for their household requirements as well as irrigation needs. Also, the forest cover of KNP was also reducing due to encroachments for firewood extraction by these communities. It was established that while the communities were dependent on the KNP to compensate for their lack of livelihood options and lack of essential facilities, the ecological balance of KNP was deteriorating due to this dependence. The twin issues of livelihood options and maintenance of ecological balance of KNP had to be resolved.

Consultation with sectoral experts in agriculture and pisciculture helped identify a number of initiatives to increase livelihood options of the communities as well as protecting the ecosystem of KNP. These include rejuvenating selected water bodies (beel) within KNP and augment water holding capacity to reduce intensity of floods. Also, the project aims to increase livelihood options by mainstreaming organic farming and fisheries in the northern and southern periphery of the park.



3.1.2 IDENTIFY CLIMATE RISK OF SYSTEM AND VALIDATE THE PROBLEM TREE

After it is established that the problem under consideration has considerable linkage with climate change, a climate risk assessment needs to be undertaken to understand the degree to which geophysical, biological and socio-economic systems are susceptible to, or unable to cope with, adverse effects of climate change including climate variability and extremes. This step is expected to scientifically validate the problem tree outcomes and hence provides additional robustness to the project design. More importantly, where private sector or financial institution

involvement is being pursued, the climate risk assessment provides such prospective funders with a risk portfolio to suitably price the capital they intend to invest in the project. The specific need for risk assessment in the context of climate change adaptation project development is given below[38]:

In order to understand this assessment, important terms, as provided in Fifth Assessment Report of IPCC (AR5)[39], have been defined below:

1. System of interest: The system of interest defines the boundary for which assessment will be conducted and includes something of value like lives, livelihoods, health, ecosystems and species, economic, social and cultural assets, services (including environmental services) and infrastructure. Its specific nature depends on the purpose of the assessment and can be delimited by either socio-economic boundaries (e.g. country, state, district, community, groups within a community) or natural/ecological boundaries (e.g. river basin, sub-basin, watershed, agro-climatic zone, and ecosystem).
2. Risk: The potential for consequences where something of value (like) is at stake and where the outcome is uncertain, recognising the diversity of values. Risk is often represented as probability or likelihood of occurrence of hazardous events or trends multiplied by the impact. It is a function of hazard, exposure and vulnerability.
3. Hazard: The potential occurrence of climate-related physical events or trends or their physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems and environmental resources. A hazard is not necessarily an extreme weather event (e.g. tropical storm, flooding), but can also be a slow onset trend (e.g. less water from snow melt, increase in average temperature, sea-level rise, salinity intrusion, etc.). If possible, the probability of a specific hazardous event or trend should be estimated.
4. Exposure: The presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected.
5. Vulnerability: The propensity or predisposition of the system of interest to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt. It comprises two elements:
   - i. **Sensitivity:** Factors which directly affect the consequences of a hazard. It may include ecological or physical attributes of a system (e.g. type of soil on agriculture fields, water retention capacity for flood control, building material of houses) as well as social, economic and cultural attributes (e.g. age structure, income structure).
   - ii. **Capacity:** It gives the ability of societies and communities to prepare for and respond to current and future climate impacts. Capacity comprises two major components:
     1. **Coping Capacity:** The ability of people, institutions, organisations, and systems, using available skills, values, beliefs, resources, and opportunities, to address, manage, and overcome adverse condition in the short to medium term.
     2. **Adaptive Capacity[40]:** The ability of a system to adjust to climate change (including climate variability and extremes) and to moderate potential damages. It refers to the pool of assets (social, physical, financial, natural, human, and cultural) and re-

sources (technological, knowledge and governance) which an individual, household or community may mobilise in order to cope with climate change impacts.

Detailed description of each stage of the climate risk assessment is given below:

3.1.2.1 STAGE 1: DEFINING PURPOSE OF CLIMATE RISK ASSESSMENT

This section helps to establish the rationale as to why the study is being undertaken. In the current context, climate risk assessment aims to provide a quantified output on the impact of climate change in the selected geographical region which will be used to establish the severity of the situation.

3.1.2.2 STAGE 2: PLANNING THE ASSESSMENT

Step 1: Set boundaries of climate risk assessment

In order to accomplish this task, the following activities need to be undertaken:

Activity	Description
Define resources available	Identify resources (viz. financial resource, human resource and time) available for assessment
Define system of interest	Define socio-economic boundaries (e.g. country, state, district, community, groups within a community) or natural/ecological boundaries (e.g. river basin, sub-basin, watershed, agro-climatic zone, ecosystem) for the project
Identify unit of study	Administrative or socio-economic units (e.g. district, block, village, household, gender group) or natural/ecological units (e.g. river sub-basins, watersheds, and agro-climatic zones) need to be surveyed Dependent on the purpose of the assessment

Step 2: Define the general approach of climate risk assessment

The decision for a certain climate change risk assessment approach depends on the specific purpose of the assessment, its focus, the system of interest, its unit of study, and the available resources. Based on these factors, either of the two approaches may be adopted. A brief introduction to both approaches are given below:

1. **Top-Down Approach:** This approach tends to focus on quantifiable biophysical effects of climate change. Scenarios of future socio-economic development are fed into mathematical models to forecast future climatic variables, e.g. mean annual precipitation, mean annual temperature, amount of monsoon precipitation, etc. Subsequently, the future state of the system of interest is evaluated according to previously defined criteria.
2. **Bottom-up approach:** This approach provides an analysis of what puts citizens in situations vulnerable to a given natural hazard, thereby addressing the underlying development context behind people's vulnerability to climate change rather than focusing on the hazard itself, as is the case with the top-down approach.

The following matrix will provide guidance to the project proponent in the requirement of each approach for the factors involved in the study:

Factors	Top-Down	Bottom-up
Geographical extent	Larger geographical extent, ideally at national, state level	Smaller spatial area, ideally at district, city level
Available resources	Highly skilled personnel required with technical knowhow of using specialised computer software. E.g.[41]: Coastal Zone Simulation Model(COSMO), Water Evaluation and Planning System (WEAP), Agricultural Production Systems Simulator (APSIM) Number of personnel required is low	Moderately skilled personnel required for collecting local data as well skilled personnel for data analysis Number of personnel required is high to facilitate stakeholder participation exercises as well undertake data analysis
Availability of data	Detailed level of climatic data and other socio-economic indicators should be available	Limited amount of local level climatic and socio-economic data, available from secondary sources can be supported by local data gathered through surveys
Indicative list of stakeholders involved	Governmental agencies (for data), research institutions and consultancies (for specialist knowledge)	Local stakeholders, marginalised groups, NGOs working in the area

Depending on the prevailing conditions for each factor mentioned above, the project proponent can select the suitable approach.

3.1.2.3 STAGE 3: ASSESSING CURRENT CLIMATE RISK

The Vulnerability Sourcebook[42], referred in conjunction with a risk supplement[43] provides step by step direction on conducting climate risk assessment based on the AR5 definitions. A brief overview of the various modules contained in the guidebook and adopted to the climate risk context are given below:

No.	Module	Significance of module
1	Preparing the risk assessment	Develop an understanding of the context of climate risk assessment for adaptation Identify objectives and expected outcomes of the assessment Determine scope of assessment Preparation of an implementation plan
2	Developing impact chains (these may be adopted from the problem tree that has been developed in the previous section)	Identify potential climate impacts and risks Determine hazard(s) and intermediate impacts Determine vulnerability of social-ecological system Determine exposure
3	Identifying and selecting indicators for risk components	Selection of factors describing hazards, vulnerability and exposure Identify indicator levels for each factor
4	Data acquisition and management	Identify data required to assess the indicators Identify sources from which data can be provided Undertake documentation of the data
5	Normalisation of indicator data	Determine scale of measurement for each indicator and normalised on a common scale of measurement
6	Weighing and aggregating indicators	Allocate weightage to each indicators to capture the degree of influence on a risk component Develop composite indicator for representing a single risk component
7	Aggregating risk components to risk rating	Allocate weightage to each indicators to capture the degree of influence on a risk component

No.	Module	Significance of module
8	Presenting results of assessment	Summarising the outcomes of the assessment Providing interpretations of the outcomes related to assessment

Certain key work-steps have been explained further:

Assess the profile of the system of interest

The system profile details the general status quo of the system of interest. Since climate risk is dependent on socio-economic factors apart from climate change related stresses and stimuli, the baseline conditions for biophysical and socio-economic aspects requires clarity. The table below lists the guiding questions which provides outputs for determining profile of the system of interest along with the methodology to be adopted[44]:

No.	Questions	Significance	Methodology adopted
1	What is the state of natural resources in the system of interest?	Identification of natural resources present within the system of interest (e.g. forests, agriculture, water) Spatial distribution of natural resources (e.g. area under a certain forest type, soils suitable for crop production, location of rivers) Quantification of natural resources (e.g. available volume of timber and water)	Literature review of the available geographical information
		Access to natural resources (e.g. access to potable water or water for irrigation, access to agricultural land) Temporal trends of natural resources (e.g. change in forest cover and type, change in groundwater availability for irrigation) Quality of natural resources (e.g. biodiversity, water quality, soil nutrient status)	Literature review of information from secondary sources (if available) and undertaking household surveys, stakeholder consultation to fill up the data gaps
2	What kind of socio-economic dynamics exist in the system of interest?	Demographic profile (e.g. number and density of the population, population below poverty line, literacy rate) Livelihood profiles (e.g. main sources of livelihood, diversity of livelihood, gender-specific livelihood data)	Literature review of information from secondary sources (if available) and undertaking household surveys, stakeholder consultation to fill up the data gaps
		Intra-household dynamics (e.g. lower household income since women are not allowed to enter workforce) Inter-household dynamics (e.g. caste considerations prevent marginalised sections of society from medical care from a hospital present in the village) Human health status (e.g. incidences of vector-borne diseases)	Household surveys, focus group discussions, stakeholder consultations
3	What are the environmental issues in the system of interest?	Identification of key environmental issues (e.g. overgrazing, deforestation, water pollution) Sectoral implications due to identified environmental issues (e.g. impacts on forest-dependent or agriculture-dependent livelihoods) Identification of temporal trends (e.g. percentage decline in forest cover, decline in water quality or groundwater table)	Undertake brainstorming sessions, focus group discussions, household surveys, stakeholder consultations

No.	Questions	Significance	Methodology adopted
4	What are the developmental issues in the system of interest?	Identification of governance and institutional context (e.g. existing governance structure, rules, regulations, village institutions) Key developmental issues (e.g. migration from rural areas) Regions, sectors and groups that should be the focus for development activities (e.g. regions with low access to basic infrastructure, women, children, landless agricultural labourers)	Undertake focus group discussions, household surveys, stakeholder consultations

Identification of environmental and developmental issues in Questions 2, 3 and 4 have been answered by the findings from the problem tree.

Assess the observed climate

From the data that has been collected, a number of climate or weather related key variables should be considered in the assessment of the current exposure of the system of interest:

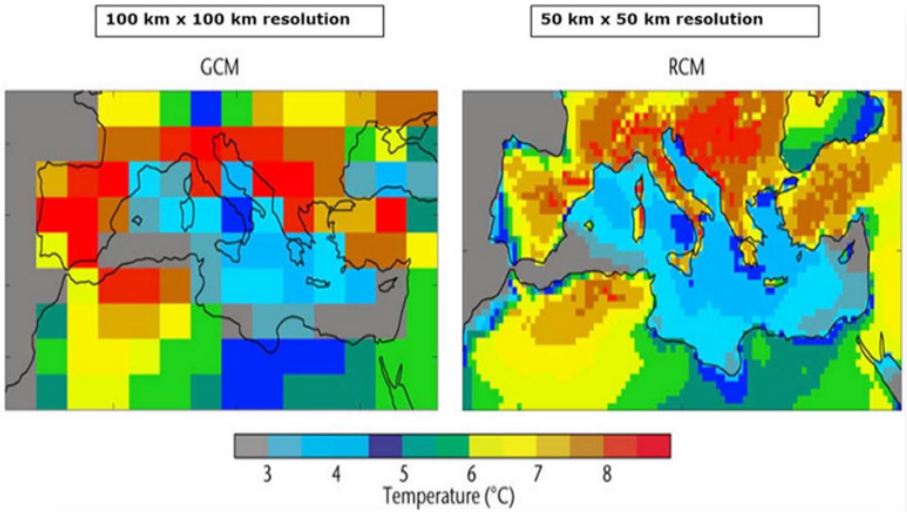
1. Maximum, minimum and average monthly temperature
2. Maximum, minimum and average monthly precipitation
3. Standard deviation of average summer monsoon precipitation
4. Severity of extreme events (droughts, floods, cyclones, etc.)
5. Return period of extreme events.

The outputs of this analysis will answer the following questions and subsequently establish the exposure:

Questions	Significance
How high is the inter-annual variability of climate variables? (e.g.: Difference in highest and lowest temperature)	Degree of variance of climate variables
What are the observed key climatic hazards in the system of interest? (e.g.: Cyclones, landslides)	Effect of variance of climate variables i.e. hazards
What are the frequency, intensity, timing and duration of extreme events?	Spatial dispersion of hazards in system of interest based on intensity
Where are the hotspots, i.e. where have the largest changes occurred in climate variables from past to present conditions?	

For each climate variable, trends (positive or negative) order of magnitude of such trends needs to be identified. The variability can be established by using the following methods:

1. Global and Regional Climate Model (GCM and RCM)45: GCM are numerical models that represent physical processes in the atmosphere, ocean, cryosphere and land surface. RCM, which is nested in the GCM, provides finer spatial and temporal detail than a GCM. Depending on the area to be examined, GCM or RCM can be used. While GCM provides climate simulations for grid cells with a resolution of about 300×300 km, RCM has a resolution of about 50×50 km. Such RCMs are available with GIZ-Institute of Natural Resources Management for use by project developers. The resultant output of these models provide a 'heat map' representing the positive and negative variations (trend) of a specific climate variable. These models provide the geographically and physically consistent estimates of regional climate change that are required for identifying climate variability and subsequently, in impact analysis. Typical outputs are as follows:



2. Seasonal calendars[46]: A seasonal calendar is a participatory tool for documenting regular cyclical periods and significant events that occur during a year and influence the life of a community. Major climatic and environmental periods and hazards should be marked in the calendar. This tool provides only general insights and veracity of details provided depends on the experience and knowledge of the participating members

3. Oral histories: Oral histories are qualitative narratives sourced through individuals sharing their histories and strategies. They are particularly effective for gathering information on local changes in weather conditions over past decades, where there is often limited data. However, such data needs to be verified with scientific facts for veracity.

4. Climate hazard trend analyses[47]: Climate hazard trend analysis is a participatory tool that helps in capturing the hazards applicable for the specific location, establish impact of climatic hazards and also the changes in impact over time. It also captures the reactions to hazards and coping/adaptation strategies for climatic hazards in the past. The success of this method relies on the availability of a knowledgeable person who can provide historical insights.

Assess the effects of climate stimuli on the system of interest

The effect of a climate-related stimuli may be direct (e.g., a change in crop yield in response to a change in the mean, range, or variability of temperature) or indirect (e.g., depleted immunity of rural citizens due to lower availability of food). In order to ascertain sensitivity, information on the impact of climate stimuli on the identified sectors of the system of interest is to be collected at the level of the unit of study. The key questions that need to be answered in this step are:

Questions	Significance
How do current climatic variability and extremes impact on the system of interest? (e.g.: Variation in rainfall leads to floods or drought)	Direct effect of climatic variations
Which climate variables impact on non-climatic stresses? (e.g. natural forest exposed to the non-climatic stress of deforestation would be impacted by climate stimuli like changes in precipitation and temperature)	Indirect effect of climatic variations

The methods and tools that can be applied to measure sensitivity are indicator based methods[48] (it involves the selection of certain indicators to define the effects of climate change. This will help classify regions within the system of interest according to the degree of variation of these indicators. A ranking scale can be determined by the evaluation team and a corresponding map can be generated to depict the variability and sector specific simulation models.[49]

Furthermore, climate hazard trend analysis and stakeholder consultation techniques, as discussed

in previous sections, may also be adopted.

Assess the capacity of population to respond to climate variability and extremes

The five possible types of resources relevant for the assessment of capacity to climate change and the possible indicators to assess their adaptive/coping capacity is given in the table below:

Resource	Definition	Variables	Possible Indicators
Social	People's relationships with each other through networks and the associational life of their community	Community attachment Social cohesion	Number of community events
Human	Skills, education, experiences and general abilities of individuals combined with the availability of 'productive' individuals	Productive population Education infrastructure Literacy levels	Trends in dependency ratios School/institutional availability
Institutional	Government-related infra- structure (fixed assets): utilities like electricity; transportation; water; institutional buildings and services related to health; social support; and communications	Political action Utilities and infrastructure Emergency preparedness Health services Communications services	Elected representation Age and condition of utilities infrastructure Number of health services available
Natural	Endowments and resources of a region belonging to the biophysical realm, including forest, air, water, arable land, soil, genetic resources, and environmental services	Potable water quality and quantity Surface water Soil conditions Forest reserves Marine reserves	Frequency of potable water contamination Frequency of potable water shortage Quality and quantity of fish reserves
Economic	Financial assets, including built infrastructure and a number of features enabling economic development	Employment levels and opportunities Economic assets	Trends in job diversity and income levels Local business owner- ship rates

Following questions may be considered in this step:

Questions	Significance
What response measures exist to deal with climate variability and hazards?	Presence of measures to build adaptive/coping capacity
How have key environmental, socio-economic and developmental issues been addressed by various measures? (e.g. policies, programmes, local adaptation measures)	Effectiveness of these measures
Have response measures specifically addressed the identified hotspots? (e.g. regions, sectors, groups)	

The suggested methods and tools for assessing adaptive/coping capacity are indicator based methods, focus group discussion and household surveys, cognitive mapping[50](group of interactive methods to illustrate different perceptions and helpful in understanding effectiveness of any measures.), Delphi technique (method to elicit judgment and information from a range of experienced participants iterative written correspondence).

3.1.2.4 STAGE 4: ASSESSING FUTURE CLIMATE RISK

Future vulnerability assessments link projections of socio-economic development (non-climatic factors) to possible future climatic scenarios. A scenario is a plausible description of how future scenarios may emerge based on current recognisable signals and trends, and on assumptions about how these will progress in the future. Scenarios allow the user to analyse the future in the context of climate change. This step predicts the plausible vulnerability levels for the system of interest and helps understand the difference in current and future vulnerability.

The development of most scenarios follow top-down approaches in which small teams, consisting of experts from different sectors, work on generalised and often global models. This provides the user with scenarios developed within a consistent framework. Bottom-up scenarios are developed using participatory methods and tend to be oriented toward local levels. They are more likely to capture local vulnerabilities and dynamics but perform increasingly poorly for larger spatial aggregations and for predicting future trends. The top-down approach, thus, provides a much more logical projection of the future and hence, should be adopted for the assessment conducted in this stage.

Socio-Economic Scenarios	Land-use & land-cover change (LUC-LUCC) scenarios	Environmental Scenarios	Sea-level rise scenarios

• Characterise the sensitivity, adaptive/coping capacity, and vulnerability of social and economic systems in relation to climate change
• Requires identification & extrapolation of:
  • Demographic data
  • Technological change
  • Economic activity
  • Price of key commodities etc.
	• Develop land cover scenario
	• Based on previous studies/regression or process models
	• Models combined with expert judgement to develop scenario
	• Verified with known trends & likely developments. In case of variations, scenario re-assessed
		• Understand changes in environmental factors other than climate that will occur in the future regardless of climate change.
		• Developed by using outputs of General Circulation Models (GCMs)
			• Assess climate change impacts and adaptations in the coastal zone
			• Measured from eutastic/global sea level and relative sea level data
			• Historic data of global & regional sea level needs to be reviewed & suitably extrapolated to develop scenario

In order to make future projections of vulnerability, scenario development[51] i.e. description of the future state needs to be undertaken. Such scenarios are called exploratory (or descriptive) scenarios and can be of the following types:

While the brief explanation given above provides the approach to developing scenarios, the steps involved in developing scenarios is complex and requires expert guidance. The development of future scenarios described above, will help the top-down models to assess the climate change parameters and determine the future vulnerability of the system of interest.

Scenarios will develop an understanding of the future state of the proposed project area. This will provide picture of the effect of climate change (combined with the existing socio-economic practices) in future. The information obtained the scenarios should hence be used to identify activities that can lead to long term positive impacts.

It is recommended that the problem tree be reviewed to incorporate the findings of the assessment and validate the problem that has been identified. If necessary, the problem statement can be reviewed to prepare a revised problem tree.

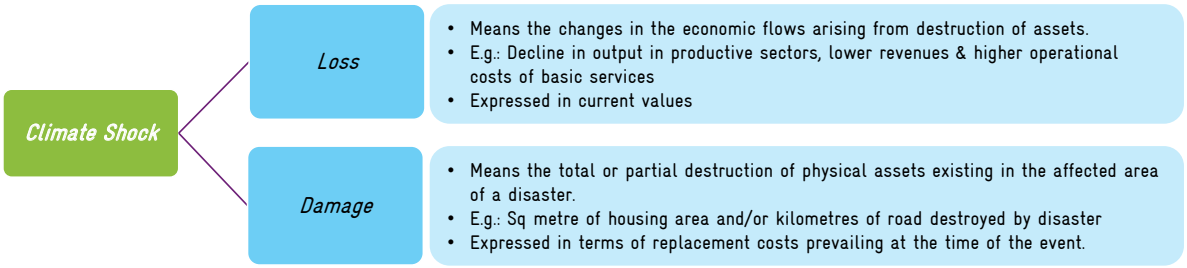
3.1.3 IMPACT ASSESSMENT

Climate risk assessment helps define the potential climate change risks that the system of interest is exposed to. However, it does not help to quantify the impact these risks have on the system and hence, does not assist in estimating the efficacy of adaptation measures/ projects. This is where impact assessment assumes importance. After assessing the current and future vulnerabilities, an impact assessment needs to be undertaken to quantify the climate change risks in economic terms.

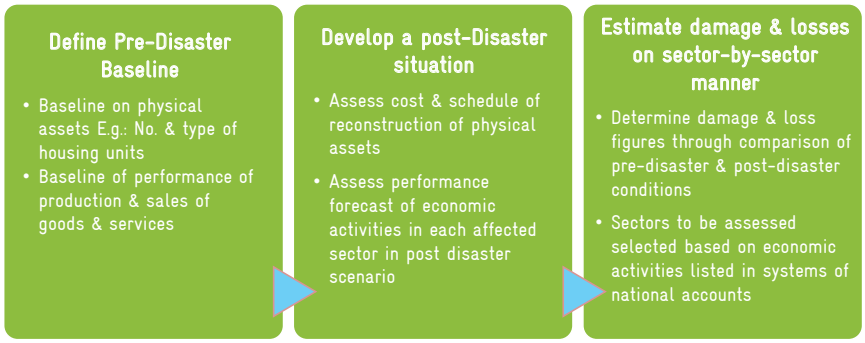
As discussed in Section 2.1, adverse effects of climate change manifests either in the form of climate shock or stress. While manifestation of climate change shocks can lead to disasters like cyclones and floods, climate stress leads to persistent change in climatic conditions leading to detrimental conditions for both human and natural systems. In order to assess impact of these two types of climate change manifestations, different methodology needs to be adopted. The appropriate methodology for each is given herewith:

3.1.3.1 CLIMATE SHOCK

Climate shock events or disaster risks can leads to either loss or damage to the system of interest or both, as elaborated in the diagram below:



A comprehensive assessment of the loss and damage caused due to climate change risks can be undertaken by adopting the Damage and Loss Assessment (DaLA) methodology adopted by the Global Facility for Disaster Reduction and Recovery (GFDRR) of the World Bank[52]. The typical steps to be followed during an assessment of damage and losses are the following[53]:



The methodology to determine the loss and damage for each sector is different and encapsulates the effect of disaster specific to the sector. The sector specific assessment is followed by an analysis of macroeconomic impact and impact on personal well-being due to the loss and damage caused by a disaster.

3.1.3.2 CLIMATE STRESS

Since impacts due to climatic stress occur over a period of time, assessing these impacts is a complex undertaking. The assessment has to take into consideration the future projections for environmental trends as well as socio-economic trends in presence and absence of climate change. In order to derive the future projections, various impact models need to be implemented. A compilation of frameworks and supporting toolkits for assessing impact of climate change is available in the UNFCCC publication[54] – "Compendium on methods and tools to evaluate impacts of, and vulnerability and adaptation to, climate change".

Key frameworks/modelling tools which can be referred for impact assessment from the document are as follows:

- IPCC Technical Guidelines for Assessing Climate Change Impacts and Adaptations
- U.S. Country Studies Program (USCSP)
- SimCLIM

Considering the complex nature of assessing impact for climatic stress, it is advised that experts in the field of climate modelling be consulted and subsequently employed to undertake the activity. While the reference document provided above as well as other references provided therein can impart information on the models and frameworks, their implementation will require expert guidance.

3.2 Project Conceptualisation

TASKS

- Identify solutions to root causes of the problems
- Cluster solutions in to projects
- Define baseline scenario
- Define a future state
- Establish project objective
- Prepare a high level design for the identified project
- Operating model
- Prepare project budget

TOOLS/KNOWLEDGE SOURCES

- Solution tree

3.2.1 IDENTIFY SOLUTIONS TO ROOT CAUSES OF THE PROBLEM

Based on the revised Problem Tree derived from the findings of the vulnerability assessment, it is time to identify a corresponding solution. This can be achieved by designing the Solution Tree. The solution tree is directly derived from the problem tree and it helps understand the solution options available for resolving the core issues identified in the problem tree.

Like a Problem Tree, development of a comprehensive solution tree involves a participatory process. In such situations, the experience and expertise of government agencies, multi-lateral funding agencies, NGOs, philanthropic organisations, private sector participants, who have been previously involved in adaptation projects, would help identify the plausible solutions to the identified problem. Hence, it is imperative that these agencies are involved in the development of the Solution Tree, just as they were involved in the development of the Problem Tree.

Private sector entities actively look at addressing supply chain concerns, workforce challenges and/or searching for projects which are eligible for CSR contribution under Schedule VII under the Companies Act 2013.

Hence, private sector entities would possess an innate business interest to attend the solution formulation sessions.

In order to formulate the Solution Tree, a positive statement needs to be constructed for each negative statement derived from the Problem Tree. For example, "People lack access to clean drinking water" could be turned into, "Provide people with access to clean drinking water". Application of this formula for root cause in problem tree will provide the overall objective, application on the causes will provide the various solution options available while, application on effects will provide the outcomes of the solutions.

It may be possible that diverse solutions might appear in addressing the overall objective as discussed in the section above and accordingly, requisite steps need to be undertaken to identify the separate projects involved in solving the core problem.

3.2.2 CLUSTER SOLUTIONS INTO PROJECTS

While the solution tree will provide the probable solutions to the core problem, it is possible that a single or multiple solution(s) can be converted into a potential project. In order to explore this probability, the solutions need to be analysed to identify whether there is any common string among them. Based on the typical solutions identified for climate change adaptation projects, there are broadly 2 project types[55], namely:

Structural Projects	*Non-Structural Projects*
Projects involving development of physical infrastructure (e.g.: dams, dykes, flood-ways) by applying engineering techniques or technology to achieve resilience to climate change impact in structures or systems	Projects involving use of knowledge, practice or agreement to achieve resilience to climate change impact, especially through policies and laws, public awareness raising, training and education, institutional strengthening, technical assistance etc.

Although the steps required for undertaking these 2 type of projects are broadly similar, the skill-sets required are different. This difference has direct effect on the activities to be undertaken hereon and hence, the classification needs to be established at this step. Also multiple solutions can be clustered in to these two groups and can subsequently form part of a single project. For example, considering the core problem of decreased food availability given above, there can be a number of solutions to address the issues as given in the table:

Causes	Solutions	Type of Project
Soil fertility	Spread awareness to improve soil fertility and distribution of fertilizers	Non-Structural
Not suitable breed/variety	Distribution of drought resistant variety of seeds and awareness on using the seeds	
Flood	Construction of dams, dykes, flood-ways	Structural
Drought	Construction of dams and water transportation channels	

Ideally, structural and non-structural solutions should be clustered into separate projects. Hence, to address the core issue on food availability, there can be various structural and non-structural project options.

Once the project options are identified, a high level project design needs to be prepared for each of these options. The project design would help provide necessary information required to assess the feasibility of the options and subsequently to prioritise the feasible options, which is discussed under Section 3.3. The remainder of the current section, provides guidance required for developing the high level design of each project option.

3.2.3 DEFINE BASELINE SCENARIO

Baselining will help to quantify the climate change adaptation issue(s) that will be taken up by the project. To take the example of the core issue of decreased food availability, a possible adaptation solution can be providing climate resilient seed to the farmers. In such a case, the baselining exercise will help derive a statement like – "50% of farmer population in district X of state Y do not have access to climate resilient seeds". This exercise will help the project proponents set measurable targets for the project i.e. objective of the project and hence, needs to be as specific as possible.

Information on baseline scenario can be derived from climate risk assessment (Section 3.1.2) conducted previously while the degree of severity of the problem can be taken from Impact Assessment (Section 3.1.3).

3.2.4 DEFINE A FUTURE STATE ON BAU

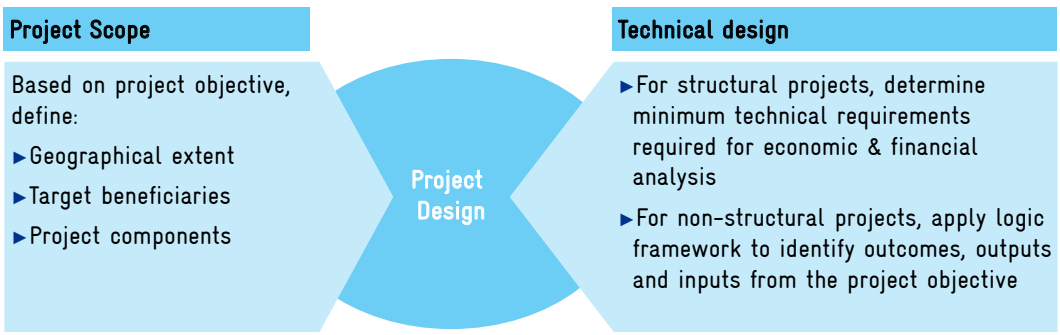
In order to understand the extent of change to which climate change will impact the system of interest in the future considering existing conditions, another technical study needs to be conducted. This study will be similar to the one conducted for baselining activity and as such, can be integrated with it. Such a study will help derive a statement like -"80% of farmer population in district X of state Y do not have access to climate resilient seeds; currently it stands at 50%".

3.2.5 ESTABLISH PROJECT OBJECTIVES

Once the baseline and future conditions are identified, the project objective needs to be established. Project objective is a statement which clearly and succinctly communicates the results that the proposed project intends to achieve. The objective should be one or two sentences at most and encapsulate the desired long term effects or the "ideal state" that the project is expected to realise.

3.2.6 DEVELOP HIGH LEVEL PROJECT DESIGN

The design of the project will involve following 2 major components:



3.2.7 OPERATING MODEL

Operating model provides the mechanism by which the project objectives are realised. This is achieved by identifying the stakeholders involved, defining the relationship between them i.e. their roles and responsibilities, and identifying the flow of finances among them. This stage will help establish whether a project is philanthropic in nature or if there is a revenue generating potential. In case of revenue generating potential being identified, the potential should be quantified based on the market rates or industry standard rates of the product/services that can generate revenue. Traditionally adaptation projects have been funded through grants and loans. In most cases, the loans are repaid by the state and/or central governments through allocated funds. The concept of a self-sustaining operating model, wherein the funds generated from project activities are utilised to repay creditors, is required to mainstream adaptation measures and increase participation of private agencies as well. There are examples of adaptation projects, both globally and in India, which have adopted various mechanisms to realise self-sustenance.

In case of India, a notable example is the Umbrella Programme for Natural Resource Management (UPNRM)[56], a joint effort by National Bank for Agriculture and Rural Development (NABARD), KfW and GIZ, which promotes environmentally sustainable growth by encouraging private investments that are pro-poor. UPNRM has developed an approach that provides a mix of financial and technical support which comprises capacity building, marketing, infrastructure support, and, risk mitigation strategies. The financing mechanisms adopted are unique like the UPNRM "Credit Plus" facility. According to this facility projects and businesses are provided loans with an integral 'accompanying measure' or grant. The grant component is to build the project implementing agencies' (channel partners) - competencies and help to capacitate the poor in managing their rural businesses and livelihoods. Unlike conventional financial products, UPNRM loans allow terms that depend on the nature of the project, channel partner and the target group, while their interest rate is lower than that of commercial credits. The loans can be both long term in nature (wherein investments in NRM measures, livelihood activities, infrastructure, plant and machinery, development of marketing chains etc.) as well as for working capital requirements for the small scale farmers.

Select examples of various operating models being implemented in various areas for adaptation are given below for reference:

1. Water Resource Management

a. Water purifying plant in Madavgan Farata of Pune district in Maharashtra[57]:
A water purification unit was setup under the UPNRM in Madavgan Farata of Pune district in Maharashtra – a severe drought-prone. The unit was setup by a private firm, Waterlife Private Limited (WPL) after securing loans under the UPNRM. After it was setup, WPL sold potable water to residents and proceeds from sales is being used to fund operation and maintenance of the unit as well as loan repayment. It is expected that the loan will be repaid in 4-5 years, after which WPL will hand over the operations and maintenance to the villagers. In order to develop capacity of villagers in operations and maintenance of the unit, WPL is regularly holding capacity building sessions.

b. Development of WaterCredit to provide water[58]:
A non-profit organisation Water.org has developed WaterCredit, a market driven model that provides micro loans to Indian families having low access to water due to drought and lack of affordable means to fulfil their water needs. They rely on water merchants who charge exorbitant fees. The program provides affordable financing options for their homes which costs a fraction of their existing annual water costs. The initiative has led to 2.9 million loans benefitting 12 million people and witnesses loan repayment rates above 99%. This initiative has led to income savings of vulnerable population with limited income as well as improving access to potable water.

2. Agriculture and Agro-forestry

a. Adapting to climate change by growing medicinal and aromatic plants[59,60]:
Farmers in Baramulla, Bandipora and Pulwama districts of Kashmir, have been facing reduced

income from agriculture due to climatic uncertainties, lost crops, debt and poverty and lack of examples in feasible farming alternatives. The Jammu & Kashmir MAP Grower Cooperative, formed in 2009, has demonstrated the viability and profitability of lavender, which can be grown on what is locally called "kandi" (semi-barren rain fed farmlands). It is highly resilient, almost pest-free and cattle have no taste for it. The cooperative, formed by the membership of the farmers, buys seeds from producers and provides to the farmers at subsidised rates. The fact that lavender is a high value crop and that cooperative has national and international market linkages, through Fasiam Agro Farms, has led to higher income realisation by the farmers. This provides an incentive for more farmers to join the initiative. The investment made in the initiative in terms of subsidies is returned to the cooperative as membership fees. The success of the project may be gauged from the fact that since its inception in 2009, the cooperative has grown from 30 to 300 members.

b. Crop diversification techniques for farmers[61]:
PepsiCo and PAGREXCO (Punjab Agri Export Corporation) partnered in 2002 to start a "Citrus Development Initiative", marking a step towards promotion of crop diversification and helping farmers adapt in a water-constrained climate. In consultation with local government, PepsiCo introduced less water intensive citrus plantations for farmers as an alternative to paddy, and set up two fruit processing plants in the region. The initiative has emerged as one of the most successful models of public-private partnerships in Indian agri-business, promoting crop diversification and creating a localised supply base for citrus juice for PepsiCo's Tropicana business.

3. Public Health Management

a. Dengue Insurance by ACA Insurance in Indonesia[62,63]:
A dengue outbreak in Indonesia in 2009, prompted an insurance firm, ACA Insurance to develop a dengue insurance. This product helps a person, who has paid a small premium, to avail insurance coverage in case he/she is diagnosed with dengue. Due to the minimal premium value, this insurance product has helped provide the financial resources required by the poor to develop resilience to the disease. This example of dengue insurance can be adopted to tackle incidence of vector-borne diseases in areas where such vectors were not hitherto endemic but are now invading due to global warming and climate change.

4. Disaster Risk Management

a. Community based shelter management in Orissa[64]:
At the aftermath of the super cyclone in 1999, 97 multipurpose cyclone shelters (MPCS) have been constructed in 6 districts. Community Based Cyclone Shelter Management and Maintenance Committees (CSMMCs) were formed for management and maintenance of the shelters. The CSMMC are also authorised to put the building for economic/ community uses like community house, kalian mandap, etc. and earn user fees. The amount so earned is used for maintenance of the building.

b. Micro-insurance products by Allianz[65,66]:
Bajaj Allianz has developed tailor-made savings linked micro-insurance products for vulnerable people exposed to natural disasters. A weekly premium of an amount as low as INR 35 can provide customers insurance cover. If unclaimed, the deposit is refunded with interest after five years. This instrument provides the requisite financial resources to empower local communities in undertaking post disaster rehabilitation activities.

5. Biodiversity conservation and Soil and land protection

a. Conservation of forests and mangroves with economic diversification as a means to adapt to climate change[67]:
Bunge, an agribusiness and food company, funded and implemented the project involving conservation of forests and mangrove cover in coastal region through economic diversification and integration of local communities in coastal areas of Colombia. The measures have resulted in reduction of vulnerability to erosion and sea-level rise, conservation of biodiversity in the coastal region as well as engagement of local communities on a profitable/sustainable way (by introducing production of cash crops like cocoa, palms, non-timber forest products). The harvest of cash crops are being collected by Bunge for its business purposes, resulting in commercial benefits to the funding agency. This example provides a business case proving the integration of local/aboriginal communities in a multinational value chain, while providing both parties with sustainable growth and development.

3.2.8 PREPARATION OF PROJECT BUDGET

This stage consolidates the costs incurred in implementing the project, comprising the financial costs. The process involved for the two project groups are given below:

a. **Structural Project:** Total budget of the project would be a sum of the capital and operating and maintenance costs (either both or one of these depending on the type of project). The capital expenditure (CapEx) assessment will be based on the components of the preliminary technical design and on the estimates of prevailing market costs, recent costs for similar work and materials. Similarly, detailed operating expenditure (OpEx) estimates would be based on a schedule of activities over the lifetime of the project assets. The type and timing of maintenance will vary depending on the type of project. Operating costs would include an estimate of labour requirements.

b. **Non-Structural Project:** The costs involved in implementing activities identified in the log frame need to be estimated. For such projects, CapEx is usually minimal or non-existent and the major cost component is in the form of personnel/expert costs.

3.3 Project Feasibility and Prioritisation

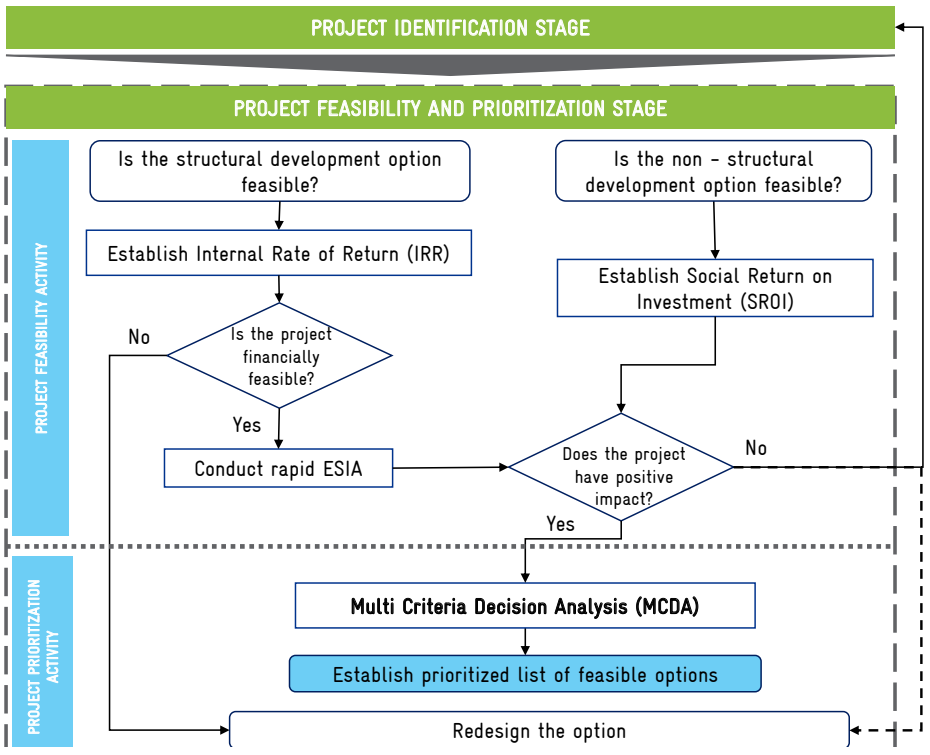
TASKS

- Establish financial/socio-economic feasibility
- Prioritise project options

TOOLS/KNOWLEDGE SOURCES

- Cost Benefit Analysis (CBA)
- Multi Criteria Decision Analysis (MCDA)

As discussed in Section 3.2.2, once a high level project design has been prepared for all project options, there is a need to assess the feasibility of each of these options and prioritise the feasible options. The activities involved in determining the feasibility is based on the type of project (structural and non-structural) and following flow chart gives the activity path for the 2 types of project:



As depicted in the flow chart, if it is established that a project option (structural or non-structural) does not have positive impact, the option is taken back to the previous stage of project development i.e. project Identification stage for re-assessment. The Solution Tree is re-assessed to validate that the project option is a valid solution for the problem. Thereafter, the option goes through the steps of project identification stage to incorporate requisite modifications to ensure benefits can be derived from it. The modified project option then goes through the activities to test feasibility. It is only when the project proponent is thoroughly convinced that the solution cannot have an overall positive impact, can the project option be discarded (as depicted in dotted line). This iterative exercise helps validate the activities undertaken in the project identification stage and facilitates development of the most effective solution for the identified problem.

3.3.1 ESTABLISH FINANCIAL/SOCIO-ECONOMIC FEASIBILITY

This step takes input from the budget preparation section (i.e. costs) and operating model (i.e. revenue) to identify whether the project is feasible in financial terms. For this section, Cost Benefit Analysis (CBA) tool can be implemented[68] to establish feasibility of the project options. It involves 2 major steps, which are briefly given below:

FINANCIAL/ECONOMIC ANALYSIS

- ➔ Determine IRR (for structural projects)
- ➔ Determine EIRR (for non-structural projects)
- ➔ Viable value of IRR/EIRR at which project to be considered feasible need to be determined

SENSITIVITY ANALYSIS

- ➔ Determine variability of key parameters that can potentially affect the project
- ➔ If unviable EIRR/IRR values are generated by conducting sensitivity analysis for a specific parameter, adequate risk mitigation measures to be taken

3.3.2 PRIORITISATION THROUGH MULTI CRITERIA DECISION ANALYSIS[69]

When several competing and feasible options need to be compared and prioritised, a Multi-Criteria Decision Analysis (MCDA) can be used. MCDA helps rank and thus prioritise among multiple adaptation options based on a qualitative assessment of criteria such as co-benefits, ease of implementation, acceptability to local population and resources required, etc. Since reliable quantitative information on this may be difficult to attain, a qualitative expert judgment is the typical way to fill the information gap.

According to UNFCCC[70], MCDA techniques should be based on simple scoring methods to avoid the risk of complicating an already subjective assessment method. The marking system is at the discretion of the project proponent and any method can be applied, based on the convenience in representation by the proponent.

In order to factor in the relative importance of the criteria, each criterion may be given different weights. For example, effectiveness may be given a higher weight than resources required (or vice versa). Obviously, weights should add up to 100%. Determination of the various criteria, as well as their weightage or relative importance may be undertaken through stakeholder consultation followed by expert advice. A sample MCDA matrix relevant to the project is given below:

Parameter	Weightage	Option #1		Option #2		....	Option #n	
Opportunity Name		A		B		....	N	
Potential of increasing resilience of human/natural systems	20%	🔴	Low	🟡	Medium	....	🔴	Low
Investment volume	10%	🟡	Medium	🔴	Low	....	🟡	Medium
Inclusiveness	5%	🔴	Low	🟢	High	....	🔴	Low
Scale of climate change impact	20%	🟢	High	🟢	High	....	🔴	Low
Presence of a revenue model	10%	🔴	Yes	🔴	No	....	🔴	No
Potential of adverse impact on human/natural systems	5%	🔴	Low	🟡	Medium	....	🟡	Medium
.....			....		....	....		....
any other parameter for prioritisation	..		....		....	....		....
OVERALL SCORE	100%	Long-Term		Short-Term		....	Avoid	

3.4 Detailed Design and Planning of the Project

TASKS

- Developing the components of DPR
- Developing additional considerations for a DPR of adaptation project

TOOLS/KNOWLEDGE SOURCES

- Risk Management Framework
- Results Framework
- Monitoring & Evaluation Plan

3.4.1 COMPONENTS OF A DPR

Once the feasibility stage is complete, the project proponent is apprised of the feasible options available for application. The feasibility stage provides a high level definition of the project. In order to undertake implementation of project, further analyses of the details relevant to such a project become imperative. A detailed project report (DPR) provides the necessary level of detailing for executing project and for soliciting funds from prospective financier. At a minimum, the DPR should contain:

Part 1: Project Background	Part 2: Project Design	Part 3: Project Implementation Arrangement
Problem Context Project Justification and Objective	Project Component Technical Design Project Organisation Project Budget Project Timelines	Risk Management Plan Monitoring and Evaluation plan Statutory Requirements

While the list of activities given above covers the necessary areas required to be investigated at this stage, they are indicative in nature. A brief description of the activities required in each part is given in the table below.

Component of DPR	Suggested Content
Project background	Describe project area, existing climatic and socio-economic scenario Provide need for undertaking project and define objectives
Project design	List project components Prepare detailed technical design for project List statutory clearances, licenses, permits, etc. needed for construction and operation of project Design governance framework and allocate roles to relevant stakeholders Prepare an activity-based and cost head-based project budget statement Define project timelines and milestones
Project implementation	Prepare risk management plan and contingencies Develop a monitoring & evaluation framework

Depending on the specific nature of project, certain additional sections need to be incorporated, within the individual parts. Also knowledge of DPR is commonplace among project management professionals and depending on the type of project (structural and non-structural), there are established methodologies to develop each component of DPR. The components of a DPR and the specific methodology to be adopted will also depend on the requirement of the financing agency, if any. However, there are certain aspects, specific to adaptation projects, which need to be incorporated. Guiding notes on these aspects are provided in the subsequent section.

3.4.2 ADDITIONAL CONSIDERATIONS FOR ADAPTATION PROJECT

3.4.2.1 INTEGRATING CLIMATE RESILIENT DESIGN STANDARDS AND CONSIDERATIONS

Specifically for structural projects, there are several resilient design standards, guidelines and considerations which the project should technically incorporate. As an example, following are suggested as relevant:

1. Green Rating for Integrated Habitat Assessment (GRIHA)[71] aims to 'rate' a building on the degree of its 'greenness', i.e. minimise the demand on non-renewable resources, maximise the utilisation efficiency of these resources when in use, and maximise the reuse, recycling, and utilisation of renewable resources. While the direct outcome of this rating is climate mitigation, the indirect benefits are aligned to climate adaptation viz. prevention of urban heat island effect, improved water and waste management among others. The rating parameters can be taken into consideration during design stage to incorporate design elements to reduce resource usage and increase resource efficiency.
2. Climate Resiliency Design Guidelines[72] provide step-by-step instructions on how to supplement historic climate data with specific, regional, forward-looking climate change data in the design of city facilities for New York. The guidelines can be suitably adopted for designing urban climate resilient infrastructure in India, taking into account the available data and the local impacts of the climate change. The guidelines provide options for reducing urban heat island effect, storm water management in buildings and drainage systems to reduce urban flooding, safeguarding against rise in water level of local water bodies among other options.
3. The Resiliency Action List (RELi)[73] provides a comprehensive process for incorporating resilience into new building design and planning. It is one of the most comprehensive new building standards reviewed, combining principles of resiliency and sustainability at the building and community level. It provides criteria for safer design of infrastructure for extreme weather, wildfire and seismic events, fundamental emergency operations that need to be considered

while designing the infrastructure and other hazard adaptation measures that need to be incorporated in the design.

4. **Climate Resilient Road Guidelines[74] was produced as part of the Nordic Development Fund's project C15:** Adaptation Approaches for the Transport Sector under the ADB funded Rural Roads Improvement Project in Cambodia. The guidelines provide engineering level adaptation options covering aspects like road planning and design, drainage, erosion, and, hydrology.

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3.4.2.2 PROJECT BUDGET

The preparation of project budget is a standardised process wherein value of each project activity is determined from existing market prices and from industry standards.

Additionally it recommended that the dual system of budget preparation be adopted to facilitate monitoring and evaluation activities. In this system, two summary budget breakdowns are to be prepared in line with global budgeting practices[75,76]. First is at the output level, which gives Activity Based Cost and the second on the Category Based Cost (five cost categories). A schematic table of the 2 cost types are given below:

a. Activity Based Cost

No.	Project Component	Activity	Sub-Activity	Unit	Quantity	Rate	Total Cost

b. Category Based Cost

No.	Cost Category	Total Costs	Source of fund
	Material & equipment		
	Civil services		
	Preliminary & pre-operative expenses		
	Working capital		
	Interest During Construction (if relevant)		
Net Project Cost			

Preparation of an activity based cost schedule helps in monitoring and evaluating the performance of individual activities. Similarly, a category based costing helps identify the category where performance deviates or is at par with the planned performance. This provides guidance in devising corrective measures.

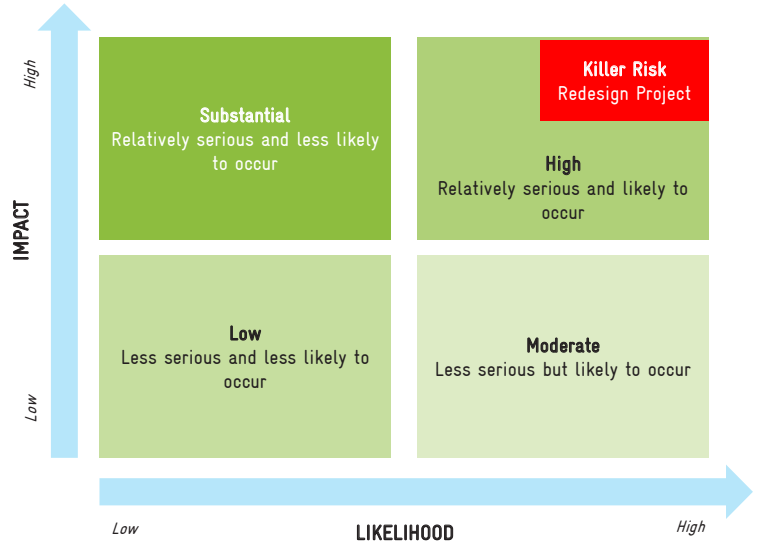
3.4.2.3 RISK MANAGEMENT PLAN

In order to prepare the risk management plan, project proponents are expected to (i) identify any substantial risks that the project/programme may face, (ii) propose respective risk mitigation measures and (ii) consolidate the findings in a risk management plan (RMP). In order to identify the risks, the various risk categories need to be defined. An indicative list of the risk categories that can be considered for adaptation projects are given below:

No.	Risk Category	Example
1	Technical	Unreliable technical studies due to lack of reliable climatic data
2	Institutional	Lack of coordination between implementing agencies, lack of capacity to manage project implementation, staff turnover, lack of participation from relevant stakeholders
3	Financial	Lack of sustainability of financing for project outputs/outcomes, cost overruns
4	Political	Political unrest, lack of transparency, political interference in allocation of resources, policy and regulatory uncertainty
5	Resources (capacity & capability)	Inadequate availability of resources with requisite qualification
6	Management (Internal)	No succession plan if project manager leaves organisation
7	Environmental	Potential harm to balance in ecosystem in project area
8	Social	Displacement of residents in project area
9	Health & Safety	Resources remain unwell due to unhealthy working conditions

The project proponents are required to refer to case studies of adaptation projects having similar objectives and undertake expert consultation to identify possible risks in the categories mentioned above or any additional categories, if necessary. For example, the Environmental and Social Management Plan (ESMP), prepared as part of the ESIA will provide guidance on the environmental and social risks that are present for the project.

After identification of the risks, the common method for risk assessment is the estimation of impact and likelihood of each risk element[77]. A combination of impact and the likelihood can be used to prioritise the risks. The risk prioritisation can be visualised through a Risk Assessment Matrix[78], illustrated alongside:



In order to account for the risks, both prevention and contingency measures need to be identified. The prevention/mitigation measures aims at either preventing the risks from occurring or reducing impact of the risks. Risk response/contingency measures on the other hand, suggests the measures to be undertaken in case a risk occurs. As an illustrative example, the reduction and contingency measure for a risk on climate change adaptation project is given below:

Risk	Reduction Measures	Risk Response/ Contingency
High level endorsement of proposed policy and regulatory changes to support coastal adaptation may be lacking from MoEF&CC due to existing priority areas currently tabled.	Engage MoEF&CC in initial policy review process to increase their ownership of the revised policy. Prepare policy briefs that clearly and simply communicate the proposed changes Budget for 5 days administrative time for MoEF&CC staff to review the proposed changes	Highlight the national importance and strategic benefits of policy endorsements to the PM via memo copying all heads of department.

Drawing from the Risk Management Framework[79], an illustrative Risk Management Plan has been prepared which incorporates all the findings and measures identified in the previous section:

No.	Risk Description	Risk Type	Likelihood Rating (L)	Impact Rating (I)	Risk Rating (R)	Impact Description	Reduction Measure	Contingency measure
**	***	Political Economic/ Financial Resources (capability) Governance (internal) Security Ecological Social Health & Safety	Rate the likelihood that the risk will occur. L = (1=low likelihood, 5=Very likely)	Rate the scale of impact on the project if the risk occurs. I = (1= low impact, 5=high impact)	Relative ranking of risk R=I*L	Provide short description of the impact to the project if the risk occurs	Steps to minimise likelihood of risk from occurring	Steps to reduce impact of risk if it occurs

3.4.2.4 MONITORING AND EVALUATION (M&E) PLAN

A first step in preparing M&E Plan is determining the performance indicators which will be measured to monitor the performance of a project. In this regard, a results framework[80] provides a program-level framework for mangers to establish the performance indicators.

An indicative list of performance indicators has been provided by GCF[81] for a typical set of outcomes for an adaptation project.

No.	Expected Results	Indicators
1	Increased climate-resilient sustainable development	Total number of direct and indirect beneficiaries; number of beneficiaries relative to total population
2	Increased resilience and enhanced livelihoods of the most vulnerable people, communities and regions	Percentage reduction in the number of people affected by climate-related disasters, including the differences between vulnerable groups (women, elderly, etc.) and the population as a whole
3		Number (percentage) of households adopting a wider variety of livelihood strategies/coping mechanisms
4	Increased resilience of health and wellbeing, and food and water security	Percentage of food-secure households (reduced food gaps)
5		Percentage of households with year-round access to adequate water (quality and quantity for household use)
6		Area (hectares, ha) of agricultural land made more resilient to climate change through changed agricultural practices (e.g. planting times, new and resilient native varieties, efficient irrigation systems adopted)
7	Increased resilience of infrastructure and the built environment to climate change threats	Value of infrastructure made more resilient to rapid-onset events (e.g. floods, storm surges, heatwaves) and slow-onset processes (e.g. sea-level rise)
8		Number of new infrastructure projects or physical assets strengthened or constructed to withstand conditions resulting from climate variability and change (e.g. to heat, humidity, wind velocity and floods)
9	Improved resilience of ecosystems	Area (ha) of habitat or extent (kilometres, km) of coastline rehabilitated (e.g. reduced external pressures such as overgrazing and land degradation through logging/collecting); restored (e.g. through replanting); or protected (e.g. improved fire management; flood plain/buffer maintenance)
10		Number and area of agroforestry projects, forest–pastoral systems, or ecosystem-based adaptation systems established or enhanced
11	Strengthened government institutional and regulatory systems for climate-responsive development planning	Degree of integration/mainstreaming of climate change in national and sector planning and coordination in information sharing and project implementation
12	Increased generation and use of climate information in decision-making	Evidence that climate data are collected, analysed and applied to decision-making in climate-sensitive sectors at critical times by government, private sector and men/women.
13		Perception of men, women, vulnerable populations and emergency response agencies of the timeliness, content and reach of early warning systems
14	Strengthened capacity and reduced exposure to climate risks	Extent to which vulnerable households, communities, businesses and public sector services use improved tools, instruments, strategies and activities (including those supported by the Fund) to respond to climate variability and climate change
15	Strengthened awareness of climate threats and risk reduction processes	Percentage of target population aware of the potential impacts of climate change and range of possible responses

The list of the indicators given above can provide guidance on the type of indicators that should be selected for a particular adaptation intervention. Once these indicators are established, along with the means of verification for these indicators, a results framework matrix[82] can be developed:

The ***M&E Plan*** is derived from the results framework mentioned above which incorporates additional elements like (i) Frequency of measurement, (ii) Intermediate targets and (iii) Responsibility for measurement.

A template for M&E plan[83] is provided below:

Description	Indicator	Baseline	Target	Means of verification	Frequency	Responsibility
Objective/ Outcome/ Outputs	What indicator will you use to measure the item(s) in the description column?	What is the existing state / value of the indicator?	What is the post-project target value for the indicator? Target value can also be for any intermediate progress point of project	Where and how is data to inform the indicator coming from?	How often/ at what stage of project should the indicator be measured?	Who (name, role or department) is responsible for collecting the data?

Financing a Climate-Adaptation Project

TASKS

- Identify potential finance sources
- Financial structuring using multiple finance sources
- Prepare proposal/pitch
- Disbursement of funds

TOOLS/KNOWLEDGE SOURCES

- Reference documents, policies, etc.

4.1 Identify potential funding sources

Once the DPR is prepared, the necessary detailing required to kick off project implementation stage is in place. The project proponent now needs to secure finances to support implementation. The flow chart below provides the levels of assessment that the project proponent should undertake to identify the potential financier.

In this stage all possible sources of funds need to be considered. It may be possible that a single source of funding may not be sufficient to fund the project. The cross cutting and complex nature of climate change adaptation projects often requires a collaborative approach in which multiple agencies and institutions with complementary capacities work together on a single project. When developing a project, candidate countries can engage with public funding agencies, private investors, NGOs, local institutions, and government agencies. This kind of collaboration allows the project to bring the capacities and resources of multiple organisations to bear on a given problem. This also allows the costs and risks of different categories of activities (e.g., physical investment, capacity building, and project management) to be borne by the most appropriate funder.

KEY REQUIREMENT FOR FINANCING AN ADAPTATION PROJECT

1. Sound project design: Solution development should be based on sound project design principles that take into account the specific needs of a climate change adaptation project.
2. Monetising climate risks and benefits through EIRR: Determine a quantitative value of the risks arising due to climate change and the benefits to be realised by undertaking the project.
3. Stakeholder involvement: Ensure a comprehensive problem identification process has been undertaken and a robust solution has been developed through participation of all relevant stakeholders.
4. Appropriate finance mix: Based on the risk profile of the project and funds available with the project proponent i.e. its financial risk exposure, the appropriate debt to equity ratio should be determined.
5. Sound governance and risk management framework: In order to ensure that project progress meets the expected standards, project governance structure needs to be well defined and comprehensive M&E and risk management plans should be in place.
6. High impact quotient: Develop a compelling value proposition for financing agency through devising of a clear revenue stream, by providing an enhanced brand value or by exhibiting a coherent alignment with the focus areas of the financing agency.

In order to understand the alignment with the focus areas of the respective funding agencies, the proponent needs to review the necessary policy documents of the agencies. A brief of the study conducted for the various agencies are given in following sections.

4.1.1 SELF-FINANCING

The proponents should assess whether they have enough funds available to execute the project in its entirety or the extent to which it can fund the project. It must be noted that all other sources of funding may require a commitment from the proponent on part of the funds. This can either be a Co-Financing (multiple institutions/organisations providing finances for a single project wherein project proponent can be required to be one of the co-financiers) option or Matching Fund (proponent has to provide for funds matching the financial commitment made by other financing agency e.g. multi-lateral funding agencies). The applicability of a particular option is completely dependent on the requirements of the financing agency. Hence, it is essential that project proponents should secure a part of the budgetary requirement by itself.

One mechanism for securing funds is crowdfunding[84] - process of several individuals pooling their financial resources to support efforts, projects or campaigns initiated by other people, typically via an internet-based online **Crowdfunding Platform (CFP).** Crowdfunding exists for a variety of funding modalities including donations, in-kind rewards, lending and equity investments. The link between the individual crowd-funder and the recipient can be direct as Person-to-Person (P2P) or indirect, for instance through an investment fund. The motivation of the funders can range from purely philanthropic to purely financial, with the majority funding themselves in the middle and expecting a 'dual return' of social and financial benefits.

EXAMPLE OF CROWDFUNDING

A notable example crowdfunding for international development is Kiva.org. It is an internet based platform that connects willing individuals who want to make a small loan to a micro-entrepreneur in a developing country. In 2017, Kiva has been able to channel over USD 1 billion in loans[85] to 2.5 million people with an overall repayment rate of almost 97%.

The scale of investment for business is fairly larger than the ones available for climate change. However, there are examples of crowdfunding being applied for both mitigation and adaptation projects. An example is available in India[86], wherein Mr. Sonam Wangchuk raised USD 125,000 through US based crowdfunding website Indiegogo[87] to build ice pyramids or artificial glaciers in Ladakh to solve water scarcity crisis in Ladakh. The ice stupas or artificial cones of ice act as source of water for crops during lean season and help combat shrinking glaciers. In fact, the effort received 105% of its goal of raising USD 119,500 and has resulted in Mr. Wangchuk receiving Rolex innovation grant. He intends to use the fund to create the next generation of ice towers and to fund an "alternative university". A similar approach has been applied by the Belgian town of Ghent[88], wherein a crowdfunding platform developed to allow citizens share their ideas and raise necessary funds to realise them.

Project proponents can use such CFPs to partially or fully fund their adaptation initiative, depending on the scale of investment required. In case of large scale project, such crowdfunding initiatives might not be enough to raise required capital.

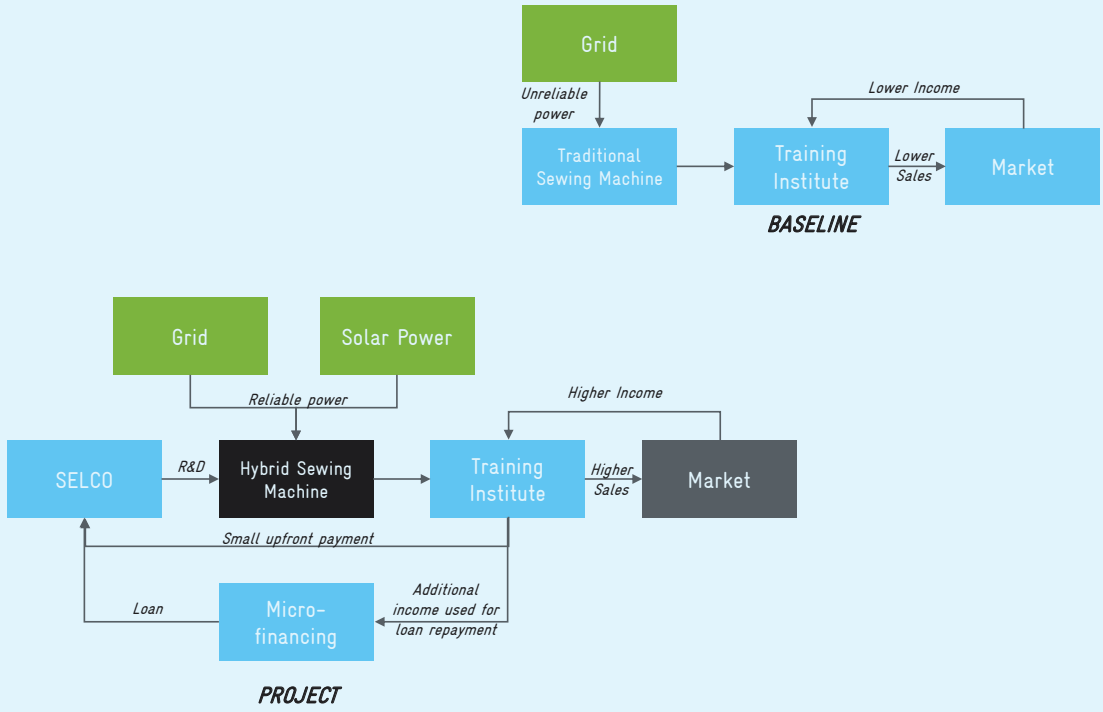
4.1.2 LEVERAGING MITIGATION FINANCES TO FUND PROJECTS WITH ADAPTATION CO-BENEFITS

Historically mitigation measures have been attracting greater financing than adaptation initiatives – Only a quarter of public funds from developed to developing nations are directed toward adaptation project and 20% of investments from multilateral development banks are going

to adaptation[89]. While focus on adaptation is increasing, the corresponding increase in fund flows is inadequate for current levels. In such a scenario, exploring opportunities where typical mitigation solutions for which adaptation co-benefits can be established, can be useful means of utilising funding opportunities.

EXAMPLE OF MITIGATION SOLUTION HAVING ADAPTATION CO-BENEFIT

A typical example of mitigation solutions having adaptation co-benefits (by increasing adaptive/ coping capacity)[90] is the case of Selco India which provides innovative solar solutions for the poor. Selco developed a 50:50 solar/ grid-powered sewing machine with additional features, for a local sewing training institute where unreliable electricity affected income, work and training hours. The institute catered to the financially weak sections that are typically the most vulnerable to climate change. Selco collaborated with a financial institution to provide a customised loan plan over five years to purchase five sewing machines; as a result, income increased, with bonus earnings from the additional features of the machines and savings on electricity bills, ensuring quicker repayment of the loan.



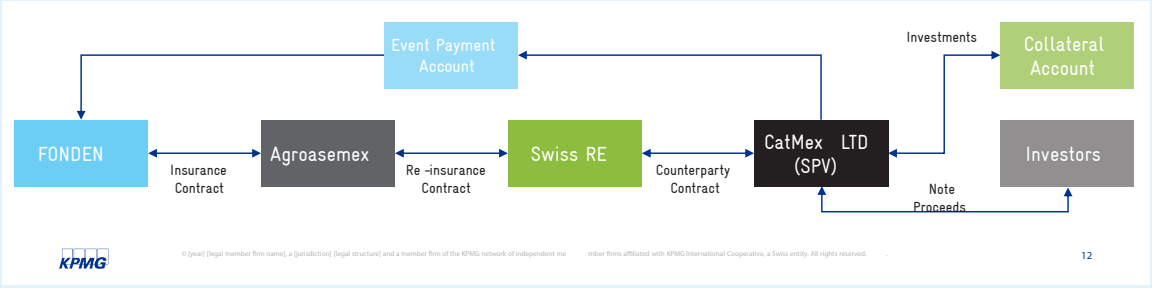
4.1.3 ACCESSING CAPITAL MARKETS

While crowdfunding depends on the voluntary donations of individuals, there is another route through which proponents can generate funds i.e. through market based instruments. These instruments serve as investment options to capital market participants. This helps project proponent access a larger market and accordingly the potential to generate funds increases. An example of such an instrument is given below:

Catastrophe bonds: With catastrophe bonds, issuers pay interest to bond holders and return bond principal by the bond's maturity date. However, if a specified event (like an earthquake, flood or hurricane) occurs then, after such an event all principal and interest payments to the bondholder are forgone.

EXAMPLE OF CATASTROPHE BONDS

Mexico's MultiCatBond[91] is a four-tranche catastrophe bond with a three-year maturity under the World Bank's MultiCatProgram. The issuer of the bond is a Special Purpose Vehicle (SPV) that indirectly provides parametric insurance to FONDEN (Mexico Natural Disaster Fund) against earthquake risk in three regions around Mexico City and hurricanes on the Atlantic and Pacific coasts. The catastrophe bond will repay the principal to investors unless an earthquake or hurricane triggers a transfer of the funds to the Mexican government.

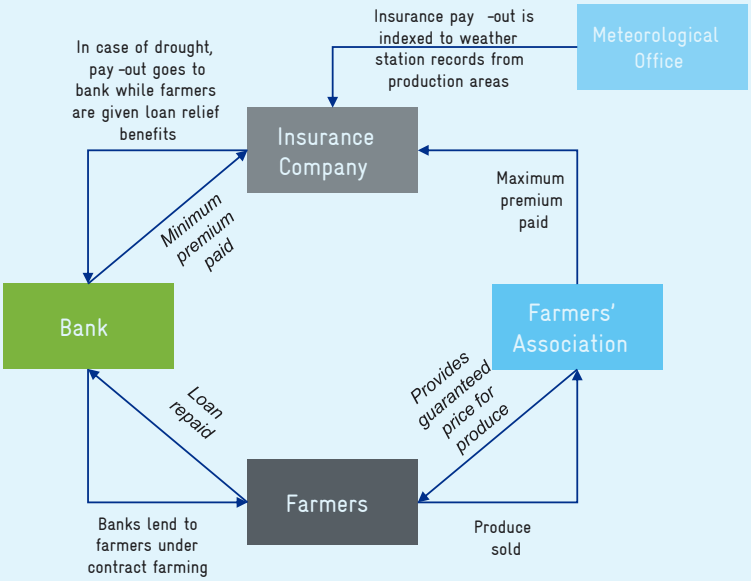


Weather Derivative[92]: A weather derivative is similar to a catastrophe bond, except that it aims to fund climate stress events.

EXAMPLE OF WEATHER DERIVATIVE

An example of accessing international financial markets to fund adaptation initiatives is the use of weather derivatives in Malawi. A major portion of Malawi's economy is dependent on agriculture, but agriculture is prone to drought due to erratic rainfall. As a crisis response to a severe drought in 2005, Government of Malawi had to spend USD 200 million. In order to mitigate the impact of drought on the economy and the federal budget, World Bank helped the government transfer a portion of the risk of severe drought to the international financial market using weather derivatives in 2009-10. The weather derivative contracts were structured as an option on a rainfall index.

The index links rainfall and maize production, so that if precipitation falls below a certain level (i.e. 10% below historical average), the index will reflect the projected loss in maize production. In the event of a drought, maize prices in the region typically increase. The Government of Malawi agreed to use any pay-out from the weather derivative contract to lock in the price of maize imports before market prices increase as a result of poor harvest due to drought. This instrument provided the Government of Malawi access to funds which had a potential of providing USD 4.4 million in case rainfall and maize production fell below the predetermined levels.

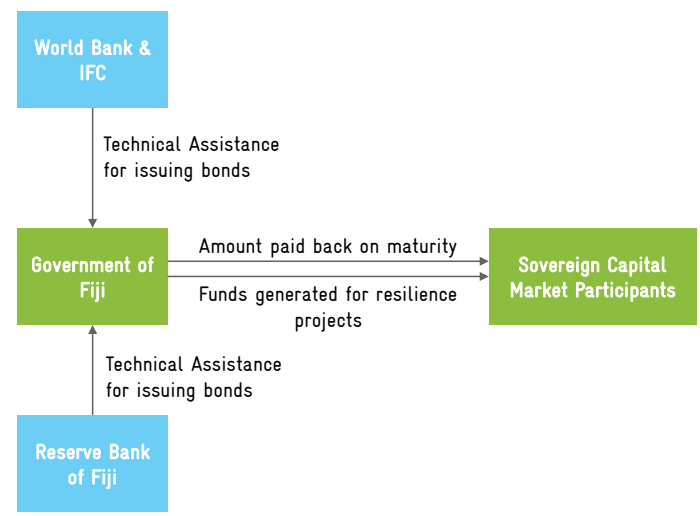


Green Bond[93]**:** A type of fixed income, liquid financial instruments that are used to raise funds dedicated to climate-mitigation, adaptation, and other environment-friendly projects, providing investors with an attractive investment proposition as well as an opportunity to support environmentally sound projects.

EXAMPLE OF GREEN BOND

Home to over 870,000 people, Fiji's 300 volcanic islands include low-lying atolls that are highly susceptible to cyclones and floods. In 2016, Tropical Cyclone Winston—the most intense tropical cyclone in the Southern Hemisphere on record—passed directly over Fiji, causing economic losses that amounted to almost one third of the country's GDP.

To protect its citizens and their livelihoods, the Government of Fiji intended to undertake resilience projects. In order to generate funds for these projects, Fiji developed and launched a sovereign green bond- the first developing nation to do so. At the request of Fiji's Reserve Bank, the World Bank and the International Finance Corporation (IFC) provided technical assistance to the government in issuing a sovereign green bond.



There were 2 types of bonds issued with varying maturity period i.e. 5 years and 13 years and varying coupon i.e. 4% and 6%. The bonds, issued by the Government of Fiji, helped raise 100 million Fijian dollars which would primarily focus on climate resilient projects. Proceeds from the bond will also be used to fund projects which support Fiji's national commitment of 100% energy generation from renewable energy and reduction of it CO_2 emission by 30% by 2030.

An important point to be noted here is the liability of returns. Being market based instruments, the proponent is liable to provide returns to investors during the specified time (e.g.: Date of maturity of bonds). Any default by the proponent can lead to severe regulatory action and sanctions. Hence, adequate appraisal should be undertaken by the project proponent to prevent any defaults. To this end, assistance from capital market experts should be taken to complete the appraisal exercise.

4.1.4 CENTRAL/STATE GOVERNMENT

In order to understand the areas where government agencies are focussing on, the proponent needs to review various policy documents and international commitment documents like NAPCC (National Action Plan on Climate Change)[94], respective SAPCC (State Action Plan for Climate Change)[95], NDC (Nationally Determined Contributions)[96]. Relevant to the specific requirement of financing an adaptation project, the following funds are currently present:

a. National Adaptation Fund for Climate Change (NAFCC)97

The National Adaptation Fund for Climate Change (NAFCC) is a Central Sector Scheme which was set up in the year 2015-16 with the following objectives:

i. Support climate change adaptation activities aligned with relevant missions under NAPCC and the SAPCCs in (i) Agriculture, (ii) Horticulture, (iii) Forestry (particu-

larly agro-forestry), (iv) Coastal and low-lying system, (v) Disaster management, (vi) Human health, (vii) Marine system, (viii) Rural livelihood sectors.

ii. Assisting vulnerability and climate change impact assessment studies.

iii. Capacity building of stakeholders on climate change adaptation

iv. Mainstreaming approaches/learning from project/programme implementation through knowledge management.

The result areas under NAFCC[98] are as follows:

i. Ensure availability of food and water to the most vulnerable population

ii. Building resilience of ecosystem to climate change

iii. Developing climate resilient livelihoods to ensure sustainable existence

iv. Institutional capacity building for tackling issues related to climate change.

v. Creating awareness of effects of climate change and develop community level ownership for projects aimed at managing risks related to climate change

vi. Improved policies and regulations

The activities under this scheme are implemented in a project model of National Bank for Agriculture and Rural Development (NABARD) which has been designated as the National Implementing Entity (NIE) for implementation of projects under NAFCC. Since its inception till 2017-18, 27 adaptation projects[99] have been sanctioned to receive financial support.

b. National Clean Energy Fund (NCEF)100

The Finance Bill 2010-11 provided for creation of a corpus called National Clean Energy Fund to invest in entrepreneurial ventures and research in the field of clean energy technologies. Subsequent to the budget announcement, the Central Board of Excise & Customs (CBEC) issued a notification dated June 22, 2010 to notify the Clean Energy Cess Rules, 2010. An Inter-Ministerial Group (IMG) had been constituted to approve the projects/ schemes eligible for financing under the NCEF. Such projects may be:

i. Sponsored by a Ministry/Department of the government

ii. Submitted by individual/ consortium of organisations in the government/public sector/ private sector in the form of loan or viability gap funding, as the IMG deems fit on case to case basis. Government assistance under the NCEF shall in no case exceed 40% of the total project cost.

Even though the fund is focussed on climate mitigation action, funds from such a fund can be utilised in a fundamentally climate change adaptation project. In such a case the fundamental premise of climate change adaptation i.e. increasing resilience of human or natural systems is achieved by adopting mitigation solution. An example of such an arrangement is given below:

EXAMPLE OF GOVERNMENT FUNDED MITIGATION PROJECT WITH ADAPTATION CO-BENEFITS[101]

Gosaba is one of the main deltaic islands in Sundarbans region, situated about 80 km south west of Kolkata and the last inhabited area and police station before the deep forests of Sundarbans start. The residents of the area had limited opportunities for agricultural practices, considering the inherent salinity of the surrounding water bodies and a major source of income was through sale of baby prawns that naturally inhabit the waters. The income from the sale of prawns provide limited access to finances. However, the long contact with salty water, led to skin diseases as well as reproductive tract infections for women.

Also, access to drinking water was limited as there was limited scope of pumping underground water. The village lacked access to electricity from grid, due to its remote location and access to electricity was limited to few houses and shops which relied on small diesel generators running for three to four hours every day. Invariably opportunity illumination from this electricity was low and the rate was far higher than what people from mainland paid for grid power. With development in the area being inadequate, treating health issues remained a constant challenge and ate in to the limited earnings of the families.

These issues got compounded due to increasing salinity of the water bodies caused by increasing temperatures. A compound effect of lack of electricity and increasing salinity of water was severely hampering the ability of the local community to cope with existing and future climate change.

On the basis of the survey of the area in 1996 by West Bengal Renewable Energy Development Agency (WBREDA), a 500kW biomass run power plant, based on gasification technology from a private company – Ankur Scientific Energy Technologies, was proposed to be setup in Gosaba.

75% of the project cost was funded by the erstwhile Ministry of Non-Conventional Energy Source (MNES), Government of India and remaining by West Bengal State Government. In order to develop the solution specifically suited to the local conditions, extensive stakeholder consultation were undertaken which included local communities, government agencies and the private sector player. Apart from the power plant, a 71 hectare plantation in low-line river bank silt beds was setup to provide high quality woody biomass, which will serves as fuel for the plant as well as check soil erosion and maintain the ecological balance of the region. It was envisaged that the access to electricity would help bring in alternative means of livelihood of the populace as well as improve access to healthcare facilities in the region. A separate 13 member Gosaba Rural Energy co-operative was constituted and adequate capacity building initiatives were adopted to ensure the local population can operate and maintain the plant with support from the private player.

As a result of the intervention, the socio-economic scenario of the island improved drastically. Number of commercial establishments increased (which included 10 hotels) and attracted people from nearby islands for fulfilling their shopping needs. the electricity is also used for public purposes such as street lights, school lighting, drinking water supply and irrigation along with powering the small-scale industry like boat repairing works, lathe machine units, grill welding and domestic iron implements sharpening machines to name a few. Subsequently a bank opened up to support the economic activities as well improvement in telecommunication system. The availability of electricity helped local hospital run equipment to conduct basic operations. Accordingly, income levels have enhanced and this has led to a flourishing township in a place where once people almost lived from hand to mouth. This has all been possible only because of the proper use of biomass generated electricity.

4.1.5 NON-PROFIT ORGANISATIONS/FUNDS

These include non-government organisations (NGOs), philanthropic organisations/funds, and Corporate Social Responsibility (CSR) departments of private and public sector enterprises which have the objective of undertaking public welfare initiatives. In this regard, a provision on CSR had been incorporated under Section 135 of the Companies Act, 2013[102]. Under this section, companies meeting certain criteria related to net worth, turnover or net profit need to constitute a CSR Committee and ensure spending of at least 2% of the average net profits during the three immediately preceding financial years, in CSR activities. In this regard, there are many companies which are undertaking CSR activities which might have strong adaptation component.

In order to assess whether there is a possibility of getting funds from NGOs/Funds for adaptation projects, the project proponent must study the CSR reports of potential enterprises and organisation vision/objective documents of the philanthropic organisations or NGOs to understand the degree of alignment of the project objectives with the organisations' objectives provided in the documents.

4.1.6 PRIVATE SECTOR AND FINANCIAL INSTITUTIONS (FIS)

This group of financier combine public and private sector enterprises, and financial institutions. Such group of organisations will either extend credit (in case of public/private sector banks and other private sector financial institutions) or provide funds for the project (in case of enterprises). In both cases, the objective of the investment is returns, either through repayment of loans or generation of revenue to recover project costs/generate profits from project activities. Hence, project being funded by such organisations need to have a revenue generating model to ensure financier gets a return on their investment.

While conventional private sector organisations and FIs mostly evaluate financial returns/ valuations from an investment, there is a growing trend to evaluate environmental, social and governance (ESG) impact of an investment[103]. While there is an overlay of social consciousness, the main objective of ESG evaluation remains financial performance. Examples of ESG criteria used by investors range from company's impact on climate change or carbon emissions, water use or conservation efforts, anti-corruption policies, board member diversity, human rights efforts or community development. ESG investment involves institutional investors or retail investors investing in an organisation (at times in specific projects/ programmes) on equity/non-equity basis.

ESG FUNDS IN INDIA

An example of institutional ESG investment is of a USD 1 billion ESG fund by a collaboration of three former Tata group executives with asset managers Quantum Advisors[104]. The fund will invest in small to mid-cap companies complying with the ESG criteria, for an 8-9% stake. Example of retail ESG investment can found in asset management companies like SBI Mutual Fund[105]. SBI Mutual Fund designed thematic mutual funds, pool in funds from retail investors, to invest in companies that follow the ESG norms.

The concept of ESG investment is picking up in India as well as globally. Although there are no major example of ESG investment in climate change adaptation globally, it is an area which is expected to develop in the near future. Also, as discussed, the ESG investment involves equity control implying that while investors are sensitive to the positive environmental or social impact of an initiative, the investment is made on the premise of financial returns.

In order to tap ESG investors, project proponent needs to understand the underlying principles behind ESG investing. While it is an area of development, United Nations supported Principles for Responsible Investment (PRI) provides for the defining principles of ESG[106]. These principles, along with the prevailing market information regarding ESG funds operating in the sphere of climate change adaptation, can help project proponents explore this source of funding. The fundamental need to increase participation of the private sector is to evolve an appropriate appraisal process of adaptation projects and quantification of climate risks.

4.1.6.1 APPRAISAL PROCESS USED BY FINANCIAL INSTITUTIONS FOR ADAPTATION PROJECTS

Methodologies for assessing the impact of climate change on the corporate lending portfolios of banks have been developed and have been elaborated in a report prepared by **Acclimatise and**

UNEP Finance Initiative[107]. These methodologies have been piloted in 16 banks globally and despite them currently undergoing refinements in order to find wider acceptance, they provide guidance on the way climate change can be accounted for in the near future for assessing climate change risk related to project financing. The report contains two physical risk methodologies developed for the three pilot sectors viz. agriculture, energy and real estate.

One methodology enables banks to analyse credit risk for borrowers in the agriculture and energy sectors. It focuses on analysing climate-related impacts on borrower revenues and cost of goods sold (also known as 'cost of sales'), and estimating changes in probability of default. A second methodology, for real estate, enables banks to assess potential changes in property values and loan-to-value ratios due to extreme weather events. This methodology is applicable to retail mortgages and income-producing real estate. Both of these methodologies are elaborated briefly below:

1. Methodology for agriculture and energy sector portfolios

a. Assessing changes in sector productivity: Changes in temperature, precipitation and related variables can affect productivity and output of the economic activities in energy and agriculture sector. For instance, the temperature of water used to cool thermal power plants plays a critical role in determining how much power can be generated. For hydropower plants, changes in precipitation, evaporation and snow/glacier melt can all affect river flows, reservoir inflows and ultimately, power production. The impacts of incremental climate change on sector productivity are estimated based on published climate change impact assessments. From the productivity loss, the production losses are estimated from empirical evidence. For agriculture, the methodology provides high-level estimates of the typical proportion of production lost per extreme event type (e.g. proportion of crop lost following a drought). For energy, the impacts of extreme events are expressed as typical 'downtimes' during which production ceases (e.g. downtime for a power plant following a tropical cyclone).

b. Assessing loss in income due to climate change: The production losses determined in the previous section is converted into changes in revenue and cost of goods sold by considering the empirical evidence on selling price and cost price available for the commodity or product.

c. Determining changes in Probability of Default (PD): Estimates of changes in revenues and cost of goods sold (COGS) are used to evaluate changes in credit risk for individual borrowers and sector portfolios. This process involves stressing factors/ratios in the bank's rating models that have revenue and cost components and calculating revised risk grades across the portfolio.

2. Methodology for real estate

a. Estimating impacts of extreme events on property values: Drawing on empirical evidence, the real estate methodology provides high-level estimates of changes in property values due to extreme events. Evidence indicates that experience of extreme events can reduce property values by between 5% and 20%.

b. Determining changes in loan-to-value (LTV) ratios: The high-level estimates of changes in property values are applied to properties that are identified to be at risk of future extreme events, and revised LTV ratios are calculated. The LTV ratio is a financial term used by lenders to express the ratio of a loan to the value of an asset purchased.

Apart from the adaptation project specific appraisal process, most banks undertake a generic appraisal process[108,109,110] to qualify a project proposal. Based on the findings of the appraisal process, banks may or may not sanction the loans. Once sanctioned, specific procedure led down by the bank needs to be followed by the project proponents to secure the loan amount.

DIRECT PRIVATE FUNDING FOR CLIMATE ADAPTATION PROJECT

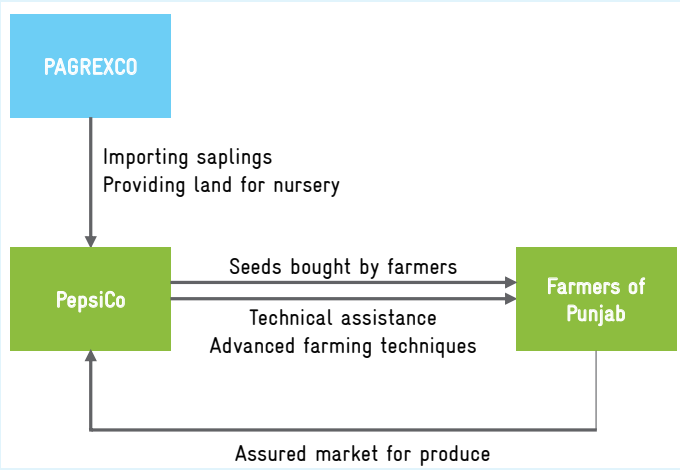
Case Study 1:

In the Green Revolution era, Punjab shifted from their traditional crops (maize, pearl millet, pulses and oilseeds) to the wheat-paddy cultivation cycle[111]. The change in cropping pattern was to ensure food security for the country, however, it started having detrimental effect on the groundwater levels in the state. The introduction of short-duration hybrid rice variety, Govinda, in 1993-94 further increased the issue of water availability and led to declining soil health as well. With 97% of agricultural land irrigated in the state[112], the only other alternative was rain water. However, monsoon rainfall in the state became irregular with heavy downpours being followed by dry spells. The aberrant weather patterns also catalysed a boom in whitefly – an insect that sucks sap from plants during its nymphal stage[113]. Shifting to less water intensive crops and adopting crop diversification techniques were recommended to tackle the growing issues of climate change.

Case Study 2:

In this backdrop, The PepsiCo and PAGREXCO (Punjab Agri Export Corporation) partnered to start Citrus Development initiative in 2002. Under this arrangement[114], PepsiCo deployed the agri-research teams of Tropicana– the 100% fruit juice brand of PepsiCo– with the objective of locally sourcing the fruit for making Tropicana orange juice. A study was made on the data of potential yields over the first two years of commercial crops, based on which the final decision was taken for setting up a processing unit.

PepsiCo India provided farmers with technical support, equipment and knowledge based on the aforesaid research and trials and provide direct seeding machines to facilitate farming of the citrus fruits. The Punjab Government on the other hand provided key role in creating nursery infrastructure in Jallowal, importing the germplasm and making land available for demonstration plots at multiple locations[115].



The project has played a significant role in introducing a less water intensive alternative to crops such as paddy in Punjab. It has provided farmers with the options to choose from 16 varieties of rootstock and 34 varieties of citrus, with each plant capable of providing multiple harvest of fruits in a year. Technical support and expertise were extended to the Punjab Government to set up two fruit processing plants in Hoshiarpur and Abohar – prime citrus growing areas in Punjab. By the end of the year 2002, 10,000 acres of land came under cultivation which went up to 35,000 by 2008.

This initiative has emerged as one of the most successful models of public-private partnerships in increasing resilience of the farming community as well as providing plausible business solutions.

4.1.7 BILATERAL/MULTILATERAL FUNDING AGENCIES OR INTERNATIONAL FUNDS

This stage comprises international funding sources and should be availed only when national level sources of funds have been exhausted. This level comprises (i) Bilateral funding agencies, (ii) Multilateral funding agencies, and (iii) International funds. A brief snapshot of each of these bodies is given in the table below:

No.	Name of Agency/ Fund	Type	Focus Areas for climate change adaptation in India
	GIZ[116]	Bilateral	■ Environmental protection and resource conservation O Conservation of biodiversity and natural resources with a focus on preserving forests, wetland, coastal and marine ecosystems and their biodiversity ■ Improving climate change adaptation in rural areas with a focus on agriculture
	International Climate Initiative (IKI) [117]	Bilateral (Germany)	■ Adapting to the impacts of climate change O Support ecosystem based adaptation (EbA) projects i.e. using biological diversity, natural resources and ecosystem services to increase people's capacity to adapt to the effects of climate change. O Development of risk management instruments i.e. innovative insurance solutions for protection against weather risks O Developing and implementing National Adaptation Strategies (NAPs) ■ Conserving biological diversity O Provide advisory services on structuring and implementing National biodiversity strategies and action plans (NBSAPs) O Prepare national and regional The Economics of Ecosystems and Biodiversity (TEEB) studies O Build technological and institutional capacities in conducting NBSAPs and TEEB studies ■ Protection and sustainable use of ecosystems and biological resource to support human livelihood
	United States Agency for International Development (USAID)[118]	Bilateral	■ Improving lives of vulnerable population O Improving health services (especially for women and children) O Improving access to safe drinking water O Improve literacy ■ Improving environmental sustainability O Strengthen forest dependent communities ■ Making agriculture climate resilient and secure livelihood of farmers through improved farming techniques and practices
	World Bank[119]	Multilateral	■ Resource Efficient Growth O Promote resource efficiency in rural sector O Improve sustainability of cities O Improve disaster risk management and resilience to climate change ■ Investing in human capital through quality education, improved water supply and sanitation, access to quality healthcare ■ Key objectives across two priority themes given above: ■ Shifting agriculture to be more climate resilient ■ Better resource management to increase resilience ■ Developing market mechanisms to facilitate financing for climate change adaptation

No.	Name of Agency/ Fund	Type	Focus Areas for climate change adaptation in India
	United Nations Development Programme (UNDP)[120]	Multilateral	■ Increasing state governments' adoption and implementation of climate adaptation and disaster risk reduction in line with Sendai Framework ■ Protection, restoration or management of terrestrial, coastal and marine areas through integrated programmes for ecosystem resilience and community based climate adaptation ■ Application of integrated approach to reduce pollution and environmental degradation with a focus on chemicals and waste management ■ Enhance energy access within vulnerable communities
	Asian Development Bank (ADB)[121]	Multilateral	■ Sustainable natural resource use ○ Irrigation modernisation to support National Water Mission ○ Support for coastal erosion management by developing sustainable solutions like beach nourishment, dune management, artificial reefs etc. ■ Climate and disaster resilience ○ Promotion of climate proofing infrastructure projects ○ Increasing urban climate change resilience, especially in environmentally sensitive states and cities like hilly and forested cities, cities likely to face water related disaster risks ○ Assessment of disaster and climate change vulnerability and incorporating appropriate resilience measures in project design
	Adaptation Fund[122]	International Fund	■ Helping the most vulnerable communities in developing countries adapt to climate change
	Green Climate Fund[123]	International Fund	■ Increased resilience of environmental systems and human population in: ■ Health, food and water security ■ Livelihoods of people and communities ■ Ecosystem and ecosystem services ■ Infrastructure and built environment
	Special Climate Change Fund (SCCF)[124]	International Fund	Provides funds for adaptation activities which should be country-drive, cost-effective and integrated in to country's development and poverty-reduction strategies in the areas of: ■ Water resources management ■ Land management ■ Agriculture ■ Health ■ Infrastructure development ■ Fragile ecosystems (including mountain ecosystems) ■ Integrated coastal zone management ■ Climatic disaster risk management

In order to secure the funds from such agencies, the focus areas of the target financier should be studied to ensure alignment of project objectives. Also, as discussed, the stipulations of Government of India demands that all proposal and pre-proposal related documents need to be routed through relevant government bodies. Hence, project proponent should understand existing procedure before proceeding to this step.

The funding from such sources is usually in form of the following:

a. **Grants:** A grant is a set of resources — money, technical assistance and/or goods in kind — typically transferred from developed nations to developing/under developed nations. This transfer is made with no expectation that they will be repaid. Hence, even if project does not generate revenue but provide economic benefits a project can be funded under grants.

b. **Soft loans:** Loans with no interest or a below-market rate of interest. Soft loans have lenient terms, such as extended grace periods in which only interest or service charges are due, interest holidays and typically offer longer amortisation schedules (in some cases up to 50 years).

In both cases, the lender will have their own set of evaluation criteria to determine whether a project can qualify for grant or loans. The figure given below the criteria of GCF for evaluating an adaptation proposal:

GCF Investment Criteria	Significance of the Criteria
Impact potential	Does the programme/project contribute to the achievement of the Fund's objectives and result areas?
Paradigm shift potential	To what degree can the proposed programme/project catalyse impact beyond project investment?
Sustainable development potential	What are the programme/project's wider benefits and priorities, including environmental, social and economic co-benefits? What is its gender-sensitive development impact?
Responsive to recipient's needs	Does it fulfil the vulnerability and financing needs of the beneficiary country and population in the targeted group?
Promote country ownership	Does the beneficiary country own the project/programme? Does it have capacity – including policies, climate strategies and institutions – to implement a funded project/programme?
Efficiency & effectiveness	Is the project/programme economically and financially sound?

4.2 Financial structuring through risk normalisation

In most cases and apart from self-financing, any one of the aforementioned funding sources is unwilling to fund projects alone even though prior estimates and appraisals indicate feasibility. This is often attributed to the 'gut feeling' of financiers emerging from the inherent gap between theoretical feasibility assessments and actual issues that may be observed in future and is typical for large projects wherein government funding is lacking. This has traditionally hampered of upscaling climate change adaptation projects. In such cases, risk is normalised either by sharing the risk or seeking adequate coverage. While insurance products are an example of risk coverage, risk sharing requires various financers to share the capital expenditure either through upfront contribution or by guaranteeing revenues. Various modes of risk sharing and coverage are detailed below:

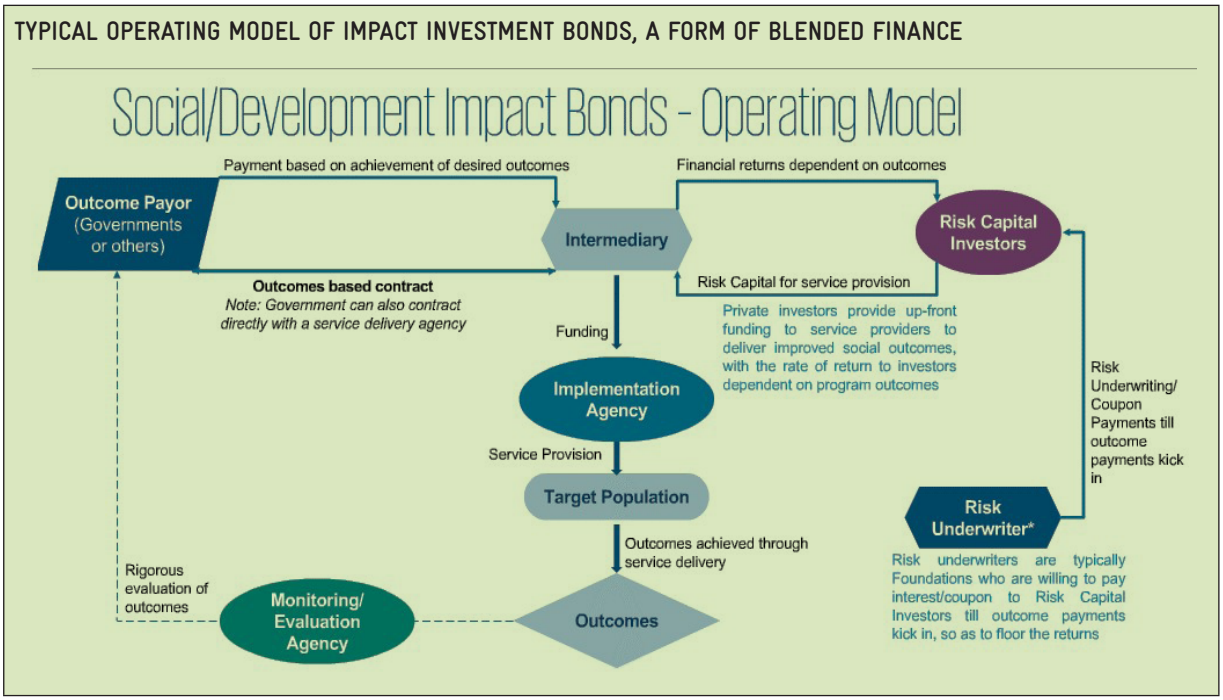
4.2.1 BLENDED FINANCE

Blended Finance[125] options typically mix small amounts of public concessional funds with private sector commercial funds to finance first-of-a-kind projects that have a high development impact and a strong potential to create a demonstration effect, but have not yet established a commercial track record. Blended Finance can help rebalance the risk-reward profile of pioneering projects for private sector investors, thus drawing in private sector financing into these projects, while also leveraging the use of scarce public funds.

When executed effectively, it fills the gap between public and fully commercial financing, attracting commercial banks and private investors alike to crowd-in new sources of climate finance and help develop markets. When done poorly, it can lead to market distortion, inappropriate risk allocation, and windfall profits. Hence, necessary precautions need to considered before developing the mechanism as well as ensure strong governance is in place to monitor and evaluate the fund utilisation as well as disbursement. The area of blended finance is in the stage of development and going ahead it is expected to bridge the investment gaps for the Sustainable Development Goals (SDGs)[126]. Supporting Mechanisms[127] have been traditionally used by development funders in a Blended Finance package to attract and support private sector investors by managing risks and reducing transaction costs. These Mechanisms can generally be classified as providing:

1. Technical Assistance, to supplement the capacity of investees and lower transaction costs.
2. Risk Underwriting, to fully or partially protect the investor against risks.
3. Market Incentives, guaranteed payments contingent on performance of future pricing and/or payment in exchange for upfront investment in new or distressed markets.

TYPICAL OPERATING MODEL OF IMPACT INVESTMENT BONDS, A FORM OF BLENDED FINANCE



Blended Finance can also be enabled by development funders via Direct Funding throughout the project or enterprise life cycle. Direct Funding includes grants, equity, and debt that can help support:

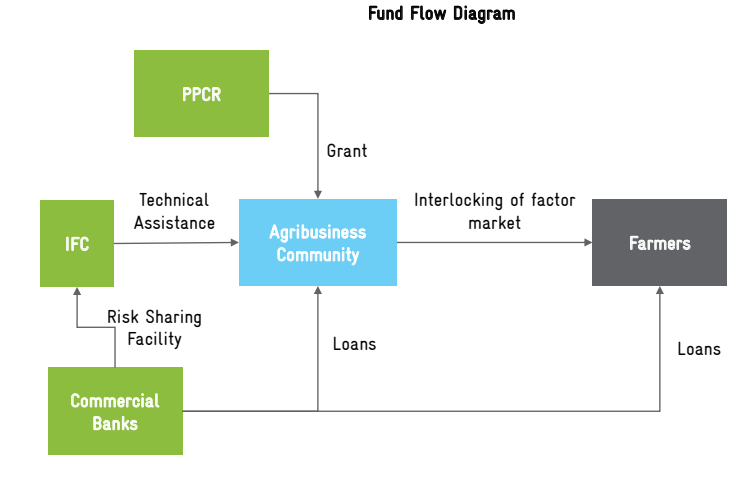
1. Preparing, reducing commissioning uncertainty and 'first mover disadvantage.'
2. Pioneering, helping high-risk enterprises or projects to experiment with, test, and pilot new

business approaches.

3. Facilitating, offering investments at more generous terms than the market to encourage investments with a high expected development impact.
4. Anchoring, seeking to 'crowd in' private capital on equal terms to achieve 'first close' or demonstrate viability.
5. Transitioning, providing a pipeline of mature and sizeable investments cultivated by development funders that attracts scalable investments through exits to commercial players.

EXAMPLE OF BLENDED FINANCE

An example of blended Finance used in the context of adaptation is the pilot program for climate resilience for agriculture sector in Nepal undertaken by World Bank (IFC)[128]. The project aims to reduce credit risks and capacity gaps that prevent small farmers from accessing financing for investments in agricultural measures that can help reduce their climate vulnerability. While IFC provides technical assistance to agribusiness community to reduce the capacity gaps, it also has a risk sharing facility with commercial banks to reduce credit risk profile of farmers. The risk sharing facility ensures bank provide loans to farmers to pursue climate resilient practices and in case of default by the farmers, the same can be covered by IFC. The investment flow diagram given below explains the inter-relationship of the various players involved in the project.



4.2.2 PARTIAL RISK SHARING FACILITIES (PRSF)

PRSF has emerged as a viable solution in which the project proponents submit a proposal to the relevant government department seeking partial risk offset of the project against the claimed and bank-verified benefits of the project. Such risk offset may be in the form of:

- part-financing like Viability Gap Funding (VGF)
- concessions on interest rate applied by lending institution
- sovereign guarantees for minimum offtake invoked if non-ideal operating conditions emerge and persists

This reduces the risk exposure of the financial institution and increases bankability of the project. A classic case of sovereign guarantee is its use in the form of a minimum offtake guarantee by the Government of Tamil Nadu for the 100 MLD Minjur desalination project[129].

4.2.3 INSURING PROJECTS

An increasingly used approach to increase bankability of projects is the use of insurance/re-insurance products[130]. Insurance products help shift financial vulnerability from lower-income parties to parties better able to bear risk. There are multiple instances where such instruments have been used to a great effect.

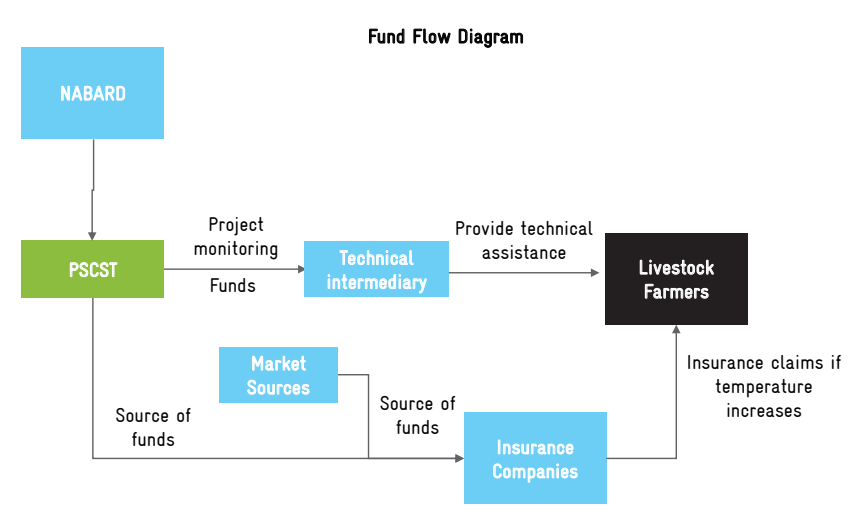
Reinsurance also can help national governments to sponsor insurance products for individuals and businesses at a local level which are ill-equipped to bear the consequences of severe weather events. If structured correctly, insurance may help low-income actors to productively manage otherwise inefficient investment patterns, prevent persistent "poverty traps", as well as prevent intrinsically tragic losses.

EXAMPLES OF WEATHER-BASED INSURANCE INSTRUMENT

Case-Study 1:

A case in point is the weather based milk insurance instrument under the project to develop climate resilient livestock production system in Punjab under NAFCC[131]. The design of weather indexed insurance product is based on the correlation of Temperature Humidity Index (THI) with the loss in milk yield and hence, aims to provide continuity of the income of small and marginalised farmers during heat stress conditions. It was estimated that when THI value exceeded 72, milk production in crossbred cows decreased by 35-40% with respect to peak performance period of the stock, resulting in daily loss in income by 45%. The project is under implementation and it is proposed that insurance companies will be involved in this module of the project.

The use of insurance product was a unique step provided in the project to hedge the climate change related risks of the livestock farmers. However, a quantifiable relationship between loss of livelihood and rise in temperature i.e. a metric had to be established to provide a sound basis for the insurance product. Also, the threshold limit of the metric for triggering the insurance claim from the farmers had to be carefully analysed to ensure that interests of the farmers are safeguarded as well as provide a plausible business proposition to the insurance companies, which will be processing the insurance claims. The project was proposed by Punjab State Council for Science and Technology (PSCST), Government of Punjab (prepared with technical support from GIZ) for consideration of funding from NAFCC.



Case Study 2:

Another example is that of MicroEnsure, a microfinance company which acted as an insurance intermediary to World Bank's initiative to introduce one of Africa's first Weather Index crop Insurance in 2005-06[132]. The pilot, run in Malawi, was followed up by a larger programme in Tanzania, Rwanda, India and the Philippines. In Rwanda[133], the insurance product i.e. weather index crop insurance was used by financial institutions to reduce their risk when lending to non-commercialised smallholder farmers. For these farmers, much of the agricultural land is rain fed, with little or no irrigation available. In case, there is any failure of rainfall and inclement weather conditions, the farmers have limited or no yields, leading to default on their loans. The banks, which are availing of the insurance, are safeguarded from the loss arising out of the default.

The use of this product has led to increase in agricultural portfolio of banks – Kenya Commercial Bank's lending to agricultural sector in Rwanda increased from approximately USD 108,000 for 1,600 farmers in 2012 to over USD 233,000 for 6,400 farmers in 2013. As an outcome, increased rural investment is leading to higher agricultural outputs and subsequently to higher incomes. Due to this product, rural investment increased, which in turns provides higher agricultural outputs leading to higher incomes. In addition, weather index insurance provides a safety net against the effects of adverse weather.

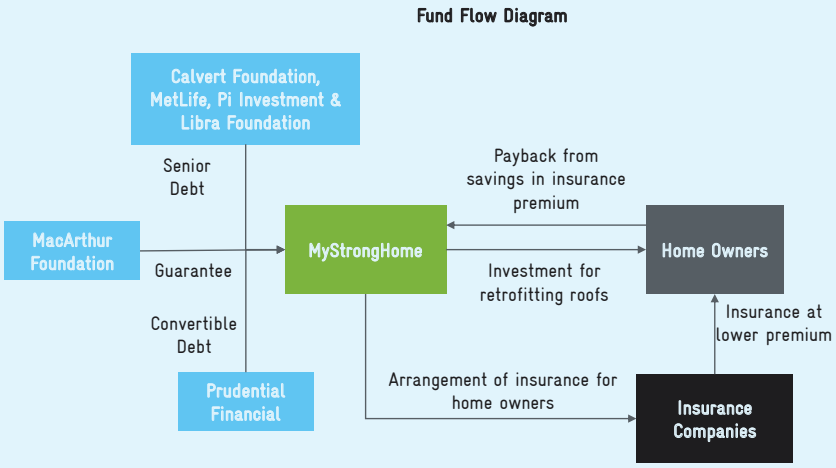
4.2.4 IMPACT INVESTMENT

Impact investing refers to investments made into companies, organisations, and funds with the intention to generate a measurable, beneficial social or environmental impact alongside a financial return[134]. It aims to demonstrate that small amounts of philanthropic capital, combined with large doses of business acumen can result in thriving enterprises that can cause an observable social change/ improvement. It provides a financing structure wherein an initiative can be funded by a combination of sources viz. private equity/venture capital, debt or fixed income. It is usually implemented in case of initiatives/organisations which will witness implementation of new technology or operation/business model, having no precedence.

EXAMPLES OF IMPACT INVESTMENT

In 2017, New York based MyStrongHome[135] raised capital USD 8 million through mix of financial instruments provided by multiple organisations to fund its for-profit venture of retrofitting vulnerable homes to be more climate resilient. It is a first-of-its-kind company that combines specialised climate-resilient construction, insurance and financing to mitigate climate risk and increase safety and security for families in vulnerable coastal communities. The investment is allowing MyStrongHome serve its first 1,000 homeowners and prove their model so they can address the market of more than 1.6 million homes across six coastal states of USA.

Under its model, the company checks and retrofits the roof of a household which falls within its eligible area. The company then works with insurers to arrange for lower premiums as a result of the improvements, and that savings covers the cost of the new roof.



In order to generate seed fund for the retrofit, a combination of senior debt and convertible debt has been used along with a guarantee for senior debt[136]. The senior debt was structured and arranged by Calvert Foundation as a part of its new Capital Aggregation business and includes a lead participation from MetLife as well as Pi Investments and The Libra Foundation. The John D. and Catherine T. MacArthur Foundation provided a critical guarantee for the senior debt to de-risk this promising new enterprise and the formation of its market. The guarantee is structured to decline as the business builds a track record and shows how catalytic impact investments can pave the way for large-scale, private market solutions. An additional USD 2 million in convertible debt was structured and arranged by Prudential Financial and includes foundations, including the Greater New Orleans Foundation, as well as individuals.

4.3 Preparation of project proposal

Once the target financier is identified, a proposal has to be prepared for assessment of the financier. Funds and MFIs like GCF[137], NAFCC[138], and GEF[139] have their own proposal templates. The proposal assessment is undertaken to assess the following general aspects:

Identify severity of the problem » Justification of project » Validate effectiveness of solution » Feasibility of solution » Justification of project budget » Review fund disbursement schedule

In case there are no templates available, the project proponent can create the proposal answering the questions given above. Care must be taken to ensure all necessary requirements are fulfilled and the proposal is aligned to the strategic objective of the financier.

4.4 Disbursement of Funds

Once proposal is assessed and financier is assured of the need for financing, the fund disbursement mechanism needs to be agreed upon between the proponent and the financing agency. In recent times, programme/project financing follows a milestone-based disbursement model. Under this methodology, the achievement of each milestone is independently verified by the financier before the next disbursement is released. This helps the financier to limit its financial exposure to a project even during the construction phase while simultaneously, creating a framework for monitoring the timely and quality completion of construction and pre-commissioning phases. Such a mechanism can help provide financing institutions the necessary safeguards to ensure that there is proper usage of funds.

A closely resembling example for such disbursement is the use of Disbursement Linked Indicators (DLIs) in projects funded through the World Bank's Program-for-Results (PforR) approach[140]. Under this mechanism, the following process is undertaken[141]:

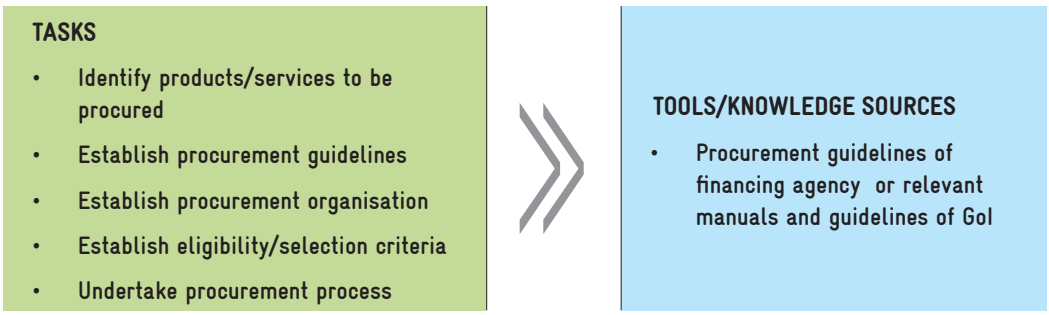
1. DLIs are identified which can help measure the progress of the project. DLIs include service delivery indicators, outputs and/or outcomes and include institutional indicators including those on fiduciary, environmental and social issues.
2. The values of these DLIs for which fund disbursement will be made is mutually agreed upon. Also, the verification protocol along with the timing/frequency of verification to determine value of DLIs that need to be established before disbursement.
3. DLIs should be made scalable, meaning disbursement is proportional to progress in achieving the DLI. This helps provide a more stable basis for disbursements than threshold-type conditions.

For example, an adaptation project which seeks to increase productivity of farm lands through adopting climate resilient measures and improved agricultural practices can have the following DLIs:

1. DLI 1: Annual increase in cultivable land area (progressive and radical);
2. DLI 2: Annual increase in irrigated area (ha) in marshlands and hillsides;
3. DLI 3: Increases in average crop yields per ha for key food and export crops and livestock (dairy);
4. DLI 4: No. of innovation technologies introduced and released and adopted by farmers;
5. DLI 5: Percentage increase in agricultural finance available of total finance;
6. DLI 6: Amount of climate resilient seeds distributed

The values for each of these DLIs will trigger a disbursement by the financing institution. These values will be determined through mutual agreement of the project proponent and financing institution.

Project Procurement



5.1 Identify products/services to be procured

Once funds have been secured, the next stage is utilisation of the funds for project implementation. The project proponent at this stage is required to identify the set of goods, works or services that it needs to procure to execute the project. From the perspective of adaptation projects, the definition for the three categories of procurement (as adopted from the General Finance Rules 2017[142] issued by Ministry of Finance, Government of India) viz. goods, works and services are provided.

Based on the requirements of the activities and assessment of internal capabilities, the proponents can identify the type of procurement (goods, works or services) required. The project timelines also provide the sequence in which the activities need to be completed, thereby providing guidance on the sequence in which identified products/services need to be procured.

5.2 Establish procurement guidelines

In order to ensure that procurement is conducted in an impartial and transparent manner as well as to comply with the prevailing rules and regulations of India and those of the financier, procurement guidelines need to be established. Many financiers have their own set of procurement guidelines[143] which needs to be followed while undertaking any procurement related activities. In the absence of any guidelines of the financier, manuals and guidelines issued by Government of India regarding procurement of goods and services can be referred[144]. These manuals and guidelines, although prepared for government bodies, can be adopted for use by any entity undertaking procurement within India, since these guidelines have been prepared keeping the existing policy and regulatory framework in mind.

5.3 Establish procurement unit

Next, a unit needs to be setup within a project management organisation to handle the entire procurement process for the project proponent. This unit needs to be headed by a Procurement Committee which will oversee all procurement activities. The composition of the unit as well as procurement committee, roles and responsibilities need to be defined based on the requirements stated in the procurement guidelines.

5.4 Establish eligibility/selection criteria

The next step in procurement is establishing the criteria on which the eligibility of potential bidders shall be assessed, followed by the criteria on which eligible bidders can be selected.
The approach for developing selection criteria for structural and non-structural project differs. In case of structural projects, a number of international standards can be referred to establish the selection criteria (*refer Section 3.4.2.1*). In case of non-structural projects, selection criteria used

in previous projects with similar scope of work/objectives can serve as guidance in developing the selection criteria for the project in question. The Procurement Committee can add additional criteria as deemed appropriate or as required by the selected procurement guidelines.

5.5 Undertake procurement process

With the procurement unit in place, the actual work for procurement can begin. It starts with the preparation of the bid documents for the selected services or goods, issuing the bid document, evaluation and final selection of requisite goods or service providers. In case a pre-qualification is involved, an extra step would be added. All requisite steps for procurement shall be completed in accordance with the guidelines selected in previous steps. Depending on the requirement of project proponents, different type of procurement strategies (competitive, non-competitive bidding) can be adopted.

Conclusion

Planning, designing, obtaining approval and finally executing an adaptation project requires cross-functional expertise. In most cases, it would be impossible for the project proponents to have an in-house source of such a wide gamut of expertise. Hence, it is recommended that the project proponents undertake investments in developing a good knowledge base as well as develop the vertical and horizontal sector linkages and coordination with non-government stakeholders (especially expert groups and the affected population) in order to design an effective project.

While all efforts have been undertaken to make the guidebook a good starting point for planning out an adaptation project, the project proponent must take into account the prevailing market conditions and regulatory landscape while referring to this guidebook. With a growing focus on private sector participation in adaptation project, it is expected that new financing mechanisms might get developed over a period of time which may not have been captured in this document. However, it is envisaged that users of this guidebook will continually add the learning from their experience to further enrich this document and help making it a comprehensive reference document for developing climate change adaptation projects in India.

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