

**Arthur D Little**

*Mozambique:  
Building resilience  
with the private sector*

*January, 2012*



### **0 Executive Summary**

1 Phase 1

2 Phase 2

3 Phase 3

### Arthur D. Little was asked by INGC to engage the private sector in building climate change resilience in Mozambique

- Mozambique is frequently burdened by natural hazards that have a major impact on the country's development.
- Due to climate change, the country's exposure to natural hazards is expected to increase - significantly affecting the country's development potential.
- In 2009, INGC (Instituto Nacional de Gestão de Calamidades) performed a study in to climate change impact in the risk of calamities in Mozambique
- Afterwards, nine different themes were defined with the main goal of covering all the areas that climate change might impact and a second phase of the project started
- ADL was asked to help build climate change resilience in Mozambique through private sector investment in attractive and sustainable business opportunities (Theme 4)
- The scope of this project can be divided in 3 phases:
  1. Diagnosis and formulation
  2. Evaluation
  3. Implementation support
- The focus of this document is to show the most relevant methodological steps undertaken and planned
  - In the first phase we indentified High Climate Change Risk / High Climate Change Impact areas and private investment opportunities for adaptation and mitigation measures.
  - In the second phase we performed feasibility and cost-benefit analysis on the long list of adaptation measures, studied the main barriers to investment and contacted several financing entities
  - In the third step we will analyze further in more detail the most promising projects

Source: INGC – Study on the Impact of Climate Change on Disaster Risk in Mozambique: Main report

**We defined a blueprint process that allowed us to answer a set of key questions about risks and impacts of climate change and to develop adaptation projects for several areas**

### Main outputs of the project

#### The main outputs of this project ...

A 'blueprint process' with tools and steps for arriving at a portfolio of adaptation options, which can be applied in other geographical areas to identify suitable and viable adaptation projects

A high-risk impact map by geographical area and an 'industry response plan'

A portfolio of viable, 'climate proof' adaptation options identified, with input from scientists, private sector and policy makers

Several priority adaptation measures worked out in detail to prepare for implementation, should funds become available

Analysis of barriers to investment and policy and strategy recommendations to help reduce those barriers

#### ... allow us to answer key questions such as:

■ How can we arrive at a portfolio of adaptation options?

- What are the specific implications of climate change in this geographical area?
- What are the key sectors at risk?
- How is my investment at risk (how often, how soon, etc)?

- What do I need to do to change?
- How does financing this project help me achieve my strategic aims?
- Should I invest, where and how?

- What is the needed investment to ensure adaptation to climate change?
- Are these type of projects financed in favorable conditions?

- What are the existing barriers to attracting private investors?
- How can we attract investors who are committed to helping Mozambique achieve sustainable development and adapt to climate change, and reject investors who are not?

Methodology focus

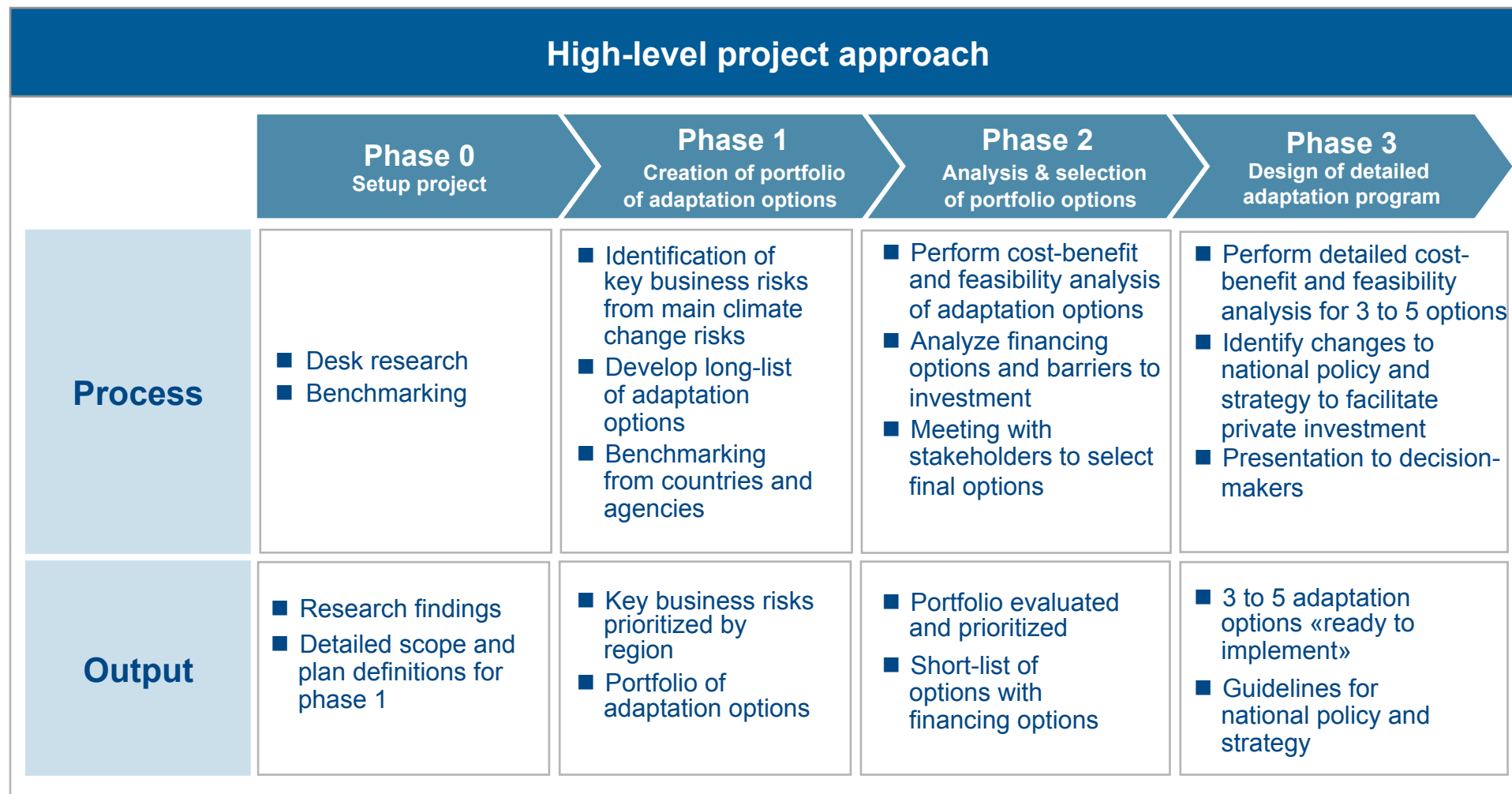
Output focus



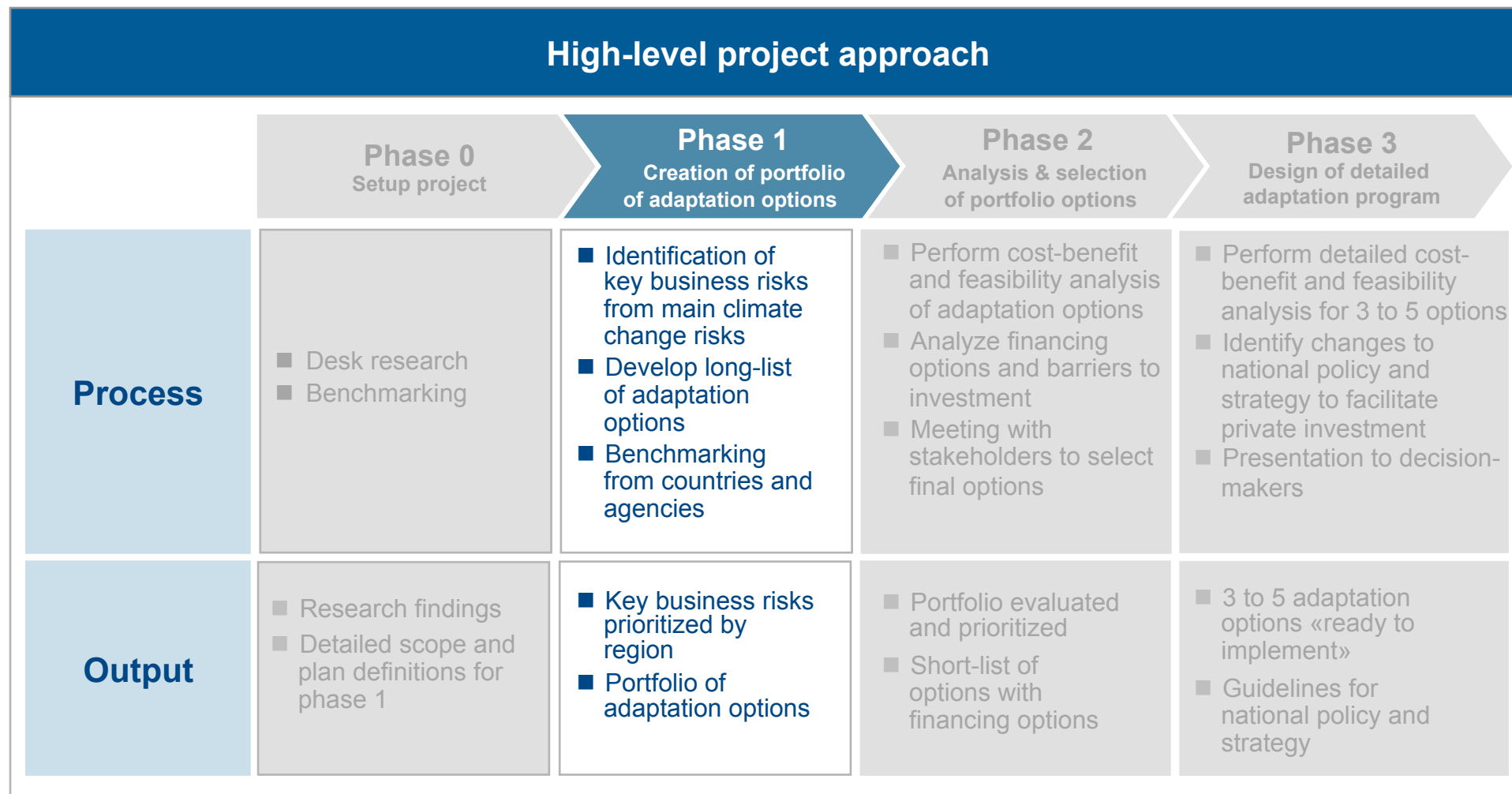
The process defined comprises a detailed analysis by region, the identification of a long-list of adaptation measures, the selection of top priority projects and policy change suggestions

High-level blueprint process		
Phase	Main steps	Key tools
<b>Regional Analysis</b>	<ul style="list-style-type: none"> <li>■ Country context analysis</li> <li>■ Climate Change analysis</li> <li>■ Business context analysis</li> </ul>	<ul style="list-style-type: none"> <li>■ Assessment of economic and social indicators</li> <li>■ Exposure analysis based on historical analysis and future trends</li> <li>■ Vulnerability analysis was based on the historical impact and expected economic and social development</li> <li>■ Analysis of the economic context and main private investments</li> </ul>
<b>Long list of adaptation options</b>	<ul style="list-style-type: none"> <li>■ Portfolio of adaptation options identification</li> <li>■ Combination of the High Climate Change Risk / High Climate Change Impact areas</li> </ul>	<ul style="list-style-type: none"> <li>■ Benchmarking of case-studies of adaptation options</li> <li>■ Input from experts</li> </ul>
<b>Top priority projects identification</b>	<ul style="list-style-type: none"> <li>■ Screening analysis</li> <li>■ Options evaluation</li> </ul>	<ul style="list-style-type: none"> <li>■ Analysis of adaptation measure's strategic fit and operational viability</li> <li>■ Feasibility and cost-benefit analysis</li> </ul>
<b>3-5 projects selection</b>	<ul style="list-style-type: none"> <li>■ Barriers to investment analysis</li> <li>■ Financing options assessment</li> </ul>	<ul style="list-style-type: none"> <li>■ Country risks and barriers, province constraints, currency and sector risks and government strategic areas identification</li> <li>■ Orientation of investment, limitation of the total amount available and financial products and services analysis</li> </ul>
<b>Policy change suggestions</b>	<ul style="list-style-type: none"> <li>■ Government support needed to implement adaptation projects in each area</li> </ul>	<ul style="list-style-type: none"> <li>■ Analysis of barriers to investment</li> <li>■ Feedback from private investors and financial institutions</li> </ul>

Arthur D. Little designed a 3 phase approach to the development of blueprint process to help the identification of a portfolio of adaptation options

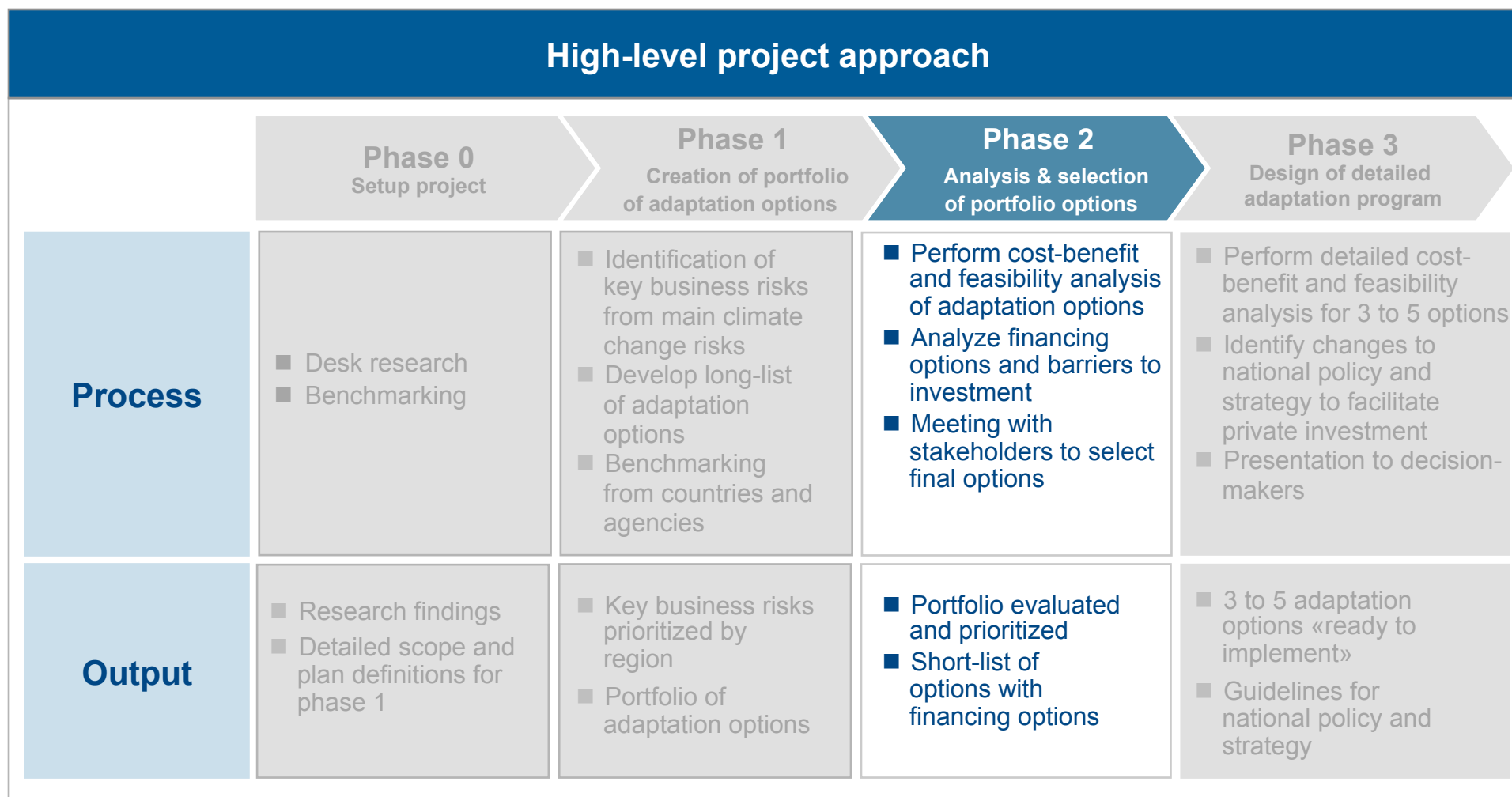


**Phase 1 aimed at the creation of a portfolio of adaptation options and identification of the key business risks...**

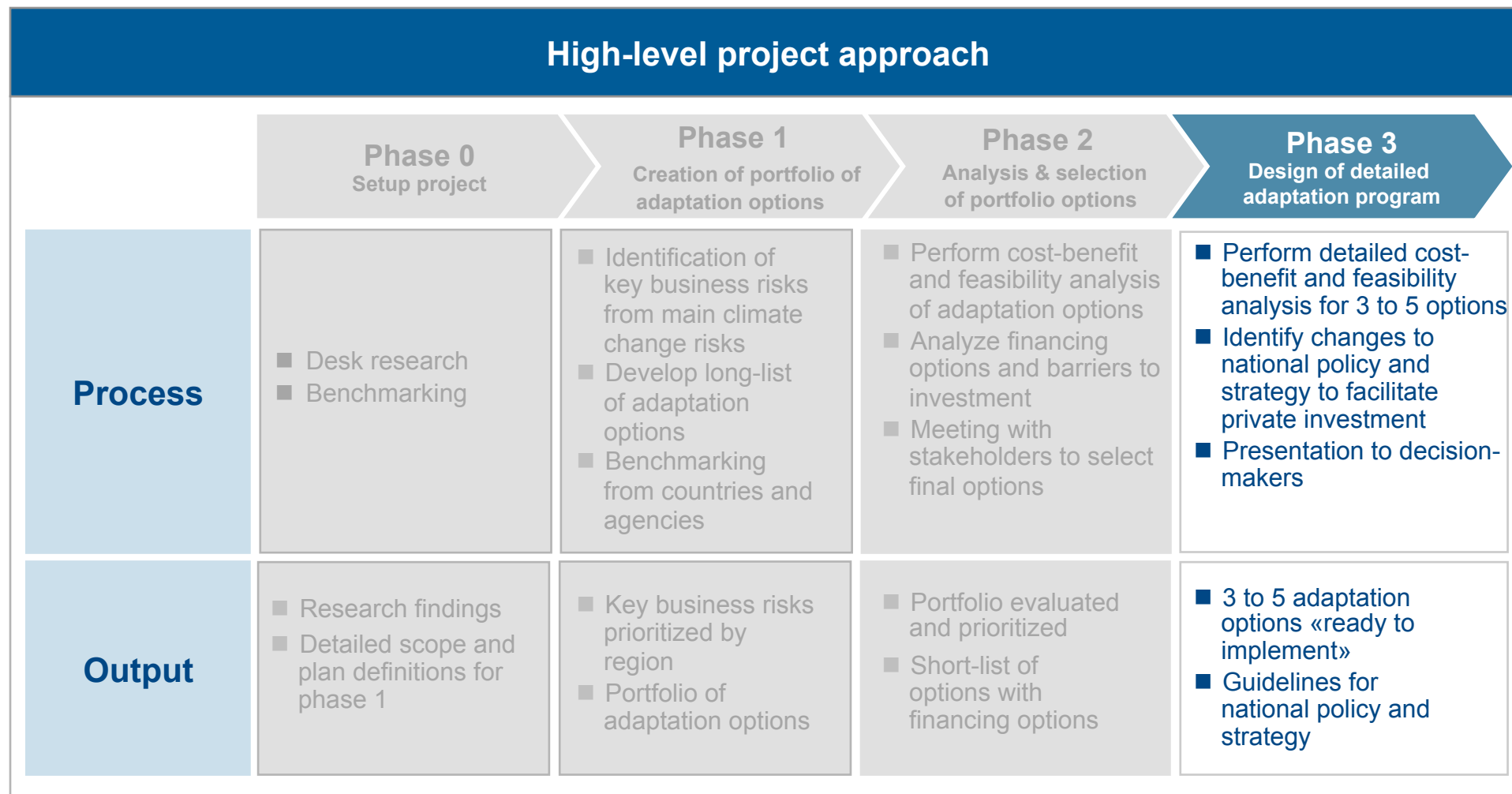




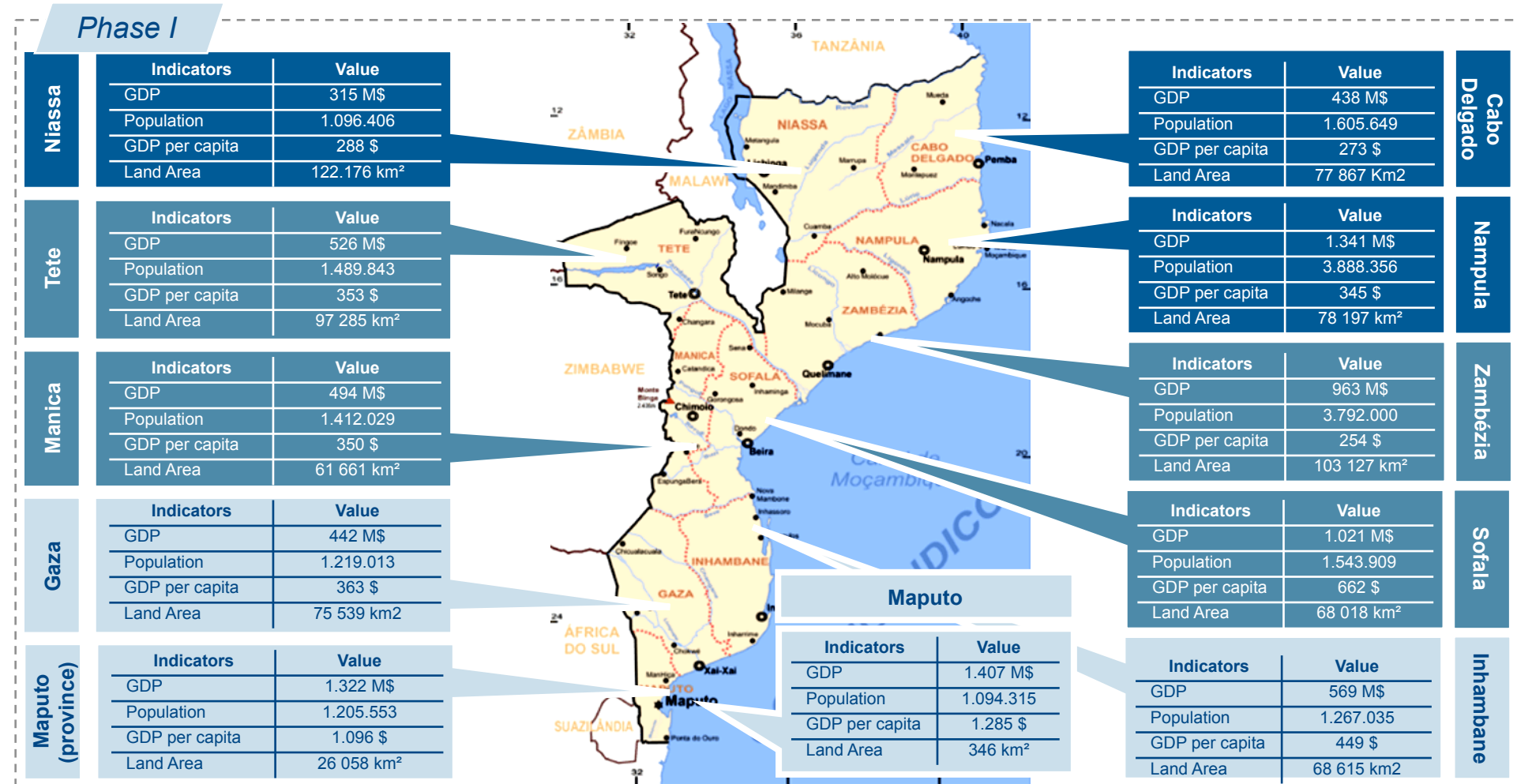
... Phase 2 aimed at the identification of a short-list of adaptation measures...



... and finally, in Phase three a detailed description of the four selected programs was performed



The provinces that have the highest percentage of country's GDP are Maputo city and province, Nampula and Sofala



Source: Instituto Nacional de Estatística de Moçambique, 2009 (population data refers to 2007)

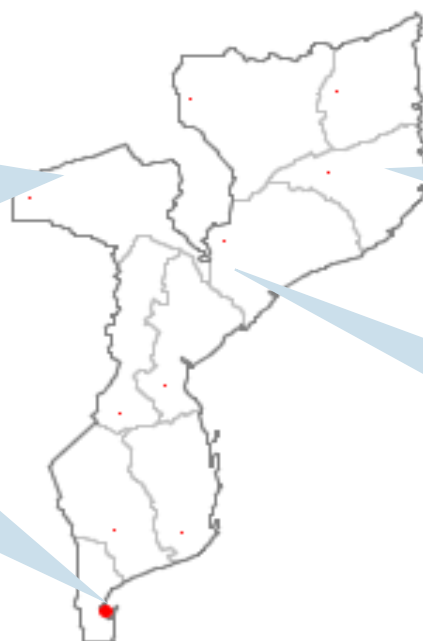
The value of approved investments that will take place in the short to medium<sup>1</sup> term is worth some \$19 billion of which more than 80% are located in Nampula, Tete, Maputo and Zambézia

### Phase I

#### Main approved private investment projects and prospects<sup>2</sup>

Tete	\$ 3.8 B	20%
Investments	Value	
Hidroeléctrica de Mphanda Nkuwa (Changara/Chiuta)	\$ 1.9 B	
Carvão de Moatize	\$ 1.5 B	
Eqstra Moçambique (Tete)	\$ 165 M	

Maputo	\$ 2.7 B	14%
Investments	Value	
Ilha de Xefina (Cidade de Maputo)	\$ 320 M	
MCEL (Cidade de Maputo)	\$ 140 M	
Obrigado Fazenda de Açúcar e Milho (Moamba)	\$ 100 M	



Nampula	\$ 7.5 B	39%
Investments	Value	
Ayr Petro-Nacala (Nacala)	\$ 5.0 B	
Lúrio Green Resources (Ribawe)	\$ 2.2 B	
Cervejas de Moçambique – Fábrica de Nampula	\$ 55 M	

Zambézia	\$ 2.4 B	13%
Investments	Value	
Portucel Moçambique (Ile)	\$ 2.3 B	
Moçamgalp (Luguela)	\$ 19 M	
Quifel Agrícola (Gurue)	\$ 17 M	

Other provinces	\$ 2.6 B	14%
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In addition to the private investment, it is expected significant public investment in these regions, such as Nacala port and airport (\$700 M) and improvement of Maputo and Beira ports (\$ 1,4 B)<sup>3</sup>

<sup>1</sup> In the next 5 to 15 years; <sup>2</sup>CPI (2005-2010) – Investment promotion centre (Centro Promoção de Investimento); <sup>3</sup>Nacala XXI, Nacala, Beira and Maputo development corridors, Mozambique investment forum 2010, Investment Opportunities in the Industrial Sector, Investing in Mozambique 2010; Companies



Six areas were identified as priority, considering its high climate change risk/high climate change impact levels

### Phase I



● High (risk/impact) ● Medium (risk/impact) ● Low (risk/impact)



These six areas have an estimated value at risk of some \$14B and may affect around 7 million persons

### Phase I

#### Key “High Climate Change Risk / High Climate Change Impact”



##### Nacala

- Key risk: Infrastructure destruction
- Events: cyclones and droughts
- People affected: 305.000
- Value at risk<sup>1</sup>: \$5.700M



##### Moatize, Motarara & Changara

- Key Risk: Water stress
- Events: floods and droughts
- People affected: 950.000
- Value at risk<sup>1</sup>: \$5.400M



##### Maputo city

- Risk : Flooding
- Events: cyclones and floods
- People affected<sup>2</sup>: 720.000
- Value at risk<sup>1</sup>: \$2.300M



##### Beira (Buzi and Dondo)

- Key Risk : Infrastructure destruction
- Events: cyclones, floods and droughts
- People affected: 937.000
- Value at risk<sup>1</sup>: \$1.000M



##### Vilanculos

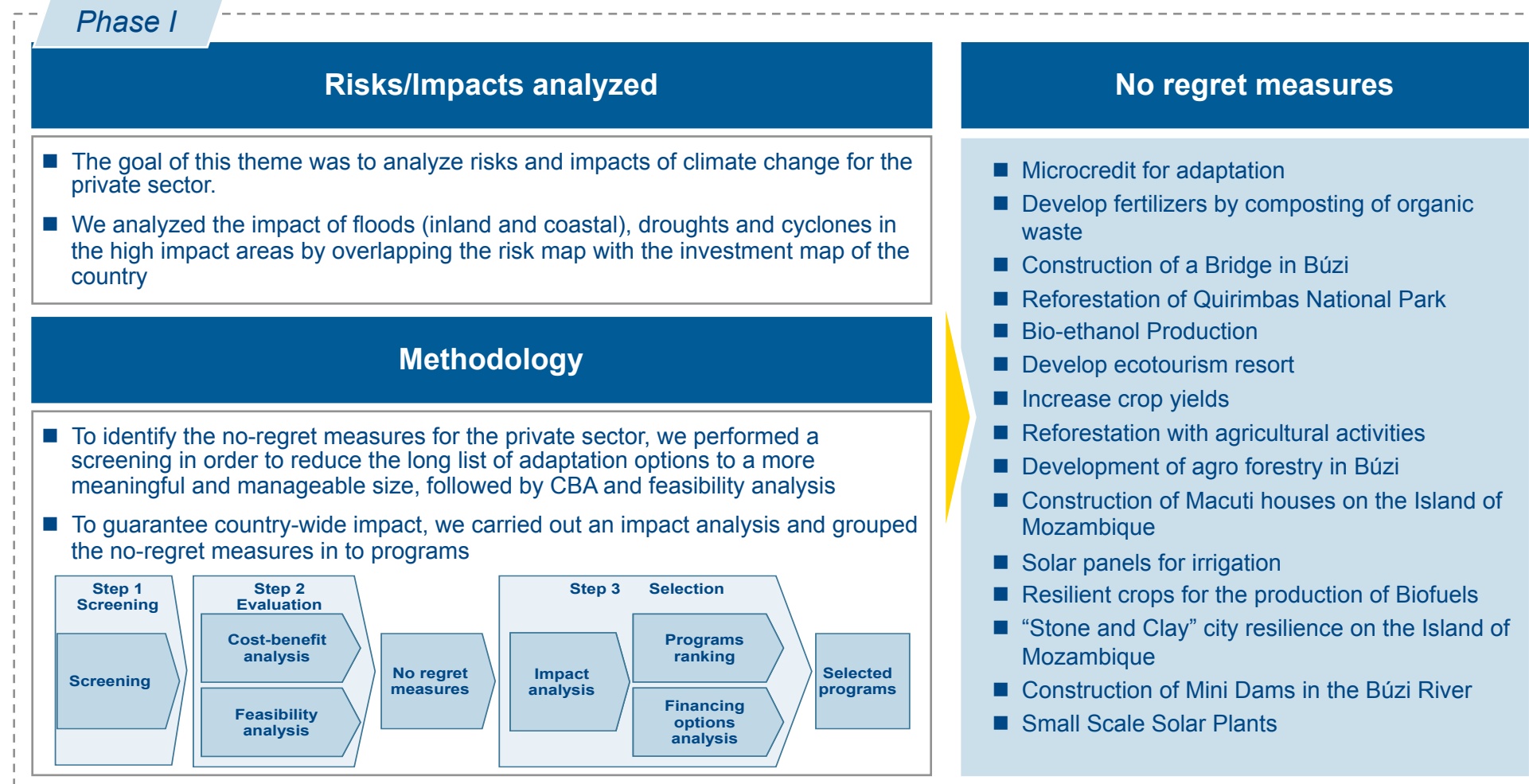
- Risk: Water stress
- Events: cyclones, floods and droughts
- People affected: 843.000
- Value at risk<sup>1</sup>: \$120M



##### Gaza

- Risk : Water stress
- Events: cyclones, floods and droughts
- People affected: 3.550.000
- Value at risk<sup>1</sup>: \$870M

### We have analyzed climate change impacts for the private sector and developed a set of 16 no-regret measures for the most important sectors of the country



## 0 Executive Summary – Phase II

The priority adaptation projects were grouped into Programs with a nation-wide impact, covering the most relevant private sectors in Mozambique

### Phase I

No regret measures	Feasibility	CBA	Impact	Sector	Comments	Program
Microcredit for adaptation			Nationwide	Financial	The projects are by nature <b>replicable</b> all over the country and can <b>reach</b> a large target population	Microcredit
Composting of organic waste			Nationwide	Waste Mng		Waste Management
Construction of a Bridge			Nationwide	Infrastructure		Infrastructure
Reforestation of Quirimbas			Local	Forestry	All the projects are related with forestry management and will involve local communities	AgroForestry Fund
Reforestation with agriculture			Local	Forestry		
Agro forestry in Nampula			Local	Forestry		
Agro forestry in Cabo Delgado			Local	Forestry		
Develop ecotourism resort			Local	Tourism	All the projects are focused on <b>community tourism</b> and the fund would have a major impact on rural communities development	Community tourism
Construction of Macuti houses			Local	Tourism		
“Stone and Clay” city resilience			Local	Tourism		
Small Scale Solar Plant			Local	Tourism		
Solar panels for irrigation			Local	Energy	<ul style="list-style-type: none"> <li>If considered in a aggregated fashion these projects constitute a <b>clean energy program</b> with major impact</li> <li>A <b>water management program</b> has major impact for the country</li> </ul>	Clean energy Water Management
Bioethanol Production			Local	Energy/Water		
Resilient crops for Biofuel			Local	Energy/Water		
Construction of Mini Dams in Búzi			Local	Energy/Water		
Increase crops yield			Local	Water		

To select the top 4 projects, a forced ranking was executed against predefined evaluation criterion and the portfolio was presented to the CTA and to the international financial and donor community

Source: Arthur D. Little analysis



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Feasibility:

Low Medium High



### Four programs were selected as top priority: Micro & Small Scale Lending, Composting, Clean Energy and Agroforestry

#### Phase II

#### Micro & Small Scale Lending

- The **purpose of this Program** is to develop a micro and small scale lending program for adaptation initiatives in Mozambique supported by the government and run by private companies or NGO's
- The **target segment** of the population is mainly micro and small companies and communities working as companies in **sectors** like tourism, agriculture, industry or energy
- A credit line specifically dedicated to **Climate Change Adaptation Initiatives** has the potential to create a very significant impact in building resilience to climate change

#### Waste Management and Composting

- The **main goal of this Program** is to develop a financial product to help boost composting businesses in Mozambique
- The program will be nationwide and cover all the major cities of the country and will be developed through several concurrent pilot projects
- The main products are organic fertilizer and methane emissions reduction
- The **climate change benefits** of composting are high as it positively impacts city infrastructures and the food security of rural communities

#### Clean Energy Program

- The **main goal of this Program** is to encourage private sector companies' investment in clean energy in order to adapt to climate change
- **Target projects** of this program will be focused on creating energy independence for **agriculture, tourism** and other sectors, as well as for rural communities, via the promotion of sustainable electricity generation
- This program will give access to funding for enterprises, communities and energy providers nation-wide

#### AgroForestry Fund

- The **purpose of this Program** is to create an Agro forestry fund to develop worthy Agroforestry projects
- Along with **financial returns** to investors, these projects **provide** rural communities with the **tools** to become **better environmental stewards** in saving their forests, improving water conservation and improving living conditions.
- Agroforestry projects drive **crop and income diversification, soil and water conservation** and efficient nutrient cycling and conservation

**The Clean Energy Program will address on one hand the insufficient electricity supply in Mozambique, and on the other hand take advantage of the tremendous natural resources**

### Phase III

#### Clean Energy Program

##### Project Summary

- Mozambique has tremendous untapped natural resources for the development of renewable energy (wind, solar, hydro,...)
- With this Program, the Mozambican Government aims to boost a sector that is crucial for building resilience to climate change, one that has not been widely addressed so far
- The Program will allow investment in micro (1-10 kW)/mini scale (10-100 kW) and distributed utilities (100-1.000 kW) projects. These installations are crucial for the development of some social services (hospitals, schools) and the flourishing of commerce, industry, agriculture and fishing

##### Forecasted Investment

175-200 M€

##### Major Investors

Specialized funds, Private Equity, National & Multilateral Development Finance, Industry players

##### Pilot Project

Construction of a 1MW on-grid PV plant in Maputo

**The two main goals of the Composting Program are the improvement of the waste management procedures and the increase in fertilizer usage in agriculture**

### Phase III

#### Composting

##### Project Summary

- Low agricultural yields and waste management are two significant problems in Mozambique
- To address both, the Mozambican Government will launch this Program which addresses solid organic waste treatment and builds resilience to climate change by incentivizing the wider usage of fertilizers in agriculture, increasing yields and economic returns
- The composting sites will use waste from households, communities, commerce and industry, in order to produce fertilizers that will then be sold to farmers and cooperatives

##### Forecasted Investment

15-30 M€

##### Major Investors

Environmental Funds, Private Impact, Grants & Foundations, National & Multilateral Development Finance

##### Pilot Project

Pilot project in Pemba, in partnership with the Aga Khan Foundation



### The Micro and Small Scale Lending Program will help financing, with bearable interest rates, projects that help building resilience to climate change in Mozambique

#### Phase III

#### Micro & Small Scale Lending

##### Project Summary

- Mozambique is one of the world's countries with lowest access to financing, which hinders the birth and growth of entrepreneurs/SMEs, the backbone of any country's economy
- The Program aims to help fund projects that foster resilience to climate change and at the same time fortify Mozambique's economy
- By creating pre-negotiated packs with suppliers of irrigation, energy, transport and other equipment, we plan to be able to offer attractive loan conditions for stimulating micro and small-scale financing of resilience building initiatives and projects nation-wide

##### Forecasted Investment

25-50 M€

##### Major Investors

Regional and international wholesale banks, National & Multilateral Development Finance Institutions, Micro-Finance Funds

##### Pilot Project

Partnership to be established with two of the biggest banks in Mozambique (Socremo or Novobanco)

**Finally, the Agro Forestry's Program main goal is the forestry valuation and management improvement, while developing sustainable agricultural practices**

### Phase III

#### AgroForestry Fund

##### Project Summary

- Agroforestry provides an integrated approach combining agricultural and forestry technologies to create more diverse, productive, profitable and sustainable land-use systems that build resilience at the local level
- The AgroForestry Fund will invest in projects that generate both revenues and climate change resilience at multiple levels from forestry and agricultural products to eco-tourism
- This Program will be focused firstly on regions with excellent conditions for forest plantation (Niasa, Nampula, Zambezia and Manica)

##### Forecasted Investment

50-100 M€

##### Major Investors

Specialized Funds, Private Equity, National & Multilateral Development Finance, Pension Funds, Industry players

##### Pilot Project

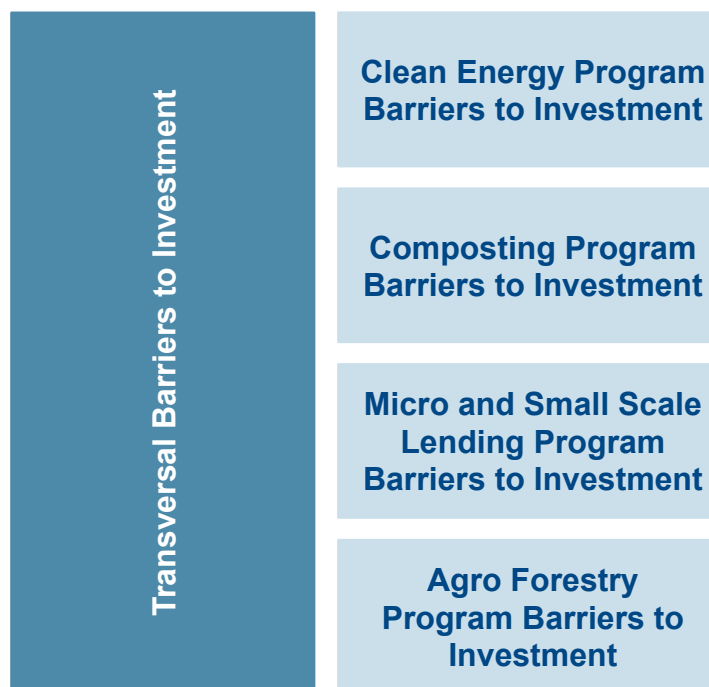
Agroforestry project with development of eco-tourism and poultry initiatives



However, to bring these Programs to light it's necessary to overcome a series of investment barriers that have been detrimental to the external investment in Mozambique

Phase III

### Framework of analysis



### Key issues

	Access to electricity and a decrease in foreign investment due to the current global crisis are two of the most pressing barriers. Another big deterrents of private investment, specially foreign investment, are the levels of corruption.
	From a list of issues that should be overcome in the near future the most pressing are the establishment of feed-in tariffs and of an adequate legislative framework
	In the Composting Program the most important barriers are also on the economic/financial and legislative side, with initial investment and lack of legislation playing an important role
	Logistic barriers and inadequate mindset are the most pressing barriers concerning the Micro & Small Scale Lending Program
	The most significant issue to overcome is the cultural barrier associated with the limited awareness of the benefits of this type of initiatives



### Penetration of insurance products into developing markets is extremely low but a growing number of players are trying to understand what the future could hold

#### Phase III

#### Insurance Sector Workshop

##### Summary of activities

A significant number of major global insurance and re-insurance companies have been interviewed and their views sought on the potential deeper involvement in the programs into 2012 and beyond. A number of regional players were also interviewed

##### Interviewed parties

AXA, Allianz, Swiss Re, Micro-ensure, Zurich, Willis Group, The Hartford, Fin-mark, CDC, Bankable Frontiers, Nedbank, Guy Carpenter, Climate Wise, Micro-risk

##### Data mapping

Availability of reliable, historic data remain a critical factor in determining risk and understanding where product risks end and insurance can take over

##### Governance and regulation

As with other financial products, a stable, enforceable regulatory framework remains a requisite for scalable corporate transactions.

##### Pricing and value

Lack of data, cluster risks and a challenging operating environment make pricing risk extremely difficult for climate related risks

##### Products versus events

Involvement of the insurance sector varies across the pilot projects. Factors that are product-related e.g. for the renewables or composting programs are easier to insure than weather or climate related factors e.g. agroforestry

##### Distribution and collection

For programs with higher volume collection and product distribution e.g. microfinance and agroforestry local partnership with trusted players with an understanding of the operating environment will be key

##### Pilot project approach

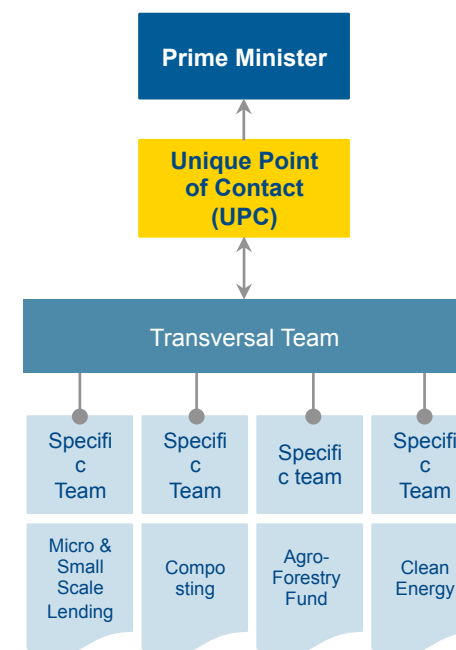
A number of players agreed that a pilot project approach with tangible and investable projects could be interesting. It is important however that the projects are of sufficient scale to enable appropriate levels of “investment”

**A crucial aspect for the success of these Programs is the creation of a sound support structure, to ensure efficient communication and a swift decision making process**

### Phase III

#### Strategic Recommendations

- **INGC** has a **dedicated team** working exclusively on the set-up of each of these Programs
- A **Unique Point of Contact (UPC)** will be established to support international investment in to these and other climate change adaptation and resilience building programs, ensuring a clear and effective channel for investment.
- This UPC is supported by a team of experts that will manage the economic, technical and legal aspects of the projects in each Program and the relationship between international investors and local promoters, authorities and communities.
- In addition to building climate change resilience, another important target of these Programs is **to build the required skills and capabilities** in Mozambique to ensure the execution and continuity of these Programs, as well as to develop future initiatives. With this in mind, a Capability-Building project is to be launched where local resources will receive appropriate training, side-by-side learning with external experts and necessary technical assistance
- However, without a portion of **public funding** to start these initial four Programs and without ensuring **proactive Government support**, the private sector will not be interested to make the investments on their side as the costs/barriers will be too great



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2 Phase 2

3 Phase 3

## Index

0 Executive Summary

**1 Phase 1**

**1.1 Executive Summary**

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1.5 Benchmarking

1.6 Risks and opportunities for private investors

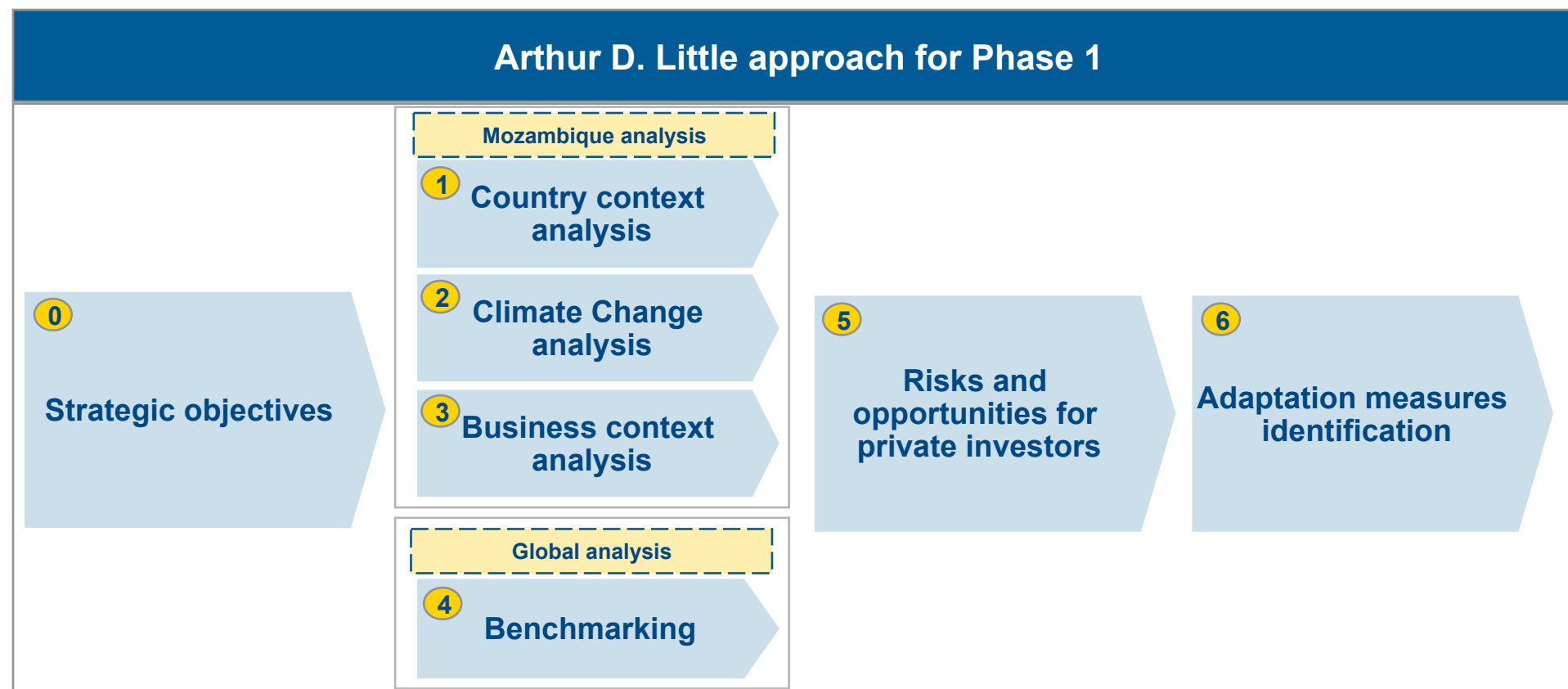
1.7 Potential adaptation options

1.8 Annexes

2 Phase 2

3 Phase 3

For Phase 1, ADL designed an approach that addresses the Business context, Climate Change analysis, Impact and Opportunities for investment and Adaptation measures identification



**Each methodological step is explained in detail in each of the following chapters of the document**

### Key findings

- **Mozambique has approximately 22 million people and a GDP of about \$9 billion**, of which more than 50% comes from agriculture, trading and manufacturing. **The provinces that have the most percentage of country's GDP are Maputo city and provinces, Nampula and Sofala**
- The value of approved **investments that will take place** in the short to medium term is **worth some \$19 B**, of which more than **80% are located in Nampula, Tete, Maputo e Zambézia**
- **Climate change risk analysis indicates** that the North is more affected by cyclones while Center and South are more affected by floods and droughts
- The overlap between “climate risk map” and “investment map” indicates **6 priority areas** because of its High Climate Change Risk / High Climate Change Impact profile: **Nacala, Moatize, Motarara and Changara, Beira (Buzi and Dondo), Vilanculos, Gaza and Maputo**
- **Nacala's most significant business risks are failure in distribution channels and production interruption** with an estimated **value at risk of some \$5B** and **people affected of 305.000**
- **Moatize's most significant risks are interruption in production and operations and failure in logistics** with an estimated **value at risk of some \$5B** and **people affected of 950.000**
- The most significant business risks for **Beira** are **failure in logistics and raw material defectiveness** with an estimated **value at risk of \$1B** and **people affected of 937.000**

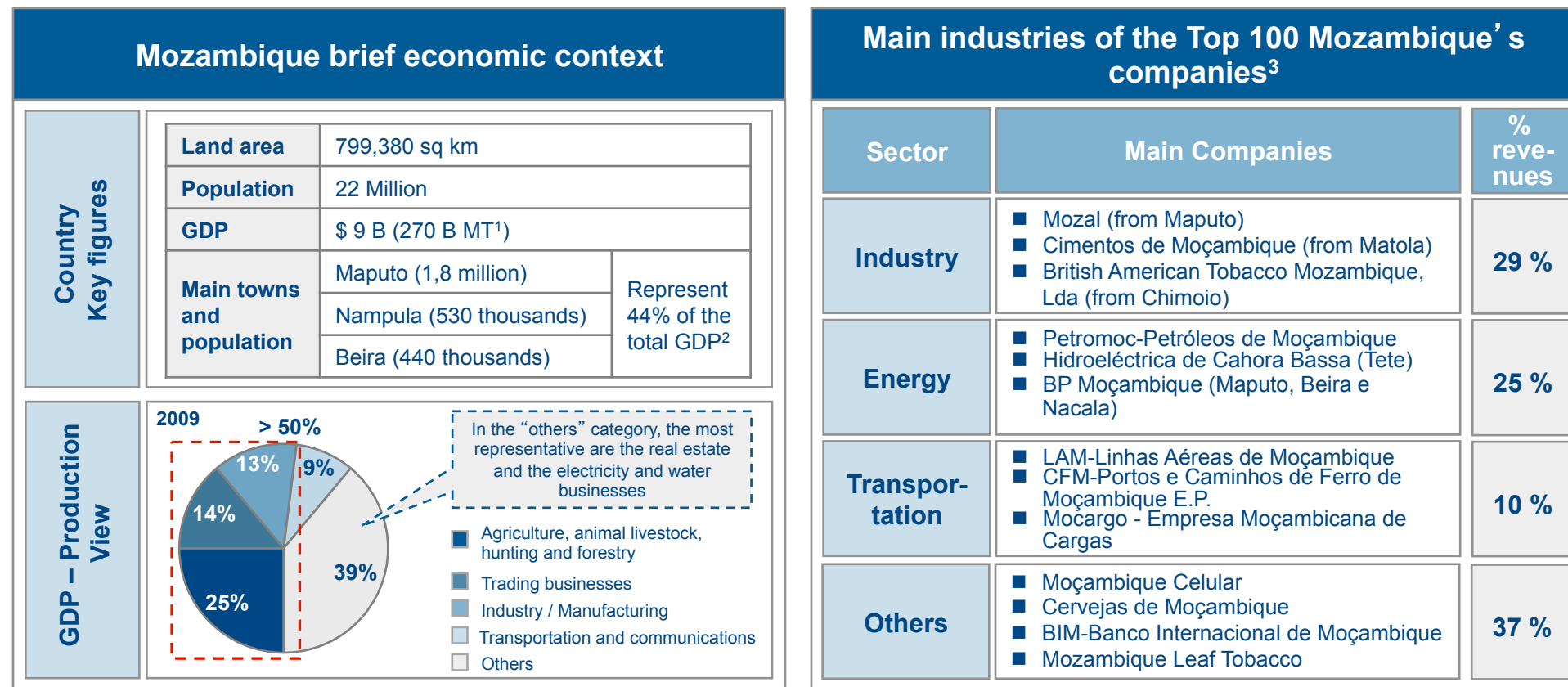
### Key findings

- **Vilanculos's** most significant business risks are **quality decrease in products and services and workforce absenteeism** with an estimated **value at risk of \$120 M** and **people affected of 843.000**
- The most significant business risks for **Gaza** are **raw material defectiveness and quality decrease in products and services** with an estimated **value at risk of \$870 M** and **people affected of 3.550.000**
- Maputo city 's most significant business risks are **failure in logistics and workforce absenteeism** with an estimated **value at risk of some \$2B** and **people affected of 720.000**
- **The SWOT analysis for Mozambique indicates** an attractive set of **business opportunities** for the key sectors at risk namely **Mineral Resources, Transport, Agriculture, Energy and Tourism**
- These opportunities were complemented with a **benchmarking analysis** that **highlighted 75 case-studies with the potential to** integrate **Mozambique's** portfolio of adaptation options
- By combining the benchmarking with other themes input and with the priority areas, **we identified a long-list of 70 adaptation and mitigations measures**
- The long-list of potential measures for the **North includes** 17 measures, of which **7 options** are **at Nacala**
- For the **Central region**, **there is a long-list** of 26 potential measures, including **15 adaptation options** for the priority areas of **Beira, Buzi and Dondo, and Moatize, Motarara and Changara**
- In the **South**, we identified 27 potential measures, of which **21 adaptation and mitigation options** are directed **at the priority areas of Maputo city, Vilanculos and Gaza**



## 1.1 Executive Summary – Mozambique economy and investments

Mozambique has approximately 22 million people and a gross domestic product of about \$9 billion, of which more than 50% comes from agriculture, trading and manufacturing

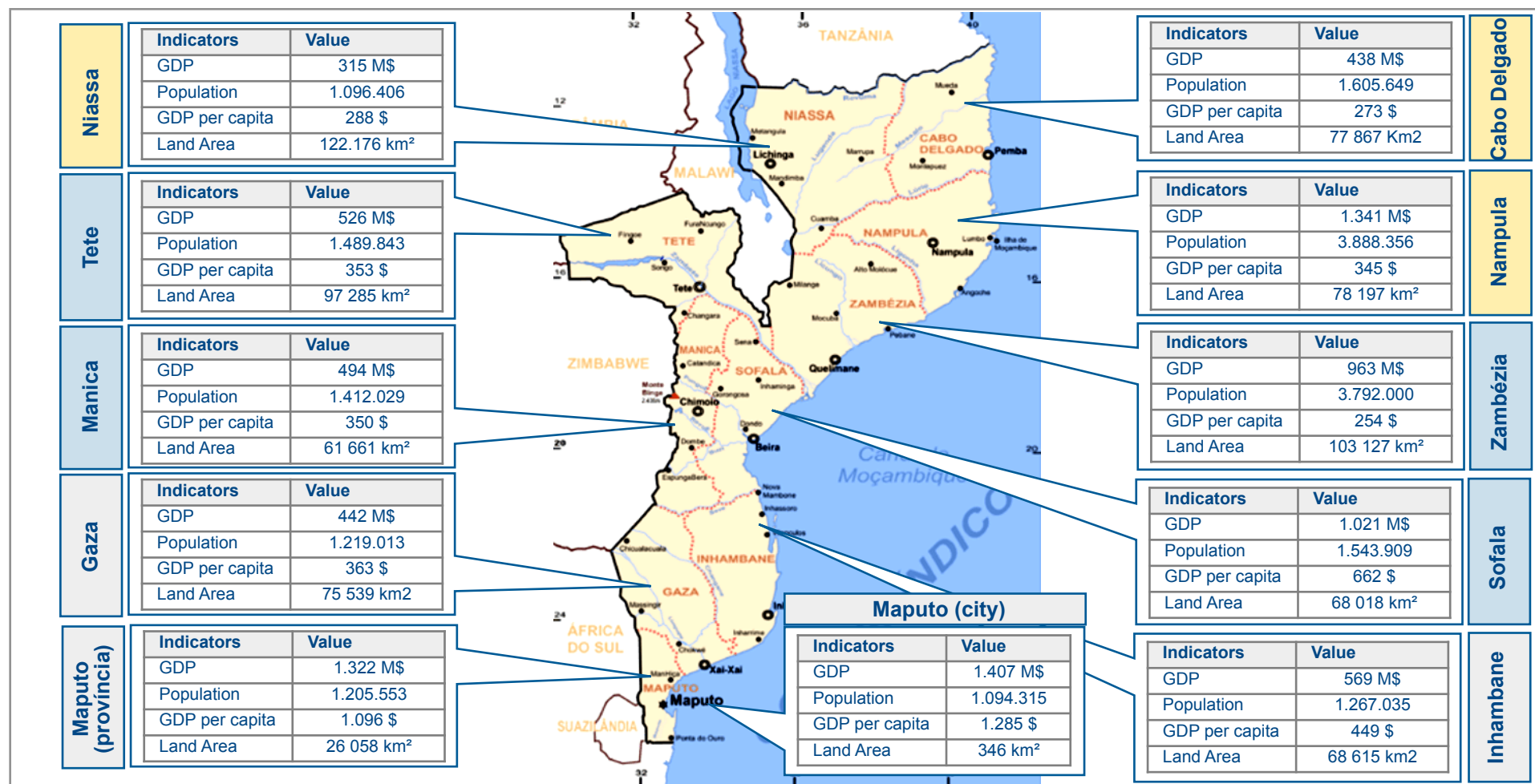


Nevertheless, some of the top companies in the country belong to Energy and Transportation sectors

Source: INE, 100 maiores empresas de Moçambique – documento KPMG

□ % revenues from sector

The provinces that have the most percentage of country's GDP are Maputo city and provinces, Nampula and Sofala



Souce: Instituto Nacional de Estatística de Moçambique, 2009 (population data refers to 2007)

## 1.1 Executive Summary – Mozambique economy and investments

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*investments concentrated in two major projects*

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*investment diluted in several projects*

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*investments concentrated in two major projects*

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*investments concentrated in one major project*

Other provinces		
	\$ 2.6 B	14%

In addition to the private investment, it is expected significant public investment in these regions, such as Nacala port and airport (\$700 M) and improvement of Maputo and Beira ports (\$ 1,4 B)<sup>2</sup>

Source:



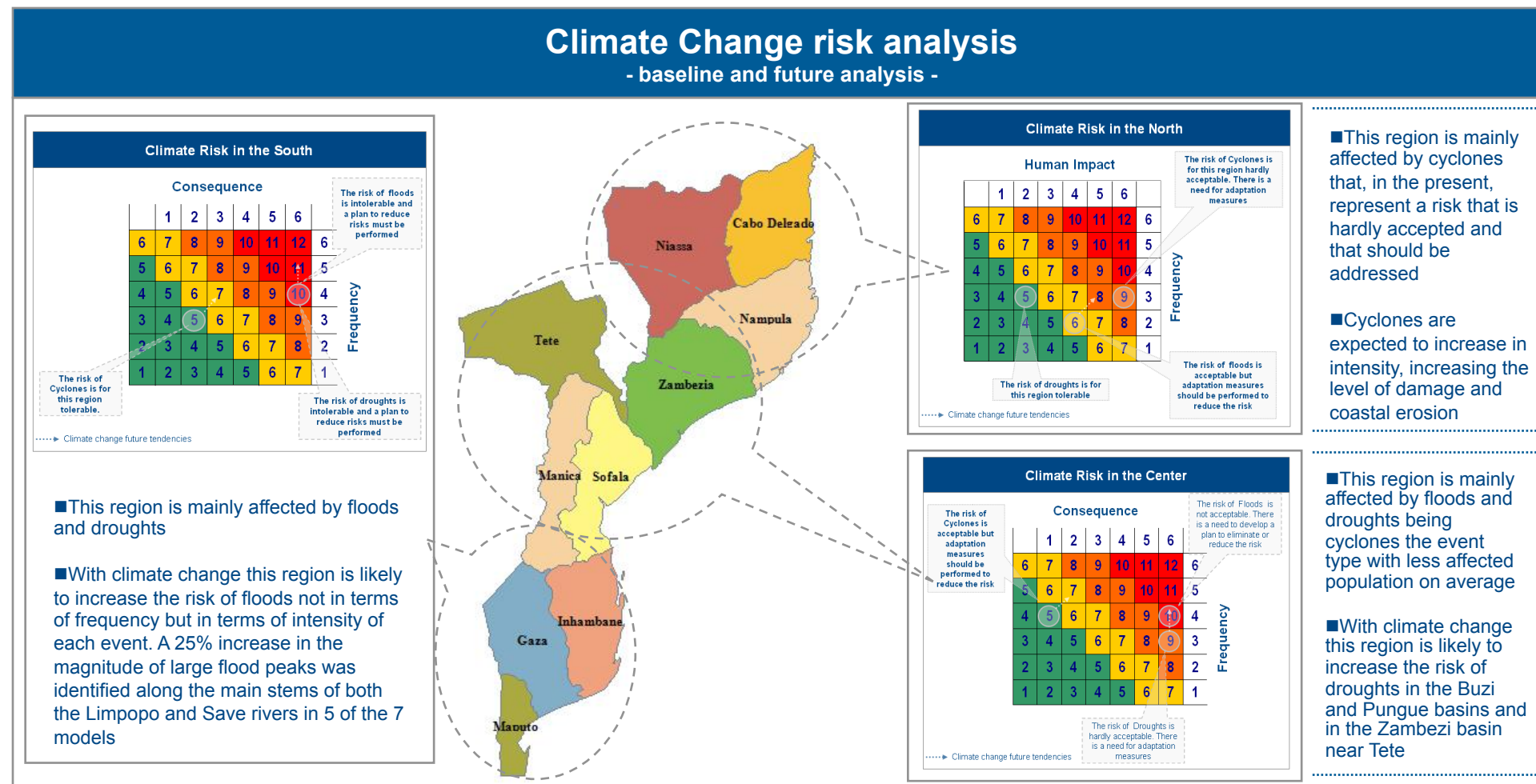
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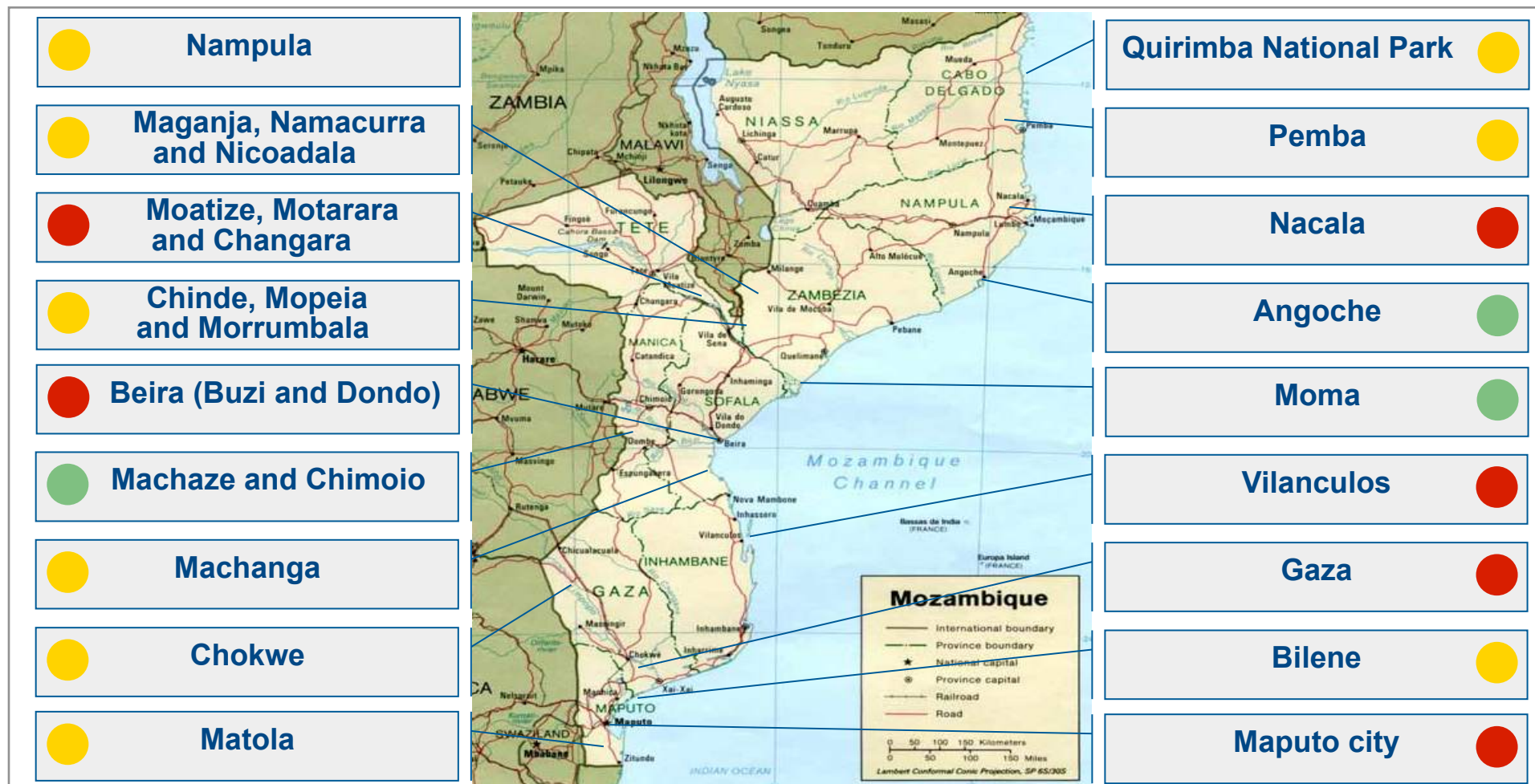
<sup>2</sup>Nacala XXI, Nacala, Beira and Maputo development corridors, Mozambique investment forum 2010, Investment Opportunities in the Industrial Sector, Investing in Mozambique 2010, companies websites

## 1.1 Executive Summary – Climate change risk analysis

Climate change risk analysis indicates that the North is more affected by cyclones while Center and South are more affected by floods and droughts



The overlap between “climate risk map” and “investment map” indicates 6 high climate change risk / high climate change impact

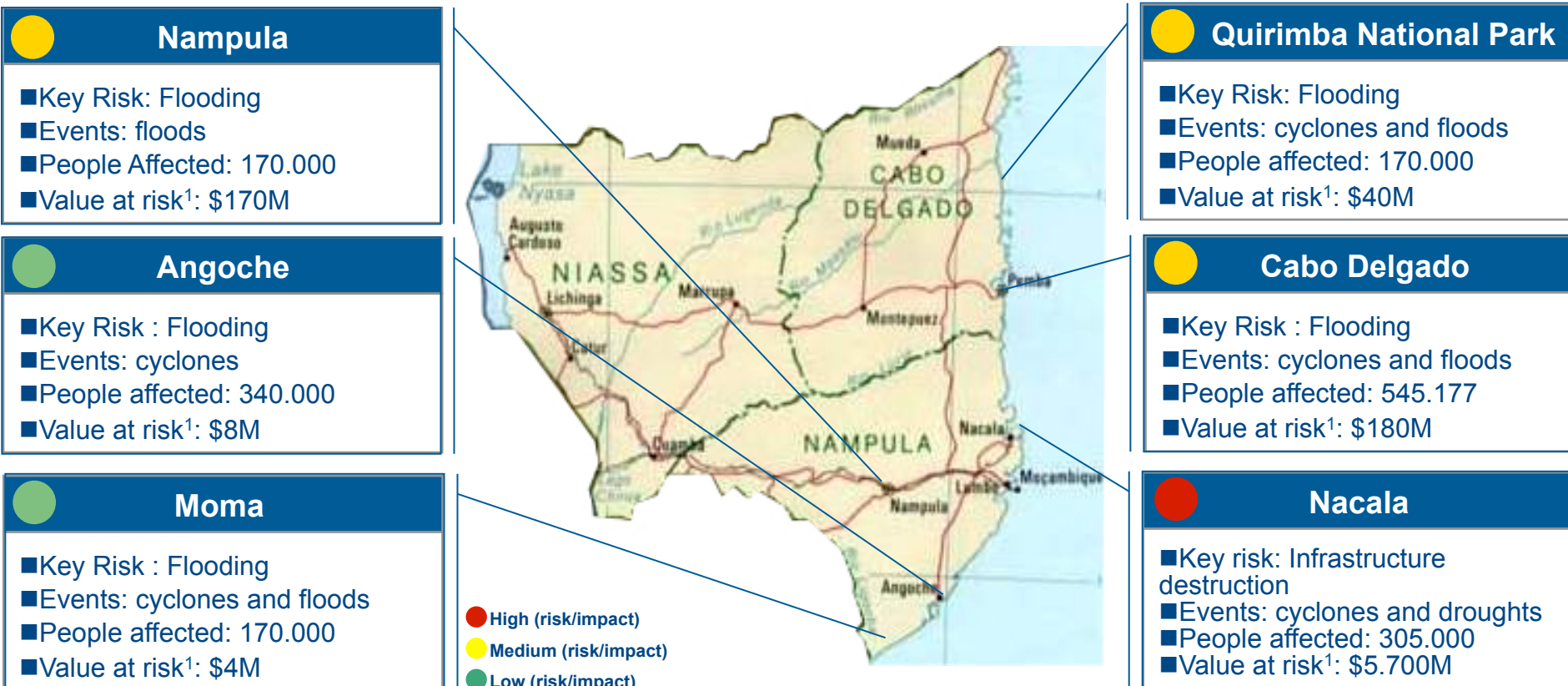


● High (risk/impact) ● Medium (risk/impact) ● Low (risk/impact)



Nacala's estimated value at risk is some \$5B and people affected is around 300.000

### Key “High Climate Change Risk / High Climate Change Impact” areas in the North



Source: EM-DAT: The OFDA/CRED International Disaster Database; INGC – Study on the Impact of Climate Change on Disaster Risk in Mozambique; Desconsultar database; <sup>1</sup> Value at risk – this value does not consider the multiplier effect.

Moatize has an estimated value at risk of some \$5B and people affected around 950.000, while Beira has an estimated value at risk of \$1B and people affected around 937.000

### Key “High Climate Change Risk / High Climate Change Impact” areas in the Center

#### Moatize, Motarara and Changara

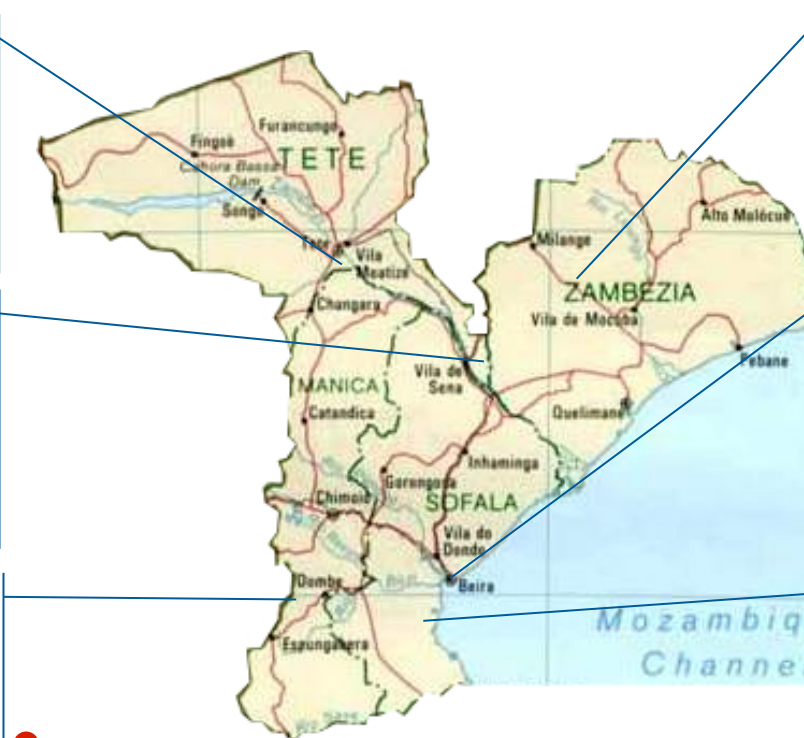
- Key Risk: Water stress
- Events: floods and droughts
- People affected: 950.000
- Value at risk<sup>1</sup>: \$5.400M

#### Chinde, Mopeia and Morrumbala

- Key Risk: Flooding
- Events: floods
- People affected: 843.000
- Value at risk<sup>1</sup>: \$7M

#### Machaze and Chimoio

- Key Risk : Water scarcity
- Events: droughts
- People affected: 170.000
- Value at risk<sup>1</sup>: \$50M



- High (risk/impact)
- Medium (risk/impact)
- Low (risk/impact)

#### Maganja, Namacurra and Nicoadala

- Key Risk: Flooding
- Events: Cyclones, floods and droughts
- People affected: 500.000
- Value at risk<sup>1</sup>: \$22M

#### Beira (Buzi and Dondo)

- Key Risk : Infrastructure destruction
- Events: cyclones, floods and droughts
- People affected: 937.000
- Value at risk<sup>1</sup>: \$1.000M

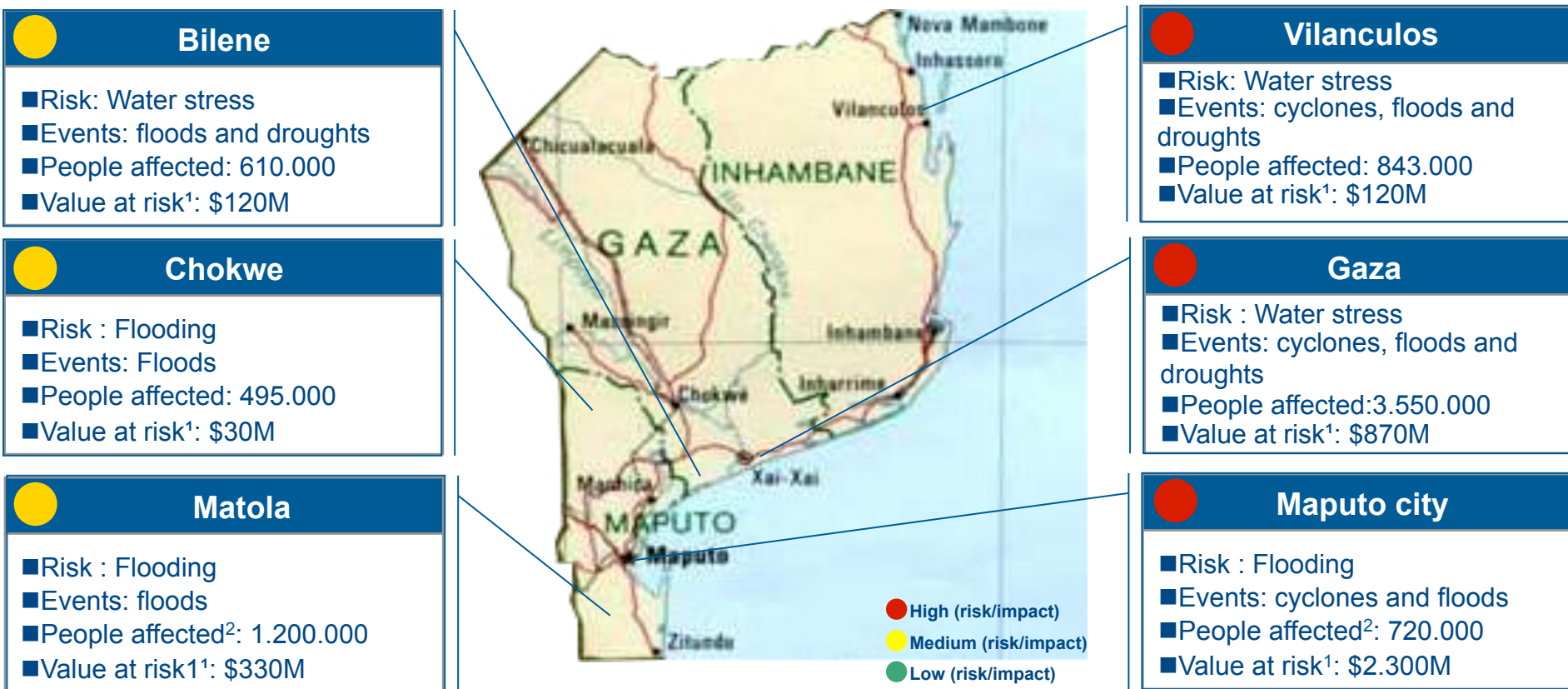
#### Machanga

- Key Risk : Flooding
- Events: floods
- People affected: 793.000
- Value at risk<sup>1</sup>: \$0M<sup>2</sup>

Source: EM-DAT: The OFDA/CRED International Disaster Database; INGC – Study on the Impact of Climate Change on Disaster Risk in Mozambique; Desconsular database.

**Vilanculos, Gaza and Maputo city's estimated value at risk is some \$3 B and people affected is over 5.000.000**

### Key “High Climate Change Risk / High Climate Change Impact” areas in the South



Source: EM-DAT: The OFDA/CRED International Disaster Database; INGC – Study on the Impact of Climate Change on Disaster Risk in Mozambique; Desconsular database.

<sup>1</sup> Value at risk – this value is not considering the multiplier effect.

<sup>2</sup> The information regarding People affected in Maputo and Matola considered only one event. We used a proxy to all the events



The SWOT analysis for Mozambique indicates an attractive set of business opportunities for the key sectors at risk namely Mineral Resources, Transport, Agriculture, Energy and Tourism

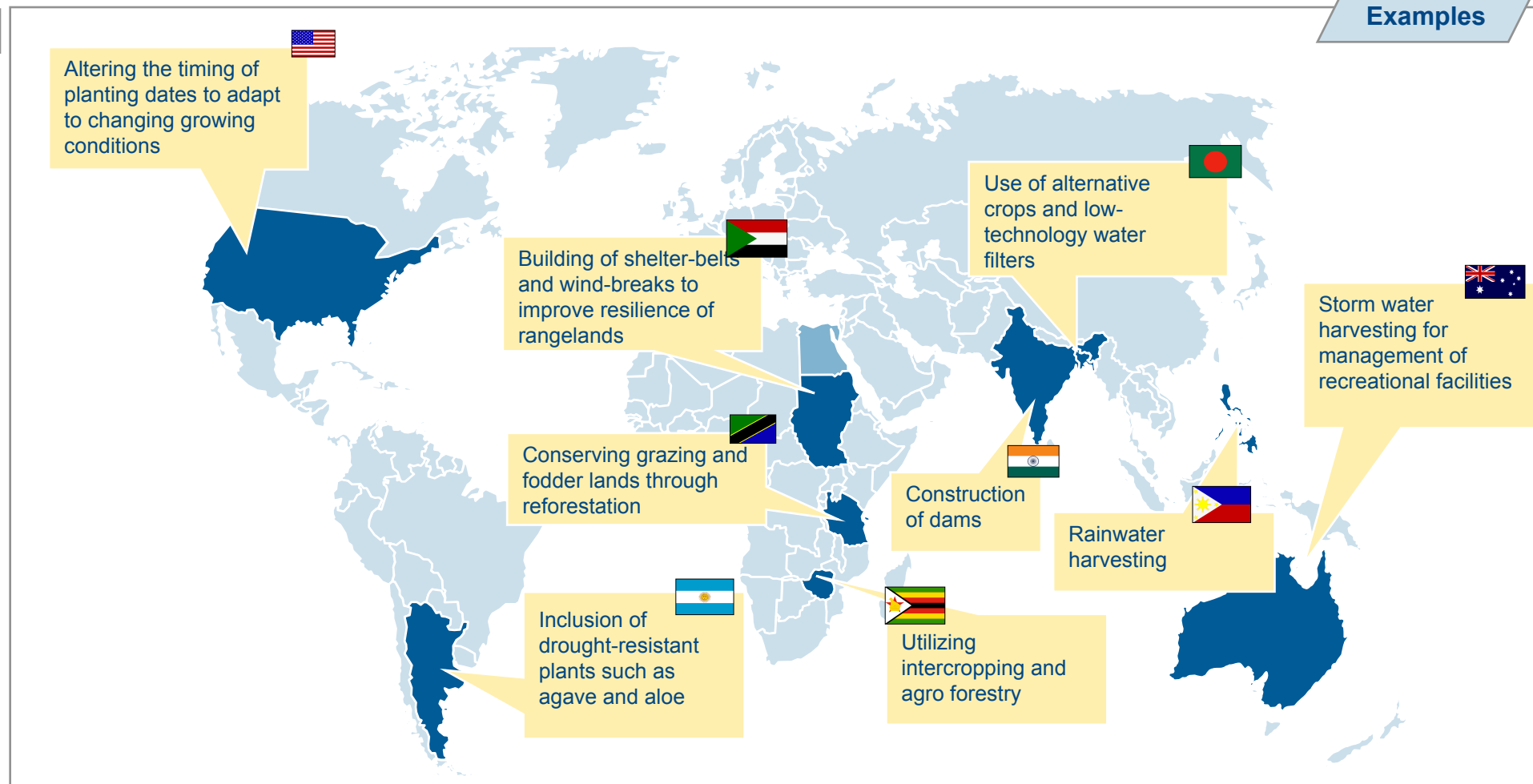
	Key Areas	Business Risks	Business Opportunities
Mineral Resources	<ul style="list-style-type: none"> <li>Nacala</li> <li>Moatize</li> </ul>	<ul style="list-style-type: none"> <li>Production interruption – impacts on physical assets and breakdown of equipments due to floods and cyclones</li> <li>Workforce absenteeism – unhealthy workforce due to flood related diseases</li> <li>Failure in distribution channels – inaccessibility of roads and ports due to floods and heavy rains and cyclones</li> </ul>	<ul style="list-style-type: none"> <li>Coastal protection in Nacala</li> <li>Improve healthcare conditions of the employees in Nacala and Moatize</li> <li>Creation of new shipping routes in Nacala and Moatize</li> <li>Construction of floodgates and mini dams in Moatize</li> <li>Support community plans to improve food security in Moatize</li> </ul>
Transport	<ul style="list-style-type: none"> <li>Nacala</li> <li>Beira</li> <li>Maputo city</li> </ul>	<ul style="list-style-type: none"> <li>Operations interruption – impacts on physical assets such as ports infrastructure mainly due to cyclones</li> <li>Workforce absenteeism – unhealthy workforce due to flood related diseases</li> <li>Quality decrease in services – a consequence of the breakdown of equipments and productivity reduction due to the increase in diseases incidence</li> </ul>	<ul style="list-style-type: none"> <li>Coastal protection (e.g. construction of revetments or seawalls) in Nacala, Beira and Maputo</li> <li>Development of anti-flood plans in Nacala, Beira and Maputo</li> <li>Development of near shore breakwaters in Beira and Maputo</li> <li>Development of a sustainable urban drainage system in Beira and Maputo</li> </ul>
Agriculture	<ul style="list-style-type: none"> <li>Beira</li> <li>Vilanculos</li> <li>Gaza</li> </ul>	<ul style="list-style-type: none"> <li>Raw material defectiveness – failure of crops due to droughts and floods</li> <li>Quality decrease in products – decrease in crops quality</li> <li>Workforce absenteeism – unhealthy workforce due to flood related diseases</li> </ul>	<ul style="list-style-type: none"> <li>Diversifying crop types and varieties and produce high-resistance crops in Beira, Vilanculos and Gaza</li> <li>Increasing yields through optimal management of crop calendars in Beira and Vilanculos</li> <li>Construction of mini dams to control floods in Beira, Vilanculos and Gaza</li> <li>Introduction of water filters in Gaza</li> </ul>
Energy	<ul style="list-style-type: none"> <li>Moatize</li> </ul>	<ul style="list-style-type: none"> <li>Production interruption</li> <li>Failure in distribution channels</li> <li>Raw material defectiveness – lack of water may affect the production of energy production</li> </ul>	<ul style="list-style-type: none"> <li>Increase demand for other types of energy sources (e.g. “green” energy)</li> <li>Increase revenues associated with the increase demand for energy</li> </ul>
Tourism	<ul style="list-style-type: none"> <li>Vilanculos</li> <li>Gaza</li> <li>Maputo</li> </ul>	<ul style="list-style-type: none"> <li>Quality decrease in services – supply chain interruptions due to inaccessibility of transports and degradation of areas of interest to tourists</li> <li>Failures in logistics – water and food scarcity due to supply chain interruptions</li> <li>Operations interruption – Damage to tourism infrastructure due to cyclones</li> </ul>	<ul style="list-style-type: none"> <li>Development of sustainable resorts in Vilanculos, Gaza and Maputo</li> <li>Coastal protection (e.g. construction of revetments or seawalls) in Vilanculos, Gaza and Maputo</li> <li>Support of the development of the local markets for food (e.g. support local agriculture to improve access to food in extreme weather events) in Vilanculos and Gaza</li> </ul>

Source: ADL analysis, World Business Council for Sustainable Development – Business risks and opportunities resulting from climate change impacts

These opportunities were complemented with a benchmarking analysis that highlighted 75 case-studies with the potential to integrate Mozambique's portfolio of adaptation options

4





Examples





Main sources: ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

## 1.1 Executive Summary – Long-list of adaptation measures to the North region

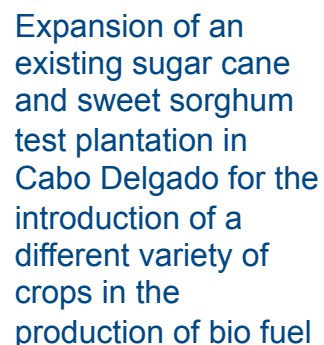
The long-list of potential measures for the North includes 16 measures, of which 5 options are at Nacala

Long-list of adaptation measures in the North	
 <b>Nacala</b>	<ul style="list-style-type: none"> <li>■ Introduction of rainwater harvesting techniques</li> <li>■ Construction of seawall or revetments (e.g.: rock revetments)</li> <li>■ Build roads from Pemba to Nacala</li> <li>■ Introduction of different crops for the production of Biofuel</li> <li>■ Improvement of climate forecast infrastructure</li> </ul>
 <b>Quirimba National Park</b>	<ul style="list-style-type: none"> <li>■ Develop ecotourism resort</li> <li>■ Production of solar energy</li> <li>■ Production of Energy based on Biomass</li> </ul>
 <b>Cabo Delgado</b>	<ul style="list-style-type: none"> <li>■ Introduction of a different variety of crops in the production of bio fuel</li> <li>■ Construction of Mini Dams</li> <li>■ Develop storage facilities in Pemba port</li> <li>■ Produce solar energy at tourist facilities to decrease energy dependence</li> <li>■ Development of agro forestry</li> </ul>
 <b>Nampula</b>	<ul style="list-style-type: none"> <li>■ Construction of Mini Dams</li> <li>■ Increase crops yield through the reduction of ground-level ozone</li> <li>■ Construction of a pharmaceutical factory / supply channels</li> </ul>

Main sources: Meetings with private investors, other themes' input, ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

 High (risk / impact)  
 Medium (risk / impact)

## Project brief description



## Private sector benefit

### - Inside the Fence -

- Investment return superior to 10% of capital employed
- Capital gains superior to €4.000.000

## Community benefits - Beyond the Fence -

- Income generating activities for local communities
- Direct and Indirect jobs increase

## Country benefits

### - Beyond the Horizon -

- Less dependence on oil which contributes to country's energy security
- Reduction in greenhouse gas emissions

## Promoters






## Examples of funding parties





## 1.1 Executive Summary – Long-list of adaptation measures to the Central region

For the Central region, there is a long-list of 26 potential measures, including 15 adaptation options for the priority areas of Beira, Buzi and Dondo, and Moatize, Motarara and Changara

### Long-list of adaptation measures in the Centre

 <p>Beira</p>	<ul style="list-style-type: none"> <li>■ Increase crops yield through the reduction of ground-level ozone</li> <li>■ Construction of seawall or revetments (e.g.: rock revetments)</li> <li>■ Introduce emergency phones along the railway</li> <li>■ Develop storage facilities in Beira port</li> <li>■ Produce solar energy at tourist facilities to decrease energy dependence</li> </ul>
 <p>Buzi and Dondo</p>	<ul style="list-style-type: none"> <li>■ Construction of floodgate / river breakwater wall</li> <li>■ Construction of mini dam</li> <li>■ Introduce water filters techniques</li> <li>■ Upgrade main routes (e.g.: Bridges)</li> <li>■ Forestation with product diversity (softwood / hardwood and / or short / long rotation)</li> </ul>
 <p>Moatize, Motarara and Changara</p>	<ul style="list-style-type: none"> <li>■ Construction of mini dams</li> <li>■ Construction of floodgate / river breakwater wall</li> <li>■ Increase crops yield through the reduction of ground-level ozone</li> <li>■ Introduce redundancy and business continuity in railways</li> <li>■ Introduce emergency phones along the railway</li> </ul>

Main sources: Meetings with private investors, other themes' input, ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

 High (risk / impact)  
 Medium (risk / impact)

### New sugar factory with bridge and mini-dam construction in Buzi

#### Project brief description



Production of sugar cane and construction of a sugar factory with an annual projected production capacity of 150.000 tons. Additionally, a bridge and a mini dam will be constructed.

#### Main potential benefits

##### Private sector benefit - Inside the Fence -

- Annual revenues of \$50.000.000 through sugar cane exports, which have an attractive profit margin

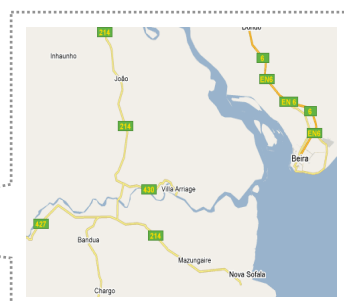
##### Community benefits - Beyond the Fence -

- 3.000 to 4.000 direct jobs creation
- Energy security and better irrigation options for the region and small agriculture

##### Country benefits - Beyond the Horizon -

- Infrastructure and value chain protection
- Less dependence on oil which contributes to country's energy security

#### High impact area



#### Funding mechanisms

##### Promoters



##### Examples of funding parties




Source: EPA's Renewable Fuel Standards Program Regulatory Impact Analysis, released in February 2010





## 1.1 Executive Summary – Long-list of adaptation measures to the South region

In the South, we identified 26 potential measures, of which 16 options are directed at the priority areas of Maputo city, Vilanculos and Gaza

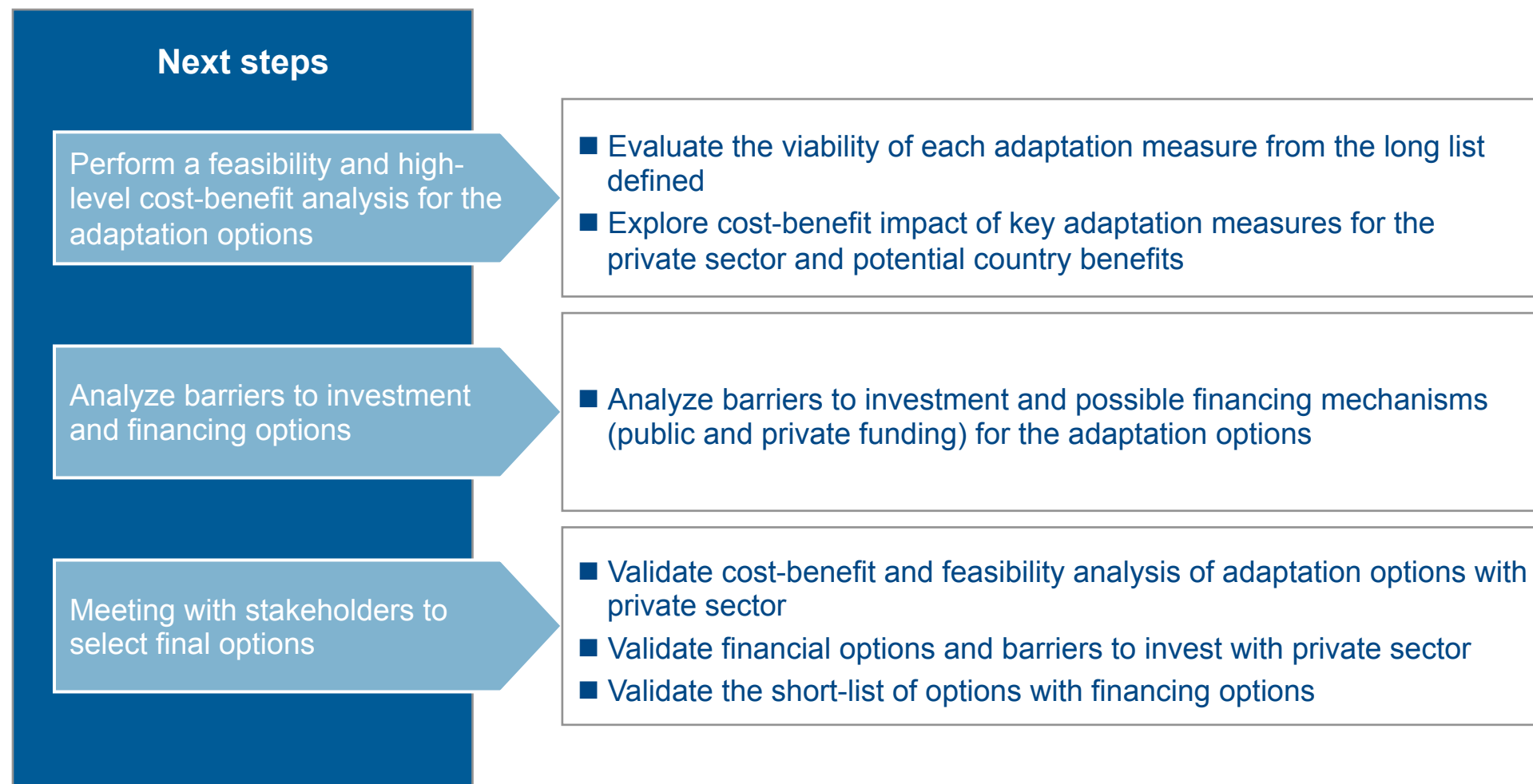
### Long-list of adaptation measures in the South

 <p>Gaza</p>	<ul style="list-style-type: none"> <li>■ Introduce water filters techniques</li> <li>■ Construction of a pharmaceutical factory / supply channels</li> <li>■ Develop dams in Limpopo</li> <li>■ Upgrade roads</li> <li>■ Construction of storage facilities</li> <li>■ Introduction of drainage systems</li> </ul>
 <p>Vilanculos</p>	<ul style="list-style-type: none"> <li>■ Diversifying crop types / varieties and produce high-resistance crops</li> <li>■ Conversion of arable farmland into salt marsh and grassland to provide sustainable defenses</li> <li>■ Develop ecotourism resort with energy and communications independence</li> <li>■ Reforestation of mangroves</li> </ul>
 <p>Maputo city</p>	<ul style="list-style-type: none"> <li>■ Improvement of sustainable urban drainage systems</li> <li>■ Construction of near shore breakwaters</li> <li>■ Development of a fast reestablishment plan for financial transactions</li> <li>■ Produce solar energy at tourist facilities to decrease energy dependence</li> <li>■ Increase of storage facilities in Maputo port</li> <li>■ Strengthening of pharmaceutical supply channels</li> <li>■ Introduce redundancy and business continuity in key buildings, roads and railways</li> </ul>

Main sources: Meetings with private investors, other themes' input, ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

 High (risk / impact)  
 Medium (risk / impact)

**We will focus our next steps in the evaluation and prioritization of the portfolio of adaptation options**





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3 Phase 3

### ADL was asked by INGC to engage private sector in building climate change resilience in Mozambique

- Mozambique is frequently burdened by natural hazards that have a major impact in the country's development
- Due to climate change, the country's exposure to natural hazards is expected to increase affecting significantly the country's development potential.
- In 2009, INGC (Instituto Nacional de Gestão de Calamidades) performed a study about climate change impact in the risk of calamities in Mozambique
- Afterwards, nine different themes were defined with the main goal of covering all the areas that climate change might impact and a second phase of the project started
- ADL was asked to help to build climate change resilience in Mozambique through private sector investment in attractive and sustainable business opportunities (Theme 4)
- The scope of this project can be divided in 3 phases:
  1. Diagnosis and formulation
  2. Evaluation
  3. Implementation support
- The focus of this document is the first phase where we identified High Climate Change Risk / High Climate Change Impact areas and private investment opportunities for adaptation and mitigation measures. To do that we took several steps:
  - Performed several analysis regarding country and business context analysis as well as climate change analysis in order to identify risks and opportunities for private investors
  - Made a global benchmarking to identify adaptation measures in countries with similar natural hazards events
  - Develop a long list of adaptation measures. The list of adaptation measures was the result of the global benchmarking and the inputs received from themes, namely theme 2 “Coastal protection”, theme 4 “Ecoenergia” and theme 6 “Food-meeting demands”
  - The resulting long list of adaptation measures was validated with a private investor workgroup

Source: INGC – Study on the Impact of Climate Change on Disaster Risk in Mozambique: Main report

Our project aims to build climate change resilience in Mozambique through private sector investment in attractive business opportunities

### Project scope and approach

Focus of  
the  
document

#### Diagnosis and Formulation

To identify **private investment opportunities** for adaptation and mitigation measures in high climate risk and impact areas

#### Evaluation

To **evaluate private sector's investment levels and cost-benefit** of the adaptation and mitigation measures

#### Implementation Support

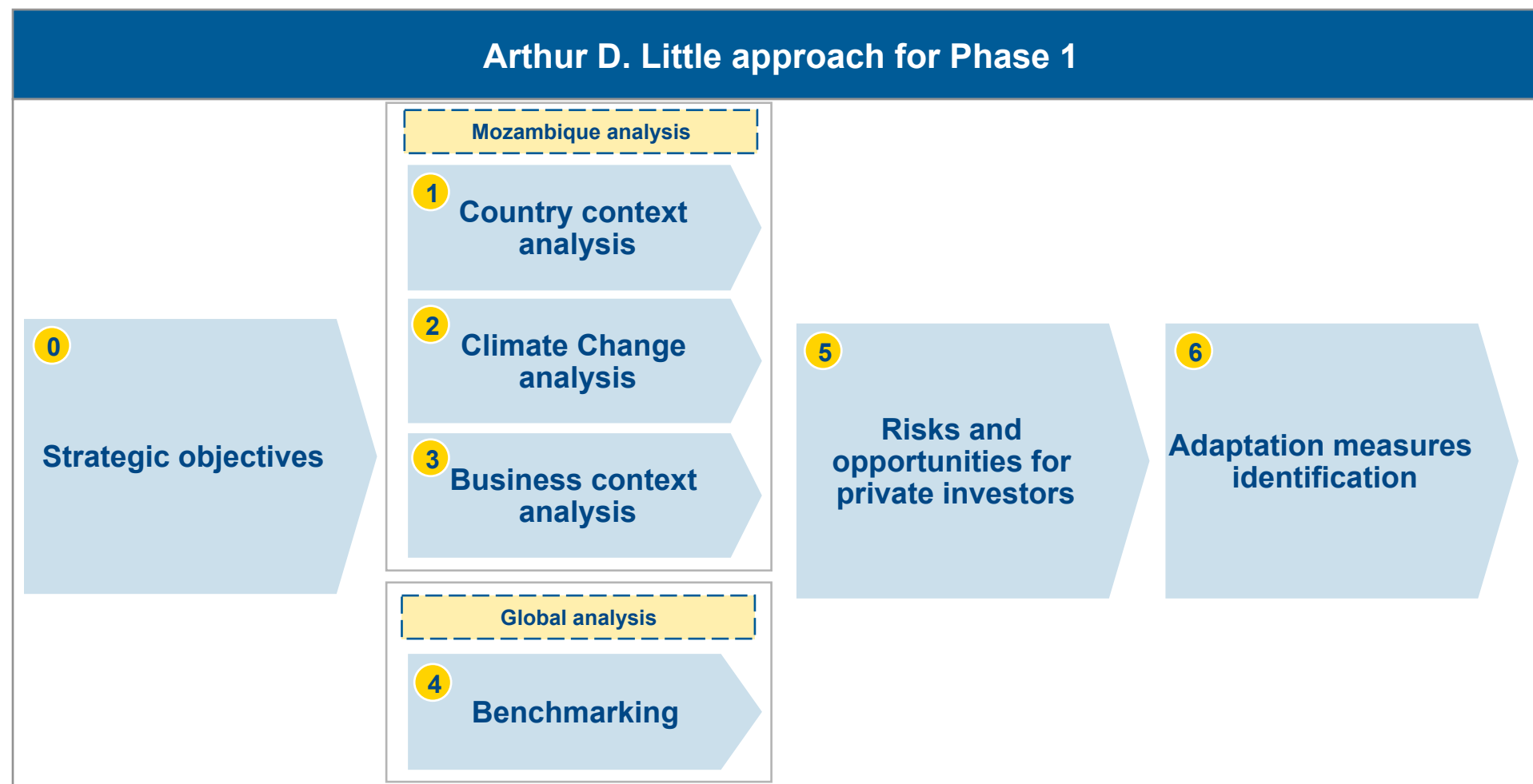
To recommend **changes in government policy and strategy** to facilitate the implementation of the adaptation and mitigation measures

The Phase 1 consisted in the identification of key business risks and in the creation of portfolio of adaptation options

High-level project approach				
	Phase 0 Setup project	Phase 1 Creation of portfolio of adaptation options	Phase 2 Analysis & selection of adaptation options	Phase 3 Design of detailed adaptation program
Input <i>Main sources</i>	UKCIP, IPCC, DEFRA, SKCC, ONU and regional agencies	INE, CPI, Cities development corridors, PES, OFDA/CRED; INGC; stakeholder meetings; phase 2 teams consultations; private sector workgroup; Strategic environmental assessment and adaptation to climate change© OECD 2008	Phase 2 Teams consultations; private sector workgroup; Benchmark; private investors meetings and workshops; Project promoters; Key reports (e.g. Catalysing low-carbon growth; Worldbank reports)	Phase 2 Teams consultations; private sector workgroup; private investors meetings and workshops; Project promoters; Stakeholder meetings
Process	<ul style="list-style-type: none"> <li>■ Desk research</li> <li>■ Benchmarking</li> <li>■ Project management meetings</li> </ul>	<ul style="list-style-type: none"> <li>■ Identification of key business risks from main climate change risks</li> <li>■ Develop long-list of adaptation options</li> <li>■ Benchmarking from countries and agencies</li> </ul>	<ul style="list-style-type: none"> <li>■ Perform cost-benefit and feasibility analysis of adaptation options</li> <li>■ Analyze financing options and barriers to investment</li> <li>■ Meeting with stakeholders to select final options</li> </ul>	<ul style="list-style-type: none"> <li>■ Perform detailed cost-benefit and feasibility analysis for 3 to 5 options</li> <li>■ Identify changes to national policy and strategy to facilitate private investment</li> <li>■ Presentation to decision-makers</li> </ul>
Technique	Arthur D. Little “Project Management Office” proprietary methodology	ADL Risk Management, Benchmarking and Idea Generation methodologies, methods of SEA framework,	ADL fundraising framework and business case methodologies, methods of SEA framework;	ADL business cases frameworks, funding meetings and private investors workshops
Output	<ul style="list-style-type: none"> <li>■ Research findings</li> <li>■ Detailed scope and plan definitions for phase 1</li> </ul>	<ul style="list-style-type: none"> <li>■ Key business risks prioritized by region</li> <li>■ Portfolio of adaptation options</li> </ul>	<ul style="list-style-type: none"> <li>■ Portfolio evaluated and prioritized</li> <li>■ Short-list of options with financing options</li> </ul>	<ul style="list-style-type: none"> <li>■ 3 to 5 adaptation options «ready to implement»</li> <li>■ Guidelines for national policy and strategy</li> </ul>

Team focus in phase 1

For Phase 1, ADL designed an approach that addresses the Business context, Climate Change analysis, Impact and Opportunities for investment and Adaptation measures identification



Source: Based on Arthur D. little Methodologies, SEA - Strategic Environmental Assessment – Good Practices Guide, EACC - Economics of Adaptation to Climate Change, OECD – SEA and adaptation to climate change, ECA - Climate Adaptation Working Group, WBCSD – Adaptation, ECA – Enhancing the climate risk and adaption fact base for the Caribbean

This document presents the methodology and main findings of phase 1

Document Structure		
Strategic objectives	Focused on <b>the definition of key questions and strategic objectives</b>	0
Strategic assessment	Focused on <b>country context analysis</b> (analysis of the economic, social and geographical indicators), <b>climate change analysis</b> (analysis of the vulnerability and exposure of the regions) and <b>business context analysis</b> (analysis of the GDP and main approved private investment projects)	1 2 3
Benchmarking	Focused on <b>benchmarking analysis</b> from other countries and agencies	4
Risks and opportunities for private investment	Focused on the <b>identification of Key “High Climate Change Risk / High Climate Change Impact” areas in the North, Centre and South</b> and opportunities for private investment on these areas	5
Potential adaptation options	Focused on <b>adaptation measures identification</b> by combining the benchmarking with other themes input in order to define a long-list of adaptation measures	6

● Methodological phases covered

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**Theme 4 has a set of key questions that guides the project approach through all the phases**

### Key questions

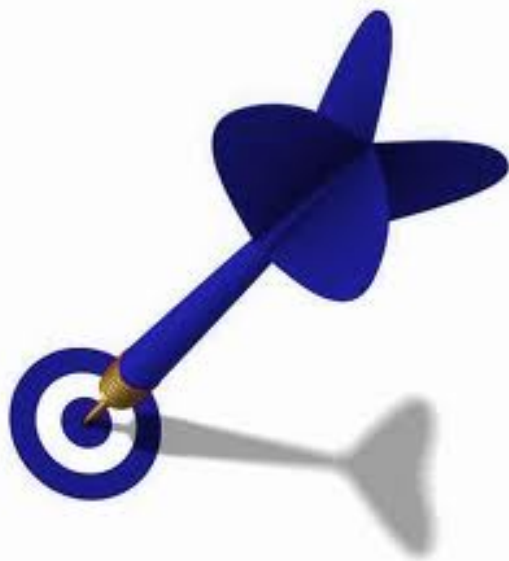
- What should be the set of adaptation measures to increase resilience to climate change in priority geographic areas of Mozambique, in each of the 8 themes?
- What role should the private sector play in the adaptation to climate change in Mozambique, in the priority geographic areas of the country?
- What are the barriers to private investment in the priority geographic areas?
- What are the solutions and possibilities for public-private funding for the selected adaptation measures?
- What are the recommendations for changes in government policy and strategy to facilitate the implementation of the adaptation and mitigation measures identified by the public and private sector?

Source: Construindo Resiliência com o Sector Privado – Technical proposal adenda



For the Phase 1, we aim to achieve three strategic objectives

### Strategic objectives



To **prioritize geographical areas and sectors** in Mozambique by combining high climate risk (in terms of exposure and vulnerability) with high business risks for the private sector (in terms of value of investments at risk )

To **assess the private sector's risks and opportunities**, in each prioritized geographical area and sector, based on the strategic assessment (country, climate change and business analysis) and the benchmarking of international best practices

To **identify a long-list of adaptation and mitigation options** with the potential to involve the private sector in increasing Mozambique's resilience to climate change

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### Introduction to “Strategic assessment”:

1

#### Country context analysis:

In this phase, we have done an assessment on economic and social indicators of the country in order to be used as an input for the following phases. The main document used in support of our analysis was «EACC - Economics of Adaptation to Climate report»

#### Climate change analysis:

In the beginning of this phase we researched the best practices to perform a climate change analysis focused on private sector engagement. The framework selected (SEA)<sup>1</sup> is best suited to a local than to a country level but we decided to adapt it to the country level selecting the methodologies with best fit.

In order to perform a climate change analysis we started by getting a regional perspective of the climate change impacts and then drilled down to specific areas. We considered this as the best approach since it allows us to get a global perspective (where there is more consistent data) and then focus on the most risky areas

- The exposure analysis was based on historical analysis of each region (North, Center and South) and future climate scenarios
  - For the historical analysis we crossed the information of an international database (EM-DAT) with a National Database that is being developed by INGC (Desconsultar) in order to guarantee the consistency of the data we used from each source
  - For the future scenarios we used the scenarios and conclusions of INGC phase 1 report
- The vulnerability analysis was based on the historical impact of each district / province and expected economic and social development (e.g. urban / rural population change). Once again we crossed the information from the different sources in order to guarantee the consistency of the data.

#### Business context analysis:

In this phase, we have analyzed Mozambique's economic context and main private investments. This analysis was based on methodologies from “ECA – Shaping climate-resilient development” and “EACC - Economics of Adaptation to Climate Change”. We focused on relevant documentation about Mozambique economy structure, top companies and private investments related information (e.g. CPI), meetings with private investors, phone interviews which conclusions will be validated in the workshop with a target of 20 private investors

Source: EACC - Economics of Adaptation to Climate Change, ECA – Shaping climate-resilient development: a report of the economics of climate adaptation group

Mozambique has approximately 22 million people and a GDP per capita of about \$ 900, which positions the country as one of the poorest countries in the world

1

### Mozambique brief context



#### Economic Indicators

#### Value

**GDP**

US\$ 9 B

**GDP per capita**

US\$ 897

#### Social Indicators

#### Value

**Population**

22 Million

**Human development index**

Low (0,284)

#### Geographical Indicators

#### Value

**Land area**

799,380 sq km

**Population density**

24 p./sq km

Source: Ranking do IDH 2010 - PNUD, Instituto Nacional de Estatística, Banco Central da República de Moçambique, Portal do Governo de Moçambique

There are considerable inequalities among Mozambique's regions: the South region is the one that contributes the most for the country's GDP

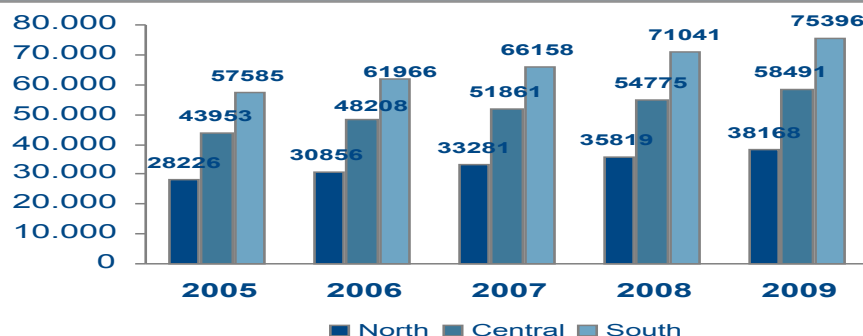
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### Region contribution to GDP (INE, 2009)

#### Average GDP contribution per region

North	Central	South
22%	34%	44%

#### GDP per region (10<sup>3</sup> MT)



The different stages of development of Mozambique regions is reflected in the comparative importance of each sector for the regional GDP

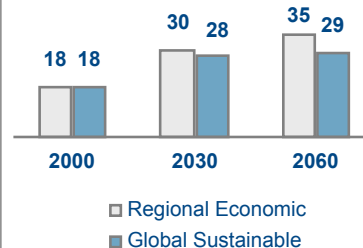
### Social context

#### Current status

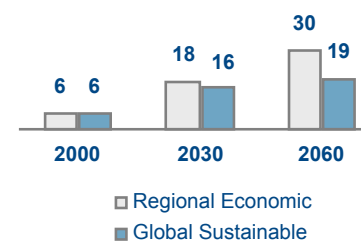
- Mozambique continues to be one of the poorest countries in the world and the social context is not following the economic growth despite the fast economic development.
- The human development index 2010 ranked Mozambique in 165<sup>o</sup> out of 169 countries
- HIV epidemics is a huge concern and it is estimated that 500 people get infected per day in Mozambique.
- 80% of the population is dedicated to agriculture and fisheries and lack the technical skills to work in other areas that private companies need

#### Socio Economic Scenarios for the future<sup>1</sup>

##### Population growth



##### Urbanisation

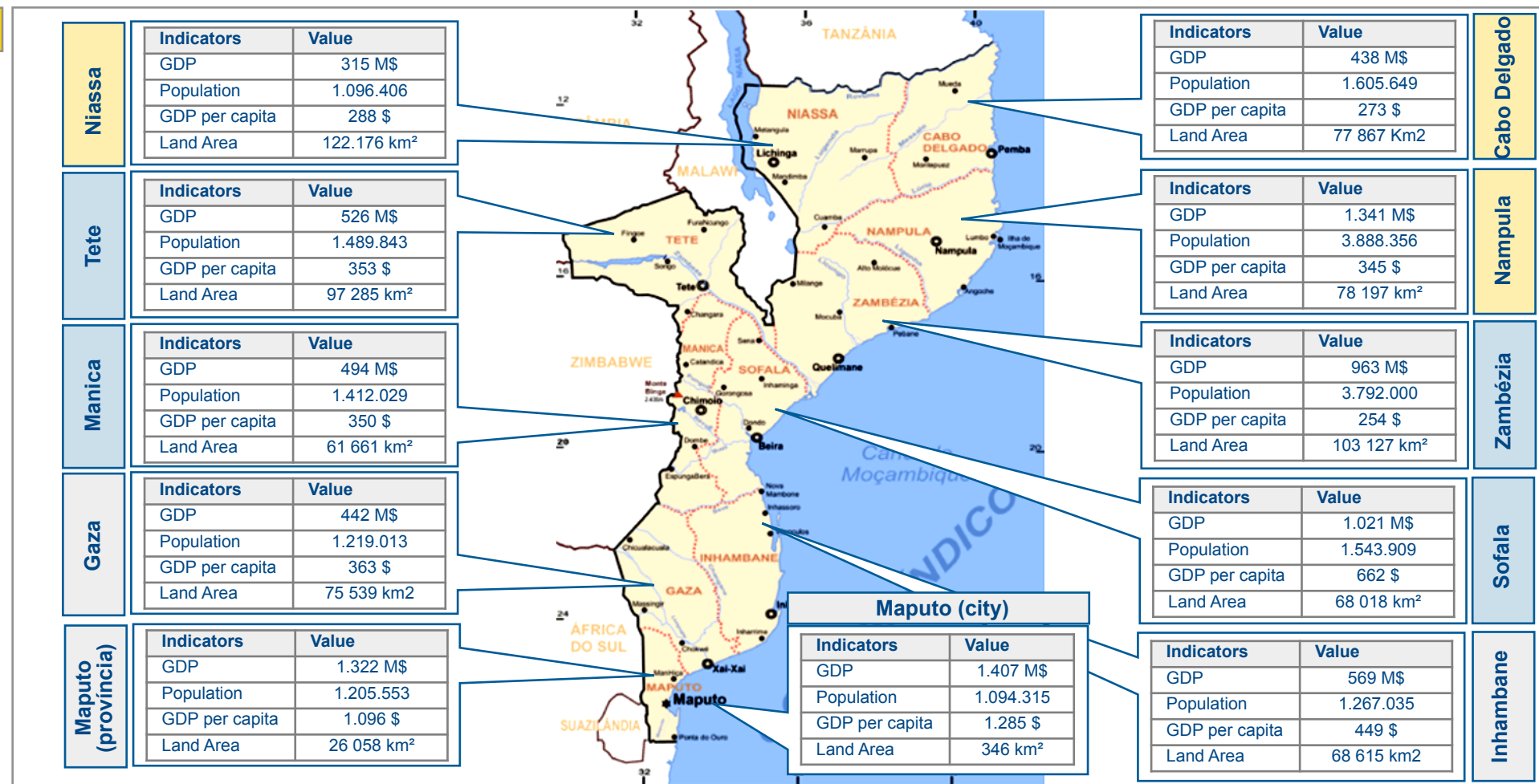


There are consistent trends between both scenarios: the decline of agriculture in the South, negative externalities, of agricultural expansion and intensification, the vulnerable coastal zone and rapid urbanization and population growth

Source INE Mozambique; - Human development index 2010 from UNDP, INGC Climate Change Report

In more detail, the provinces that have the most percentage of country's GDP are Maputo city and province, Nampula and Sofala

1



Souce: Instituto Nacional de Estatística de Moçambique, 2009 (population data refers to 2007)

## 1.4 Strategic assessment – Climate change analysis

Climate change analysis was performed considering exposure and vulnerability to each type of event as well as the future climate scenarios for Mozambique

2

	Exposure	Vulnerability	Climate Change Risk
Input	<ul style="list-style-type: none"> <li>■ EM-DAT: The OFDA/CRED International Disaster Database;</li> <li>■ INGC report</li> <li>■ Desconsular database (developed by INGC)</li> </ul>	<ul style="list-style-type: none"> <li>■ Desconsular database;</li> <li>■ INGC report;</li> <li>■ World Bank reports,</li> <li>■ Mozambique government reports</li> <li>■ INE</li> </ul>	<ul style="list-style-type: none"> <li>■ INGC report</li> <li>■ World Bank reports</li> <li>■ Desconsular database;</li> </ul>
Process	<ul style="list-style-type: none"> <li>■ First, we developed a model based on the data regarding natural events existent in EM-DAT and INGC phase 1 report</li> <li>■ Secondly, we cross-checked it with the information contained in Desconsular to guarantee the consistency of the data from the different sources</li> <li>■ Finally, by aggregating the results of INGC phase 1 report we applied scenario development</li> </ul>	<ul style="list-style-type: none"> <li>■ First, we designed a model with the data regarding the impact of natural events on the populations and in terms of number of deaths</li> <li>■ Secondly, we cross-checked the information contained in the databases to guarantee the consistency of the data from the different sources</li> <li>■ Finally, by aggregating the results of INGC phase 1 report with socio-economic development scenarios, we applied scenario development</li> </ul>	<ul style="list-style-type: none"> <li>■ First, with the outputs of the last two steps we built the risk matrix for each region</li> <li>■ Secondly, using our model with Desconsular indicators we were able to drill down to a district level and determine the risk for each district</li> <li>■ Finally, we developed a risk matrix for the areas most at risk in each region</li> </ul>
Technique	<ul style="list-style-type: none"> <li>■ Trends analysis,</li> <li>■ Consistency analysis</li> <li>■ Aggregation methods</li> </ul>	<ul style="list-style-type: none"> <li>■ Vulnerability analysis</li> <li>■ Consistency analysis</li> <li>■ Cross impact analysis – socio-economic development vs human impact</li> <li>■ SEA methodology</li> </ul>	<ul style="list-style-type: none"> <li>■ Risk Management Methodology</li> <li>■ Consistency analysis</li> <li>■ Experts consultations</li> <li>■ SEA methodology</li> </ul>
Output	<ul style="list-style-type: none"> <li>■ Historical frequency of droughts, floods and cyclones in Mozambique</li> <li>■ Future likely scenarios for this events and sea level rise</li> </ul>	<ul style="list-style-type: none"> <li>■ Historical affected population due to droughts, floods and cyclones in Mozambique</li> <li>■ Future likely scenarios considering climate hazards and economic development</li> </ul>	<ul style="list-style-type: none"> <li>■ Risk matrix for the present and future trends</li> </ul>

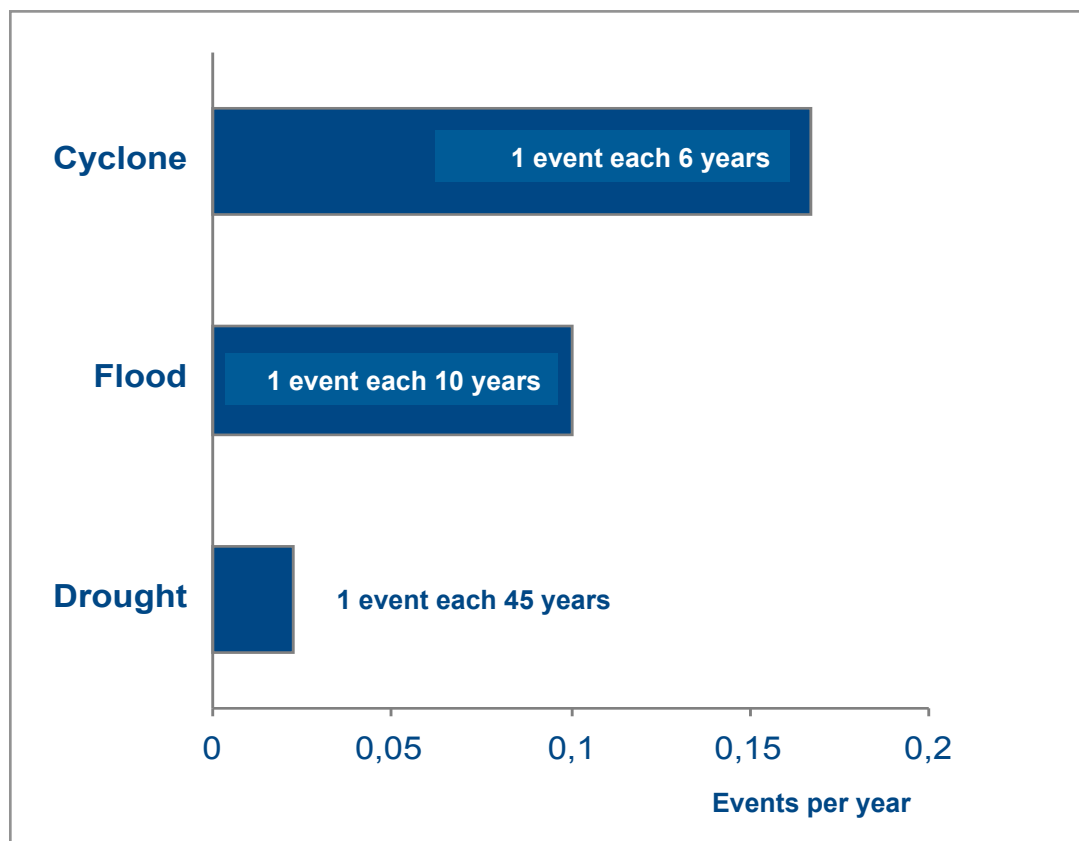
Source: Strategic environmental assessment and adaptation to climate change© OECD 2008, Strategic Environmental Assessment Good Practices Guide - Maria do Rosário Partidário; Prevention Consortium - The quality and accuracy of disaster data – a comparative analysis of three global data-sets

The North is historically the region with less burden due to natural hazards. With climate change this region is likely to increase the frequency of floods due to storms and cyclones

2

### Frequency of natural hazards in the North

### Comments



- The Northern region is the region with less burden regarding natural hazards.
- Still, this region had 15% of the flood events that occurred in Mozambique and 25% of the tropical cyclone events
- With climate change, there is a general expectation of increased flood peaks in small watersheds wherever storms make landfall in this region
- Regarding cyclones, there is not a representative sample to enable us to get to a conclusion regarding frequency, there seems to be more confidence that the relative frequency of category 4-5 cyclones versus 1-3 cyclones will increase

Source: EM-DAT: The OFDA/CRED International Disaster Database [www.emdat.be](http://www.emdat.be) - Université Catholique de Louvain - Brussels - Belgium  
 INGC – Study on the Impact of Climate Change on Disaster Risk in Mozambique: Main report; -Strategic environmental assessment and adaptation to climate change© OECD 2008, Strategic Environmental Assessment Good Practices Guide - Maria do Rosário Partidário;

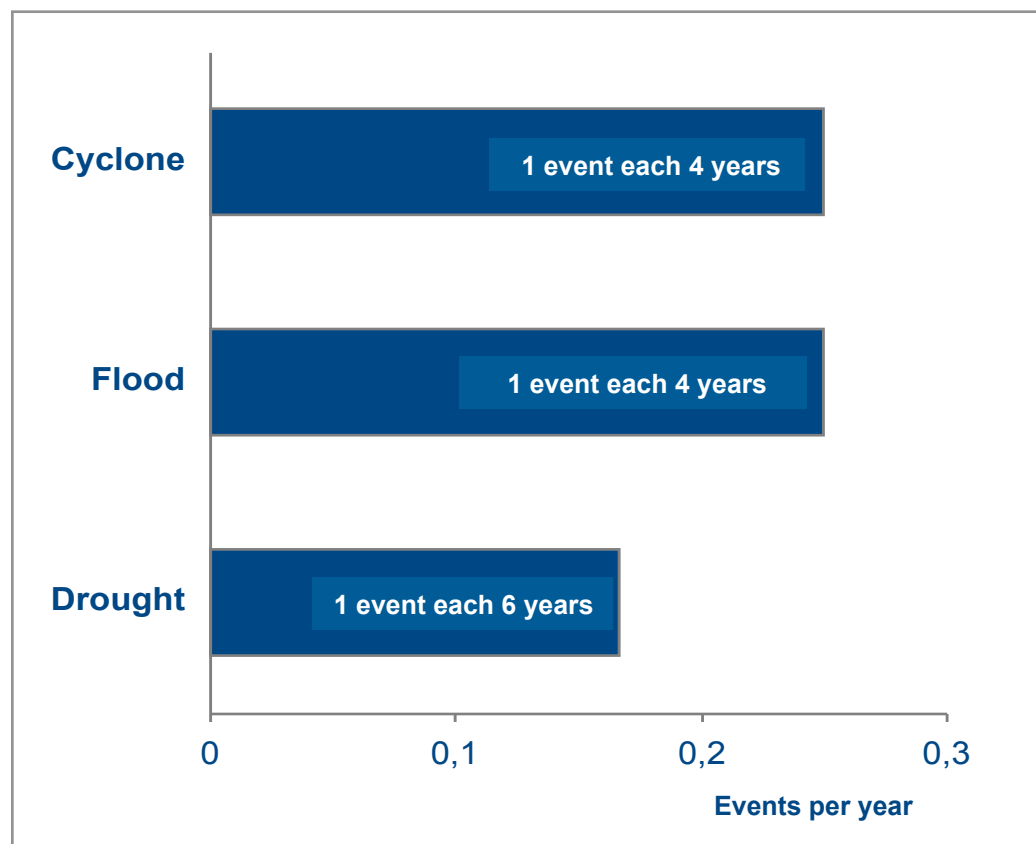


The Center is historically the region with more burden due to natural hazards. With climate change this region is likely to increase the risk of droughts and cyclones

2

### Frequency of natural hazards in the Center

### Comments



- The central region is frequently impacted by floods and cyclones and less frequently (1 event in each 6 years) by droughts.
- With climate change this region is likely to increase the risk of droughts and crop failure
- Moreover, although some slight increase in rainfall is expected in most of the Central region, six out of 7 models predict a 15% reduction of Zambezi flow which is likely to have an impact in hydroelectric production
- Regarding cyclones, there is not a representative sample to enable us to get to a conclusion regarding frequency, there seems to be more confidence that the relative frequency of category 4-5 cyclones versus 1-3 cyclones will increase

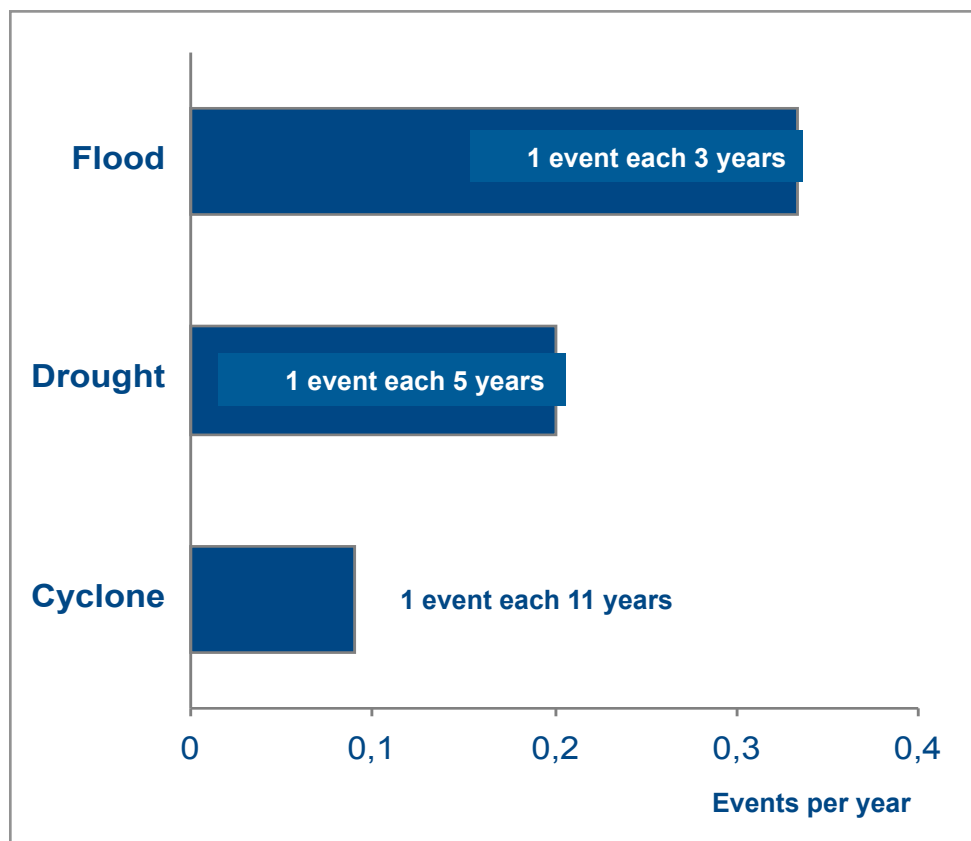
Source: EM-DAT: The OFDA/CRED International Disaster Database [www.emdat.be](http://www.emdat.be) - Université Catholique de Louvain - Brussels - Belgium  
 INGC – Study on the Impact of Climate Change on Disaster Risk in Mozambique: Main report; -Strategic environmental assessment and adaptation to climate change© OECD 2008, Strategic Environmental Assessment Good Practices Guide - Maria do Rosário Partidário;

The South is mainly impacted by floods and droughts and with climate change this region is likely to suffer from more floods and more intense cyclones

2

### Frequency of natural hazards in the South

### Comments

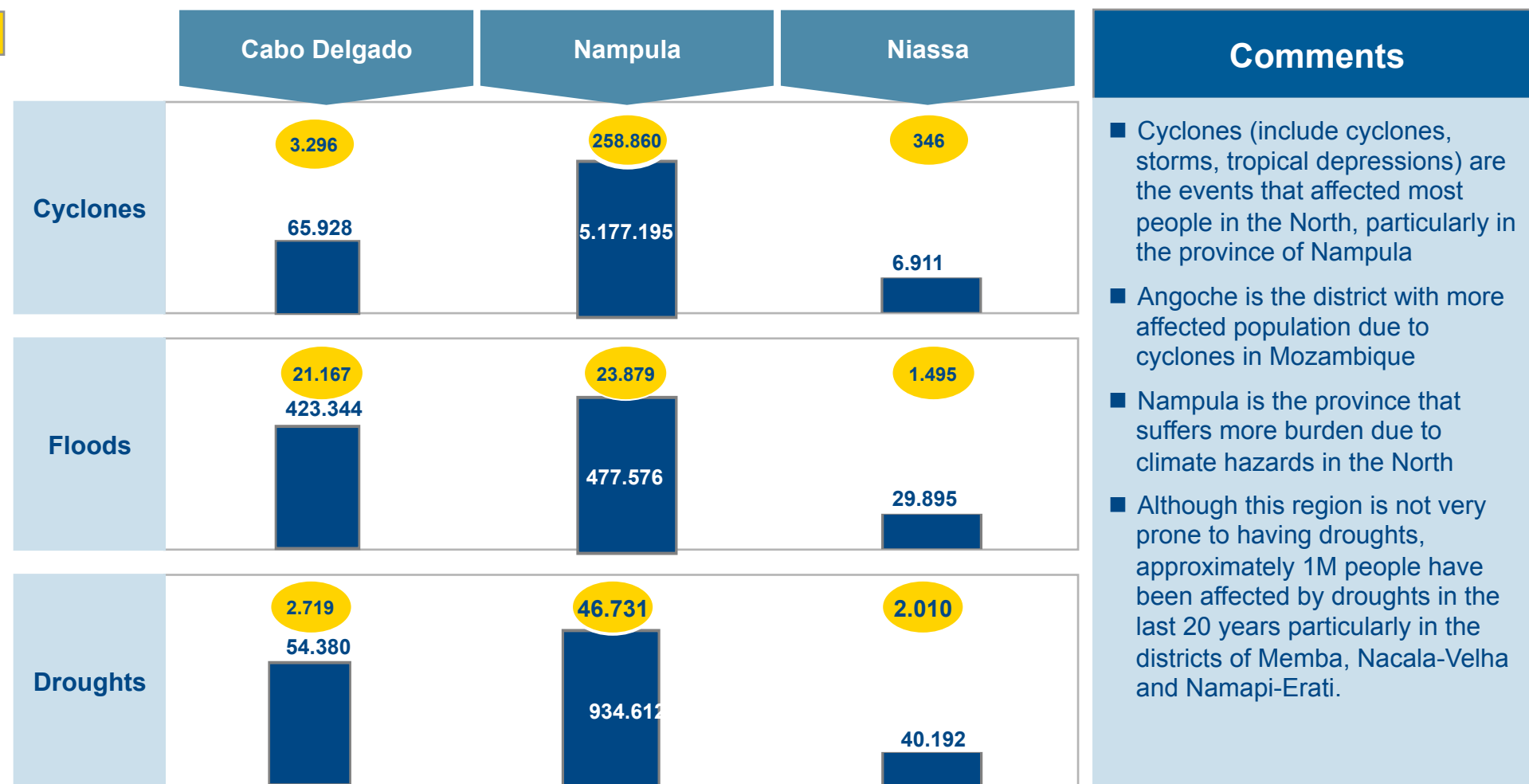


- The south is more impacted by floods and droughts and less frequently (1 event in each 11 years) by cyclones.
- With climate change the south is likely to have more floods and cyclones are likely to increase intensity.
- Drought frequency is uncertain but drought intensity is likely to increase at least in the near future.
- The risk of floods is likely to increase not in terms of frequency but in terms of intensity of each event.
- Regarding cyclones, there is not a representative sample to enable us to get to a conclusion regarding frequency, there seems to be more confidence that the relative frequency of category 4-5 cyclones versus 1-3 cyclones will increase

Source: EM-DAT: The OFDA/CRED International Disaster Database [www.emdat.be](http://www.emdat.be) - Université Catholique de Louvain - Brussels - Belgium  
 INGC – Study on the Impact of Climate Change on Disaster Risk in Mozambique: Main report; -Strategic environmental assessment and adaptation to climate change© OECD 2008, Strategic Environmental Assessment Good Practices Guide - Maria do Rosário Partidário;

Nampula is the northern province with more population affected by natural hazards, particularly with cyclones that, on average, affect more than 250.000 people per year

2

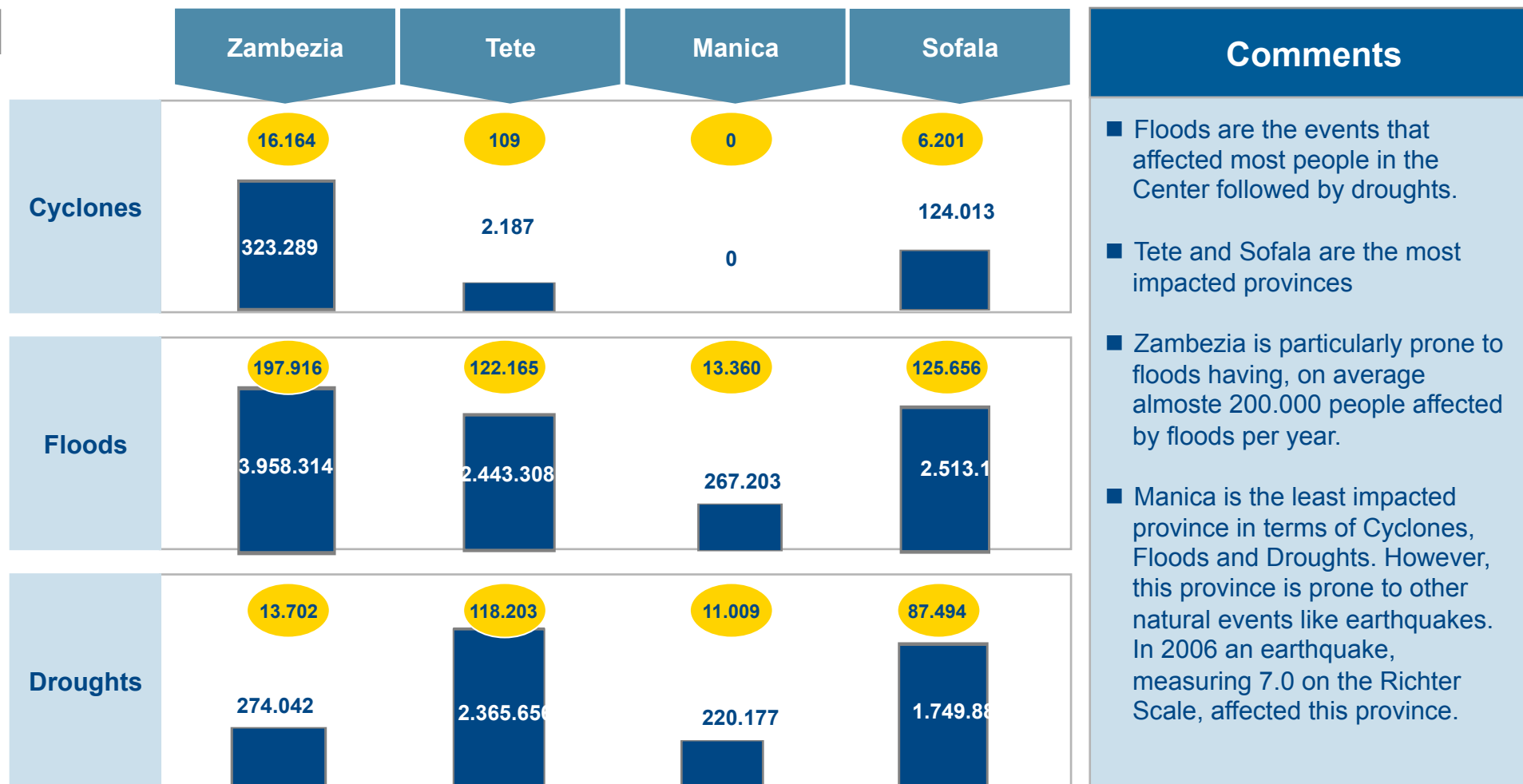


Source: Desconsultar database, INGC – Study on the Impact of Climate Change on Disaster Risk in Mozambique: Main report; -Strategic environmental assessment and adaptation to climate change© OECD 2008, Strategic Environmental Assessment Good Practices Guide - Maria do Rosário Partidário;

 Average affected persons per year

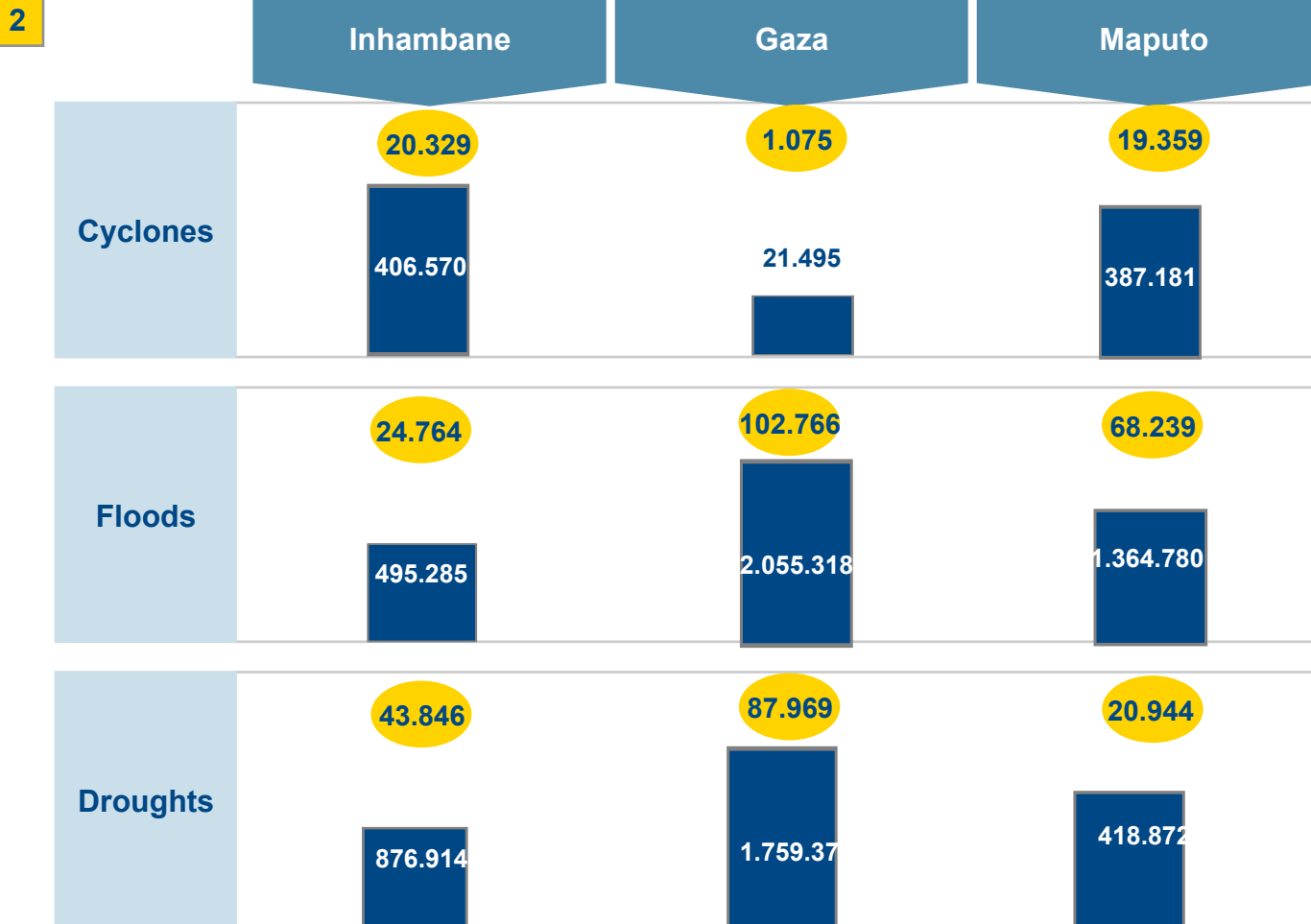
**Tete is the central province with more population affected by natural hazards that, on average, affect more than 240.000 people per year**

2



 Average affected persons per year

Gaza is the southern province with more population affected by natural hazards that, on average, affect more than 190.000 people per year



### Comments

- Floods are the events that affected most people in the South followed by droughts.
- Gaza is the most affected province, being Xai-Xai the most impacted district with almost 1M people affected by natural hazards in the past 20 years
- In the province of Inhambane, Vilanculos is the most affected district with 23.000 people affected by natural hazards per year

Source: Desconsultar database, INGC – Study on the Impact of Climate Change on Disaster Risk in Mozambique: Main report; -Strategic environmental assessment and adaptation to climate change© OECD 2008, Strategic Environmental Assessment Good Practices Guide - Maria do Rosário Partidário;

Average affected persons per year

The major climate risk for this region is flooding caused by heavy rains and cyclones. With climate change these risks are expected to increase

2

### Climate Change Risk in the North - baseline and future analysis -

#### Human Impact

	1	2	3	4	5	6	
6	7	8	9	10	11	12	6
5	6	7	8	9	10	11	5
4	5	6	7	8	9	10	4
3	4	5	6	7	8	9	3
2	3	4	5	6	7	8	2
1	2	3	4	5	6	7	1

The risk of Cyclones is for this region hardly acceptable. There is a need for adaptation measures

Frequency

The risk of droughts is for this region tolerable

The risk of floods is acceptable but adaptation measures should be performed to reduce the risk

.....► Climate change future tendencies

### Comments

- This region is mainly affected by cyclones that, in the present, represent a risk that is hardly accepted and that should be addressed
- Cyclones are expected to increase in intensity, increasing the level of damage and coastal erosion
- Moreover, although there is not representative sample to enable us to get to a conclusion, cyclone frequency appears to be increasing
- With climate change this region is expected to have a slight increase in rainfall with increase fluctuation during the year that might lead to more floods.
- Finally the combined effected of sea level rise and cyclones is likely to increase the risk for coastal areas like Nacala

Source: EM-DAT: The OFDA/CRED International Disaster Database [www.emdat.be](http://www.emdat.be) - Université Catholique de Louvain - Brussels – Belgium, - Desconsultar database, - INGC – Study on the Impact of Climate Change on Disaster Risk in Mozambique: Main report; -Strategic environmental assessment and adaptation to climate change© OECD 2008, Strategic Environmental Assessment Good Practices Guide - Maria do Rosário Partidário;

Although the risks are very similar in the most affected areas of the Northern region, Nacala seems to be the most affected area because it is impacted by cyclones, floods and droughts

2

### Climate risk in selected areas in the North - baseline and future analysis -

#### Quirimba National Park

		Human Impact						Frequency
		1	2	3	4	5	6	
Floods	6	7	8	9	10	11	12	6
	5	6	7	8	9	10	11	5
Cyclones	4	5	6	7	8	9	10	4
	3	4	5	6	7	8	9	3
Droughts	2	3	4	5	6	7	8	2
	1	2	3	4	5	6	7	1

#### Nampula

		Human Impact						Frequency
		1	2	3	4	5	6	
Cyclones	6	7	8	9	10	11	12	6
	5	6	7	8	9	10	11	5
Floods	4	5	6	7	8	9	10	4
	3	4	5	6	7	8	9	3
Droughts	2	3	4	5	6	7	8	2
	1	2	3	4	5	6	7	1



#### Cabo Delgado

		Human Impact						Frequency
		1	2	3	4	5	6	
Floods	6	7	8	9	10	11	12	6
	5	6	7	8	9	10	11	5
Cyclones	4	5	6	7	8	9	10	4
	3	4	5	6	7	8	9	3
Droughts	2	3	4	5	6	7	8	2
	1	2	3	4	5	6	7	1

#### Nacala

		Human Impact						Frequency
		1	2	3	4	5	6	
Floods	6	7	8	9	10	11	12	6
	5	6	7	8	9	10	11	5
Cyclones	4	5	6	7	8	9	10	4
	3	4	5	6	7	8	9	3
Droughts	2	3	4	5	6	7	8	2
	1	2	3	4	5	6	7	1

Nacala has events of cyclones, floods and droughts with more human impact than the other regions



The major climate risks for this region are flooding and water scarcity. With climate change this region is likely to have more droughts and cyclones

2

### Climate Change Risk in the Center - baseline and future analysis -

The risk of Cyclones is acceptable but adaptation measures should be performed to reduce the risk



The risk of Floods is not acceptable. There is a need to develop a plan to eliminate or reduce the risk

The risk of Droughts is hardly acceptable. There is a need for adaptation measures

.....> Climate change future tendencies

### Comments

- This region is mainly affected by floods and droughts being cyclones the event that cause the least impact on the population.
- With climate change this region is likely to increase the risk of droughts in Buzi and Pungue basins as well as in Zambezi basin.
- Moreover, the risk of cyclones will increase mainly due to two facts:
  - Cyclone intensity is expected to increase
  - Population concentration is likely to increase in coastal zones, leading to an increase number of population affected when a cyclone or a storm hit
- The combined effect of sea level rise and cyclones is likely to increase the risk for coastal areas like Beira
- Finally, the risk of floods is not expected to change

Source: EM-DAT: The OFDA/CRED International Disaster Database [www.emdat.be](http://www.emdat.be) - Université Catholique de Louvain - Brussels – Belgium, - Desconsultar database, - INGC – Study on the Impact of Climate Change on Disaster Risk in Mozambique: Main report; -Strategic environmental assessment and adaptation to climate change© OECD 2008, Strategic Environmental Assessment Good Practices Guide - Maria do Rosário Partidário;

The region of Moatize, Motarara and Changara seems to have floods and droughts events with more human impact than the other regions in the Center

2

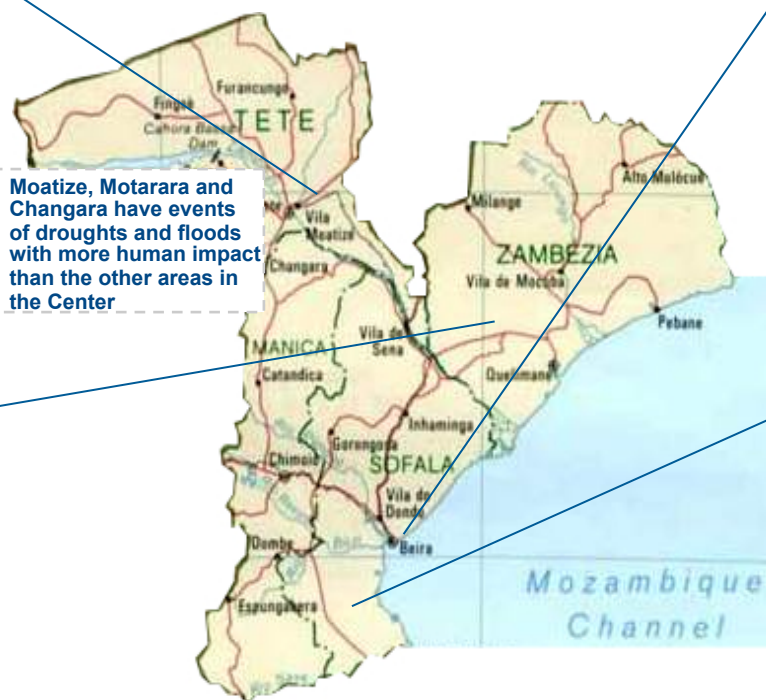
### Climate risk in selected areas in the Center - baseline and future analysis -

#### Moatize, Motarara and Changara

		Human Impact						
		1	2	3	4	5	6	
Floods	6	7	8	9	10	11	12	6
	5	6	7	8	9	10	11	5
	4	5	6	7	8	9	10	4
	3	4	5	6	7	8	9	3
Droughts	2	3	4	5	6	7	8	2
	1	2	3	4	5	6	7	1

Frequency

Moatize, Motarara and Changara have events of droughts and floods with more human impact than the other areas in the Center



#### Beira (Buzi and Dondo)

		Human Impact						
		1	2	3	4	5	6	
Floods	6	7	8	9	10	11	12	6
	5	6	7	8	9	10	11	5
	4	5	6	7	8	9	10	4
	3	4	5	6	7	8	9	3
Droughts	2	3	4	5	6	7	8	2
	1	2	3	4	5	6	7	1

Frequency

#### Chinde, Mopeia and Morrumbala

		Human Impact						
		1	2	3	4	5	6	
Floods	6	7	8	9	10	11	12	6
	5	6	7	8	9	10	11	5
	4	5	6	7	8	9	10	4
	3	4	5	6	7	8	9	3
Droughts	2	3	4	5	6	7	8	2
	1	2	3	4	5	6	7	1

Frequency

#### Maganja, Namacurra and Nicoadala

		Human Impact						
		1	2	3	4	5	6	
Floods	6	7	8	9	10	11	12	6
	5	6	7	8	9	10	11	5
	4	5	6	7	8	9	10	4
	3	4	5	6	7	8	9	3
Droughts	2	3	4	5	6	7	8	2
	1	2	3	4	5	6	7	1

Frequency

## 1.4 Strategic assessment – South region risk analysis

The major climate risks for this region are flooding and water scarcity. With climate change this region is likely to suffer more impact from floods and cyclones

2

### Climate Change Risk in the South - baseline and future analysis -

#### Consequence

	1	2	3	4	5	6	
6	7	8	9	10	11	12	6
5	6	7	8	9	10	11	5
4	5	6	7	8	9	10	4
3	4	5	6	7	8	9	3
2	3	4	5	6	7	8	2
1	2	3	4	5	6	7	1

The risk of floods is intolerable and a plan to reduce risks must be performed

Frequency

The risk of Cyclones is for this region tolerable.

The risk of droughts is intolerable and a plan to reduce risks must be performed

.....> Climate change future tendencies

### Comments

- This region is mainly affected by floods and droughts
- With climate change this region is likely to increase the risk of floods not in terms of frequency but in terms of intensity of each event. A 25% increase in the magnitude of large flood peaks was identified along the main stems of both the Limpopo and Save rivers in 5 of the 7 models
- Moreover, the risk of cyclones will increase mainly due to two facts:
  - Cyclone intensity is expected to increase
  - Population concentration is likely to increase in coastal zones, leading to an increase number of population affected when a cyclone or a storm hit
- The combined effect of sea level rise and cyclones is likely to increase the risk for coastal areas like Vilanculos, Xai-Xai or Maputo
- Finally although drought frequency is uncertain, drought intensity is likely to increase at least in the near future.

Source: EM-DAT: The OFDA/CRED International Disaster Database [www.emdat.be](http://www.emdat.be) - Université Catholique de Louvain - Brussels – Belgium, - Desconsultar database, - INGC – Study on the Impact of Climate Change on Disaster Risk in Mozambique: Main report; -Strategic environmental assessment and adaptation to climate change© OECD 2008, Strategic Environmental Assessment Good Practices Guide - Maria do Rosário Partidário;

The region of Vilanculos seems to have cyclones and flood events with more human impact than the other regions in the South

2

### Climate risk in selected areas in the South - baseline and future analysis -

#### Vilanculos

##### Human Impact

	1	2	3	4	5	6	
Floods	6	7	8	9	10	11	6
	5	6	7	8	9	10	5
Droughts	4	5	6	7	8	9	4
	3	4	5	6	7	8	3
Cyclones	2	3	4	5	6	7	2
	1	2	3	4	5	6	1

Vilanculos events of floods and cyclones have high human impact

Gaza events of floods and droughts have high human impact

#### Gaza

##### Human Impact

	1	2	3	4	5	6	
Floods	6	7	8	9	10	11	6
	5	6	7	8	9	10	5
Droughts	4	5	6	7	8	9	4
	3	4	5	6	7	8	3
Cyclones	2	3	4	5	6	7	2
	1	2	3	4	5	6	1

#### Matola

##### Human Impact

	1	2	3	4	5	6	
Floods	6	7	8	9	10	11	6
	5	6	7	8	9	10	5
	4	5	6	7	8	9	4
	3	4	5	6	7	8	3
	2	3	4	5	6	7	2
	1	2	3	4	5	6	1

#### Maputo

##### Human Impact

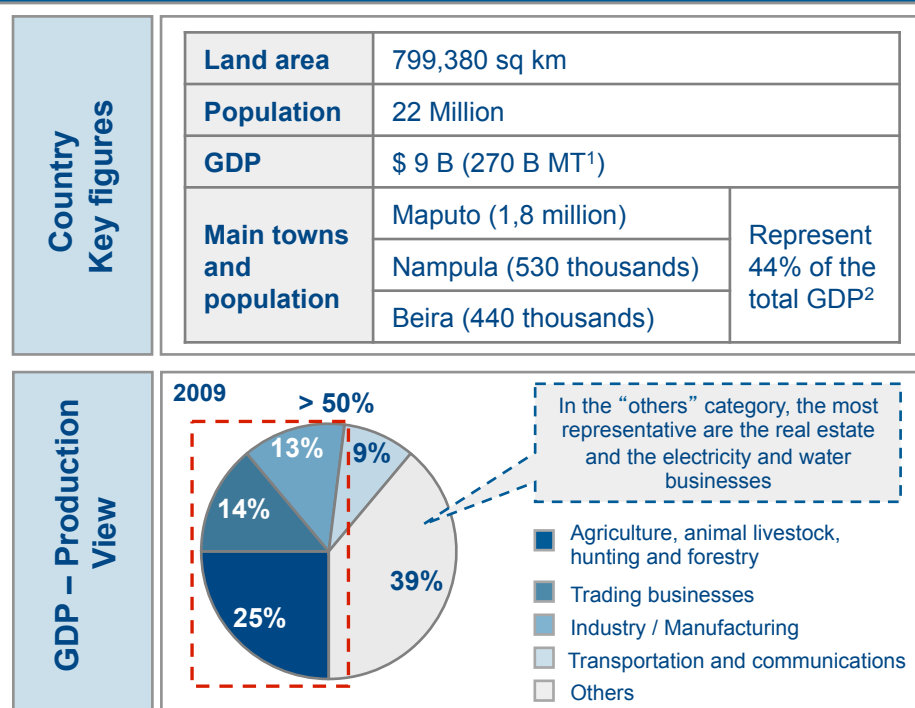
	1	2	3	4	5	6	
Floods	6	7	8	9	10	11	6
	5	6	7	8	9	10	5
	4	5	6	7	8	9	4
	3	4	5	6	7	8	3
Cyclones	2	3	4	5	6	7	2
	1	2	3	4	5	6	1



Mozambique has approximately 22 million people and a gross domestic product of about \$9 billion, of which more than 50% comes from agriculture, trading and manufacturing

3

### Mozambique brief economic context



### Main industries of the Top 100 Mozambique's companies<sup>3</sup>

Sector	Main Companies	% revenues
Industry	<ul style="list-style-type: none"> <li>■ Mozal (from Maputo)</li> <li>■ Cimentos de Moçambique (from Matola)</li> <li>■ British American Tobacco Mozambique, Lda (from Chimoio)</li> </ul>	29 %
Energy	<ul style="list-style-type: none"> <li>■ Petromoc-Petróleos de Moçambique</li> <li>■ Hidroeléctrica de Cahora Bassa (Tete)</li> <li>■ BP Moçambique (Maputo, Beira e Nacala)</li> </ul>	25 %
Transportation	<ul style="list-style-type: none"> <li>■ LAM-Linhas Aéreas de Moçambique</li> <li>■ CFM-Portos e Caminhos de Ferro de Moçambique E.P.</li> <li>■ Mocargo - Empresa Moçambicana de Cargas</li> </ul>	10 %
Others	<ul style="list-style-type: none"> <li>■ Moçambique Celular</li> <li>■ Cervejas de Moçambique</li> <li>■ BIM-Banco Internacional de Moçambique</li> <li>■ Mozambique Leaf Tobacco</li> </ul>	37 %

Nevertheless, some of the top companies in the country belong to Energy and Transportation sectors

Source: INE, 100 maiores empresas de Moçambique – documento KPMG

■ % revenues from sector

The value of approved investments that will take place in the short to medium term<sup>1</sup> is worth some \$19 B, of which more than 80% are located in Nampula, Tete, Maputo e Zambézia

3

### Main approved private investment projects and prospects<sup>2</sup>

Tete		\$ 3.8 B	20%
Investments	Value		
Hidroelétrica de Mphanda Nkuwa (Changara/Chiuta)	\$ 1.9 B		
Carvão de Moatize	\$ 1.5 B		
Eqstra Moçambique (Tete)	\$ 165 M		

*investments concentrated in two major projects*

Maputo		\$ 2.7 B	14%
Investments	Value		
Ilha de Xefina (Cidade de Maputo)	\$ 320 M		
MCEL (Cidade de Maputo)	\$ 140 M		
Obrigado Fazenda de Açúcar e Milho (Moamba)	\$ 100 M		

*investment diluted in several projects*

Nampula		\$ 7.5 B	39%
Investments	Value		
Ayr Petro-Nacala (Nacala)	\$ 5.0 B		
Lúrio Green Resources (Ribawe)	\$ 2.2 B		
Cervejas de Moçambique – Fábrica de Nampula	\$ 55 M		

*investments concentrated in two major projects*

Zambézia		\$ 2.4 B	13%
Investments	Value		
Portucel Moçambique (Ile)	\$ 2.3 B		
Moçamgalp (Luguela)	\$ 19 M		
Quifel Agrícola (Gurue)	\$ 17 M		

*investments concentrated in one major project*

Other provinces		\$ 2.6 B	14%
-----------------	--	----------	-----

In addition to the private investment, it is expected significant public investment in these regions, such as Nacala port and airport (\$700 M) and improvement of Maputo and Beira ports (\$ 1,4 B)<sup>2</sup>

Source:



<sup>1</sup> in the next 5 to 15 years

<sup>2</sup>CPI (2005-2010) – Investment promotion centre (Centro Promoção de Investimento)

<sup>2</sup>Nacala XXI, Nacala, Beira and Maputo development corridors, Mozambique investment forum 2010, Investment Opportunities in the Industrial Sector, Investing in Mozambique 2010, companies websites



### The most significant investments belong to mineral resources, energy and agriculture companies (1/2)

3	Region	Province	Sector	Value
North	North	Niassa	Agriculture, Forestry and Livestock	\$185M
		Niassa	Tourism	\$8M
		Cabo Delgado	Agriculture, Forestry and Livestock	\$110M
		Cabo Delgado	Tourism	\$60M
		Nampula	Mineral resources and Energy	\$5B
		Nampula	Agriculture, Forestry and Livestock	\$2.3B
		Nampula	Transports and Communications	\$700M
Center	Center	Tete	Mineral resources and Energy	\$7.3B
		Tete	Services	\$240M
		Tete	Tourism	\$60M
		Zambeze	Agriculture, Forestry and Livestock	\$2,4B
		Zambeze	Industry	\$25M
		Manica	Agriculture, Forestry and Livestock	\$310M
		Manica	Industry	\$60M
		Sofala	Transports and Communications	\$620M
		Sofala	Agriculture, Forestry and Livestock	\$440M
		Sofala	Tourism	\$120M
		Sofala	Industry	\$90M

Source:



<sup>1</sup>CPI (2005-2010) – Investment promotion centre (Centro Promoção de Investimento)

<sup>2</sup>Nacala XXI, Nacala, Beira and Maputo development corridors, Mozambique investment forum 2010, Investment Opportunities in the Industrial Sector, Investing in Mozambique 2010, companies websites



### The most significant investments belong to mineral resources, energy and agriculture companies (2/2)

3

Region	Province	Sector	Value
South	Gaza	Agriculture, Forestry and Livestock	\$630M
	Gaza	Tourism	\$230M
	Inhambane	Tourism	\$190M
	Inhambane	Agriculture, Forestry and Livestock	\$22M
	Maputo	Transports and Communications	\$1.2B
	Maputo	Tourism	\$710M
	Maputo	Industry	\$660M
	Maputo	Agriculture	\$320M
	Maputo	Services	\$220M
	Maputo	Construction	\$130M
	Maputo	Banking	\$115M

Source:



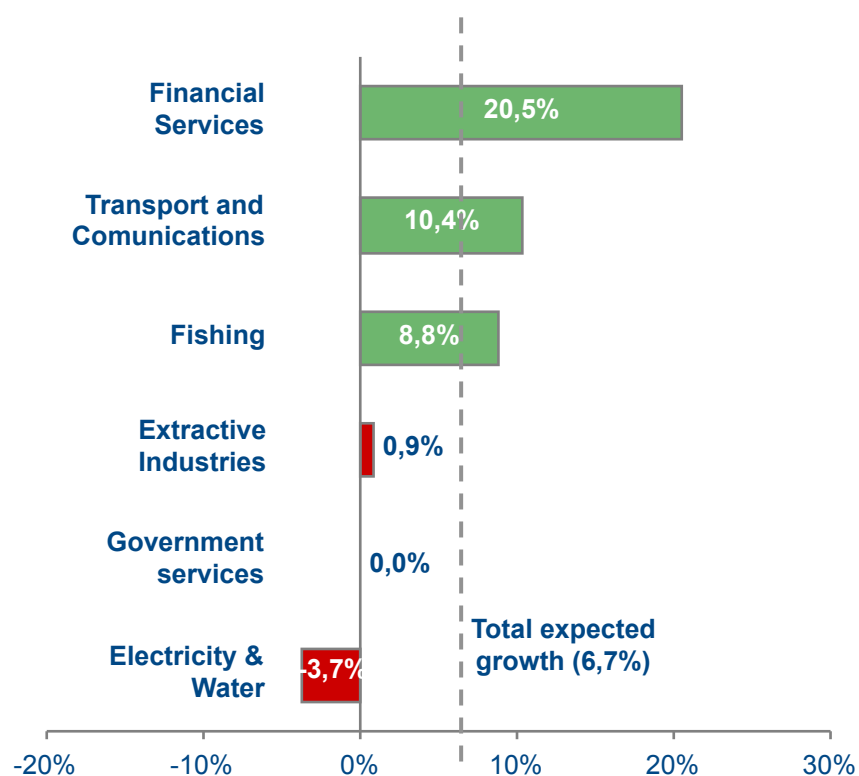
<sup>1</sup>CPI (2005-2010) – Investment promotion centre (Centro Promoção de Investimento)

<sup>2</sup>Nacala XXI, Nacala, Beira and Maputo development corridors, Mozambique investment forum 2010, Investment Opportunities in the Industrial Sector, Investing in Mozambique 2010, companies websites

The leading economic sectors in 2011 seem to be Financial services, Transport and communications and Fishing

3

### Expected Growth in 2011



Source: Government of Mozambique, Economic and Social Plan (PES), 2011

### Comments

- The Economist Intelligence Unit is optimistic about the growth in **financial services, demand for which will be driven by both consumers and large investment projects** – although the EIU expect a more modest growth of **around 12%**
- Regarding **Transport and Communications**, there is a **match between the Government and EIU expectations** – transport is a priority sector for public investment, and communications will continue to be buoyed by unmet demand for mobile-phone and Internet services
- With regard to **Extractive Industries** expectations, the EIU team believes that the **government's growth projection is overly pessimistic**, rather EIU expects an expansion of around 6-8%

Source: The Economist Intelligence Unit

- The three industries with the most significant growth rate
- The three industries with the lowest growth rate

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### Introduction to “Benchmarking”:

4

In this phase we identified adaptation measures in countries with similar natural hazards events. To do that we based our methodology on the study from Economics of Climate Adaptation entitled «Shaping Climate Resilient Development»

- In a first step, we focused on the methodologies and facts described on document cited above in order to structure our desk research

- Secondly, we have replicated the approach for other relevant documentation focusing our analysis on case-studies of adaptation measures on countries with similar natural hazards events. Some examples of the sources we used are: World bank documentation, Shaping climate-resilient development – a framework for decision-making, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, United Nations Framework Convention on Climate Change, Food and Agriculture Organization of the United Nations

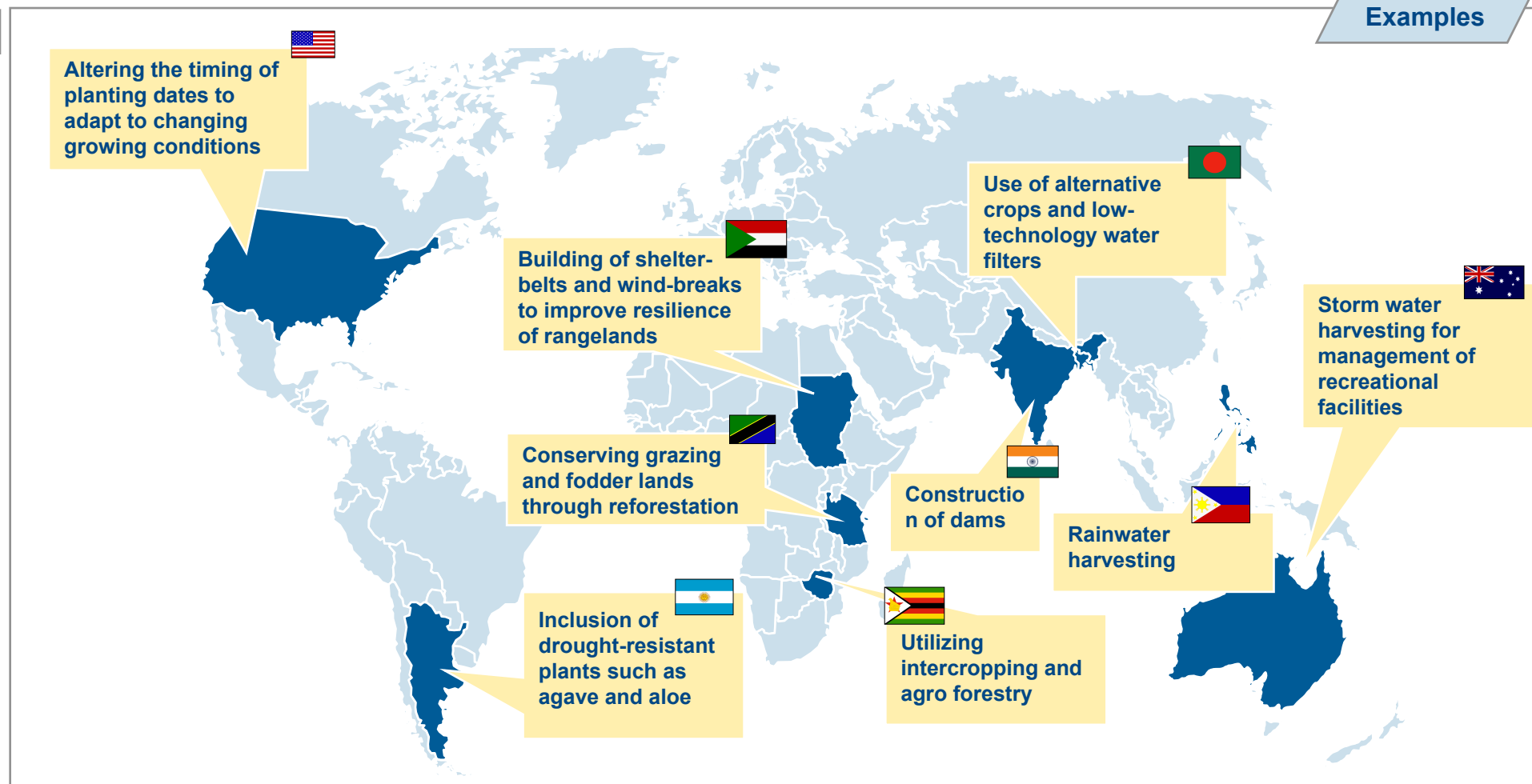
- Finally, we have compiled the more suitable case-studies and done a case comparison in order to identify the potential adaptation measures – we identified which climate impacts were subject to each adaptation measure considered

Source: ECA – Shaping climate-resilient development: a report of the economics of climate adaptation group

From the available studies and reports on adaptation measures for climate change impacts, we identified more than 75 case-studies for our portfolio of adaptation options (1/15)

4


Examples



Main sources: ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

From the available studies and reports on adaptation measures for climate change impacts, we identified more than 75 case-studies for our portfolio of adaptation options (2/15)



4

Country	Adaptation measures	Adaptation to the following climate impacts	Source
<b>Argentina</b>  	Adjustment of planting dates and crop variety - e.g. Inclusion of drought-resistant plants such as agave and aloe	Drought	Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change
	Accumulation of commodity stocks as economic reserve		
	Spatially separated plots for cropping and grazing to diversify exposures		
	Diversification of income by adding livestock operations		
	Set-up/provision of crop insurance		
	Creation of local financial pools (as alternative to commercial crop insurance)		

Main sources: ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

From the available studies and reports on adaptation measures for climate change impacts, we identified more than 75 case-studies for our portfolio of adaptation options (3/15)

4






Country	Adaptation measures	Adaptation to the following climate impacts	Source
<b>Australia</b> 	Storm water harvesting for management of recreational facilities	Water scarcity	Australia - climate change adaption actions for local government
	Storm water recycling through wetlands	Water stress	
<b>Bangladesh</b> 	Rice tolerant crops	Loss of crops	UNFCCC (United Nations Framework Convention on Climate Change)
	Flood-resilient aquaculture in Faridpur	Low productivity of fisheries	
	Flood-resistant housing in Faridpur	Damage to human settlements	
	Flood-resistant housing through micro-loans	Damage to human settlements	

Main sources: ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change





From the available studies and reports on adaptation measures for climate change impacts, we identified more than 75 case-studies for our portfolio of adaptation options (4/15)

4

Country	Adaptation measures	Adaptation to the following climate impacts	Source
<b>Bangladesh</b> 	Use of alternative crops and low-technology water filters	Sea-level rise and salt-water intrusion	Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change
	Building of flow regulators in coastal embankments	Sea-level rise and salt-water intrusion	
<b>Botswana</b> 	Domesticating wild fruit trees	Loss of crops	UNFCCC (United Nations Framework Convention on Climate Change)
<b>Brazil</b> 	Preventing soil erosion and landslides by reforestation in Rio de Janeiro	Soil erosion	
<b>Burkina Faso</b> 	Forestation through vegetative propagation	Land degradation	
<b>Caribbean islands - Grenada</b> 	Establishing grass barriers to minimize soil loss and associated degradation and conserve limited water resources	Soil erosion	FAO (Food and Agriculture Organization)

From the available studies and reports on adaptation measures for climate change impacts, we identified more than 75 case-studies for our portfolio of adaptation options (5/15)





4

Country	Adaptation measures	Adaptation to the following climate impacts	Source
<b>Caribbean islands - Grenada</b> 	Integrating agroforestry practices in the farming system	Loss of crops - soil erosion	UNFCCC (United Nations Framework Convention on Climate Change)
	Building a hurricane-resistant poultry pen	Increasing farmers' likelihood to recover from disaster by protecting an important source of income and food security.	FAO (Food and Agriculture Organization)
<b>China</b> 	Water resources management in Yangtze River Basin	Water management	International Cooperation Bureau Yangtze (Changjing) Water Resources Commission, MWR, China
	Tree-planting pits in the Loess Highlands	Soil erosion	UNFCCC (United Nations Framework Convention on Climate Change)
	Rainwater harvesting	Water scarcity	The World Bank
	Wind and solar thermal power	Reduction of oil dependence	Eskom

Main sources: ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

**From the available studies and reports on adaptation measures for climate change impacts, we identified more than 75 case-studies for our portfolio of adaptation options (6/15)**



4

Country	Adaptation measures	Adaptation to the following climate impacts	Source
<b>China</b> 	Improve drought resistance of wheat cultivations in Shandong Province	Water shortage	FAO (Food and Agriculture Organization)
	Enhanced resilience of water drainage and irrigation system for Disaster Risk Management in Shandong	Water stress	FAO (Food and Agriculture Organization)
<b>Egypt</b> 	Installation of hard structures in areas vulnerable to coastal erosion	Sea level rise - regulation of setback distances for coastal infrastructure	Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change
<b>El Salvador</b> 	Drought-resistant agriculture	Loss of crops	UNFCCC (United Nations Framework Convention on Climate Change)
	Addressing drought problems by reforesting areas with fruit trees to protect soil from erosion caused by water and wind while augmenting the local food supply	Soil erosion	The World Bank
<b>Fiji</b> 	Coral gardening in Cuvu Mina	Coastal inundation/erosion	UNFCCC (United Nations Framework Convention on Climate Change)

Main sources: ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

From the available studies and reports on adaptation measures for climate change impacts, we identified more than 75 case-studies for our portfolio of adaptation options (7/15)

4



Country	Adaptation measures	Adaptation to the following climate impacts	Source
<b>India</b> 	Rice tolerant crops pilot project	Loss of crops	UNFCCC (United Nations Framework Convention on Climate Change)
	Using bamboo to transport stream and spring water to irrigate plantations in Northeast India	Loss of crops, water shortage, higher crop yields	
	Bajra millet in Rajasthan	Loss of crops	
	Anicuts in India	Water shortage	
	Harvesting water and recharging ground water through earthen dams in India	Water management	<a href="http://www.rainwaterharvesting.org/">http://www.rainwaterharvesting.org/</a>
<b>Jamaica</b> 	Alley cropping - planting trees in rows with food or cash crops between them	Land degradation and soil erosion	UNFCCC (United Nations Framework Convention on Climate Change)

Main sources: ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

## 1.5 Benchmarking – Adaptation measures

From the available studies and reports on adaptation measures for climate change impacts, we identified more than 75 case-studies for our portfolio of adaptation options (8/15)




4

Country	Adaptation measures	Adaptation to the following climate impacts	Source
<b>Kenya</b> 	Crop diversification	Loss of crops	UNFCCC (United Nations Framework Convention on Climate Change)
	Adoption of drought resistant/escaping crops	Loss of crops	
	Improving sustainable livelihoods in dry land areas	Loss of crops	FAO (Food and Agriculture Organization)
<b>Mexico</b> 	Adjustment of planting dates and crop variety - e.g. Inclusion of drought-resistant plants such as agave and aloe)	Drought	Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change
	Accumulation of commodity stocks as economic reserve	Drought	
	Spatially separated plots for cropping and grazing to diversify exposures	Drought	

Main sources: ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

From the available studies and reports on adaptation measures for climate change impacts, we identified more than 75 case-studies for our portfolio of adaptation options (9/15)


4

Country	Adaptation measures	Adaptation to the following climate impacts	Source
<b>Mexico</b> 	Diversification of income by adding livestock operations	Drought	Working Group II Contribution of the Fourth Assessment Report of the Intergovernmental Panel on Climate Change
	Set-up/provision of crop insurance	Drought	
	Creation of local financial pools (as alternative to commercial crop insurance)	Drought	
<b>Netherlands</b> 	Construction of Dykes	Loss of land, coastal inundation/erosion	UNFCCC (United Nations Framework Convention on Climate Change)
<b>Peru</b> 	Utilizing an ancient irrigation and drainage system in Waru waru	Loss of crops (droughts and floods)	UNESCO

Main sources: ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

From the available studies and reports on adaptation measures for climate change impacts, we identified more than 75 case-studies for our portfolio of adaptation options (10/15)

4


Country	Adaptation measures	Adaptation to the following climate impacts	Source
<b>Philippines</b> 	Community-based disaster preparedness	Damage to human settlements	UNFCCC (United Nations Framework Convention on Climate Change)
	Typhoon-resistant housing	Damage to human settlements	
	Adjustment of siccultural treatment schedules to suit climate variations	Drought and floods	Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change
	Use of shallow tube wells	Drought and floods	
	Rotation method of irrigation during water shortage	Drought and floods	
	Construction of water impounding basins	Drought and floods	

Main sources: ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change



From the available studies and reports on adaptation measures for climate change impacts, we identified more than 75 case-studies for our portfolio of adaptation options (11/15)


4

Country	Adaptation measures	Adaptation to the following climate impacts	Source
<div>Philippines</div> <div></div>	Construction of fire lines and controlled burning	Drought / Floods	Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change
	Adoption of soil and water conservation measures for upland farming		
	Rainwater harvesting	Drought and salt-water intrusion	
	Leakage reduction		
	Hydroponic farming		
	Bank loans allowing for purchase of rainwater storage tanks		

Main sources: ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

From the available studies and reports on adaptation measures for climate change impacts, we identified more than 75 case-studies for our portfolio of adaptation options (12/15)




4

Country	Adaptation measures	Adaptation to the following climate impacts	Source
<b>Philippines</b> 	Capacity building for shoreline defence system design	Sea-level rise and storm surges	Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change
	Introduction of participatory risk assessment	Sea-level rise and storm surges	
	Provision of grants to strengthen coastal resilience and rehabilitation of infrastructures	Sea-level rise and storm surges	
	Construction of cyclone-resistant housing units	Sea-level rise and storm surges	
	Retrofit of buildings to improved hazard standards	Sea-level rise and storm surges	
	Review of building codes	Sea-level rise and storm surges	

Main sources: ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

From the available studies and reports on adaptation measures for climate change impacts, we identified more than 75 case-studies for our portfolio of adaptation options (13/15)







4

Country	Adaptation measures	Adaptation to the following climate impacts	Source
<b>Philippines</b> 	Reforestation of mangroves	Sea-level rise and storm surges	Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change
<b>Sudan</b> 	Traditional rainwater harvesting and water conserving techniques	Drought	
	Building of shelter-belts and wind-breaks to improve resilience of rangelands	Drought	
	Monitoring of the number of grazing animals and cut trees	Drought	
	Set-up of revolving credit funds	Drought	
<b>Sri Lanka</b> 	Introduction of Agro forestry	Land degradation, water shortage	UNFCCC (United Nations Framework Convention on Climate Change)

Main sources: ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

From the available studies and reports on adaptation measures for climate change impacts, we identified more than 75 case-studies for our portfolio of adaptation options (14/15)



4

Country	Adaptation measures	Adaptation to the following climate impacts	Source
Tanzania 	Conserving grazing and fodder lands through reforestation	Land degradation	UNFCCC (United Nations Framework Convention on Climate Change)
Thailand 	Mangrove reforestation in southern Thailand	Coastal inundation/erosion	
East Timor 	Seed selection	Loss of crops	
UK 	Coastal realignment - converting arable farmland into salt marsh and grassland to provide sustainable sea defences	Floods and sea-level rise	Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change
USA 	Altering the timing of planting dates to adapt to changing growing conditions	Loss of crops	Environmental protecting agency USA
Vietnam 	Building forecasting capacity and building an adaptation strategy for the Mekong Delta	Loss of land and damage to human settlements	UNFCCC (United Nations Framework Convention on Climate Change)

Main sources: ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

From the available studies and reports on adaptation measures for climate change impacts, we identified more than 75 case-studies for our portfolio of adaptation options (15/15)

4

Country	Adaptation measures	Adaptation to the following climate impacts	Source
Yemen 	Introduction of spate irrigation	Water shortage, higher crop yields	UNFCCC (United Nations Framework Convention on Climate Change)
Zimbabwe 	Utilizing intercropping and agro forestry	Improving water efficiency and reduce land degradation	

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### Introduction to “Risks and opportunities for private investors”:

5

In this phase we have done SWOT analysis for each “High Climate Change Risk / High Climate Change Impact area” focused on the business risks and opportunities per sector. To support us in doing that we used the report «Adaptation - An issue brief for business» that systematize a way of approaching business risks and opportunities

#### **Risks for private investors**

To assess the risks for private investors we identified the riskier areas and economic sectors in Mozambique as well as the business risks associated with it.

##### **High Climate Change Risk / High Climate Change Impact areas identification:**

We identified High Climate Change Risk / High Climate Change Impact areas in each region of Mozambique by overlapping the climate risk maps and the investment maps developed in previous phases.

We had meetings with other themes (themes 1- Google, 2 – Coastal Protection, 4- Ecoenergia, 6 - Agriculture and 9 - strategy) and had a second round of meetings with themes 2 and 4 where we debated our preliminary results.

In addition we validated our preliminary findings with a group of private investors

We will have a final validation after the meetings and workshops we are promoting with private and public sectors players.

##### **Key sectors at risk identification:**

We identified key sectors at risk by crossing the high risk areas with investments per sector

#### **Opportunities for private investors**

We identified business opportunities for private investors in the most at risk sectors in each “High Climate Change Risk / High Climate Change Impact” area

We had meetings with themes 2 and 4 and with a group of investors where we debated our preliminary results

Source: Adaptation - An issue brief for business –World Business Council for Sustainable Development

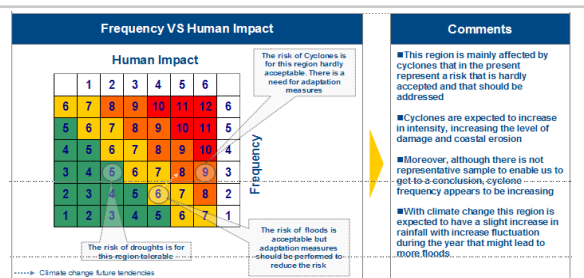


The overlap between climate change and business context analysis inputs allowed the identification of High Climate Change Risk / High Climate Change Impact areas

5

### High Climate Change Risk / High Climate Change Impact areas identification

Climate change analysis



Output: Climate risk map



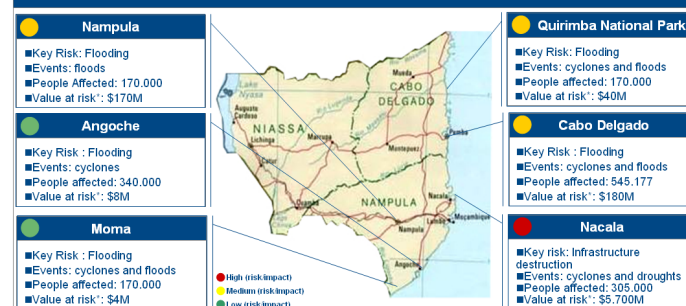
Business context analysis

Region	Province	Sector	Value
North	Niasa	Agriculture, Forestry and Livestock	\$105M
	Niasa	Tourism	\$8M
	Cabo Delgado	Agriculture, Forestry and Livestock	\$110M
	Cabo Delgado	Tourism	\$90M
	Nampula	Mineral resources and Energy	\$5B
	Nampula	Agriculture, Forestry and Livestock	\$2.3B
Center	Nampula	Transport and Communications	\$700M
	Tete	Mineral resources and Energy	\$7.3B
	Tete	Services	\$240M
	Tete	Tourism	\$90M
	Zambeze	Agriculture, Forestry and Livestock	\$2.4B
	Zambeze	Industry	\$25M
	Manica	Agriculture, Forestry and Livestock	\$310M
	Manica	Industry	\$60M
	Sofala	Transport and Communications	\$620M
	Sofala	Agriculture, Forestry and Livestock	\$440M
	Sofala	Tourism	\$120M
	Sofala	Industry	\$90M

Output: Investment map

Overlap between “climate risk map” and “investment map” to find “High Climate Change Risk / High Climate Change Impact” areas

Key “High Risk / High Impact” areas in the North





Source: SEA - Strategic Environmental Assessment – Good Practices Guide, EACC - Economics of Adaptation to Climate Change, OECD – SEA and adaptation to climate change, ECA - Climate Adaptation Working Group

The classification of the High Climate Change Risk / High Climate Change Impact areas was developed considering climate risks and value at risk and was applied regionally

5

### Classification of High Climate Change Risk / High Climate Change Impact areas

- The classification was developed considering climate change risks (exposure and vulnerability) and value at risk (private and public investments).
- The classification is the following:
 

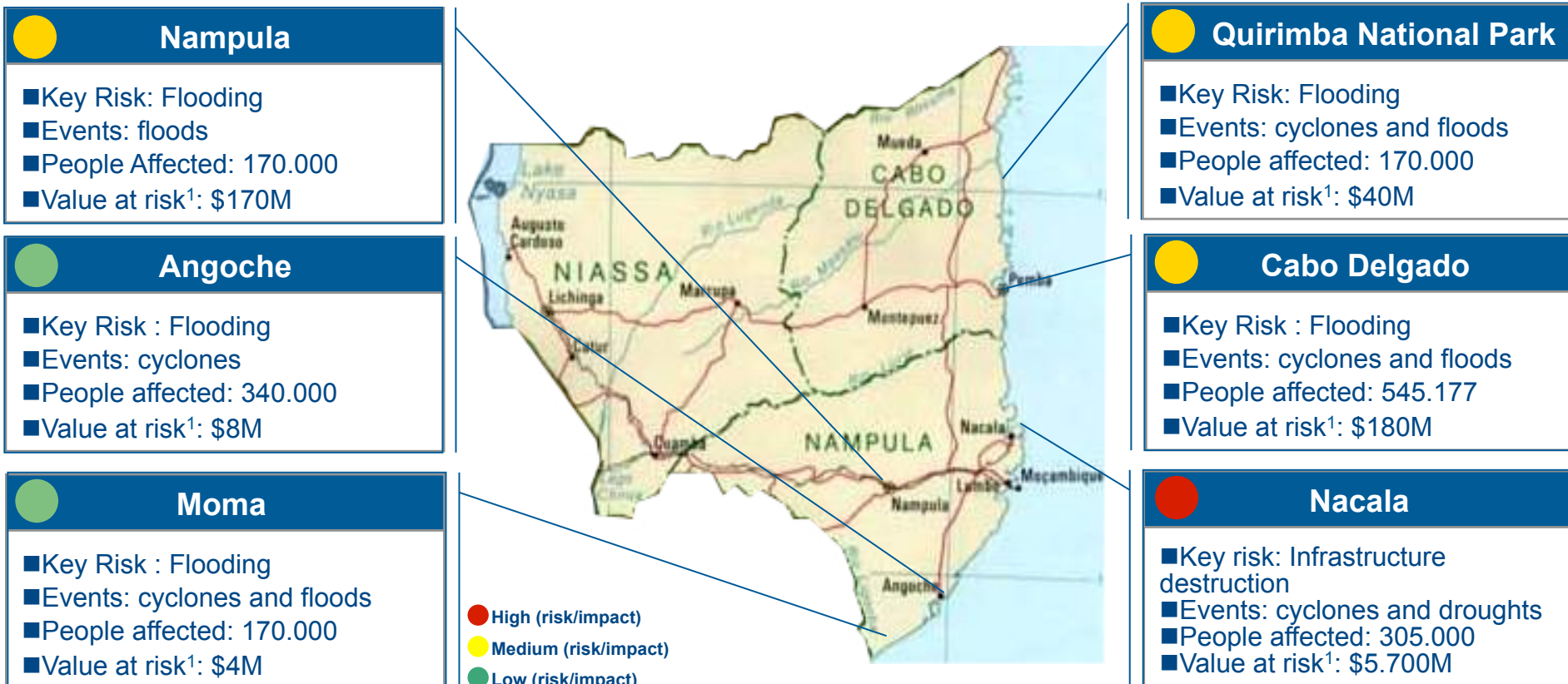
	<b>High risk / impact</b>
	<b>Medium risk / impact</b>
	<b>Low risk / impact</b>

  - Areas that in the climate risk map were considered as the areas most at risk in the region and that have highest strategic and economic value at risk
  - Areas that in the climate risk map were among the areas considered at risk in the region and that have medium strategic and economic value at risk
  - Areas that in the climate risk map were considered as being at risk and had low strategic and economic value at risk
- The classification of the areas at risk was made taking in consideration the importance of each region for the development of the country and the regional climate change scenarios leading to the decision of classifying the risk areas per region
  - The Northern region represents 22% of the country's GDP and is the region less burdened from climate hazards. Moreover, this region is likely to suffer the least from climate change
  - The Central region represents 34% of the country's GDP and is heavily burdened by climate hazards.
  - The South represents 44% of the country's GDP and is heavily burdened by climate hazards.

Nampula is the Northern province most affected by climate events, being Nacala the district with higher Climate Change risk / impact

5

### Key “High Climate Change Risk / High Climate Change Impact” areas in the North





Source: EM-DAT: The OFDA/CRED International Disaster Database; INGC – Study on the Impact of Climate Change on Disaster Risk in Mozambique; Desconsulatar database.

### The most significant business risks for Nacala are failure in distribution channels and production interruption

5

#### Nacala Business Risks

Climate change risks	Cyclones and droughts	
Main climate impacts	Business risks	
<ul style="list-style-type: none"> <li>■ Infrastructure destruction</li> <li>■ Breakdown of equipments</li> <li>■ Communications cuts</li> <li>■ Energy cuts</li> <li>■ Transportation failure</li> </ul>		<ul style="list-style-type: none"> <li>■ Failure in distribution channel</li> </ul>
<ul style="list-style-type: none"> <li>■ Energy cuts</li> <li>■ Damage to properties</li> <li>■ Reduction of working force</li> <li>■ Loss of crops</li> <li>■ Loss of livestock</li> <li>■ Erosion of the soil</li> <li>■ Crops pests</li> </ul>		<ul style="list-style-type: none"> <li>■ Production interruption</li> </ul>

#### Key sectors at risk

Sector	Main companies and projects at risk	Value at risk <sup>1</sup>
Mineral Resources	Ayr Petro-Nacala or other oil company	\$5B
Industry	Sociedade Algodoeira de Nampula Shizan super plast Compagri Bakhresa grain milling Others	\$40M
Agriculture	Aviam Bilacom	\$20M
Transports	Nacala port investment International airport	\$700M

 High

 Moderate

 Low

Source: CPI, approved projects from 2005 till November 2010

Tete and Sofala are the provinces most affected by climate events in the Center being Moatize and Beira the districts with higher Climate Change risk / impact

5

### Key “High Climate Change Risk / High Climate Change Impact” areas in the Center

#### Moatize, Motarara and Changara

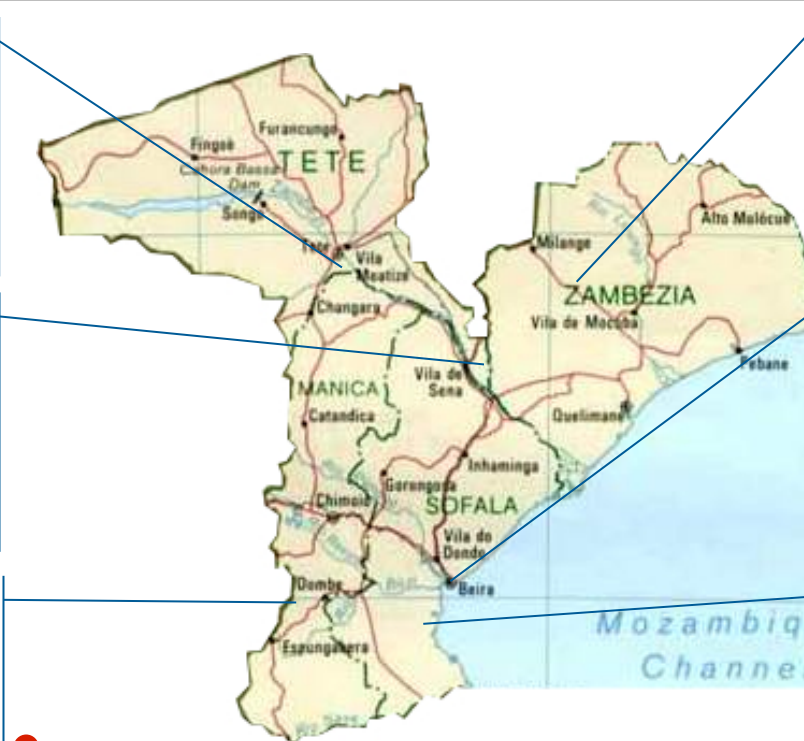
- Key Risk: Water stress
- Events: floods and droughts
- People affected: 950.000
- Value at risk<sup>1</sup>: \$5.400M

#### Chinde, Mopeia and Morrumbala

- Key Risk: Flooding
- Events: floods
- People affected: 843.000
- Value at risk<sup>1</sup>: \$7M

#### Machaze and Chimoio

- Key Risk : Water scarcity
- Events: droughts
- People affected: 170.000
- Value at risk<sup>1</sup>: \$50M



- High (risk/impact)
- Medium (risk/impact)
- Low (risk/impact)

#### Maganja, Namacurra and Nicoadala

- Key Risk: Flooding
- Events: Cyclones, floods and droughts
- People affected: 500.000
- Value at risk<sup>1</sup>: \$22M

#### Beira (Buzi and Dondo)

- Key Risk : Infrastructure destruction
- Events: cyclones, floods and droughts
- People affected: 937.000
- Value at risk<sup>1</sup>: \$1.000M



#### Machanga

- Key Risk : Flooding
- Events: floods
- People affected: 793.000
- Value at risk<sup>1</sup>: \$0M<sup>2</sup>

Source: EM-DAT: The OFDA/CRED International Disaster Database; INGC – Study on the Impact of Climate Change on Disaster Risk in Mozambique; Desconsular database.

**The most significant business risks for Moatize are interruption in production and operations and failure in logistics**

5

Moatize / Changara Business Risks		
Climate change risks	Floods and droughts	
Main climate impacts	Business risks	
<ul style="list-style-type: none"> <li>■ Energy cuts</li> <li>■ Communications cuts</li> <li>■ Damage to properties</li> <li>■ Breakdown of equipments</li> <li>■ Reduction of workforce due to reconstruction efforts</li> </ul>		<ul style="list-style-type: none"> <li>■ <b>Production / Operations interruption</b></li> </ul>
<ul style="list-style-type: none"> <li>■ Blockage of roads</li> <li>■ Damages in railways</li> <li>■ Navigability of the river</li> </ul>		<ul style="list-style-type: none"> <li>■ <b>Failure in logistics</b></li> </ul>

Key sectors at risk		
Sector	Main companies and projects at risk	Value at risk <sup>1</sup>
<b>Mineral resources</b>	Moatize coal Benga Project Zambezi project	\$4,3B
<b>Energy</b>	Thermoelectric power station Hidroeléctrica de Mphanda Nkuwa	\$3B
<b>Industry</b>	CPZ Mozambique Fábrica de Explosivos	\$11M

Source: CPI, approved projects from 2005 till November 2010, government presentations, companies websites  
Key projects in Beira corridor

 High

 Moderate



 Low



### The most significant business risks for Beira are failure in logistics and raw material defectiveness

5

#### Beira Business Risks

Climate change risks	Cyclones Floods and droughts	
Main climate impacts	Business risks	
<ul style="list-style-type: none"> <li>■ Infrastructure destruction</li> <li>■ Blockage of roads</li> <li>■ Damages in railway</li> <li>■ Breakdown of equipments</li> <li>■ Closure of the port</li> <li>■ Transportation failure</li> <li>■ Reduction of working force due to reconstruction efforts</li> </ul>		<ul style="list-style-type: none"> <li>■ Failure in Logistics</li> </ul>
<ul style="list-style-type: none"> <li>■ Loss of crops</li> <li>■ Loss of livestock</li> <li>■ Erosion of the soil</li> <li>■ Salinization of the soil</li> <li>■ Crops pests</li> <li>■ Contamination of water supplies</li> </ul>		<ul style="list-style-type: none"> <li>■ Raw material defectiveness</li> </ul>

#### Key sectors at risk

Sector	Main companies and projects at risk	Value at risk <sup>1</sup>
Agriculture	Mozambique Principle Energy Priu Agricultura Buzi Marnorte- Empresa Agrícola de Moçambique Companhia do Buzi Lamego Others	\$420M
Mineral Resources	Petrobeira	\$38M
Tourism	Maria Lagoon Resort Others	\$120M
Transports	Beira Port Investment Beira Grain Terminal Others	\$620M

 High
  Moderate
  Low

Source: CPI, approved projects from 2005 till November 2010

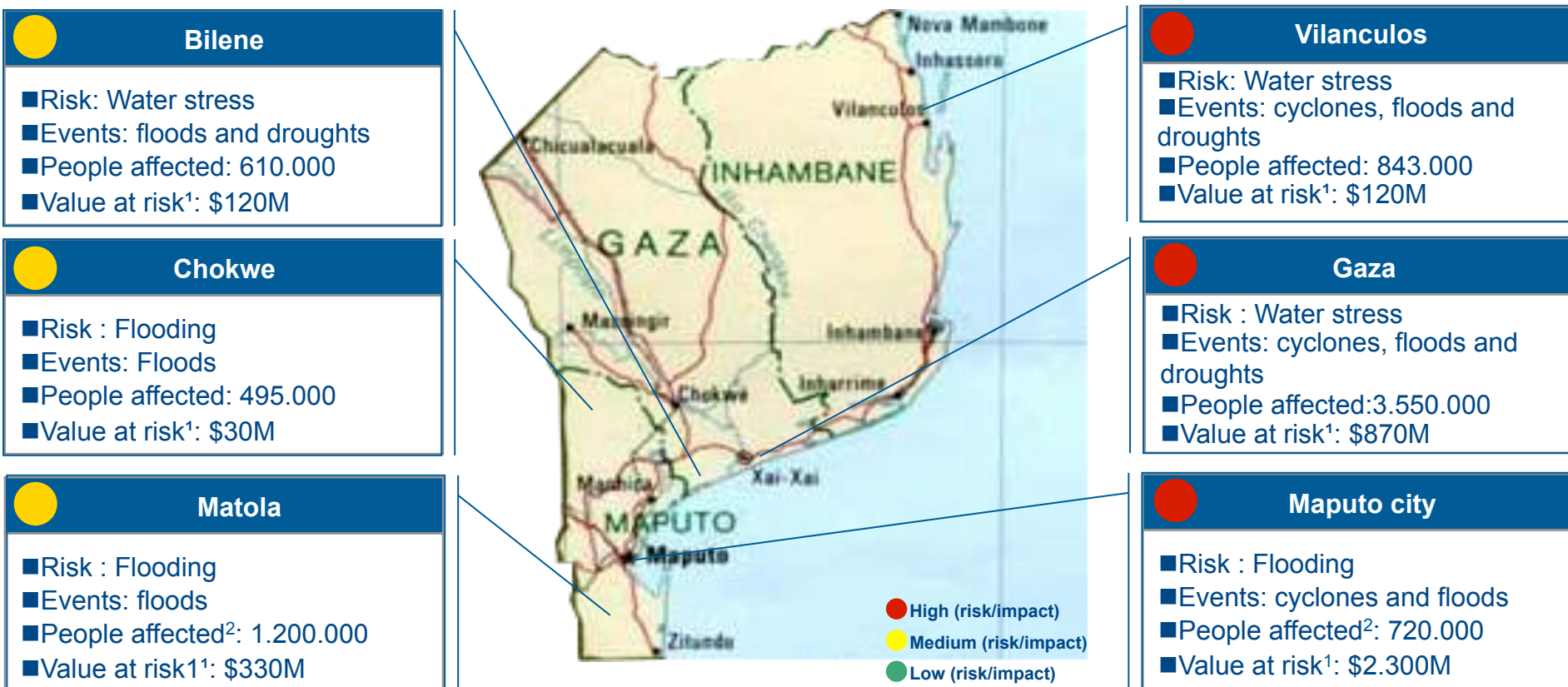
Key projects in Beira corridor


<sup>1</sup> The value at risk is a rough estimation based on the revenues of an established company or the investment predicted in a project

In the South, the coastal areas are the most impacted by climate events mainly caused by cyclones and floods

5

### Key “High Climate Change Risk / High Climate Change Impact” areas in the South



Source: EM-DAT: The OFDA/CRED International Disaster Database; INGC – Study on the Impact of Climate Change on Disaster Risk in Mozambique; Desconsultar database.



<sup>1</sup> Value at risk – this value is not considering the multiplier effect.

<sup>2</sup> The information regarding People affected in Maputo and Matola considered only one event. We used a proxy to all the events



The most significant business risks for Vilanculos are quality decrease in products and services and workforce absenteeism

5

Vilanculos Business Risks		
Climate change risks	Cyclones and droughts	
Main climate impacts	Business risks	
<ul style="list-style-type: none"> <li>■ Damage to properties</li> <li>■ Breakdown of equipments</li> <li>■ Coastal erosion</li> <li>■ Loss of biomass</li> <li>■ Energy cuts</li> <li>■ Communications cuts</li> <li>■ Difficulty in the access to quality intermediary products</li> <li>■ Reduction of working force</li> </ul>		<ul style="list-style-type: none"> <li>■ <b>Quality decrease in products and services</b></li> </ul>
<ul style="list-style-type: none"> <li>■ Development of water born diseases</li> <li>■ Reduction of working force due to reconstruction efforts</li> </ul>		<ul style="list-style-type: none"> <li>■ <b>Workforce absenteeism</b></li> </ul>

Key sectors at risk		
Sector	Main companies and projects at risk	Value at risk <sup>1</sup>
Tourism	Complexo Turístico Praia do Paraíso	\$110M
	Comune Golf Estate	
	Dona Ana Development VilanKulo	
	Bazaruto Village	
	Benguerra Villas	
	Blue Paradise Mozambique	

 High

 Moderate



 Low

Source: CPI, approved projects from 2005 till November 2010

The most significant business risks for Gaza are raw material defectiveness and quality decrease in products and services

5

### Gaza Business Risks

Climate change risks	Cyclones, floods and droughts	
Main climate impacts	Business risks	
<ul style="list-style-type: none"> <li>Loss of crops</li> <li>Loss of livestock</li> <li>Erosion of the soil</li> <li>Salinization of the soil</li> <li>Crops pests</li> <li>Contamination of water supplies</li> </ul>		<ul style="list-style-type: none"> <li><b>Raw material defectiveness</b></li> </ul>
<ul style="list-style-type: none"> <li>Damage to properties</li> <li>Breakdown of equipments</li> <li>Coastal erosion</li> <li>Loss of biomass</li> <li>Energy cuts</li> <li>Communications cuts</li> <li>Difficulty in the access to quality intermediary products</li> <li>Reduction of working force</li> </ul>		<ul style="list-style-type: none"> <li><b>Quality decrease in products and services</b></li> </ul>

### Key sectors at risk

Sector	Main companies and projects at risk	Value at risk <sup>1</sup>
<b>Agriculture</b>	Procana CAM- Companhia agro-empresarial de Moçambique Arromoz Chicualala Agri Farm Companhia Agro-social Igo Sammartini Hubei Liafeng Mozambique Others	\$630M
<b>Tourism</b>	São Martinho Beach Club Chongoene Resorts Dunas de Bilene Coco beach resort Monte Belo Village Complexo Turístico Vista da Lagoa Others	\$230M

 High

 Moderate



 Low

Source: CPI, approved projects from 2005 till November 2010

### The most significant business risks for Maputo are failure in logistics and workforce absenteeism

5

#### Maputo Business Risks

Climate change risks	Cyclones and floods	
Main climate impacts	Business risks	
<ul style="list-style-type: none"> <li>■ Infrastructure destruction</li> <li>■ Blockage of roads</li> <li>■ Damages in railway</li> <li>■ Breakdown of equipments</li> <li>■ Closure of the port</li> <li>■ Transportation failure</li> <li>■ Reduction of working force due to reconstruction efforts</li> </ul>		<ul style="list-style-type: none"> <li>■ Failure in Logistics</li> </ul>
<ul style="list-style-type: none"> <li>■ Development of water born diseases</li> <li>■ Reduction of working force due to reconstruction efforts</li> </ul>		<ul style="list-style-type: none"> <li>■ Workforce absenteeism</li> </ul>

#### Key sectors at risk

Sector	Main companies and projects at risk	Value at risk <sup>1</sup>
Tourism	Ilha de Xefina The Horizon Hotel Karibo Others	\$460M
Services	Semlex – Biometric system EDPM – dragagem do porto de Maputo MCNET Mozambique community network	\$140M
Industry	Pembe Mozambique Fasorel-fase I Hipermáquinas Moçambique Others	\$100M
Banking	Banco único Moza Banco Banco Terra Others	\$115M
Transports and communications	Maputo Port Mcel Mintiro International	\$1,1B

 High

 Moderate

 Low

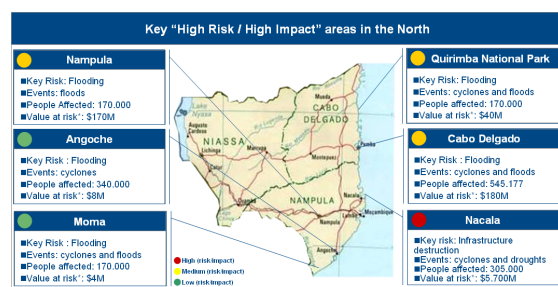
Source: CPI, approved projects from 2005 till November 2010

The overlap between the locals at risk and investments per sector inputs allowed the identification of key sectors at risk

5

### Key sectors at risk identification method

High risk  
high impact  
areas



Output: High climate change risk  
high climate change impact areas

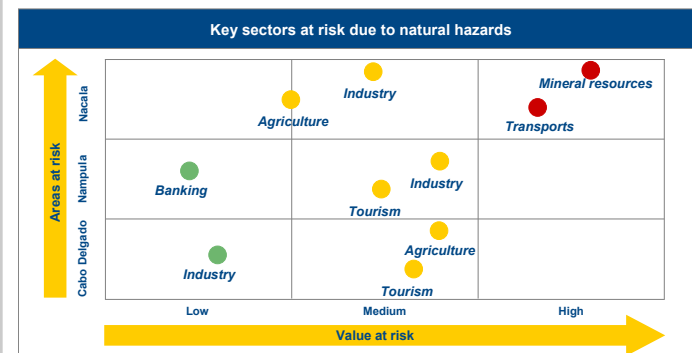


Value at risk

Region	Province	Sector	Value
North	Nampula	Agriculture, Forestry and Livestock	\$185M
	Nampula	Tourism	\$8M
	Cabo Delgado	Agriculture, Forestry and Livestock	\$110M
	Cabo Delgado	Tourism	\$60M
	Nampula	Mineral resources and Energy	\$5B
	Nampula	Agriculture, Forestry and Livestock	\$2.3B
Center	Nampula	Transport and Communications	\$700M
	Tete	Mineral resources and Energy	\$7.3B
	Tete	Services	\$240M
	Tete	Tourism	\$90M
	Zambeze	Agriculture, Forestry and Livestock	\$2.4B
	Zambeze	Industry	\$25M
	Manica	Agriculture, Forestry and Livestock	\$310M
	Manica	Industry	\$60M
	Sofala	Transport and Communications	\$620M
	Sofala	Agriculture, Forestry and Livestock	\$440M
	Sofala	Tourism	\$120M
	Sofala	Industry	\$90M

Output: Investment map

Overlap between "high climate change risk  
high climate change impact areas" and  
"value at risk map" to find "the key sectors  
at risk"



Source: Adaptation - An issue brief for business –World Business Council for Sustainable Development, SEA - Strategic Environmental Assessment – Good Practices Guide, EACC - Economics of Adaptation to Climate Change, OECD – SEA and adaptation to climate change, ECA – Shaping climate-resilient development: a report of the economics of climate adaptation group

**The classification of the high risk sectors was developed considering the value at risk per sector and the High Climate Change Risk / High Climate Change Impact areas**

5

### Classification of High Climate Change Risk / High Climate Change Impact areas

- The classification was developed considering the climate change risks in each high risk area and the value at risk of the projects in that area
- The classification is the following:

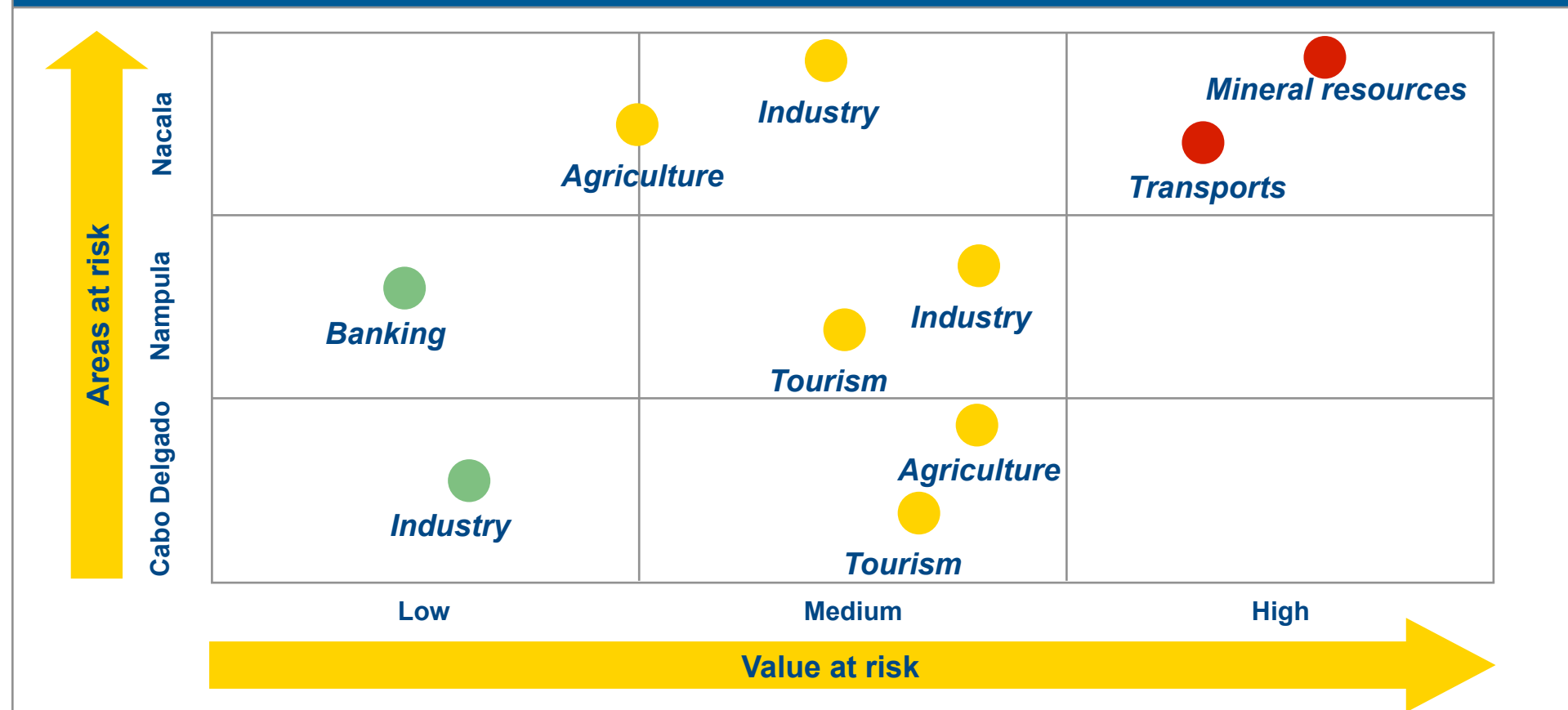
	<b>High risk sector</b>	○ Sectors with high value at risk in high risk areas
	<b>Medium risk sector</b>	○ Sectors with medium to high value at risk in medium risk/ impact areas
	<b>Low risk sector</b>	○ Sectors with low value at risk in medium risk/ impact areas
- The classification of the sectors at risk was made taking in consideration the value of the investment projects in each sector of each area at risk.
  - Low risk – The value of the investments in the sector is below \$20M
  - Medium risk – The value of the investments in the sector is below \$200M
  - High risk – The value of the investments in the sector is higher than \$200M

Source: Adaptation - An issue brief for business –World Business Council for Sustainable Development

In the North the sectors most at risk are Mineral resources and Transportation followed by Industry, Agriculture and Tourism

5

### Key sectors at risk due to natural hazards in the North region

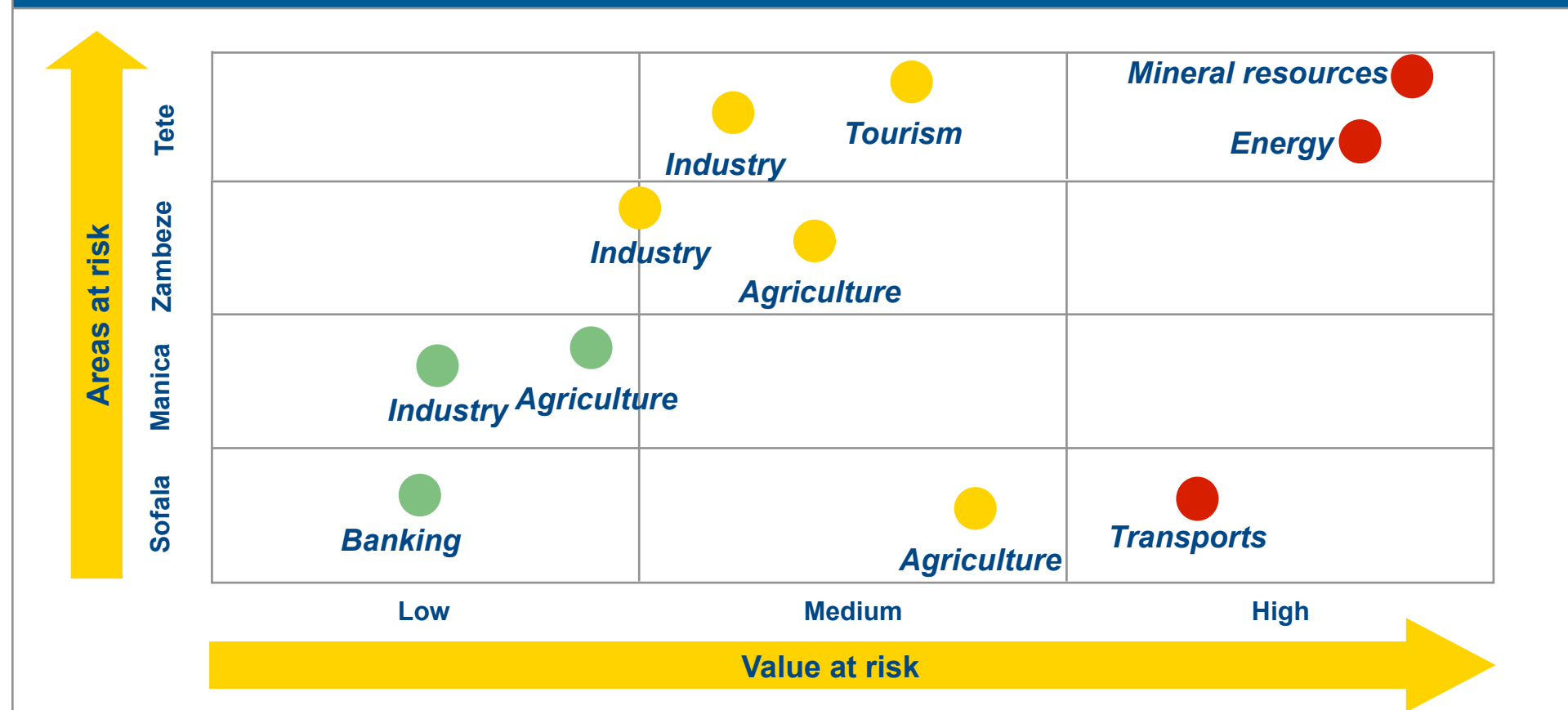


Source: ADL analysis, Adaptation - An issue brief for business –World Business Council for Sustainable Development

For the Centre, the sectors more at risk are Mineral Resources, Energy and Transportation followed by Tourism, Agriculture and Industry

5

### Key sectors at risk due to natural hazards in the Central region

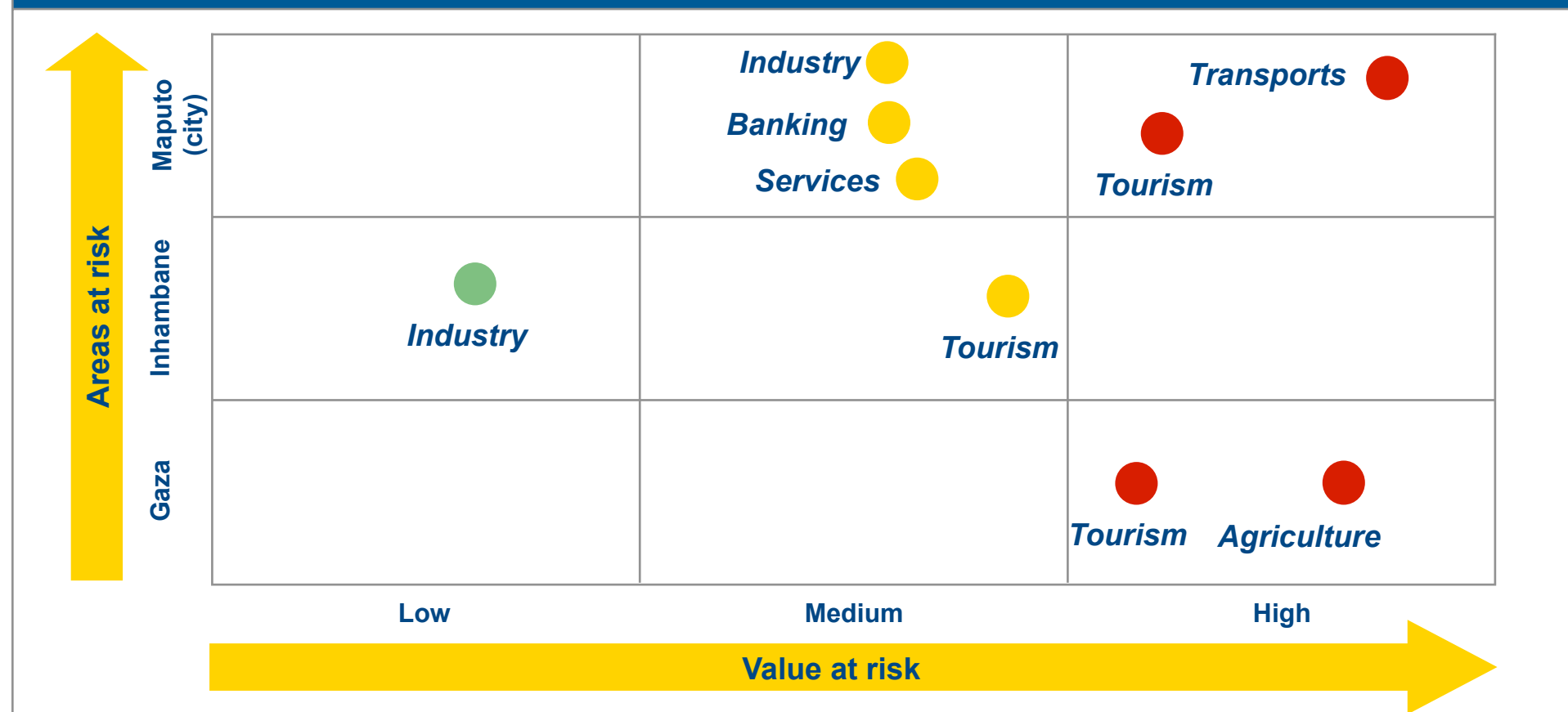


Source: ADL analysis, Adaptation - An issue brief for business –World Business Council for Sustainable Development

For the South, the sectors more at risk are Transports and Communications, Agriculture and Tourism

5

### Key sectors at risk due to natural hazards in the South region



Source: ADL analysis, Adaptation - An issue brief for business –World Business Council for Sustainable Development





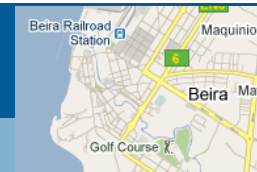
**In Nacala, the most at risk industries are Mineral Resources and Transports with production / operation interruption and workforce absenteeism being the main business risks**

5

### Nacala

	Business Risks	Business Opportunities
Mineral Resources	<ul style="list-style-type: none"> <li>■ Production interruption – impacts on physical assets and breakdown of equipments due to floods and cyclones</li> <li>■ Workforce absenteeism – unhealthy workforce due to flood related diseases</li> <li>■ Failure in distribution channels – inaccessibility of roads and ports due to floods, heavy rains and cyclones</li> </ul>	<ul style="list-style-type: none"> <li>■ Coastal protection (e.g. construction of revetments or seawalls)</li> <li>■ Improve healthcare conditions of the employees</li> <li>■ Creation of new shipping routes</li> </ul>
Transport	<ul style="list-style-type: none"> <li>■ Operations interruption – impacts on physical assets such as ports infrastructure mainly due to cyclones</li> <li>■ Workforce absenteeism – unhealthy workforce due to flood related diseases</li> <li>■ Quality decrease in services – a consequence of the breakdown of equipments and productivity reduction due to the increase in diseases incidence</li> </ul>	<ul style="list-style-type: none"> <li>■ Coastal protection (e.g. construction of revetments or seawalls)</li> <li>■ Development of anti-flood plans</li> </ul>

Source: ADL analysis, World Business Council for Sustainable Development – Business risks and opportunities resulting from climate change impacts



**In Beira, the most at risk industries are Transport and Agriculture with quality of products and services decrease and workforce absenteeism being the main business risks**

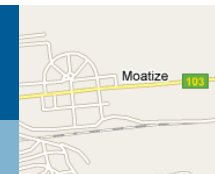
5

### Beira

	Business Risks	Business Opportunities
Transport	<ul style="list-style-type: none"> <li>■ Operations interruption – impacts on physical assets such as ports infrastructure mainly due to cyclones</li> <li>■ Workforce absenteeism – unhealthy workforce due to flood related diseases</li> <li>■ Quality decrease in services – a consequence of the breakdown of equipment's and productivity reduction due to the increase in diseases incidence</li> </ul>	<ul style="list-style-type: none"> <li>■ Coastal protection (e.g. construction of revetments or seawalls)</li> <li>■ Development of near shore breakwaters</li> <li>■ Development of a sustainable urban drainage system</li> <li>■ Development of anti-flood plans</li> </ul>
Agriculture	<ul style="list-style-type: none"> <li>■ Raw material defectiveness – failure of crops due to droughts and floods</li> <li>■ Quality decrease in products – decrease in crops quality</li> <li>■ Workforce absenteeism – unhealthy workforce due to flood related diseases</li> </ul>	<ul style="list-style-type: none"> <li>■ Diversifying crop types and varieties and produce high-resistance crops (e.g. salinity tolerant seeds)</li> <li>■ Increasing yields through optimal management of crop calendars</li> <li>■ Construction of mini dams to control floods</li> </ul>

**Although Transport and Agriculture seem to be the main sectors at risk, the economic value of Tourism and Mineral Resources indicates that they are also important sectors to take into consideration**

Source: ADL analysis, World Business Council for Sustainable Development – Business risks and opportunities resulting from climate change impacts



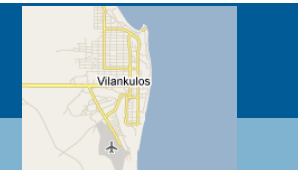
In Moatize, the most at risk industries are Mineral Resources and Energy with production interruption and failure in distribution channels being the main business risks

5

### Moatize

	Business Risks	Business Opportunities
Mineral Resources	<ul style="list-style-type: none"> <li>■ Production interruption – impacts on physical assets and breakdown of equipments due to floods</li> <li>■ Workforce absenteeism – unhealthy workforce due to flood related diseases</li> <li>■ Failure in distribution channels – inaccessibility of roads and ports due to floods and heavy rains</li> </ul>	<ul style="list-style-type: none"> <li>■ Improve healthcare conditions of the employees</li> <li>■ Construction of floodgates and mini dams to improve water management</li> <li>■ Support community plans to improve food security</li> <li>■ Creation of new shipping routes</li> </ul>
Energy	<ul style="list-style-type: none"> <li>■ Production interruption</li> <li>■ Failure in distribution channels</li> <li>■ Raw material defectiveness – lack of water may affect the production of energy production</li> </ul>	<ul style="list-style-type: none"> <li>■ Increase demand for other types of energy sources (e.g. “green” energy)</li> <li>■ Increase revenues associated with the increase demand for energy</li> </ul>

Source: ADL analysis, World Business Council for Sustainable Development – Business risks and opportunities resulting from climate change impacts



## 1.6 Risks and opportunities for private investors – SWOT for Vilanculos

In Vilanculos, the most at risk industries are Tourism and Agriculture with quality decrease in products and services being the main business risk

5

### Vilanculos

	Business Risks	Business Opportunities
<b>Tourism</b>	<ul style="list-style-type: none"> <li>■ Quality decrease in services – supply chain interruptions due to inaccessibility of transports and degradation of areas of interest to tourists</li> <li>■ Failures in logistics – water and food scarcity due to supply chain interruptions</li> <li>■ Operations interruption – Damage to tourism infrastructure due to cyclones</li> </ul>	<ul style="list-style-type: none"> <li>■ Development of sustainable resorts</li> <li>■ Coastal protection (e.g. construction of revetments or seawalls)</li> <li>■ Support of the development of the local markets for food (e.g. support local agriculture to improve access to food in extreme weather events)</li> </ul>
<b>Agriculture</b>	<ul style="list-style-type: none"> <li>■ Raw material defectiveness – failure of crops due to droughts and floods</li> <li>■ Quality decrease in products – decrease in crops quality</li> <li>■ Workforce absenteeism – unhealthy workforce due to flood related diseases</li> </ul>	<ul style="list-style-type: none"> <li>■ Diversifying crop types and varieties and produce high-resistance crops (e.g. salinity tolerant seeds)</li> <li>■ Increasing yields through optimal management of crop calendars</li> <li>■ Construction of mini dams to control floods</li> </ul>

Source: ADL analysis, World Business Council for Sustainable Development – Business risks and opportunities resulting from climate change impacts



**In Gaza, the most at risk industries are Agriculture and Tourism with quality decrease in products / services being the main business risk**

5

### Gaza

	Business Risks	Business Opportunities
<b>Agriculture</b>	<ul style="list-style-type: none"> <li>■ Raw material defectiveness – failure of crops due to droughts and floods</li> <li>■ Quality decrease in products – decrease in crops quality</li> <li>■ Workforce absenteeism – unhealthy workforce due to flood related diseases</li> </ul>	<ul style="list-style-type: none"> <li>■ Diversifying crop types and varieties and produce high-resistance crops (e.g. salinity tolerant seeds)</li> <li>■ Introduction of water filters to address water salinization issues</li> <li>■ Construction of mini dams to control floods</li> </ul>
<b>Tourism</b>	<ul style="list-style-type: none"> <li>■ Quality decrease in services – supply chain interruptions due to inaccessibility of transports and degradation of areas of interest to tourists</li> <li>■ Failures in logistics – water and food scarcity due to supply chain interruptions</li> <li>■ Operations interruption – Damage to tourism infrastructure due to cyclones</li> </ul>	<ul style="list-style-type: none"> <li>■ Development of sustainable resorts</li> <li>■ Coastal protection (e.g. construction of revetments or seawalls)</li> <li>■ Support of the development of the local markets for food (e.g. support local agriculture to improve access to food in extreme weather events)</li> </ul>

Source: ADL analysis, World Business Council for Sustainable Development – Business risks and opportunities resulting from climate change impacts



## 1.6 Risks and opportunities for private investors – SWOT for Maputo city

In Maputo, the most at risk industries are Transport and Tourism with quality decrease in services and operations interruption being the main business risks

5

### Maputo city

	Business Risks	Business Opportunities
Transport	<ul style="list-style-type: none"> <li>■ Operations interruption – impacts on physical assets such as ports infrastructure mainly due to cyclones</li> <li>■ Workforce absenteeism – unhealthy workforce due to flood related diseases</li> <li>■ Quality decrease in services – a consequence of the breakdown of equipments and productivity reduction due to the increase in diseases incidence</li> </ul>	<ul style="list-style-type: none"> <li>■ Coastal protection (e.g. construction of revetments or seawalls)</li> <li>■ Development of near shore breakwaters</li> <li>■ Development of a sustainable urban drainage system</li> <li>■ Development of anti-flood plans</li> </ul>
Tourism	<ul style="list-style-type: none"> <li>■ Quality decrease in services – supply chain interruptions due to inaccessibility of transports and degradation of areas of interest to tourists</li> <li>■ Failures in logistics – water and food scarcity due to supply chain interruptions</li> <li>■ Operations interruption – Damage to tourism infrastructure due to cyclones</li> </ul>	<ul style="list-style-type: none"> <li>■ Development of sustainable resorts</li> <li>■ Coastal protection (e.g. construction of revetments or seawalls)</li> </ul>

Although Transport and Tourism seem to be the main sectors at risk, the economic value of Banking, Services and Industry indicates that they are also important sectors to take into consideration

Source: ADL analysis, World Business Council for Sustainable Development – Business risks and opportunities resulting from climate change impacts

## Index

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**1 Phase 1**

**1.1 Executive Summary**

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1.4 Strategic assessment

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1.6 Risks and opportunities for private investors

**1.7 Potential adaptation options**

1.8 Annexes

2 Phase 2

3 Phase 3

### Introduction to “Potential adaptation options”

6

In this phase, we identified potential adaptation options. To support the process of identifying a long-list of potential adaptation measures we based our methodology on two main sources: «Economics of Adaptation to Climate Change» and «SEA and adaptation to climate change»

- First, we focused on relevant information we identified in the benchmarking phase
- Secondly, we had meetings with theme 2 – “Coastal Protection”, theme 4 – Ecoenergia – “Building Resilience in Partnership with the Private Sector and theme 6 – “Food – Meeting Demands” in order to obtain their inputs on adaptation measures and incorporate them in our analysis and document
- Thirdly, we crossed-checked the information gathered in the two steps above with our analysis of “High Climate Change Risk / High Climate Change Impact” areas in order to define the long-list of adaptation measures
- Finally, we have discussed our preliminary adaptation measures with three potential private investors who have investments/are interested to invest in Mozambique to validate our hypothesis and incorporate their ideas and potential prospects



## 1.7 Potential adaptation options – Long-list of adaptation measures identification process

By combining the benchmarking with other themes input and with the “High Climate Change Risk / High Climate Change Impact” areas, we identified a long-list of adaptation measures

6

Non exhaustive

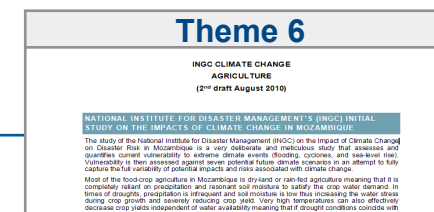
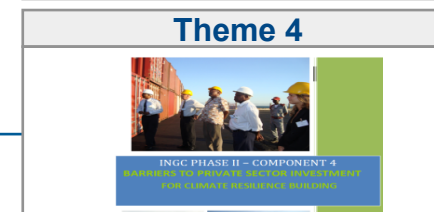
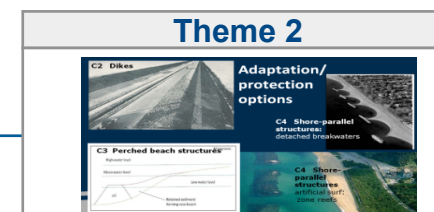
## Long-list of adaptation measures identification process

Long list of adaptation measures					
Adaptation measure (what)	Target region (where)	Adaptation to the following climate impacts (why)	Examples of interest Parties (possible funding mechanism)	Comments (how)	Illustrative Picture
Introduction of a different variety of crops to the production of bio fuel	Onza (Cabo Delgado)	<ul style="list-style-type: none"> <li>Loss of crops</li> <li>Loss of livelihood</li> <li>Energy cuts</li> </ul>	Bioenergy	<ul style="list-style-type: none"> <li>High rice/wheat crops will be available for processing of being seasonal and substitute agriculture</li> <li>The production of bio fuel will contribute to the diversification of energy resources and subsequently reducing the need for oil</li> <li>In addition, the investors will be working in agro and agro-industrial sector.</li> </ul>	
Construction of Blue House	Ribaca (Pangulua)	<ul style="list-style-type: none"> <li>Damage to properties</li> <li>Breakdown of infrastructure</li> <li>Energy cuts</li> <li>Communication cuts</li> <li>Loss of crops</li> </ul>	Green Resources	<ul style="list-style-type: none"> <li>Intelligence water management conditions and energy independence for the investor</li> <li>This investment will contribute to boost the economy of the village nearby</li> </ul>	
Develop eco-tourism resort	Quemba National Park (Cabo Delgado)	<ul style="list-style-type: none"> <li>Damage to properties</li> <li>Breakdown of infrastructure</li> <li>Energy cuts</li> <li>Loss of livelihood</li> <li>Loss of crops</li> </ul>	Inter-Continental Hotels, Pwani, CIP Hotels, BCU Hotels & Resorts	<ul style="list-style-type: none"> <li>With Resort (not water-based) seen as eco-tourism, the resort will be better prepared to react to cyclones, and to protect biodiversity and boost economy of the village nearby</li> </ul>	

“High CC Risk / High CC Impact” areas		
Climate Change risks	Cyclones and Floods	Business risks
<ul style="list-style-type: none"> <li>Failure in Logistics</li> <li>Workforce absenteeism</li> </ul>	<ul style="list-style-type: none"> <li>Failure in Logistics</li> <li>Workforce absenteeism</li> </ul>	<ul style="list-style-type: none"> <li>Failure in Logistics</li> <li>Workforce absenteeism</li> </ul>

Input from other themes		
Meetings	Key learning	Potential future cooperation
Theme 1	Knowledge regarding the interconnections between the different teams	Access to detailed Mozambique maps
Theme 2	Documentation supporting coastal possible adaptation concepts and measures, such as shoreline and beach nourishment, beachfronts, reclamation or wave fences	Complete adaptation measures and cost-benefit analysis
Theme 4	Ideas and general thoughts on possible adaptation measures in Cabo Delgado	List of adaptation measures
Theme 6	Overview of the previous phase of the project and inputs related to possible adaptation measures	Funding mechanisms for the most appropriate adaptation measures
Theme 9	Overall alignment of the scope of the project	Funding mechanisms for the most appropriate adaptation measures
Other themes	Unfortunately we didn't have the opportunity to meet yet	Incorporation of other themes adaptation measures

Input from benchmarking		
Country	Adaptation measure	Goals
Australia	Stormwater harvesting for management of recreational facilities	Water scarcity
Australia	Stormwater Recycling Through Wetlands	Water stress
Bangladesh	Not tolerant crops in Bangladesh	Loss of crops
Bangladesh	Flood-resistant aquaculture in Faridpur, Bangladesh	Low productivity of fisheries
Bangladesh	Flood-resistant housing in Faridpur, Bangladesh	Damage to human settlements
Bangladesh	Flood-resistant housing through micro-loans in Bangladesh	Damage to human settlements
Botswana	Domesticating wild fruit trees in Botswana	Loss of crops
Brazil	Preventing soil erosion and landslides by reforestation in Rio de Janeiro, Brazil	Soil erosion
Burkina Faso	Afforestation through vegetative propagation in Burkina Faso	Land degradation



Main sources: Meetings with private investors, other themes' input, ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

**We identified a long-list of potential adaptation measures for the “High Climate Change Risk / High Climate Change Impact” areas**

6

### Potential adaptation measures – long list

Non-exhaustive

North	Center	South
<ul style="list-style-type: none"> <li>■ Introduction of rainwater harvesting techniques in Nacala</li> <li>■ Construction of seawall or revetments (e.g.: Rock Revetments) in Nacala</li> <li>■ Introduce emergency phones along the railway in Nacala</li> <li>■ Build roads from Pemba to Nacala</li> <li>■ Introduction of different crops for the production of Biofuel in Nacala</li> <li>■ Improvement of climate forecast infrastructure in Nacala<sup>1</sup></li> <li>■ Develop ecotourism resort with energy and communications independence in Nacala</li> </ul>	<ul style="list-style-type: none"> <li>■ Increase crops yield in Beira</li> <li>■ Develop storage facilities in Beira port</li> <li>■ Produce solar energy at tourist facilities to decrease energy dependence in Beira</li> <li>■ Construction of floodgate / river breakwater wall (Buzi and Dondo)</li> <li>■ Introduce water filters techniques in</li> <li>■ Upgrade main routes ahead of predicted occurrences of floods in Buzi</li> <li>■ Reforestation with product diversity in Buzi</li> <li>■ Construction of mini dam in Moatize and Buzi</li> <li>■ Construction of floodgate / river breakwater wall in Moatize</li> <li>■ Increase crops yield in Moatize</li> <li>■ Introduce redundancy and business continuity in railways in Moatize</li> <li>■ Introduce emergency phones along the railway in Moatize</li> </ul>	<ul style="list-style-type: none"> <li>■ Introduction of water filters techniques in Gaza (Xai-Xai)</li> <li>■ Introduction of Drainage Systems in Gaza</li> <li>■ Construction of a pharmaceutical factory / supply channels in Gaza</li> <li>■ Develop dams and upgrade roads in Gaza</li> <li>■ Diversifying crop types and varieties and produce high-resistance crops in Vilanculos</li> <li>■ Conversion of arable farmland into salt marsh and grassland to provide sustainable defences in Vilanculos</li> <li>■ Conversion of arable farmland into aquaculture areas</li> <li>■ Reforestation of mangroves in Vilanculos</li> <li>■ Develop ecotourism resort with energy and communications independence in Vilanculos</li> <li>■ Construction of sustainable urban drainage systems in Maputo</li> <li>■ Construction of near shore breakwaters in Maputo</li> <li>■ Development of a fast reestablishment plan for financial transactions in Maputo</li> <li>■ Produce solar energy at tourist facilities to decrease energy dependence in Maputo</li> <li>■ Increase of storage facilities in Maputo port</li> <li>■ Strengthening of pharmaceutical supply channels in Maputo</li> <li>■ Introduce redundancy and business continuity in key buildings, roads and railways in Maputo</li> </ul>





Main sources: Meetings with private investors, other themes' input, ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

<sup>1</sup> Pilot Project to be expanded for other areas



### We identified a long-list of potential adaptation measures for the most at risk areas in the North

6

#### Long-list of adaptation measures in the North

 <p>Nacala</p>	<ul style="list-style-type: none"> <li>■ Introduction of rainwater harvesting techniques</li> <li>■ Construction of seawall or revetments (e.g.: rock revetments)</li> <li>■ Introduce emergency phones along the railway</li> <li>■ Build roads from Pemba to Nacala</li> <li>■ Introduction of different crops for the production of Biofuel</li> <li>■ Improvement of climate forecast infrastructure</li> <li>■ Develop ecotourism resort with energy and communications independence in Nacala</li> </ul>
 <p>Quirimba National Park</p>	<ul style="list-style-type: none"> <li>■ Develop ecotourism resort</li> <li>■ Production of solar energy</li> <li>■ Production of Energy based on Biomass</li> </ul>
 <p>Cabo Delgado</p>	<ul style="list-style-type: none"> <li>■ Introduction of a different variety of crops in the production of bio fuel</li> <li>■ Construction of Mini Dams</li> <li>■ Develop storage facilities in Pemba port</li> <li>■ Produce solar energy at tourist facilities to decrease energy dependence</li> <li>■ Development of agro forestry</li> </ul>
 <p>Nampula</p>	<ul style="list-style-type: none"> <li>■ Construction of Mini Dams</li> <li>■ Increase crops yield through the reduction of ground-level ozone</li> <li>■ Construction of a pharmaceutical factory / supply channels</li> </ul>



Main sources: Meetings with private investors, other themes' input, ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

 High (risk / impact)  
 Medium (risk / impact)

## 1.7 Potential adaptation options – Long-list of adaptation measures in the North

### Rainwater harvesting techniques can be introduced by agricultural companies improving water management in a region affected by floods and droughts

6





Adaptation measure (What)	Target region (Where)	Adaptation to the following climate impacts (why)	Examples of Interest Parties (possible funding mechanisms)	Comments (why)	Illustrative Picture
<b>Rainwater harvesting</b>	Nacala (Nampula)	<ul style="list-style-type: none"> <li>▪ loss of crops</li> <li>▪ loss of livestock</li> </ul>	Matanuska Moçambique, Afoils corporation, Aviam	<ul style="list-style-type: none"> <li>▪ Will improve water management conditions for the Nacala Industry</li> <li>▪ Will contribute for the improvement of subsistence agriculture (there is a significant number of droughts reported in this area)</li> </ul>	
<b>Revetments (e.g.: Rock Revetments) or Seawall</b>	Nacala (Nampula)	<ul style="list-style-type: none"> <li>▪ Damage to properties</li> <li>▪ Breakdown of equipments</li> <li>▪ Energy cuts</li> </ul>	Ayr PetroNacala, other petro companies	<ul style="list-style-type: none"> <li>▪ Revetments will contribute to decrease the probability of a calamity in the Nacala oil refinery</li> </ul>	

Main sources: Meetings with private investors, other themes' input, ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

## 1.7 Potential adaptation options – Long-list of adaptation measures in the North

### Introduction of different variety of crops and development of ecotourism resorts in Cabo Delgado could be attractive adaptation measures for private investors

6




Adaptation measure (What)	Target region (Where)	Adaptation to the following climate impacts (why)	Examples of Interest Parties (possible funding mechanisms)	Comments (why)	Illustrative Picture
<b>Introduction of a different variety of crops in the production of bio fuel</b>	Ocuca (Cabo Delgado)	<ul style="list-style-type: none"> <li>▪ Loss of crops</li> <li>▪ Loss of livestock</li> <li>▪ Energy cuts</li> </ul>	Ecoenergia	<ul style="list-style-type: none"> <li>▪ High resistance crops will decrease the probability of losing industrial and subsistence agriculture</li> <li>▪ The production of bio fuel will contribute to the diversification of energy sources and subsequently reducing the need for oil</li> <li>▪ In addition, the investors will be investing in dams and co-generate energy</li> </ul>	 
<b>Construction of Mini Dams</b>	Ribaue (Nampula)	<ul style="list-style-type: none"> <li>▪ Damage to properties</li> <li>▪ Breakdown of equipments</li> <li>▪ Energy cuts</li> <li>▪ Communication cuts</li> <li>▪ Loss of crops</li> </ul>	Green Resources	<ul style="list-style-type: none"> <li>▪ Will improve water management conditions and Energy independence for the investor</li> <li>▪ This investment will contribute to boost the economy of the villages nearby</li> </ul>	
<b>Develop ecotourism resort</b>	Quirimba National Park (Cabo Delgado)	<ul style="list-style-type: none"> <li>▪ Damage to properties</li> <li>▪ Breakdown of equipments</li> <li>▪ Loss of Biomass</li> <li>▪ Energy cuts</li> </ul>	Inter-Continental Hotels, Pestana, VIP Hotels, RIU Hotels & Resorts	<ul style="list-style-type: none"> <li>▪ With Resort (self sustainable) own infrastructures, the resort will be better prepared to resist to cyclones, and to protect biodiversity and boost economy of the villages nearby</li> </ul>	

Main sources: Meetings with private investors, other themes' input, ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change



**We identified a long-list of potential adaptation measures for the most at risk areas in the Center (1/2)**

6

### Long-list of adaptation measures in the Centre

 <p>Beira</p>	<ul style="list-style-type: none"> <li>■ Increase crops yield through the reduction of ground-level ozone</li> <li>■ Construction of seawall or revetments (e.g.: rock revetments)</li> <li>■ Introduce emergency phones along the railway</li> <li>■ Develop storage facilities in Beira port</li> <li>■ Produce solar energy at tourist facilities to decrease energy dependence</li> </ul>
 <p>Buzi and Dondo</p>	<ul style="list-style-type: none"> <li>■ Construction of floodgate / river breakwater wall</li> <li>■ Construction of mini dam</li> <li>■ Introduce water filters techniques</li> <li>■ Upgrade main routes (e.g.: Bridges)</li> <li>■ Forestation with product diversity (softwood / hardwood and / or short / long rotation)</li> </ul>
 <p>Moatize, Motarara and Changara</p>	<ul style="list-style-type: none"> <li>■ Construction of mini dams</li> <li>■ Construction of floodgate / river breakwater wall</li> <li>■ Increase crops yield through the reduction of ground-level ozone</li> <li>■ Introduce redundancy and business continuity in railways</li> <li>■ Introduce emergency phones along the railway</li> </ul>

Main sources: Meetings with private investors, other themes' input, ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

 High (risk / impact)  
 Medium (risk / impact)

### We identified a long-list of potential adaptation measures for the most at risk areas in the Center (2/2)

6

#### Long-list of adaptation measures in the Centre



Manganja,  
Namacurra and  
Nicoadala

- Introduction of drought-resistance seeds
- Upgrade main routes ahead of predicted occurrences of floods
- Develop and implement an integrated fire management system
- Construction of mini dams
- Produce solar energy at tourist facilities to decrease energy dependence



Chinde, Mopeia  
and Morrumbaia

- Construction of mini dams
- Introduction of flood-resistance seeds
- Develop irrigation / drainage system



Machanga




- Introduction of flood-resistance seeds
- Forestation of mangroves
- Increase crops yield through the reduction of ground-level ozone



## 1.7 Potential adaptation options – Long-list of adaptation measures in the Centre

### The construction of floodgates and the increase of crop yields could be attractive adaptation measures for private investors in Moatize

6

Adaptation measure (What)	Target region (Where)	Adaptation to the following climate impacts (why)	Examples of Interest Parties (possible funding mechanisms)	Comments (why)	Illustrative Picture
<b>Construction of Mini Dams</b>	Moatize (Tete)	<ul style="list-style-type: none"> <li>Damage to properties</li> <li>Breakdown of equipments</li> <li>Energy cuts</li> <li>Communication cuts</li> <li>Loss of crops</li> </ul>	Carvão de Moatize	<ul style="list-style-type: none"> <li>Will improve water management conditions and Energy independence for the investor</li> <li>This investment will contribute to boost the economy of the villages nearby</li> </ul>	
<b>Floodgate / River breakwater wall</b>	Moatize (Tete)	<ul style="list-style-type: none"> <li>Energy cuts</li> <li>Communication cuts</li> <li>Breakdown of equipments</li> <li>Blockage of roads</li> </ul>	Carvão de Moatize	<ul style="list-style-type: none"> <li>Will improve water management and decrease the probability of floods and failure in operations of Carvão de Moatize and other industries in the area</li> <li>Will contribute to improve transportation of goods by the river channels</li> </ul>	
<b>Increase crop yields</b>	Moatize (Tete)	* Loss of crops	Moçambique Leaf Tobacco	<ul style="list-style-type: none"> <li>The increase in crops yield will be beneficial for the industries and population in the area</li> </ul>	






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## 1.7 Potential adaptation options – Long-list of adaptation measures in the Centre

### The construction of mini dams could be attractive adaptation measures for private investors in Búzi, Sofala

6


Adaptation measure (What)	Target region (Where)	Adaptation to the following climate impacts (why)	Examples of Interest Parties (possible funding mechanisms)	Comments (why)	Illustrative Picture
<b>Introduction of drought-resistance seeds</b>	Machaze and Chimoio (Manica)	<ul style="list-style-type: none"> <li>Loss of crops</li> </ul>	Mozbife	<ul style="list-style-type: none"> <li>The introduction of drought-resistance crops will influence the agricultural industry in Manica</li> </ul>	
<b>Increase crops yield</b>	Beira (Sofala)	<ul style="list-style-type: none"> <li>Loss of crops</li> </ul>	Moçambique Leaf Tobacco	<ul style="list-style-type: none"> <li>The increase in crops yield will be beneficial for the industries and population in the area</li> </ul>	
<b>Floodgate / River breakwater wall</b>	Buzi and Dondo (Sofala)	<ul style="list-style-type: none"> <li>Energy cuts</li> <li>Communication cuts</li> <li>Breakdown of equipments</li> <li>Blockage of roads</li> </ul>	Prio Agricultura, Búzi Açucar	<ul style="list-style-type: none"> <li>Will improve water management and decrease the probability of floods</li> <li>Will contribute to improve transportation of goods by the river channels</li> </ul>	
<b>Construction of Mini Dams</b>	Buzi (Sofala)	<ul style="list-style-type: none"> <li>Damage to properties</li> <li>Breakdown of equipments</li> <li>Energy cuts</li> <li>Communication cuts</li> <li>Loss of crops</li> </ul>	Búzi Açucar	<ul style="list-style-type: none"> <li>Will improve water management conditions and Energy independence for the investor</li> <li>This investment will contribute to boost the economy of the villages nearby</li> </ul>	
<b>Revetments (e.g.: Rock revetments) or Seawall</b>	Beira (Sofala)	<ul style="list-style-type: none"> <li>Damage to properties</li> <li>Breakdown of equipments</li> <li>Energy cuts</li> </ul>	Maria Lagoon Resort, Petro Beira	<ul style="list-style-type: none"> <li>Beira is one of the most in danger areas - Cyclones and Floods are expected to become more frequent and intensive</li> <li>Revetments will contribute to decrease the probability of a calamity in the city infrastructures (e.g. it is important for the tourists operators)</li> </ul>	

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### We identified a long-list of potential adaptation measures for the most at risk areas in the South (1/2)

6

#### Long-list of adaptation measures in the South

 <p>Gaza</p>	<ul style="list-style-type: none"> <li>■ Introduce water filters techniques</li> <li>■ Construction of a pharmaceutical factory / supply channels</li> <li>■ Develop dams in Limpopo</li> <li>■ Upgrade roads</li> <li>■ Construction of storage facilities</li> <li>■ Introduction of drainage systems</li> </ul>
 <p>Vilanculos</p>	<ul style="list-style-type: none"> <li>■ Diversifying crop types / varieties and produce high-resistance crops</li> <li>■ Conversion of arable farmland into salt marsh and grassland to provide sustainable defenses</li> <li>■ Conversion of arable farmland into aquaculture areas</li> <li>■ Develop ecotourism resort with energy and communications independence</li> <li>■ Reforestation of mangroves</li> </ul>
 <p>Maputo city</p>	<ul style="list-style-type: none"> <li>■ Improvement of sustainable urban drainage systems</li> <li>■ Construction of near shore breakwaters</li> <li>■ Development of a fast reestablishment plan for financial transactions</li> <li>■ Produce solar energy at tourist facilities to decrease energy dependence</li> <li>■ Increase of storage facilities in Maputo port</li> <li>■ Strengthening of pharmaceutical supply channels</li> <li>■ Introduce redundancy and business continuity in key buildings, roads and railways</li> </ul>




Main sources: Meetings with private investors, other themes' input, ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

 High (risk / impact)  
 Medium (risk / impact)



### We identified a long-list of potential adaptation measures for the most at risk areas in the South (2/2)

6

#### Long-list of adaptation measures in the South

 <p>Bilene</p>	<ul style="list-style-type: none"> <li>■ Develop irrigation system</li> <li>■ Introduction of drought-resistance seeds</li> <li>■ Produce solar energy at tourist facilities to decrease energy dependence</li> </ul>
 <p>Chokwe</p>	<ul style="list-style-type: none"> <li>■ Construction of mini dams</li> <li>■ Construction of floodgates</li> <li>■ Improvement of existing irrigation system</li> </ul>
 <p>Matola</p>	<ul style="list-style-type: none"> <li>■ Increase crops yield through the reduction of ground-level ozone</li> <li>■ Construction of seawall or revetments (e.g.: rock revetments)</li> <li>■ Increase of storage facilities in Matola port</li> </ul>



Main sources: Meetings with private investors, other themes' input, ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

 High (risk / impact)  
 Medium (risk / impact)

## 1.7 Potential adaptation options – Long-list of adaptation measures in the South

**Diversifying crop types and varieties and produce high-resistance crops can be introduced by agricultural companies improving water management in a region affected by cyclones**

6




Adaptation measure (What)	Target region (Where)	Adaptation to the following climate impacts (why)	Examples of Interest Parties (possible funding mechanisms)	Comments (why)	Illustrative Picture
<b>Diversifying crop types and varieties and produce high-resistance crops (or reforestation)</b>	Vilanculos (Inhambane)	<ul style="list-style-type: none"> <li>▪ Crops pests</li> <li>▪ Loss of crops</li> <li>▪ Loss of livestock</li> </ul>	Companhia Agro-empresarial de Moçambique, Obrigado, Fazenda de Açucar e Milho,	<ul style="list-style-type: none"> <li>▪ Vilanculos is the town in the south region that suffers more damage in crops from cyclone events</li> <li>▪ High resistance crops will decrease the probability of loss of industrial and subsistence agriculture"</li> </ul>	
<b>Coastal realignment - conversion of arable farmland</b>	Vilanculos (Inhambane)	<ul style="list-style-type: none"> <li>▪ Damage to properties</li> <li>▪ Breakdown of equipments</li> <li>▪ Energy cuts</li> </ul>	<i>to be investigated</i>	<ul style="list-style-type: none"> <li>▪ Vilanculos is one of the most affected by sea floods</li> <li>▪ The conversion of arable land into salt marsh will protect the coast of Vilancukos</li> </ul>	

Main sources: Meetings with private investors, other themes' input, ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

## 1.7 Potential adaptation options – Long-list of adaptation measures in the South

**The introduction of water filters in Xai-Xai could prevent further salinization of the soil and the construction of SUDS in Maputo would help to reduce the effect of heavy rains and floods**

6

Adaptation measure (What)	Target region (Where)	Adaptation to the following climate impacts (why)	Examples of Interest Parties (possible funding mechanisms)	Comments (why)	Illustrative Picture
<b>Water filters</b>	Gaza (Xai-Xai)	<ul style="list-style-type: none"> <li>Salinization of the soil</li> <li>Contamination of water supplies</li> </ul>	Chongoene Resorts, Companhia Agro-Social Igo Sammartini, J.F.S	<ul style="list-style-type: none"> <li>Water desalinization technologies will give access to clean water for the investors</li> <li>This investment will contribute to boost the agriculture</li> </ul>	
<b>Sustainable Urban Drainage Systems (SUDS)</b>	Maputo City	<ul style="list-style-type: none"> <li>Development of water born diseases</li> <li>Damage to properties</li> <li>Salinization of the soil</li> </ul>	<i>to be investigated</i>	<ul style="list-style-type: none"> <li>Drainage systems would help expel the water to the sea again</li> </ul>	
<b>Near shore breakwaters</b>	Maputo City	<ul style="list-style-type: none"> <li>Blockage of roads</li> <li>Damages in railways</li> <li>Damages in harbours / ports</li> <li>Damage to properties</li> <li>Breakdown of equipments</li> <li>Coastal erosion</li> </ul>	The Horizon, Hotel Karibo, Mozal	<ul style="list-style-type: none"> <li>Near shore breakwaters would contribute more successfully to the protection of the infrastructure and equipments</li> </ul>	

Main sources: Meetings with private investors, other themes' input, ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

## 1.7 Potential adaptation options – Example of potential projects

**We are already working with private investors to identify potential projects for the adaptation measures to be further evaluated and detailed in the second phase of the project**

6

	Description	Adaptation & Benefits
<b>A</b> <b>Self Energy with other partner (e.g. Vale)</b> <i>Mini Dams in Tete (e.g. Moatize)</i>	<ul style="list-style-type: none"> <li>Construction of two mini dams to address energy cuts, communication cuts and loss of agriculture production with a potential of about 2 and 7,5 MW</li> </ul>	<ul style="list-style-type: none"> <li>Energy security</li> <li>Better irrigation</li> <li>Less dependency on rain fed agriculture</li> <li>Infrastructure and value chain protection</li> </ul>
<b>B</b> <b>Ecoenergia (extension)</b> <i>Introduction of a different variety of crops in the production of bio fuel (Cabo Delgado)</i>	<ul style="list-style-type: none"> <li>The project is an expansion of an existing sugar cane and sweet sorghum test plantation in Cabo Delgado</li> <li>The agricultural operations will involve 400 ha of sugar cane and, for the ethanol production at the second phase (from year three), 50 up to 100 ha of Sweet Sorghum</li> </ul>	<ul style="list-style-type: none"> <li>Water security</li> <li>Crop resilience</li> <li>Energy security</li> <li>Better irrigation</li> </ul>
<b>C</b> <b>Companhia do Búzi</b> <i>New sugar factory with bridge and mini-dam construction</i>	<ul style="list-style-type: none"> <li>Production of sugar cane and construction of a sugar factory with an annual projected production capacity of 150.000 tons</li> <li>Currently, the group is performing final studies for the evaluation of the economic-financial and technical viability</li> </ul>	<ul style="list-style-type: none"> <li>Energy security</li> <li>Better irrigation</li> <li>Infrastructure and value chain protection</li> </ul>

Source: Meetings with private investors and investor's documentation



### Construction of two mini dams to address energy and communication cuts and loss of agriculture production in Moatize

6

A

#### Project brief description



Construction of two mini dams to address energy cuts, communication cuts and loss of agriculture production with a potential of about 2 and 7,5 MW

#### Main potential benefits

##### Private sector benefit - Inside the Fence -

- Investment return close to 8% of capital employed
- Capital gains superior to €2.000.000

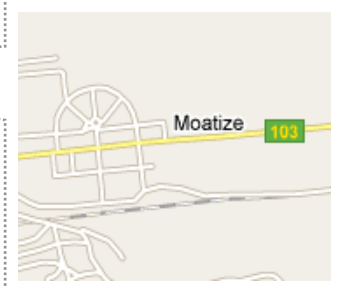
##### Community benefits - Beyond the Fence -

- Income generating activities for local communities
- Direct and Indirect jobs increase

##### Country benefits - Beyond the Horizon -

- Better irrigation - half of the world's dams are built exclusively for irrigation
- Control floods - in at least 75 countries dams have been built to control floods.

#### High impact area



#### Funding mechanisms

##### Promoters



##### Examples of funding parties



Source: Dams and Development: – A New Framework for Decision-Making, The Report of the World Commission on Dams

6  
B

## A photograph showing a large pile of bright green, wet microalgae biomass. A yellow forklift is lifting a metal cage filled with the biomass and placing it into a white container. A person in a white shirt and shorts is standing next to the pile, holding a red tool. The scene is outdoors under a clear blue sky.

## Main potential benefits

- Investment return superior to 10% of capital employed
- Capital gains superior to €4.000.000

- Income generating activities for local communities
- Direct and Indirect jobs increase

- Less dependence on oil which contributes to country's energy security
- Reduction in greenhouse gas emissions



## Promoters



## Examples of funding parties





### New sugar factory with bridge and mini-dam construction in Buzi

6

C

#### Project brief description



Production of sugar cane and construction of a sugar factory with an annual projected production capacity of 150.000 tons. Additionally, a bridge and a mini dam will be constructed.

#### Main potential benefits

##### Private sector benefit - Inside the Fence -

- Annual revenues of \$50.000.000 through sugar cane exports, which have an attractive profit margin

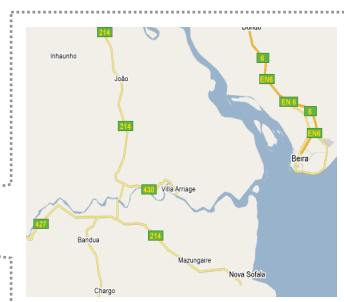
##### Community benefits - Beyond the Fence -

- 3.000 to 4.000 direct jobs creation
- Energy security and better irrigation options for the region and small agriculture

##### Country benefits - Beyond the Horizon -

- Infrastructure and value chain protection
- Less dependence on oil which contributes to country's energy security

#### High impact area



#### Funding mechanisms

##### Promoters



##### Examples of funding parties



Source: EPA's Renewable Fuel Standards Program Regulatory Impact Analysis, released in February 2010

## Index

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**1.8 Annexes**

2 Phase 2

3 Phase 3

«ECA – Shaping climate-resilient development: a report of the economics of climate adaptation» group was used as a methodology for strategic assessment and benchmarking phases

### Interpretation of ECA's approach

**Design a systematic approach to climate adaptation**

Used in strategic assessment in order to evaluate “Exposure”, “Vulnerability” and “Climate Risk”

**Find solutions from test cases**

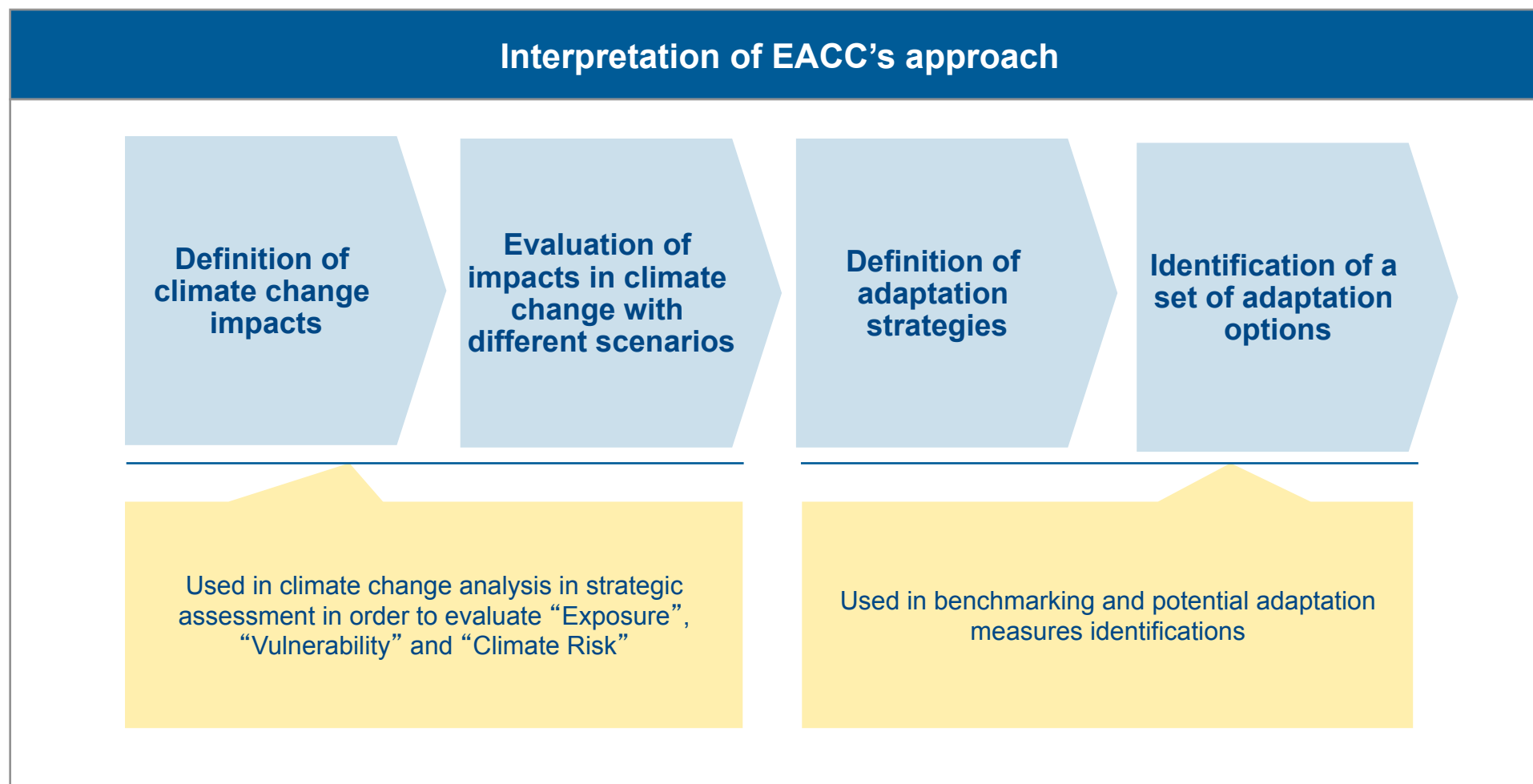
Used in our benchmark approach in order to look for adaptation measures that could be adopted in Mozambique and build scenarios to guide decision-making

**Steps to implement a comprehensive strategy for climate-resilient development**

Used in the assessment of risks and opportunities for private investors in order to prioritize hazards and locations, and in the identification of funding mechanisms from the international community

Source: ECA - Climate Adaptation Working Group

«EACC – Economics of Adaptation to Climate Change» was used as a methodology in climate change analysis, benchmarking and potential adaptation measures identification phases



Source: EACC - Economics of Adaptation to Climate Change

**SEA an adaptation to climate change from OECD was used as methodology in strategic assessment, risks and opportunities for private sector and potential adaptation options**

### Interpretation of «OECD – SEA and adaptation to climate change» approach

**Establishing the  
Context**

**Used in strategic assessment in  
order to evaluate business  
context**

**Implementing the  
SEA**

**Used in strategic assessment in  
order to evaluate “Vulnerability”  
and “Climate Risk”. Moreover,  
used in “Risks and opportunities  
for private investors” and in  
“Potential adaptation options”**

**Informing and  
Influencing  
Decision Makers**

**Will be used in next phases to  
recommend and communicate  
policy changes**

**Monitoring and  
Evaluation**

Source: OECD – SEA and adaptation to climate change

**«Adaptation - An issue brief for business» was used as methodology for the definition of risks and opportunities for private investors**

### Interpretation of «Adaptation - An issue brief for business» approach

**Definition of business risks and opportunities**

Used in “Risks and opportunities for private investors” mainly in the definition of key business risks and opportunities in high climate impact areas

**Division of risks and opportunities according to the spheres of activity or influence**

Used in “Risks and opportunities for private investors” mainly in the definition of key business risks per sector

**Division of risks and opportunities per business sector**

Used in “Risks and opportunities for private investors” mainly in the definition of key sectors at risk

Source: Adaptation - An issue brief for business –World Business Council for Sustainable Development

### List of key sources (1/5)

	Sources
<b>1</b> Introduction	<ul style="list-style-type: none"><li>■ INGC – Study on the Impact of Climate Change on Disaster Risk in Mozambique: Main report;</li><li>■ Theme 2 “Coastal protection”, theme 4 “Ecoenergia” and theme 6 “ Food- meeting demands”</li><li>■ Construindo Resiliência com o Sector Privado – Technical proposal adenda</li></ul>
<b>2</b> Strategic Objectives	<ul style="list-style-type: none"><li>■ INGC – Study on the Impact of Climate Change on Disaster Risk in Mozambique</li><li>■ Construindo Resiliência com o Sector Privado – Technical proposal adenda</li></ul>

### List of key sources (2/5)

3

Strategic  
assessment

#### Sources

- EACC - Economics of Adaptation to Climate Change
- ECA – Shaping climate-resilient development: a report of the economics of climate adaptation group
- Strategic environmental assessment and adaptation to climate change© OECD 2008,
- Strategic Environmental Assessment Good Practices Guide - Maria do Rosário Partidário
- INE Mozambique
- Banco Central da República de Moçambique
- Portal do Governo de Moçambique
- Human development index 2010 from UNDP
- Prevention Consortium - The quality and accuracy of disaster data – a comparative analysis of three global data-sets
- EM-DAT -The OFDA/CRED International Disaster Database - [www.emdat.be](http://www.emdat.be) - Université Catholique de Louvain - Brussels - Belgium
- INGC – Study on the Impact of Climate Change on Disaster Risk in Mozambique: Main report;
- Desconsultar database
- 100 maiores empresas de Moçambique – document KPMG
- Nacala XXI, Nacala, Beira and Maputo development corridors
- Mozambique investment forum 2010
- Investment Opportunities in the Industrial Sector
- Investing in Mozambique 2010



### List of key sources (3/5)

4

#### Benchmark

#### Sources

- Meetings with private investors
- Other themes' input
- ECA - Climate Adaptation Working Group
- OECD – SEA and adaptation to climate change
- Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change
- Australia - climate change adaption actions for local government
- UNFCCC - United Nations Framework Convention on Climate Change
- FAO - Food and Agriculture Organization
- International Cooperation Bureau Yangtze (Changjing) Water Resources Commission, MWR, China
- The World Bank
- <http://www.rainwaterharvesting.org/>
- UNESCO
- Environmental protecting agency USA

### List of key sources (4/5)

5

Risks and  
Opportunities for  
private investors

#### Sources

- Adaptation - An issue brief for business –World Business Council for Sustainable Development
- SEA - Strategic Environmental Assessment – Good Practices Guide
- EACC - Economics of Adaptation to Climate Change
- OECD – SEA and adaptation to climate change
- ECA - Climate Adaptation Working Group
- Strategic environmental assessment and adaptation to climate change© OECD 2008
- Strategic Environmental Assessment Good Practices Guide - Maria do Rosário Partidário;
- Prevention Consortium - The quality and accuracy of disaster data – a comparative analysis of three global data-sets
- EM-DAT – The OFDA/CRED International Disaster Database
- INGC – Study on the Impact of Climate Change on Disaster Risk in Mozambique
- Desconsultar database.
- CPI, approved projects from 2005 till November 2010
- World Business Council for Sustainable Development – Business risks and opportunities resulting from climate change impacts

### List of key sources (5/5)

5

Risks and  
Opportunities for  
private investors

#### Sources

- Adaptation - An issue brief for business –World Business Council for Sustainable Development
- EACC - Economics of Adaptation to Climate Change
- OECD – SEA and adaptation to climate change
- ECA - Climate Adaptation Working Group
- Strategic environmental assessment and adaptation to climate change© OECD 2008
- Strategic Environmental Assessment Good Practices Guide - Maria do Rosário Partidário;
- Prevention Consortium - The quality and accuracy of disaster data – a comparative analysis of three global data-sets
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0 Executive Summary

1 Phase 1

**2 Phase 2**

**2.1 Executive Summary**

2.2 Strategic Objectives

2.3 Screening Phase

2.4 Evaluation Phase

2.5 Adaptation measures shortlist

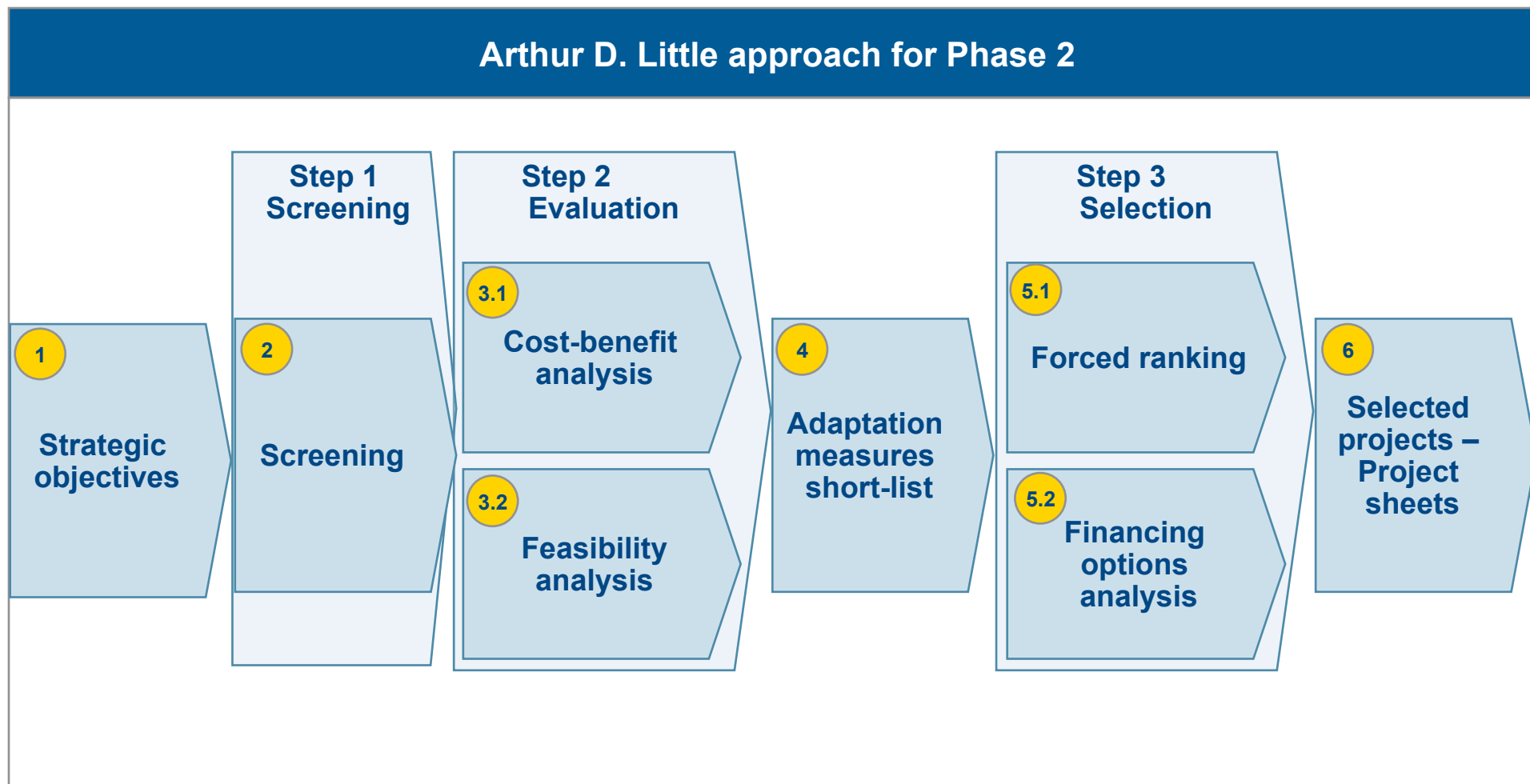
2.6 Selection Phase

2.7 Selected Projects – Project Sheets

3 Phase 3

## 2.1 Executive Summary – Approach for Phase 2

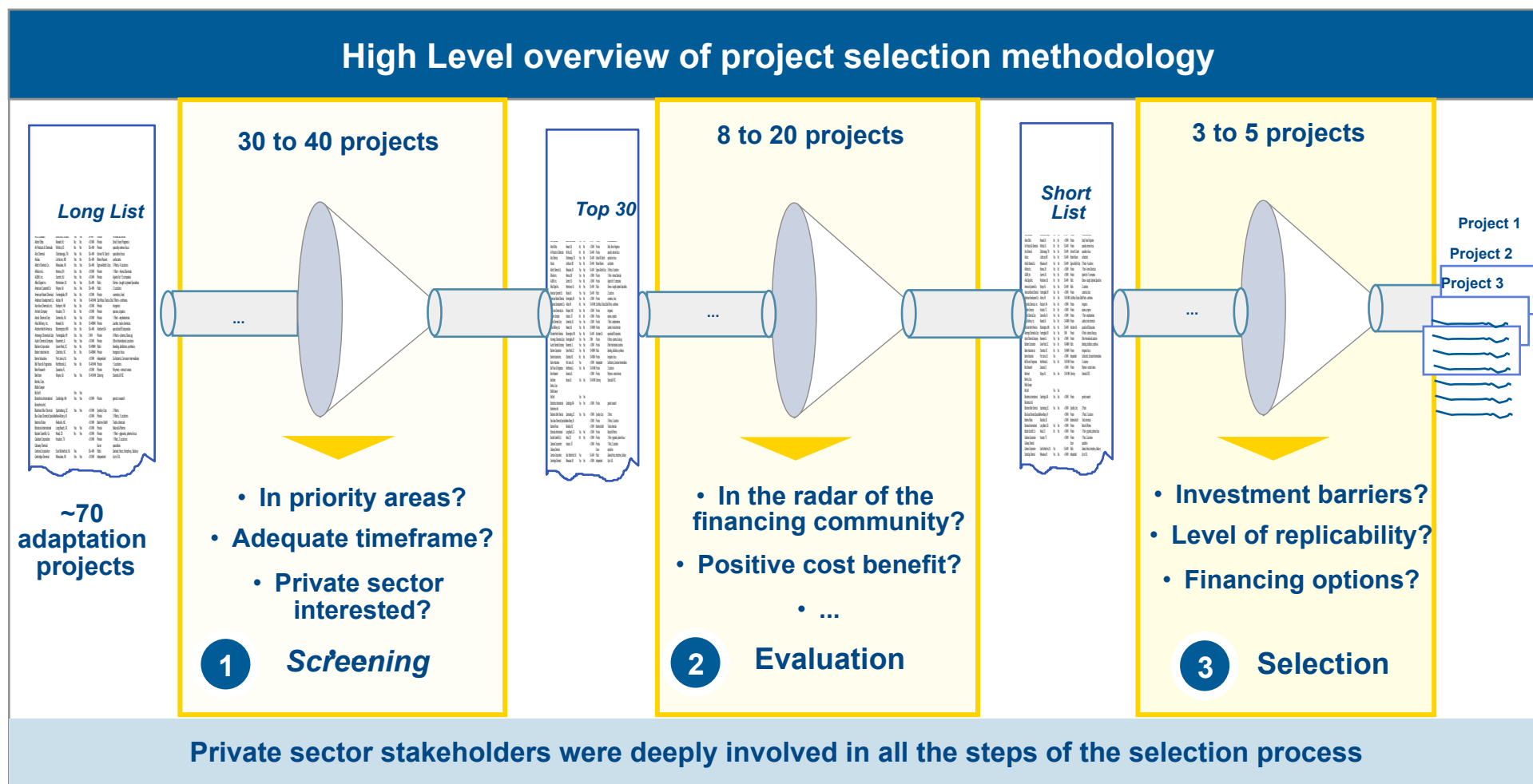
The approach designed to select 3-5 adaptation projects to detail from an original long list has three main steps: Screening, Evaluation and Selection



Source: Based on Arthur D. little Methodologies, ECA – Shaping climate-resilient development: a report of the economics of climate adaptation group, ECA – Enhancing the climate risk and adaptation fact base for the Caribbean, And yet it moves – UNEPFI; Catalyzing low-carbon growth in developing economies - UNEP









## 2.1 Executive Summary – Approach for Phase 2

The selection of the 3 to 5 adaptation projects for Phase 3 is supported in our methodology and the continuous involvement of public and private sector *stakeholders*



Source: Mozambique Investment Climate Assessment – World Bank –October2009; Catalyzing low-carbon growth in developing economies – UNEP –October2009, Business Confidence Index 2010, UNEP, SEFI – Public Finance Mechanisms to mobilize investment in climate change mitigation

**We are now in the end of the evaluation phase, having performed site visits to 10 of the 16 short-listed projects and having had meetings with the investors associated with all projects**

<p><b>A</b></p> <p><b>Mini dam construction</b></p> <ul style="list-style-type: none"> <li>■ Region: Búzi (Beira)</li> <li>■ Investor: Búzi Açúcar</li> <li>■ Focus: irrigation and water flow control</li> </ul> 	<p><b>B</b></p> <p><b>Bridge construction</b></p> <ul style="list-style-type: none"> <li>■ Region: Búzi (Beira)</li> <li>■ Investor: Búzi Açúcar</li> <li>■ Focus: ensure passage in extreme floods and droughts</li> </ul> 	<p><b>C</b></p> <p><b>Reforestation with agricultural activities</b></p> <ul style="list-style-type: none"> <li>■ Region: Búzi (Beira)</li> <li>■ Investor : Búzi Açúcar</li> <li>■ Focus: carbon reduction and community involvement</li> </ul> 	<p><b>D</b></p> <p><b>Macuti houses</b></p> <ul style="list-style-type: none"> <li>■ Region: Mozambique Island</li> <li>■ Investor: Technoserve and SME</li> <li>■ Focus: resilient construction</li> </ul> 
<p><b>E</b></p> <p><b>“Stone and Clay” city resilience</b></p> <ul style="list-style-type: none"> <li>■ Region: Mozambique Island</li> <li>■ Investor: Technoserve and Tourism sector investor</li> <li>■ Focus: resilient construction</li> </ul> 	<p><b>F</b></p> <p><b>Organic waste composting</b></p> <ul style="list-style-type: none"> <li>■ Region: Pemba</li> <li>■ Investor: Aga Khan</li> <li>■ Focus: Soil recovery and food security</li> </ul> 	<p><b>G</b></p> <p><b>Bioetanol Production</b></p> <ul style="list-style-type: none"> <li>■ Region: Ocua (Chiure)</li> <li>■ Investor: Ecoenergia</li> <li>■ Focus: adaptation to drought and clean energy production</li> </ul> 	<p><b>H</b></p> <p><b>Solar panels for irrigation</b></p> <ul style="list-style-type: none"> <li>■ Region: Ocua (Chiure)</li> <li>■ Investor: Ecoenergia</li> <li>■ Focus: irrigation, clean energy and community involvement</li> </ul> 

Source: Arthur D. Little analysis

**We are now in the end of the evaluation phase, having performed site visits to 10 of the 16 short-listed projects and having had meetings with the investors associated with all projects**

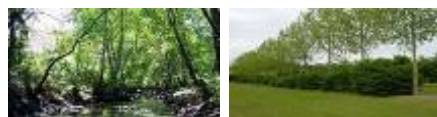
### I Small scale solar plant

- Region: Maputo district
- Investor: Selfenergy
- Focus: Clean energy and carbon emissions reduction



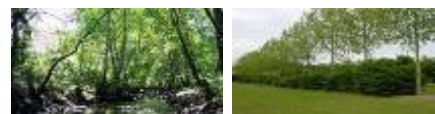
### J Reforestation in Quirimbas

- Region: Quirimbas Park
- Investor: Aga Khan
- Focus: carbon reduction and community involvement



### K Agro forestry in Cabo Delgado

- Region: Cabo Delgado
- Investor: Pemba Sun / Technoserve
- Focus: carbon reduction and community involvement



### L Micro credit for adaptation

- Region: Nation wide
- Investor: Aga Kan
- Focus: Finance adaptation at a micro level



### M Resilient crops

- Region: Nacala
- Investor: Aviam
- Focus: drought resistant crops (Jatropha)



### N Increase crops yield

- Region: Ocuia
- Investor: Ouro verde
- Focus: Food security – reduction of ground level ozone



### O Ecotourism

- Region: Maputo Special Reserve
- Investor: Technoserve
- Focus: Biodiversity protection



### P Agro forestry in Nampula

- Region: Nampula
- Investor: Green resources / Technoserve
- Focus: carbon reduction and community involvement



Source: Arthur D. Little analysis



From the top 16 list, 3 projects have major significance for the country, whereas the remaining projects are regionally important but lack significant country-wide impact

Project	Potential Impact	Comments
Microcredit for adaptation	Nationwide	<ul style="list-style-type: none"> <li>Only three projects have a nationwide impact <i>per se</i>: <ol style="list-style-type: none"> <li>The projects by themselves are replicable all over the country and can reach a significant number of small businesses (e.g. microcredit and composting projects)</li> <li>The projects are a flagship in a sector that needs to be considered as key for climate change adaptation (e.g. Infrastructure and financing mechanisms)</li> </ol> </li> <li>The remaining projects, although regionally significant seem fragmented and are not significant enough to raise the interest of international investors</li> </ul>
Develop of fertilizers by composting of organic waste		
Construction of a Bridge		
Reforestation of Quirimbas National Park	Cabo Delgado	
Bioetanol Production	Cabo Delgado	
Develop ecotourism resort	Maputo	
Increase crops yield	Cabo Delgado	
Reforestation with agricultural activities	Buzi and Dondo	
Development of agro forestry	Cabo Delgado	
Development of agro forestry	Nampula	
Construction of Macuti houses in Mozambique island	Nacala	
Solar panels for irrigation	Cabo Delgado	
Introduction of Resilient crops for the production of Biofuel	Nacala	
“Stone and Clay” city resilience in Mozambique island	Nacala	
Construction of Mini Dams	Buzi and Dondo	
Small Scale Solar Plants	Maputo	

## 2.1 Executive Summary

To design initiatives with a country-wide impact, the projects were aggregated in programs to address some of Mozambique's most strategic challenges: energy, water, forestry, tourism

### Project aggregation by strategic area

Projects	Areas	Energy	Water	Tourism	Forestry
Reforestation of Quirimbas National Park					X
Bioetanol Production		X	X		
Develop ecotourism resort				X	
Increase crops yield			X		
Reforestation with agricultural activities					X
Development of agro forestry					X
Development of agro forestry					X
Construction of Macuti houses in Mozambique island				X	
Solar panels for irrigation		X			
Introduction of Resilient crops for the production of Biofuel		X	X		
"Stone and Clay" city resilience in Mozambique island				X	
Construction of Mini Dams in Búzi River		X	X		
Small Scale Solar Plant		X			

All the projects related with tourism are focused on **community tourism** and included in a community tourism fund that can have a major impact in rural communities development




































From the 4 forestry projects in the top list, 3 are related with **agro forestry** and if analyzed together deliver a significant impact in the country

All the projects are focused on **clean energy generation** and if considered in a aggregated fashion can constitute a clean energy program with major impact for the country

The water projects range from **infrastructural projects** like floods control to correlated measures such as the use of resilient crops, but all deal with water management

## 2.1 Executive Summary

A forced ranking was executed against predefined criterion leading to the prioritization of four initiatives to take forward to Phase 3

Project / Program	Investment Barriers	Need technical studies	Relative CC impact	Community impact	Pilot project a Flagship	Comments
Microcredit for adaptation						■ There are no relevant barriers for investment and studies are already in finalization. The pilot project – Macuti Houses – is a flagship for the country
Waste management and composting						■ There are some barriers for investment and studies are already ongoing. The pilot projects are flagship and pioneers for the country
Construction of a Bridge						■ There are some barriers for investment and studies are already ongoing. The construction of the bridge works as a pilot project for infrastructure adaptation to climate change in Mozambique
Clean energy program						■ There are barriers for investment and studies are already in progress. Several pilot electricity generation projects are already under study and would represent interesting flagship projects.
Agro forestry fund						■ No relevant barriers to investment and studies needed are SEAs. The pilot projects are flagship
Water management program						■ There are barriers and technical studies are needed. The pilot project – Mini dam in Cabo Delgado – is not a flagship project
Community tourism fund						■ There are barriers for investment and studies are already needed. Maputo special reserve tourism project is a pioneer since its is working with the community as a foundation

Source: Arthur D. Little analysis

Note: Detail in Annex

 Lower grade  Higher grade

**Broadly speaking, the subject areas and programs we have identified resonated well with both the financial community and the CTA**

### Comments regarding the projects

#### Microfinance program

Financial institutions like **Ned bank and Standard bank** showed appetite for these types of projects.

In the essence the approach we are taking has been done many times before. The key for the success is to identify a **trustworthy counterparty** that knows the country / region and has extensive experience in developing projects in microfinance

#### Agro Forestry fund

There is a huge amount of interest in projects in these areas but it is harder to get big funds interested in Mozambique . Returns profiles for private equities funds and venture capital houses are likely in the region of 40-50% for Mozambique – this will be very tough to achieve

A number of government development agencies and foundations e.g **Danish and Norwegian governments** and a range of other softer money have expressed interest in this type of project. A key question will be how to combine soft and harder money together . We also need to keep the project focused

#### CTA comments

**Agro forestry** and **Composting** programs are very important for the country and for the private sector since they have the ability to mix private sector interest with community development

The **clean energy program** is in line with government objectives but careful is needed since several projects were announced but no results were seen

**Microcredit** seems the least important project for larger private sector since it will have the greatest impact in families and micro companies

#### Waste management and organic fertilizer

For the development of pilot projects the majority of the financing institutions, although recognizing the value of the project, do not want to invest their money on it.

Government Development Agencies (like AFD) are interested in supporting these projects  
If the first pilots are successful and willing to get carbon credits and returns from fertilizers other financing institutions will be interested to invest

We have developed project sheets for all of the selected projects and presented them to a sample of entities from the international financing community

Microcredit for adaptation	Waste management and production of organic fertilizers	Clean energy program	Illustrative Agro forestry fund
<p><b>Potential Project:</b> Microcredit for adaptation</p> <p><b>Arthur D Little INGC</b></p> <p><b>• Short Description:</b></p> <p>The purpose of this project is to develop a micro-credit program for adaptation in Mozambique supported by the government and run by private companies or NGOs.</p> <p>In Mozambique the access to credit is very difficult, consequently one of the main barriers to investment and to the development of the country.</p> <p>Microfinance provides access to basic financial services to the poor. Through small loans with compulsory, frequent repayments to groups or individuals, microfinance helps the poor build up their assets, establish or develop a business, and protect against risks.</p> <p>Microfinance has the potential to help poor and most vulnerable populations adapt to climate change by providing individuals small companies with a means of accumulating and managing the assets and capabilities needed to become less susceptible to the impact of natural hazards.</p> <p>The micro-credit program in Mozambique is intended to have several private partners, be nationwide and cover all the sectors affected by climate change and will be developed in phases to increase the probability of success.</p> <p>Examples of projects potentially financed by microfinance are:</p> <ul style="list-style-type: none"> <li>In Agriculture - Development of irrigation systems like drip irrigation, introduction of organic fertilizers and introduction of resistant seeds</li> <li>In tourism - Construction of more resistant houses for tourism (see detailed example in the end of the document)</li> <li>In industry - Development of small businesses of aquaculture (several agricultural areas along the coast will be flooded more frequently due to climate change and the use of fish pens to aquaculture is a viable option for the communities)</li> </ul> <p>The target segment of the population is mainly micro and small companies and communities working as companies (for instance a farmer that is producing crops is a target if the crops are to be sold in the local market).</p> <p>In a first phase the program the project will be implemented in the Northern region of the country in the sectors most impacted by climate change and in which micro financing would have an impact: Agriculture, Tourism and Industry.</p> <p>In a second phase the program will be extended to the entire country and sectors.</p> <p><b>• Potential benefits and interest for private investors and / or donors:</b></p> <p>With the increase of natural disasters around the world there is an increase interest in the so called "impact investing" where an investment is made considering not only the financial return but also</p>	<p><b>Potential Project:</b> Waste management and production of organic fertilizers in Mozambique</p> <p><b>Arthur D Little INGC</b></p> <p><b>• Short Description:</b></p> <p>The main goal of this project is to develop a financial product to help boost composting businesses in Mozambique.</p> <p>Composting is a process in which organic wastes are degraded by microorganisms at elevated temperatures under both aerobic and anaerobic conditions.</p> <p>In Mozambique composting is still a new concept and there is opportunity to develop projects in this area.</p> <p>Due to city development, Mozambique is starting to face a major problem related with waste management. In the formerly pristine environment, waste is disposed indiscriminately in rivers, marsh and wastelands.</p> <p>Moreover, Mozambique government is committed to improve agricultural productivity through sound and sustainable soil nutrient management practices and agricultural policies (Mozambique use of fertilizers is way below African average).</p> <p>Composting of the organic fraction of the city waste will avoid methane emissions from anaerobic decay, increase the lifetime of the existing landfill massively and produce high quality compost for use as natural fertilizer.</p> <p>A composting project is a highly replicable project and has an interesting inter-relationship with both local authorities and communities.</p> <p>The composting program in Mozambique is intended to be nationwide and cover all the major cities of the country and will be developed through several concurrent pilot projects to improve the probability of success. The first wave of projects will be in cities included in INGC climate change priority areas (e.g. Pemba, Nacala, Quelimane, Beira, <del>Maputo</del>).</p> <p><b>• Why a pilot project?</b></p> <p>A Pilot Project is a highly effective and efficient method of answering to the majority of the questions raised in a composting project. Pilot projects running simultaneously will enable the private investors and the municipalities to:</p> <ul style="list-style-type: none"> <li>o Compare alternative technologies on a small scale</li> <li>o Gain hands-on experience (learning by doing the best ways to develop the fertilizer)</li> <li>o Determine which permits are required and establish relationships with the regulating agencies</li> <li>o Produce a finished compost product for laboratory analysis and test marketing</li> <li>o Establish a design basis for a full scale compost facility</li> <li>o Develop a reasonable cost model to take in capital investment, operating costs, <del>energy</del> and less projects, and return on investment.</li> </ul>	<p><b>Potential Project:</b> Clean energy program</p> <p><b>Arthur D Little INGC</b></p> <p><b>• Short Description:</b></p> <p>The main goal of the project is to create a <del>clean</del> energy program to encourage private sector companies' investment on clean energy in order to adapt to climate change.</p> <p>The use of energy is a strong factor for economic growth and human development. Key sectors like education, healthcare and business in general need an increasing amount of energy. The lack of access to modern energy (electricity, gas) is a major part of being poor and without means of economic opportunities and co-dependence on traditional forms of energy (biomass such as wood, charcoal, dung from animals or agricultural waste) has a number of detrimental effects on the lives of the poor, undermining people's health and environment.</p> <p>Mozambique development is severely constrained by the lack of energy, access particularly in more rural regions of the country. Moreover, Mozambique is highly dependent on oil imports, situation that have high impact in the country external trade balance.</p> <p>Target projects of this program will be focused on sectors like agriculture, tourism or distributed electricity. The goal is to finance innovative solutions to climate variability that helps businesses and / or communities to adapt to climate.</p> <p>This program will be responsible for a high impact on climate change in Mozambique since it gives access to enterprises and energy providers to compete for funding for clean energy investments nation wide.</p> <p>The program is going to finance the several stages the project since technical assistance to seed capital and development capital and to cover different types of technologies: solar, wind, biogas, <del>hydro</del>, mini-hydro, and biomass energy generation.</p> <p>Examples from our long list of projects that could enter this program are: mini dams construction, solar ponds installation mainly for irrigation or for tourism facilities, <del>hydro</del>, production or biomass energy production.</p> <p>In Mozambique there is still no approved legislation defining fee in tariffs or off-grid tariffs which can be a major constraint for traditional investors.</p> <p>So, the project would be structured in three distinct types of projects:</p> <p>The first type of projects is the high impact social benefits projects such as powering distant villages or improving irrigation. An example of a type one project is the electrification of rural villages.</p> <p>The second type of projects will be the substitute projects in which private entities will replace the use of fuel for some use of clean energy. An example of project can be the production of biogas or the introduction of solar ponds to substitute diesel in tourist facilities.</p> <p>The third type of projects will be the most "traditional type" of projects, based on feed in tariffs and can only be developed when Mozambique legislation regarding <del>energy</del> consider those</p>	<p><b>Potential Project:</b> Development of Agro forestry in Mozambique</p> <p><b>Arthur D Little INGC</b></p> <p><b>• Short Description:</b></p> <p>The main goal of the project is to create an Agro forestry fund to develop agricultural / forestry projects that along with financial returns provide rural communities with tools to become better environmental stewards in order to save their forests and water and improve their living conditions.</p> <p>The fund will manage private equity dedicated to sustainable forestry projects - and can have investors such as foundations, family offices and pension funds.</p> <p>Agro forestry is an integrated approach of using the interactive benefits from combining trees and shrubs with crops and/or livestock.</p> <p>A Agro forestry fund has the potential to help investors adapt to climate change by providing funds to reform and capabilities needed to involve the communities in the reforestation process in order to avoid "slash and burn" agriculture approaches by the communities, which involves cutting and burning of forests or woodlands to create fields and has a detrimental effect on long-term quality of land.</p> <p>Target companies can include those profiting from outstanding forest management practices (including the manufacture of environmentally certified wood products), community foundations that want to develop and improve the living conditions of the communities or agricultural companies that want to diversify their products while protecting their lands.</p> <p>There are several opportunities to invest in sustainable forestry projects in Mozambique - the team identified some opportunities of agro forestry in Cabo Delgado, Manhiça, Zambezia and Beira.</p> <p><b>• Potential benefits and interest for private investors and / or donors:</b></p> <p>The projects will be able to demonstrate a return on investment and a strong social / environmental impact.</p> <p>The type of results will highly depend on each project and can be:</p> <ul style="list-style-type: none"> <li>• Financial returns through CDM certificates</li> <li>• Financial returns through the creation of a market for the cash crops planted</li> <li>• Financial returns through the selling of new products (e.g. fruits)</li> <li>• Diversified crops and labor resources</li> <li>• Increasing food security for a region</li> <li>• More income and community jobs per hectare of land.</li> </ul>

In the next phase we will develop project dossiers for each of this projects

0 Executive Summary

1 Phase 1

**2 Phase 2**

2.1 Executive Summary

**2.2 Strategic Objectives**

2.3 Screening Phase

2.4 Evaluation Phase

2.5 Adaptation measures shortlist

2.6 Selection Phase

2.7 Selected Projects – Project Sheets

3 Phase 3

For Phase 2, we aimed to achieve four strategic objectives

### Strategic objectives for Phase 2



To develop a screening methodology to apply to the **adaptation measures portfolio** in order to get a more manageable short-list of adaptation options

To perform an **evaluation of the adaptation measures portfolio** based on the **high-level cost-benefit analysis** and a **feasibility evaluation** on the options included in the long-list of adaptation measures

To **involve private investors in the evaluation** of each shortlisted adaptation measure and **develop participation plans** for individual or groups of private investors to each final adaptation option

To **select 3 to 5 adaptation and mitigation options** to be detailed in the project's next phase

0 Executive Summary

1 Phase 1

**2 Phase 2**

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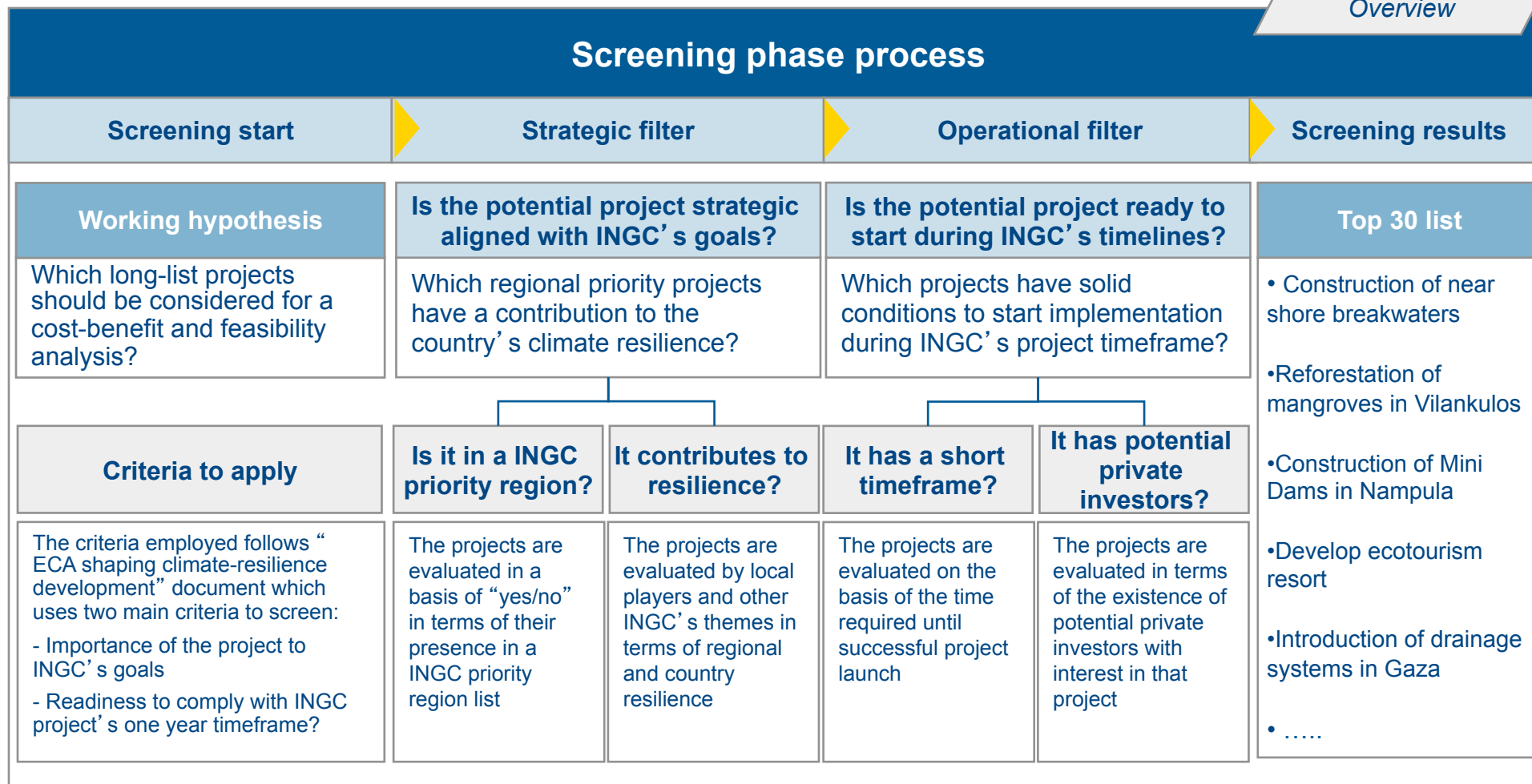
2.7 Selected Projects – Project Sheets

3 Phase 3



The screening process is based on “ ECA shaping climate-resilience development” document which suggests to reduce the long list to a more manageable size before cost-benefit analysis

Overview



The long-list projects that stay in the screening phase have a set of actions to promote their implementation in the medium-term

Overview

### Screening phase is a continuous process

Work Hypothesis	Key Milestones	Project typology	Next actions
<p><b>Screening phase</b></p> <p>Which long-list projects should be considered for a cost-benefit and feasibility analysis?</p>	<p><b>Go to next phase</b> ✓</p> <p>Projects with the best conditions to achieve INGC's goals while complying with the one year timeframe?</p> <p><b>Stay in this phase</b> ✗</p> <p>Projects without one or more critical conditions to achieve success under INGC's goals and timings</p>	<p><b>Projects with potential high cost-benefit and feasibility</b></p> <p><b>Projects in non-priority regions</b></p> <p><b>Projects with low resilience contribution</b></p> <p><b>Projects with long timeframe</b></p> <p><b>Projects without clear interested private investors</b></p>	<ul style="list-style-type: none"> <li>Evaluate projects in greater detail in terms of investments, costs, losses averted, increased benefits and feasibility</li> <li>Push projects to be included in a package with projects in priority regions</li> <li>"Force" project as a requirement or fiscal benefit for new investments in that region</li> <li>Group a number of low resilience projects to achieve one "critical mass project"</li> <li>"Force" project as a requirement or fiscal benefit for new investments in that region</li> <li>Monitor projects every year to understand best timing to support project's roll-out</li> <li>Pitch projects for public sector and not-for-profit support</li> <li>Evaluate insurance options</li> </ul>

Firstly, we aligned the potential projects with INGC's goals and eliminated all the potential projects planned for non strategic areas

*Example of eliminated projects*

### Excluded areas / projects

#### Chinde, Mopeia and Morrumbala

- Develop irrigation / drainage system
- Introduction of flood tolerant crops
- Construction of Mini Dams

#### Machanga

- Introduction of flood tolerant crops
- Forestation of mangroves
- Increase crops yield through the reduction of ground-level ozone

#### Bilene

- Develop irrigation system
- Produce solar energy at tourist facilities to decrease energy dependence
- Introduction of drought tolerant crops



#### Maganja, Namacurra and Nicoadala

- Develop and implement an integrated fire management system
- Introduction of drought tolerant crops
- Upgrade main routes ahead of predicted occurrences of floods

#### Matola

- Increase crops yield through the reduction of ground-level ozone
- Increase of storage facilities in Matola port

**We eliminated the potential adaptation projects planned for areas that were not considered a priority for INGC (1/3)**

### Overlap between INGC priority areas and Arthur D. Little areas in the North

#### Cabo Delgado



- Includes two priority areas (Pemba and Ecoenergia Pilot area)
- Examples of selected projects:
  - Development of agro forestry
  - Produce solar energy at tourist facilities to decrease energy dependence

#### Nampula



- Includes two priority areas (Angoche e Nacala)
- Example of the selected projects
  - Construction of a pharmaceutical factory / supply channels
  - Construction of Mini Dams



#### Quirimba National Park



- Not considered as a priority area
- Example of projects that were eliminated:
  - Production of Energy based on Biomass
  - Production of solar energy

#### Nacala



- One of the priority areas
- Example of the selected projects:
  - Develop ecotourism resort
  - Improvement of climate forecast infrastructure
  - Introduction of different crops for the production of Biofuel

**We eliminated the potential adaptation projects planned for areas that were not considered a priority for INGC (2/3)**

### Overlap between INGC priority areas and Arthur D. Little areas in the Center

#### Moatize, Motarara and Changara



- One of the priority areas
- Example of the selected projects:
  - Construction of floodgate / river breakwater wall
  - Introduce redundancy and business continuity in railways
  - Construction of Mini Dams

#### Chinde, Mopeia and Morrumbala



- Not considered as a priority area
- Example of projects that were eliminated:
  - Develop irrigation / drainage system
  - Introduction of flood tolerant crops



#### Machanga



- Not considered as a priority area
- Example of projects that were eliminated:
  - Introduction of flood tolerant crops
  - Forestation of mangroves

#### Maganja, Namacurra and Nicoadala



- Not considered as a priority area
- Example of projects that were eliminated:
  - Develop and implement an integrated fire management system
  - Introduction of drought tolerant crops

#### Beira Buzi and Dondo

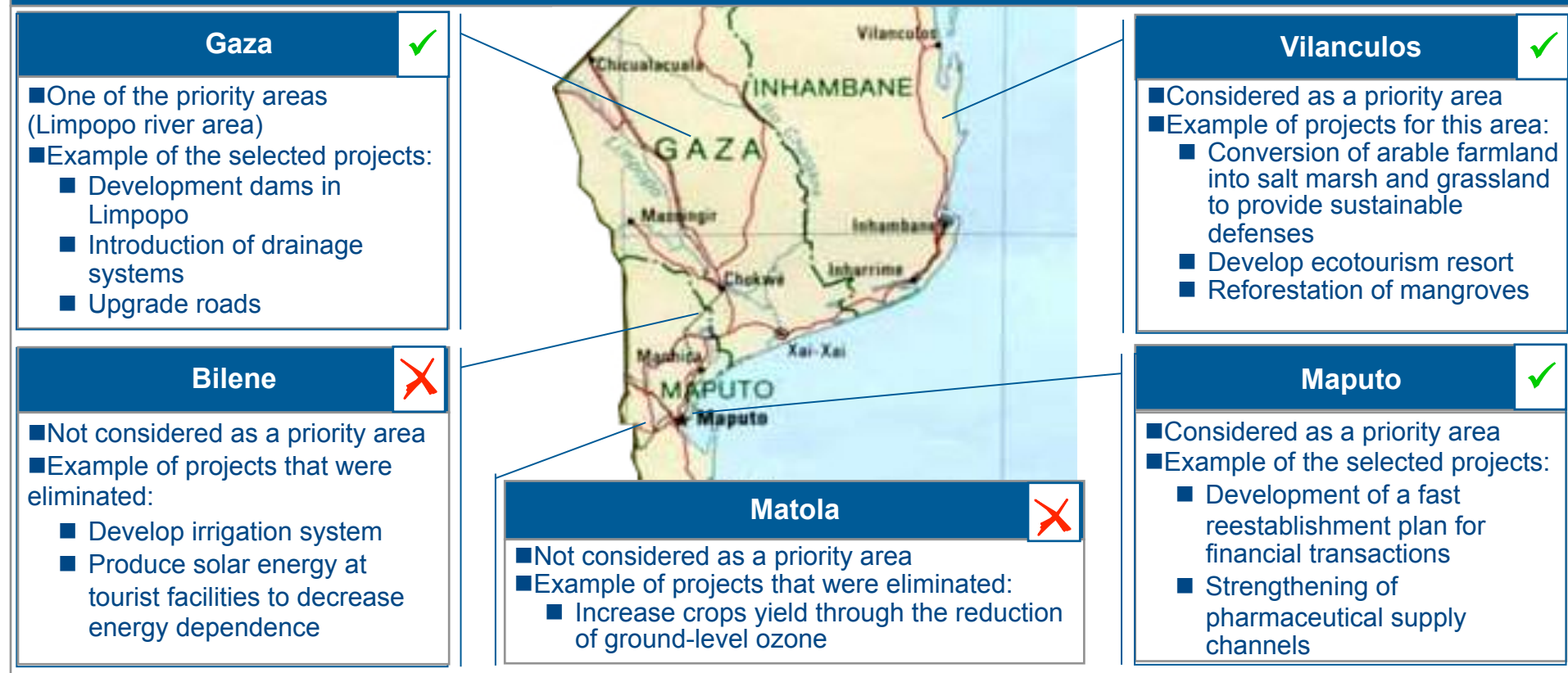


- Includes two priority areas (Beira and Buzi)
- Example of the selected projects:
  - Develop storage facilities in Beira port
  - Increase crops yield through the reduction of ground-level ozone



**We eliminated the potential adaptation projects planned for areas that were not considered a priority for INGC (3/3)**

### Overlap between INGC priority areas and Arthur D. Little areas in the South



Based on validations with sector experts, we then eliminated all of the potential projects considered of low significance for resilience

### Regional and country resilience significance

“Floodgates improve water management and decrease the probability of floods and also control salt intrusion that will and is already a problem in many places along the coast”

“I agree that the introduction of tolerant crops is a very important issue”

Rui Brito (Crops Theme)

“Rain water harvesting and the improvement of climate forecast infrastructure are projects of very high interest and very high importance, we definitely support each of them as they are very critical in terms of operations and could help also all the sub region specially on forecast weather and develop new culture with the rainfall harvesting”

Stephane Derweduwen (AVIAM)

- “Desalination plants are expensive and need a lot of electricity.”

Laurie Barwell ( Coastal Theme)

- “Desalination do not have interest for this region”

Carlos Henriques (MozFood)

- “desalination is extremely expensive both to build and to operate and needs strong technology understanding for running the plant. Capable staff needs to be available”

Georg Peterson (Water Theme)






“The development of these projects:

- 1 - Forestation / Reforestation with product diversity
- 2 - Construction of a bridge and
- 3 - Increase crops yield through the reduction of ground-level ozone

I believe that they will be of high importance for the region”

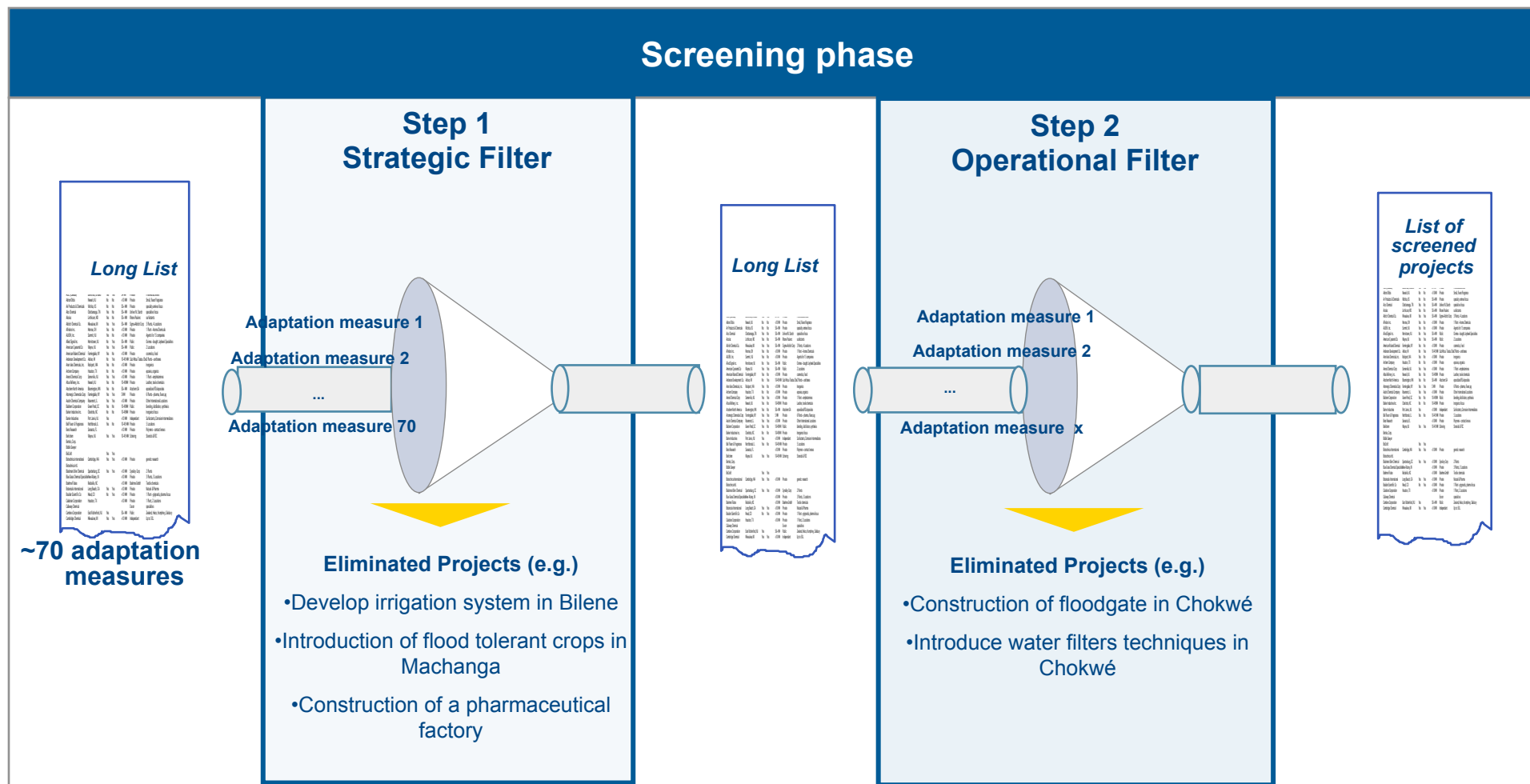
Jorge Petiz (Buzi Açucar)

**Finally, we eliminated all the adaptation measures that could not be implemented in a short-term future or that could not be linked to any private sector investor**

Adaptation measure	Timeframe	Private investor that might be interested?	Continue to next step?
Construction of a pharmaceutical factory in Nampula	<b>Long</b> – Any pharma company will need to perform multiple strategy studies before deciding to develop a factory in Mozambique	<ul style="list-style-type: none"> <li>■ GlaxoSmithKline</li> <li>■ Pfizer</li> <li>■ Generic pharma companies</li> </ul>	
Development of a drainage system in Gaza (Chokwé)	<b>Short</b> – A local company that is already feeling the need of this type of project might commit with it in the short term	<ul style="list-style-type: none"> <li>■ MozFoods</li> <li>■ J.F.S.</li> </ul>	
Introduction of drought tolerant crops	<b>Short</b> – A local company that is already feeling the need of this type of project might commit with it in the short term	We could not identify any private investor that might be interested in this project for this particular area	
Rainwater Harvesting	<b>Short</b> – A local company could support development of this project, as it does not require high technology to implement	<ul style="list-style-type: none"> <li>■ Aviam</li> </ul>	
Increase crops yield through the reduction of ground-level ozone in Beira	<b>Short</b> – A local company could support development of this project and the results are seen in a crop cycle	<ul style="list-style-type: none"> <li>■ Buzi Açucar</li> <li>■ Mafambisse</li> <li>■ Priu Agriculture</li> </ul>	



From the long list of approximately 70 potential adaptation options we identified a list of 40 projects that were then evaluated in terms of cost benefit and feasibility



0 Executive Summary

1 Phase 1

**2 Phase 2**

2.1 Executive Summary

2.2 Strategic Objectives

2.3 Screening Phase

**2.4 Evaluation Phase**

2.4.1 Cost-benefit analysis

2.4.2 Feasibility analysis

2.5 Adaptation measures shortlist

2.6 Selection Phase

2.7 Selected Projects – Project Sheets

3 Phase 3

After project screening, we developed a thorough cost-benefit and feasibility analysis in order to identify a shortlist of the most attractive projects

Overview

Evaluation phase process			
Evaluation start	Key indicators	Key criteria	Evaluation results
Which projects should be shortlisted for a more detailed evaluation, in terms of financing options and investment barriers?	Cost-benefit	<ol style="list-style-type: none"> <li><b>Investment</b> – expected investment of the adaptation measure</li> <li><b>Operating costs</b> – expected operating and maintenance costs of the adaptation measure</li> <li><b>Expected increased revenues</b> – expected delta in revenues deriving from the adaptation measure</li> <li><b>Loss averted</b> – costs that are expected no longer exist due to the implementation of the adaptation measure</li> </ol>	Top 10 list
	Feasibility	<ol style="list-style-type: none"> <li><b>Private investor's familiarity:</b> Is the private investor familiar with Mozambique's business context?</li> <li><b>Private investor's commitment:</b> Is the private investor committed to invest in this adaptation project?</li> <li><b>Financing institution's interest:</b> Is the project a high priority for the financing institutions?</li> </ol>	<div>High cost-benefit projects</div> <div>+</div> <div>High feasibility projects</div>

0 Executive Summary

1 Phase 1

**2 Phase 2**

2.1 Executive Summary

2.2 Strategic Objectives

2.3 Screening Phase

**2.4 Evaluation Phase**

**2.4.1 Cost-benefit analysis**

2.4.2 Feasibility analysis

2.4.3 Short list identification

2.5 Adaptation measures shortlist

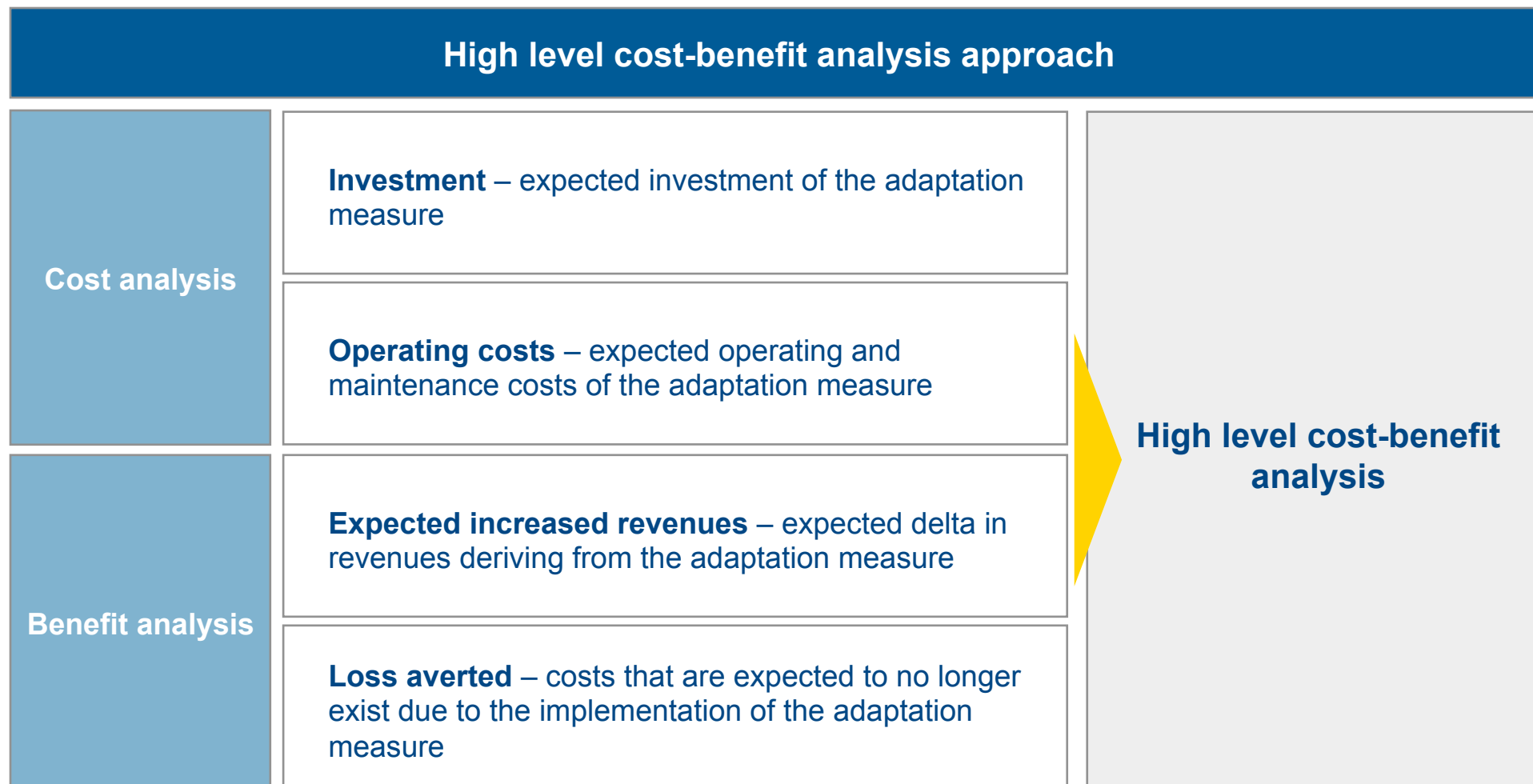
2.6 Selection Phase

2.7 Selected Projects – Project Sheets

3 Phase 3

## 2.4.1 Evaluation phase – Cost-Benefit analysis - Approach

The cost-benefit analysis is focused only on the variations of costs (investment and operating) and benefits (losses averted and increased revenues)



Source: ECA – Shaping climate-resilient development: a report of the economics of climate adaptation group, ECA – Enhancing the climate risk and adaptation fact base for the Caribbean

## 2.4.1 Evaluation phase – Cost-Benefit analysis

**The 33 potential projects that were selected in the screening phase, were then grouped into 19 sets of similar measures for cost-benefit analysis (1/2)**

Nº	Adaptation Measures	Projects grouped into 19 sets of similar measures	
1	Construction of Mini Dams in Búzi	Construction of Mini Dams	
	Construction of Mini Dams in Cabo Delgado		
	Construction of Mini Dams in Nampula		
2	Construction of Coastal protections Beira	Construction of Seawalls	
	Construction of Coastal protections Nacala		
3	Construction of Coastal protections Maputo	Construction of near shore breakwaters	
4	Conversion of arable farmland into salt marsh and grassland to provide sustainable defenses in Vilanculos	Conversion of arable farmland into salt marsh and grassland	
5	Construction of Macuti houses in Mozambique island	Mozambique island	Develop tourism resort
	“Stone and Clay” city resilience in Mozambique island		
	Resettlement to the Coastal Land in Mozambique island		
	Develop ecotourism resort in Maputo	Ecotourism	
	Develop ecotourism resort with energy and communications independence in Vilanculos		
6	Reforestation with agricultural activities in Buzi	Development of Agro forestry	
	Development of agro forestry in Cabo Delgado		
	Development of agro forestry in Nampula		
7	Development of microcredit solutions for adaptation	Development of microcredit solutions for adaptation	
8	Reforestation of mangroves in Vilanculos	Reforestation	
	Reforestation of Quirimbas National Park		

## 2.4.1 Evaluation phase – Cost-Benefit analysis

**The 33 potential projects that were selected in the screening phase, were then grouped into 19 sets of similar measures for cost-benefit analysis (2/2)**

Nº	Adaptation Measures	Projects grouped into 19 sets of similar measures
9	Increase crops yield through the reduction of ground-level ozone in Cabo Delgado	Increase crops yield through the reduction of ground-level ozone
	Increase crops yield through the reduction of ground-level ozone in Búzi	
10	Small scale solar plant in Maputo	Small scale solar plant
11	Introduce water filters techniques in Búzi	Introduce water filters techniques
12	Introduction of a different variety of crops in the production of bio fuel in Cabo Delgado	Introduction of resilient crops for the production of Biofuel
	Introduction of Resilient crops for the production of Biofuel in Nacala	
13	Introduction of rainwater harvesting techniques in Nacala	Introduction of rainwater harvesting techniques
14	Produce solar energy at tourist facilities to decrease energy dependence in Quirimbas National Park	Produce solar energy at tourist facilities to decrease energy dependence
	Produce solar energy at tourist facilities to decrease energy dependence in Vilanculos	
	Produce solar energy at tourist facilities to decrease energy dependence in Beira	
15	Production of Energy based on Biomass in Quirimbas National Park	Production of Energy based on Biomass
16	Solar panels for irrigation in Cabo Delgado	Solar panels for irrigation
17	Upgrade main routes ahead of predicted occurrences of floods (e.g.: Bridges) in Búzi	Small infrastructures development
18	Introduction of drainage systems in Gaza	Introduction of drainage systems
19	Development of fertilizers by composting of organic waste	Development of fertilizers by composting of organic waste

**The construction of a mini dams will improve water management and produce energy – the cost-benefit analysis shows that the measure is worthwhile**

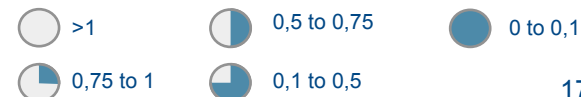
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### Construction of mini-dams

Cost-benefit



Description	A mini dam is a small hydroelectric power that generates energy, helps to improve irrigation and control floods
Potential Benefits	The construction of a mini dam will improve water management conditions helping in flood control and contributing to the reduction of energy dependence for the investor. This investment can also contribute to boost the economy of the villages nearby
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> <li>■ Meetings with private investor</li> <li>■ Private investor documentation with a detailed business case on the implementation of mini dams construction</li> </ul>
Main sources	<ul style="list-style-type: none"> <li>■ Private investor documentation</li> </ul>





### Seawalls will contribute to the protection of the infrastructure and equipments near the coast – the cost-benefit analysis shows a negative cost-benefit

2

#### Construction of Seawalls

Cost-benefit



Description	Form of coastal defense constructed where the sea impacts directly upon the landforms of the coast. Its prime purpose is to modify the potentially destructive action of tides and waves such that areas of human habitation, conservation, leisure and economic activities, are protected in the long term from the effects of erosion and / or flooding
Potential Benefits	Seawalls will contribute more successfully to the protection of the infrastructure and equipments
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> <li>■ Benchmarking of levels of investment and operating costs</li> <li>■ Considered cost-benefit ratio based on EACC report estimations of total adaptation costs and total damage costs due to sea level rise with and without adaptation measures</li> <li>■ Benchmarking of Seawalls construction in similar countries – We have seen that cost-benefit ratio is negative in the great majority of the benchmark cases identified                             <ul style="list-style-type: none"> <li>– Minimum cost-benefit observed 1,4:1</li> </ul> </li> </ul>
Main sources	<ul style="list-style-type: none"> <li>■ Theme 2 presentation: information on costs and potential benefits from the adaptation measures</li> <li>■ Economics of Adaptation to Climate Change reports: world bank information on total adaptation costs and total damage costs due to sea level rise with and without adaptation measures</li> <li>■ Economics of Climate Adaptation reports: case studies proxys of cost-benefit</li> </ul>



### Construction of breakwaters will contribute to the protection of infrastructures and equipments – the cost-benefit analysis shows a negative cost-benefit

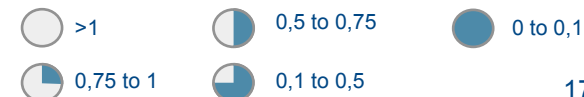
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#### Construction of near shore breakwaters

Cost-benefit



Description	Near shore breakwaters are segmented, shore parallel structures built along the upper beach at approximately high water mark. They are normally built of rock, but can be formed of concrete armour units
Potential Benefits	Near shore breakwaters will contribute successfully to the protection of infrastructure and equipments
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> <li>■ Benchmarking of levels of investment and operating costs</li> <li>■ Benchmarking of construction of near shore breakwaters in similar countries – We have seen that cost-benefit ratio is negative in the great majority of the benchmark cases identified                             <ul style="list-style-type: none"> <li>– Case studies indicate a range of cost-benefit ratio between 1:1 (in Cayman islands and Jamaica) and 55:1 (in Dominica)</li> </ul> </li> <li>■ The coastal protection measures (including the construction of near shore breakwaters) were based on the Bermuda case study                             <ul style="list-style-type: none"> <li>– This case study reveals a cost-benefit ratio similar to Mozambique's reality on coastal protection measures that were considered in EACC (e.g. sea walls and dikes)</li> </ul> </li> </ul>
Main sources	<ul style="list-style-type: none"> <li>■ Theme 2 presentation: information on costs and potential benefits from the adaptation measures</li> <li>■ Economics of Adaptation to Climate Change reports: world bank information on total adaptation costs and total damage costs due to sea level rise with and without adaptation measures</li> <li>■ Economics of Climate Adaptation reports: case studies proxy of cost-benefit</li> </ul>



### The conversion of arable land into salt marsh may contribute to the protection of coastal areas – the cost-benefit analysis shows that the measure is worthwhile

4

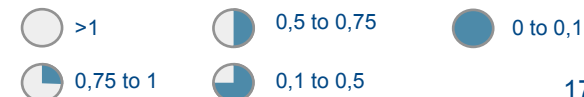
#### Conversion of arable land into salt marsh

Cost-benefit



Description	A salt marsh is an environment between land and salty or brackish water, dominated by dense stands of halophytic (salt-tolerant) plants such as herbs, grasses, or low shrubs
Potential Benefits	This adaptation measure should contribute to protect the coastal area – private investors can invest in a measure like this in order to protect their investments near the coast, preventing damage to properties, breakdown of equipments and energy cuts
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> <li>■ Considered “Conversion of arable farmland into salt marsh” as a coastal zoning mechanism</li> <li>■ Case studies indicate a range of cost-benefit ratio between 0,05:1 (in several Caribbean countries<sup>1</sup>) and 0,75:1 (in Dominica)</li> <li>■ The coastal protection measures (including the conversion of arable land into salt marsh) were based on the Bermuda case study <ul style="list-style-type: none"> <li>– This case study reveals a cost-benefit ratio similar to Mozambique’s reality on coastal protection measures (related to sea level rise) that were considered in EACC (e.g. sea walls and dikes)</li> </ul> </li> </ul>
Main sources	<ul style="list-style-type: none"> <li>■ Theme 2 presentation: information on costs and potential benefits from the adaptation measures</li> <li>■ Economics of Adaptation to Climate Change reports: world bank information on total adaptation costs and total damage costs due to sea level rise with and without adaptation measures</li> <li>■ Economics of Climate Adaptation reports: case studies proxy of cost-benefit</li> </ul>

<sup>1</sup> Anguilla, Antigua and Barbuda, Barbados, Bermuda, Jamaica and Sta Lucia



### An ecotourism resort contributes to the development of local communities – the cost-benefit analysis shows that the measure is worthwhile

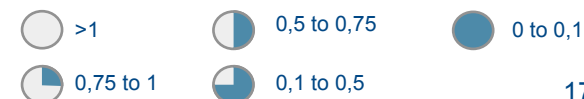
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#### Development of an Ecotourism resort

Cost-benefit



Description	Ecotourism resort provides for conservation measures, includes meaningful community participation and is profitable and can sustain itself.
Potential Benefits	With its own self-sustainable infrastructures, the resort will be better prepared to resist to natural hazards, protect biodiversity and boost development of the villages nearby
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> <li>■ Private investor documentation with information regarding the potential demand of the project</li> <li>■ Benchmarking of average revenues per night</li> <li>■ Estimation of operating costs considering similar examples from ADL experience (an example of the construction of a hotel of a tourism player)</li> </ul>
Main sources	<ul style="list-style-type: none"> <li>■ Technoserve – Tourism Development Plan for Ilha de Mocambique</li> <li>■ Hotels websites</li> </ul>



**The development of agro forestry may contribute for the reduction of soil erosion – the cost-benefit analysis shows that the measure is highly worthwhile**

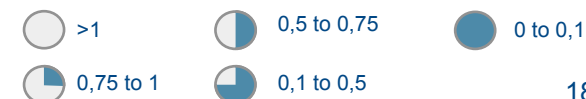
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### Development of agro forestry

Cost-benefit



Description	The development of agro forestry consists in the integration of trees with crops
Potential Benefits	The integration of trees with crops contributes to the reduction of soil erosion and consequently increases in revenues (both through the increase of crops yield or alternative revenue sources) and in food security. This measure can represent at the same time a mitigation option since it depends on reforestation
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> <li>■ Benchmarking of experiences and business cases described in FAO reports                             <ul style="list-style-type: none"> <li>– The main benefits are considered to be increasing crops yield, avoiding losses of productivity (it is implied above that agroforestry would replace present systems that are lower-yielding but stable in output) and alternative revenues in the form of poles, firewood and fruit</li> <li>– The main costs are related with the cost of planting and maintaining the new trees and initial decrease of crops yield (it is assumed that land is diverted to trees)</li> </ul> </li> </ul>
Main sources	<ul style="list-style-type: none"> <li>■ FAO – Food and Agriculture Organization: benefits and costs associated to this measure</li> </ul>



**The development of a microcredit line for adaptation will help poor individuals and families to adapt to climate change - this measure is highly worthwhile and will be detailed in Phase 3**

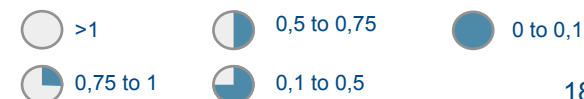
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### Development of microcredit solutions for adaptation

Cost-benefit



Description	The main goal of this project is to develop a microcredit line focused only on adaptation projects supported by the government and run by private companies or NGO's
Potential Benefits	Microfinance has the potential to help the poorest and most vulnerable segments of the populations adapt to climate change by providing individuals & small companies with a means of accumulating and managing the assets and capabilities needed to become less susceptible to the impact of natural hazards
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> <li>The cost benefit of such a program is always very positive, but will only be fully validated in Phase 3. According to Blue Orchard: “The high cost of capital in the developing world (20-100% APR), the high demand for credit, and the low cost of labor, make transaction-intensive microfinance quite profitable if done right”</li> </ul>
Main sources	<ul style="list-style-type: none"> <li>Aga Khan, Blue Orchard, Monitor Institute</li> </ul>



### Reforestation may contribute to the protection of coastal areas and / or soils – the cost-benefit analysis shows that the measure is worthwhile

8

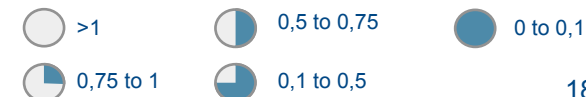
#### Reforestation

Cost-benefit



Description	Reforestation consists in restocking of existing forests which have been depleted
Potential Benefits	This adaptation measure should contribute to improve soil conditions, help control floods and reduce cyclone impacts. It can also have a very positive impact on investments near the coast.
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> <li>■ Benchmarking of reforestation of mangroves in other developing countries – We have seen that cost-benefit ratio is high in the great majority of the benchmark cases identified</li> <li>■ Case studies indicate a range of cost-benefit ratio between 0,1:1 (in several Caribbean countries<sup>1</sup>) and 1:1 (the maximum, in Dominica)</li> <li>■ The coastal protection measures (reforestation of mangroves) were based on the Bermuda case study – This case study reveals a cost-benefit ratio similar to Mozambique's reality on coastal protection measures that were considered in EACC (e.g. sea walls and dikes)</li> </ul>
Main sources	<ul style="list-style-type: none"> <li>■ Theme 2 presentation: information on costs and potential benefits from the adaptation measures</li> <li>■ Economics of Adaptation to Climate Change reports: world bank information on total adaptation costs and total damage costs due to sea level rise with and without adaptation measures</li> <li>■ Economics of Climate Adaptation reports: case studies proxy of cost-benefit</li> </ul>

<sup>1</sup> Anguilla, Antigua and Barbuda, Barbados, Bermuda, Jamaica and Sta Lucia



**This project contributes to increase revenues and food security – the cost-benefit analysis shows that the measure is highly worthwhile**

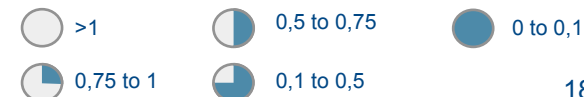
9

### Increase crops yield through the reduction of ground-level ozone

Cost-benefit



Description	This adaptation measure is based on the hypothesis that ground-level ozone is one essential factor that determines the final crop yield. The project seeks to determine if average Crop yield in Mozambique can be increased by 20% or more as the result of minimizing the effects of ground level ozone
Potential Benefits	The introduction of different techniques might increase crop yields without using high technology. This contributes to revenues increase for private investors and to the increase of food security in the region
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> <li>■ Meetings with Theme 6 to understand the potential costs and benefits of the adaptation measure: <ul style="list-style-type: none"> <li>– Without high investment it is possible, just by controlling the current operating costs (e.g. in fertilizers), to increase crops yield and revenues associated by 20%</li> </ul> </li> <li>■ Meeting with potential private investor interested in the measure to understand how much 20% could represent in additional revenues</li> </ul>
Main sources	<ul style="list-style-type: none"> <li>■ Theme 6: project' s budget and success cases benefits</li> </ul>





### The construction of small scale solar plants will reduce energy dependence – the cost-benefit analysis shows that the measure is worthwhile

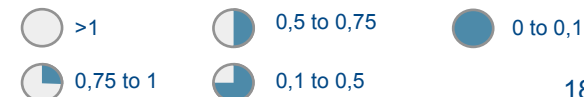
10

#### Small scale solar plant

Cost-benefit



Description	The development of small scale solar plants are planned for Mozambique to explore the country abundant resources to produce clean energy in a decentralized fashion
Potential Benefits	<p>This adaptation measure should reduce energy dependence of private investors or bring electricity to rural communities that otherwise would not have access</p> <p>A private investor has done an extensive cost-benefit analysis comparing the production of solar energy with the production of energy based on fuel and concluded that the production of solar energy is always more cost-efficient. Moreover, if a feed in tariff is introduced this project has a positive NPV even when not considering fuel-based electricity generation</p>
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> <li>■ Meetings with private investor</li> <li>■ Private investor documentation with a detailed business case on the implementation of solar photovoltaic energy</li> </ul>
Main sources	<ul style="list-style-type: none"> <li>■ Private investor documentation: potential benefits and costs of the implementation of solar pv mini-generation plants in Maputo, Beira and Pemba</li> </ul>



**The introduction of water filter techniques contributes to the desalinization of the water – the cost-benefit analysis shows that the measure has a negative cost-benefit**

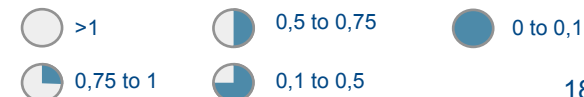
11

### Introduce water filters

Cost-benefit



Description	Introduction of water filters for the agricultural application of desalinized water.
Potential Benefits	Water desalinization technologies will give access to clean water for the investors. This investment will contribute to boost agriculture
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> <li>■ Benchmarking of levels of investment and operating costs                             <ul style="list-style-type: none"> <li>– Investment per hectare</li> <li>– Operating costs per hectare</li> <li>– Energy consumption per hectare</li> </ul> </li> <li>■ Meetings with private investor to estimate the potential loss averted of a measure like this</li> </ul>
Main sources	<ul style="list-style-type: none"> <li>■ Theme 2: high operating costs (e.g. high costs related to energy consumption, very expensive techniques and huge amount of water needed for agricultural purposes)</li> <li>■ Texas Water Development Board</li> </ul>



**The introduction of different crops for the production of bio fuel may contribute to energy independence – the cost-benefit analysis shows that the measure is worthwhile**

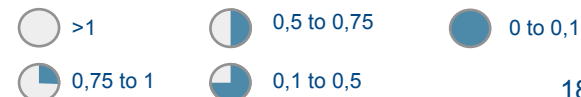
12

### Introduce different crops for bio fuel production

Cost-benefit



Description	Introduction of a different variety of crops in the production of bio fuel by expanding an existing sugar cane and sweet sorghum test plantation in Cabo Delgado
Potential Benefits	This adaptation measure should not only enable income generating activities for local communities, direct and indirect jobs, but also reduce the dependence on oil which contributes to the country's energy security and reduction in greenhouse gas emissions
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> <li>■ Private investor documentation with a detailed business case on the implementation of biofuel production                             <ul style="list-style-type: none"> <li>– Main private sector benefit: investment return superior to 10% of capital employed and capital gains superior to €4.000.000</li> <li>– Main community benefits: Income generating activities for local communities and direct and indirect jobs increase</li> <li>– Main region benefits: Less dependence on oil which contributes to country's energy security and reduction in greenhouse gas emissions</li> </ul> </li> </ul>
Main sources	<ul style="list-style-type: none"> <li>■ Theme 4: Ecoenergia</li> </ul>



### The introduction of rainwater harvesting techniques contributes to improve water management – the cost-benefit analysis shows that the measure is worthwhile

13

#### Introduction of rainwater harvesting techniques

Cost-benefit



Description	Rainwater harvesting is the storing of rainwater for reuse. It has been used for example to provide drinking water, water for livestock and water for irrigation
Potential Benefits	<p>This adaptation measure should improve water management conditions and contribute for the improvement of agriculture and living conditions of the population (there is a significant number of droughts reported in the North of the country for example).</p> <p>Rainwater harvesting is convenient in the sense that it provides water at the point of consumption, reducing operation and maintenance problems. Running costs, also, are almost negligible</p>
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> <li>■ Benchmark of costs/m<sup>3</sup> of storage water in The Global Development Research Center reports</li> <li>■ Benchmark of how much land can be irrigated, with a flow of how many liters and for how long – in order to calculate the average number of liters needed to irrigate 1 hectare (Agriinfo.in)</li> <li>■ Used as proxy revenues per hectare of a private investor to compare with the costs per hectare (derived from the two points above)</li> </ul>
Main sources	<ul style="list-style-type: none"> <li>■ The Global Development Research Center: costs of storage water infrastructures</li> <li>■ Agriinfo.in - My Agriculture Information Bank: land irrigation details</li> </ul>

<sup>1</sup> Anguilla, Antigua and Barbuda, Barbados, Bermuda, Jamaica and Sta Lucia



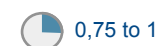
>1



0,5 to 0,75



0 to 0,1



0,75 to 1



0,1 to 0,5

**The production of solar energy may contribute to decrease energy dependence – the cost-benefit analysis shows that the measure is worthwhile**

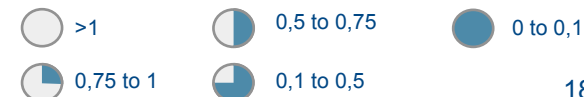
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### Production of solar energy at tourist facilities

Cost-benefit



Description	The introduction of solar photovoltaics provides energy independence to the facility
Potential Benefits	<p>This adaptation measure should reduce energy dependence of the tourist facility.</p> <p>A private investor has carried out an extensive cost-benefit analysis comparing the production of solar energy with the production of energy based on fuel and concluded that the production of solar energy is always more cost-efficient</p>
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> <li>■ Meetings with private investor</li> <li>■ Private investor documentation with a detailed business case on the implementation of solar photovoltaic energy</li> </ul>
Main sources	<ul style="list-style-type: none"> <li>■ Private investor documentation: potential benefits and costs of the implementation of solar photovoltaics</li> </ul>



**The production of electricity based on Biomass needs to be performed in large scale to be cost effective – the cost-benefit analysis shows a negative cost-benefit for Quirimbas**

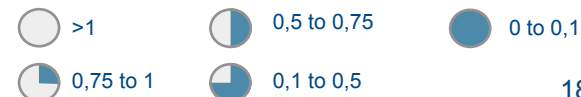
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### Production of Energy based on Biomass in Quirimbas

Cost-benefit



Description	The development of this adaptation project would be the construction of a biomass plant to produce energy to lodges and communities in Quirimba National Park
Potential Benefits	Biomass produce less emissions than fossil fuel, contains less sulfur than coal (producing less SO <sub>2</sub> ). Moreover, a project like this in Quirimbas would bring electricity for the lodges and communities nearby that still do not have access to the grid. Finally, biomass utilization could prevent the effects of forest fires on the atmosphere
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> <li>■ Benchmarking of levels of investment and operating costs and relative size of the plants</li> </ul>
Main sources	<ul style="list-style-type: none"> <li>■ Gekgasifier., FAO</li> </ul>



### Solar panels will generate energy to pump water for irrigation reducing fuel dependency - the cost-benefit analysis shows that the measure is worthwhile

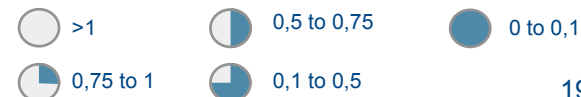
16

#### Solar panels for irrigation in Cabo Delgado

Cost-benefit



Description	Installation of solar panels to generate energy to pump water from the river and distribute it through the irrigation system
Potential Benefits	Solar irrigation can be the answer to watering needs of this region. The alternative source of energy is fuel and according to a private investor extensive cost-benefit analysis comparing the production of solar energy with the production of energy based on fuel and concluded that the production of solar energy is always more cost-efficient
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> <li>■ Meetings with private investor to understand the potential costs and benefits of the adaptation measure</li> <li>■ Private investor documentation with a detailed business case on the implementation of solar photovoltaic energy</li> </ul>
Main sources	<ul style="list-style-type: none"> <li>■ UNDP project for the province of Gaza</li> <li>■ Use of solar panels for irrigation in Brazil</li> <li>■ Private investor</li> </ul>



### Upgrading main routes can improve distribution channels and minimize loss averted – the cost-benefit analysis shows that the measure is worthwhile

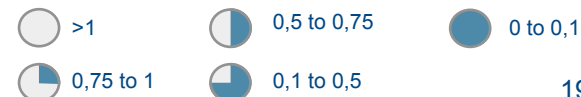
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#### Small infrastructures development

Cost-benefit



Description	Improving routes used in the distribution of the crops. It was considered the construction of a bridge in the Buzi area
Potential Benefits	Upgrading main routes contributes to the improvement of distribution channels, which contributes to minimize loss averted. For example, in Buzi area the only way to cross the river is through a boat named “batelão”. For at least 3 weeks every year the “batelão” cannot work due to river flooding that, with climate change is likely to increase impacting the area even more.
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> <li>■ Benchmark of bridges construction costs</li> <li>■ Meetings with private investor to understand the potential costs and benefits of the adaptation measure</li> </ul>
Main sources	<ul style="list-style-type: none"> <li>■ Private investor working group member</li> <li>■ California Department of Transportation: Construction costs of bridges</li> </ul>





**A drainage system could have a significant impact in drainage and salinization issues – the cost-benefit analysis shows that the measure is highly worthwhile**

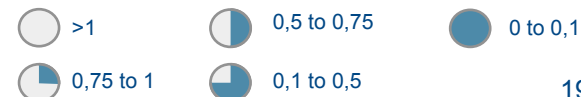
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### Introduction of Drainage Systems

Cost-benefit



Description	A drainage system is a system that controls the surface water to avoid for example the loss of crops in agriculture land
Potential Benefits	Will improve water management and agriculture helping in floods control. With climate change, the regions in the south for example, are likely to have more floods, meaning that not only private sector investments in the region may be highly affected but also food security in the villages nearby can decrease
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> <li>■ Meetings with private investor to evaluate the potential benefit of the measure</li> <li>■ Benchmarking of the introduction of Drainage Systems in other developing countries – We have seen that cost-benefit ratio can be approximately 0 because, despite the initial investment, it is assumed that this adaptation measure implies operating cost savings by reducing labour and other costs related to manual drainage. Nevertheless, it also contributes to high loss averted</li> </ul>
Main sources	<ul style="list-style-type: none"> <li>■ Private investor working group member: estimations of losses due to drainage issues</li> <li>■ Economics of Climate Adaptation reports: : case studies proxys of cost-benefit</li> </ul>



### Development of fertilizers by composting of organic waste will improve waste management and produce organic fertilizer - the cost-benefit analysis shows that the measure is worthwhile

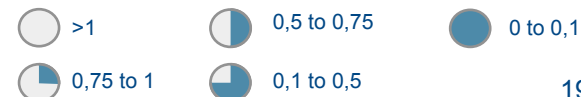
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#### Development of fertilizers by composting of organic waste

Cost-benefit



Description	Composting is a process in which organic wastes are degraded by microorganisms at elevated temperatures under both aerobic and anaerobic conditions.
Potential Benefits	Composting of the organic fraction of city waste will avoid methane emissions from anaerobic decay, increase the lifetime of the existing landfill massively and produce high quality compost for use as natural fertilizer.
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> <li>■ Meeting with private investors to understand costs and potential benefits of the project</li> <li>■ Use of information provided by a private investor that is starting a pilot project in Beira.</li> <li>■ Financial returns are expected to come mainly through CDM certificates and the selling of organic fertilizers and need to be further studied in phase 3 of the project</li> </ul>
Main sources	<ul style="list-style-type: none"> <li>■ Aga Khan, Terra Nova</li> </ul>



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**2.4 Evaluation Phase**

2.4.1 Cost-benefit analysis

**2.4.2 Feasibility analysis**

2.4.3 Short list identification

2.5 Adaptation measures shortlist

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3 Phase 3

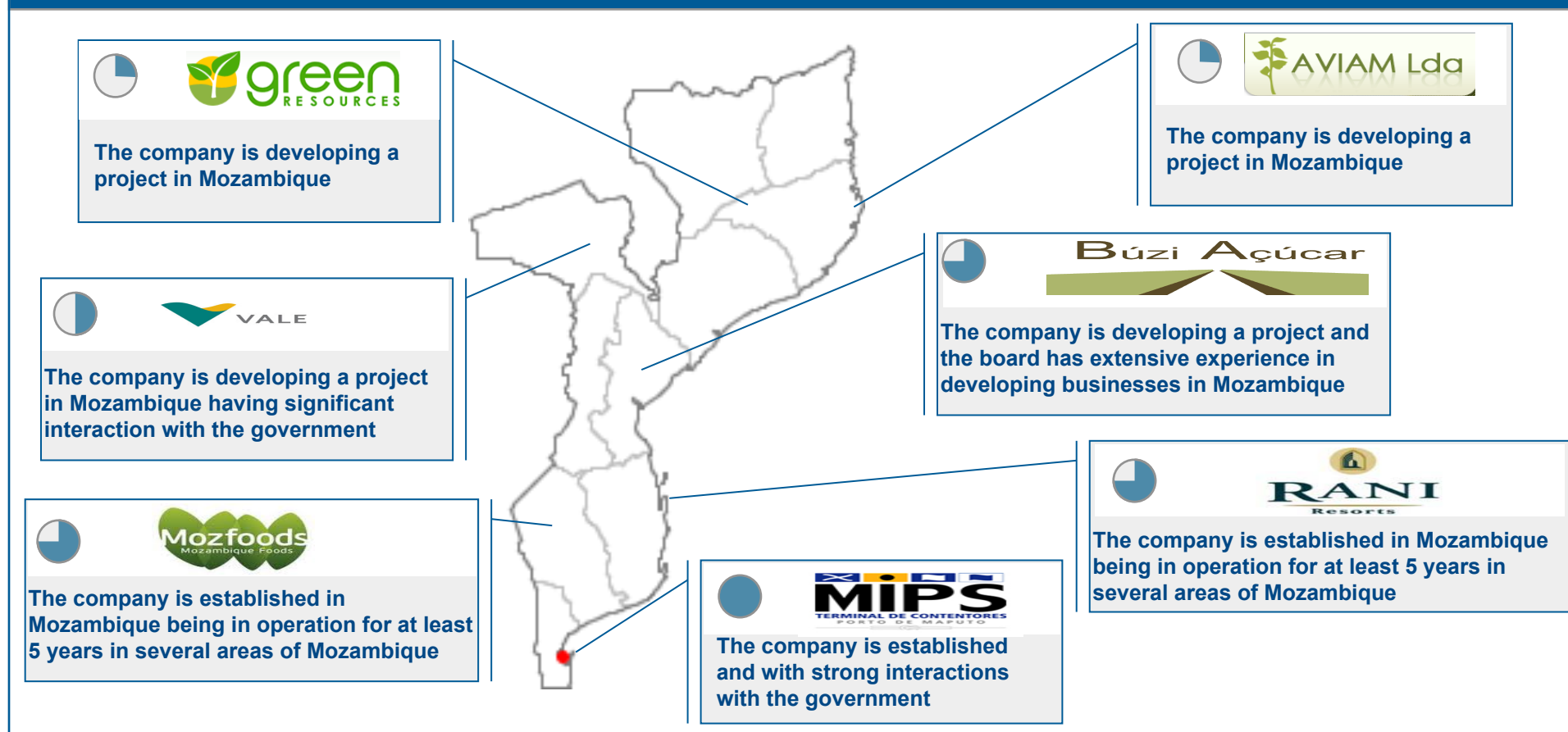
**For the feasibility analysis, we approached private investors as well as public and private financial institutions to help us evaluate the feasibility of each adaptation project**

Feasibility analysis							
	%	Classification					Comments / Objectives
		0	0,25	0,5	0,75	1	
<b>Familiarity - Is the private investor familiar with Mozambique business context?</b>	15%	No familiarity	Low	Medium	High	Very high	The main goal is to evaluate private investor's knowledge regarding business barriers that a project development faces in Mozambique A private investor operating in Mozambique for several years will have the highest valuation. An investor that is thinking about entering will have the lowest valuation.
<b>Interest - Is the private investor committed to invest in this adaptation project</b>	70%	Low	-	Medium	-	High	The main goal is to evaluate which adaptation options garner most interest among private investors and therefore are more likely to be supported in the future
<b>Financing priority - Is the project a high priority for the financing institutions?</b>	15%	No	-	yes (indirect)	-	yes (direct)	The main goal is to evaluate which adaptation projects are more likely to get financing considering the priority sectors of reference financing entities.

First, private investors linked to potential adaptation projects were evaluated according to their business knowledge of Mozambique

*Selected examples*

### Business knowledge of Mozambique



Then, the adaptation projects were evaluated according to private investors' willingness to invest in the development of a particular project

Project	Company	Expressed Interest
Construction of mini dam	Búzi Açúcar	
Improvement of climate forecast infrastructure	AVIAM Lda	
Introduction of drainage systems	Mozfoods	
Upgrade main routes ahead of predicted occurrences of floods (e.g.: Bridges)	Búzi Açúcar	

Top projects	
Nº	High Interest Projects
1	Reforestation with agricultural activities
2	Introduction of drainage systems
3	Increase crops yield through the reduction of ground-level ozone
4	Solar panels for irrigation
5	Upgrade main routes ahead of predicted occurrences of floods (e.g.: Bridges)
6	Construction of Mini Dams
7	Introduction of a different variety of crops in the production of bio fuel
8	Construction of Mini Dams
9	Develop of fertilizers by composting of organic waste
10	Construction of Macuti houses in Mozambique island
11	Resettlement to the Coastal Land in Mozambique island
12	Develop ecotourism resort
13	“Stone and Clay” city resilience in Mozambique island
14	Introduction of Resilient crops for the production of Biofuel
15	Introduction of rainwater harvesting techniques






High Interest



Medium Interest

Finally, we assessed the financing priorities of international sources of development financing considering the interactions we had with three reference players

Entity	Priority sectors	Financing	Examples of projects
	<ul style="list-style-type: none"> <li>■ Ports</li> <li>■ Tourism</li> <li>■ Forestry</li> <li>■ Urban drainage systems</li> </ul>	<ul style="list-style-type: none"> <li>■ Directly to the private investor</li> </ul>	<ul style="list-style-type: none"> <li>■ Reforestation with product diversity (softwood / hardwood and / or short / long rotation)</li> <li>■ Develop ecotourism resort with energy and communications independence</li> <li>■ Construction of near shore breakwaters</li> </ul>
	<ul style="list-style-type: none"> <li>■ Agriculture</li> <li>■ Water</li> </ul>	<ul style="list-style-type: none"> <li>■ Through the government</li> </ul>	<ul style="list-style-type: none"> <li>■ Introduction of rainwater harvesting techniques</li> <li>■ Increase crops yield through the reduction of ground-level ozone</li> <li>■ Introduction of drainage systems</li> </ul>
	<ul style="list-style-type: none"> <li>■ Infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>■ Through the government</li> </ul>	<ul style="list-style-type: none"> <li>■ Upgrade main routes ahead of predicted occurrences of floods (e.g.: Bridges)</li> <li>■ Improvement of climate forecast infrastructure</li> </ul>

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## 2.4.3 Evaluation phase – Short List identification

**We evaluated the 33 potential adaptation projects feasibility and cost benefit and selected the options with a grade of at least 0,7 (1/3)**

Adaptation Measures	Area	Region	Company	Feasibility			Cost benefit analysis	Total
				Familiarity	Expressed Interest	Financing priority		
Reforestation with agricultural activities	Buzi and Dondo	Center	Buzi Açucar	0,75	1	1	1	<b>0,98</b>
Introduction of drainage systems	Gaza	South	Mozfoods	0,75	1	0,5	1	<b>0,93</b>
Increase crops yield through the reduction of ground-level ozone	Cabo Delgado	North	Ouro Verde	0,75	1	0,5	1	<b>0,93</b>
Reforestation of Quirimbas National Park	Cabo Delgado	North	Aga Khan	1	0,5	1	1	<b>0,79</b>
Solar panels for irrigation	Cabo Delgado	North	Ouro Verde	0,75	1	1	0,5	<b>0,78</b>
Small scale solar plant	Maputo city	South	Selfenergy	0,75	1	1	0,5	<b>0,78</b>
Upgrade main routes ahead of predicted occurrences of floods	Buzi and Dondo	Center	Buzi Açucar	0,75	1	0,5	0,5	<b>0,73</b>
Construction of Mini Dams	Buzi and Dondo	Center	Buzi Açucar	0,75	1	0,5	0,5	<b>0,73</b>
Introduction of a different variety of crops in the production of bio fuel	Cabo Delgado	North	Ouro Verde	0,75	1	0,5	0,5	<b>0,73</b>
Introduction of Resilient crops for the production of Biofuel	Nacala	North	Aviam	0,25	1	1	0,5	<b>0,73</b>
Development of agro forestry	Cabo Delgado	North	Pemba Sun	0,25	0,5	1	1	<b>0,72</b>

## 2.4.3 Evaluation phase – Short List identification

**We evaluated the 33 potential adaptation projects feasibility and cost benefit and selected the options with a grade of at least 0,7 (2/3)**

Adaptation Measures	Area	Region	Company	Feasibility			Cost benefit analysis	Total
				Familiarity	Expressed Interest	Financing priority		
Development of agro forestry	Nampula	North	Green Resources	0,25	0,5	1	1	<b>0,72</b>
Develop of fertilizers by composting of organic waste	Cabo Delgado	North	Aga Khan	1	1	0	0,5	<b>0,71</b>
Construction of Macuti houses in Mozambique island	Nacala	North	Technoserve	1	1	0	0,5	<b>0,71</b>
Develop ecotourism resort	Maputo	South	Technoserve	1	1	0	0,5	<b>0,71</b>
“Stone and Clay” city resilience in Mozambique island	Nacala	North	Technoserve	1	1	0	0,5	<b>0,71</b>
Introduction of rainwater harvesting techniques	Nacala	North	Aviam	0,25	1	0,5	0,5	0,69
Produce solar energy at tourist facilities to decrease energy dependence (Quirimbas)	Cabo Delgado	North	Rani Resorts	0,75	0,5	1	0,5	0,57
Development of microcredit solutions for adaptation	Nationwide	Nationwide	Aga Khan	0,75	0,5	1	0,5	0,57
Conversion of arable farmland into salt marsh and grassland	Vilanculos	South	Grupo Pestana	0,75	0	1	1	0,56
Reforestation of mangroves	Vilanculos	South	Rani resorts	0,75	0	1	1	0,56
Construction of Mini Dams	Cabo Delgado	North	Ouro Verde	0,75	0,5	0,5	0,5	0,52

## 2.4.3 Evaluation phase – Short List identification

**We evaluated the 33 potential adaptation projects feasibility and cost benefit and selected the options with a grade of at least 0,7 (3/3)**

Adaptation Measures	Area	Region	Company	Feasibility			Cost benefit analysis	Total
				Familiarity	Expressed Interest	Financing priority		
Resettlement to the Coastal Land in Mozambique island	Nacala	North	Technoserve	1	1	0	0	0,51
Increase crops yield through the reduction of ground-level ozone	Buzi and Dondo	Center	Buzi Açucar	0,75	0	0,5	1	0,51
Develop ecotourism resort	Vilanculos	South	Rani Resorts	0,75	0,5	0	0,5	0,48
Produce solar energy at tourist facilities	Vilanculos	South	Rani Resorts	0,75	0	1	0,5	0,36
Produce solar energy at tourist facilities	Beira	Center	Grupo Pestana	0,75	0	1	0,5	0,36
Introduce water filters techniques	Buzi and Dondo	Center	Buzi Açucar	0,75	0,5	0	0	0,28
Construction of Mini Dams	Nampula	North	Green Resources	0,25	0	0,5	0,5	0,27
Construction of Coastal protections	Maputo city	South	Maputo Port	1	0	1	0	0,18
Construction of Coastal protections	Beira	Center	Beira Port	1	0	1	0	0,18
Construction of Coastal protections	Nacala	North	Nacala Port	1	0	1	0	0,18
Production of Energy based on Biomass	Quirimba National Park	North	Guludo Beach Lodge	0,5	0	1	0	0,14

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## 2.5 Adaptation Measures Short List

We are now in the end of the evaluation phase, having performed site visits to 10 of the 16 short-listed projects and having had meetings with the investors associated with all projects

<p><b>A</b></p> <p><b>Mini dam construction</b></p> <ul style="list-style-type: none"> <li>■ Region: Búzi (Beira)</li> <li>■ Investor: Búzi Açúcar</li> <li>■ Focus: irrigation and water flow control</li> </ul> 	<p><b>B</b></p> <p><b>Bridge construction</b></p> <ul style="list-style-type: none"> <li>■ Region: Búzi (Beira)</li> <li>■ Investor: Búzi Açúcar</li> <li>■ Focus: ensure passage in extreme floods and droughts</li> </ul> 	<p><b>C</b></p> <p><b>Reforestation with agricultural activities</b></p> <ul style="list-style-type: none"> <li>■ Region: Búzi (Beira)</li> <li>■ Investor : Búzi Açúcar</li> <li>■ Focus: carbon reduction and community involvement</li> </ul> 	<p><b>D</b></p> <p><b>Macuti houses</b></p> <ul style="list-style-type: none"> <li>■ Region: Mozambique Island</li> <li>■ Investor: Technoserve and SME</li> <li>■ Focus: resilient construction</li> </ul> 
<p><b>E</b></p> <p><b>“Stone and Clay” city resilience</b></p> <ul style="list-style-type: none"> <li>■ Region: Mozambique Island</li> <li>■ Investor: Technoserve and Tourism sector investor</li> <li>■ Focus: resilient construction</li> </ul> 	<p><b>F</b></p> <p><b>Organic waste composting</b></p> <ul style="list-style-type: none"> <li>■ Region: Pemba</li> <li>■ Investor: Aga Khan</li> <li>■ Focus: Soil recovery and food security</li> </ul> 	<p><b>G</b></p> <p><b>Bioetanol Production</b></p> <ul style="list-style-type: none"> <li>■ Region: Ocua (Chiure)</li> <li>■ Investor: Ecoenergia</li> <li>■ Focus: adaptation to drought and clean energy production</li> </ul> 	<p><b>H</b></p> <p><b>Solar panels for irrigation</b></p> <ul style="list-style-type: none"> <li>■ Region: Ocua (Chiure)</li> <li>■ Investor: Ecoenergia</li> <li>■ Focus: irrigation, clean energy and community involvement</li> </ul> 

Source: Arthur D. Little analysis

## 2.5 Adaptation Measures Short List

We are now in the end of the evaluation phase, having performed site visits to 10 of the 16 short-listed projects and having had meetings with the investors associated with all projects

### I Small scale solar plant

- Region: Maputo district
- Investor: Selfenergy
- Focus: Clean energy and carbon emissions reduction



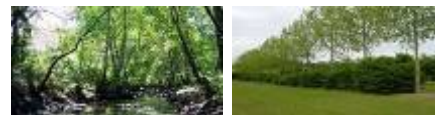
### J Reforestation in Quirimbas

- Region: Quirimbas Park
- Investor: Aga Khan
- Focus: carbon reduction and community involvement



### K Agro forestry in Cabo Delgado

- Region: Cabo Delgado
- Investor: Pemba Sun / Technoserve
- Focus: carbon reduction and community involvement



### L Micro credit for adaptation

- Region: Nation wide
- Investor: Aga Kan
- Focus: Finance adaptation at a micro level



### M Resilient crops

- Region: Nacala
- Investor: Aviam
- Focus: drought resistant crops (Jatropha)



### N Increase crops yield

- Region: Ocuia
- Investor: Ouro verde
- Focus: Food security – reduction of ground level ozone



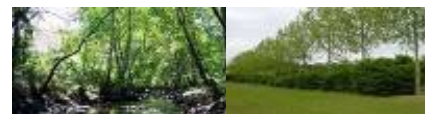
### O Ecotourism

- Region: Maputo Special Reserve
- Investor: Technoserve
- Focus: Biodiversity protection



### P Agro forestry in Nampula

- Region: Nampula
- Investor: Green resources / Technoserve
- Focus: carbon reduction and community involvement



Source: Arthur D. Little analysis

**The construction of a mini dam will significantly improve water management - both in the periods of drought and flood**

A

### Construction of a mini dam in Búzi river

#### Main objectives and benefits

- Búzi Açúcar project has an associated investment of about \$ 120M and is expected to create over 3,500 jobs.
- The aim is to produce sugar cane in an area of 15,000 ha, to feed the New Búzi Sugar Factory, with a projected annual production capacity of 150,000 tons of sugar
- The Búzi area is fairly flat and there are many crop losses due to floods
- With climate change, it is predicted that floods and droughts will be more intense leading to a higher rate of crop losses
- The construction of a mini-dam will allow for better management of river flow in both drought and flood periods benefiting the company and the surrounding communities
- It will become possible to manage the flow of the river - store water between November and March for re-use for irrigation in the months July to September
- With a mini dam it will be possible to mitigate between 10-20% of the crop losses due to floods

#### Potential costs

- ~ 4,5 M€ (*indicative*) <sup>1</sup>
- Technical studies are needed to detail project construction and operating costs

#### Barriers to implementation

- Agreement with the Sofala Government, MICOA and MOP
- Viability of the infrastructure investment in the required area

#### Potential financing institutions and partners

- World Bank, DFID and ADB
- Búzi Açúcar, Sofala Government, Ministry of Obras Públicas and Self energy

Source: Búzi Açúcar, Self Energy



**Improving the main lines of transport and communication will allow better access to distribution channels for goods and people in the event of extreme weather**

### B Construction of a bridge over the Búzi river

#### Main objectives and benefits of the project

- In the area of Búzi, the only way to cross the river is through a “batelão” - which transports people, cars and trucks with raw materials such as sugar cane and wood
- At least 10% of the year (6 weeks) the “batelão” can not work due to river flooding or drought – both situations will become more accentuated with climate change
- The road that links the two sides of the river is one of the main choices to shorten the trip between Beira and Maputo (between the Centre and South) which translates into increased traffic that allows the development of local economy
- Many of the shipments of sugar cane must be transported by “batelão” (average trip lasts about 30 minutes)
- With climate change, it is predicted that floods and droughts are intensifying in the area and, hence, this transportation of people and goods will be interrupted for several weeks a year
- The road (EN214), which contains the passage via barge, is one of the roads defined as a priority by the government and a tender was launched for consultation at the central level of the feasibility project for the construction of the bridge

#### Potential costs

- 2,5 M€, according to *benchmarks* <sup>1</sup>
- Technical studies are needed to detail project construction and operating costs

#### Barriers to implementation

- Agreement with the Government of Sofala and the Central Government on the responsibilities of management and investment
- Technical studies are required (tender ongoing)

#### Potential financing institutions and partners

- World Bank, DFID and ADB
- Búzi Açúcar, Sofala Government and Central Government

Source: Búzi Açúcar, ANE



**The planting of native trees decreases the effect of deforestation – and where integrated with agroforestry techniques allows greater community involvement**

### C Reforestation with agricultural activities in Búzi area

Main objectives and benefits	Potential costs
<ul style="list-style-type: none"> <li>■ Búzi Açúcar has a concession of 15.000 ha to produce sugar cane. In addition to that area the company received also an area of 45,000 ha of forest area that is supposed to recover and keep</li> <li>■ This forest has been depleted over the years and is now very sparse and weakened</li> <li>■ There are plans for reforestation with indigenous species, but currently “frozen” for lack of funding</li> <li>■ It is necessary to involve the community so that there is a greater likelihood of success in reforestation - an example might be the use of agro forestry in partnership with an NGO so that no customary burning for the subsequent planting of the fields or cutting trees occurs</li> <li>■ Using the mechanisms of carbon credits, taking into account the average CO2 sequestration to plant trees and price per ton of CO2 an investor can hope a return of almost \$ 10M in 25 years of planting<sup>1</sup></li> </ul>	<ul style="list-style-type: none"> <li>■ 4 M\$ <sup>1</sup></li> </ul>
	Barriers to implementation
	<ul style="list-style-type: none"> <li>■ Carbon credit enabling legislation</li> <li>■ Technical studies needed</li> </ul>
	Potential financing institutions and partners
	<ul style="list-style-type: none"> <li>■ IFC, DFID, Green Belt</li> <li>■ Búzi Açúcar, Sofala Government, CTA, Small farmers, Technoserve</li> </ul>

Source: Búzi Açúcar



<sup>1</sup> Used as a proxy for a more detailed study of reforestation in Haiti - the costs include the planting and maintenance over 10 years to an area of 7000 ha and the returns are calculated as the sum of annual returns in 25 years

## 2.5 Adaptation measures Short List - Adaptation project – Rehabilitation of 10 Macuti Houses

**The project goal is to implement a project for the rehabilitation of traditional houses to develop eco-tourism**

### D Rehabilitation of 10 Macuti Houses

#### Main objectives and benefits

- The Island of Mozambique is classified as World Heritage by UNESCO and has high vulnerability and exposure to climate risks
- With climate change, the intensity of the cyclones that affect the area is expected to increase causing more damage and increasing the risk of the population of the Island
- The traditional construction of houses of lime and Macuti is very resistant to extreme events.
- In fact, in two recent cyclones that hit the island, the majority of these traditional houses remained while the “adulterated houses” was destroyed
- The project goal is to implement a pilot for the rehabilitation of 10 traditional houses and develop eco-tourism in these houses
- The key to the success of this project is in the business training of some families who can see their estimated household income triple

#### Potential costs

- ~ 2.000 USD by house

#### Barriers to implementation

- Selection of "entrepreneurial" families
- Approval by relevant government entities

#### Potential financing institutions and partners

- Micro Credit, subsidized credit from commercial banks and USAID
- Community Foundation of the Island of Mozambique, APETUR, GACIM. Municipality of the Island of Mozambique and Technoserve

Source: Fundação das Comunidades da Ilha de Moçambique, Technoserve

The Cidade de Pedra e Cal has several historic buildings that are highly degraded and that may be structurally reinforced and rehabilitated by private entities

### E Rehabilitation of historical building in Cidade de Pedra e Cal

Main objectives and benefits	Potential costs
<ul style="list-style-type: none"> <li>■ Mozambique Island is, according to UNESCO, home to some of the most important World Heritage Sites and needs to be conserved and rehabilitated</li> <li>■ The island is already vulnerable to natural hazards and is expected to be in greater risk due to climate change</li> <li>■ Sustainable tourism development on the island can help to increase local communities development and resilience to climate change</li> <li>■ Rehabilitation and strengthening of historical buildings and heritage of the area by private investors for tourism promotion as boutique hotels</li> <li>■ Introduction of counterparts as: <ul style="list-style-type: none"> <li>– Rehabilitation of community common areas</li> <li>– Protection of coastal areas of greatest erosion</li> <li>– Charity Road</li> <li>– Contribution to the Community Foundation</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>■ ~6,3MUSD</li> <li>■ Technical studies are needed to detail project costs</li> </ul>
	Barriers to implementation
	<ul style="list-style-type: none"> <li>■ Ownership of buildings</li> <li>■ Infrastructure and drainage development in Macuti City</li> </ul>
	Potential financing institutions and partners
	<ul style="list-style-type: none"> <li>■ Private investors (e.g. Rani chain and boutique hotels) and IFC</li> <li>■ Community Foundation of the Island of Mozambique, APETUR, GACIM, Municipality of the Island of Mozambique and Technoserve</li> </ul>

Source: Fundação das Comunidades da Ilha de Moçambique, Technoserve

## 2.5 Adaptation measures Short List – Adaptation project – Organic waste by composting

**The objective is to improve the urban environment, reduce health risks through the recycling of most of the municipality's solid organic waste and increase agricultural productivity**

### F Organic waste by composting

Key objectives and benefits	Potential Costs
<ul style="list-style-type: none"> <li>■ Composting is a process in which organic wastes are degraded by microorganisms at elevated temperatures under both aerobic and anaerobic conditions.</li> <li>■ Due to city development, Mozambique is starting to face a major problem related with waste management across the country. In the formerly pristine environment, waste is disposed indiscriminately in rivers, canals and roadside.</li> <li>■ The goal of this project is to develop a pilot between the Pemba Municipality and a private investor where the city's organic waste will be used to produce natural fertilizer</li> <li>■ The product will improve agricultural productivity and allow the regeneration of soils that have been damaged by rapid erosion</li> <li>■ By decreasing the amount of waste entering the municipal rubbish dump, the project will reduce emissions of methane – this fact will allow the investor to sell certified carbon credits</li> </ul>	<ul style="list-style-type: none"> <li>■ 900 k\$</li> </ul>
	Implementation Barriers
	<ul style="list-style-type: none"> <li>■ Agreement of Pemba Municipalities and municipal operation (regarding waste management)</li> </ul>
	Potential financing entities
	<ul style="list-style-type: none"> <li>■ World Bank, DFID, African Development Bank</li> <li>■ Aga Khan, Terra Nova, MICOA</li> </ul>

Source: Terra Nova

**The use of sweet sorghum will act as encouragement for the surrounding communities and will enable a dramatic reduction in water used**

### **G** Production of unrefined organic sugar and bio-ethanol in Ocuja

#### Main objectives and benefits

- The Ouro Verde project is a project that aims to produce commercially unrefined organic sugar and ethanol in a region where there has never been a sugar plantation
- The project is associated with an investment of about \$ 12.5 M
- By the end of 2011 the project aims to plant 100ha of sugar cane and start building the production plant
- In the second phase, the plantation will extend to 490 ha and the factory will produce unrefined organic sugar and bio-ethanol. As sub-products there will be the production of energy through bagasse
- The main benefits of the project will be:
  - Maximizing the productivity and resilience (through tests on various varieties of sugarcane and sorghum)
  - Minimize use of water
  - Food production (crop rotation for soil improvement)
  - Improved resilience of local populations

#### Potential costs

- ~ \$12,5M
- Having already two investors (Ecoenergia and Agricane) the project still needs about \$ 1M

#### Barriers to implementation

- Tests with sweet sorghum hybrids do not give the expected crop yield results and hence the commercial viability of producing sugarcane in this region of the country may not be validated

#### Potential financing institutions and partners

- ADB, IFC and High Net Worth Individuals
- Cabo Delgado Government, ICRISAT and Crops Advance

Source: Ecoenergia



**The use of solar panels will ensure energy independence of the project and transfer energy to the surrounding communities**

H

### Introduction of solar panels for irrigation

#### Main objectives and benefits

- The Ouro Verde project is a project that aims to produce commercially unrefined organic sugar and ethanol in Ocuca.
- The project is located at the "end of line" of the electricity transmission network of the Cahora Bassa dam, so energy is delivered irregularly (there are many losses/interruptions along the transmission line). Energy independence for the local communities is therefore critical.
- A major goal of the company is energy independence from the transmission grid for the operation of the irrigation system.
- There are already some examples of the use of solar panels for water extraction from water holes for local communities. The use of solar panels is an option that may be feasible considering the energy needs and levels of sunlight in the region
- An additional objective of the project is to bring energy into the surrounding communities

#### Potential costs

- ~ \$30k / ha (indicative)

#### Barriers to implementation

- High initial investment

#### Potential financing institutions and partners

- High Net Worth Individuals, Commercial Banks, PNUD
- Cabo Delgado Government, Selfenergy

Source: Ecoenergia, Self Energy



1 Used as a proxy study of use of solar panels for irrigation in Brazil and a UNDP project for the province of Gaza

**The development of small scale solar plants will allow the harnessing of the country abundant resources to produce clean energy in a decentralized way**

### I Small Scale Solar Plant

#### Main objectives and benefits

- The development of small scale solar plants are thought for Mozambique to explore the country abundant resources to produce clean energy in a decentralized fashion
- The main goals are the production of clean energy, reducing the dependence on external sources of energy like fuel.
- The development of this project will also minimize losses of energy and implies less investment in infrastructure
- This adaptation measure should reduce energy dependence of private investors or bring electricity to rural communities that otherwise would not have access
- The project as a positive NPV if a feed in tariff is in place. When compared with the use of fuel, solar energy is more cost effective

#### Potential Costs

- Capex – 3,6M€/MW

#### Implementation Barriers

- Renewable Energy Strategy has been issued but a FIT law is still to be materialized

#### Potential financing institutions and partners

- IRENA – International Renewable Energy Agency
- Private Stakeholders as Selfenergy in a ESCO model

Source: Selfenergy

### The planting of native trees decreases the effect of deforestation and contributes to the restoration of the ecosystem in Quirimbas

J

#### Reforestation in Quirimbas

##### Main objectives and benefits

- The Quirimbas National Park protects over 750.000 hectares of coastal forest and mangroves, rich coral reefs and abundant marine life,
- The park was established in 2002 with the goal to protect, conserve and, where necessary, restore ecosystem processes and genetic diversity of all terrestrial and marine resources.
- There are several areas of the park that need to be restored due to deforestation
- The Aga Khan foundation is closely connected with the park and has been working with the park communities developing conservation agriculture and livestock. In this moment Aga Khan is planning to develop a reforestation program for the park in order to reduce the effects of deforestation
- Using carbon credits mechanisms, taking into account the average CO<sub>2</sub> sequestration and the average price per ton of CO<sub>2</sub>, an investor can expect a return of almost \$ 10M in 25 years<sup>1</sup>

##### Potential Costs

- 4 M\$ <sup>1</sup>
- Technical studies are needed to detail project costs

##### Implementation Barriers

- Legislation on enabling carbon credits in Mozambique is not yet defined

##### Potential financing institutions and partners

- IFC, DFID, Green Belt
- Aga Khan, Cabo Delgado Provincial Government, CTA, Small farmers

Source: Aga Khan, Green Belt



<sup>1</sup> Used as a proxy a more detailed study of reforestation in Haiti - the costs include the planting and maintenance over 10 years of 7000 ha and the returns are calculated as the sum of annual returns in 25 years



**Agro forestry – integration of trees with crops – contributes to the reduction of soil erosion and to the increase in food security for local communities**

K

### Agro forestry in Cabo Delgado

#### Main objectives and benefits

- Pemba sun is a Forestry & Sawmilling business operating in Cabo Delgado Province.
- The core focus of the company is low-volume, high-value local processing of hardwoods and to export Mozambican hardwood lumber.
- Long-term sustainability of forestry resources is a key business driver and Pemba Sun is willing to develop community projects that involve communities in the preservation of the forest
- A partnership between Pemba Sun and Technoserve aims to improve the soil's conservation, biodiversity and food security for the people in the region – The AgroForestry Village Program - has as the ultimate beneficiary the rural farmer that has to be part of the development process and has to reap socio-economic benefits (jobs, improved farming practices, markets, socio facilities and services)

#### Potential Costs

- ~ 140 k\$ per ha / year

*Similar projects are calculated for a 10 years period*

#### Implementation Barriers

- There is the need of high involvement of the local communities

#### Potential financing institutions and partners

- High Net Worth Individuals
- IFC, DFID, ADB

Source: Technoserve, Portucel, Food and Agriculture Organization of the United Nations

### Development of Micro-credit financing lines for investments in climate change resilience projects by farmers, small and medium-sized companies and local communities

#### L Micro Credit for Climate Change Adaptation Initiatives

Main objectives and benefits	Potential Costs
<ul style="list-style-type: none"> <li>■ The Aga Khan Foundation opened a microcredit bank in Mozambique and is now studying the best way of entering the market with this type of loans.</li> <li>■ The main issues faced by the Foundation are a) loans valuation, b) client training and c) follow up measures</li> <li>■ The Aga Khan Foundation indicated that it would be interested in analyzing the development of a Micro credit line for investments in climate change resilience.</li> <li>■ Examples of interventions could be: <ul style="list-style-type: none"> <li>– development of irrigation projects that utilize drip irrigation or rainwater harvesting</li> <li>– provision of water to domestic and agricultural users from ground water resource</li> <li>– Construction of Macuti houses for tourism</li> <li>– ...</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>■ To be determined in depth if the project goes forward to Phase 3.</li> </ul>
	Implementation Barriers
	<ul style="list-style-type: none"> <li>■ Microbank is based in Pemba and mechanisms must be set to reach high impact areas</li> <li>■ Awareness in the private sector</li> </ul>
	Potential financing institutions and partners
	<ul style="list-style-type: none"> <li>■ IFC, Standard Bank, Barclays (ABSA)</li> <li>■ Aga Kan</li> </ul>

Source: Aga Khan

**The project's main goal is to produce clean energy using a highly resilient crop that grows in marginal lands and needs no irrigation**

### M Introduction of resilient crops for the production of Bio-fuel

Main objectives and benefits	Potential Costs
<ul style="list-style-type: none"> <li>■ Aviam is developing a project of cultivation and development of Jatropha Curcas and production of vegetable oil in the Nacala region</li> <li>■ The project's main goal is to use a resilient crop to produce clean energy and to boost environmental, economic and social development in the region.</li> <li>■ Nacala is the northern province most affected by droughts and. with climate change, the severity of drought is likely to increase since rainfall is expected to increase in intensity but decrease in frequency</li> <li>■ Jatropha Curcas grows in arid and marginal lands and its products are not edible. Moreover, no irrigation is required.</li> <li>■ At present, Aviam is preparing nurseries and cultivating 10.000 hectares of land as a pilot project</li> <li>■ In the future, the company plans to extend the plantations and set up a system of outgrowing which will give local workers the opportunity to cultivate Jatropha Curcas independently</li> </ul>	<ul style="list-style-type: none"> <li>■ ~ 21M USD</li> </ul>
	Implementation Barriers
	<ul style="list-style-type: none"> <li>■ Project viability – needs to be analyzed carefully given the dependence on the yields from Jatropha Curcas plantations</li> </ul>
	Potential financing institutions and partners
	<ul style="list-style-type: none"> <li>■ DFID, ADB, IFC, Commercial Banks</li> <li>■ CTA, Vale, Plant research international, International entities investigating the use of Jatropha Curcas</li> </ul>

Source: AVIAM

## 2.5 Adaptation measures Short List – Adaptation project – Increase crops yield

**This pilot project seeks to determine if average crop yields can be increased by 20% or more using Ouro Verde's test site**

N

### Increase agricultural crop yields

#### Main objectives and benefits

- This pilot project seeks to determine if average crop yield in Mozambique can be increased by 20% or more, as a result of minimizing the effects of ground level ozone
- The pilot project consists of three components:
  1. Research and compilation of available data,
  2. New data generation at test sites,
  3. Reference data generation by ground-level ozone monitoring sites.
- The pilot will follow a similar successful experience in Brazil (yield was doubled) and will use Ouroverde's land as a test site
- The potential implications of the above findings are highly relevant to Mozambique's goal to increase crop yields in the coming decade.

#### Potential Costs

- ~350KUSD for the pilot project

#### Implementation Barriers

- New concept under peer review in the scientific community

#### Potential financing institutions and partners

- IFC, WB and ADB
- Cropsadvance, Ecoenergia

Source: Cropsadvance



### Community tourism organizations – Eco-tourism Pilot project in the Maputo special reserve

0

#### Maputo special reserve Eco-tourism pilot project

##### Main objectives and benefits

- The Mozambique government wants to support and develop the concept of community tourism organizations. The concept was tested previously and did not work mainly due to the fact that communities were not prepared for running a touristic business
- Technoserve and the African Safari Lodge Foundation have developed a different concept of community tourism organizations that are now being tested in some regions.
- The concept is to create a joint venture between a community foundation and a tourism operator where both invest and are co-owners of the tourism project
- The Maputo special reserve is one of the selected areas and it is important in terms of conservation since it is rich in biodiversity and has a wealth of plant and marine life. Moreover, it is home to a genetically distinct population of more than 350 elephants
- The main goal of the Maputo special reserve project is to develop 3 lodges (one near the sea, one near the lake and one in the forest) under the eco-tourism concept.

##### Potential costs

- \$3M for 3 lodges

##### Barriers to implementation

- Community Involvement
- Approval by relevant government entities
- Technical studies are needed

##### Potential financing institutions and partners

- WB, IFC and private investors (e.g. eco-lodge owners)
- Technoserv, African Safari Lodge Foundation

**Agro forestry (the integration of trees with crops) contributes to the reduction of soil erosion and to increasing food security for local communities**

P

### Agro forestry in Nampula

#### Main objectives and benefits

- Green Resources is a plantation, carbon offset, forest products and renewable energy company
- Green Resources has obtained permission to develop 126,000 hectares of forest plantation for carbon sequestration, as well as for producing wood for building materials, energy and pulp in Nampula province (inside the Nacala development corridor)
- In addition, Green Resources will assist in the establishment of 54,000 ha of forests by local smallholders and companies.
- A partnership between Green Resources and Technoserve aims to improve soil conservation, biodiversity and food security for the people in the region. The AgroForestry Village Program has as the ultimate beneficiary the rural farmer that has to be part of the development process and has to reap socio-economic benefits (e.g. employment, improved farming practices, market access, social facilities and services)

#### Potential Costs

- ~ 140 k\$ per ha / year
- Similar projects are calculated for a 10 years period*

#### Implementation Barriers

- There is the need for high involvement of the local communities

#### Potential financing institutions and partners

- High Net Worth Individuals, IFC, DFID and ADB
- Technoserve, Nampula Provincial Government

Source: Technoserve, Green Resources, Food and Agriculture Organization of the United Nations

## 2.5 Adaptation measures Short List – Country-wide significance

From the top 16 list, 3 projects have major significance for the country, whereas the remaining projects are regionally important but lack significant country-wide impact

Project	Potential Impact	Comments
Microcredit for adaptation	Nationwide	<ul style="list-style-type: none"> <li>Only three projects have a nationwide impact <i>per se</i>:               <ol style="list-style-type: none"> <li>The projects by themselves are replicable all over the country and can reach a significant number of small businesses (e.g. microcredit and composting projects)</li> <li>The projects are a flagship in a sector that needs to be considered as key for climate change adaptation (e.g. Infrastructure and financing mechanisms)</li> </ol> </li> <li>The remaining projects, although regionally significant seem fragmented and are not significant enough to raise the interest of international investors</li> </ul>
Develop of fertilizers by composting of organic waste		
Construction of a Bridge		
Reforestation of Quirimbas National Park	Cabo Delgado	
Bioetanol Production	Cabo Delgado	
Develop ecotourism resort	Maputo	
Increase crops yield	Cabo Delgado	
Reforestation with agricultural activities	Buzi and Dondo	
Development of agro forestry	Cabo Delgado	
Development of agro forestry	Nampula	
Construction of Macuti houses in Mozambique island	Nacala	
Solar panels for irrigation	Cabo Delgado	
Introduction of Resilient crops for the production of Biofuel	Nacala	
“Stone and Clay” city resilience in Mozambique island	Nacala	
Construction of Mini Dams	Buzi and Dondo	
Small Scale Solar Plants	Maputo	

## 2.5 Adaptation measures Short List – Country-wide significance

To design initiatives with a country-wide impact, the projects were aggregated in programs to address some of Mozambique's most strategic challenges: energy, water, forestry, tourism

### Project aggregation by strategic area

Projects	Areas	Energy	Water	Tourism	Forestry
Reforestation of Quirimbas National Park					X
Bioetanol Production		X	X		
Develop ecotourism resort				X	
Increase crops yield			X		
Reforestation with agricultural activities					X
Development of agro forestry					X
Development of agro forestry					X
Construction of Macuti houses in Mozambique island				X	
Solar panels for irrigation		X			
Introduction of Resilient crops for the production of Biofuel		X	X		
"Stone and Clay" city resilience in Mozambique island				X	
Construction of Mini Dams in Búzi River		X	X		
Small Scale Solar Plant		X			

All the projects related with tourism are focused on **community tourism** and included in a community tourism fund that can have a major impact in rural communities development

From the 4 forestry projects in the top list, 3 are related with **agro forestry** and if analyzed together may have a significant impact in the country

All the projects are focused on **clean energy generation** and if considered in a aggregated fashion can constitute a clean energy program with major impact for the country

The water projects range from **infrastructural projects** like floods control to correlated measures like the use of resilient crops but all deal with water management



0 Executive Summary

1 Phase 1

**2 Phase 2**

2.1 Executive Summary

2.2 Strategic Objectives

2.3 Screening Phase

2.4 Evaluation Phase

2.5 Adaptation measures shortlist

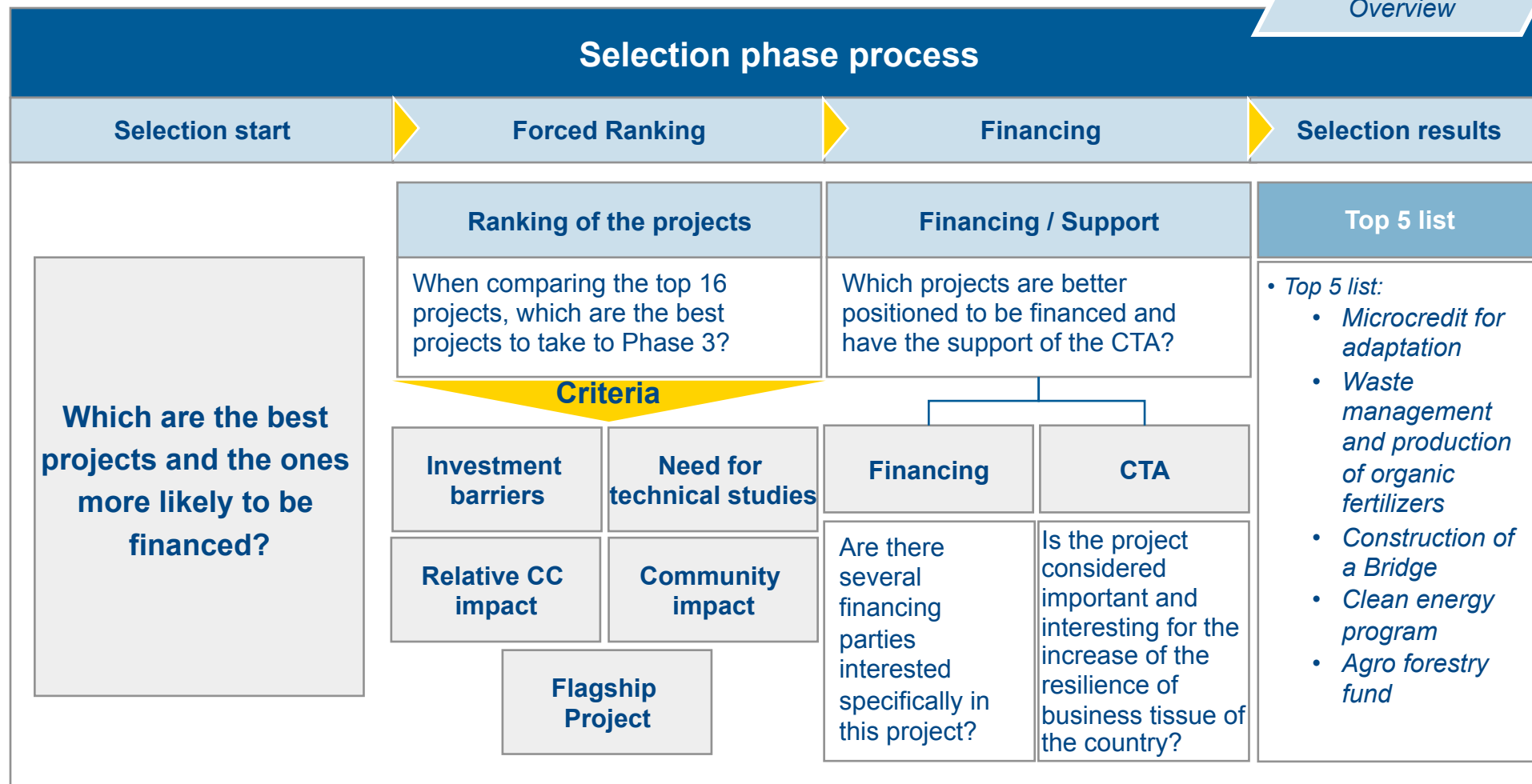
**2.6 Selection Phase**

2.7 Selected Projects – Project Sheets

3 Phase 3




































In the selection phase, with the final 7 projects defined, we have performed two final methodological steps in order to reach the final list of 3 to 5 projects for detailed analysis

Overview



## 2.6 Selection phase

A forced ranking was executed against predefined criterion leading to the prioritization of four initiatives to take forward to Phase 3

Project / Program	Investment Barriers	Need technical studies	Relative CC impact	Community impact	Pilot project a Flagship	Comments
Microcredit for adaptation						■ There are no relevant barriers for investment and studies are already in finalization. The pilot project – Macuti Houses – is a flagship for the country
Waste management and composting						■ There are some barriers for investment and studies are already ongoing. The pilot projects are flagship and pioneers for the country
Construction of a Bridge						■ There are some barriers for investment and studies are already ongoing. The construction of the bridge works as a pilot project for infrastructure adaptation to climate change in Mozambique
Clean energy program						■ There are barriers for investment and studies are already in progress. Several pilot electricity generation projects are already under study and would represent interesting flagship projects.
Agro forestry fund						■ No relevant barriers to investment and studies needed are SEAs. The pilot projects are flagship
Water management program						■ There are barriers and technical studies are needed. The pilot project – Mini dam in Cabo Delgado – is not a flagship project
Community tourism fund						■ There are barriers for investment and studies are already needed. Maputo special reserve tourism project is a pioneer since its is working with the community as a foundation

Source: Arthur D. Little analysis

Note: Detail in Annex

 Lower grade  Higher grade

**Broadly speaking, the subject areas and programs we have identified resonated well with both the financial community and the CTA**

### Comments regarding the projects

#### Microfinance program

Financial institutions like **Ned bank and Standard bank** showed appetite for these type of projects.

In the essence the approach we are taking has been done many times before. The key for the success is to identify a **trustworthy counterparty** that knows the country / region and has extensive experience in developing projects in microfinance

#### Agro Forestry fund

There is a huge amount of interest in projects in these areas but it is harder to get big funds interested in Mozambique . Returns profiles for private equities funds and venture capital houses are likely in the region of 40-50% for Mozambique – this will be very tough to achieve

A number of government development agencies and foundations e.g **Danish and Norwegian governments** and a range of other softer money have expressed interest in this type of project. A key question will be how to combine soft and harder money together . We also need to keep the project focused

#### CTA comments

**Agro forestry** and **Composting** programs are very important for the country and for the private sector since they have the ability to mix private sector interest with community development

The **clean energy program** is in line with government objectives but careful is needed since several projects were announced but no results were seen

**Microcredit** seems the list important project for larger private sector since it will have the greatest impact in families and micro companies

#### Waste management and organic fertilizer

For the development of pilot projects the majority of the financing institutions, although recognizing the value of the project, do not want to invest their money on it.

Government Development Agencies (like AFD) are interested in supporting these projects

If the first pilots are successful and willing to get carbon credits and returns from fertilizers other financing institutions will be interested to invest

0 Executive Summary

1 Phase 1

**2 Phase 2**

2.1 Executive Summary

2.2 Strategic Objectives

2.3 Screening Phase

2.4 Evaluation Phase

2.5 Adaptation measures shortlist

2.6 Selection Phase

**2.7 Selected Projects – Project Sheets**

3 Phase 3

We have developed project sheets for all of the selected projects and presented them to a sample of entities from the international financing community

Microcredit for adaptation	Waste management and production of organic fertilizers	Clean energy program	Illustrative Agro forestry fund
<p><b>Potential Project:</b> Microcredit for adaptation</p> <p><b>Arthur D Little INGC</b></p> <p><b>• Short Description:</b></p> <p>The purpose of this project is to develop a micro-credit program for adaptation in Mozambique supported by the government and run by private companies or NGOs.</p> <p>In Mozambique the access to credit is very difficult, consequently one of the main barriers to investment and to the development of the country.</p> <p>Microfinance provides access to basic financial services to the poor. Through small loans with compulsory, frequent repayments to groups or individuals, microfinance helps the poor build up their assets, establish or develop a business, and protect against risks.</p> <p>Microfinance has the potential to help poor and most vulnerable populations adapt to climate change by providing individuals small investments with a means of accumulating and managing the assets and capabilities needed to become less susceptible to the impact of natural hazards.</p> <p>The Micro-credit program in Mozambique is intended to have several private partners, be nationwide and cover all the sectors affected by climate change and will be developed in phases to increase the probability of success.</p> <p>Examples of projects potentially financed by microfinance are:</p> <ul style="list-style-type: none"> <li>In Agriculture - Development of irrigation systems like drip irrigation, introduction of organic fertilizers and introduction of resistant seeds</li> <li>In tourism - Construction of more resistant houses for tourism (see detailed example in the end of the document)</li> <li>In industry - Development of small businesses of aquaculture (several agricultural areas along the coast will be flooded more frequently due to climate change and the use of fish pens to aquaculture is a viable option for the communities)</li> </ul> <p>The target segment of the population is mainly micro and small companies and communities working as companies (for instance a farmer that is producing crops in a region if the crops are to be sold in the local market).</p> <p>In a first phase the program the project will be implemented in the Northern region of the country in the sectors most impacted by climate change and in which micro financing would have an impact: Agriculture, Tourism and Industry.</p> <p>In a second phase the program will be extended to the entire country and sectors.</p> <p><b>• Potential benefits and interest for private investors and / or donors:</b></p> <p>With the increase of natural disasters around the world there is an increase interest in the so called "impact investing" where an investment is made considering not only the financial return but also</p>	<p><b>Potential Project:</b> Waste management and production of organic fertilizers in Mozambique</p> <p><b>Arthur D Little INGC</b></p> <p><b>• Short Description:</b></p> <p>The main goal of this project is to develop a financial product to help boost composting businesses in Mozambique.</p> <p>Composting is a process in which organic wastes are degraded by microorganisms at elevated temperatures under both aerobic and anaerobic conditions.</p> <p>In Mozambique composting is still a new concept and there is opportunity to develop projects in this area.</p> <p>Due to city development, Mozambique is starting to face a major problem related with waste management. In the formerly pristine environment, waste is disposed indiscriminately in rivers, canals and roadsides.</p> <p>Moreover, Mozambique government is committed to improve agricultural productivity through sound and sustainable soil nutrient management practices and agricultural policies (Mozambique uses of fertilizers is way below African average).</p> <p>Composting of the organic fraction of the city waste will avoid methane emissions from anaerobic decay, increase the lifetime of the existing landfill massively and produce high quality compost for use as natural fertilizer.</p> <p>A composting project is a highly replicable project and has an interesting inter-relationship with both local authorities and communities.</p> <p>The composting program in Mozambique is intended to be nationwide and cover all the major cities of the country, and will be developed through several successful pilot projects to improve the probability of success. The first wave of projects will be in cities included in INGC climate change priority areas (e.g. Pemba, Nacala, Quelimane, Beira, Maputo, etc.).</p> <p><b>• Why a pilot project?</b></p> <p>A Pilot Project is a highly effective and efficient method of answering to the majority of the questions raised in a composting project. Pilot projects running simultaneously will enable the private investors and the municipalities to:</p> <ul style="list-style-type: none"> <li>Compare alternative technologies on a small scale</li> <li>Gain hands-on experience (learning by doing the best ways to develop the fertilizer)</li> <li>Determine which permits are required and establish confidence with the regulating agencies</li> <li>Produce a finished compost product for laboratory analysis and test marketing</li> <li>Establish a design basis for a full scale compost facility</li> <li>Develop a reasonable cost model to look at capital investment, operating costs, profits and loss projects, and return on investment.</li> </ul>	<p><b>Potential Project:</b> Clean energy program</p> <p><b>Arthur D Little INGC</b></p> <p><b>• Short Description:</b></p> <p>The main goal of the project is to create a Clean energy program to encourage private sector companies' investment on clean energy in order to adapt to climate change.</p> <p>The use of energy is a strong factor for economic growth and human development. Key sectors like education, healthcare and business in general need an increasing amount of energy. The lack of access to modern energy (electricity, gas) is a major part of being poor and without means of economic opportunities and overdependence on traditional forms of energy (biomass such as wood, charcoal, dung from animals or agricultural waste) has a number of detrimental effects on the lives of the poor, undermining people's health and environment.</p> <p>Mozambique development is severely constrained by the lack of energy access particularly in more rural regions of the country. Moreover, Mozambique is highly dependent on oil imports, situation that has high impact in the country external trade balance.</p> <p>Target projects of this program will be focused on sectors like agriculture, tourism or distributed electricity. The goal is to finance innovative solutions to climate variability that helps businesses and / or communities to adapt to climate.</p> <p>This program will be responsible for a high impact on climate change in Mozambique since it gives access to enterprises and energy providers to compete for funding for clean energy investments nationwide.</p> <p>The program is going to finance the several stages the project since technical assistance to seed capital and development capital and to cover different types of technologies: solar, wind, biogas, hydro, mini-hydro, and biomass energy generation.</p> <p>Examples from our long list of projects that could enter this program are: mini dams construction, solar panels installation mainly for irrigation or for tourism facilities, hydro production or biomass energy production.</p> <p>In Mozambique there is still no approved legislation defining fee in tariffs or off-grid tariffs which can be a major constraint for traditional investors.</p> <p>So, the project would be structured in three distinct types of projects:</p> <p>The first type of projects is the high impact social benefits projects such as powering distant villages or improving irrigation. An example of a type one project is the electrification of rural villages.</p> <p>The second type of projects will be the substitute projects in which private entities will replace the use of fuel for some sort of clean energy. An example of a project can be the production of bioethanol or the introduction of solar panels to substitute diesel in tourist facilities.</p> <p>The third type of projects will be the more "traditional type" of projects, based on feed in tariffs and can only be developed when Mozambique legislation regarding renewable energy consider these</p>	<p><b>Potential Project:</b> Development of Agro forestry in Mozambique</p> <p><b>Arthur D Little INGC</b></p> <p><b>• Short Description:</b></p> <p>The main goal of the project is to create an Agro forestry fund to develop agricultural / forestry projects that along with financial returns provide rural communities with tools to become better environmental stewards in order to save their forests and water and improve their living conditions.</p> <p>The fund will manage private equity dedicated to sustainable forestry projects - and can have investors such as foundations, family offices and pension funds.</p> <p>Agro forestry is an integrated approach of using the intensive benefits from combining trees and shrubs with crops and/or livestock.</p> <p>Agro forestry fund has the potential to help investors adapt to climate change by providing funds to reform and capabilities needed to involve the communities in the reforestation process in order to avoid "slash and burn" agriculture approaches by the communities, which involves cutting and burning of forests or woodlands to create fields and has a detrimental effect on long-term quality of land.</p> <p>Target companies can include those profiting from expanding forest management practices (including the manufacture of environmentally certified wood products), community foundations that want to develop and improve the living conditions of the communities or agricultural companies that want to diversify their products while protecting their lands.</p> <p>There are several opportunities to invest in sustainable forestry projects in Mozambique - the team identified some opportunities of agro forestry in Cabo Delgado, Manhiça, Zumbo and Sofala.</p> <p><b>• Potential benefits and interest for private investors and / or donors:</b></p> <p>The projects will be able to demonstrate a return on investment and a strong social / environmental impact.</p> <p>The type of results will highly depend on each project and can be:</p> <ul style="list-style-type: none"> <li>Financial returns through CDM certificates</li> <li>Financial returns through the creation of a market for the cash crops planted</li> <li>Financial returns through the selling of new products (e.g. fruits)</li> <li>Diversified crops and labor resources</li> <li>Increasing food security for a region</li> <li>More income and community jobs per hectare of land.</li> </ul>

In the next phase we will develop project dossiers for each of this projects

0 Executive Summary

1 Phase 1

2 Phase 2

**3 Phase 3**

**3.1 Executive Summary**

3.2 The Four Programs

3.3 Involvement of the Insurance Sector

3.4 Barriers to Business Analysis

3.5 Strategic Recommendations

### Four programs were selected as top priority in the reduction of vulnerability/increase of resilience: Micro & Small Scale Lending, Composting, Clean Energy and Agroforestry

#### Phase II

#### Micro & Small Scale Lending

- The **purpose of this Program** is to develop a micro and small scale lending program for adaptation initiatives in Mozambique supported by the government and run by private companies or NGO's
- The **target segment** of the population is mainly micro and small companies and communities working as companies in **sectors** like tourism, agriculture, industry or energy
- A credit line specifically dedicated to **Climate Change Adaptation Initiatives** has the potential to create a very significant impact in building resilience to climate change

#### Waste Management and Composting

- The **main goal of this Program** is to develop a financial product to help boost composting businesses in Mozambique
- The program will be nationwide and cover all the major cities of the country and will be developed through several concurrent pilot projects
- The main products are organic fertilizer and methane emissions reduction
- The **climate change benefits** of composting are high as it positively impacts city infrastructures and the food security of rural communities

#### Clean Energy Program

- The **main goal of this Program** is to encourage private sector companies' investment in clean energy in order to adapt to climate change
- **Target projects** of this program will be focused on creating energy independence for **agriculture, tourism** and other sectors, as well as for rural communities, via the promotion of sustainable electricity generation
- This program will give access to funding for enterprises, communities and energy providers nation-wide

#### AgroForestry Fund

- The **purpose of this Program** is to create an Agro forestry fund to develop worthy Agroforestry projects
- Along with **financial returns** to investors, these projects **provide** rural communities with the **tools** to become **better environmental stewards** in saving their forests, improving water conservation and improving living conditions.
- Agroforestry projects drive **crop and income diversification, soil and water conservation** and efficient nutrient cycling and conservation



**The Clean Energy Program will address on one hand the insufficient electricity supply in Mozambique, and on the other hand take advantage of the tremendous natural resources**

### Phase III

#### Clean Energy Program

##### Project Summary

- Mozambique has tremendous untapped natural resources for the development of renewable energy (wind, solar, hydro,...)
- With this Program, the Mozambican Government aims to boost a sector that is crucial for building resilience to climate change, one that has not been widely addressed so far
- The Program will allow investment in micro (1-10 kW)/mini scale (10-100 kW) and distributed utilities (100-1.000 kW) projects. These installations are crucial for the development of some social services (hospitals, schools) and the flourishing of commerce, industry, agriculture and fishing

##### Forecasted Investment

175-200 M€

##### Major Investors

Specialized funds, Private Equity, National & Multilateral Development Finance, Industry players

##### Pilot Project

Construction of a 1MW on-grid PV plant in Maputo

**The two main goals of the Composting Program are the improvement of the waste management procedures and the increase in fertilizer usage in agriculture**

### Phase III

#### Composting

##### Project Summary

- Low agricultural yields and waste management are two significant problems in Mozambique
- To address both, the Mozambican Government will launch this Program which addresses solid organic waste treatment and builds resilience to climate change by incentivizing the wider usage of fertilizers in agriculture, increasing yields and economic returns
- The composting sites will use waste from households, communities, commerce and industry, in order to produce fertilizers that will then be sold to farmers and cooperatives

##### Forecasted Investment

15-30 M€

##### Major Investors

Environmental Funds, Private Impact, Grants & Foundations, National & Multilateral Development Finance

##### Pilot Project

Pilot project in Pemba, in partnership with the Aga Khan Foundation

### The Micro and Small Scale Lending Program will help financing, with bearable interest rates, projects that help building resilience to climate change in Mozambique

#### Phase III

#### Micro & Small Scale Lending

##### Project Summary

- Mozambique is one of the world's countries with lowest access to financing, which hinders the birth and growth of entrepreneurs/SMEs, the backbone of any country's economy
- The Program aims to help fund projects that foster resilience to climate change and at the same time fortify Mozambique's economy
- By creating pre-negotiated packs with suppliers of irrigation, energy, transport and other equipment, we plan to be able to offer attractive loan conditions for stimulating micro and small-scale financing of resilience building initiatives and projects nationwide

##### Forecasted Investment

25-50 M€

##### Major Investors

Regional and international wholesale banks, National & Multilateral Development Finance Institutions, Micro-Finance Funds

##### Pilot Project

Partnership to be established with two of the biggest banks in Mozambique (Socremo or Novobanco)

**Finally, the Agro Forestry's Program main goal is the forestry valuation and management improvement, while developing sustainable agricultural practices**

### Phase III

#### AgroForestry Fund

##### Project Summary

- Agroforestry provides an integrated approach combining agricultural and forestry technologies to create more diverse, productive, profitable and sustainable land-use systems that build resilience at the local level
- The AgroForestry Fund will invest in projects that generate both revenues and climate change resilience at multiple levels from forestry and agricultural products to eco-tourism
- This Program will be focused firstly on regions with excellent conditions for forest plantation (Niasa, Nampula, Zambezia and Manica)

##### Forecasted Investment

50-100 M€

##### Major Investors

Specialized Funds, Private Equity, National & Multilateral Development Finance, Pension Funds, Industry players

##### Pilot Project

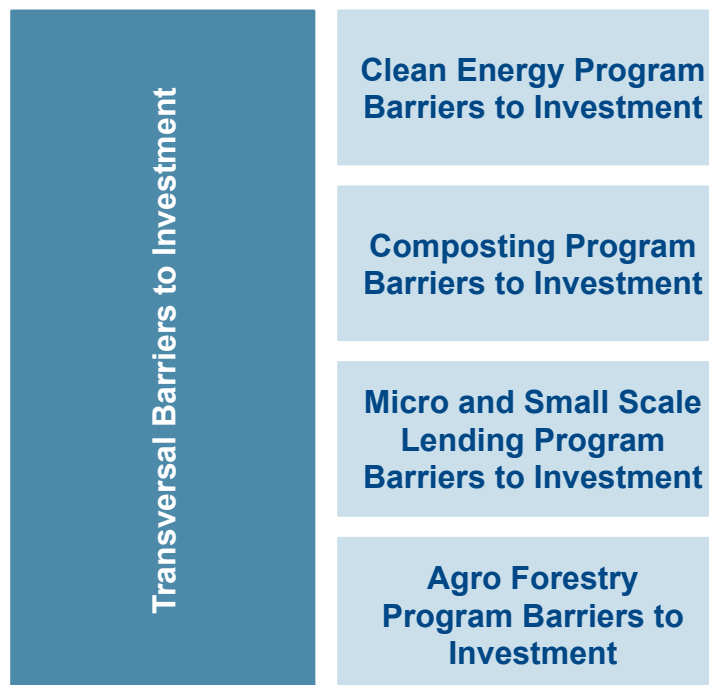
Agroforestry project with development of eco-tourism and poultry initiatives

However, to bring these Programs to light it's necessary to overcome a series of investment barriers that have been detrimental to the external investment in Mozambique

Phase III

### Framework of analysis

### Key issues



	Access to electricity and a decrease in foreign investment due to the current global crisis are two of the most pressing barriers. Another big deterrents of private investment, specially foreign investment, are the levels of corruption.
	From a list of issues that should be overcome in the near future the most pressing are the establishment of feed-in tariffs and of an adequate legislative framework
	In the Composting Program the most important barriers are also on the economic/financial and legislative side, with initial investment and lack of legislation playing an important role
	Logistic barriers and inadequate mindset are the most pressing barriers concerning the Micro & Small Scale Lending Program
	The most significant issue to overcome is the cultural barrier associated with the limited awareness of the benefits of this type of initiatives

## 3.1 Executive Summary

### Penetration of insurance products into developing markets is extremely low but a growing number of players are trying to understand what the future could hold

#### Phase III

#### Insurance Sector Workshop

##### Summary of activities

A significant number of major global insurance and re-insurance companies have been interviewed and their views sought on the potential deeper involvement in the programs into 2012 and beyond. A number of regional players were also interviewed

##### Interviewed parties

AXA, Allianz, Swiss Re, Micro-ensure, Zurich, Willis Group, The Hartford, Fin-mark, CDC, Bankable Frontiers, Nedbank, Guy Carpenter, Climate Wise, Micro-risk

##### Data mapping

Availability of reliable, historic data remain a critical factor in determining risk and understanding where product risks end and insurance can take over

##### Governance and regulation

As with other financial products, a stable, enforceable regulatory framework remains a requisite for scalable corporate transactions.

##### Pricing and value

Lack of data, cluster risks and a challenging operating environment make pricing risk extremely difficult for climate related risks

##### Products versus events

Involvement of the insurance sector varies across the pilot projects. Factors that are product-related e.g. for the renewables or composting programs are easier to insure than weather or climate related factors e.g. agro-forestry

##### Distribution and collection

For programs with higher volume collection and product distribution e.g. microfinance and agroforestry local partnership with trusted players with an understanding of the operating environment will be key

##### Pilot project approach

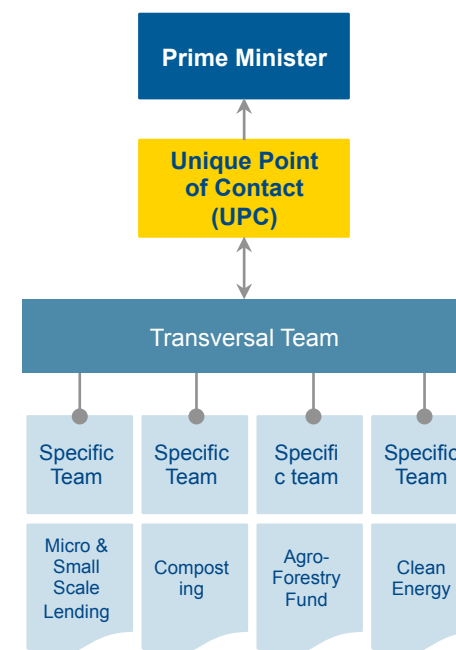
A number of players agreed that a pilot project approach with tangible and investable projects could be interesting. It is important however that the projects are of sufficient scale to enable appropriate levels of "investment"

**A crucial aspect for the success of these Programs is the creation of a sound support structure, to ensure efficient communication and a swift decision making process**

### Phase III

#### Strategic Recommendations

- **INGC** has a **dedicated team** working exclusively on the set-up of each of these Programs
- A **Unique Point of Contact (UPC)** will be established to support international investment in to these and other climate change adaptation and resilience building programs, ensuring a clear and effective channel for investment.
- This UPC is supported by a team of experts that will manage the economic, technical and legal aspects of the projects in each Program and the relationship between international investors and local promoters, authorities and communities.
- In addition to building climate change resilience, another important target of these Programs is **to build the required skills and capabilities** in Mozambique to ensure the execution and continuity of these Programs, as well as to develop future initiatives. With this in mind, a Capability-Building project is to be launched where local resources will receive appropriate training, side-by-side learning with external experts and necessary technical assistance
- However, without a portion of **public funding** to start these initial four Programs and without ensuring **proactive Government support**, the private sector will not be interested to make the investments on their side as the costs/barriers will be too great



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**3.2 The Four Programs**

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## 3.2 The Four Programs – Programs' overall structure

The major goal of the four Programs selected is the implementation in Mozambique of a set of projects to reduce vulnerability and increase resilience to climate change

Program overview	
Objective	Key components
Implementation of a set of projects that will <b>reduce vulnerability</b> and <b>increase Mozambique's resilience to climate change</b>	■ Capacity building
	■ Creation of unique point of contact for investors
	■ Provisioning of on going technical support
	■ Drive legal framework alignment for the promotion of investment
	■ Monitoring of the program implementation and operation

## 3.2 The Four Programs – Addressing Rio+20 critical issues

**The four Programs selected address all the critical issues defined by the Rio+20 agenda**

	Addressing Rio+20 critical issues
Jobs	All the Programs have direct job creation, however they also allow for indirect job creation. For instance bringing electricity to population fosters the development of new businesses in commerce, agriculture, fishing and services
Energy	The Clean Energy Program addresses this issue directly, by bringing renewable energy to the populations under a distributed energy concept
Cities	From the four Programs, Micro & Small Scale Loans and Composting are probably those that contribute more for a sustainable city development, by improving significantly the quality of life of their citizens
Food	The Agro Forestry Program addresses this issue directly, by contributing for a sustainable agricultural production, with the parallel benefit of reforestation
Water	Access to clean water is a side benefit of the Clean Energy program (by providing use to water pumps) and the Micro & Small Scale Loans (by providing the financial means to access to clean water)
Oceans	Fishing is one of the main activities in Mozambique. Access to electricity allows the conservation of fisheries and an increase in quality of life
Disasters	The four Programs share the common and primary goal of increasing resilience to climate change, and thus to natural disasters

## 3.2 The Four Programs – Programs' overall structure

Each of the Program's is divided in three stages: an initial set up phase, the pilot project set up and implementation and finally the creation of a comprehensive pipeline of projects

### Program's structure



Clean Energy



Micro & Small Scale Lending



Clean Energy



Clean Energy

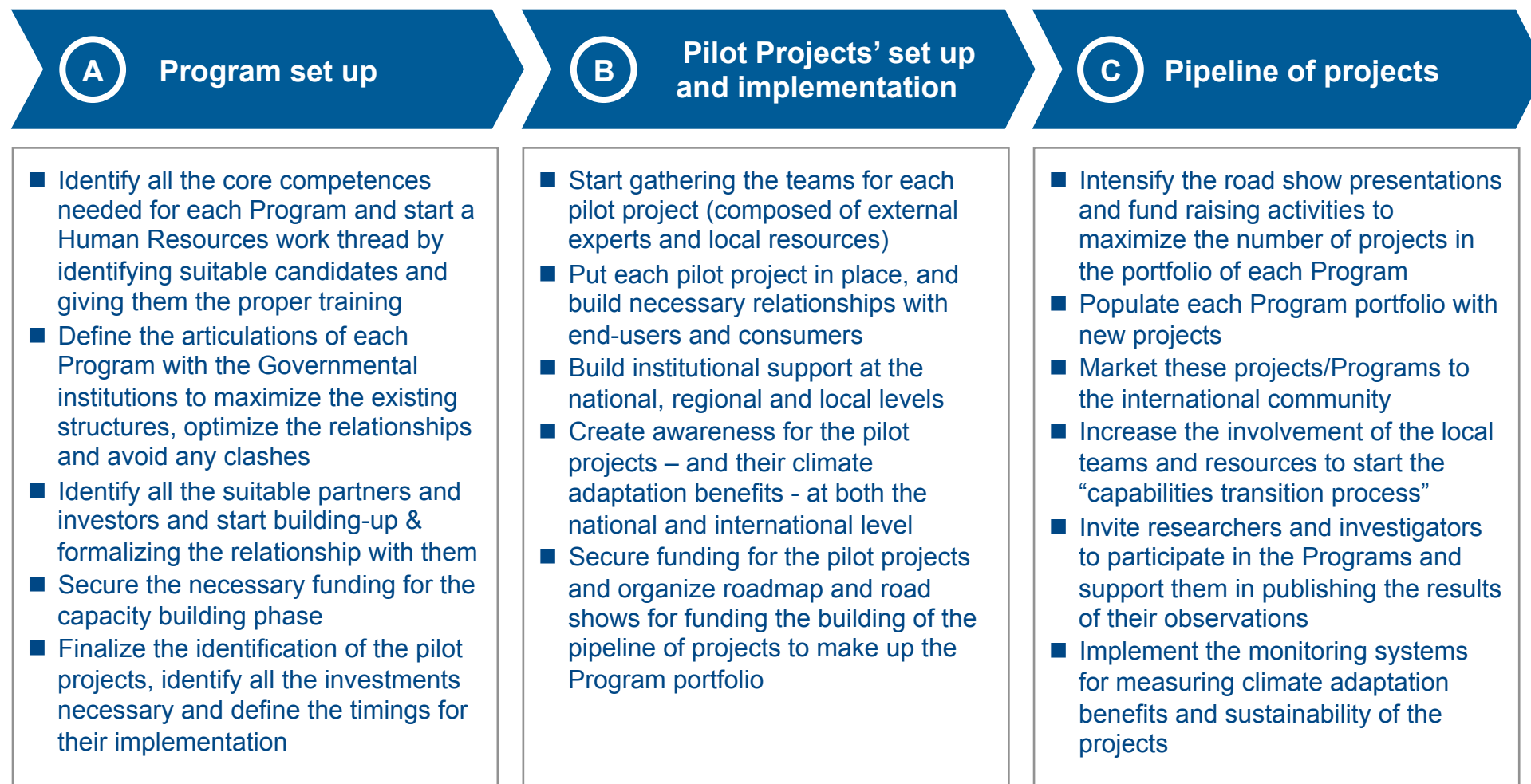
Program set up

Pilot Projects' set up  
and implementation

Build Pipeline of  
projects

## 3.2 The Four Programs – The three steps

**In the Program set up phase will be set the grounds for all the logistic/legal/financial/ personnel aspects of the Program, that will be further explored in the two subsequent phases**



## 3.2 The Four Programs – Program set up

The Program set up will require very specific competences for each of the Programs and also a unique type of financing, less focused on returns and more on building competences

Summary of activities				
Make all the necessary arrangements to have everything that is needed for each Program (personnel, structures, authorizations, hierarchies, etc...) ready to launch the pilot projects and the overall Program management as soon as possible				
Program set up	Clean Energy	Composting	Micro & Small Scale Lending	Agro Forestry Fund
	<p><b>Capacity building</b> Personnel with deep knowledge of renewable energy (solar, wind, hydro), CDM and other financing mechanisms for developing countries and of the Mozambican reality</p> <p><b>Types of funders</b> National and Multinational Development Agencies, Grants &amp; Foundations</p> <p><b>Duration</b> Approximately 3-6 months</p> <p><b>Major challenges</b> No defined feed-in tariff system, lack of financial capacity, very disperse locations, bureaucratic licensing process, difficulties in negotiating with EDM</p>	<p><b>Capacity building</b> Personnel with knowledge of composting best practices and with ground knowledge of where to get the waste and whom to sell the fertilizer</p> <p><b>Types of funders</b> National and Multinational Development Agencies, Grants &amp; Foundations</p> <p><b>Duration</b> Approximately 3-6 months</p> <p><b>Major challenges</b> Educating populations for correct waste separation and the benefits of using compost in agriculture. Creating effective network of waste collectors and fertilizer distributors</p>	<p><b>Capacity building</b> Personnel with deep financial and accounting knowledge and capacity to manage a financial institution</p> <p><b>Types of funders</b> National and Multilateral Development Agencies, Grants &amp; Foundations</p> <p><b>Duration</b> Approximately 3-6 months</p> <p><b>Major challenges</b> Educate populations for this type of lending. Evaluate project impact in building resilience for climate change. Network reach that covers all target populations</p>	<p><b>Capacity building</b> Personnel with deep agro forestry knowledge, able to connect with the populations and set up different projects</p> <p><b>Types of funders</b> National and Multilateral Development Agencies, Grant &amp; Foundations</p> <p><b>Duration</b> Approximately 3-6 months</p> <p><b>Major challenges</b> Identify projects with an adequate risk-return profile and potential for replication nation-wide. Engage the local communities and ensuring sustainability over time</p>

## 3.2 The Four Programs – Pilot Project

Each of the four pilot projects will be a “show room” for the respective Program, and thus its success must be guaranteed by choosing the best partners and collaborators

Pilot Project's set up and implementation	<b>Summary of activities</b> Implement pilot projects and start the road show activities to gather new investors for the Programs' roll-out to a portfolio of projects. Portfolio building, cycle of monitoring pilots and feedback cycle to ensure lessons learned are incorporated in to following projects.			
	Clean Energy	Composting	Micro & Small Scale Lending	Agro Forestry Fund
	<b>Capacity building</b> Personnel with capacity to understand the specificities of the project and negotiate with the Government and funders. Personnel with fund raising capacities <b>Types of funders</b> Specialized funds, Private Equity, National & Multilateral Development Finance, Industry players <b>Duration</b> Apr. 9-12 months <b>Major challenges</b> Negotiating with partners and investors. Negotiate with FUNAE, EDM or other Government institutions. All the installation operational issues.	<b>Capacity building</b> Personnel with capacity to understand the specificities of the project and negotiate with the suppliers, funders and end consumers. Personnel with fund raising capacities <b>Types of funders</b> Environmental Funds, Private Impact, Grants & Foundations, National & Multilateral Development Finance <b>Duration</b> Apr. 9-12 months <b>Major challenges</b> Negotiating with the partners and the investors. Optimize the waste collection and the fertilizer production with the consumption/ sales. Guarantee buyers for the fertilizer.	<b>Capacity building</b> Personnel with experience in setting up a financial institution and capacity to negotiate with the funders and MFIs. Personnel with fund raising capacities <b>Types of funders</b> Regional and international wholesale banks, National & Multilateral Development Finance Institutions, Micro-Finance Funds <b>Duration</b> Apr. 9-12 months <b>Major challenges</b> Negotiating with the partners and investors. Transmit confidence to borrowers. Ensure an adequate balance of interests, management costs and borrowers capacity to pay.	<b>Capacity building</b> Personnel with experience in selecting the best species and locations for the Agro Forestry fund and deep knowledge of the populations and their needs. Personnel with fund raising capacities <b>Types of funders</b> Specialized Funds, Private Equity, National & Multilateral Development Finance, Pension Funds, Industry players <b>Duration</b> Apr. 9-12 months <b>Major challenges</b> Negotiating with the partners and the investors. Negotiate conditions with population and set up an adequate forestry management program

## 3.2 The Four Programs - Building a pipeline of projects

**Building a healthy, sustainable and nation-wide pipeline of projects is the natural step after the implementation of the pilot projects and the ultimate goal of these four Programs**



## 3.2 The Four Programs – Program set up phase costs (1/2)

In the Program Set up phase, the majority of costs for the specific teams will be related with human resources (hiring & training), technical material and support & back office...

### Program Set up (6 months) – Specific teams<sup>1</sup>

<b>Clean Energy</b>				
■ Human Resources				
International experts	180.000			
Local resources	14.400			
Training	20.000			
■ Technical				
Solar, wind and hydro mapping	30.000			
Modeling	30.000			
■ Support				
Offices	1.800			
Support material (computers, mobiles,...)	6.400			
Back office personnel	2.400			
<b>Total</b>	<b>285.000</b>			

<b>Composting</b>				
■ Human Resources				
International expert	90.000			
Local resources	10.800			
Training	9.000			
■ Technical				
Nutrient requirements, new techniques,...	10.000			
Modeling	15.000			
■ Support				
Offices	1.800			
Support material (computers, mobiles,...)	4.100			
Back office personnel	2.400			
<b>Total</b>	<b>143.100</b>			

<b>Micro and Small Scale Lending</b>				
■ Human Resources				
International expert	180.000			
Local resources	18.000			
Training	24.000			
■ Technical				
Financial analysis tools, subscriptions	25.000			
Modeling	20.000			
■ Support				
Offices	1.800			
Support material (computers, mobiles,...)	6.400			
Back office personnel	2.400			
<b>Total</b>	<b>277.600</b>			

<b>Agro Forestry Fund</b>				
■ Human Resources				
International expert	90.000			
Local resources	10.800			
Training	9.000			
■ Technical				
Species' selection, yield optimization	20.000			
Modeling	15.000			
■ Support				
Offices				
Support material (computers, mobiles,...)	1.800			
Back office personnel	4.600			
	2.400			
<b>Total</b>	<b>153.600</b>			

<sup>1</sup>See Chapter 5 for more details on the Transversal Team and Unique Point of Contact. All values in euros (€)



## 3.2 The Four Programs – Program set up phase costs (2/2)

... while the costs associated with setting up the transversal team and unique point of contact are exclusively from personnel

### Program Set up (6 months) – Transversal Team & Unique Point of Contact<sup>1</sup>

Transversal Team <sup>2</sup> (6 months)	■ Coordinator	6.000
	■ Clean Energy Program Point of Contact	4.800
	■ Composting Point of Contact	4.800
	■ Micro & Small Scale Lending Point of Contact	4.800
	■ Agro Forestry Fund Point of Contact	4.800
	<b>Total</b>	<b>25.200</b>
Unique Point of contact <sup>2</sup> (6 months)	■ Coordinator	6.000
	■ Personal Assistant	3.600
	<b>Total</b>	<b>9.600</b>

<sup>1</sup>All values in euros (€); <sup>2</sup>See Chapter 5 for more details on the Transversal Team and Unique Point of Contact

## 3.2 The Four Programs – Pilot Project set up and implementation phase costs

The overall cost of the pilot projects is some 9,25 M€, with the majority being allocated to the Clean Energy and Agro Forestry Programs

### Pilot Project's set up and implementation

#### Clean Energy

**3,4 M€**

*View slide 273  
for more details*

#### Composting

**350 k€**

*View slide 302  
for more details*

#### Micro and Small Lending

**2,5 M€**

*View slide 320  
for more details*

#### AgroForestry Fund

**3 M€**

*View slide 345  
for more details*

## 3.2 The Four Programs – Pipeline of projects phase costs

Creating an healthy and interesting pipeline of projects is a crucial step in the overall Program structure, and where the majority of the investment will be made

### Pipeline of Projects

Clean Energy		Composting	
Fund raise Program target	175 - 200 M€	Fund raise Program target	15 - 30 M€
Set-up the Program	(- 300 k€)	Set-up the Program	(- 150 k€)
Pilot Project	(- 3,4 M€)	Pilot Project	(- 350 k€)
Project Pipeline	~ 171 – 196 M€	Project Pipeline	~ 15 – 30 M€

Micro and Small Lending		AgroForestry Fund	
Fund raise Program target	25 - 50 M€	Fund raise Program target	50 - 100 M€
Set-up the Program	(- 300 k€)	Set-up the Program	(- 160 k€)
Pilot Project	(- 2,5 M€)	Pilot Project	(- 3 M€)
Project Pipeline	~ 22 – 47 M€	Project Pipeline	~ 47 – 97 M€

## 3.2 The Four Programs – Overall view on costs

The total investment in the Four Programs, for the three phases, is around 265 – 380 M€ and will be raised from a mix of philanthropists and specialized funds, with debt for project roll out

Overall costs			
Stage	Value		
	6 months	6-18 months	12 months-onwards
Program Set up	895.000 €	<div>Without a portion of <b>public funding</b> to pump-prime these projects and proactive <b>Government support</b>, the private sector will not be interested to make the investments on their side as the costs/barriers will be too great</div>	
■ Unique Point of Contact	9.600 €		
■ Transversal Team	25.200 €		
■ Specific Teams	860.000 €		
Pilot Project Set up and implementation		9.250.000 €	
Pipeline of projects			255 – 370 M€
Total	265 – 380 M€		

## 3.2 The Four Programs – Phase III implementation calendar

The Phase III should take 24 months, with the initial 3-6 devoted to the Programs' set up, 9-12 to pilot projects execution and the remaining with populating the programs with new projects

Quarters	1	2	3	4	5	6	7	8
<b>Step 1: Program set up</b> Select the personnel for each Program Identify training needs, logistics, etc Secure funding for capability building Short-list investors for pilots and Programs Liaise with partners and Government institutions								
<b>Step 2: Pilot Projects</b> Start the pilot project's implementation Road show for fund raising Identifying new projects for Program portfolio Feedback cycle of lessons learned								
<b>Step 3: Pipeline of Projects</b> Allocation of funds New projects scoping and build out Mid term Program's evaluation and report Build autonomy in local resources								

Source: Arthur D. Little analysis

 Timescales

## 3.2 The Four Programs – Contacted investor's list

Potential investors and thought leaders have been canvassed and their views sought throughout the duration of the project to understand their appetite and barriers to investment

Clean Energy			Composting		
<ul style="list-style-type: none"> <li>■ Earth Capital</li> <li>■ 3i</li> <li>■ Self energy</li> <li>■ HSBC</li> <li>■ Macquarie</li> </ul>	<ul style="list-style-type: none"> <li>■ IFC</li> <li>■ GTZ</li> <li>■ CDC</li> <li>■ Sifem</li> <li>■ Globalance</li> </ul>	<ul style="list-style-type: none"> <li>■ ABN Amro</li> <li>■ Stand Chart</li> <li>■ Merrill Lynch</li> <li>■ South Pole</li> <li>■ CDKN</li> </ul>	<ul style="list-style-type: none"> <li>■ Gates Foundation</li> <li>■ CDC</li> <li>■ NovusModus</li> <li>■ IFC</li> </ul>	<ul style="list-style-type: none"> <li>■ Proparco</li> <li>■ Emerging Capital</li> <li>■ Earth Capital</li> <li>■ Nedbank</li> </ul>	<ul style="list-style-type: none"> <li>■ New Philanthropy Capital</li> <li>■ (HSBCInfrared)</li> <li>■ Barclays (ABSA)</li> </ul>
Micro and Small Scale Lending			Agro Forestry		
<ul style="list-style-type: none"> <li>■ SCB</li> <li>■ Deutsche</li> <li>■ Nedbank</li> <li>■ Standard Bank</li> <li>■ Barclays</li> </ul>	<ul style="list-style-type: none"> <li>■ CDC</li> <li>■ Norfund</li> <li>■ Proparco</li> <li>■ Swedfund</li> <li>■ DFID</li> </ul>	<ul style="list-style-type: none"> <li>■ Triodos</li> <li>■ Doen</li> <li>■ Dignity</li> <li>■ Access</li> <li>■ Oiko</li> </ul>	<ul style="list-style-type: none"> <li>■ CDC</li> <li>■ Earth Capital</li> <li>■ Emerging Capital</li> <li>■ HSBC</li> <li>■ CCC</li> </ul>	<ul style="list-style-type: none"> <li>■ DFID</li> <li>■ Gates</li> <li>■ Norad</li> <li>■ Greenbelt</li> <li>■ FMO</li> </ul>	<ul style="list-style-type: none"> <li>■ IFC</li> <li>■ EBRD</li> <li>■ Clinton Climate</li> <li>■ CDC</li> </ul>

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3.1 Executive Summary

**3.2 The Four Programs**

**3.2.1 Clean Energy Program**

3.2.2 Composting

3.2.3 Micro & Small Scale Lending

3.2.4 AgroForestry Fund

3.2.5 New Programs' Framework

3.3 Involvement of the Insurance Sector

3.4 Barriers to Business Analysis

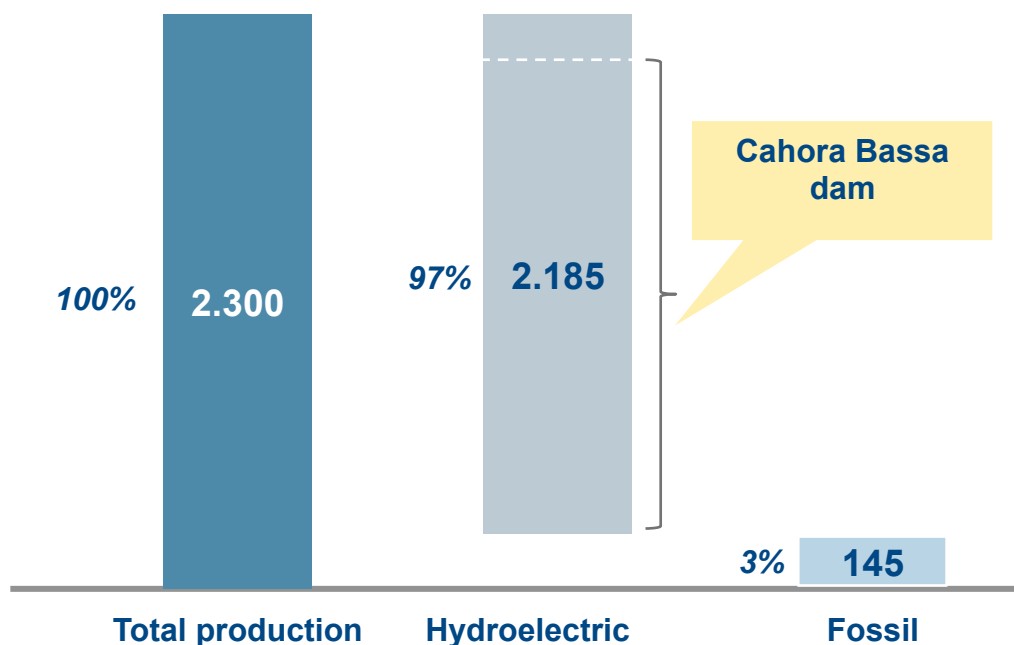
3.5 Strategic Recommendations

## 3.2.1 Introduction – Electric production capacity

Mozambique produces electricity mainly from hydro with the majority of this production being exported to South Africa given the inexistence of distribution grid to bring electricity south

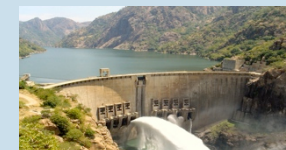
### Mozambique's electricity production capacity

Split of total capacity by source, MW



- 97% of the electricity production in Mozambique comes from hydro sources
- The 2,075 MW Cahora Bassa dam is responsible for 95% of the hydroelectric production in the country
- However, around **80% of the electricity produced in Cahora Bassa is exported** mainly to South Africa under the SAPP Agreement
- Mozambique imports power for use in the southern part of the country, namely Maputo

*Cahora Bassa dam, Mozambique*



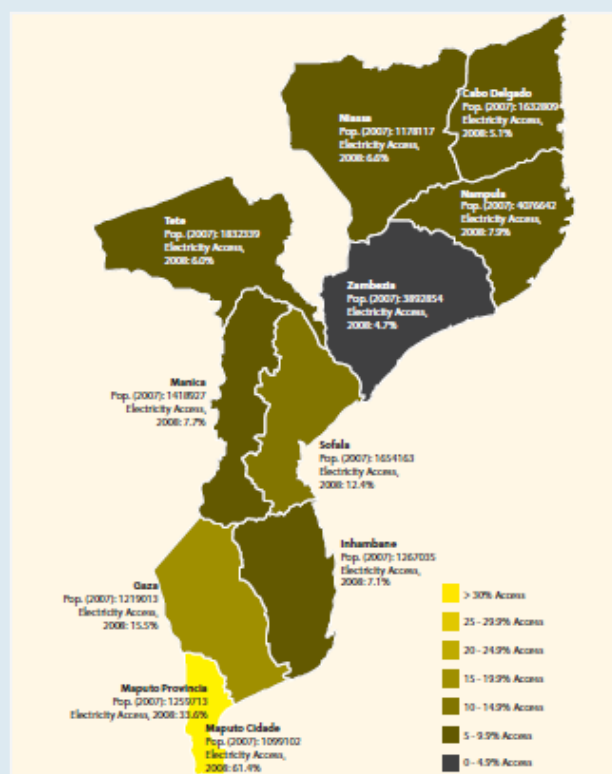
Source: FUNAE; \* solar and wind; \*\*South African Power Pool Energy Supply



## 3.2.1 Introduction – Access to electricity in Mozambique

Mozambique faces severe limitations in terms of electricity access – off-grid and decentralized approaches are seen as the best suitable solutions to serve the highly dispersed locations

### Mozambique's Electricity Transmission Infrastructure



- The national electricity grid provides power to only **17% of the population**
- The large size of the country and its dispersed settlement patterns makes **dispatching to the entire population extremely expensive**
- **Power losses** are twice as frequent when compared with the rest of the world

**Off-grid and decentralized power sources** are seen as more suitable solutions to enhance **energy security** in the country and energy **access to the populations**

Source: Strategic plan for renewable energies – Ministry of Energy; A Renewable plan for Mozambique – Mark Hankins

## 3.2.1 Introduction – Renewable energy potential in Mozambique

Despite the predominance of hydro, Mozambique has very favorable conditions across the country for the development of other renewable energy power sources, like wind and solar

### Renewable energy resources in Mozambique

#### Solar



- Has one of the **highest solar irradiation levels in the world**, distributed evenly across the country
- Annual incident solar radiation is about 1,50 million GWh, with annual daily average at 5,7kWh/m<sup>2</sup>/day.

#### Wind

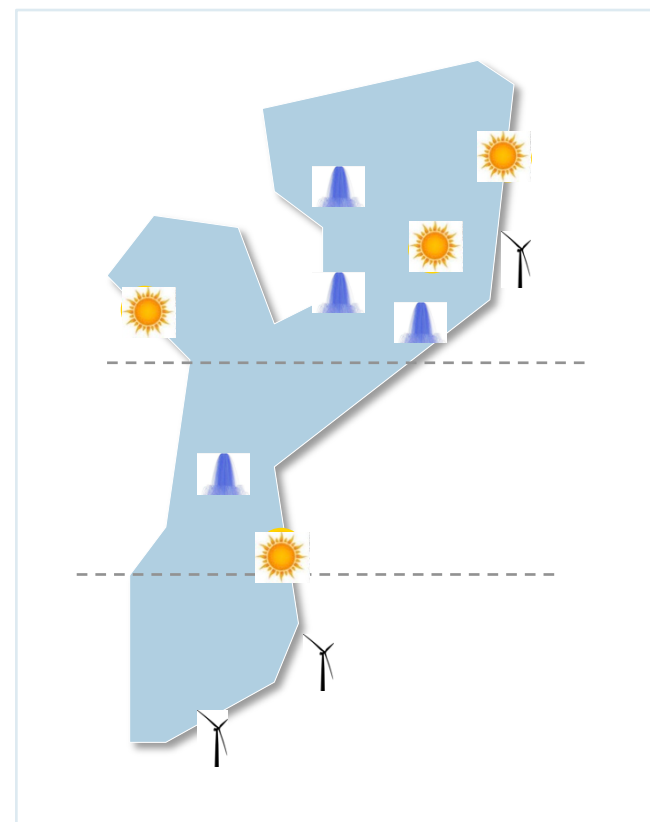


- **Resources for small-medium wind energy production** (between 6 to 7 m/s)
- Primary wind resources are located along the country's long coastline and in the Niassa area

#### Hydro



- **Hydro potential estimated to be around 12 GW**, located in Zambeze valley, Pungoe and Buzi
- Potential for 60 micro- and mini-hydropower projects with a potential of up to 1.000 MW



Source: Strategic plan for renewable energies – Ministry of Energy; A Renewable Plan for Mozambique – Mark Hankins

Nevertheless, the use of renewable energy sources, other than hydro, has been limited so far

### Use of renewable energy sources in Mozambique

#### Hydro



- Over 2.185MW of installed capacity
- The 2 GW Cahora Bassa dam is responsible for 97% of the country production
- There are 12 medium/size and large dams in Mozambique
- Considered the cheapest electricity source

#### Solar



- **On grid** projects are inexistent and there is no foreseen legal framework to promote investment
- **Off grid** projects **have been critical to provide electricity to remote communities not connected to the grid**
- These are typically small scale initiatives targeting schools, hospitals, public and also houses of families, typical funded by the government and donors.

#### Wind



- The use of wind energy is very limited, despite the favorable wind conditions
- Most common use is to support small scale pumping systems
- It is acknowledge by the government the potential of wind energy

Source: FUNAE; \* solar and wind; \*\*South African Power Pool Energy Supply

## 3.2.1 Introduction – Current legislative framework and future perspectives

The Mozambican Government has considered the investment in renewable energy to address the country's power access limitations - however adequate legal framework is still lagging

### Policy and regulation of renewable energy investments

	Situation	Mozambican Government objectives
On-grid	<ul style="list-style-type: none"> <li>■ No established legislative framework for investments in solar and wind on-grid projects</li> <li>■ <i>Feed-in-tariffs</i> (FIT) assumed to be key mechanisms to promote investment in renewable energies - government officials state that a FIT framework will be put in place in the short-term</li> </ul>	<ul style="list-style-type: none"> <li>■ Conclude mapping of national wind conditions</li> <li>■ Create legal framework to incentivize private investment in wind projects</li> <li>■ Install <b>100MW of wind</b> energy capacity</li> <li>■ Install <b>125MW of hydroelectric</b> capacity</li> </ul>
Off-grid	<ul style="list-style-type: none"> <li>■ Considered crucial to provide power to distant communities</li> <li>■ All public off-grid initiatives are centralized in one entity – FUNAE</li> <li>■ It is assumed that the definition of a sustainable tariff scheme is essential to incentive investment</li> </ul>	<ul style="list-style-type: none"> <li>■ Install <b>50.000</b> solar and wind systems for households</li> <li>■ Install <b>5.000</b> solar pumping systems</li> <li>■ Install <b>5.000</b> solar and wind systems for small business</li> <li>■ Install <b>10.000</b> of micro/mini wind generators</li> </ul>

Source: National plan for the Renewable Energy Sector

## 3.2.1 Introduction – Off-grid projects

Off-grid projects have been essential to serve distant rural communities and have been promoted mostly by FUNAE - the governmental institution that centralizes off-grid initiatives

### Off-grid projects in Mozambique - Examples



- FUNAE was set-up by the government in 1998 to centralize off-grid projects initiatives
- Raises funds from donors, to invest in the projects with no expected return
- It is responsible for the identification and selection of projects, procurement of equipment and bidding process

#### Electrification of the Chicualacuala district

- Electrification of the district using photovoltaic systems
- Included homes, businesses, healthcare facilities and water pumping systems
- Beneficiated directly around 175 families



#### Construction of Mini hydroelectric plant in Rotanda

- Electrification the using a 650kw hydroelectric plant
- Will be the main source of energy in that point of the country
- Will beneficiate a population of around 13 thousand people



Source: FUNAE

## 3.2.1 Program Description – Program overview

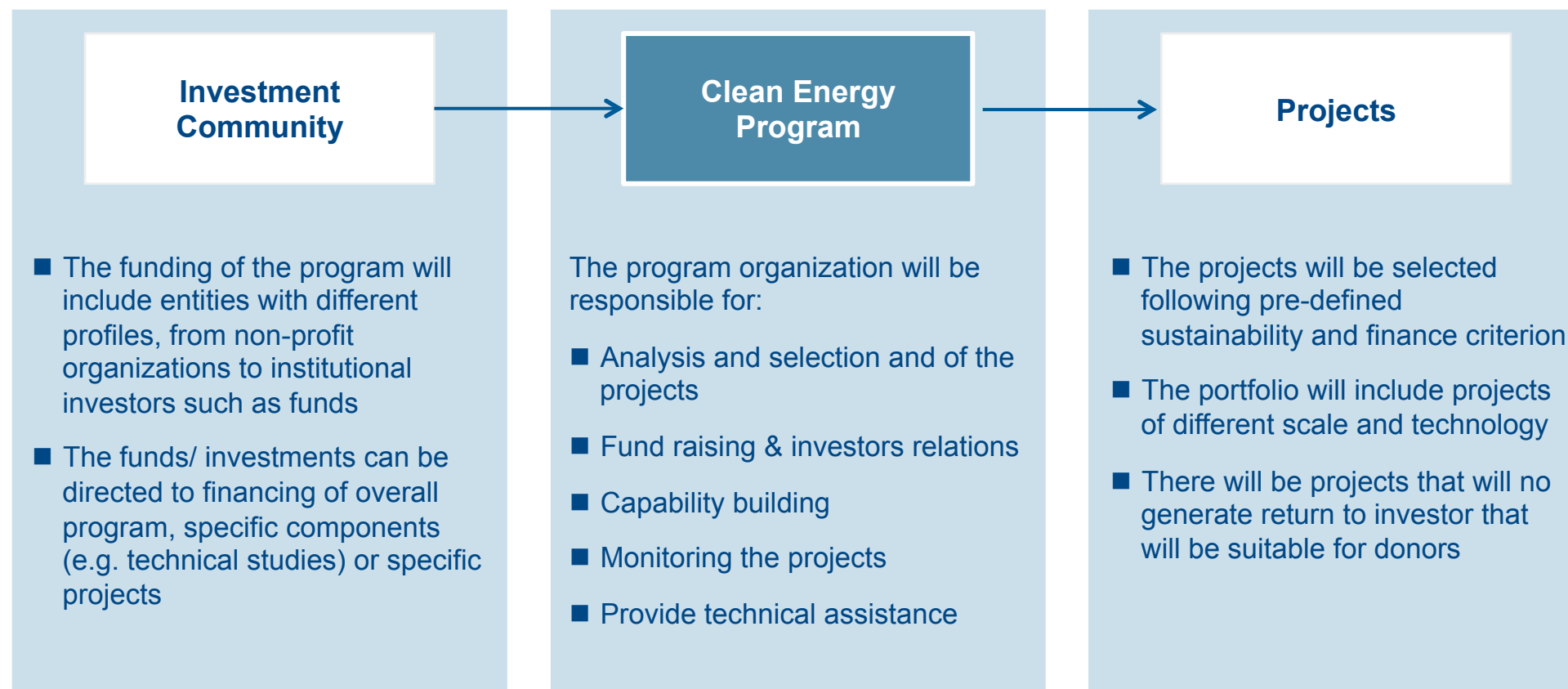
**This Program aims to implement a series of renewable energy projects aimed to increase Mozambique's resilience to climate change**

Limited electricity access	Distributed utilities	Lower CO <sub>2</sub> emissions
Address the limited access to electricity that Mozambican populations currently observe	Implement a distributed utilities approach to address the lack of a nation wide distribution grid	Promote the use of renewable energy in detriment of fuel based alternatives
International Investment	Sustainable Development	High natural resources
Open up the door to external investors to invest in Mozambique	Promote the sustainable development of commerce, agriculture and fishery	Harvest and profit from one of Mozambique's richest resources and create a reliable source of revenues

## 3.2.1 Program Description – Program model

**The Program will provide the opportunity to invest in a portfolio of projects with different return characteristics and profiles**

### Program operationalization



## 3.2.1 Program Description – Projects' profile

The portfolio will include projects with different sizes and technologies directed to meet needs of different segments of the population

### Profile of the projects to be considered in the program

#### Micro-scale *Off-grid*

- Solar and wind systems with capacity between 1kW and 10kW (e.g.: electrification of small houses and water pumping systems)
- Demand includes small families and house based business

#### Mini-scale *Off-grid*

- Solar PV systems with production capacity of 10kW-100kW (e.g.: electrification of small villages, including public streets, schools, and health care facilities)
- Demand includes local governments institutions and businesses

#### Distributed utility *Off-grid and on-grid*

- Solar PV and hydroelectric plants with capacity of 100kW- 1.000kW
- Off-grid projects can provide power to specific cities or a defined group of businesses through decentralized grids
- Demand includes local governments and group of medium-size companies

**Wind pumping**



**Solar Powered house**



**Solar Irrigation**



**Solar Power School**



**Mini Dam**



**Solar Plant**



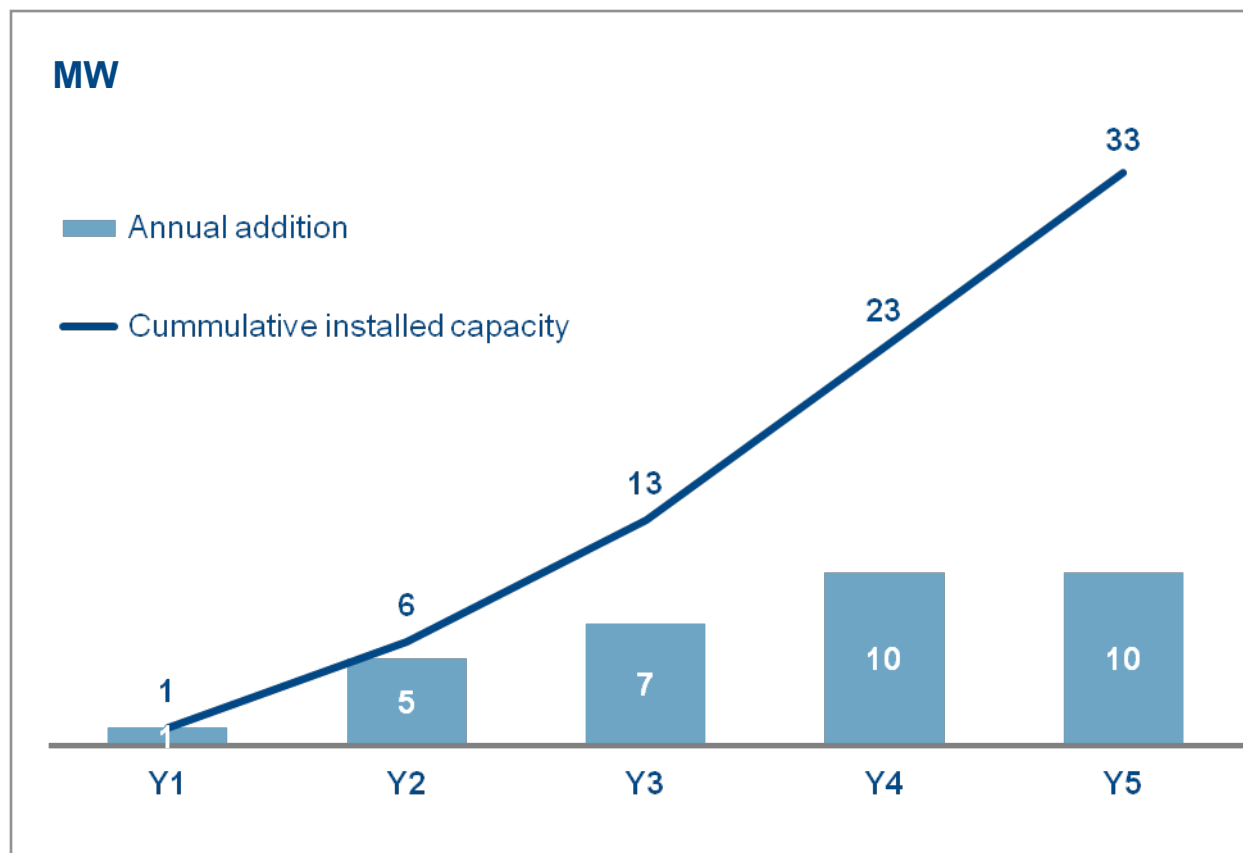
Source: Arthur Little; FUNAE



## 3.2.1 Program Description – Installed capacity

The programs aims to install around 33 MW over a 5 year period, following a gradual implementation roll-out

### Target installed capacity



- The project aims to install a total of 33 MW over the program's lifetime
- The roll-out of the projects will be gradual in order to assure the sound implementation of the program's components -such as capacity building- and a effective leverage of the learning curve
- The program will start with the implementation of a pilot project in the first year

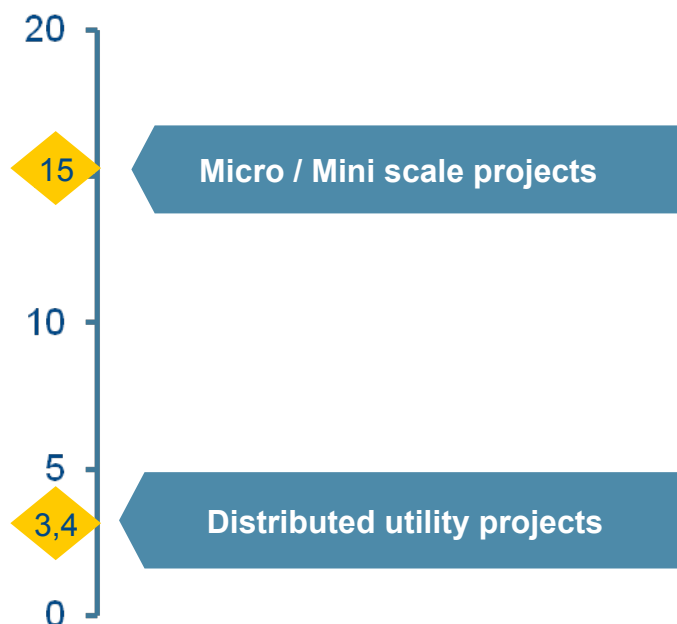
Source: Arthur Little;



The CapEx associated with each type of project varies significantly, ranging from €3,4 million to 15 million per MW

### CapEx per type of project

€ Million / MW



Based on Selfenergy Mozambique projects

- CapEx can vary significantly in function of the project size. Based on projects being developed in Mozambique:
  - Micro and Mini scale projects can reach around €15 million per MW. High cost are mainly due to the small size per project, additional equipment (e.g. batteries) and challenging logistic circumstances such as dispersed remote locations with poor road accesses
  - The Capex for on-grid distributed utility projects are significantly lower, estimated at €3,2 million per MW
- CapEx per MW is expected to decrease around 10% per year due to falling price of key components (e.g. panels) and increase efficiency in the installation of the projects and economies of scale

Source: Arthur D. Little; Selfenergy

## 3.2.1 Program Description – Investment

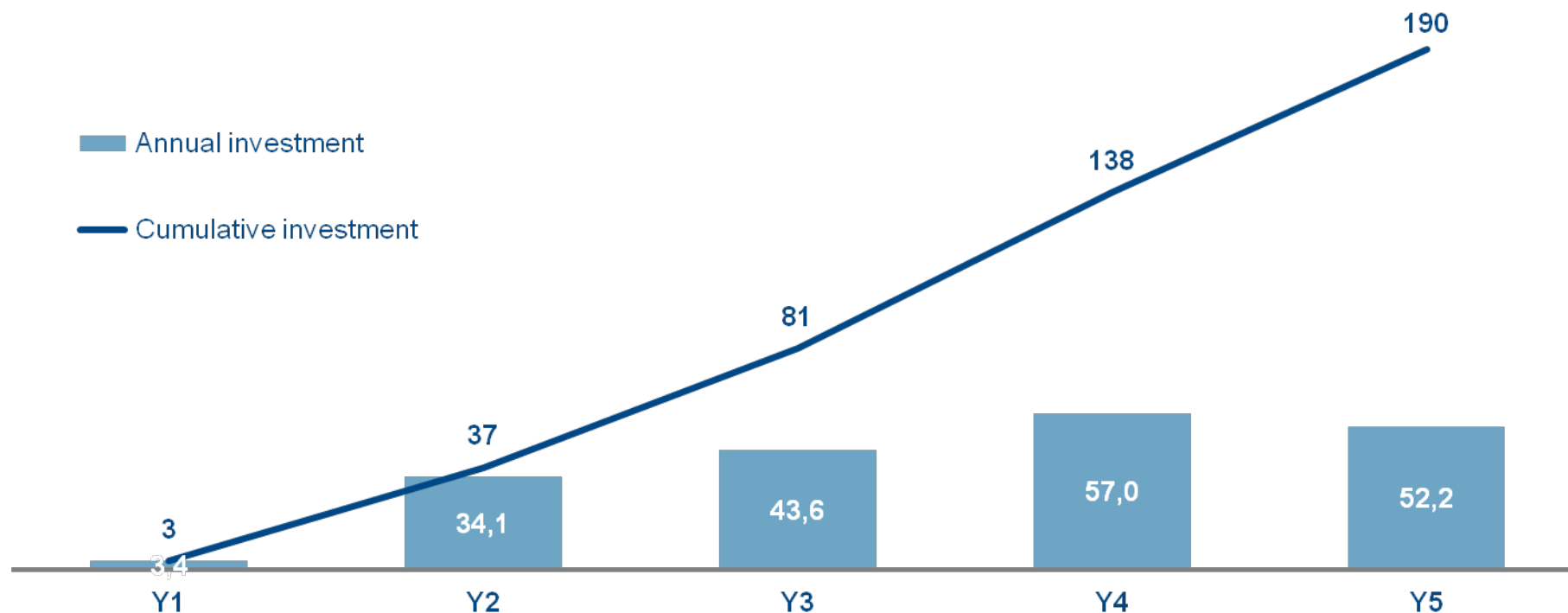
The total investment required associated with these projects is estimated to reach €190 million over the five years

### Total investment in projects

Million euros

■ Annual investment

— Cumulative investment



Source: Arthur D. Little



## 3.2.1 Program Description – Sources of funding

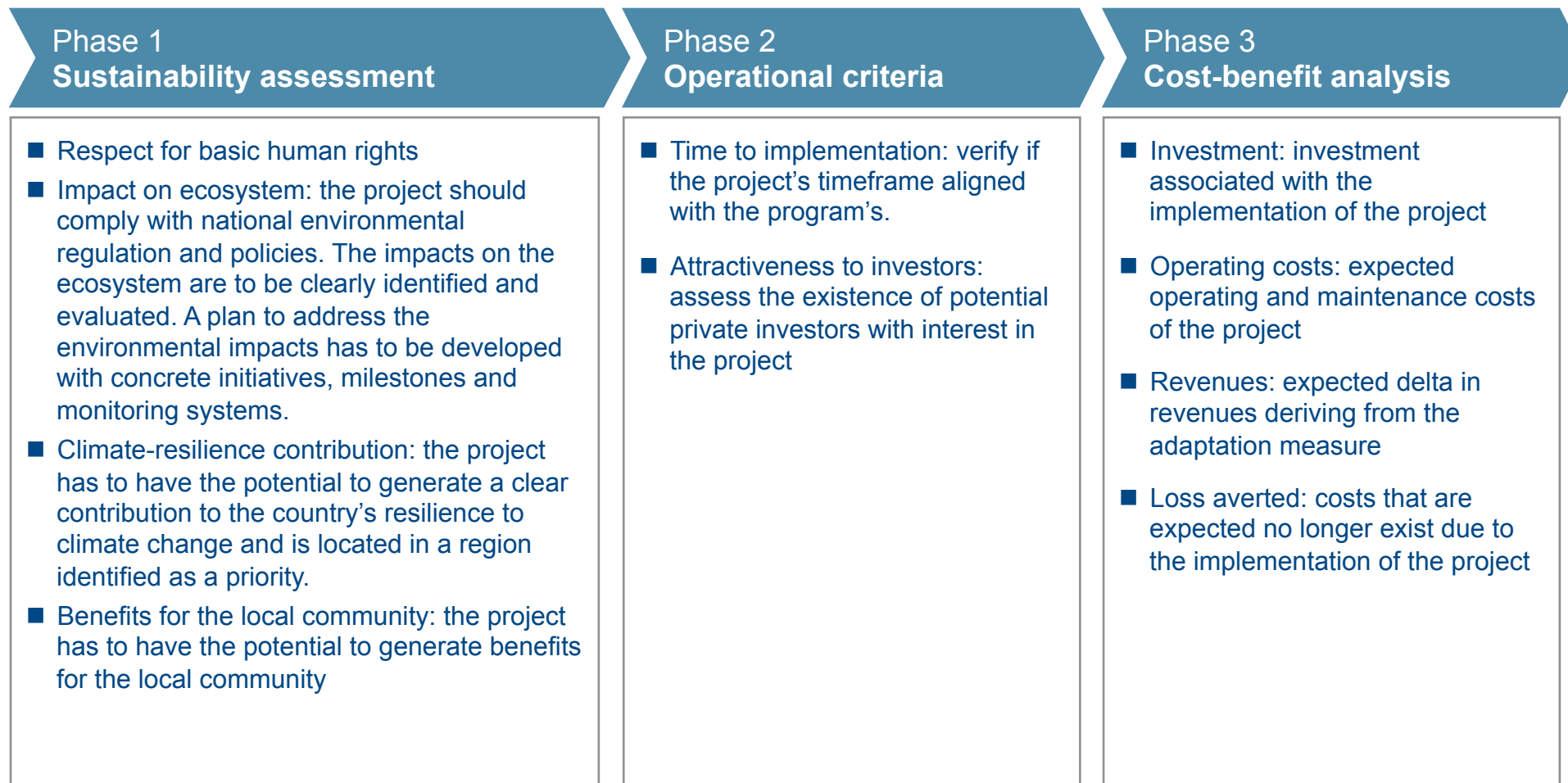
The program will count with different sources of funding depending on the typology of the project

Sources of funding	Micro-scale	Mini-scale	Distributed utilities		Technical studies
			Off-grid	On-grid	
<b>Donors</b> Include private and pure government donors	✓	✓	✓		✓
<b>Impact investors</b> Include development finance institutions and private impact investors				✓	
<b>Micro-finance institutions</b> Provide loans to individuals or small business	✓	✓			
<b>Investment funds</b> Includes infrastructure and private equity funds				✓	
<b>Local businesses</b> Group of business with significant power needs to operate			✓		

Business owners have demonstrated willingness and resources to fund jointly with other owners, projects that solve their power needs

## 3.2.1 Program Description – High level selection methodology

**Each project within the Clean Energy Program will be subject to a three phases analysis, to guarantee that fully fulfills all the selection criteria**



Source: Arthur D. Little analysis

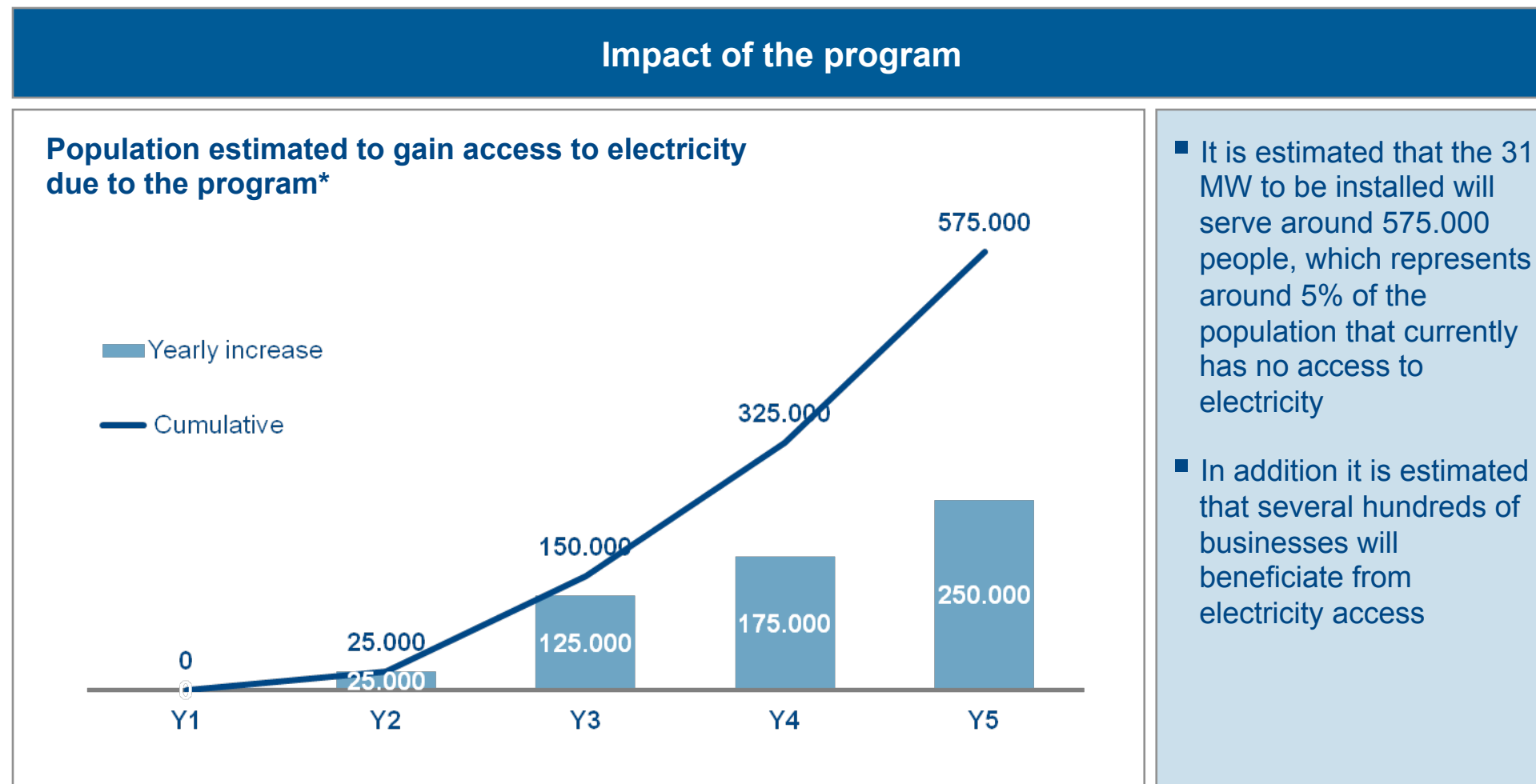
## 3.2.1 Program Description – Capacity building

**Another key aspect of this Program, is the development of “in house” competences, to foster in a near future, total local autonomy in the management of the Program**

Human Resources	Training	Learning by Doing	Technical Assistance	Assets
<ul style="list-style-type: none"> <li>■ Training and recruiting of personnel with capacity to deal directly with the international investors and project promoters</li> <li>■ Recruiting of personnel with “ground knowledge”, i.e., deep knowledge of the Mozambican reality and geographies, to identify the best opportunities</li> </ul>	<ul style="list-style-type: none"> <li>■ Development of core capabilities, including technical, financial and legal</li> <li>■ Development of workshops, seminars and study tours to the successful pilot projects for the key officials and stakeholders, as well project developers and potential investors</li> </ul>	<ul style="list-style-type: none"> <li>■ Create “mixed” teams, incorporating local personnel and external consultants, to foster the knowledge transfer and create a pool of internal resources fully capable of implementing the entire process</li> <li>■ Involvement of local communities during implementation of the projects to ensure the sustainability and local ownership of the project</li> </ul>	<ul style="list-style-type: none"> <li>■ Provide single window technical advisory services, including technical feasibility study and technical trouble shooting services to potential developers</li> </ul>	<ul style="list-style-type: none"> <li>■ Development of support infrastructure, including IT tools, monitoring instruments</li> </ul>

## 3.2.1 Program Description – Impact of the program

**It is estimated that the program will provide access to electricity to approximately 575.000 Mozambicans**



Source: Arthur D. Little; FUNAE; \*it is estimated that in Mozambique 1MW of electricity serves approximately 25.000 persons

## 3.2.1 Program Description – Impact of the program

**The increase share of the population with access to electricity will generate benefits at several levels**

Impact of the program	
Health conditions increase	<ul style="list-style-type: none"> <li>■ Inherent improvement in the healthcare facilities with the installation of electricity</li> <li>■ Improvement in air quality in households due to reduction in the use of polluting fuels for cooking and lighting; and better nutrition due to refrigerated storage</li> </ul>
Increase in the level of education	<ul style="list-style-type: none"> <li>■ Electrification of classrooms allowing for night schooling for adults</li> <li>■ Possibility to study at home</li> </ul>
Increase in public structures quality	<ul style="list-style-type: none"> <li>■ Increase in public safety due to public lightning</li> </ul>
Increase in business productivity	<ul style="list-style-type: none"> <li>■ The introduction of lightning and electric tools will increase productivity and diverse activities</li> </ul>
Pollution reduction	<ul style="list-style-type: none"> <li>■ Displacement of existing nonrenewable energy sources, mostly kerosene</li> </ul>
Poverty reduction	<ul style="list-style-type: none"> <li>■ Possibility of new business creation (small shops, agriculture and fishing yields increase, etc...) and better nutritional conditions</li> </ul>
Increased connectivity	<ul style="list-style-type: none"> <li>■ Awareness programs are easier to reach and early warning and response in the event of a disaster is more effective</li> </ul>

Source: The World Bank: The Welfare Impact of Rural Electrification:



## 3.2.1 Program Description – Sustainability monitoring

On a yearly basis this Program will be evaluated using a dedicated questionnaire, that evaluates the impact of the program in the promoters, investors, and overall community

### Sustainability Monitoring

- The sustainability monitoring is to be performed at least on a yearly basis
- A significant sample of the population should be selected to allow for representativeness
- A yearly comparison should be performed to assess the existence of improvements

**Arthur D Little**

Clean Energy Year 5

Section 1 Investors

1.1 Are the returns obtained aligned with your expectations?

Yes, totally	100%	<input type="checkbox"/>	0
Mainly	75%	<input type="checkbox"/>	0
Somehow	50%	<input checked="" type="checkbox"/>	0.5
Not much	25%	<input type="checkbox"/>	0
No	0%	<input type="checkbox"/>	0

1.2 Are you satisfied with the reporting process?

Yes, totally	100%	<input type="checkbox"/>	0
Majority	75%	<input type="checkbox"/>	0
Enough	50%	<input checked="" type="checkbox"/>	0.5
Not enough	25%	<input type="checkbox"/>	0
No	0%	<input type="checkbox"/>	0

1.3 Do you have easy and transparent access to all the documentation of the projects?

Yes, totally	100%	<input checked="" type="checkbox"/>	1
Mainly	75%	<input type="checkbox"/>	0
Somehow	50%	<input type="checkbox"/>	0
Not all	25%	<input type="checkbox"/>	0
No	0%	<input type="checkbox"/>	0

1.4 Are you satisfied with the interaction with the program's responsibilities?

Yes, totally	100%	<input type="checkbox"/>	0
Probably	75%	<input checked="" type="checkbox"/>	0.75
Maybe	50%	<input type="checkbox"/>	0
Not likely	25%	<input type="checkbox"/>	0
No	0%	<input type="checkbox"/>	0

Section	Result
1 Investors	55%
2 Projects' performance	44%
3 Sustainability	38%

INGC

The full questionnaire is given as an Appendix to this Report

## 3.2.1 Pilot Project – Description of Pilot Project I

**A pilot project understudy is the construction of a 1 MW of grid PV plan in the city of Maputo, with a total investment around 3,4 million euros**

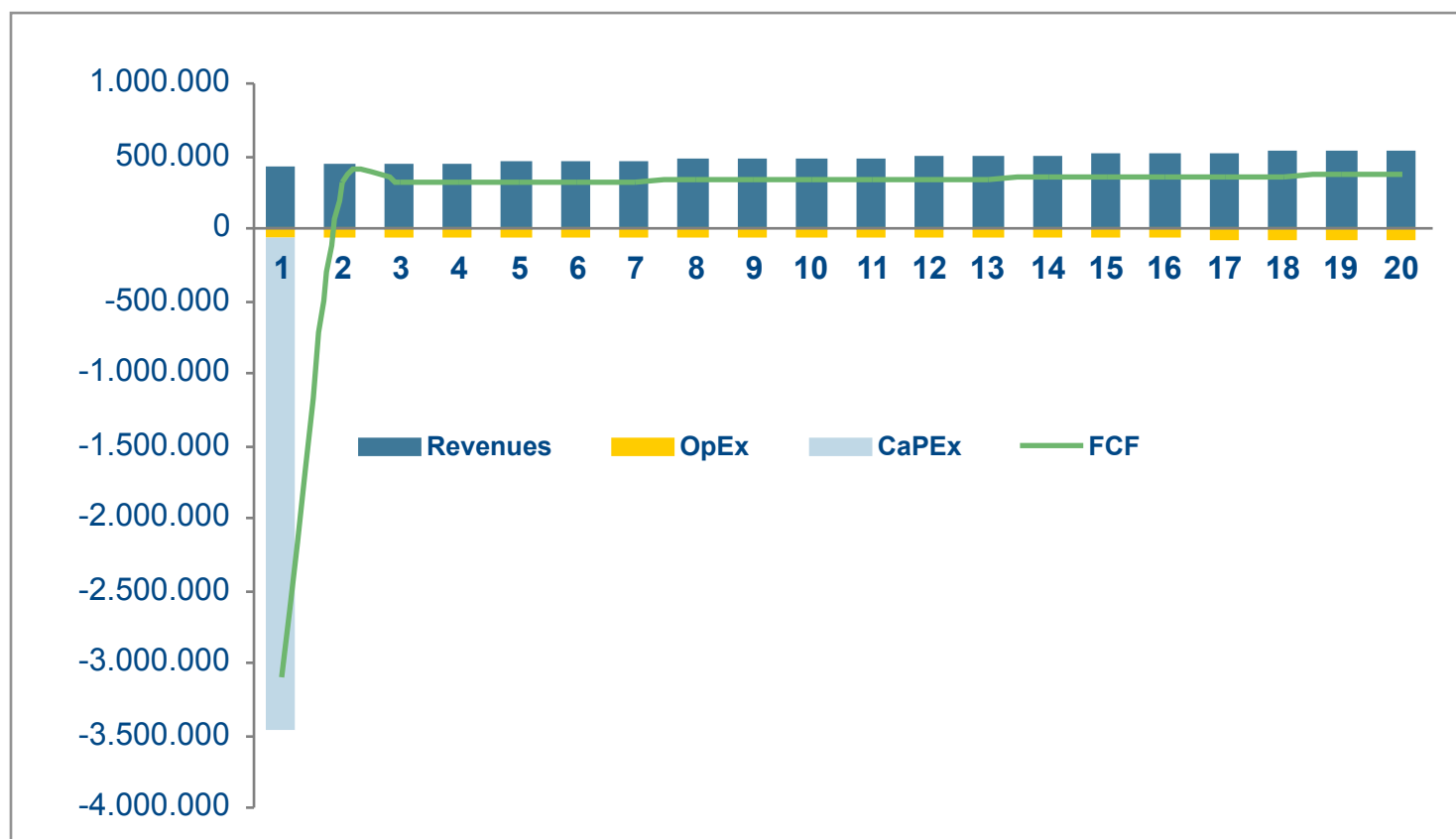
### Pilot project 1: Construction of 1 MW on-grid PV plant

Description	<ul style="list-style-type: none"> <li>■ The project consists of the construction of a 1 MW on-grid PV plant in Maputo</li> <li>■ The government has demonstrated strong willingness to introduce feed -in tariffs (FIT) for on-grid PV projects in the short-term</li> <li>■ The FIT is expected to be around €300/ MW</li> <li>■ The project has been designed by <b>Selfenergy</b></li> </ul>	Financial inputs									
Promoter	<ul style="list-style-type: none"> <li>■ Selfenergy has been involved for several years in the construction off grid projects in Mozambique</li> <li>■ Has extensive experience in the construction of PV plants <i>on</i> and <i>off</i> grid in Portugal, Spain and Mozambique</li> </ul>	<p><b>Investment:</b> €3,4 million (considers equipment and construction)</p> <p>Higher than current on-grid PV projects in developed countries due to logistics issues and limited economies of scale</p> <p><b>Operational costs:</b> 16% of revenues</p> <table> <tr> <td>O&amp;M</td><td>8%</td><td>of Revenues</td></tr> <tr> <td>Rent</td><td>3%</td><td>of Revenues</td></tr> <tr> <td>Insurance</td><td>5%</td><td>of Revenues</td></tr> </table> <p><b>Estimated equivalent hours:</b> 1.553 /year</p> <p><b>FIT:</b> €250   €275   €300 / MW</p> <p>The returns were simulated for these FIT possibilities</p>	O&M	8%	of Revenues	Rent	3%	of Revenues	Insurance	5%	of Revenues
O&M	8%	of Revenues									
Rent	3%	of Revenues									
Insurance	5%	of Revenues									

## 3.2.1 Pilot Project – High level financial analysis

Considering a 20 years timeframe and a FIT of €275/ MW, the returns for this project (in the absence of any financial leveraging) are some 8%

### High level financial analysis



FIT (€ / MW)	pIRR
250	6,8%
275	8,0%
300	9,1%

**Payback time**  
~ 11 years

Source: Arthur D. Little analysis



## 3.2.1 Pilot Project – Timings

**The first 5 months of the project will be used to set the grounds for the overall structure, that will be put in practice until the end of the year**

Months (2012)	1	2	3	4	5	6	7	8	9	10	11	12	2013
Negotiation of feed-in-tariff													
Negotiation of other licenses (land, insurance, ...)													
Infrastructure construction													
Project launch & operation													
Mid term pilot project evaluation													
Sustainability monitoring and evaluation of Pilot project results													
Fund raise for new projects & implementation of new projects													

Another pilot project understudy is the investment on the electrification of a small rural community through off-grid PV systems

### Pilot project II: Electrification of small village

#### Description

- The country has been conducting efforts to provide electricity to rural communities through off-grid systems
- The pilot project consists in the **electrification of a small village in Maputo** through off-grid PV system
- The project is to be developed by Selfenergy which has been closely involved in the initiatives developed by FUNAE
- Over the last three years Selfenergy implemented relevant off-grid projects in Mozambique such as:
  - The electrification of 50 schools, 50 healthcare centres and 2 hospitals
  - Implementation of 200 PV solar panels in Maputo

#### Financials

- The project considers PV off-grid systems with a total capacity of **200 Kw**
- **Investment:** €3 million (€15M/MW)
 

Significantly higher than on-grid projects mainly due to small scale and additional equipment, such as batteries
- **Returns:**
  - Typically investors in these projects do not expect financial returns
  - However, institutions such as micro finance institutions can provide financing to individuals or small businesses

## 3.2.1 Investors' contacts – Main messages

**Distributed renewable energy has many “followers” but a combination of strong governance, the right regulatory framework and being clear who you are dealing with is critical**

### Main messages

“The length of payback in distributed renewable energy is such that as an investor I need to know that the regulatory environment is stable enough to protect my investment”

*Earth Capital Partners - Partner*

“There are many projects to put money into which makes making a decision to invest in a country like Mozambique all the more difficult” -

*Venture Capitalist*

“Getting a real understanding of operational and maintenance costs/supply in a country like Mozambique is vital”

*Self Energy – Head of Business Development*

“As with all investment in countries like Mozambique, you need to choose right partner and know who you are dealing with”

*Emerging Capital Private Equity – ESG Head*

“We like the idea of a program to set up multiple distributed energy projects. We really need to get a strong understanding of investment profiles on the projects”

*CDC – Investment Partner*

Source: Contacted investors

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3.1 Executive Summary

**3.2 The Four Programs**

3.2.1 Clean Energy Program

**3.2.2 Composting**

3.2.3 Micro & Small Scale Lending

3.2.4 AgroForestry Fund

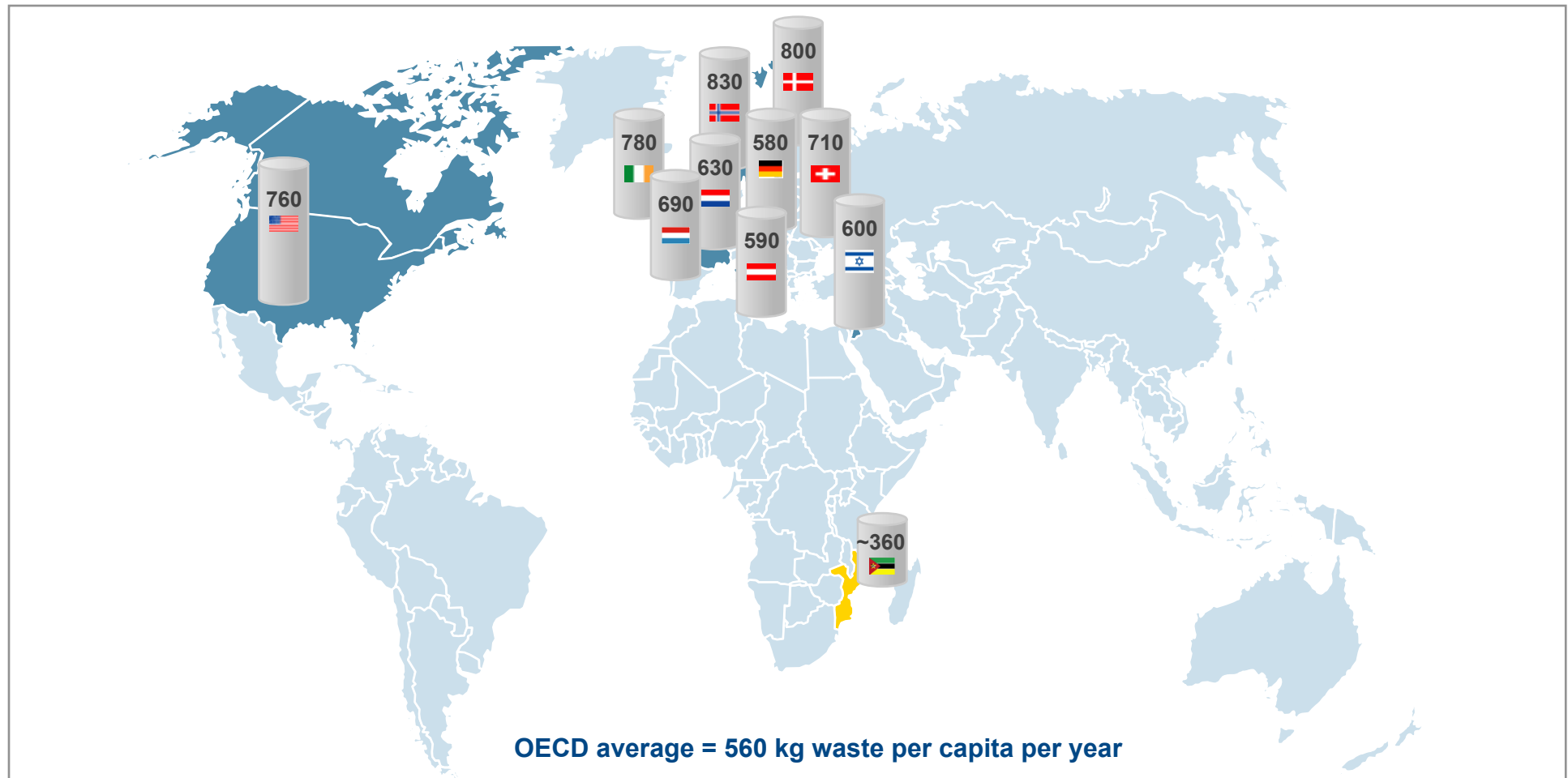
3.2.5 New Programs' Framework

3.3 Involvement of the Insurance Sector

3.4 Barriers to Business Analysis

3.5 Strategic Recommendations

The OECD average waste production per capita is around 560 kg, with the top ten countries producing an average value of some 700 kg per capita, twice the value in Mozambique

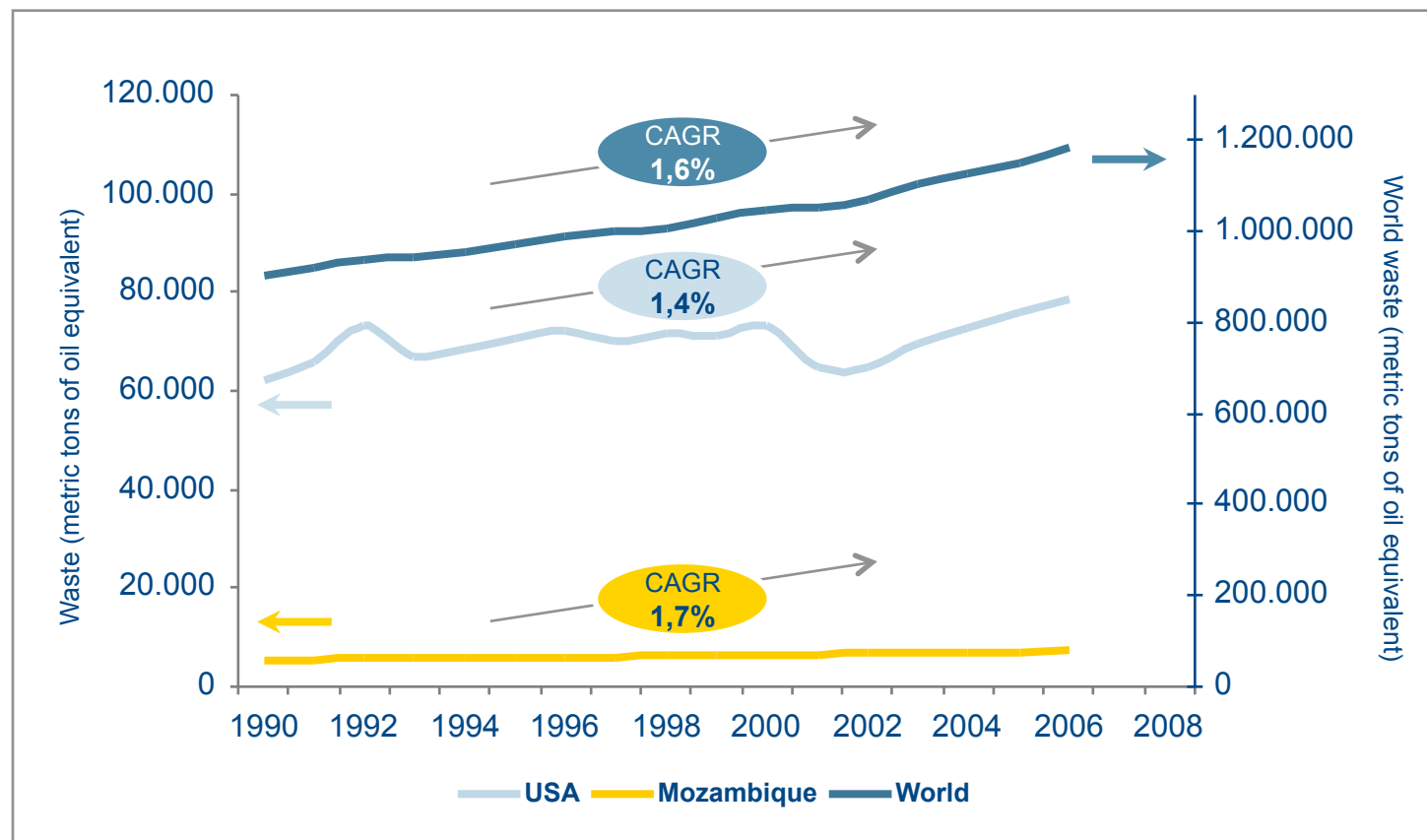


Values in kgs of waste per capita per year  
Source: OECD, 2010; UNDP



Despite the significant difference in waste production, the trend in the last 20 years evidences a growing pattern for Mozambique, with a CAGR higher than the World and USA values

### Waste production evolution in the world and in Mozambique

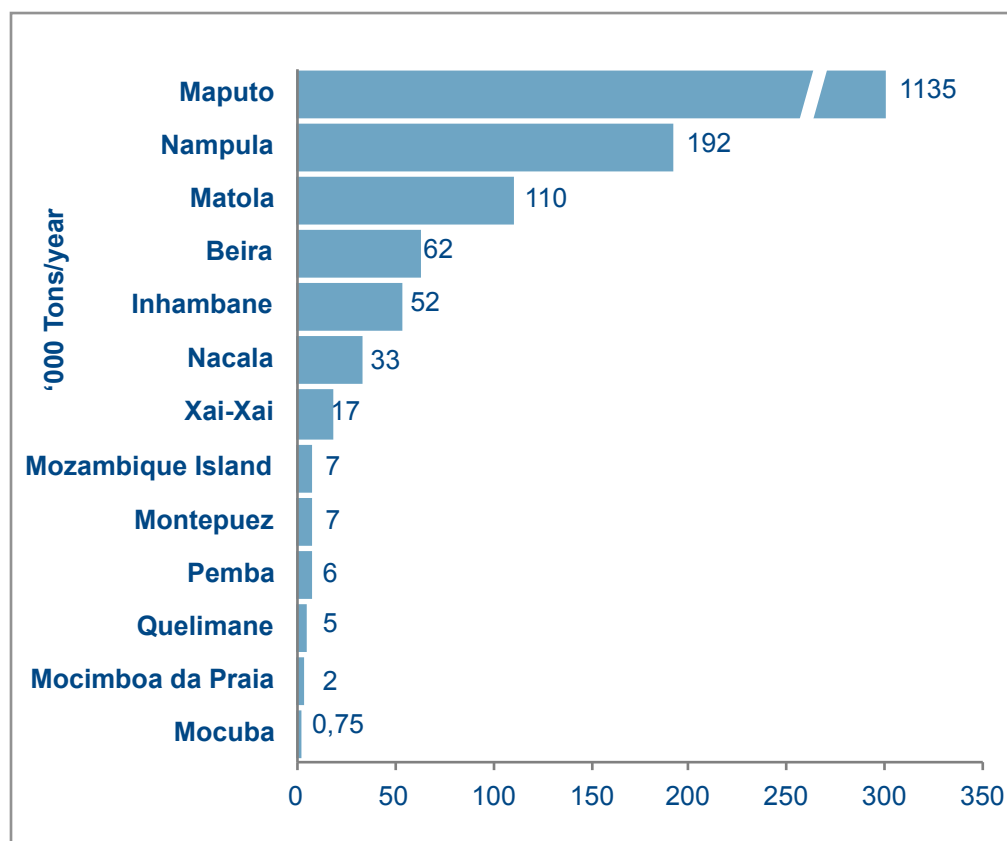


- Calculating the global amount of waste produced presents a problem. There are a number of issues, including lack of reporting by many countries and inconsistencies in the way countries report
- Nevertheless, the general pattern points towards a visible increase in waste production in the last 20 years
- Mozambican levels of waste production are far below the typical for developed countries, nevertheless their yearly increase is at levels above the ones for USA

CAGR – Compound Annual Growth Rate  
Source: World bank (WDI & GDF)

If we look closer at the Mozambican reality, we realize that the waste production pattern is quite asymmetric, with provinces like Maputo and Nampula assuming a clear leading position

### Waste production in the major Mozambican cities



Source: Mozambican National Institute of Statistics, EPA, OECD



#### Environmental costs

Waste attract rodents and insects which harbor gastrointestinal parasites, yellow fever, worms, the plague and other conditions for humans. It can contaminate surface water, groundwater, soil, and air which causes more problems for humans, other species, and ecosystems. Waste treatment and disposal produces significant green house gas (GHG) emissions, notably methane, which are contributing significantly to global climate change.

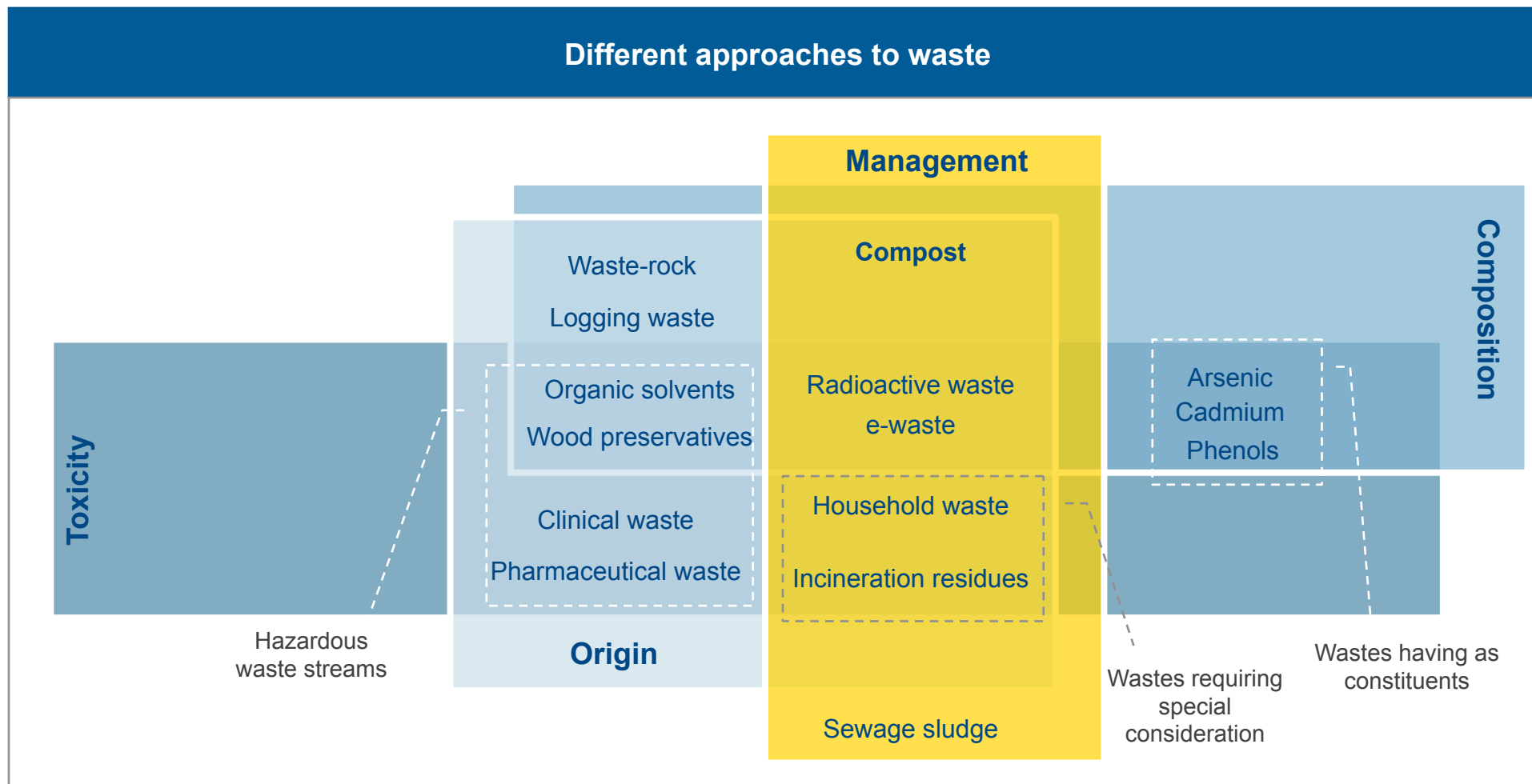
#### Social costs

Many of the environmental burdens are more often borne by marginalized groups. However, the need for expansion and siting of waste treatment and disposal facilities is increasing worldwide. There is now a growing market in the trans boundary movement of waste, and although most waste that flows between countries goes between developed nations, a significant amount of waste is moved from developed to developing nations

#### Economic costs

Money can often be saved with more efficiently designed collection routes, modifying vehicles and public education. Environmental policies such as pay as you throw can reduce the cost of management and reduce waste quantities. Waste recovery (that is, recycling, reuse) can curve economic costs because it avoids extracting raw materials and often cuts transportation costs.

Waste can be classified according to its toxicity, origin, composition or management. This Program will be focused on the management and valuation aspects of waste



Source: UNEP/GRID

**Waste production is not only an aesthetics problem. On the one hand it carries significant risks with the formation of leachates and groundwater, soil and air contamination...**

### Dangers of waste contamination

#### Groundwater Contamination

Contaminated groundwater can adversely affect animals, plants and humans if it is removed from the ground by manmade or natural processes. Depending on the geology of the area, groundwater may rise to the surface through springs or seeps, flow laterally into nearby rivers, streams, or ponds, or sink deeper into the earth. In many parts of the world, groundwater is pumped out of the ground to be used for drinking, bathing, other household uses, agriculture, and industry.

#### Soil Contamination

Contaminants in the soil can harm plants when they take up the contamination through their roots. Ingesting, inhaling, or touching contaminated soil, as well as eating plants or animals that have accumulated soil contaminants can adversely impact the health of humans and animals.

#### Air Contamination

Air pollution can cause respiratory problems and other adverse health effects as contaminants are absorbed from the lungs into other parts of the body. Certain air contaminants can also harm animals and humans when they contact the skin. Plants rely on respiration for their growth and can also be affected by exposure to contaminants transported in the air

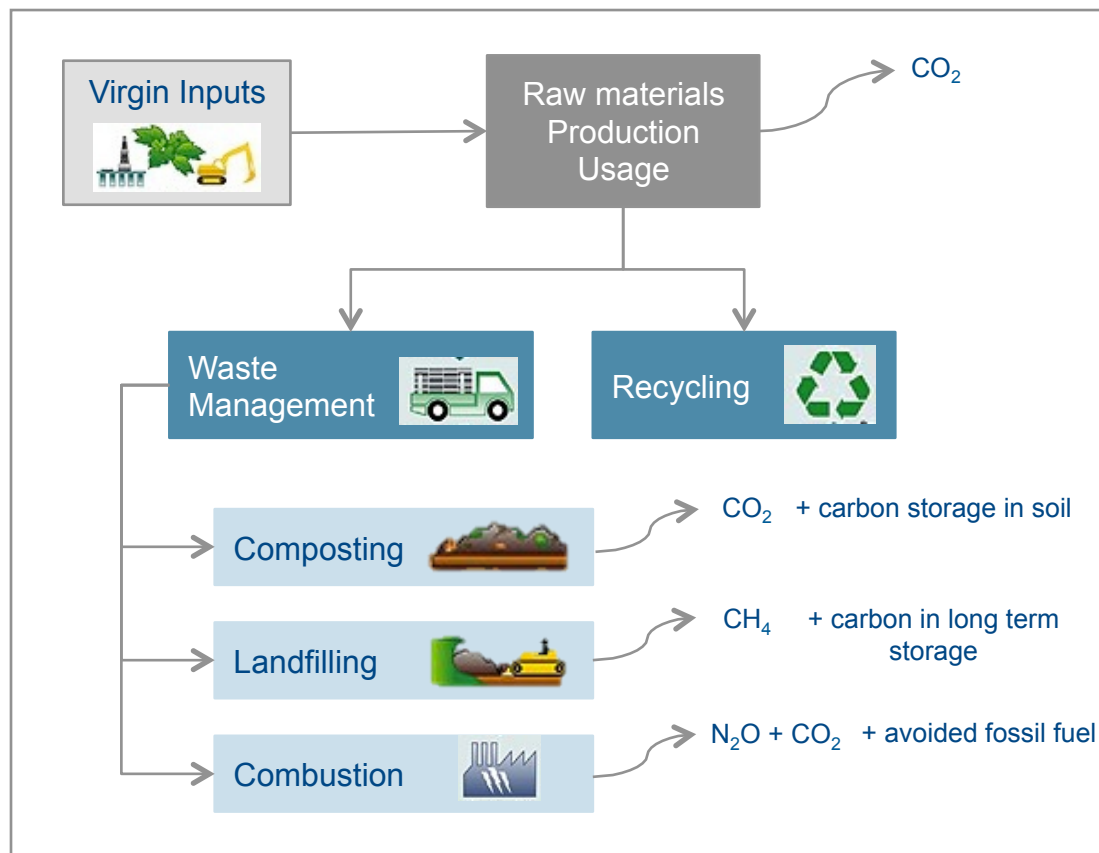
#### Leachate

Leachate is the liquid that forms as water trickles through contaminated areas leaching out the chemicals. For example, the leaching of landfill can result in a leachate containing a cocktail of chemicals. In agricultural areas leaching may concentrate pesticides or fertilizers and in feedlots bacteria may be leached from the soil. The movement of contaminated leachate may result in hazardous substances entering surface water, groundwater or soil.

Source: UNEP/GRID

... while on the other hand it is a significant greenhouse gases emitter, mainly due to the methane release for the atmosphere

### Life Cycle of Waste



If a product is not recycled at the end of its useful life, it goes through one of three waste management options: composting, combustion, and landfilling.

- **Composting:** an option for organic materials, releases some non-biogenic carbon dioxide associated with transporting and turning the compost. However, some of the carbon contained in organic materials is returned and stored in the soil and therefore not released into the atmosphere.
- **Combustion:** releases both carbon dioxide and nitrous oxide (a GHG that is 310 times more potent than carbon dioxide). However, some of the energy released during combustion can be harnessed and used to power other processes, which results in offset GHG emissions from avoided fossil fuel use.
- **Landfilling:** the most common waste management practice, results in the release of methane, that is 21 times more potent as GHG than carbon dioxide.

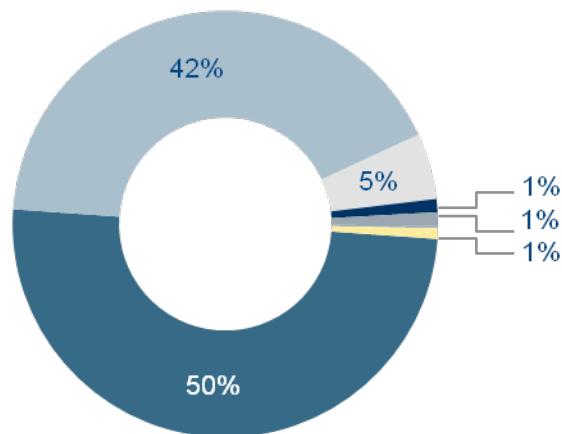
Source: EPA

## 3.2.2 Introduction – Landfill disposal

Landfill waste originates severe atmospheric pollution, due to  $\text{CH}_4$  and  $\text{CO}_2$  emissions, which helps explaining the increase in waste handling projects approved by the CDM

### Dealing with Waste – Landfill disposal

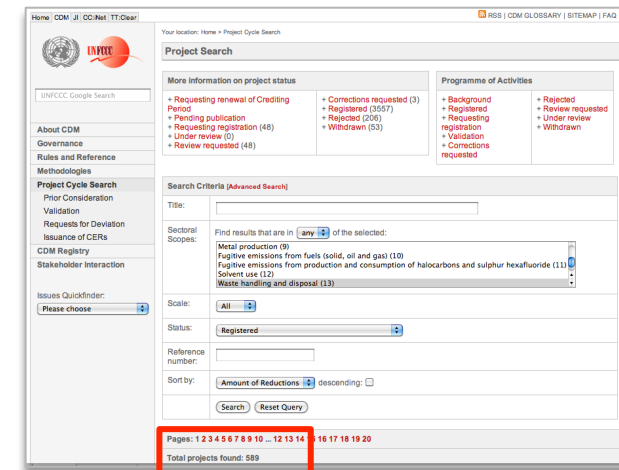
#### Landfill gas typical composition



■ Methane ■ Carbon Dioxide ■ Nitrogen ■ Oxygen ■ Ammonia ■ Sulfides ■ Others

The major components of the landfill gas are methane (with a GHG potential 21 times bigger than  $\text{CO}_2$ ) and  $\text{CO}_2$ . If not adequately treated or burnt, these gases will be emitted to the atmosphere

#### Waste handling and disposal projects in the CDM



589 results

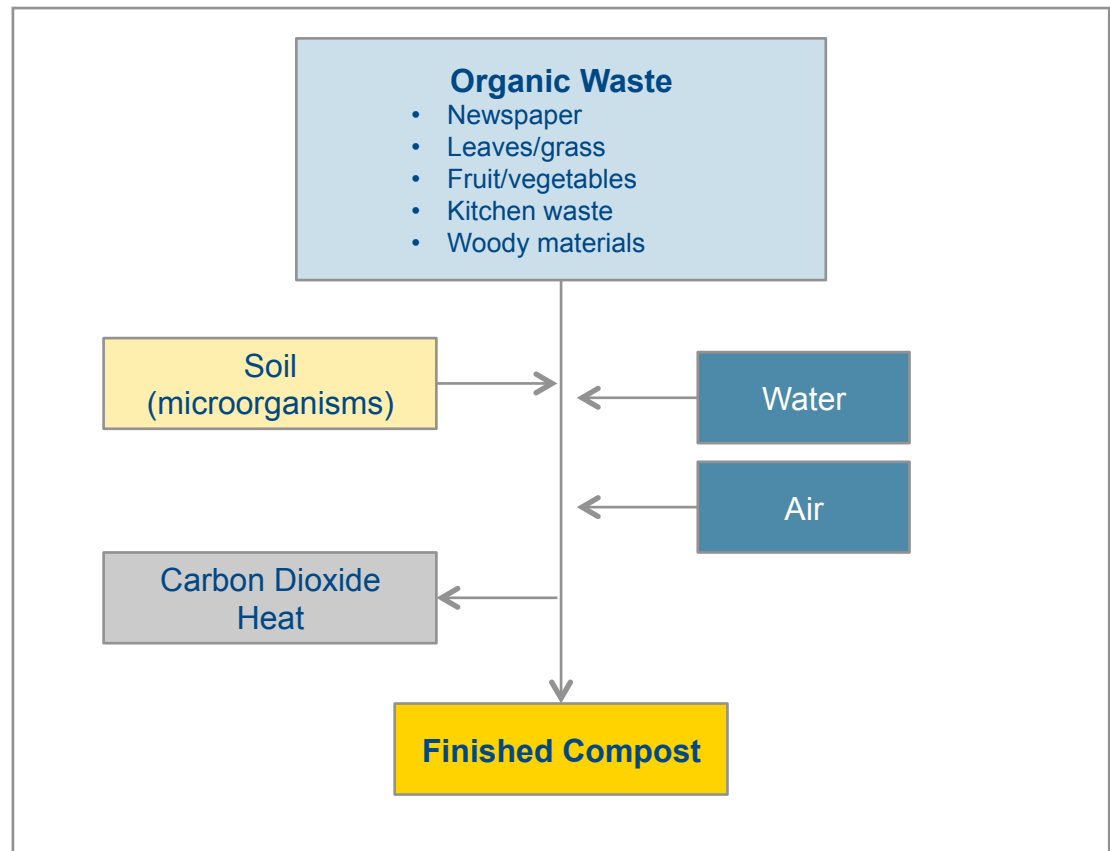
There are several options to deal with these gases, and there are currently 20 different methodologies resulting in 589 waste handling and disposal projects registered at CDM, representing 14,4% of the total projects registered.

Source: Integrated Solid Waste Management, Engineering Principles and Management Issues; CDM

**Composting not only avoids methane emissions, but also allows for carbon storage in the soil, and at the same time produces fertilizers that improve agricultural yields**

### Dealing with Waste - Composting

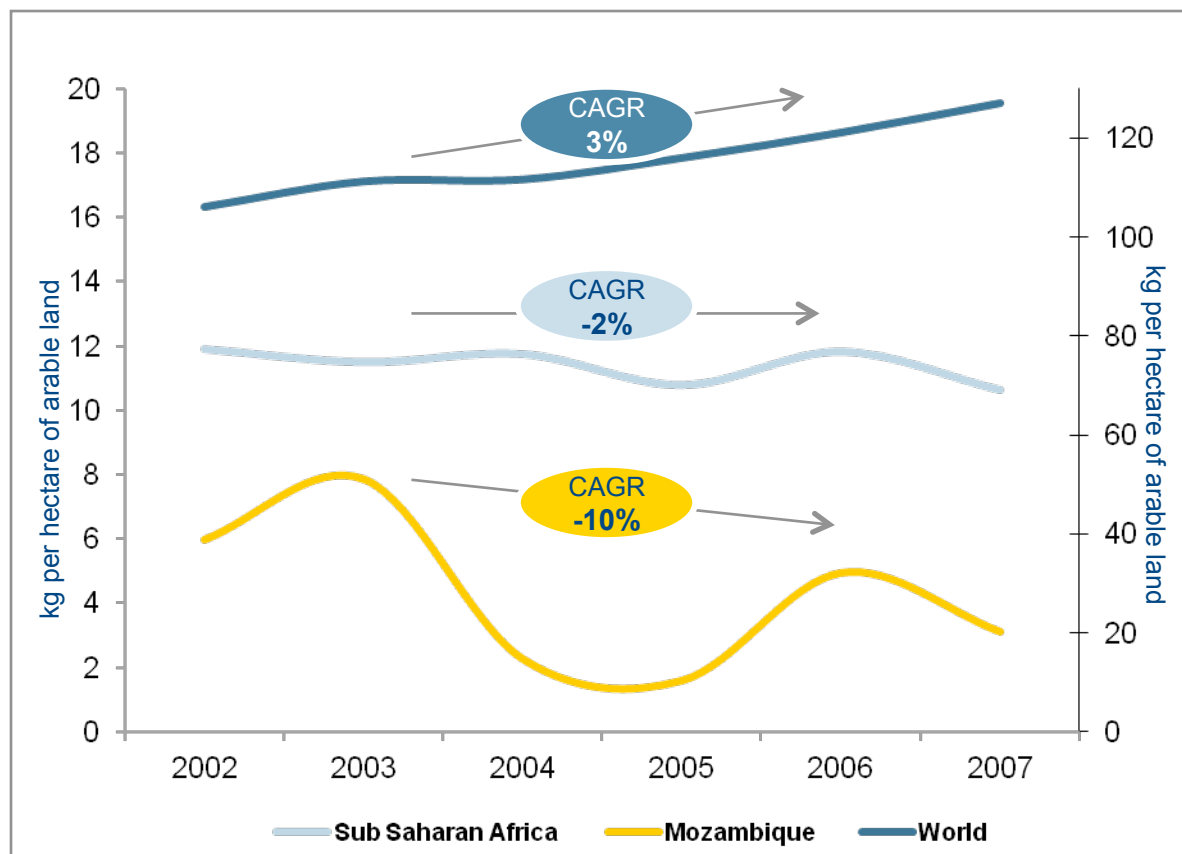
- **Compost** is organic matter that has been decomposed and recycled as a fertilizer and soil amendment. It is rich in nutrients and it's widely used in gardens, landscaping, horticulture, and agriculture. The compost itself is beneficial for the land in many ways, including as a soil conditioner, a fertilizer, addition of vital humus or humic acids, and as a natural pesticide for soil
- **Bokashi** is a method of intensive composting. It can use an aerobic or anaerobic inoculation to produce the compost. Once a starter culture is made, it can be used to extend the culture indefinitely, in a way similar to yogurt culture
- Industrial composting systems are increasingly being installed as a waste management alternative to landfills



## 3.2.2 Introduction – Fertilizers usage around the world

However, if worldwide the use of fertilizers is increasing, in Africa it has been decreasing for the last 10 years, despite some efforts to push up their utilization

### Evolution of the usage of fertilizers



- While the global tendency is for the increase in fertilizers' usage, sub Saharan countries are decreasing their consumption
- The Africa Fertilizer Summit (AFS) recommended that the African Heads of State and Government should support countries to increase the fertilizer use in Africa from the average of about 8 kg per hectare to new average of at least 50 kg per hectare by 2015.
- An extreme example is Mozambique, with an average decrease of 10% per year since 2002: the provinces with the highest potential for agricultural production practically do not use fertilizer; Nampula has 3% of households using it and Zambezia just 2%.

Source: World bank (WDI & GDF)



## 3.2.2 Program Description – Creating resilience to climate change

**Therefore, the implementation of a Composting Program appears inevitable within the “building resilience to climate change” challenge**

### Composting Program contribution for building resilience to climate change

Improvement in the local environment	<ul style="list-style-type: none"><li>■ The compost plant allows avoiding methane emissions from the organic fraction of city wastes that would have otherwise been left to decay anaerobically in a solid waste disposal site</li></ul>
Increase the lifetime of the existing landfill and soil degradation	<ul style="list-style-type: none"><li>■ The program allows increasing lifetime of the existing landfill massively and producing high quality compost to use as natural fertilizer. The program offers alternative techniques to slash-and-burn practices to fertilize soils. The fertilizer combats soil degradation and helps to keep soil humidity</li></ul>
Improvement of the local life conditions and local economy	<ul style="list-style-type: none"><li>■ The construction and operation and maintenance of the composting site will provide employment and proper wages</li></ul>

Source: Arthur D. Little analysis

## 3.2.2 Program Description – Program strategy

**This Program will be focused in developing local competences and establishing a strong network of contacts and advisors to maximize it's probability of success**

Program Strategy		
<b>Technical advisory services</b> <p>Provide technical advisory services, including technical feasibility studies and technical troubleshooting services</p>	<b>Involve local communities</b> <p>Involve local communities during implementation to ensure the sustainability and local ownership of the project.</p>	<b>Training</b> <p>Implement workshops and seminars to demonstrate the projects for the key officials and stakeholders of target regions, as well project developers and potential investors.</p>
<b>Advisory services</b> <p>Provide advisory services to conduct financial feasibility services and arrange project-financing package to potential investors.</p>	<b>Networking</b> <p>Facilitate a strong relationship between the financial sector and project development sector</p>	<b>Facilitation</b> <p>Facilitate the enactment of policies, rules and procedures to attract investments on composting technologies</p>

## 3.2.2 Program Description – Barriers to implementation

**Despite the inherent benefits, there are several barriers, mainly at the policy, institutional and financial levels, that need to be overcome, in order to bring this Program to light**

### Policy and Institutional Barriers

- **Effective coordination between institutions:** Waste management is a complex and multi-sector activity with several governmental institutions operating in this area. An effective coordination between these institutions is lacking and effective mechanisms are required for a proper coordination.
- **Absence of specific incentives for composting:** There are no direct or indirect incentives for composting projects in Mozambique. Also the municipalities in Mozambique are in poor financial health and lack resources.
- **Absence of institutional experience in dealing with composting projects:** Only very few initiatives in composting were taken in Mozambique so the institutions do not have experience in dealing with this type of projects.
- **Bureaucratic project implementation:** Working with municipalities may increase the bureaucratic burden of the project.

### Financial Barriers

- Absence of dedicated financing mechanisms within the national financial institutions to support composting projects in Mozambique
- Farmers cannot afford to buy fertilizers at the current price: The commercial banks interest rates available to fertilizer industry are between 20 and 25 percent due to risk associated in the agricultural sector and credit institutions are practically non-existent in the country so farmer's access to credit is practically null.
- High operation and maintenance cost, specially given the the uncertainty in market prices and demand of compost in a sector that is not used to use fertilizers.
- High capital investments: If not complemented with some support initiatives (like CDM) composting is unlikely to interest private investors, given the high CapEx when compared with the uncertainty in the returns

### Technical Barriers

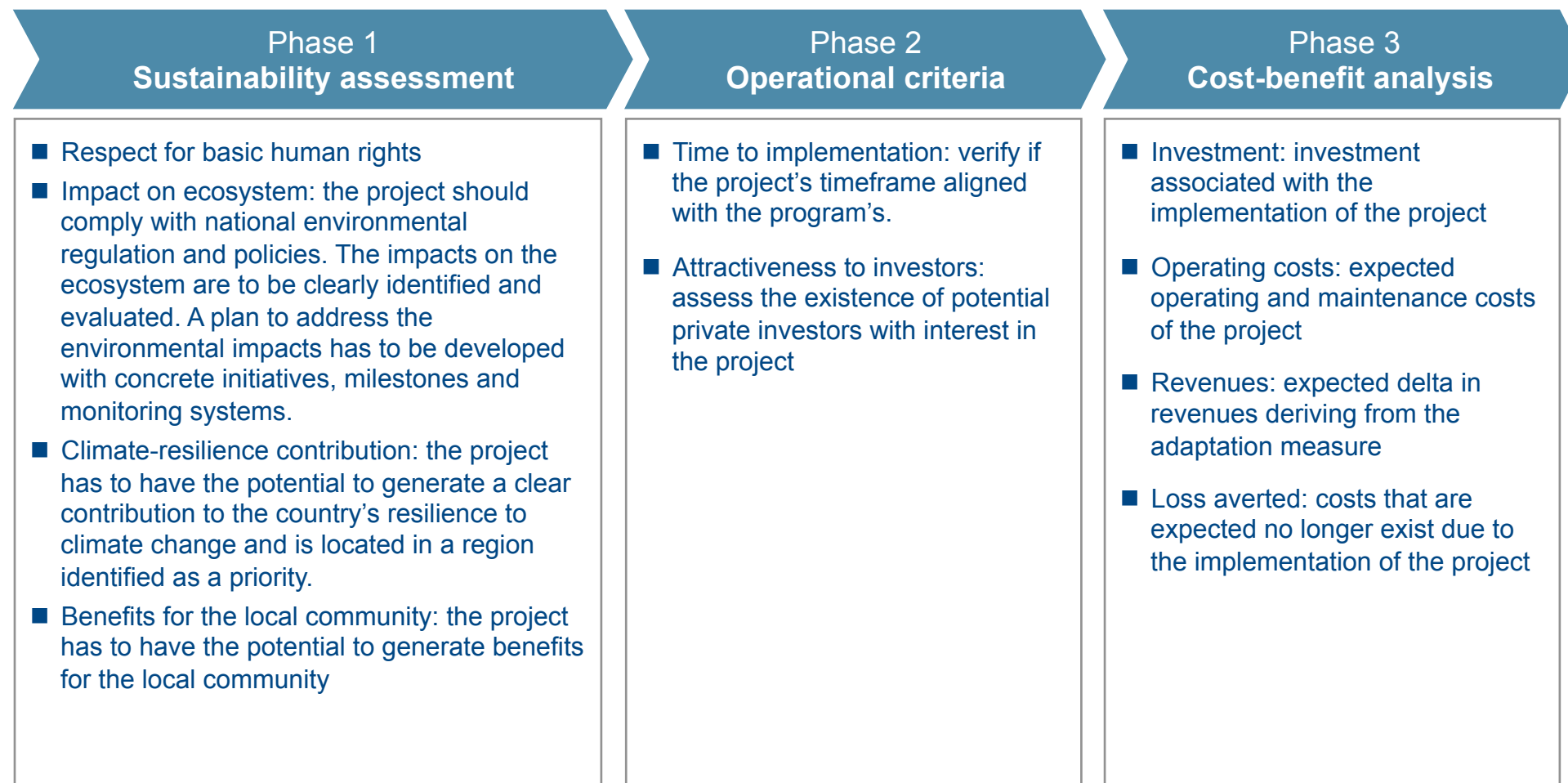
- Main utilities are not available in all provinces: The composting plant installation could be more difficult and costly due to unavailability of some basic utilities like electricity or water.
- Limited technical capacity to design, install, operate, manage and maintain a composting plant due to lack of skills and expertise

### Awareness Barriers

- Fertilizer from waste could be considered as "dirty": The concept of soil conditioner is still not widely known amongst farmers (the buyers) and can be considered as "dirty" since used waste.

Source: Arthur D. Little analysis

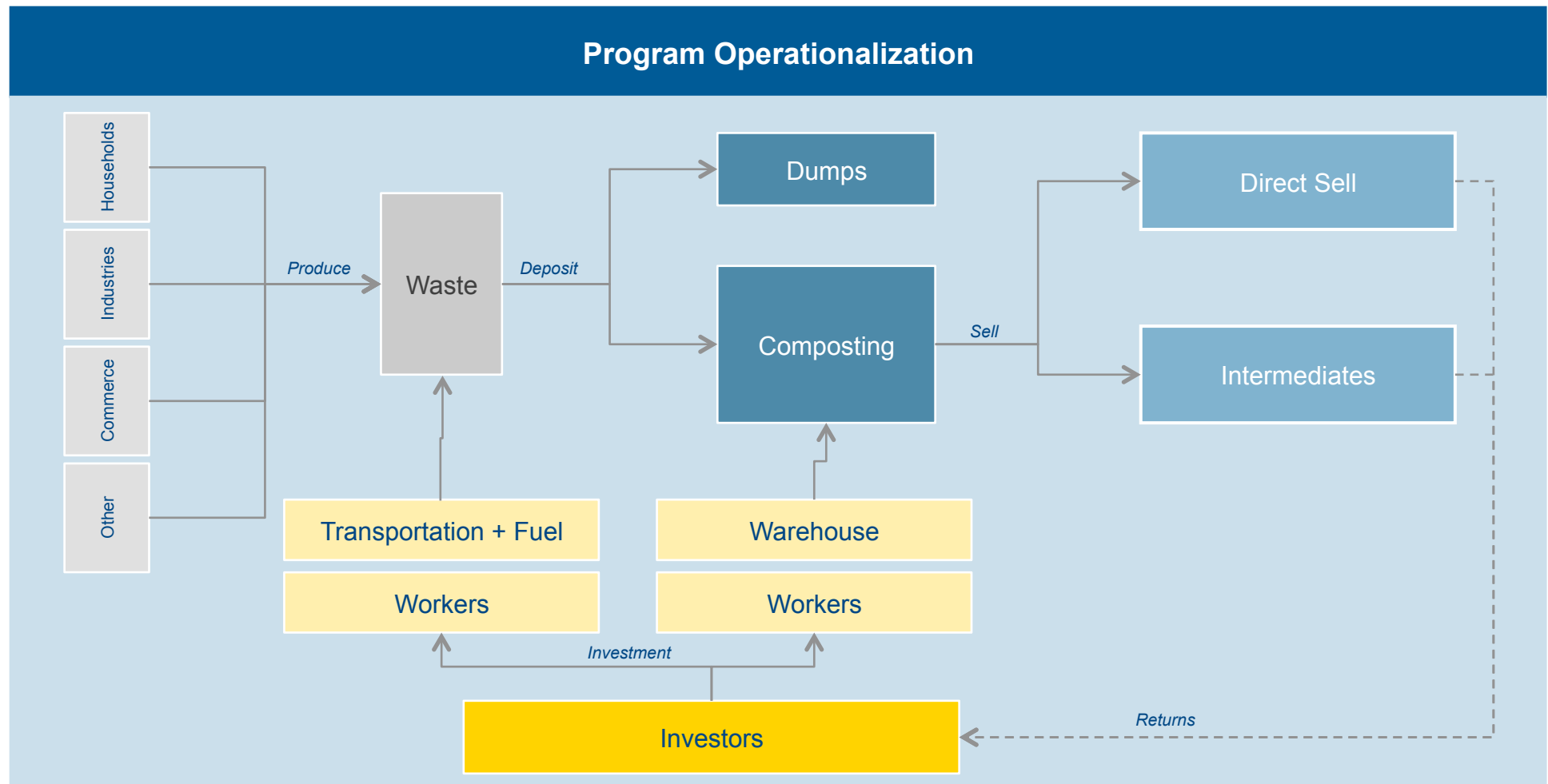
**Each project within the Composting Program will be subject to a three phases analysis, to guarantee that fully fulfills all the selection criteria**



Source: Arthur D. Little analysis

## 3.2.2 Program Description – Program operationalization

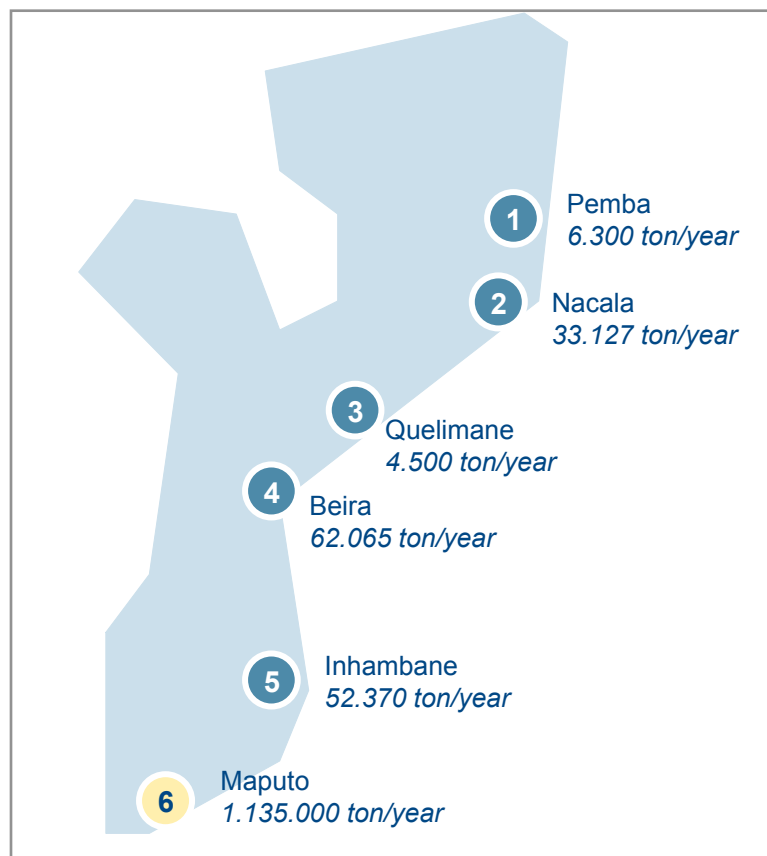
The compost will be produced in dedicated installations, using as raw material waste collected from nearby installations and households, and will be then sold directly or to intermediaries



## 3.2.2 Program Description – Program phasing

The INGC has identified five climate change priority areas, that will be the Tier 1 regions in the implementation of this program

### Program phasing

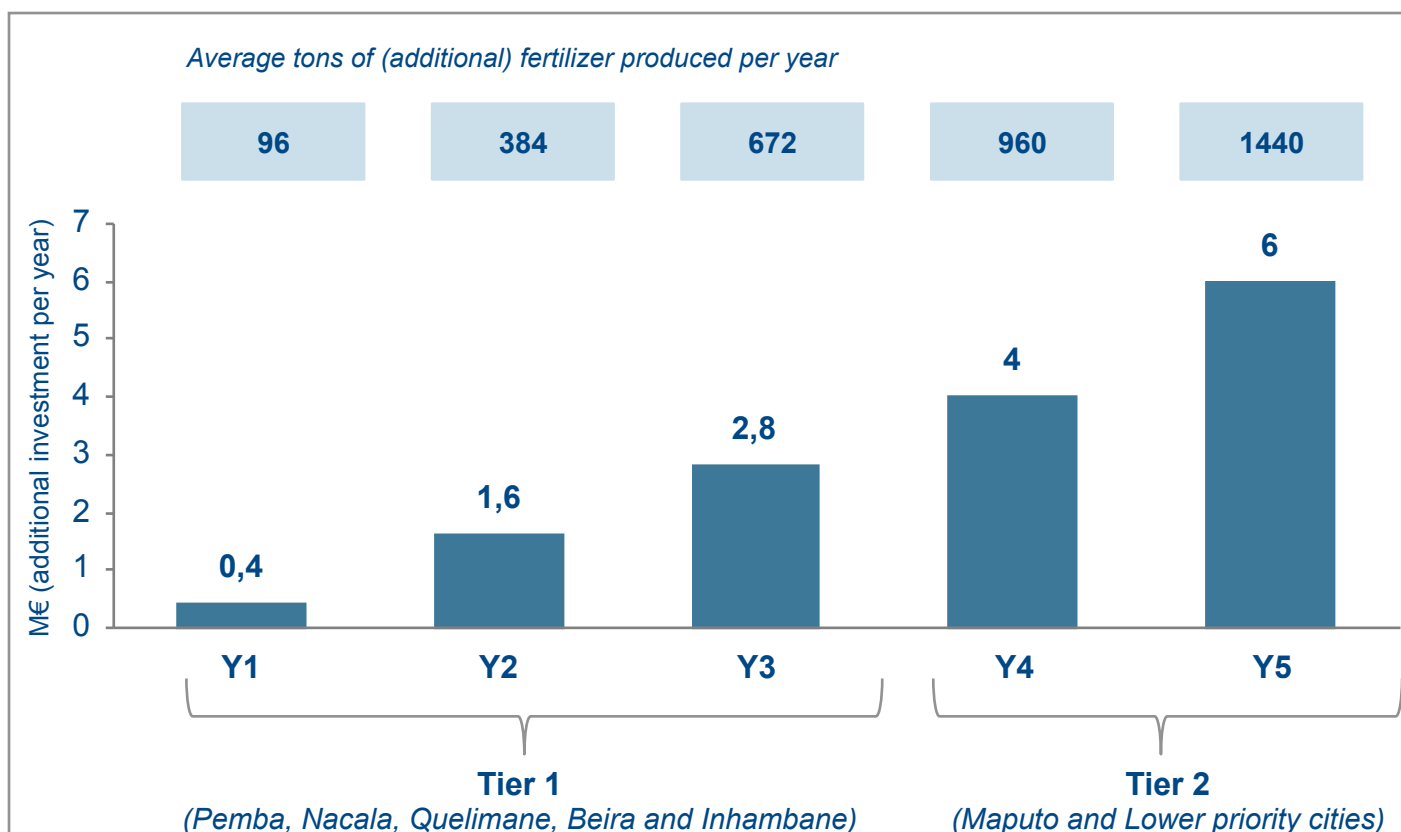


- The composting program in Mozambique is intended to be nationwide and cover all the major cities of the country and will be developed through several concurrent pilot projects to improve the probability of success
- The program has a multi-year timeframe during which the projects portfolio are developed mainly in the cities included in INGC climate change priority areas like Pemba, Nacala, Quelimane, Beira, Inhambane with a total population affected of some **1,12 million persons** in the first Phase
- In a second Phase, Maputo (given its dimension, it should benefit from the key learning's of Phase 1) and Tier 2 cities will be addressed
- Pilot projects running simultaneously will enable the private investors and the municipalities to:
  - Compare alternative technologies in a small scale
  - Gain hands-on experience (learning by doing the best ways to develop the fertilizer)
  - Determine which permits are required and establish confidence with the regulating agencies
  - Establish a design basis for a full scale compost facility
  - Develop a reasonable cost model to look at capital investment, operating costs, profit and loss projects, and return on investment

## 3.2.2 Program Description – Total Investment

In a 5 years timeframe we estimate a total investment of some 15 M€, allowing for the waste management of the Tier 1 cities and the expansion to some of the Tier 2 in the latter years

### Total amount to be invested



- In the first three years, the investment will be channeled for the Tier 1 priority cities
- This will imply an investment of some 4,8 M€ and an annual production of fertilizer of some 1.170 tons
- Maputo will be addressed in Phase 2 to benefit from the knowledge and key learning's from Phase 1
- The Tier 2 cities will be scouted during the first three years of the Program, and should combine big waste productions and fertilizer needs

## 3.2.2 Program Description – Capacity Building

**A key aspect of this Program, is the development of “in house” competences, to foster in a near future, total local autonomy in the management of the Program**

Human Resources	Training	Learning by Doing	Technical Assistance	Assets
<ul style="list-style-type: none"> <li>■ Training and recruiting of personnel with capacity to deal directly with the international investors and funders</li> <li>■ Recruiting of personnel with “ground knowledge”, i.e., deep knowledge of the Mozambican reality and geographies, to identify the best opportunities</li> </ul>	<ul style="list-style-type: none"> <li>■ Development of know how on the composting process and commercial techniques for the sale of the fertilizer</li> </ul>	<ul style="list-style-type: none"> <li>■ Create “mixed” teams, incorporating local personnel and external consultants, to foster the knowledge transfer and create, in the near future a pool of internal resources fully capable of implementing the entire process</li> </ul>	<ul style="list-style-type: none"> <li>■ Partnership with Aga Khan to assist in the technical aspects of the composting process and pass the knowledge to the local personnel</li> </ul>	<ul style="list-style-type: none"> <li>■ Trucks, small vans, composting infrastructures, terrain rental contracts, intellectual property over developments performed</li> </ul>



## 3.2.2 Program Description – Risks & Mitigation Strategies

**There are several risks that should be addressed, however, they all have adequate mitigation strategies envisaged**

Risks	Mitigation
Farmer's lack of interest in using the fertilizer (lack of awareness for the benefits, lack of habit, cost, etc...)	<ul style="list-style-type: none"> <li>▪ A marketing and awareness campaign will be held ahead of launching the program to increase awareness and teach how to use and the benefits of using the fertilizer</li> </ul>
Not enough buyers for the fertilizer	<ul style="list-style-type: none"> <li>▪ Apart from the individual farmers, small farms and communities will be addressed, to build some economies of scale. A diversified portfolio of clients is envisaged to hedge the risk</li> </ul>
Lack of financial capacity from farmers to buy the fertilizer	<ul style="list-style-type: none"> <li>▪ A protocol will be performed with the Micro and Small Scale Lending Program to help financing the fertilizer acquisition</li> </ul>
Not enough nitrogen for the composting process	<ul style="list-style-type: none"> <li>▪ Gather more livestock waste suppliers and find an alternative (organic) source of nitrogen</li> </ul>

## 3.2.2 Program Description – Sustainability monitoring

On a yearly basis the Program will be evaluated using a dedicated questionnaire, that evaluates the Program impact in the waste suppliers, fertilizer users and project workers

### Sustainability Monitoring

- The sustainability monitoring is to be performed at least on a yearly basis
- A significant sample of the population should be selected to allow for representativeness
- A yearly comparison should be performed to assess the existence of improvements

**Arthur D Little**

Composting Year 1

Section 1 Offer

1.1 Did you Yes, total  
Mainly  
Somehow  
Not much  
No

1.2 Were you Yes, total  
Majority  
Enough  
Not enough  
No

1.3 Have you Yes, total  
Mainly  
Somehow  
Not all  
No

1.4 Would you Yes, total  
Probably  
Maybe  
Not likely  
No

1.6 Did you No  
Not much  
Some

**Arthur D Little**

Composting Year 2

Section 1 Offer

1.1 Did you Yes, total  
Mainly  
Somehow  
Not much  
No

1.2 Were you Yes, total  
Majority  
Enough  
Not enough  
No

1.3 Have you Yes, total  
Mainly  
Somehow  
Not all  
No

1.4 Would you Yes, total  
Probably  
Maybe  
Not likely  
No

1.6 Did you No  
Not much  
Some

**Arthur D Little**

Composting Year 3

Section 1 Offer

1.1 Did you Yes, total  
Mainly  
Somehow  
Not much  
No

1.2 Were you Yes, total  
Majority  
Enough  
Not enough  
No

1.3 Have you Yes, total  
Mainly  
Somehow  
Not all  
No

1.4 Would you Yes, total  
Probably  
Maybe  
Not likely  
No

1.6 Did you No  
Not much  
Some

**Arthur D Little**

Composting Year 4

Section 1 Offer

1.1 Did you Yes, total  
Mainly  
Somehow  
Not much  
No

1.2 Were you Yes, total  
Majority  
Enough  
Not enough  
No

1.3 Have you Yes, total  
Mainly  
Somehow  
Not all  
No

1.4 Would you Yes, total  
Probably  
Maybe  
Not likely  
No

1.6 Did you No  
Not much  
Some

**Arthur D Little**

Composting Year 5

Section 1 Offer

1.1 Did you consider the fertilizer prices aligned with your needs?

Response	Percentage	Count
Yes, totally	100%	0
Mainly	75%	0
Somehow	50%	0,5
Not much	25%	0
No	0%	0,5

1.2 Were you given all the quantity that you asked for?

Response	Percentage	Count
Yes, totally	100%	0
Majority	75%	0
Enough	50%	0,5
Not enough	25%	0
No	0%	0,5

1.3 Have you noticed an improvement in your crops yield?

Response	Percentage	Count
Yes, totally	100%	1
Mainly	75%	0
Somehow	50%	0
Not all	25%	0
No	0%	0

1.4 Would you use this fertilizer supplier again?

Response	Percentage	Count
Yes, totally	100%	0
Probably	75%	0,75
Maybe	50%	0
Not likely	25%	0
No	0%	0,75

1.6 Did you need any information that was not readily available?

Response	Percentage	Count
No	100%	0
Not much	75%	0
Some	50%	0

Section	Result
1 Offer	55%
2 User friendliness	33%
3 Transparency	38%
4 Sustainability	75%
5 Fertilizer impact	25%
6 Investors	38%
7 Managing entities	42%

The full questionnaire is given as an Appendix to this Report

## 3.2.2 Pilot Project – Overview

The pilot project will be developed in Pemba, in partnership with the Aga Khan Foundation, with an estimated budget of 350 k€ and should break ground in Q2 2012

Pilot Project			
<b>Partner</b>	<ul style="list-style-type: none"> <li>The Aga Khan Foundation is launching the Pemba Composting project as the first in a pipeline, and are looking for partners</li> </ul>	<b>Target Geography</b>	<ul style="list-style-type: none"> <li>The initial project will be in Pemba, but Aga Khan's goal is to have a network of composting sites in the major Mozambican cities, to help solve the waste problem and at the same time produce fertilizer and increase agricultural yields</li> </ul>
<b>Amount</b>	<ul style="list-style-type: none"> <li>The set up of the Pemba project should cost some 350 k€, distributed by the Bokashi infrastructure, a truck/tractor to transport the waste to the Bokashi site, fuel and salaries for four full time workers</li> </ul>	<b>Timings</b>	<ul style="list-style-type: none"> <li>The pilot project is expected to start in Q2 2012</li> </ul>

## 3.2.2 Pilot Project – Location and main characteristics

**This project will help solving the increasing waste problem in the Pemba region and at the same time address the fertilizer requirements of the region**

### The Pemba Bokashi Project



#### Waste collection

In order to help solving the growing waste management problem in Pemba, the Aga Khan Foundation is launching a composting project, that uses the waste from industry, households and livestock for the production of fertilizer using a technique named Bokashi

#### Bokashi composting

Bokashi is a type of organic fertilizer that increases and activates the microorganisms in the soil. Regarding the traditional composting techniques, the Bokashi is faster (it takes approximately 2 weeks when compared with the 90 days in the traditional methods)

#### Selling the fertilizer

The result is an organic fertilizer, that highly increases the yields in the agricultural fields surrounding Pemba. The final goal is thus selling this fertilizer to the surrounding farmers

In the last two months this technique has already been implemented in five small associations and two households in the Pemba region, with excellent results

Source: Aga Khan Foundation

## 3.2.2 Pilot Project – Location and main characteristics

**The composting center will be located in the outskirts of Pemba, and should be able to produce 95 tons of fertilizer per year...**

### Pemba Bokashi project future location



Bokashi production site, using waste from the production of cassava in Costa Rica



Potential location for the Pemba Bokashi site

This is the chosen location for the new Pemba landfill. The Municipality has granted part of this terrain to the Bokashi project

### Bokashi specificities

- Bokashi production should be performed on an open site to promote aeration, with cement floor, but with a ceiling to avoid the rain
- The waste residues (household, industry and livestock waste) should be dry mixed, adding water until having a humidity level of some 30-40%. It's important to avoid higher levels of humidity, to prevent rotting
- The fermentation process takes approximately two weeks, producing on a weekly basis 2 tons of fertilizer
- The yearly production is some 96 tons of fertilizer

Source: Aga Khan Foundation

... a quantity perfectly aligned with the current agricultural requirements of this region

### Fertilizer demand in the region

The major Bokashi consumers will be the saffron and ginger producers from Metuge:

- Mieze
- Nangua
- Namuapala
- Nacuta
- Unidade
- Tratara

Village	Culture area (ha)	Fertilizer usage* (tons/y)
Mieze	13,8	55
Nangua	2	8
Namuapala	2	8
Nacuta	2	8
Unidade	2	8
Tratara	2	8
<b>Total</b>	<b>23,8</b>	<b>95 tons of fertilized needed</b>

Source: Aga Khan Foundation

\*Considering a metric of 4 ton/y, according to Leblanc et al, 2000





With a CapEx of some 350 k€, an Opex of 16 k€/year, and considering a selling price of 800 €/ton, the payback time is around 7 years

CapEx		OpEx	
Building	270 k€	Workforce (4 full time workers)	10.000 €/year
Truck + small vehicle	75 k€	Fuel & Others (considering a 15 km distance)	6.000 €
<b>Total</b>	<b>345 k€</b>	<b>Total (year)</b>	<b>~ 16.000€</b>

Revenues
95 tons/year x 800 €/ton = <b>~77.000 €/y</b>

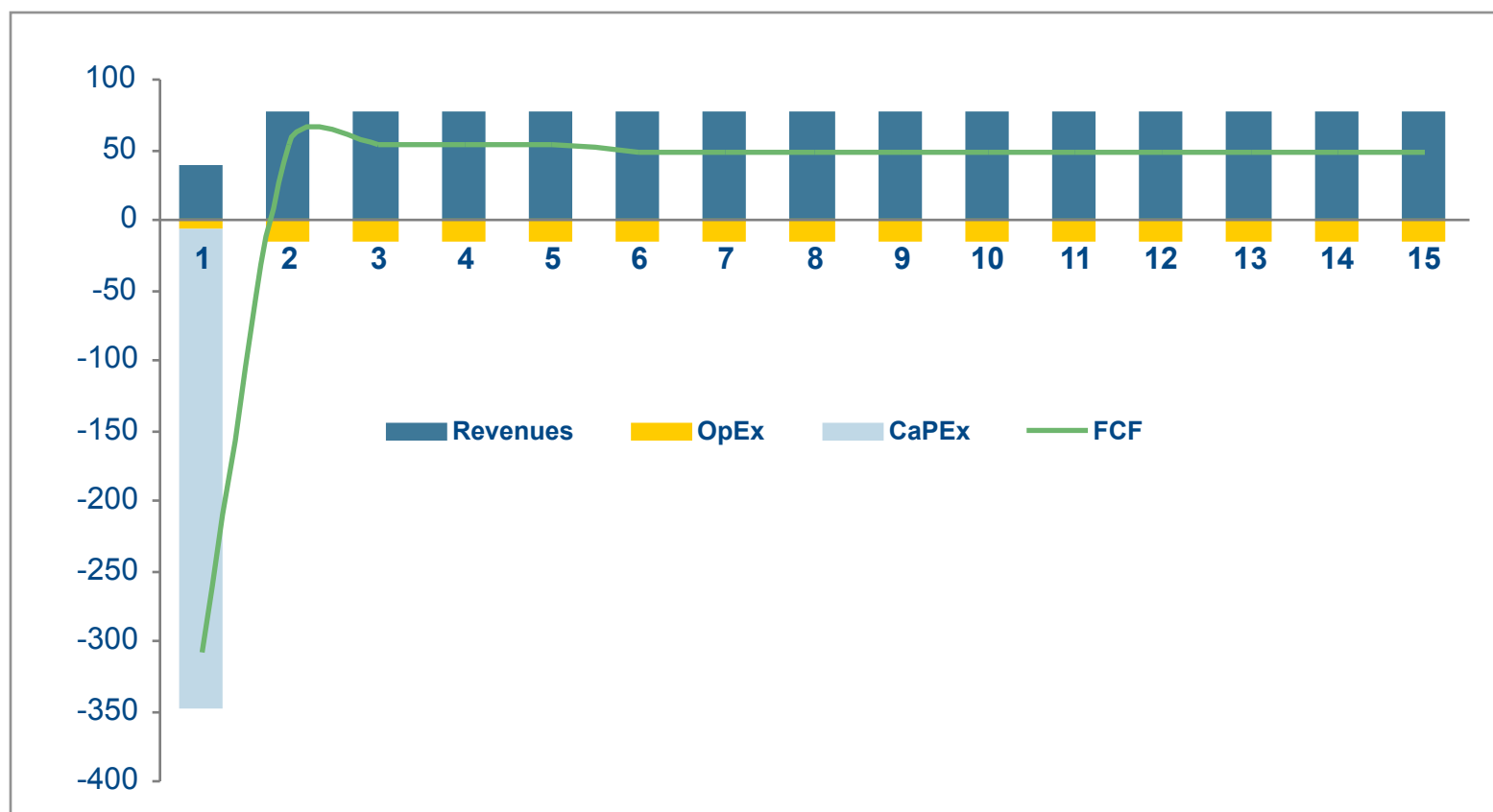
**Payback time: ~ 7 years**

Source: Aga Khan Foundation, Arthur D. Little analysis

## 3.2.2 Pilot Project – Financial Analysis

Considering a 15 years timeframe, the returns for this project (in the absence of any financial leveraging) are some 13%

### High level financial analysis



pIRR

~ 13%

Payback time

~ 7 years

Source: Arthur D. Little analysis





## 3.2.2 Pilot Project – Timings

**Given the licensing and logistic procedures, the pilot project should take some 6 months to break ground**

Months (2012)	1	2	3	4	5	6	7	8	9	10	11	12	2013
Government licensing procedures													
Infrastructure construction													
Other licensing and logistic procedures													
Identification of the target clients													
Project launch & operation													
Mid term pilot project evaluation													
Sustainability monitoring and evaluation of Pilot project results													
Fund raise for new projects & implementation of new projects													

## 3.2.2 Investors' contacts – Main messages

**There are many factors which can affect the ongoing financial viability of composting projects. Discussions with investors revealed an appetite but only following significant testing**

### Main messages

“The program makes sense and we see the value for adaptation and sustainability more broadly”

*Emerging Capital – Investment officer*

“as an investor we would need to really get a deep understanding of where material is coming from and where it is going to, especially if the output is compost for food production”

“There is an important tie in to the microfinance program which should be explored”

*UNEP FI*

“as it stands it would be a tough project for private equity to back – you would need to test the concept thoroughly with grant funding”

*Emerging markets private equity firm*

“make the pilot work and then come back and show us the mechanism and financial conditions – this needs to be a robust test case given seasonality and variance in conditions”

*IFC*

Source: Contacted investors

0 Executive Summary

1 Phase 1

2 Phase 2

**3 Phase 3**

3.1 Executive Summary

**3.2 The Four Programs**

3.2.1 Clean Energy Program

3.2.2 Composting

**3.2.3 Micro & Small Scale Lending**

3.2.4 AgroForestry Fund

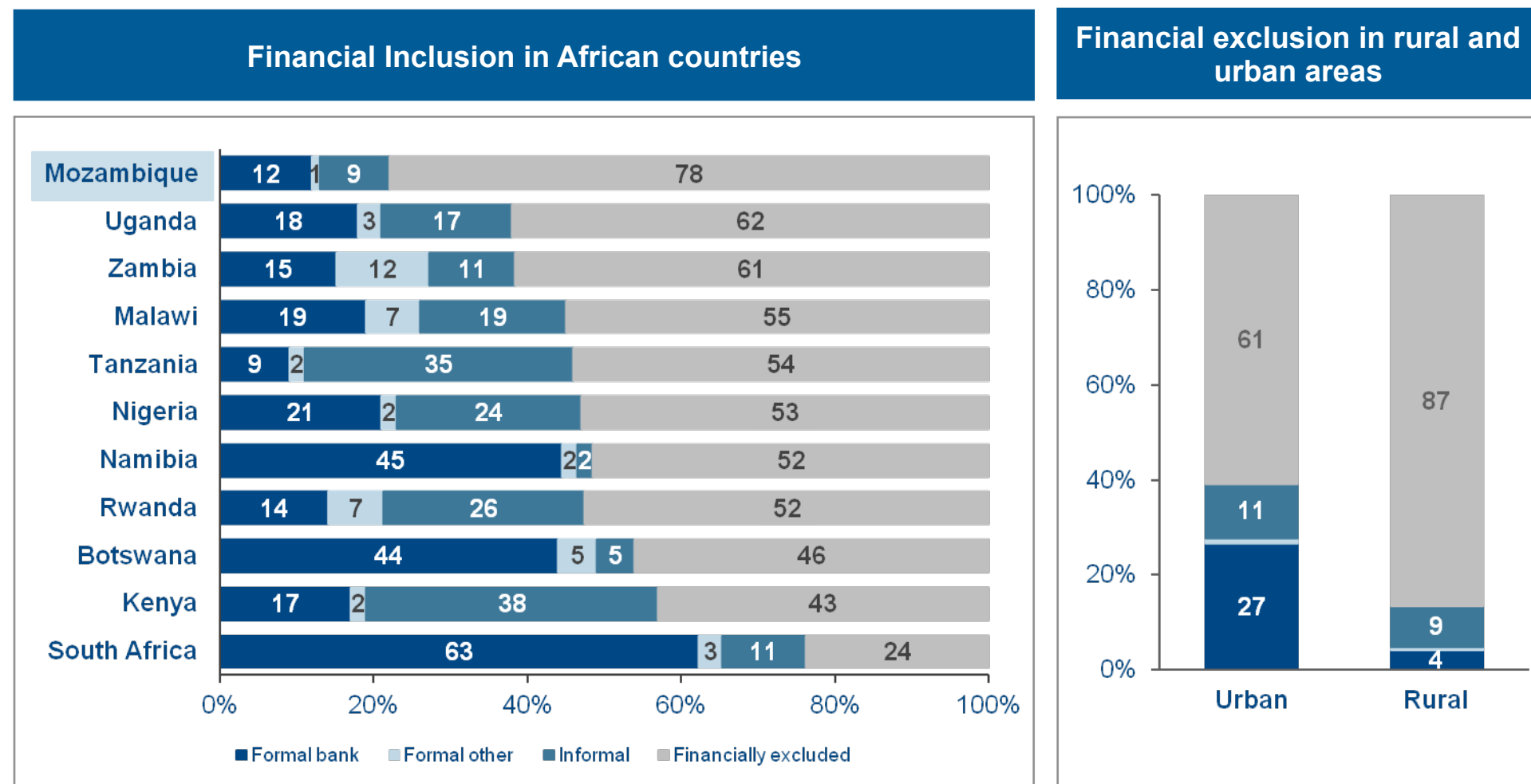
3.2.5 New Programs' Framework

3.3 Involvement of the Insurance Sector

3.4 Barriers to Business Analysis

3.5 Strategic Recommendations

**Mozambique is one of the African countries with the lowest financial inclusion level, with 78% of the adult population financially excluded**

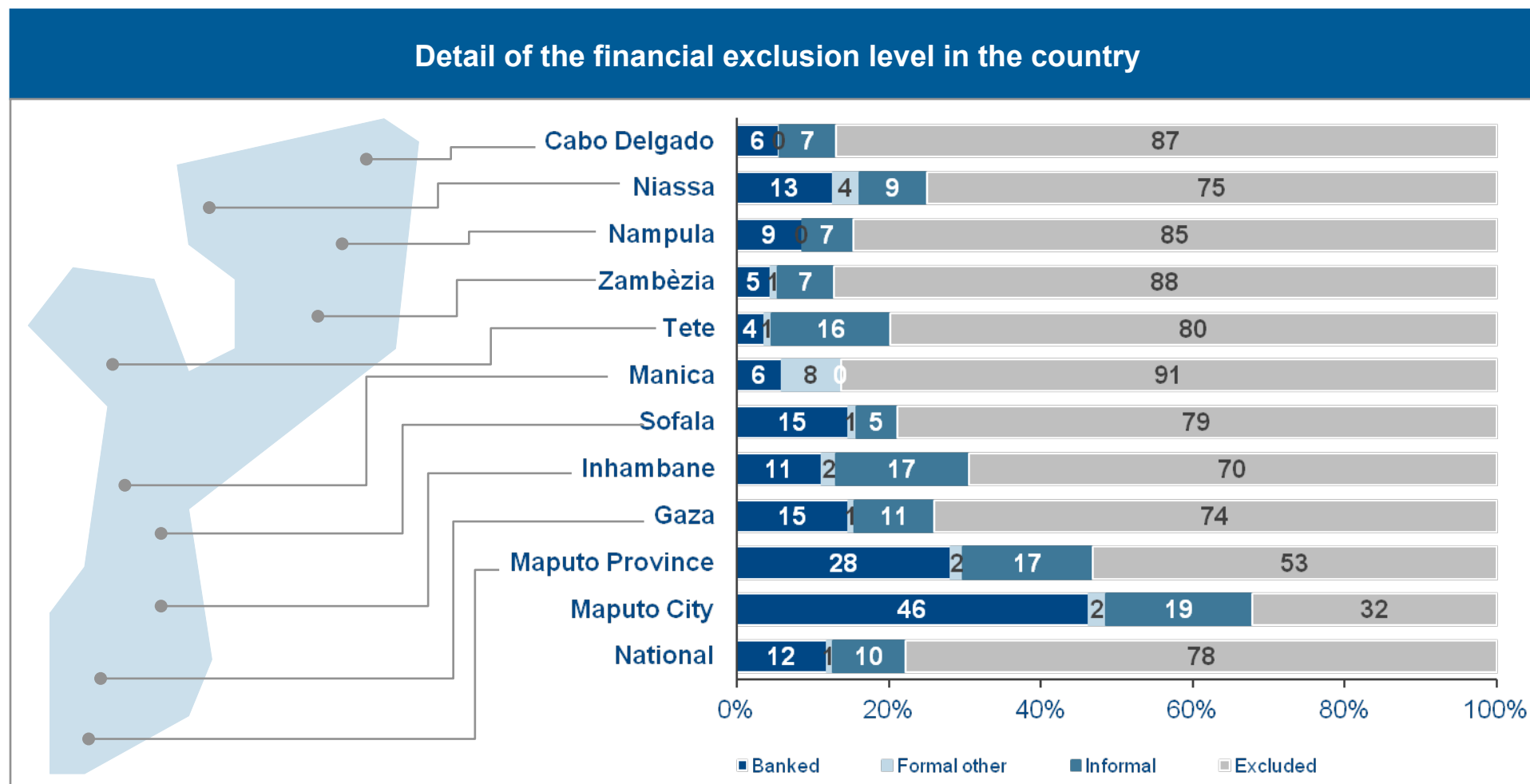


Source: FinScope



## 3.2.3 Introduction – Financial inclusion in Mozambique per region

**Maputo has the highest levels of financial inclusion and formal financial product utilization, while Manica, Nampula and Cabo Delgado are on the opposite side of this spectrum**



Source: FinScope

## 3.2.3 Introduction – Existing Micro Finance Institutions (MFI)

In order to address and overcome this problem, several institutions are providing microcredit to the needed populations



### AfricaWorks

#### Mission

To develop and implement scalable, self-sustaining business models in agribusiness and trade finance for holistic transformation of farmers, small traders and SMEs in communities.

Gross loan portfolio <b>1,1 million</b> (USD 2010)	Number of active borrowers <b>4.307</b>
Average loan per borrower <b>249,7</b> (USD 2010)	Deposits <b>437.053</b> (USD 2010)
Total assets <b>1,5 million</b> (USD 2010)	Number of depositors <b>4.742</b>



### BOM

*Banco Oportunidade de Moçambique*

#### Mission

BOM is on schedule to start opening bank branches and operate as a microfinance bank in four cities: Maputo, Chimoio, Beira and Quelimane. Is currently offering access to small loans to over 2,000 Mozambicans and aims to offer access to microfinance services to many more

Gross loan portfolio <b>3,1 million</b> (USD 2010)	Number of active borrowers <b>9.243</b>
Average loan per borrower <b>336,3</b> (USD 2010)	Deposits <b>2,3 million</b> (USD 2010)
Total assets <b>6,6 million</b> (USD 2010)	Number of depositors <b>--</b>

Source: Mixmarket, institutions' websites

## 3.2.3 Introduction – Existing Micro Finance Institutions (MFI)

**With some exceptions, the typical average loan per borrower is around 200-500 USD, and the money is commonly used for agricultural and commercial entrepreneurial projects**



### FDM

*Fundo de Desenvolvimento da Mulher*

#### Mission

Motivate the positive and lasting change of the Mozambican micro entrepreneurs life's prioritizing families lead by women.

Gross loan portfolio

**644.982** (USD 2010)

Number of active borrowers

**2.977**

Average loan per borrower

**216,7** (USD 2010)

Deposits

**178.324** (USD 2010)

Total assets

**1 million** (USD 2010)

Number of depositors

**4.977**



### Hluvuku

#### Mission

To improve the socio economic conditions of the population in the Maputo province, providing high-quality sustainable services to low income people, with competence, professionalism and zeal and considering the viability of the initiatives.

Gross loan portfolio

**2 million** (USD 2010)

Number of active borrowers

**4.425**

Average loan per borrower

**456,3** (USD 2010)

Deposits

**28.339** (USD 2010)

Total assets

**2,4 million** (USD 2010)

Number of depositors

**4.425**

Source: Mixmarket, institutions' websites

## 3.2.3 Introduction – Existing Micro Finance Institutions (MFI)

One of the most challenging problems that these institutions face is the difficulty in addressing all the needed populations, mainly due to geographical and logistic constraints



### Banco ProCredit Mozambique

#### Mission

Provide financial services to low-income segments of the Mozambican population. Position itself as a leader in the market.

Gross loan portfolio <b>32,7 million</b> (USD 2010)	Number of active borrowers <b>15.916</b>
Average loan per borrower <b>2.057</b> (USD 2010)	Deposits <b>35.8 million</b> (USD 2010)
Total assets <b>49,8 million</b> (USD 2010)	Number of depositors <b>123.570</b>



### Socremo

#### Mission

To provide - in a transparent, professional and sustainable way - financial services to low and middle income groups, with special focus on micro and small entrepreneurs.

Gross loan portfolio <b>27,1 million</b> (USD 2010)	Number of active borrowers <b>20.092</b>
Average loan per borrower <b>1.347</b> (USD 2010)	Deposits <b>31 million</b> (USD 2010)
Total assets <b>26,7</b> (USD 2009)	Number of depositors <b>133.053</b>

Source: Mixmarket, institutions' websites



## 3.2.3 Introduction – Existing Micro Finance Institutions (MFI)

The Aga Khan Foundation offers a good anecdote: the project they set up in 2004 in Cabo Delgado found so many difficulties, that had to be postponed



**Tchuma**  
Mozambique

### Mission

Tchuma's mission is to provide credit and savings services to the emerging entrepreneurs of Mozambique, particularly women.

Gross loan portfolio  
**32,7 million** (USD 2010)

Number of active borrowers  
**15.916**

Average loan per borrower  
**2.057** (USD 2010)

Deposits  
**35.8 million** (USD 2010)

Total assets  
**49,8 million** (USD 2010)

Number of depositors  
**123.570**



Aga Khan Foundation

**Aga Khan**

### Mission


The Aga Khan Foundation is part of the Aga Khan Development Network, a group of private, international, non-denominational agencies founded by His Highness the Aga Khan. The Network's organizations have individual mandates that range from the fields of health and education to culture, rural development and the promotion of private-sector enterprise. It is dedicated to improving living conditions and opportunities for the poor, without regard to faith, origin or gender.

Aga Khan initiated its microfinance project in Mozambique in 2004, in Cabo Delgado. However the rash economic conditions in this region made it very difficult to implement the project and Aga Khan is now repositioning to other more developed areas (Nampula, Maputo) that can be used as leverages to further projects in the poorer regions of the north.

Source: Mixmarket, institutions' websites

## 3.2.3 Introduction – Existing Micro Finance Institutions (MFI)






**The majority of the Micro Finance Institutions (MFI) in Mozambique are backed up and funded by world known institutions...**

MFI	Funders	
Socremo	 (accessholding.com)	Established in 2006 by an international group of private and public investors, will build up a network of microfinance banks worldwide. Investments are taken to success through a combination of growth capital, holding services and technical assistance. Access Holding has divested from Socremo recently.
	 (dignityfund.com)	The DF aims to increase the number of poor households with access to credit, savings and other financial services by providing debt financing to microfinance institutions. The DF believes that this funding will enable microfinance institutions that are seeking capital for growth to reach more poor clients, allowing them to lift out of poverty with dignity.
	 (triodos.com)	Triodos Investment Management has been one of the leading investors in the microfinance sector since making its first investments in the industry in 1994. Our aim is to build long term relationships, based on transparency and fairness, and a shared commitment to relieving poverty and caring for the planet.
Novobanco	 (doen.nl)	The Doen Foundation's ambition is to help build a sustainable world in which everyone can participate, by promoting sustainable, cultural and social pioneers. DOEN promotes people and enterprises that take the lead in the field of sustainable, cultural and social innovation. DOEN seeks out these innovators, supports and inspires them.
	 (ifc.org)	IFC provides advisory services and direct and indirect investment services to the microfinance sector. It's focus is on creating and supporting commercially viable microfinance institutions that can attract the private capital needed to scale up and respond to unmet demand.

Source: Mixmarket, institutions' websites

## 3.2.3 Introduction – Existing Micro Finance Institutions (MFI)



... that use these MFIs as preferential and trusted channels to help financing the needed populations...

MFI	Funders
Tchuma	 <p>An international financial consortium with Headquarters in Padua, Italy, and three regional offices in Sri Lanka, Argentina and Senegal. It collects savings in Europe and invests in developing and emerging countries financing microfinance institutions, producers cooperatives linked to Fair trade markets and social enterprises.</p>
	 <p>Fundació Un Sol Món was created by Caixa Catalunya, a Spanish Bank, in 2000. The fund has four priority activities: development of employment for groups at risk from social exclusion; microcredits for self-employment; international cooperation; generating awareness of poverty issues.</p>
	 <p>The unique guarantor model of MicroCredit Enterprises utilizes the financial capital and good credit of high net worth individuals and institutions to guarantee micro loans that lead to sustainable communities and social good.</p>
BOM	 <p>Oikocredit invests around 80% of its development finance portfolio in microfinance and 20% directly in other sectors, including agriculture, manufacturing and education</p>
	 <p>The United Nations Capital Development Fund (UNCDF) offers a unique combination of investment capital, capacity building and technical advisory services to promote microfinance and local development in the Least Developed Countries</p>

Source: Mixmarket, institutions' websites

## 3.2.3 Introduction – Existing Micro Finance Institutions (MFI)

... and at the same time strengthen the financial tissue in Mozambique

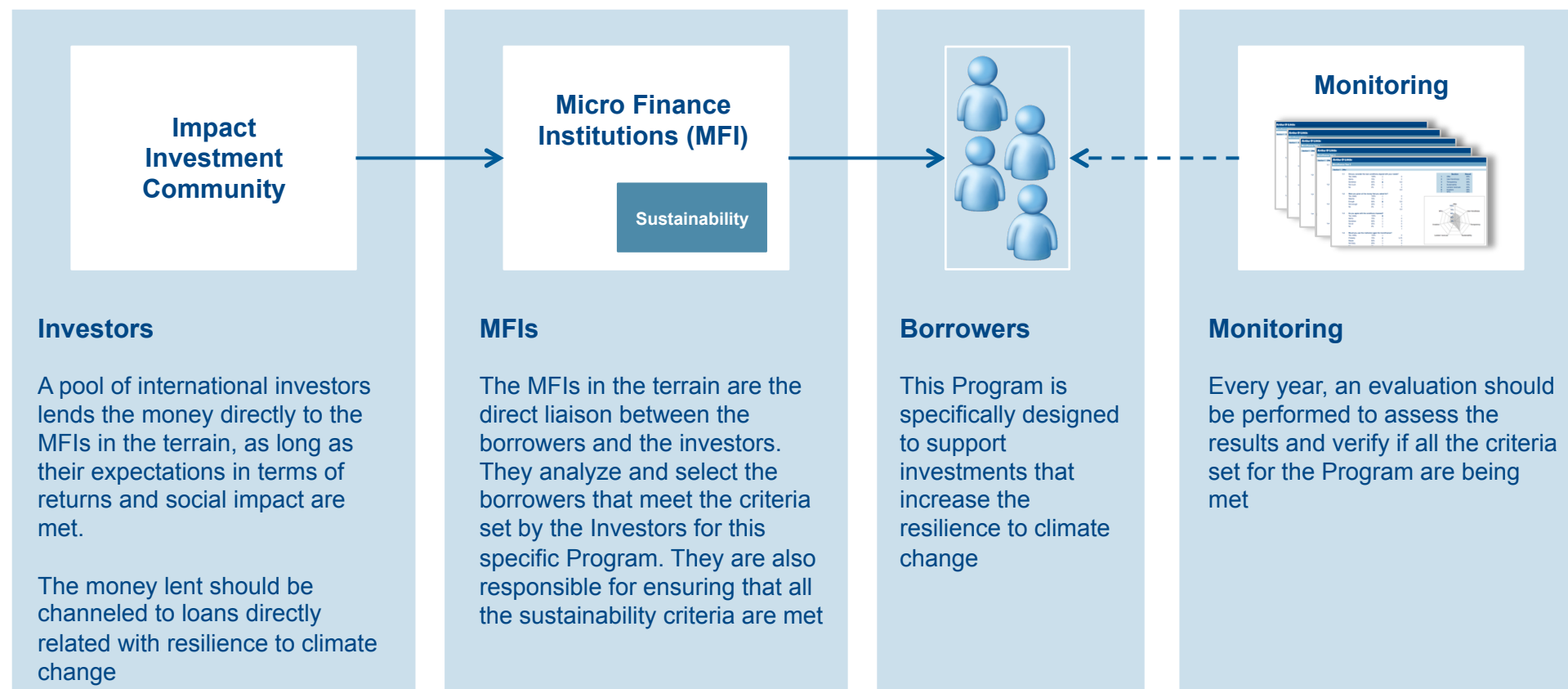
MFI	Funders	
Hluvuku	 (triplejump.eu)	<p>Triple Jump's mission is to contribute to the sustainable development of emerging market economies by facilitating investment in micro and small enterprises. Triple Jump seeks to support the expansion of viable microfinance institutions in all three stages of their development (emerging, expanding and mature) by providing capital and advisory services</p>
	 (triplejump.eu)	<p>The United Nations Capital Development Fund (UNCDF) offers a unique combination of investment capital, capacity building and technical advisory services to promote microfinance and local development in the Least Developed Countries</p>
FDM		

Source: Mixmarket, institutions' websites

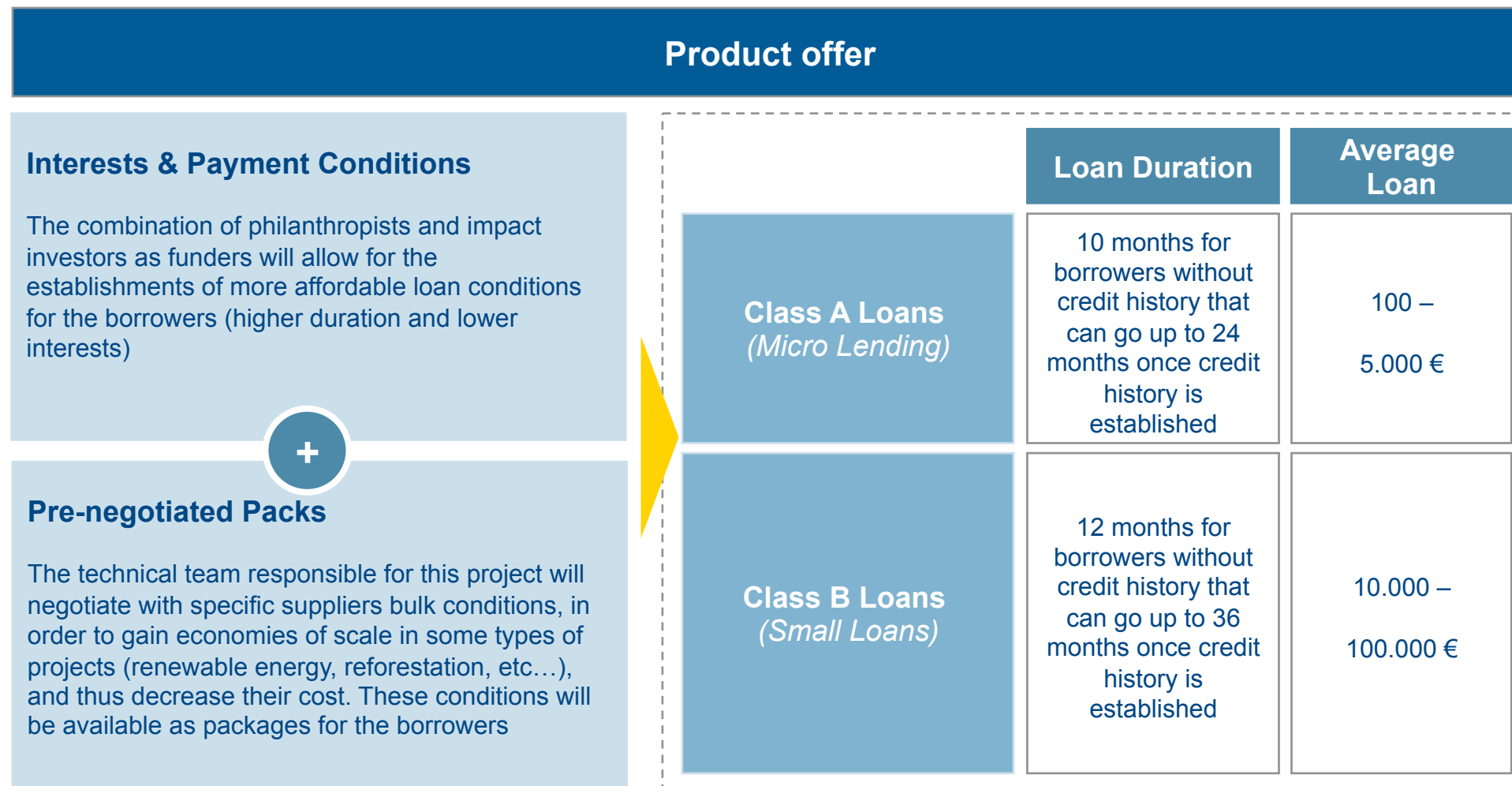
## 3.2.3 Program Description – Operationalization

The idea underlying this Program is empowering the needed populations and SMEs in the creation of resilience to climate change, by giving them credit to invest in sustainable projects

### Program operationalization

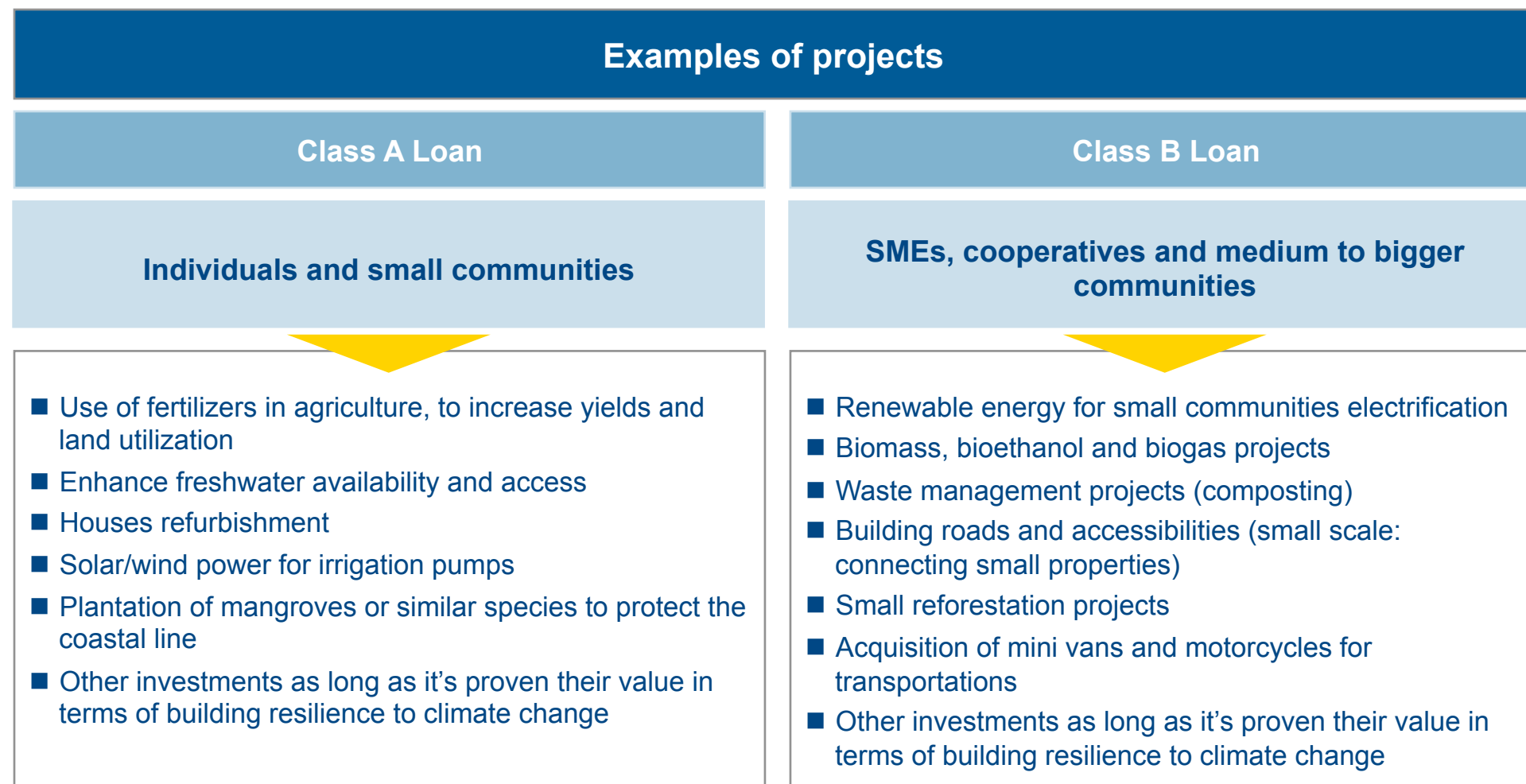


The combination of investors with different return profiles and pre-negotiated packages will result in more affordable loan conditions



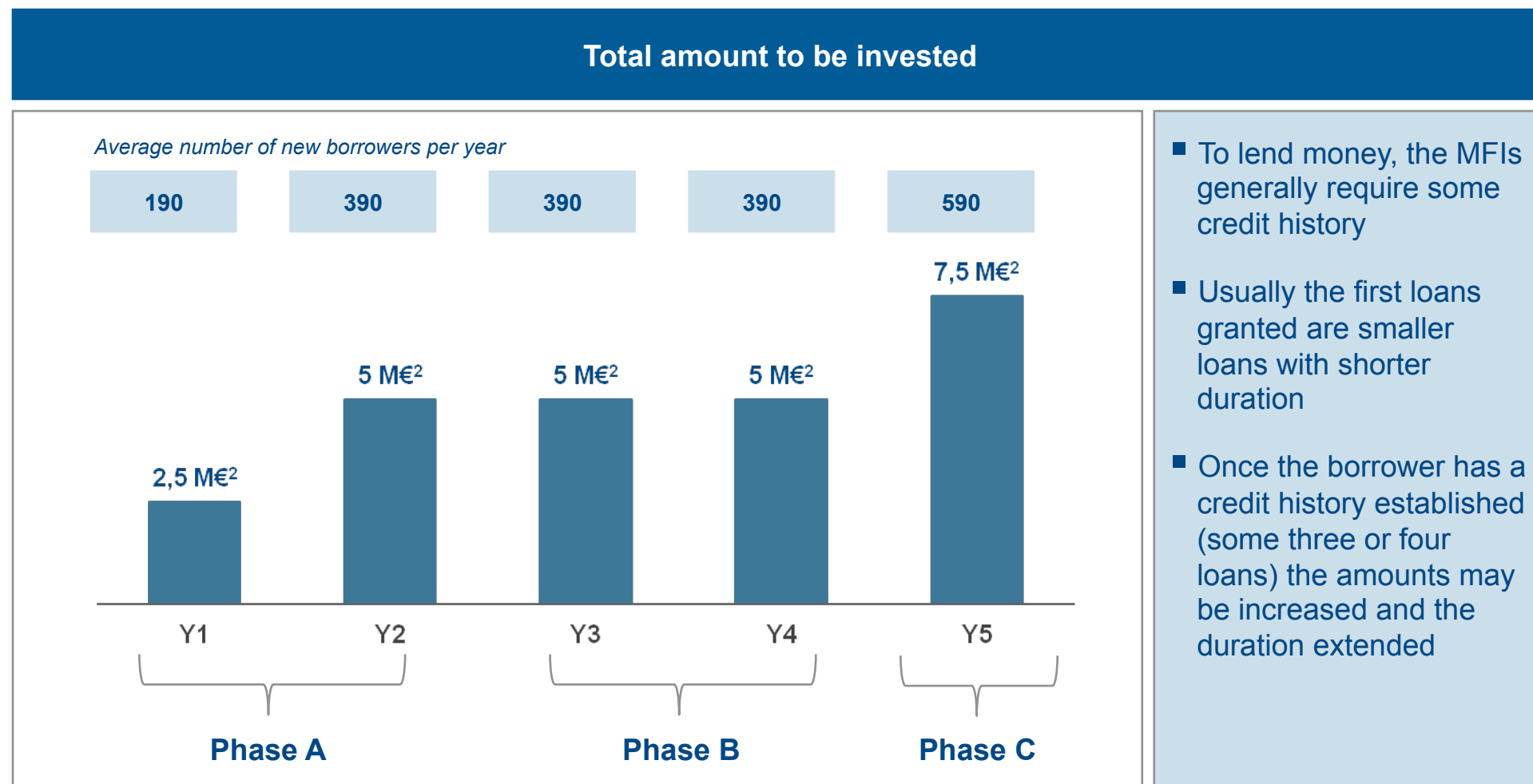
## 3.2.3 Program Description – Project's portfolio

Depending on the type of projects, the amounts involved and the background of the borrower, the loan can fall in one of two categories



## 3.2.3 Program Description – Total Investment

We forecast a total of 25 M€ raised over 5 years, which, considering a typical average loan of 12.800<sup>1</sup> €/year, should benefit some 2.000 borrowers over this period of time



<sup>1</sup>Considering a mix of 40% Class A Loans with an average value of 2.000€ and 60% Class B Loans with an average investment of 20.000€;

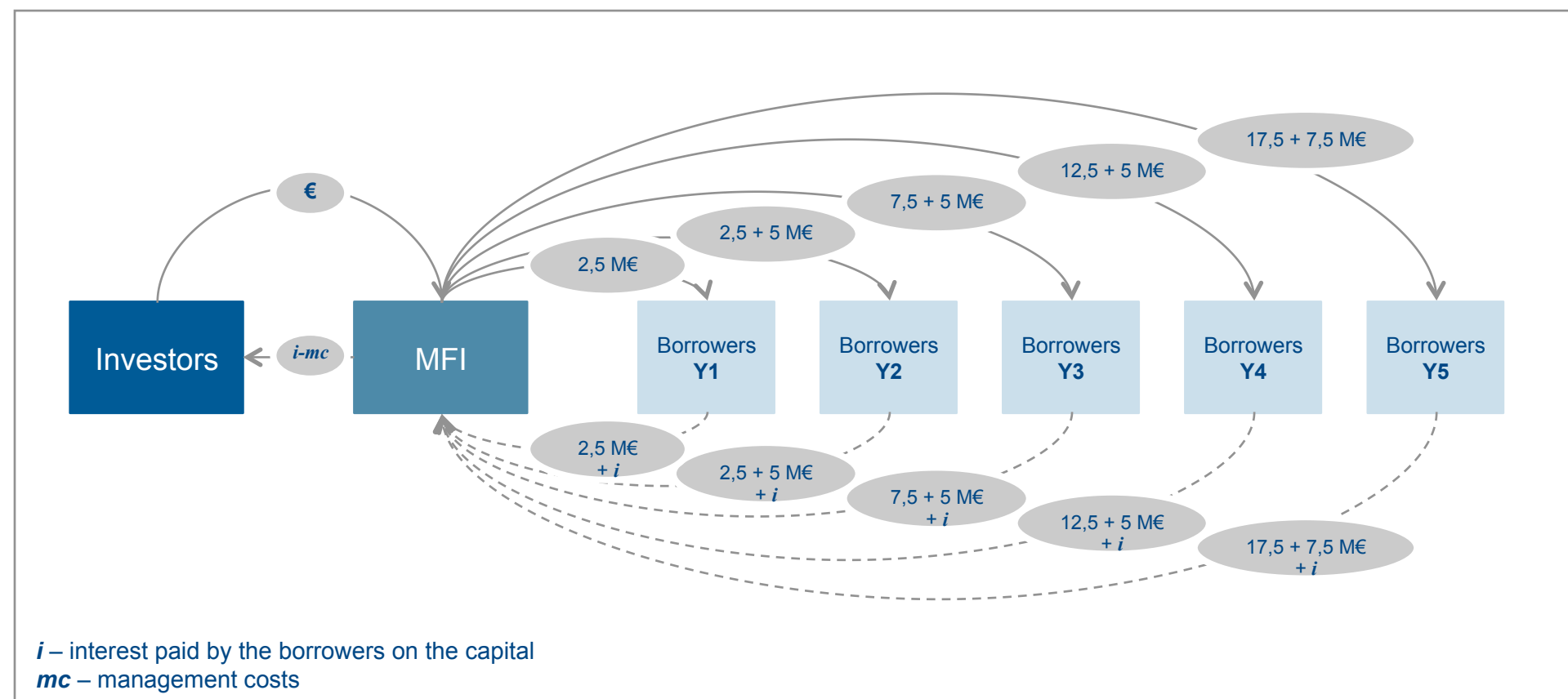
<sup>2</sup>Additional investment per year



## 3.2.3 Program Description – Investment routine

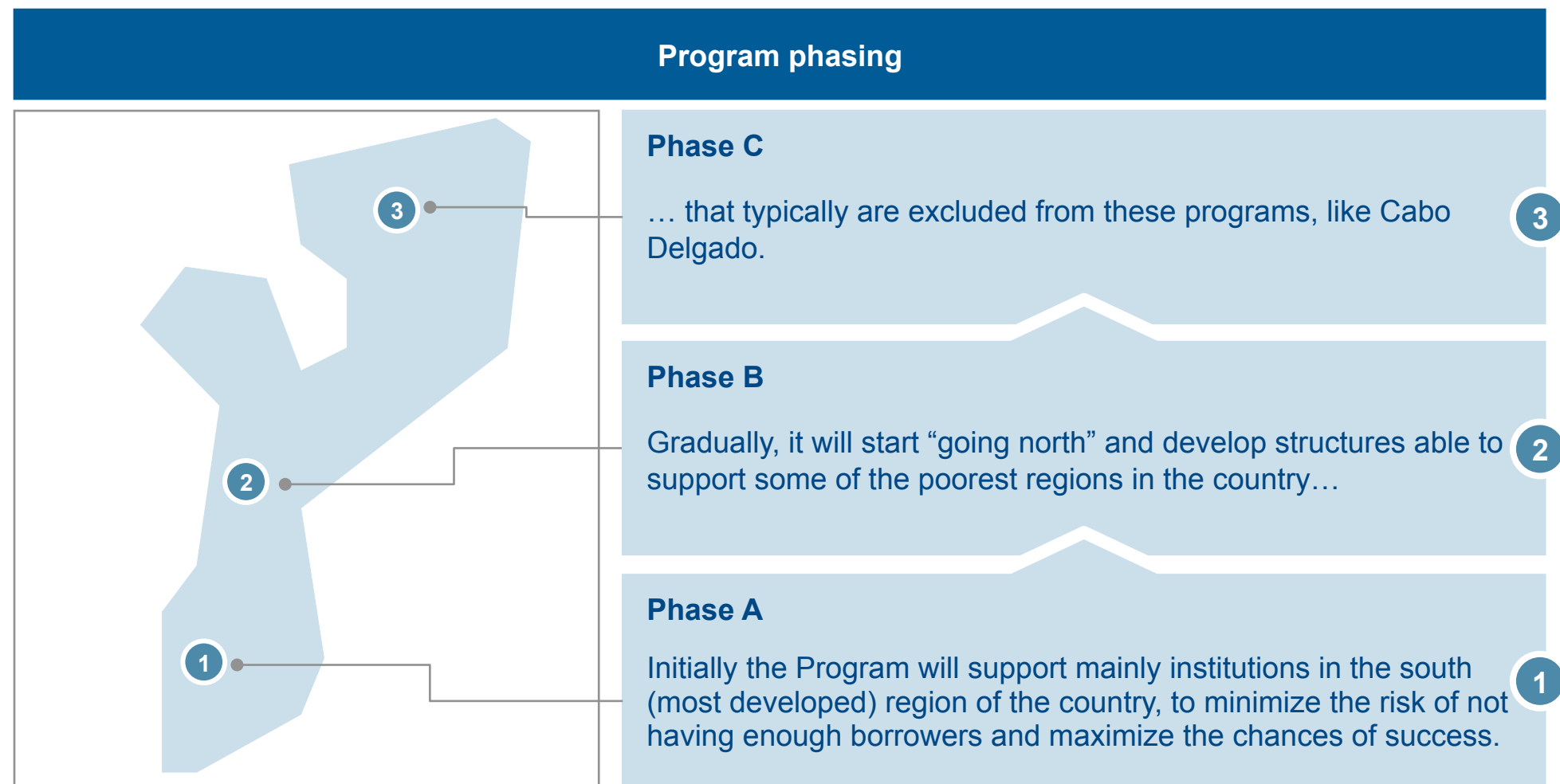
These 25 M€ are to be distributed in yearly tranches, with the interests optimized to allow for the investors' targets accomplishment and the MFIs management costs

### Investment routine



## 3.2.3 Program Description – Program phasing

To maximize the success of the Program, the initial investments will be made in the more developed areas of the south, and gradually start going north, to the more needed populations



## 3.2.3 Program Description – Capacity Building

**Another key aspect of this Program, is the development of “in house” competences, to foster in a near future, total local autonomy in the management of the Program**

Human Resources	Training	Learning by Doing	Technical Assistance	Assets
<ul style="list-style-type: none"> <li>■ Training and recruiting of personnel with capacity to deal directly with the international investors, funders and the MFIs</li> <li>■ Recruiting of personnel with “ground knowledge”, i.e., deep knowledge of the Mozambican reality and geographies, to identify the best opportunities</li> </ul>	<ul style="list-style-type: none"> <li>■ Development of financial and legal competences: the personnel should be comfortable in establishing the conditions and calculating the returns of every investment and feel at ease with the legal and contractual aspects</li> </ul>	<ul style="list-style-type: none"> <li>■ Create “mixed” teams, incorporating local personnel and external consultants, to foster the knowledge transfer and create, in the near future a pool of internal resources fully capable of implementing the entire process</li> </ul>	<ul style="list-style-type: none"> <li>■ Development of innovative and dedicated financial solutions for the local populations</li> </ul>	<ul style="list-style-type: none"> <li>■ Network of MFIs</li> </ul>

## 3.2.3 Program Description – Risks & Mitigation Strategies

**There are several risks that should be addressed, however, all of them have adequate mitigation strategies**

Risks	Mitigation
Lack of awareness and knowledge from the populations to microfinance and lending in general	<ul style="list-style-type: none"> <li>Investment in educating the population</li> <li>Illustrate the concept with success cases</li> <li>Use the endorsement of local and well known celebrities</li> </ul>
Logistics and accessibility: Mozambique is a web of small and very disperse populations, which makes it harder the access to all the needed populations	<ul style="list-style-type: none"> <li>Initiate the program in the richest regions of South and Center, to build momentum</li> <li>Make partnerships with local authorities and NGOs to facilitate the penetration in less accessible locations</li> </ul>
Lack of people with knowledge and competences to support in setting up the process and dealing with the clients	<ul style="list-style-type: none"> <li>Invest in education and training of the collaborators</li> <li>Initially the program will operate on a “hand by hand” approach, with the support of experts</li> </ul>
Default	<ul style="list-style-type: none"> <li>The risk of default is typically very small for microfinance and small lending, as there is a big exposure of the individuals and they are “ashamed” to default</li> <li>Specific insurances will be put in place and collateral guarantees will be requested</li> </ul>
Difficulty in accessing the eligibility of some projects	<ul style="list-style-type: none"> <li>An extensive list with all the eligibility criteria will be elaborated, however there is flexibility to include other projects, as long as it’s proved that they meet all the criteria. A committee will be formed to analyze these situations</li> </ul>

## 3.2.3 Program Description – Sustainability monitoring

On a yearly basis the Program will be evaluated using a dedicated questionnaire, that evaluates the impact of the program in the borrowers, investors, MFIs and overall community

### Sustainability Monitoring

- The sustainability monitoring is to be performed at least on a yearly basis
- A significant sample of the population should be selected to allow for representativeness
- A yearly comparison should be performed to assess the existence of improvements

**Arthur D Little**

Microfinance Year 1

Section 1 Offer

Microfinance Year 2

Section 1 Offer

Microfinance Year 3

Section 1 Offer

Microfinance Year 4

Section 1 Offer

Microfinance Year 5

Section 1 Offer

Section	Result
1 Offer	55%
2 User friendliness	44%
3 Transparency	38%
4 Sustainability	75%
5 Lenders' revenues	25%
6 Investors	38%
7 MFIs	38%

1.1 Did you consider the loan conditions aligned with your needs?

Yes, totally 100% ☐ 0

Mainly 75% ☐ 0

Somehow 50% ☒ 0,5

Not much 25% ☐ 0

No 0% ☐ 0

1.2 Were you given all the money that you asked for?

Yes, totally 100% ☐ 0

Majority 75% ☐ 0

Enough 50% ☒ 0,5

Not enough 25% ☐ 0

No 0% ☐ 0

1.3 Do you agree with the conditions imposed?

Yes, totally 100% ☒ 1

Mainly 75% ☐ 0

Somehow 50% ☐ 0

Not all 25% ☐ 0

No 0% ☐ 0

1.4 Would you use this institution again for microfinance?

Yes, totally 100% ☐ 0

Probably 75% ☒ 0,75

Maybe 50% ☐ 0

Not likely 25% ☐ 0

Not at all 0% ☐ 0

The full questionnaire is given as an Appendix to this Report

## 3.2.3 Pilot Project – Main characteristics

The first step of this Program is setting the grounds for the pilot project, that should be done in partnership with one of the most reputable institutions in Mozambique

Pilot Project			
<b>Partner (MFI)</b>	<ul style="list-style-type: none"> <li>■ The institution chosen should be a solid player in this market, with a widespread network of branches and a solid client's list</li> <li>■ The goal should be to create critical mass in the southern regions, that facilitates their posterior entrance in the northern regions</li> </ul>	<b>Target Geography</b>	<ul style="list-style-type: none"> <li>■ The goal of the program is to reach the whole country, however, initially the focus will be in the southern parts, typically more prone to microfinance, and then gradually address the poorer regions of the north</li> <li>■ The initial target area should be Maputo and surrounding areas</li> </ul>
<b>Amount</b>	<ul style="list-style-type: none"> <li>■ The amount for the pilot project is around 2,5 M€</li> <li>■ As most of the borrowers should not have a credit history, initially the loans should be around 250-500 € maximum, with a maturity of 6 months</li> </ul>	<b>Timings</b>	<ul style="list-style-type: none"> <li>■ The pilot project should start early 2012 and the full 2,5 M€ should be allocated within the year.</li> </ul>

**We have evaluated the top six microfinance institutions operating in Mozambique according to the following criteria:**

### Client Base

Number of clients currently in the bank's database. The higher the number, the more reliable and widespread the institution should be

### Loan conditions

Interests, duration and major requirements. Very strict requirements or extremely high interests may be a deterrent for new clients

### Partners' reliability

Quality of the current partners of the institution: well known and solid institutions give credit to the bank and help raising money

### Widespread network

Number of branches. Having a widespread network is extremely important and one of the crucial aspects of selection

### Openness to alliances

Number of alliances/partnerships established and potential openness to new ones

## 3.2.3 Pilot Project – Partner selection

The analysis of the results evidenced that given their current positioning, Socremo and Novobanco are the most adequate candidates for this partnership

	Client base	Loan conditions	Partners' reliability	Widespread network	Openness to alliances	TOTAL
Socremo						
Novobanco						
BOM						
Tchuma						
Hluvuku						
FDM						

Source: Arthur D. Little analysis, MixMarket; Financing Mozambique

Top ranked    strong    weak



## 3.2.3 Pilot Project – Timings

**The first six months of the project will be used to set the grounds for the overall structure, that will be put in practice until the end of the year**

Months (2012)	1	2	3	4	5	6	7	8	9	10	11	12	2013
Partner selection													
Identification of the criteria for the credit line (resilience to climate change)													
Identification of the target clients' profile (target geographies, gender mix, etc.)													
Fund raise													
Promotion and Commercialization													
Mid term pilot project evaluation													
Sustainability monitoring and evaluation of Pilot project results													
Fund raise for new projects & implementation of new projects													

The messages coming possible investment partners have been very consistent



Source: Contacted investors

0 Executive Summary

1 Phase 1

2 Phase 2

**3 Phase 3**

3.1 Executive Summary

**3.2 The Four Programs**

3.2.1 Clean Energy Program

3.2.2 Composting

3.2.3 Micro & Small Scale Lending

**3.2.4 AgroForestry Fund**

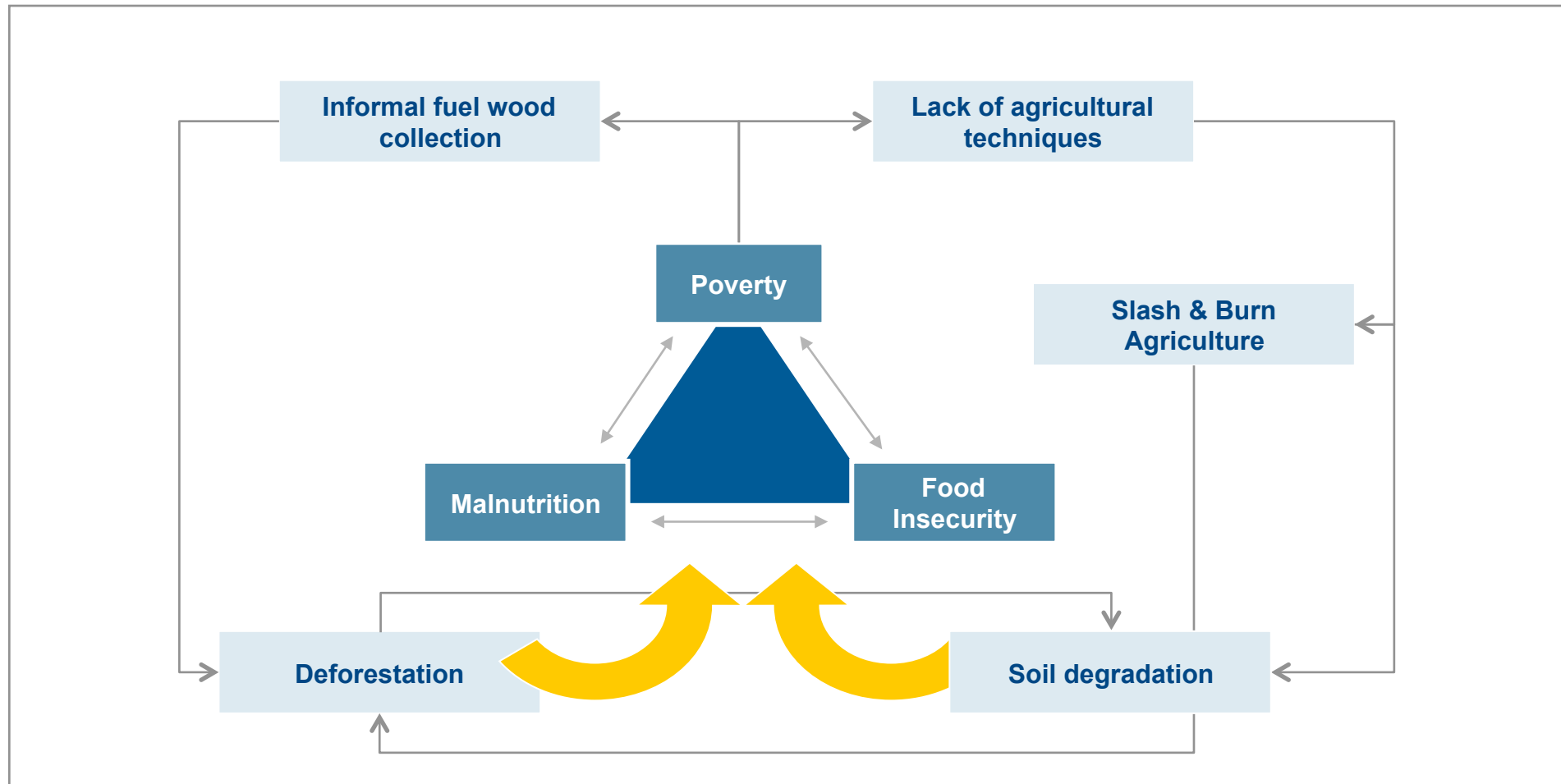
3.2.5 New Programs' Framework

3.3 Involvement of the Insurance Sector

3.4 Barriers to Business Analysis

3.5 Strategic Recommendations

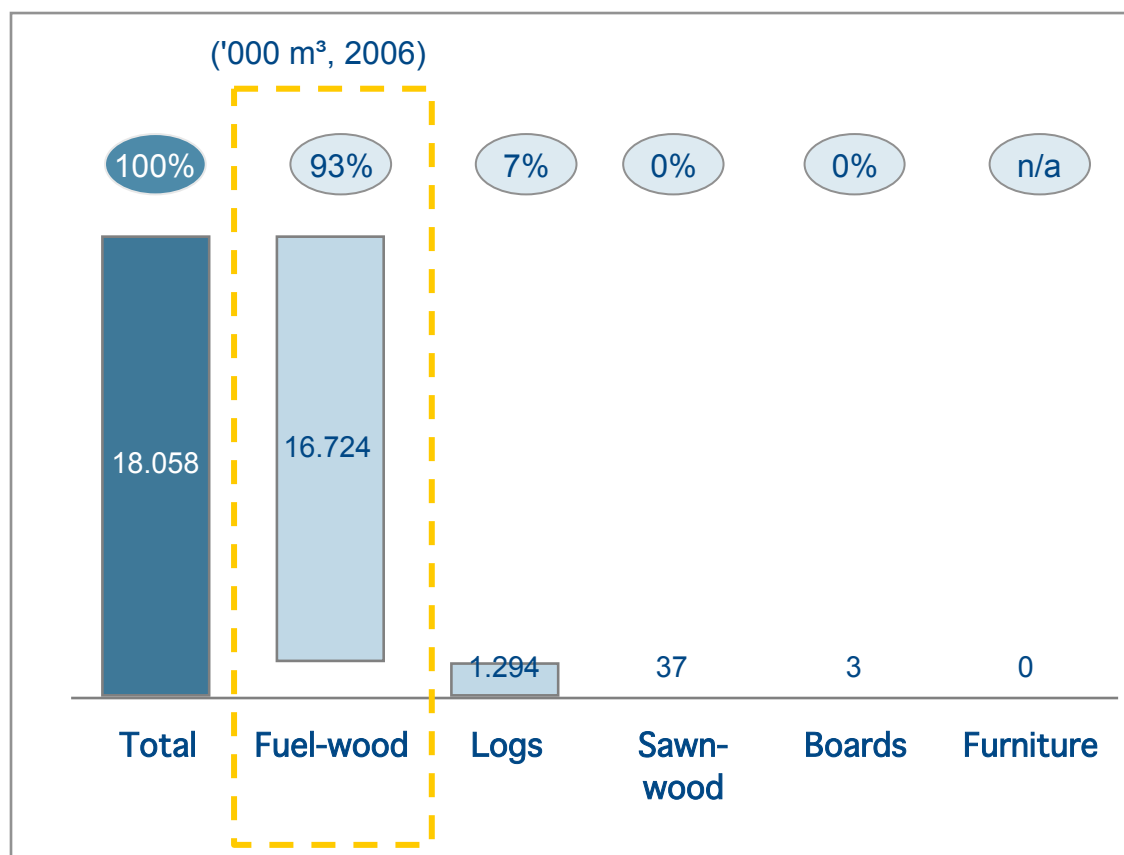
**Agriculture and forestation are in the heart of the poverty cycle where the majority of the Mozambican population is trapped**



Source: Technoserve; Arthur D. Little analysis

**Forest use is largely informal and for extracting fuel wood - leading to negative impacts on the local population and the environment**

### Forestry production in Mozambique



- Informal fuel wood collection to meet firewood demand from local population living in poverty
- Lack of agricultural knowledge leads to slash-and-burn techniques with low productivity and sub-optimal land use
- Illegal cutting and export (e.g. to China)

### Serious deforestation and soil degradation

Every year, 1 – 2 % of Mozambique's native forest area is lost

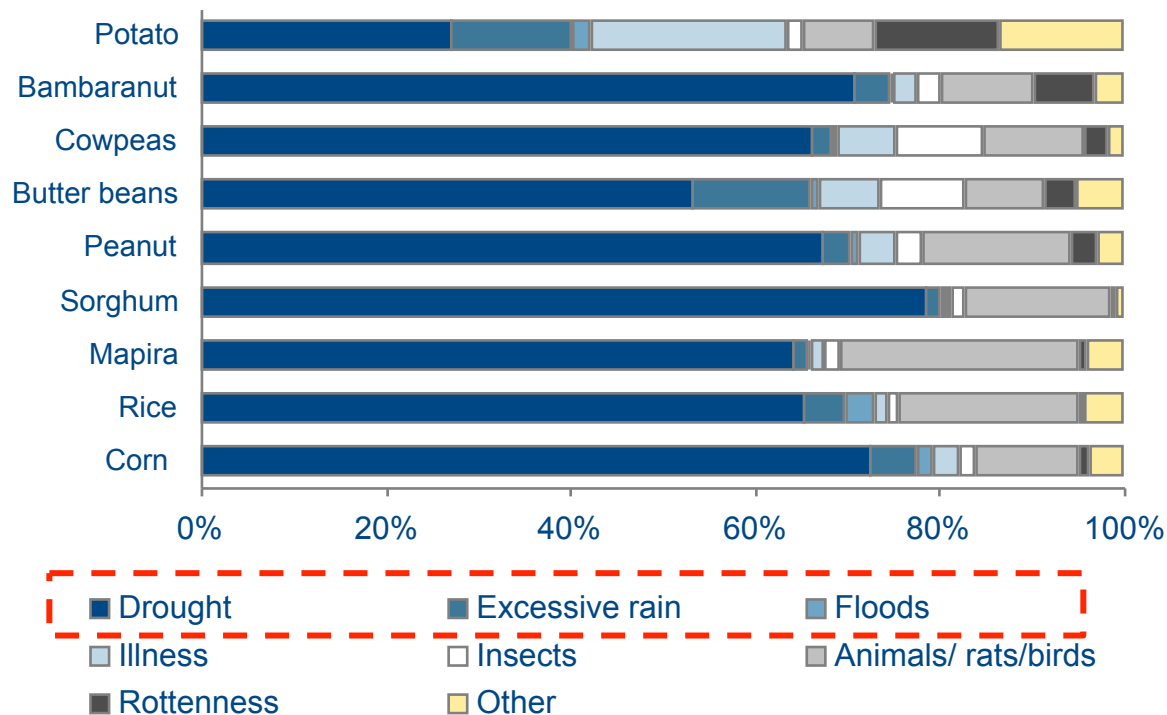
Source: African Economic Outlook (OECD), FAO ForeSTAT 2008 Technoserve

## 3.2.4 Introduction – Main sources for loss of plantations

**Climate hazards aggravate this situation as they are the main source for the lost of agricultural plantations**

### Main sources for loss of agriculture plantations in Mozambique

**Causes for loss of platations (%)**



- Drought is the most significant risk factor for agriculture in Mozambique
- The drought that occurred in 2004-2005 threw **800.000 households** to a risk situation

Source: INSTITUTO DE INVESTIGAÇÃO AGRÁRIA DE MOÇAMBIQUE

**Agroforestry is considered an effective way to address the deforestation effect and also to create resilience to the effects of climate change...**

### What is Agroforestry?

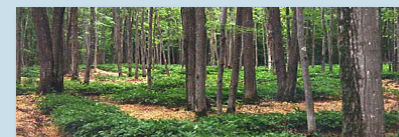
- Agroforestry is an integrated approach of using the interactive benefits from **combining trees and shrubs with crops and/or livestock**.
- It combines agricultural and forestry technologies to create more diverse, productive, profitable, healthy and sustainable land-use systems
- It is within the scope of the REDD/REDD+ program's by avoiding forest degradation and abusive agricultural expansion
- Fosters an equilibrium between forestation and sustainable agricultural development and can be a push to the UN-REDD Programme that already gives direct support to 14 nations across Africa, Asia and Latin America

### Examples of Agroforestry practices

#### Alley Cropping



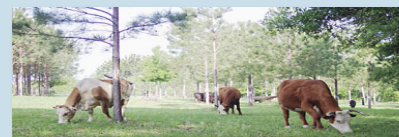
#### Forest Farming



#### Riparian Forest Buffers



#### Silvopasture



#### Windbreaks



....by providing many livelihood and environmental benefits

Benefits of Agroforestry		Example of trees grown in farms
Reduces poverty	Increases production of Agroforestry products for home consumption and sale	<b>Fertilizer trees:</b> improve land regeneration, soil health and food security  <b>Fruit trees:</b> improve nutrition  <b>Fodder trees:</b> improves smallholder livestock production  <b>Timber and fuel wood trees:</b> provide shelter and energy  <b>Medicinal trees:</b> combat diseases  <b>Trees that produce gums, resins or latex products</b>
Contributes to food security	Restoration of farm soil fertility for food crops and production of fruits, nuts and edible oils	
Reduces deforestation and pressure on woodlands	Provision of fuel wood grown on farms	
Helps farmers cope with climate change	Increases diversity of on-farm tree crops and tree cover	
Lessen the impacts of hunger and chronic illness	Improves levels of nutrition	

Source: World Agroforestry Centre

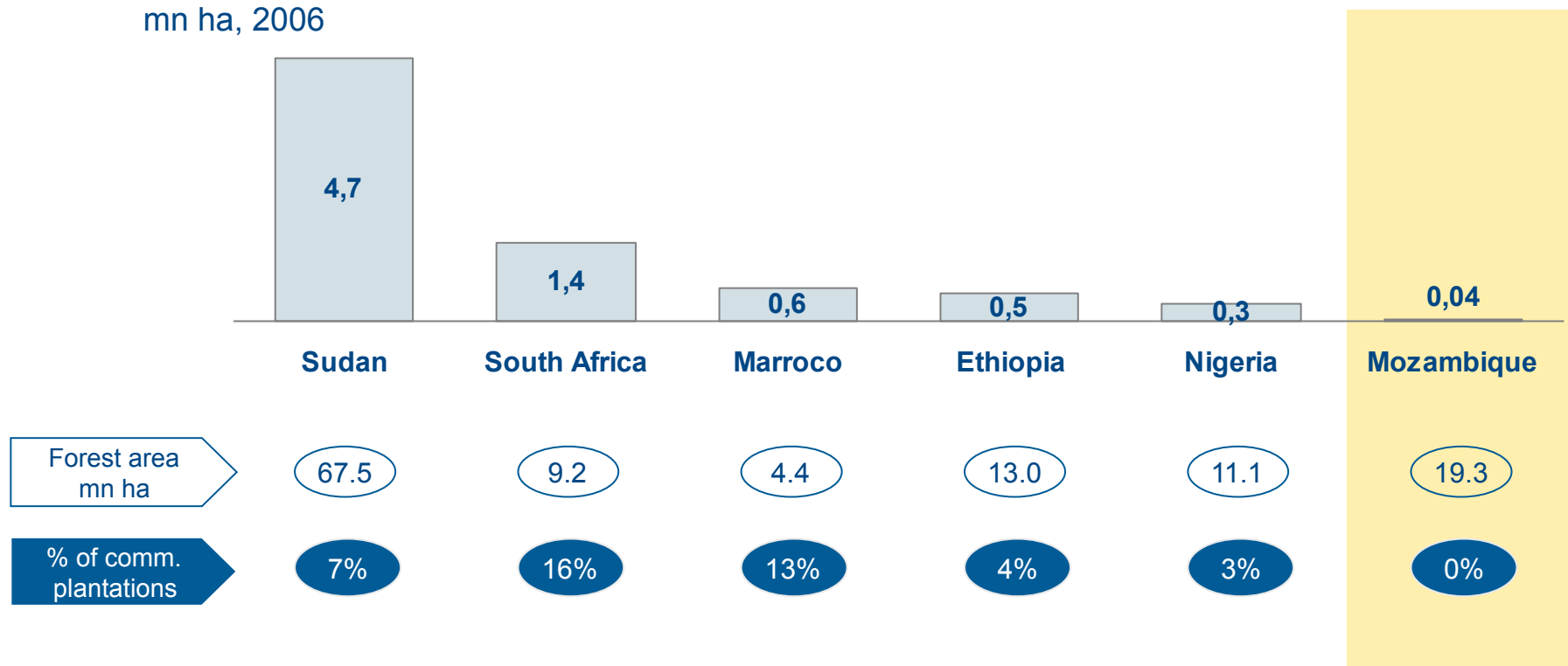


However, today the forestry industry is undeveloped...

### Commercial forestation in Mozambique

#### Area of commercial plantations

mn ha, 2006

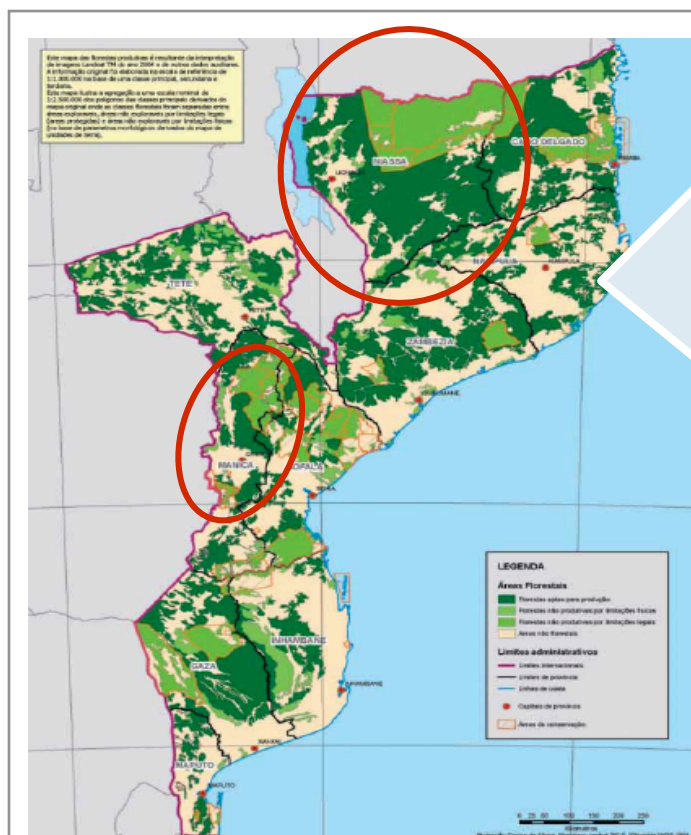


Source: FAO ForeSTATS 2008

### 3.2.4 Introduction – Forestation resources

**...despite the country possessing attractive conditions for commercial forestry plantation, especially in the Northern and Central provinces**

## Conditions for commercial forestation in Mozambique



Mozambique has large areas that are highly suitable for plantation forestry and mixed grain and livestock farming

## Favourable agroclimatic conditions

- Rainfall
- Climate
- Soil

## Abundance of natural resources

- 27 million hectares of productive forest area
- 3 to 7 million hectares of land with plantation potential
- Low population density

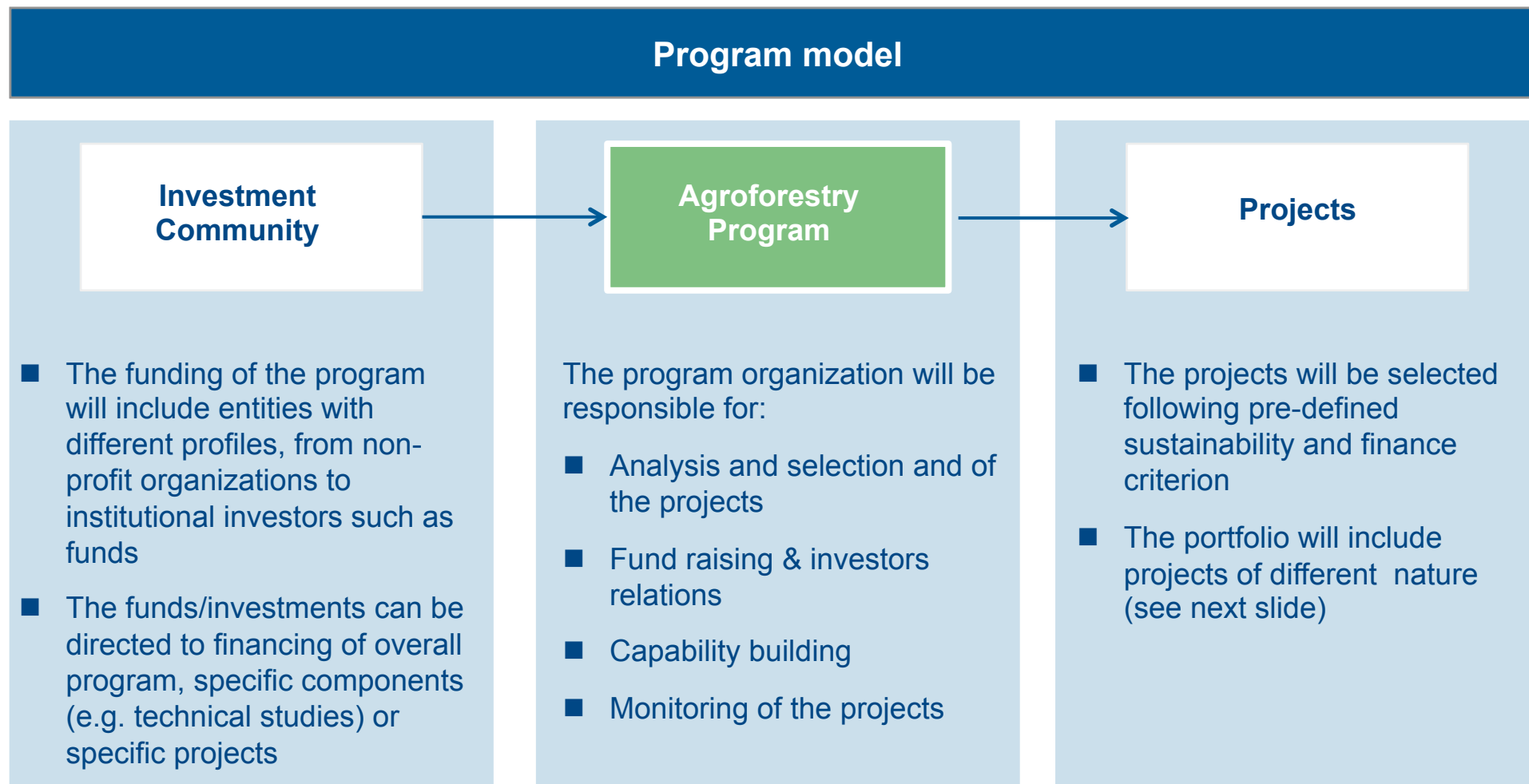
## Availability of human resources

- Young population
- High unemployment rate: 21%
- Min wage comparably low: ~ 75 USD/ month

## Improving infrastructure

- 3 ports of high capacity (Maputo, Beira, Nacala)
- Railway in restoration in 3 corridors, which allows the link to SA, ZIM, ZAM and MAL
- Road network which connects the main provinces

**The Agroforestry program aims to manage private equity dedicated to sustainable forestry projects**



## 3.2.4 Program Description – Scope of projects

**The program will support investments directed to different dimensions of the Agroforestry industry**

### Scope of the projects to be supported by the program

**A**

**Projects aimed to develop the plantation forestry industry**

- Expansion and plantation of new forest areas
- Alignment with the UN-REDD Program mission and targets
- Creation and expansion of local SME that provide goods and services to forestry companies

**B**

**Projects aimed to transform farmers into commercial orientated farmers**

- Equip farmers to better adapt to climate changes (e.g. seeds, land preparation, crop management and mobile information systems)
- Facilitate access to infrastructures, for example storage and energy, for small farmers

**C**

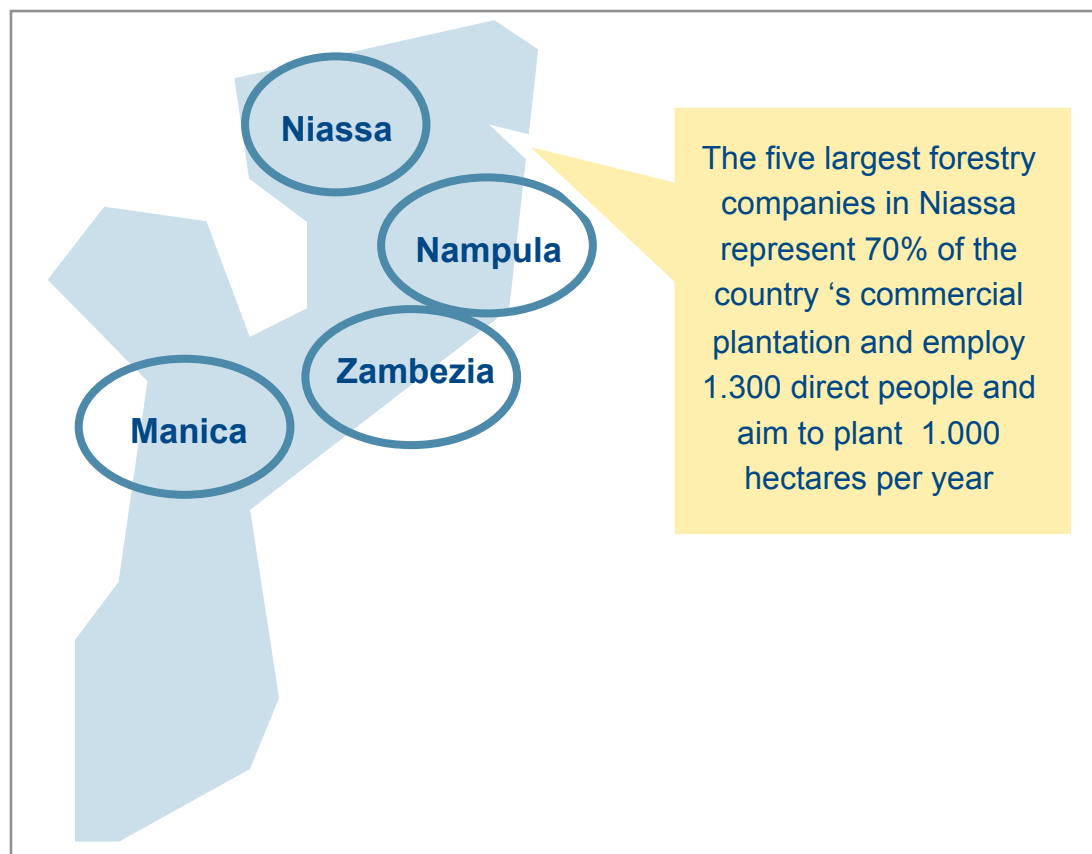
**Projects aimed to develop industries closely related with forestry**

- Potential businesses include poultry and grain production and ecotourism
- Build infrastructure
- Provide business development services (e.g. business planning)

## 3.2.4 Program Description – Primary locations

**In a first phase the program will focus on projects located in the northern and central part of Mozambique**

### Target locations



- The program will firstly focus in regions with most appropriate conditions for forest plantation and also where forestry initiatives are currently being implemented or planned by commercial companies
- **In a first phase**, the primary locations will be Niasa, Nampula, Zambezia and Manica
- **In a second phase**, other provinces in the North and Center will be addressed

Source: Technoserve, Analysis Arthur Little

## 3.2.4 Program Description – Program objectives

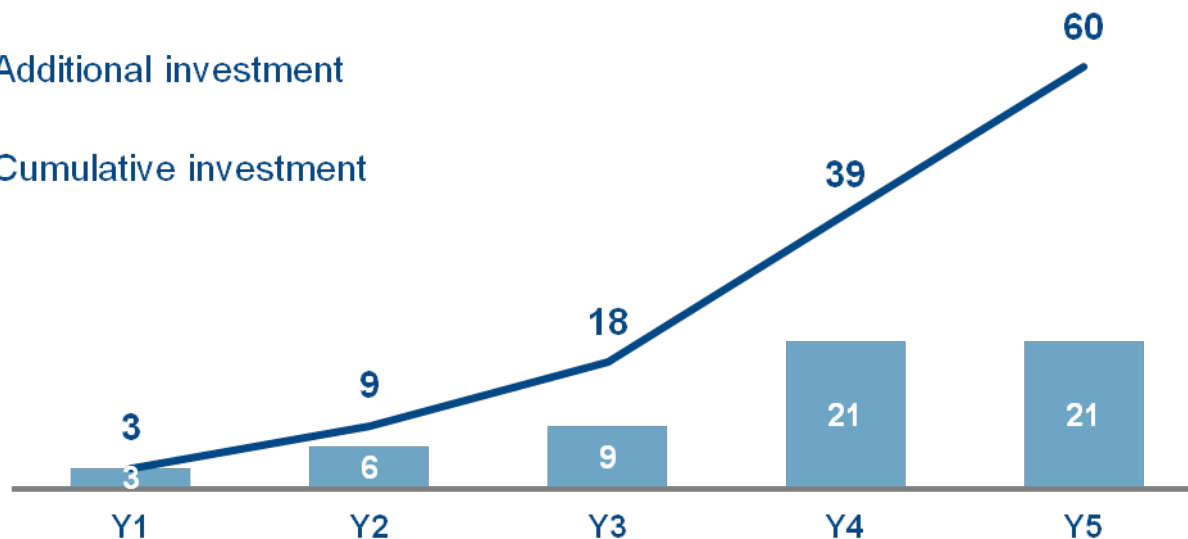
The programs aims to support around 20 projects over a 5 year period and will require an estimated investment of USD 60 million

### Investment in projects

Million USD

■ Additional investment

— Cumulative investment



New projects

1

2

3

7

7

- The program aims to invest in approximately 20 projects along a 5 year period
- Each project is estimated to require an investment of USD 3 million (see pilot project description for details)
- The implementation is expected to be gradual

## 3.2.4 Program Description – Impact of the program

**The program is expected to generate significant benefits in the communities while increasing the resilience of the country to climate change**

### Impact of the program

**20.000**

**Jobs will be created in the forestry, eco-tourism, poultry and grain-processing industry**

**40.000**

**Subsistence family farms will be transformed into commercially-oriented farms using modern agricultural techniques**

**220.000**

**Workers, farmers and their family members will see its cycle of poverty broken**

- Growth and increase competitiveness of the forestry and close related industries
- Creation of a working model for Climate Change Adaptation and Mitigation involving both the private sector and the communities benefiting the communities

Source: Figures based on projects developed by Technoserve in Mozambique< Arthur Little



## 3.2.4 Program Description – Capacity building

**Another key aspect of this Program, is the development of “in house” competences, to foster in a near future, total local autonomy in the management of the Program**

Human Resources	Training	Learning by Doing	Technical Assistance	Assets
<ul style="list-style-type: none"> <li>■ Training and recruiting of personnel with capacity to deal directly with the international investors and project promoters</li> <li>■ Recruiting of personnel with “ground knowledge”, i.e., deep knowledge of the Mozambican reality and geographies, to identify the best opportunities</li> </ul>	<ul style="list-style-type: none"> <li>■ Development of core capabilities, including technical, financial and legal</li> <li>■ Development of workshops, seminars and study tours to the successful pilot projects for the key officials and stakeholders, as well project developers and potential investors</li> </ul>	<ul style="list-style-type: none"> <li>■ Create “mixed” teams, incorporating local personnel and external consultants, to foster the knowledge transfer and create a pool of internal resources fully capable of implementing the entire process</li> <li>■ Involvement of local communities during implementation of the projects to ensure the sustainability and local ownership of the project</li> </ul>	<ul style="list-style-type: none"> <li>■ Provide single window technical advisory services, including technical feasibility study and technical trouble shooting services to potential developers</li> </ul>	<ul style="list-style-type: none"> <li>■ Development of support infrastructure, including IT tools, monitoring instruments</li> </ul>

Source: Analysis Arthur Little



On a yearly basis the Program will be evaluated using a dedicated questionnaire, that evaluates the impact of the program in the promoters, investors, and overall community

### Sustainability Monitoring

- The sustainability monitoring is to be performed at least on a yearly basis
- A significant sample of the population should be selected to allow for representativeness
- A yearly comparison should be performed to assess the existence of improvements

Arthur D Little

Agroforestry Year 1

Section 1 Investors

1.1 Are the returns obtained aligned with your expectations?  
Yes, totally 100% ☐ 0  
Mainly 75% ☐ 0  
Somewhat 50% ☒ 0.5  
Not much 25% ☐ 0  
No 0% ☐ 0

1.2 Are you satisfied with the reporting process?  
Yes, totally 100% ☐ 0  
Majority 75% ☐ 0  
Enough 50% ☒ 0.5  
Not enough 25% ☐ 0  
No 0% ☐ 0

1.3 Do you have easy and transparent access to all the documentation of the projects?  
Yes, totally 100% ☒ 1  
Mainly 75% ☐ 0  
Somewhat 50% ☐ 0  
Not all 25% ☐ 0  
No 0% ☐ 0

1.4 Are you satisfied with the interaction with the program's responsables?  
Yes, totally 100% ☐ 0  
Probably 75% ☒ 0.75  
Maybe 50% ☐ 0  
Not likely 25% ☐ 0  
No 0% ☐ 0

Section

Result

1 Investors 55%

2 Projects performance 44%

3 Sustainability 38%

Source: Analysis Arthur Little

## 3.2.4 Pilot Project – Main characteristics

The program will consider as the pilot project the **Agroforestry Village Project** promoted by a by the non-profit organization **Technoserve**

### Pilot project: Agroforestry Village project

#### Project overview

- The project is part of a program being conducted by Technoserve and is being currently financed by the United States Department of Agriculture
- The overall program includes 5 projects which are expected to be fully implemented by 2013 with a budget of \$15 million
- The project aims to develop the agroforestry industry in Mozambique, while catalyzing the development of complementary industries such as eco-tourism and poultry industries (see next slide)



#### Company profile

- Non-profit organization founded in 1968, based in the United States and present in 19 countries,
- In Mozambique, over the past 5 years, Technoserve assisted businesses to generate over \$75 million in revenue, having an impact on 150,000 smallholder farmers and creating 6,200 jobs

#### Financials

- The investment associated with the project pilot is estimated by Technoserve to around **\$3 million**

## 3.2.4 Pilot Project – Main characteristics

The Agroforestry Village project is an integrated concept including different target groups but having as main beneficiary the rural producer

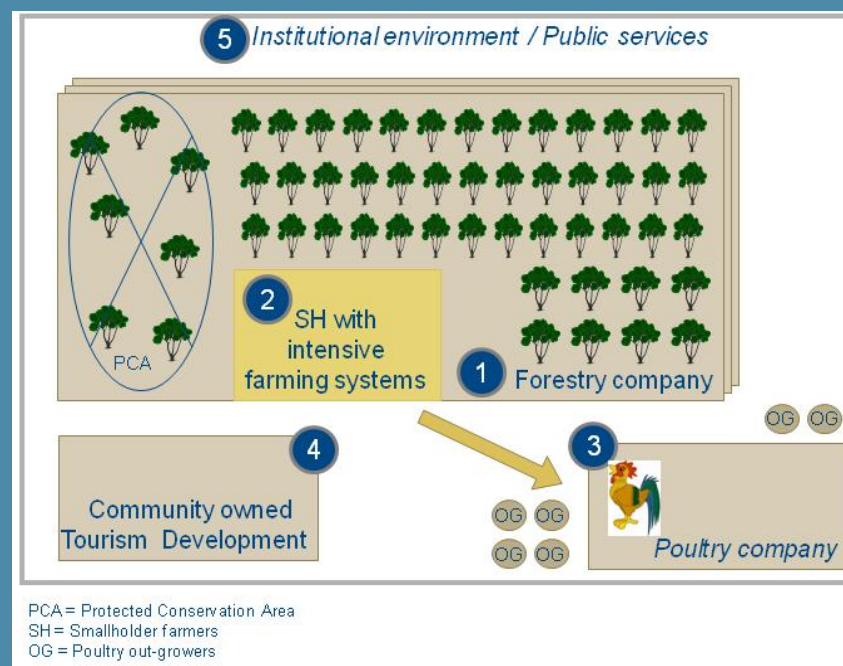
### Agroforestry village project objectives

- 1 Support the development of a competitive and sustainable **plantation forestry industry**
- 2 Transform farmers into **commercially-oriented farmers** utilizing intensive and sustainable farming systems
- 3 Promote **investment in the grain processing and poultry industry** – leveraging agricultural output
- 4 Promote **investment in the eco-tourism** to leverage the community involvement in the integrated Agro Forestry
- 5 **Improve local government capacity** to promote private investment and economic development

Source: Technoserve



### Integrated approach



### The beneficiaries of the Agro Forestry project will be subject to a strict selection process

#### Criteria for the selection of beneficiaries and respective commitments to the project

##### Smallholder Farmers

- Living on less than \$1/ day
- Willingness to learn farming and business management skills
- Willingness to become better equipped for the impacts of climate change

##### Small and Medium Size Enterprises

- Provision of goods and services to forest plantation companies
- Commitment to Technoserve
  - Supply information needed to track program progress
  - Implement innovations and improvement

##### Forest Plantation Companies

- Investment plans in targeted areas
- Commitment to Technoserve
  - Supply information needed to track program progress
  - Implement innovations and improvement (e.g. protected area management, fire/watershed management, non-timber forest products, eco-tourism, carbon credits..)

##### Poultry/Grain Processing Companies

- Established business in poultry or grain processing industry
- Reputation for paying competitive prices to farmers
- Interest in increasing purchases from small-scale farmers
- Commitment to Technoserve
  - Supply information needed to track program progress
  - Implement innovations and improvement

Source: Technoserve

## 3.2.4 Pilot Project – Timings

**The first 5 months of the project will be used to set the grounds for the overall structure, that will be put in practice until the end of the year**

Months (2012)	1	2	3	4	5	6	7	8	9	10	11	12	2013
Licensing and other logistic procedures													
Negotiation with the populations													
Identification of future client's database													
Project launch and operation													
Mid term pilot project evaluation													
Sustainability monitoring and evaluation of Pilot project results													
Fund raise for new projects & implementation of new projects													

**There is a great deal of appetite for AgroForestry and Forestry related activity, but the programs need to be clear about what types of returns they are likely to achieve**

### Main messages

“In the past our firm has been extremely interested in Mozambique but it’s not an easy place to get the sort of returns we are looking for”

*Venture Capitalist*

“It’s really important to understand whether the program requires real more aggressive returns-based investment or whether it fits better within the development finance arena – maybe it needs a combination of funders”

*Standard Bank - Sustainable Development*

“You have got to ensure that title to land and other community aspects are extremely well covered or the projects will quickly become undermined”

*Greenbelt – Investment Officer*

“If correctly structured and well governed agroforestry in Mozambique could be a very attractive investment but it will not be easy”

*CDC – Investment Head*

“You can’t invest in something like Agroforestry in a country like Mozambique unless you really understand what is going on there – you will need local people you really trust to work with”

*Ned Bank - Commodity Finance*

Source: Contacted investors

0 Executive Summary

1 Phase 1

2 Phase 2

**3 Phase 3**

3.1 Executive Summary

**3.2 The Four Programs**

3.2.1 Clean Energy Program

3.2.2 Composting

3.2.3 Micro & Small Scale Lending

3.2.4 AgroForestry Fund

**3.2.5 New Programs' Framework**

3.3 Involvement of the Insurance Sector

3.4 Barriers to Business Analysis

3.5 Strategic Recommendations

## 3.2.5 New program's Framework – Introduction

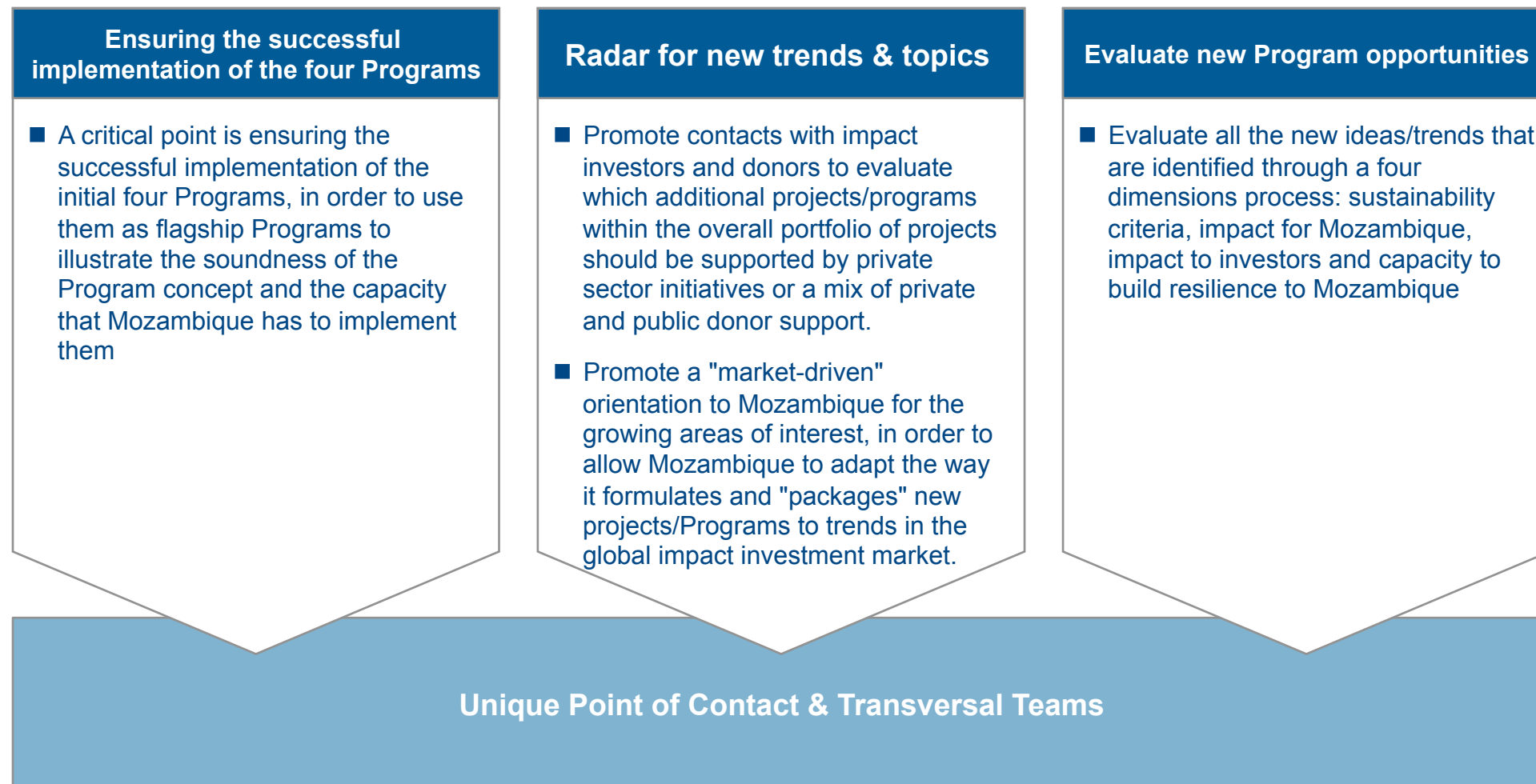
The four Programs understudy resulted directly from INGC's current project, but they should be seen as the first of a series of others aimed at increasing Mozambique's resilience





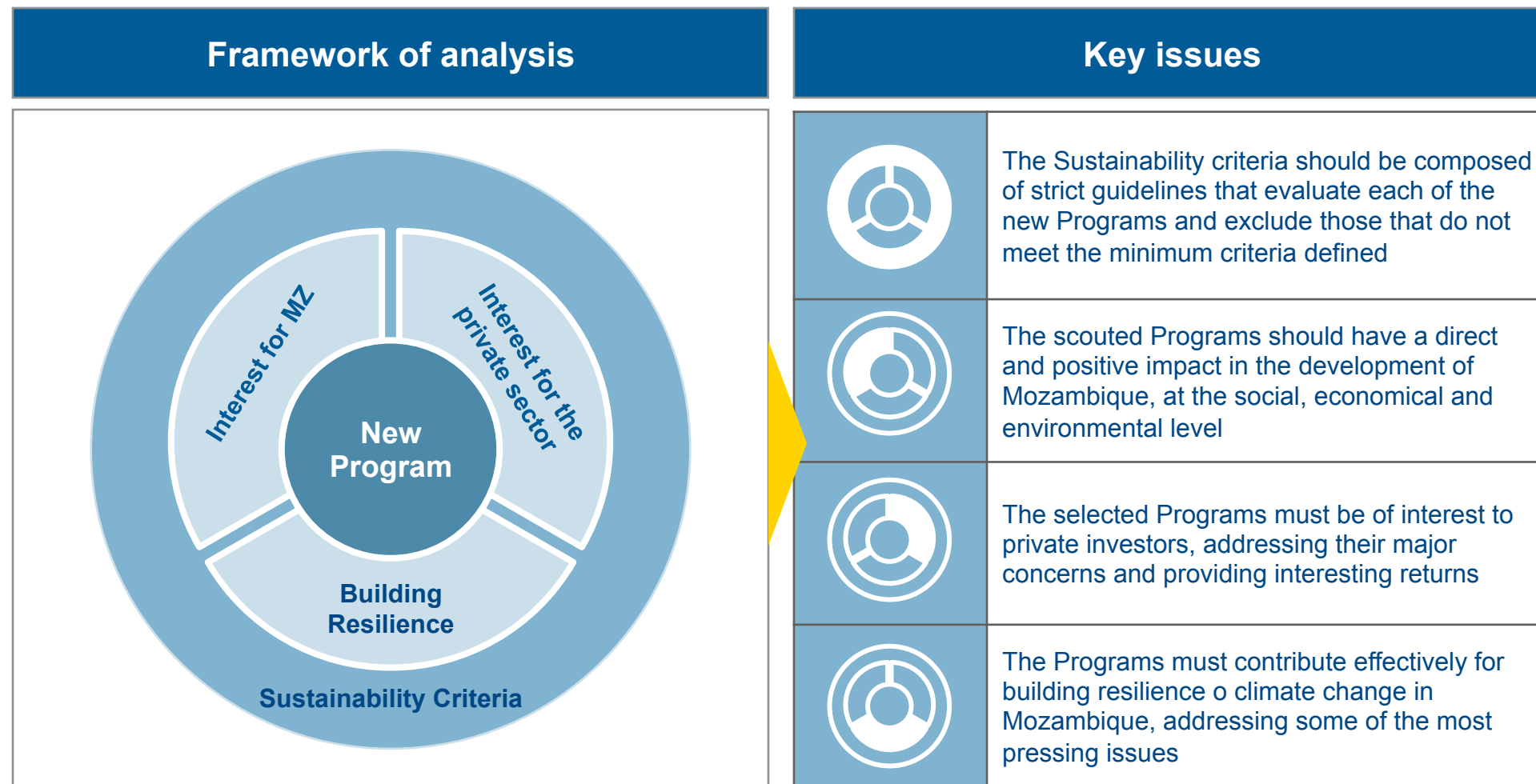
## 3.2.5 New program's Framework – Introduction

**This work stream should guarantee the implementation of the four defined Programs and also comprise a radar for new trends & topics and an evaluation procedure for new opportunities**



## 3.2.5 New program's Framework – Evaluation framework of analysis

The new Programs scouted should obey to a list of selective criteria: sustainability impact, interest for Mozambique and the investors and capacity to build resilience to climate change



## 3.2.5 New program's Framework – Sustainability Criteria

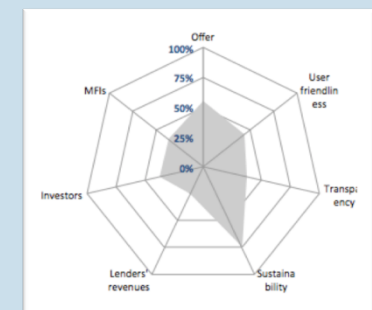
**The Sustainability criteria should be composed of strict guidelines that evaluate each of the new Programs and exclude those that do not meet the minimum criteria defined**



- Respect for basic human rights (namely gender equality)
- Respect for transparency and anti corruption practices
- Positive impact on the populations' quality of life
- Positive impact on the ecosystems and biodiversity
- Positive benefits for the local community
- Build climate change resilience
- Fight the poverty
- Foster economic growth and bring sustained income
- Contribute for a peaceful coexistence, without fomenting wars or disagreements

### *Examples*

- Elaborate a specific spider diagram to evaluate the fulfillment of all these criteria and establish a minimum score, below which the Program is excluded



**Another axis of analysis should be the impact for Mozambique and the capacity to address the most relevant sectors of activity**



- The scouted Programs should have a direct and positive impact in the development of Mozambique, at the social, economical and environmental level
- The most prominent sectors of activity in Mozambique are agriculture, trading, manufacture, transports and tourism. From these, the latter are two of the most sensitive sectors to climate change
- Programs addressing these sectors of activity should be prioritized. On the other hand, programs addressing specific concerns of the population (water availability, logistics, accessibilities) should also be given very high priority

### Examples

- Programs' that address the key sectors at risk in each region (Phase I report, Chapter 5) should be prioritized



**On the other hand, all the selected Programs must be of interest to private investors, addressing their major concerns and providing interesting returns**



- In a developing country it's very difficult to address these type of projects without the support of the private sector, whether local or foreign
- The investors' community that we've contacted evidenced as critical factors in the investment decision that should undoubtedly be present in the scouted Programs:
  - Existence of a solid track record
  - High returns to compensate the risk
  - Existence of trust and trustable persons
  - Strong working knowledge
  - Quality of Governance

### Examples

- The Programs should have a mix of interesting returns and social impact, in order to attract not only the venture capital investors, but also philanthropists and impact investors, that enable some investments that despite highly necessary, might not be financially attractive

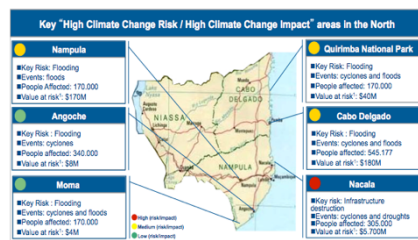


## 3.2.5 New program's Framework – Building Resilience to Climate Change

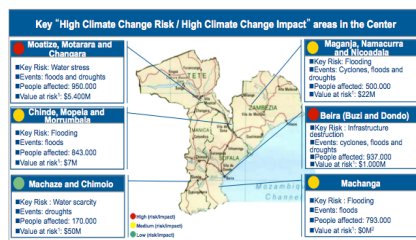
Finally, all the Programs must contribute effectively for building resilience to climate change in Mozambique, addressing some of the most pressing issues



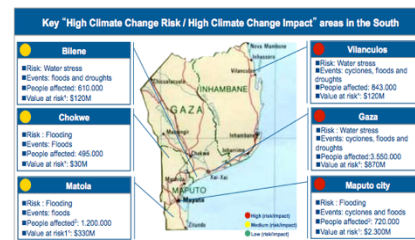
- On top of the interest to Mozambique and to the private investors, each new Program should bring an obvious and impactful resilience to climate change
- The top priorities should be the causes identified as most critical in terms of private investment for each location (for a detailed description, please refer to Phase I report, Chapter 5)



Phase I report, slide 12



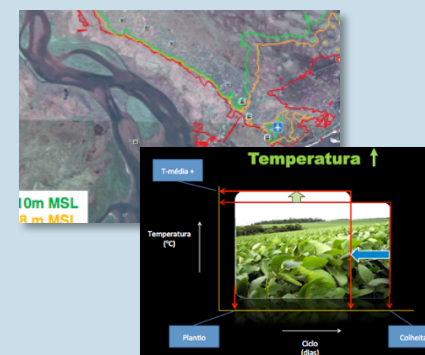
Phase I report, slide 12



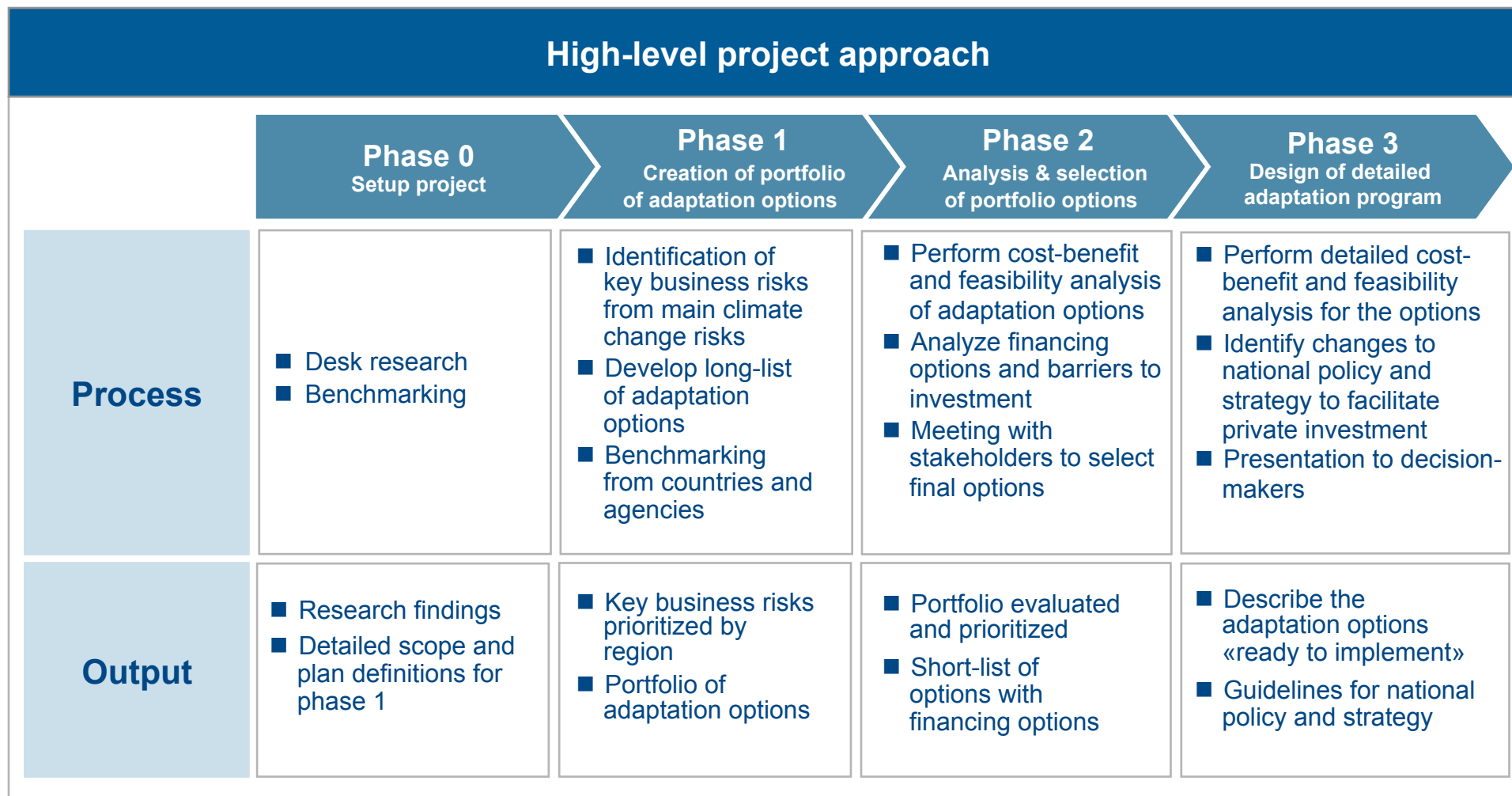
Phase I report, slide 12

### Examples

- The other themes in this project offer a valuable source of inputs for new programs, like mangrove protection, coastal line protection, crops adaptation measure, malaria protection, among so many others

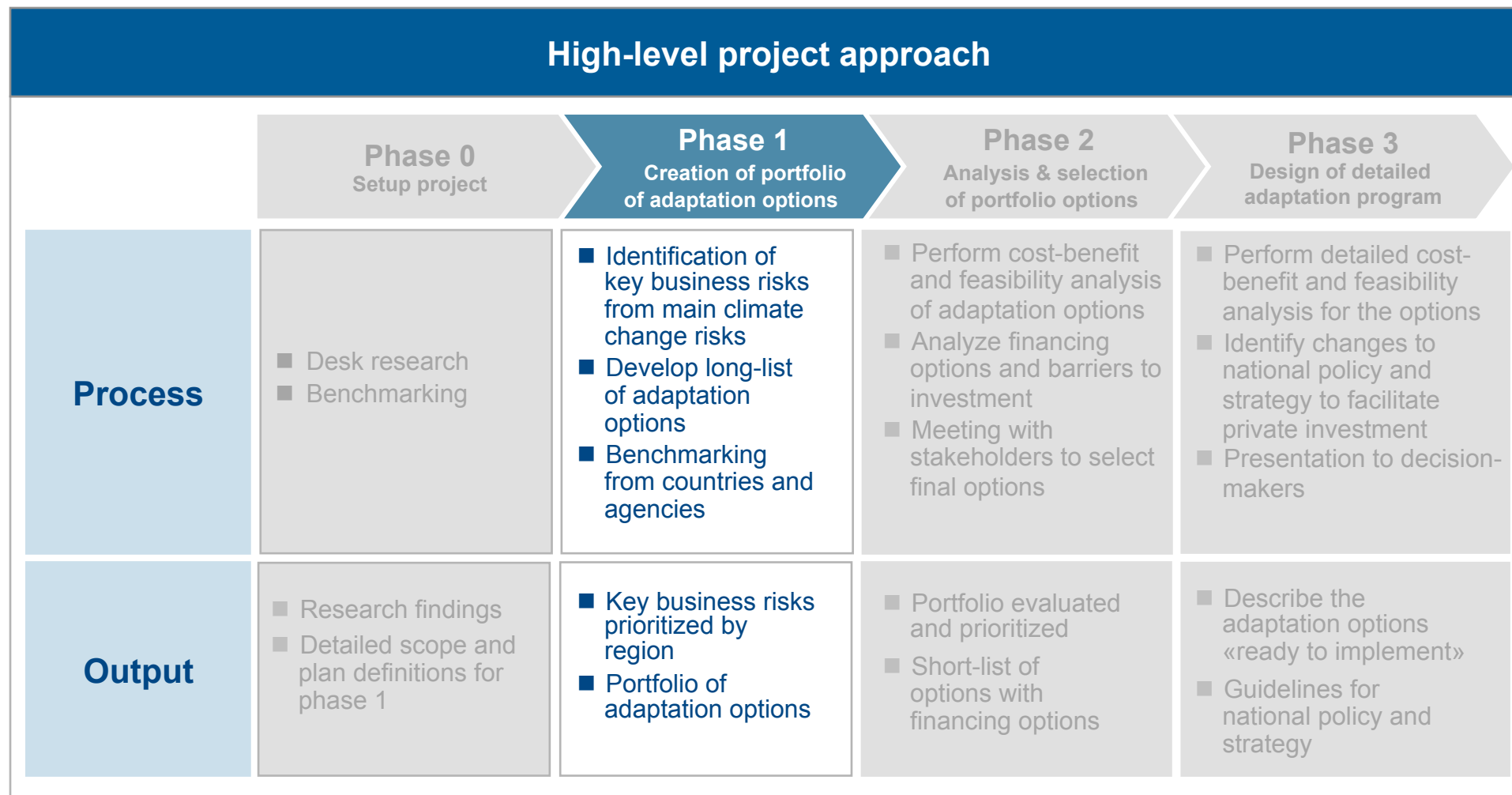


Arthur D. Little designed a 3 steps approach to the development of blueprint process to help the identification of a portfolio of adaptation options



### 3.2.5 New program's Framework – Methodology

**Phase 1 aims at the creation of a portfolio of adaptation options and identification of the key business risks...**

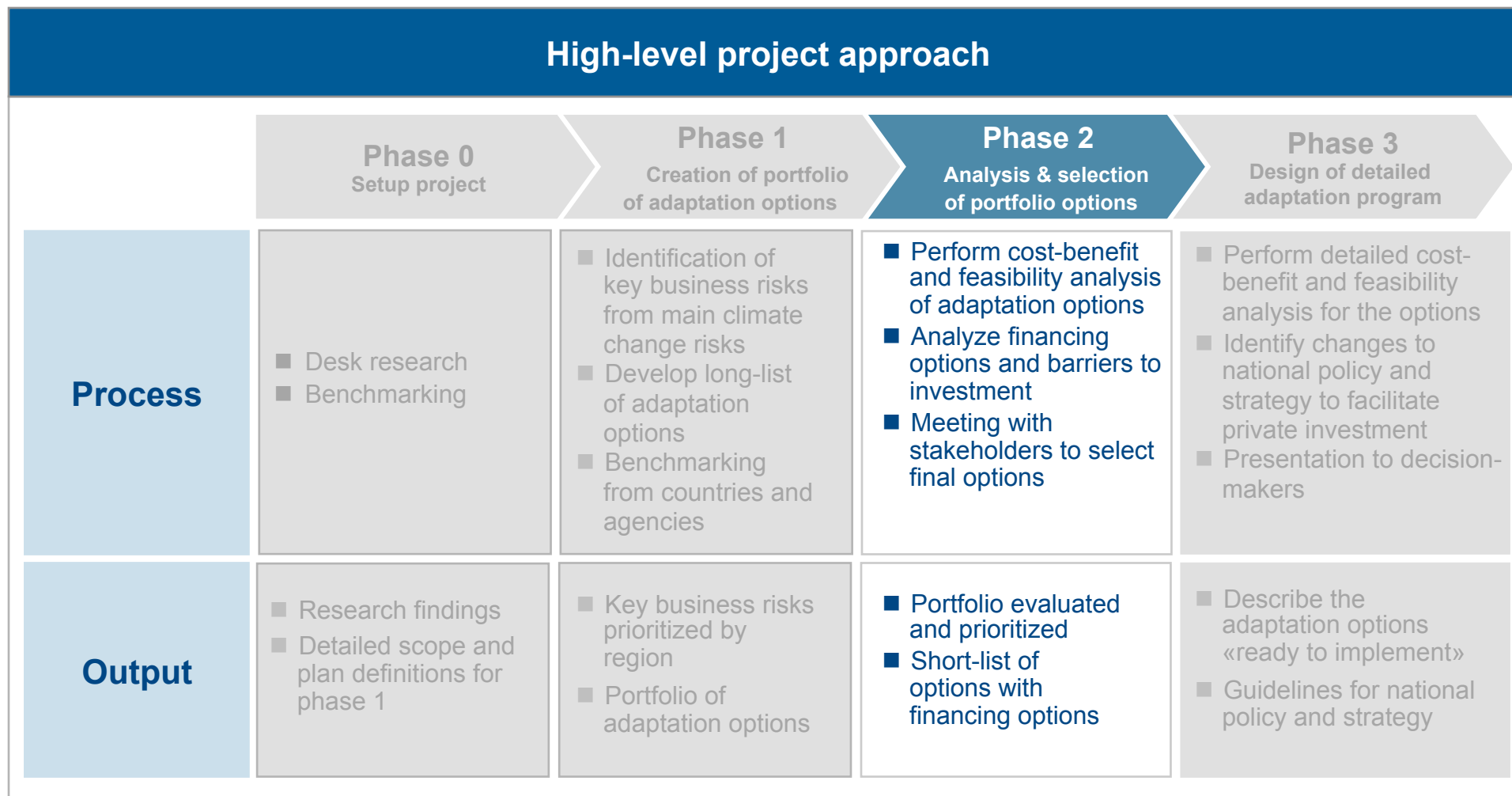






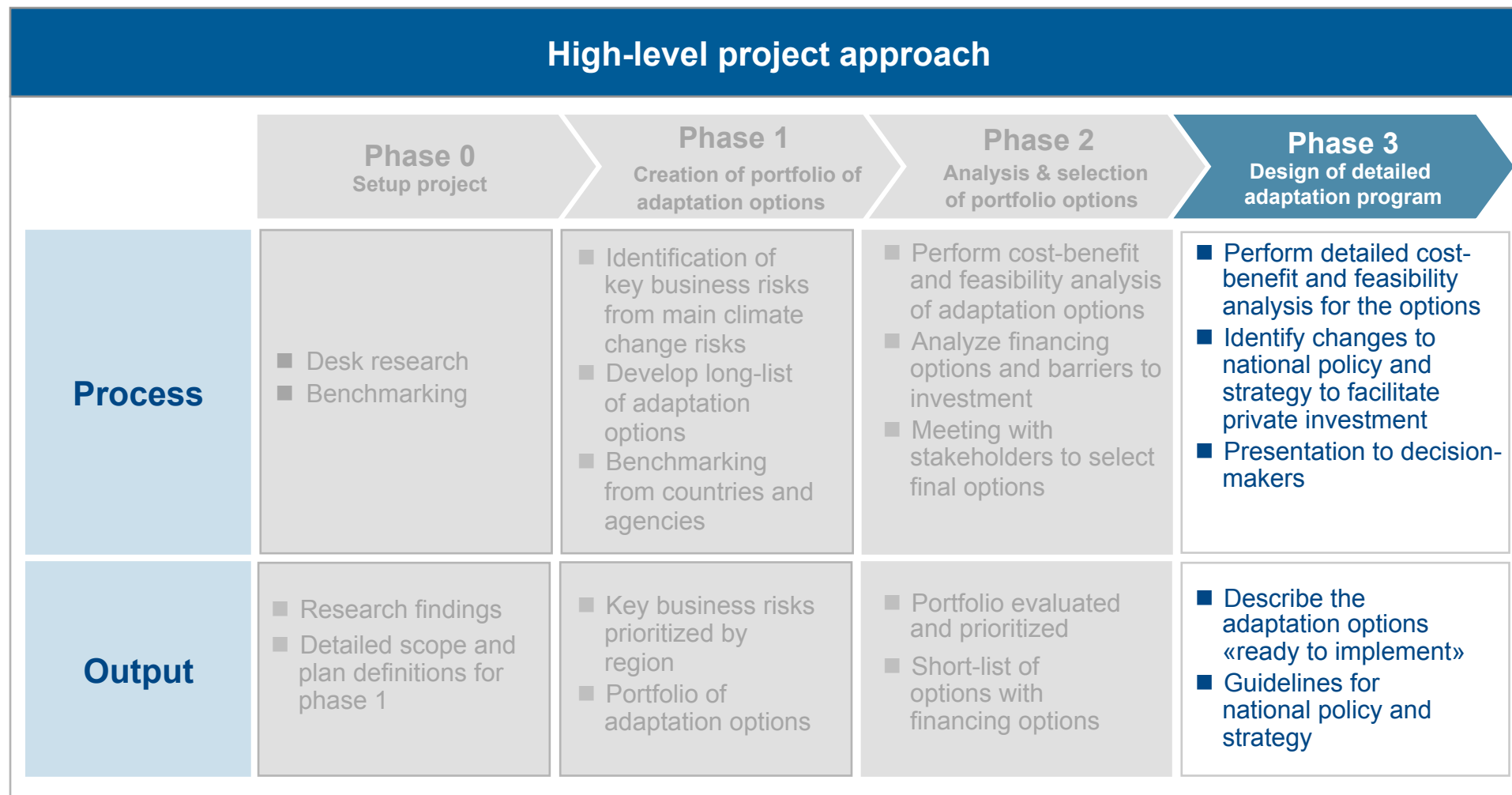
### 3.2.5 New program's Framework – Methodology

... Phase 2 aims at the identification of a short-list of adaptation measures...



### 3.2.5 New program's Framework – Methodology

... and finally, in Phase three a detailed description of the four selected programs should be performed



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## 3.3 Involvement of the Insurance Sector – Key Findings (1/2)

**Penetration of insurance products into developing markets is extremely low but a growing number of players are trying to understand what the future could hold**

Insurance Sector Workshop	<b>Summary of activities</b> A significant number of major global insurance and re-insurance companies have been interviewed and their views sought on the potential deeper involvement in the programs into 2012 and beyond. A number of regional players were also interviewed				
	<b>Interviewed parties</b> AXA, Allianz, Swiss Re, Micro-ensure, Zurich, Willis Group, The Hartford, Fin-mark, CDC, Bankable Frontiers, Nedbank, Guy Carpenter, Climate Wise, Micro-risk				
	<b>Insurance is not a silver bullet</b>	<b>Governance and regulation</b>	<b>Pricing and value</b>	<b>Products versus events</b>	<b>Data mapping</b>
	Insurance products come at the end of the process, they transfer risk that is uneconomic to mitigate through other measures. As such a robust loss/damage methodology should be followed in the pilot projects to assess and address project risk	As with other financial products, a stable, enforceable legal regulatory framework remains a requisite for scalable corporate transactions	Lack of data, cluster risks and a challenging operating environment make pricing risk extremely difficult for climate related risks but easier for more traditional product related insurance	Involvement of the insurance sector varies across the pilot projects. Factors that are product-related e.g. for the renewables or composting programs are easier to insure than weather or climate related factors e.g. agroforestry	Availability of reliable, historic data remain a critical factor in determining risk and understanding where product risks end and insurance can take over. Projects should be evaluated using a loss damage work program methodology
	<b>Pilot project approach</b> A number of players agreed that a pilot project approach with tangible and investable projects could be interesting. It is important however that the projects are of sufficient scale to enable appropriate levels of “investment”				

## 3.3 Involvement of the Insurance Sector – Key Findings (2/2)

**Penetration of insurance products into developing markets is extremely low but a growing number of players are trying to understand what the future could hold**

Insurance Sector Workshop	<b>Summary of activities</b> A significant number of major global insurance and re-insurance companies have been interviewed and their views sought on the potential deeper involvement in the programs into 2012 and beyond. A number of regional players were also interviewed				
	<b>Interviewed parties</b> AXA, Allianz, Swiss Re, Micro-ensure, Zurich, Willis Group, The Hartford, Fin-mark, CDC, Bankable Frontiers, Nedbank, Guy Carpenter, Climate Wise, Micro-risk				
	<b>Quality of infrastructure</b>	<b>Stakeholder awareness</b>	<b>Index Linked / Parametric Insurance</b>	<b>Convening the right players</b>	<b>Distribution and collection</b>
	Build quality of infrastructure and buildings has a significant impact on evaluation of risk from an insurance perspective	A major stakeholder awareness and education program needs to happen to build trust in the role of insurance in building resilience into the private sector	For climate and weather event related insurance a far more appropriate product might be parametric or index linked insurance. Unlike traditional indemnity insurance this product pays out upon a trigger event e.g. wind speed over 100kmph or Weather Warning	Relevant parts of the value chain will need to collaborate closely in the pilot projects to identify ways which each others mutual actions can support more climate resilient development	In respect of higher volume products likely in “agroforestry, small scale lending and the distribution part of composting” consideration needs to be given to collection and distribution
	<b>Pilot project approach</b> A number of players agreed that a pilot project approach with tangible and investable projects could be interesting. It is important however that the projects are of sufficient scale to enable appropriate levels of “investment”				

## 3.3 Involvement of the insurance sector – Insurance is not a silver bullet

**Insurance products come at the end of the risk management process. Projects that are not managed effectively cannot be made into good projects through insurance products**

**Each project should be subject to a robust loss/damage methodology**

### Assess Risks

- Types of Hazards
- Frequency of occurrence
- Value at risk
- Physical risk
- Stakeholder engagement

### Address Risks

- Identify options
- Evaluate options (physical, infrastructure)
- Price tag of risk
- Cost benefit analysis

### Manage, Mitigate or Transfer Risk

- Risk transfer development plan
- Which insurance products can transfer risk that is uneconomic to manage but economic to insure

*Insurance is not a silver bullet to climate change, but understanding the way insurance products are priced encourages prudent risk management. It also will result in more “insurable” risks at the end of the day*

**David Bresch – Swiss Re**

## 3.3 Involvement of the insurance sector – Insurance is not a silver bullet

Addressing project level risk in a prudent, methodological way is a vital step in creating in environment onto which appropriately priced insurance products can be delivered

A number of areas should be focused on when addressing risks

### Identify adaptation options

- Societal issues
- Education and awareness
- Infrastructure (e.g. quality of buildings and regulations)

### Physical Preparedness

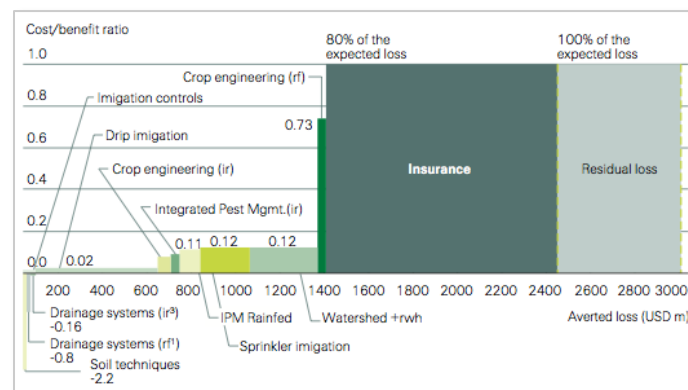
- Emergency services
- Evacuation
- Fire protection

### Economic analysis

- Cost benefit of adaptation options – is it cheaper to address the risk than insure it
- Loss/damage evaluations

Example

**Adaptation cost curve for drought risk in the state of Maharashtra, India\***



For this case, almost 50% of the loss under a high climate change scenario can be cost-effectively averted by prevention and intervention measures.

*“A well structure risk management program for your projects will result in it being far more likely that insurance products can be delivered to transfer risk “* **Head of Product Innovation – Development Finance Institution**

\*Report of the Economics of Climate Adaptation Working Group 2009

**No major insurance player has a real presence in Mozambique and similarly to the investment sector, many comment on the need for a stable regulatory framework and strong governance**

### Governance & Regulation

- The size of the opportunity in Mozambique for insurance companies when compared with the lack of understanding and uncertainty makes working in the country a very difficult proposition
- Interviewees also talked about the need for a stable and enforceable legal framework
- An interesting practice, that has been adopted in some countries is mandating insurance products alongside lending products
- Pilot programs should be used to demonstrate how close collaboration of a “basket” of players in a transaction can lower political, country and regulatory risk

#### **Building and infrastructure quality**

- Insurance companies place a good deal of emphasis on construction quality since this greatly affects likely value at risk
- Working closely with building industry and introducing relevant and reliable building/planning standards could have a significant impact in lower indemnity insurance premiums

*“Why would my Board sanction spending significant time and effort on product R&D in such a challenging environment when the margins are likely to be so low and country, security and regulatory risks are so high”*

**Anonymous – Head of  
Climate Risk – Global  
Insurance/re-insurance firm**



**The insurance sector is heavily governed and scrutinized in terms of how it calculates risk and prices it accordingly – the sector is inherently “risk averse”**

### Cluster Risks & Actuarial Value

#### **Cluster Risks**

- A major issue that will need to be addressed when insuring climate and weather related issues through indemnity type insurance is overcoming significant “cluster” risks. Flooding, sea level rise, or drought will cause a large concentration of insured parties to claim
- Interviewed parties saw this as particularly relevant to the agroforestry and microfinance programs

#### **Actuarial Value**

- Insurance firms rely on data to have confidence that premiums charged are in line with the level of risk
- Interviewed parties noted that the presence of a specific work stream on data mapping would be vital to creating greater confidence in value at risk in the pilot programs
- Insurance/risk transfer products actually incentivises prevention initiatives by putting a real price tag on the risk with a premium

*“We have a pilot program in India. The town flooded and all insured parties claimed – programs that are entirely focused at mitigating disaster and weather related risks will be highly subject to cluster risks and will be challenging to price correctly “*

**Allianz - Group Head of Sustainability**

**It is much easier for the insurance sector to become involved when insuring, products, components and equipment than weather, events or climate conditions**

### Products versus events

- Each interviewee was asked to determine which areas of the project they felt were easier to become involved with
- Feedback was consistent across the board that product and equipment related insurance must be clearly differentiated from event, weather or climate related insurance
- **Parametric insurance** could provide a more appropriate method of tackling weather and event related risks given the far lower actuarial burden on the insurance firm
- Elements of both exist in all four programs

*“You need to distinguish risks that are product-related from those that are weather, climate or event related. If you are constructing infrastructure or installing equipment, it’s vital that construction takes into account extreme conditions. Re-insurance can then attempt to cover disaster scenarios”*

**Swiss Re – Climate Risk**

**The insurance sector has always relied on strong, historical data on which to determine risk. This is critically important when addressing environmental issues/disaster risk**

### Data mapping

- Availability of reliable, historic data remain a critical factor in determining risk for insurers on indemnity insurance
- The sector will typically look at trends over a 30-40 period particularly when addressing environmental/weather/disaster risks
- High volume/lower premium insurers (e.g. micro-ensure, micro-risk) are able to take a more pragmatic view on available data
- High resolution data is less relevant when insuring product related risks or on index linked or parametric insurance (see products versus events)
- Better availability of data is not necessarily a cost intensive effort but more about understanding and evaluating existing knowledge and identifying gaps
- Micro-ensure are also operating on the ground in Mozambique. They are highly regarded in the industry and could be an extremely interesting partner for small-scale lending program

*"I am of the view that insurance firms need to take a very different approach to data when it comes to working in developing markets. The challenge though is that not having strong enough understanding of historical data will mean that investment by the larger players in the sector will remain on a very small scale"*

***Micro-ensure – President and CEO***

### The build quality of infrastructure and buildings has a significant impact on evaluation of risk from an insurance perspective

#### Quality of infrastructure

##### Building Quality

- Minimum standards of build quality governed by appropriate governance processes could make a material impact on reducing risk profiles and hence pricing in indemnity insurance extended to physical infrastructure
- Appropriate planning processes which take into account identified climate adaptation risks can also have an impact

##### Intervention mechanisms

- Whilst recognising the current public services infrastructure in Mozambique the availability and accessibility of emergency services and disaster intervention can play a part in mitigating project risk
- This could include accessibility of the infrastructure/building and likely response from emergency services e.g. fire service that could reduce value at risk

*“The importance of building quality and planning processes is vitally important in assessing value at risk”*

**Head of Sustainability –  
Willis Group**

**A major stakeholder awareness and education program needs to happen to build trust in the role of insurance in building climate resilience into the private sector**

### Stakeholder Awareness

- There is a real lack of understanding of insurance products in the developing world
- By using the pilot project we can increase awareness that appropriate climate risk management requires a balanced portfolio of prevention, intervention and insurance measures
- Interviewees felt that the fact that the project is endorsed and driven by INGC/ Government of Mozambique will have a strong element of drawing together relevant parties
- Equally a pilot project approach that is action oriented and that has already attracted “financing” interest increases the likelihood of results in the next phase

*“why would I pay for something that I might never see the benefit of....”*

**For climate and weather event related events a more appropriate product might be parametric insurance which is an event or reference-point based insurance**

### **A more appropriate way of insuring residual climate risks**

- Unlike traditional indemnity insurance this product pays out upon a trigger event or reference point happening (e.g. a wind speed of 100 km/h being reached or a severe weather warning happening)
- The product pays out equal amounts to all those insured under the policy regardless of whether damage was caused by the trigger event
- This has an interesting effect of encouraging more resilient development since the payout is not linked to damage caused by the event
- This type of product also requires a far lower actuarial burden on the insurer
- There will be winners and losers in this type of insurance

*“This type of product needs vision but could be a far more relevant and effective way of insuring against weather and climate related damage that traditional indemnity products”*

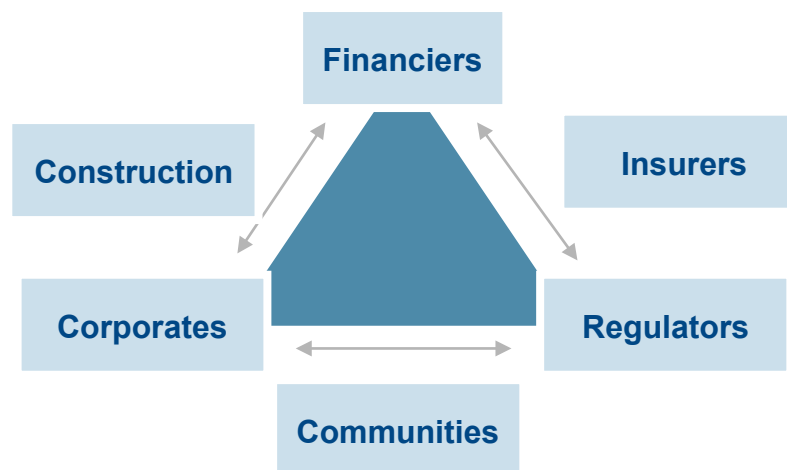
*Swiss Re*

## 3.3 Involvement of the insurance sector – Convening the right players

**Relevant parts of the value chain will need to collaborate closely in the pilot projects to identify ways which each others mutual actions can support climate resilient development**

### Aggregation

- There is a real lack of understanding of insurance products in the developing world
- Interviewees felt that by “aggregating” relevant agencies or parties together in the roll-out of the pilot programs will have a very helpful effect of understanding relevant roles and impact that each might have
- E.g. construction companies gaining a greater understanding how build quality and governance will significantly affect indemnity insurance against damage from natural weather events



*“the pilot programs provide an interesting opportunity to work in a collaborative way on activity which is supported by government and by other bodies” (referring to INGC)*

**In respect of higher volume products likely in “agroforestry, small scale lending and the distribution part of composting” consideration needs to be given to collection and distribution**

### Distribution & Collection

- Insurance products in respect of agroforestry, the distribution part of the composting program and small scale lending and microfinance are likely to higher volume and lower premium
- These types of products will require distribution and collection infrastructure
- Insured parties also need to trust they will get paid
- As such from interviews it is highly unlikely that international insurance companies will have appetite for significant involvement in the these types of products
- A local insurance market is certainly required with a supporting legal framework
- The next phase of the work should look at identifying potential local trusted partners with a track record to work with e.g. Micro-ensure, Microrisk
- There has been some activity in the developing world but this appears limited to CSR type activity
- Progressive parts of the international re-insurance sector are more likely to have appetite for involvement if scale is large enough

*“We have no infrastructure, presence in or knowledge of Mozambique. Whilst we understand how critical insurance products can be in promoting climate resilient development it would simply be not in our strategy to offer local on the ground insurance”*

**AXA – Head of Sustainability**



## 3.3 Involvement of the insurance sector – Next steps

**Whilst penetration of insurance products is extremely limited in Mozambique, research has uncovered an appetite to work with us in the next Phase of the work**

### Summary of required next steps

<b>Data Mapping</b>	<ul style="list-style-type: none"> <li>Engage with data mapping team/key industry thinkers to determine the level of resolution of data to enable informed weather/event related insurance products</li> <li>Swiss re have just completed cyclone and hurricane mapping in Mozambique)</li> </ul>
<b>Pricing and value</b>	<ul style="list-style-type: none"> <li>Work with identified partners and using the pilot program approach to refine pricing and risk evaluation of insurance products (link to data mapping)</li> </ul>
<b>Thorough risk-based economic analysis</b>	<ul style="list-style-type: none"> <li>Performing a thorough risk assessment, identifying risk prevention, intervention and insurance measures</li> <li>Insurance products are highly relevant across the four pilot programs. Identified partners and thought leaders should be worked with closely to map where relevant insurance products might be introduced to create more resilient projects/development.</li> <li>These partners should be a cross section of international insurance/reinsurance and Mozambique based insurance/micro-insurance players</li> </ul>
<b>Distribution and collection</b>	<ul style="list-style-type: none"> <li>Analysis of possible local partners to undertake distribution/collection for higher volume activity</li> <li>Strong synergies exist with the micro-finance/small scale lending program</li> </ul>

## 3.3 Involvement of the insurance sector – Next steps (continued)

**Whilst penetration of insurance products is extremely limited in Mozambique, research has uncovered an appetite to work with us in the next Phase of the work**

### Summary of possible next steps

<b>Engaging people</b>	<ul style="list-style-type: none"> <li>■ A major component in the ongoing work should be around engaging people around management and mitigation of climate risks and on the role of insurance in managing these risks</li> <li>■ The project needs to catalyze major understanding of climate related risks and their potential impact on economic development</li> <li>■ The role of insurance products are fundamental in this education program</li> </ul>
<b>Governance and Regulation</b>	<ul style="list-style-type: none"> <li>■ Identify critical government and regulatory mechanisms/interventions required to introduce a more likely insurance business in the Mozambique context</li> <li>■ This would include building regulation and standards of work /planning standards and permitting</li> <li>■ Work should also be done to examine what sort of underpinning legal framework required to more broadly develop a relevant local insurance market</li> </ul>
<b>Products versus events</b>	<ul style="list-style-type: none"> <li>■ Insurance products are highly relevant across the four pilot programs. Identified partners and thought leaders should be worked with closely to map where relevant insurance products might be introduced to create more resilient projects/development.</li> <li>■ Investigate how index/parametric based insurance can be extended on programs</li> <li>■ These partners should be a cross section of international insurance/reinsurance and Mozambique based insurance/micro-insurance players</li> </ul>
<b>Convening the right organizations</b>	<ul style="list-style-type: none"> <li>■ The right agencies need to be involved as the pilot programs are developed</li> <li>■ This would include local insurance firms, international insurers/reinsurers/regulatory bodies /development finance and donors</li> </ul>

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## 3.4 Barriers to Investment – Doing business in Mozambique

**Out of 183 countries present in the World Bank's Doing Business ranking, Mozambique is poorly positioned in #139, a decay from the 132 position obtained in 2011**

Doing Business Ranking		Some notes
Parameter	Ranking	
<b>Ease of doing business</b>	<b>139*</b>	<ul style="list-style-type: none"> <li>■ The Doing Business ranking is a tool from the World Bank to assess the transparency in the business arena in the different countries</li> <li>■ Mozambique was ranked in #132 in 2011, one of its best classifications ever in this ranking, however, a change in the electricity acquisition permits lead to a severe decrease to the 139 position</li> </ul> <div> <p><i>Mozambique made getting electricity more difficult by requiring authorization of a connection project by the Ministry of Energy and by adding an inspection of the completed external works</i></p> <p><i>in Doing Business, 2012</i></p> </div> <ul style="list-style-type: none"> <li>■ This poor classification can be a detractor to foreign investment in the country, so it's vital that aspects like construction permits, property registration, credit access, and on top of all, getting electricity, be swiftly and efficiently addressed</li> </ul>
Starting a business	70	
Dealing with construction permits	126	
Getting electricity	172	
Registering property	156	
Getting credit	150	
Protecting investors	46	
Paying taxes	107	
Trading across borders	136	
Enforcing contracts	131	
Resolving insolvency	143	

Source: Doing Business 2012, World Bank; \*Out of a total of 183 countries

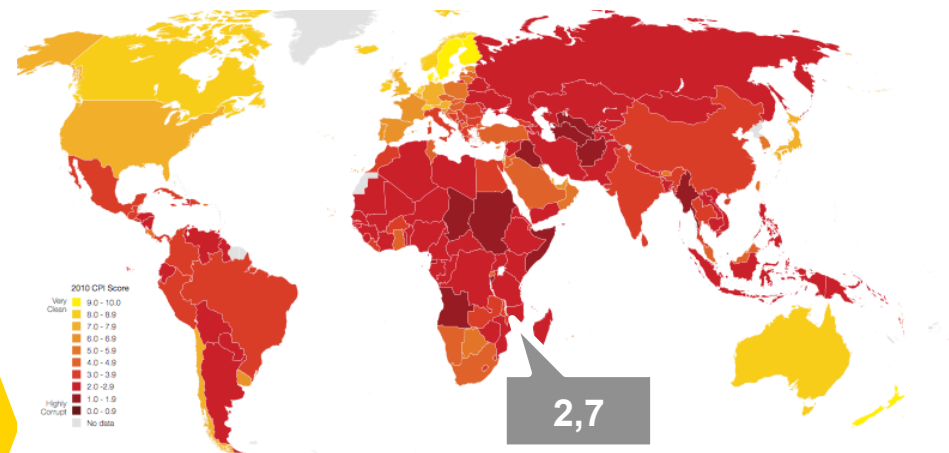
## 3.4 Barriers to Investment – Corruption Perception Index

In the Corruption Perception Index, Mozambique achieved a very poor classification of 2,7, which is seen by investors as a severe problem that decreases their confidence in investing

### Corruption Perception Index

- The Corruption Perception Index is a tool from Transparency International, that measures the level of corruption perception in the public sector through surveys to the private sector and independent consultants
- The index goes from highly corrupt (0-0,9) to very clean (9-10)
- It is estimated that a 1 point increase in this index leads to a 4% improvement in the average income
- Out of 178 countries, Mozambique was classified in 116, ex aequo with Ethiopia, Mali and Mongolia
- A rank below 3 is seen by investors as a vicious problem in the country, and leads to very low levels of confidence in terms of investment

### Mozambican Classification



#1 – Denmark (9,3)

#116 – **Mozambique**, Ethiopia, Guyana, Mali, Mongolia, Tanzania, Vietnam (2,7)

#178 – Somalia (1,1)

Source: Transparency International

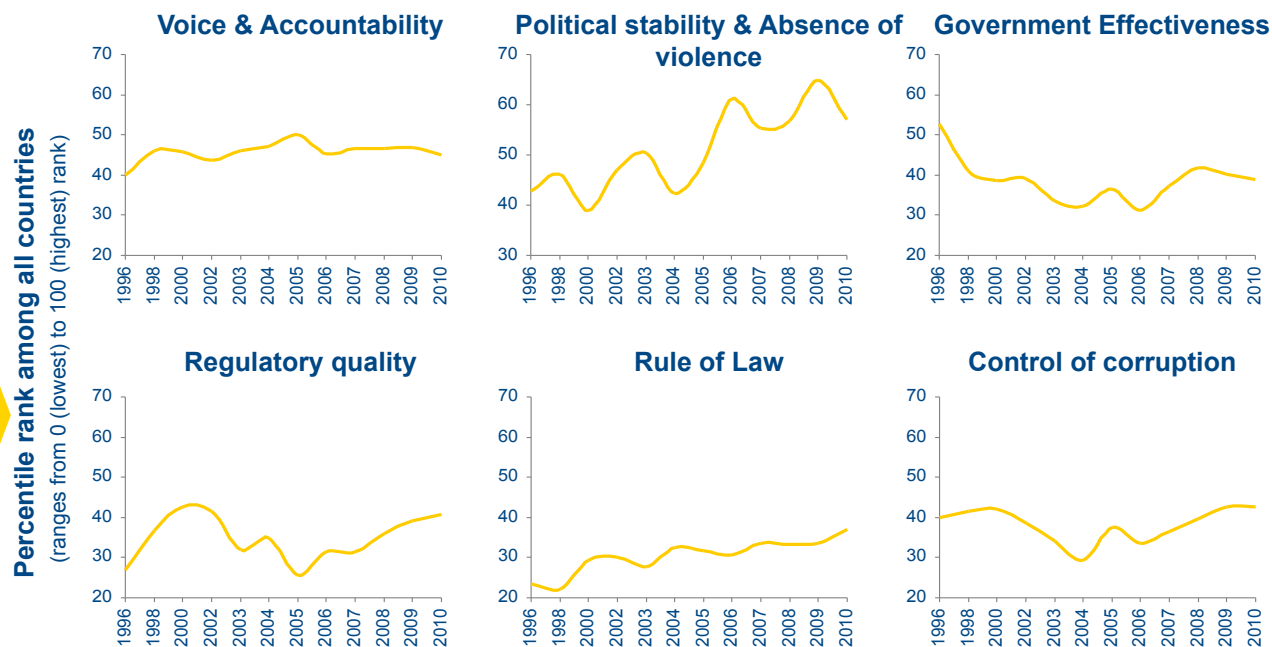
## 3.4 Barriers to Investment – Governance Indicators

It is visible a growing trend in the majority of the dimensions analyzed by the Governance Indicators, however there is still a long road ahead to escape from the bottom of the table

### Governance Indicators (WGI)

- The Worldwide Governance Indicators (WGI) project aggregates indicators from 213 economies since 1996, for six dimensions of governance:
  - Voice and accountability (freedom of speech, to chose government, free press )
  - Political stability and absence of violence (violence or terrorism)
  - Government Effectiveness (quality of public services)
  - Regulatory quality (stable and efficient regulatory framework)
  - Rule of Law (trust in the law enforcement)
  - Control of Corruption

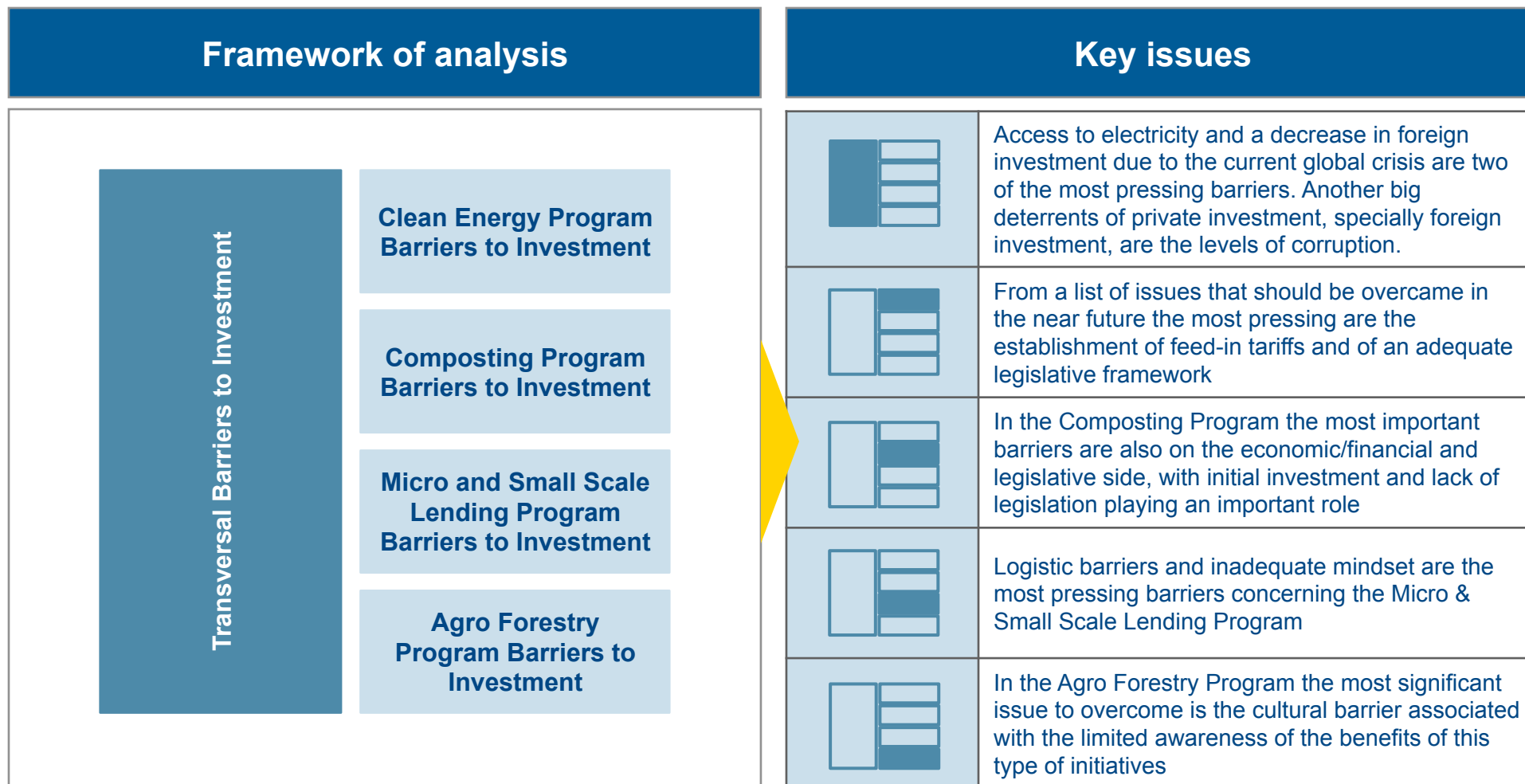
### Results for Mozambique



Despite the growing tendency for the majority of the indicators, Mozambique still presents very low values in the majority of the dimensions





## 3.4 Barriers to Investment – Framework of analysis

The four Programs selected intend to foster sustainable development and investment in Mozambique, however there are still a series of barriers that must be overcome



## 3.4 Barriers to Investment – Transversal barriers





**Access to electricity and a decrease in foreign investment due to the current global crisis are two of the most pressing issues in terms of economic & financial barriers**

Transversal barriers to Investment			
Economic & Financial	Energetic dependence of South Africa and lack of adequate infrastructures (only 13% of the population has access to electricity). The recently approved legislation makes it even harder to install electrical installations		Invest in electrical infrastructures and in the distributed electricity concept: small electrical installations, that supply electricity to small villages and population agglomerates. Enforce adequate legislation and install a feed in tariff for renewable electricity
	The ongoing global economic crisis may pose severe challenges to the investors willing to invest in Mozambique		Approve legislation that gives attractive conditions to foreign investors (tax benefits, Government guarantees, etc)
	Exchange rate and Price Stability		Eliminate excessive liquidity (emitting treasury bills, buying national currency) to prevent an increase in inflation
Logistic	Communication infrastructures (mobiles, accessibilities, etc.)		Invest in improving or creating from scratch good accessibilities: the lack of roads and good accesses is detrimental for the majority of investments



## 3.4 Barriers to Investment – Transversal barriers

One of the biggest deterrents of private investment, specially foreign investment, are the levels of corruption in Mozambique, that must be severely fought

Transversal barriers to Investment			
Legislative & Administrative	Getting permits and registering property: two of the worse classified items in the World Bank's Doing Business ranking		Speed up the bureaucratic mechanisms needed to get permits and register properties. Invest in new technologies that help smoothing these processes
	Corruption		Enforce very strict anti corruption legislation, impose adequate fines and create efficient inspection mechanisms.
	Insufficient regulatory framework (lack of legislation that promotes stability and encourages the private investment)		Promote a forum with representatives of the private sector (including foreign representatives) to discuss the top measures that should be enforced to increase private investment in Mozambique
Human Resources	Low levels of literacy and education		Increase the number of schools and the professor/ student ratio. Promote adult education. Establish scholarships for the most needed

### 3.4 Barriers to Investment – Clean Energy Program

**From a list of issues that should be overcome in the near future the most pressing are the establishment of feed-in tariffs and of an adequate legislative framework for renewables**

Clean Energy Program			
Economic/Financial	Lack of feed-in tariff or similar mechanisms (PPA, tax benefits, etc.) to incentivize the implementation of renewable energy projects		Lobby with the Government for the implementation of such mechanisms
Logistic	Bad/insufficient accessibilities and dispersed locations highly increase the construction and transport costs of these projects		Negotiate a bulk contract with the transport company. Prioritize nearby locations
Human Resources	Lack of personnel with adequate qualifications to install the devices and perform adaptations to the Mozambican reality		Invest in training local personnel, and put them in direct contact with the foreign teams doing the initial installations
Legislative	Lack of an adequate legislative framework that defines the grounds for the Government support to clean energy (feed-in tariffs duration, scope of support, etc.)		Lobby with the Government to clearly define and implement adequate legislation
Cultural	The inexistence of renewable energy projects in Mozambique doesn't create the necessary pull mechanism from the population		Create advertising campaigns to bring awareness to the populations of the benefits/ possibility of having renewable energy






### 3.4 Barriers to Investment – Composting Program

**In the Composting Program the most important barriers are also on the economic/financial and legislative side, with initial investment and lack of legislation playing an important role**

Composting Program			
Economic/Financial	It is necessary a high initial investment to brake ground, which, given Mozambique's lending conditions it's not easy to obtain		Create specific credit lines for composting programs, with lower interest rates and adequate maturities
Logistic	Typically the population does not comply with the appropriate places to dispose the garbage, so it's necessary to invest in sometimes expensive collecting routines		Create awareness programs to illustrate the dangers of non regulated waste disposal and implement a fines system
Human Resources	The techniques are simple enough, to be easily understood by the personnel, after an initial training, however it's important to implement quality control procedures		Implement rigorous quality control procedures, to ensure that the fertilizer produced is of the highest quality
Legislative	The legislation to enforce for the adequate disposal of garbage and waste is not strict enough and doesn't compel the individuals/companies to comply		Lobby with the Government to clearly define and implement adequate legislation and a fine system
Cultural	Individuals and companies are used to throw away the garbage everywhere without much concern on safety. On the other hand, the use of fertilizers is not much widespread in agriculture		Bring awareness to the benefits of using fertilizers in agriculture and on the health issues coming from wrongful waste disposal

### 3.4 Barriers to Investment – Micro & Small Scale Lending Program

## Logistic barriers and inadequate mindset are the most pressing barriers concerning the Micro & Small Scale Lending Program

Micro & Small Scale Lending Program			
Economic/Financial	The high interest rates in the country difficult the creation of an entrepreneurial mindset based on banks financing		Negotiate with partners looking for lower returns, that emphasize other metrics like impact in the population well being
Logistic	The distance between the cities makes it difficult to promote synergies. Also there's a big disparity between the south of the country and the north, poorer and with lower access to finance		Select partners with a widespread network of branches
Human Resources	Lack of personnel with specific financial knowledge to work in micro finance institutions and to be able to clarify the questions and doubts of the clients		Invest in training local personnel, and put them in direct contact with experts from the sector. Promote mixed teams
Legislative	Lack of supporting legislation, promoting entrepreneurial activities and allowing for some benefits ((e.g. tax benefits, dedicated credit lines, etc.)		Lobby with the Government to clearly define and implement adequate legislation
Cultural	Mozambique is one of the countries with lower borrowing rates, specially because individuals are still afraid of asking for money to banks, as they feel ignorant of the trading practices		Increase awareness and promote educational campaigns to show the benefits of micro and small scale lending

### 3.4 Barriers to Investment – Agro Forestry Fund Program

**In the Agro Forestry Program the most significant issue to overcome is the cultural barrier associated with the limited awareness of the benefits of this type of initiatives**

Agro Forestry Fund Program			
Economic/Financial	Forestry projects have long-term perspective which can limit its attractiveness to certain profile of investors.		Demonstrate benefits from Agroforestry initiatives to forestry investors, namely possibility of ongoing revenues, for example, from agriculture or eco-tourism
Logistic	Larger forestation projects are clearly identified, and are concentrated in certain geographic areas		Focus efforts on most attractive forestry initiatives in order to develop Agroforestry investments
Human Resources	Lack of personnel with knowledge and experience on the development of Agroforestry projects, who can promote and show case the benefits of this type of investments		Invest in training local personnel, and put them in direct contact with experts from the sector
Legislative	Lack of supporting legislation, promoting entrepreneurial activities and allowing for some benefits (e.g. tax benefits, dedicated credit lines, etc)		Lobby with the Government to clearly define and implement adequate legislation
Cultural	Limited awareness of the population and companies, regarding the potential benefits of Agroforestry initiatives . Significant part of the population still uses the forest as source of fuel wood		Create advertising campaigns to bring awareness to the populations of the benefits/ possibility of business closely related with forestation projects

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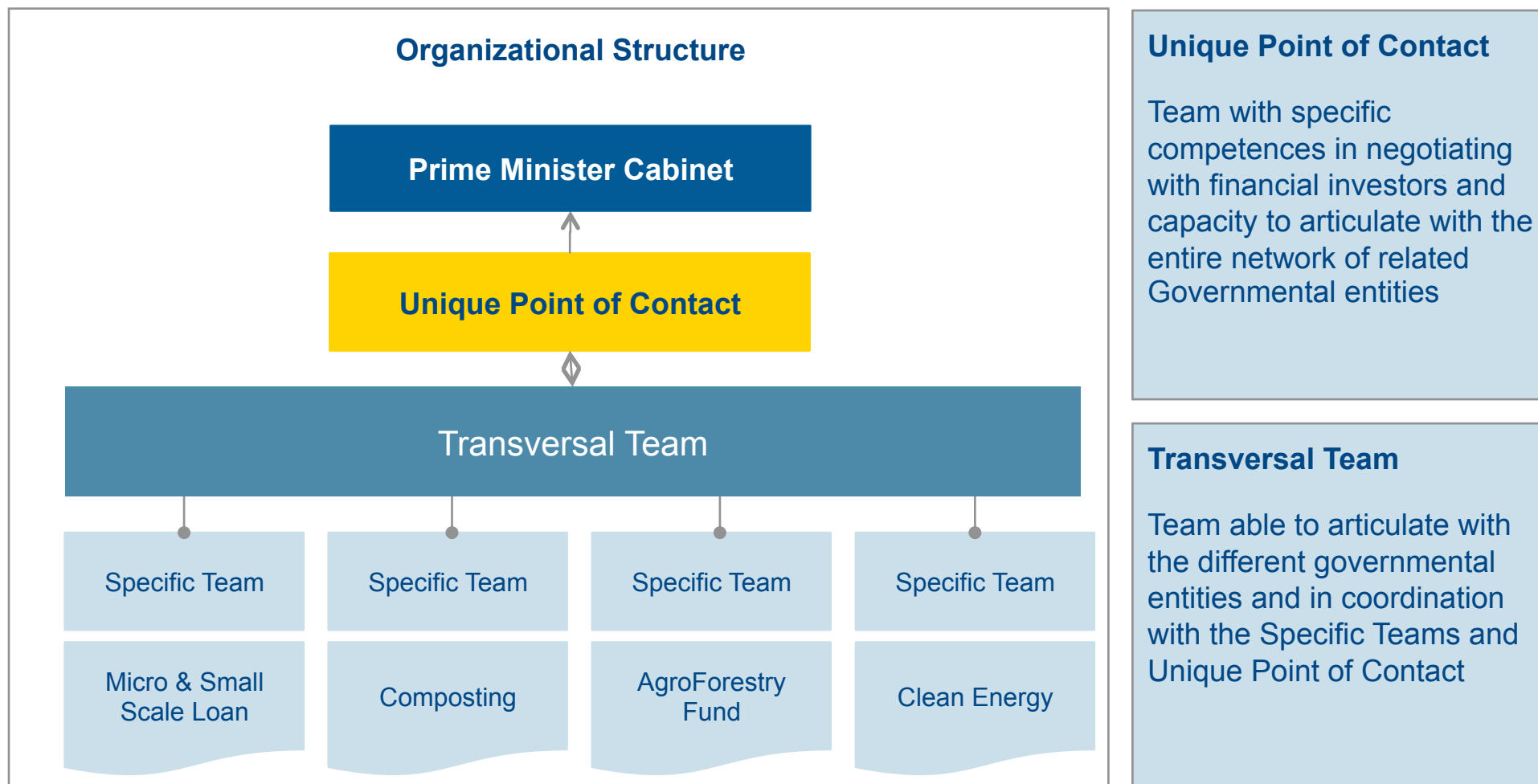
3.4 Barriers to Business Analysis

**3.5 Strategic Recommendations**

**In order to position Mozambique as an obvious target for foreign climate change investment, to reduce vulnerability and increase resilience, is necessary a commitment at the highest level**

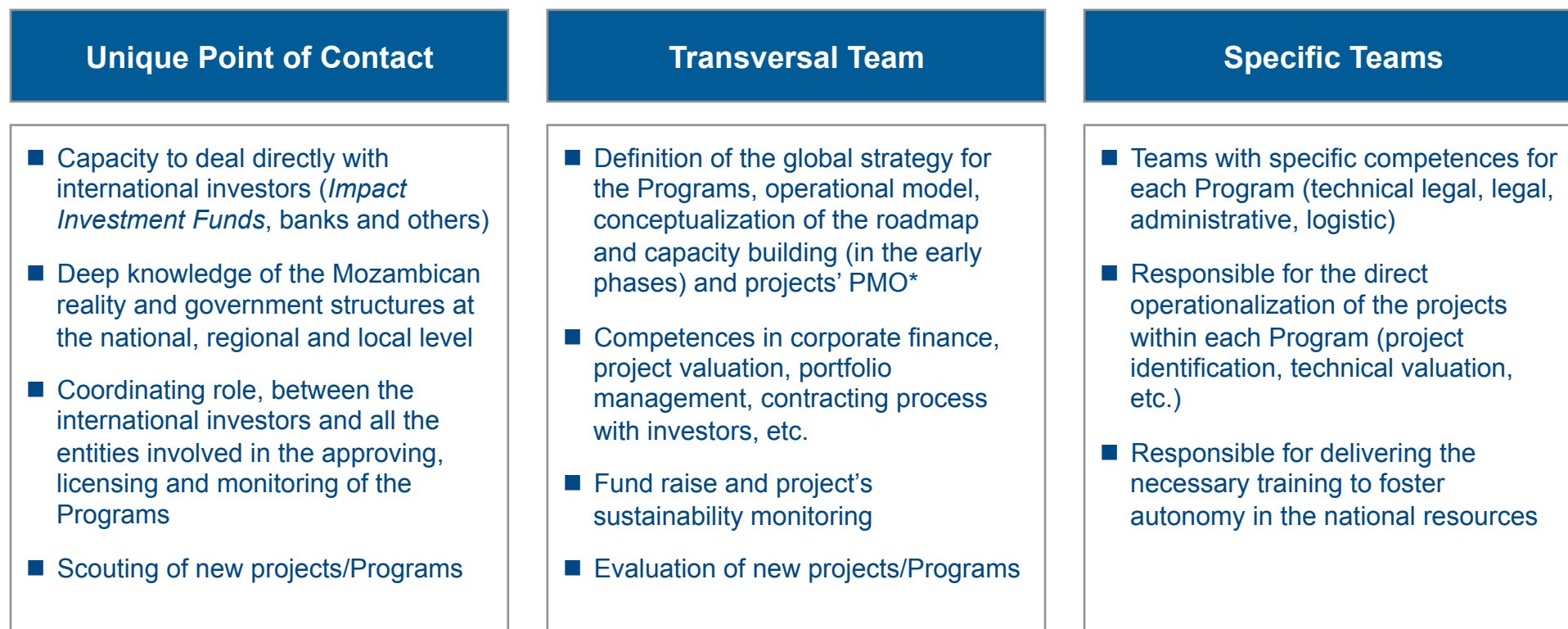
<b>Ambition</b>	Position Mozambique as a world leader and preferential destiny in the fund raise for climate change adaptation projects and climate change risk management
<b>Goals</b>	Attract 1 billion dollars of foreign private investment until 2020, for projects that reinforce Mozambique's resilience to climate change
<b>Commitment</b>	Commitment and political leadership at the highest level in the Government (Prime Minister cabinet)
<b>Mission</b>	Create the necessary competences to make Mozambique autonomous in achieving his ambition
<b>Management model</b>	Creation of a Unique Point of Contact, a Transversal Team and Specific Teams
<b>Phase III</b> (12 a 24 months)	<div>Key issues</div> <ul style="list-style-type: none"> <li>• Continuity and appropriate use of Phase I and II results</li> <li>• Swiftness in the Program's execution</li> <li>• Deep knowledge of the impacts of climate change in the country</li> </ul>

The organizational structure should be characterized by the highest level of political leadership and a clear and swift strategy approval process





### The profile of the international investors' community requires teams with highly specific competences



**INGC will be the catalyst in the establishment of the Unique Point of Contact, Transversal Team and should maintain the responsibility over the Specific Teams during the cruise velocity phase**

\*PMO – Project Management Office

### The capacity building to render Mozambique autonomous in the management of these Programs is a priority mission

<b>Human Resources</b>	Identification, profile selection and hiring of specialized personnel.
<b>Training</b>	Capacity building at the technical, financial and legal levels (among others) and knowledge transfer
<b><i>Learning by doing</i></b>	Polishing of the personnel capacities, by creating mixed teams, formed by national personnel, supported by an interim team of external consultants
<b>Technical Assistance</b>	Perform technical and scientific studies, project conceptualization, detail engineering studies, etc.
<b>Assets</b>	Development of informatic models, measurement instruments and monitoring systems

**To bring these Programs to light and make them a flagship for future opportunities it is crucial to secure funding and an adequate investment environment...**

### Main messages

#### 1 Raising the funding

Securing the funding for the Programs will require a **concerted effort** in working with investors, Unique Point of Contact, Transversal Team, Specific Teams and the network of authorities, Government, local partners/businesses and communities required to set up the plans, governance models, vehicles, etc. to channel the funding to the Programs and projects.

Essentially here is to execute whatever needs to be done to unlock the finance from whatever part of the funding community it should come from.

#### 2 Creating the investment channels/ environment for FDI

There is a strong sentiment among the international investors, that **doing business in Mozambique is difficult and cumbersome** and that this perception/reality will be one of the key barriers to be overcome if the gates to significant private sector funding for climate change adaptation measures are to be fully opened up.

The work here should **build on the recommendations that come out of the "barriers to investment"** and **take this in to concrete recommendations** and support to building the Unique Point of Contact to coordinate/facilitate/accelerate the necessary authorization, licenses, logistics etc. to help international investors gain traction in the Programs quickly and smoothly.

#### 3 Program Management Office

Ensure **that all the organizational structures that facilitate the full project execution are in place** and that all the different aspects of the execution are coordinated among themselves, in order to deliver a final and coherent result.

... that allows for a successful deployment with a tangible impact in the populations quality of life

Main messages	
4 Seed capital/early stage funding to pilot projects and capability building	<b>Providing early stage support</b> to specific pilot projects to get them "off the drawing board", i.e. through technical assistance or studies, or in funding capability-building for the development of the necessary local skilled workers/ professionals and project managers that will be required to support/oversee the implementation of the Programs.
5 Public funding is crucial	Without a portion of <b>public funding</b> to start these initial four Programs and without ensuring <b>proactive Government support</b> , the private sector will not be interested to make the investments on their side as the costs/barriers will be too great
6 Engagement of local population and other stakeholders	<b>Creating the right mind set</b> in the populations and “ <b>educate</b> ” them on sustainability issues and opportunities, so that they understand that more than a threat or “another project”, this may be a real opportunity to improve their quality of life. This will not only have a positive impact in the population literacy, but should also help to <b>create momentum</b> for these projects development.
7 Promote the creation of insurance platforms	<b>Developing micro-insurance/other insurance</b> products that build resilience into the private sector/support the programmes.

**Arthur D Little**

