Climate and Disaster Risk Screening Report for Road Project in Mozambique: Hypothetical Roads Improvement Project[1]

[1] This is the output report from applying the World Bank Group's Climate and Disaster Risk Screening Project Level Tool (Global website: climatescreeningtools.worldbank.org; World Bank users: wbclimatescreeningtools.worldbank.org). The findings, interpretations, and conclusions expressed from applying this tool are those of the individual that applied the tool and should be in no way attributed to the World Bank, to its affiliated institutions, to the Executive Directors of The World Bank or the governments they represent. The World Bank does not guarantee the accuracy of the information included in the screening and this associated output report and accepts no liability for any consequence of its use.

1. Introduction

Building resilience to climate and geophysical hazards is a vital step in the fight against poverty and for sustainable development. Screening for risks from these hazards improves the likelihood and longevity of a project's success. The project level Climate and Disaster Risks Screening Tool provides early stage due diligence on climate and disaster risks at the concept stage of project development. The tool uses an exposure - sensitivity - adaptive capacity framework to consider and characterize risks from climate and geophysical hazards, based on key components of a project and its broader development context (Annex 1).

This report summarizes the results of the screening process for Hypothetical Roads Improvement Project/Mozambique.

The potential risks flagged in this report were identified through four screening stages by connecting information on climate and geophysical hazards exposure with the user's subject matter expertise and understanding of the project components and sensitivity to rate the impacts. The tool does not provide detailed risk assessments, rather it flags risks to inform consultations, enhance dialogue with local and other experts, and define further analytical work at the project location.

This early stage due diligence can be used to strengthen the consideration of climate and disaster considerations in key components of the project design, including the physical (e.g., road rehabilitation, new road construction) and non-physical aspects (e.g., capacity building of road agencies, institutional strengthening or policies; maintenance schedules, etc.). The broader sectoral (e.g., road design standards, zoning regulations; rural urban road policies; demand for new roads network) and development context conditions (e.g., population growth, access to technology, etc.) could help modulate the risks to the delivery of the outcome/service level.

The results of the screening are presented below, with supporting narrative to guide their interpretation.

2. Climate and Disaster Risk Screening Results Summary

2.1 Project Information Summary

Table 1 below provides key project information including the location and key project development objectives. This information is provided by the task team. The activities within the components are important as their sensitivity to the climate and geophysical hazards will determine the level of potential impact from these hazards.

Table 1: Project Information

Project Information	
Title	Hypothetical Roads Improvement Project
Number	Hypothetical
Region	Sub-Saharan Africa
Country	Mozambique
Type of Assessment	Road Projects
Purpose of Screening	Enhance my understanding of climate and disaster risks towards climate resilient development
Current Project Phase	Concept (Identification)
Funding Source	IDA
Keywords	Road Maintenance, Road Transport
Location	The project is located in southern Mozambique, near the city of Maputo, connecting to highway N1. The rural road network under the project is near Caia and Songo.
GPS Coordinates	.
Physical Components	1. Upgrading of national highway N1 - The project will rehabilitate and upgrade 250 kilometers, which is a segment of the N1 Highway linking Maputo to Xai-Xai. This work would complete what has been started under a previous Bank operation that rehabilitated a large part of the national highway. The work will include replacement of damaged culverts, bridges, and repairing of badly damaged road surfaces due to storms and flash floods. 2. Piloting Climate Resilient Rural Roads - The project will support rural road network that is a key to providing rural access to markets, to increasing profitability and better links to agricultural supply chains. It will pilot a community-based road maintenance system for tertiary roads. The pilot will prepare strategies and identify low cost climate-resilient maintenance measures to shorten the emergency response time when damage occurs to ensure least disruption to the road network, especially during the rainy season.
Outcome / Service Delivery	To restore road connectivity in the southern region to integrate with existing national highway networks; and to improve climate resilience of rural road networks in the region.

* Please note that this is based on user inputs and the coverage may not be comprehensive.

2.2 Summary of Exposure to Climate and Geophysical Hazards

Table 2 presents a summary description of exposure to climate and geophysical hazards at the project location for the Historical/Current and Future time frames[1]. Exposure to climate hazards is evaluated in two time frames, because past records are not necessarily indicative of future conditions.

The descriptions provide a summary of the key characteristics and some indication of the trends in exposure from each hazard, drawing on global, quality controlled data sets from the Climate Change Knowledge Portal (CCKP). It is useful, for example to understand the temperature range and the rate of annual or decadal increase in a region; or precipitation patterns for historical and future time frames and seasonality shifts. Understanding the trends of hazards is important as they act individually and collectively on components/sub-sectors of the project. Because geophysical hazards (such as earthquakes, tsunamis, landslides, and volcano eruptions) do not have associated future projections, exposure for those hazards is assessed only in the Historical/Current timeframe.

Table 2: Summary of Exposure to Climate and Geophysical Hazards at Project Location

HAZARD	TIME FRAME	DESCRIPTION OF HAZARDS FOR YOUR LOCATION
Extreme Temperature	Current	Mean temperatures across the country rose by an average of 0.6 C since 1960 (0.15-0.16 C per decade). This trend is more prominent in the rainy season. The number of hot days (defined as the temperature exceeded on 10% of days or nights in the current climate of that region and season) increased by 25 days in the last 40 years, and much of this has occurred during the southern hemisphere autumn (March - May).
	Future	Temperatures are expected to increase by 1.4-3.7 °C by 2060, with warming more rapid in southern part and coastal areas. The number of hot days and nights (defined as the temperature exceeded on 10% of days or nights in the current climate of that region and season) are projected to increase throughout the country: hot days by 17-35% in 2060 and hot nights by 25-45% in 2060. The number of cold nights (defined as the temperature below which 10% of days or nights are recorded in the current climate of that region or season) is projected to steadily decrease.
Extreme Precipitation and Flooding	Current	Rainfall projections are less certain for the country as a whole and vary by region. Seasonal level projections are more certain and indicate decreased dry season rainfall (January-June) and increased wet season rainfall (July-September). Since the 1960s, mean rainfall decreased by an average of 2.5 millimeters per month (3.1%) per decade. Spatial manifestations are varied, with increased rainfall over the northern regions, highly variable conditions in the central regions, and persistent drought periods coupled with episodic floods in the south. The proportion of days with heavy rainfall events increased by 2.6% per decade or 25 days per year.
	Future	Rainfall projections are less certain for the country as a whole and vary by region. Seasonal level projections are more certain and indicate decreased dry season rainfall (January-June) and increased wet season rainfall (July-September). The number of heavy rainfall events (defined as a daily rainfall total which exceeds the threshold that is exceeded on 5% of rainy days in the current climate of that region or season) is projected to increase by 2060, particularly during the dry season (January-June).

[1]The Future time frame is based on changes projected to occur between the 1980-1999 average and a future average. This future average is the 2040-2059 average (i.e., the default in the Climate Change Knowledge Portal - CCKP). Users can choose to select another time frame, or choose to use national/local data sets, but if so, this should be reflected in the notes section of the tool (and will be summarized in Annex 2). The CCKP draws on global, quality-controlled datasets and is continually updated as new data become available. In some cases, the CCKP is supplemented with other sources of information. For more detail on the data used in this step, please refer to the Data Annex. Climate Change Knowledge Portal (http://climateknowledgeportal.worldbank.org).

HAZARD	TIME FRAME	DESCRIPTION OF HAZARDS FOR YOUR LOCATION
Sea Level Rise	Current	N.A.
	Future	N.A.
Storm Surge	Current	N.A.
	Future	N.A.
Strong Winds	Current	There are infrequent cyclones near the project region.
	Future	The max wind speed from tropical cyclones is expected to increase, but estimates are highly uncertain. Currently, there is no info on the projection of future cyclone incidents in the country.

Insufficient Understanding	Not Exposed No Potential Impact No Risk	Slightly Exposed Low Potential Impact Low Risk	Moderately Exposed Moderate Potential Impact Moderate Risk	Highly Exposed High Potential Impact High Risk

Please note that the colors shown in Table 2 are only for exposure at the project's location. Overall risk to project's outcome/service delivery, taking into account sensitivity of physical investments and adaptive capacity(non-physical components and development context), is depicted in Tables 3A and 3B.

2.3 Summary of Overall Project Risk

Tables 3A and 3B present the same results, with Table 3A highlighting the impact ratings on the project’s components, and the overall risk to the outcome/service level for both Historical/Current and Future time frames. Table 3B draws attention to how the climate impacts and risks shift from the Historical/Current to the Future time frame.

The impact ratings are derived on the basis of the hazard information, subject matter expertise, contextual understanding of the project, and modulated on the basis of adaptive capacity and the larger development context of the road sector and country. The results indicate if the outcome/service level of the project is at risk. The actual ratings themselves, while instructive, should inform further consultations, dialogue, and future planning processes. Keep in mind that the greatest value of the tool is that it provides a structured and systematic process for understanding the climate and disaster risks on the project.

The results indicate where risks may exist and where further work may be required to reduce or manage these climate and geophysical risks. An ongoing process of monitoring risks, refining climate and other information, and regular impact assessment may also be appropriate.

2.3.1 Results Summary - by Component / Subsector

Table 3A summarizes the impact to the physical components from each hazard at the project location. For example, high temperatures may lead to pavement cracking, so the temperature rating of the pavement binder is an important indicator of sensitivity to temperature. On the other hand, sensitivity to heavy rainfall and flooding depends on the capacity of road drainage, including culverts, storm drains, and ditches, as well as road surface concerns. By understanding the interaction of the physical works with each hazard, the impact ratings are derived.

The potential impact on the physical components due to exposure from hazards is modulated by the project's non-physical components (enabling and capacity building activities). The right kind of capacity building measures could increase preparedness and longer-term resilience and reduce the risks. An understanding of larger sector and development context with respect to key modulating factors helps to assess the climate risks in terms of adaptive capacity. For example, in the road sector, a significant system redundancy may help reduce risks; while population growth and increasing peak demand may aggravate the risks.

The results provide an indication of potential risks and where further work may be required to understand the climate and geophysical risks. An ongoing process of monitoring risks, refining climate and other information, and regular impact assessment may also be appropriate.

Table 3A: Results Summary - by Component / Subsector

Hazard → Exposure → Potential Impact → Contribution of Adaptive Capacity to Impact → Project Risk

HAZARD	Project Components						Development Context				Outcome/Service Delivery	
	Location		Physical Components		Non-Physical Components (Overall)		Transport Sector		Broader Context (Overall)			
Time Frame	Current	Future	Current	Future	Current	Future	Current	Future	Current	Future	Current	Future
Extreme Temperature					Data gathering and information management system: Slightly Reduces Impact; Emergency protocols: Significantly Reduces Impact		Slightly Reduces Impact		Financial resources: Slightly Increases Impact			
Extreme Precipitation and Flooding												
Sea Level Rise												
Storm Surge												
Strong Winds												

2.3.2 Summary – by Time Frame

The results in Table 3B display the results by time frame. Potential impacts to the components are evaluated separately for the Historical/Current and Future time frames to capture changes in the exposure from climate hazards over time. It is important to first evaluate historical trends and current baselines to understand the conditions and trends under which road systems are currently operating. Using the projections for future climate in the project location and relating them to the relevant time scale, users can focus on the aspect of their project that will be relevant to its outcome in the Future time-frame.

For example, recent trends may indicate that frequency and intensity of extreme floods are rising in such a way that they require a new set of design standards for roads, which may reduce significantly the operations and maintenance costs over time. For investments with long operational lifetimes, such as physical infrastructure, considering future climate variability and change is critical to avoid “locking in” designs and features that are only suited to current climate. Most road investments have long lifetimes, so considering future conditions is critical to avoid “locking in” designs that are not suited for higher sea levels or more frequent flooding. Coastal roads whose design is based on current sea levels, for example, may experience periodic or permanent inundation in several decades because the elevation is insufficient.

Table 3B: Results Summary - by Time Frame

Time Frame	Current						Future					
				Development Context						Development Context		
Hazard	Location	Physical Components	Non-Physical Components	Transport Sector	Broader Context (Overall)	Outcome / Service Delivery	Location	Physical Components	Non-Physical Components	Transport Sector	Broader Context (Overall)	Outcome / Service Delivery
Extreme Temperature			Data gathering and information management system Slightly Reduces Impact Emergency protocols Significantly Reduces Impact	Slightly Reduces Impact	Financial resources Slightly Increases Impact				Data gathering and information management system Slightly Reduces Impact Emergency protocols Significantly Reduces Impact	Slightly Reduces Impact	Financial resources Slightly Increases Impact	
Extreme Precipitation and Flooding												
Sea Level Rise												
Storm Surge												
Strong Winds												

Insufficient Understanding	Not Exposed No Potential Impact No Risk	Slightly Exposed Low Potential Impact Low Risk	Moderately Exposed Moderate Potential Impact Moderate Risk	Highly Exposed High Potential Impact High Risk

2.4 Key Drivers of Risks

Based on the results above, Table 4 highlights the key drivers of risk for each project component/subsector ratings, in terms of hazards that are likely to pose the greatest challenge.

The rating for the potential impact and service for each component is considered for each hazard, drawing on the exposure information and the user's subject matter expertise. For example, while the outcome/service for a project may require roads to be accessible across the rainy or dry seasons for all communities, this may be compromised due to the risk posed from multiple hazards.

Specific consideration should be given to those hazards which have high ratings, or are moving from moderate to high ratings over time. For example, sea-level rise may not be a key risk driver in the Historical/Current time frame; but may emerge as a key driver for the road sector in the future time frame. Understanding which hazards are key drivers may help flag follow-on work to manage climate risks within the design and delivery of the project.

Table 4: Key Drivers of Risk

	Historical/Current Drivers	Future Drivers
Hazards and Location	Extreme Precipitation and Flooding	Extreme Temperature Extreme Precipitation and Flooding
Physical Components	Extreme Precipitation and Flooding	Extreme Temperature Extreme Precipitation and Flooding
Outcome / Service Delivery	*	Extreme Precipitation and Flooding

Key: High Risk | Moderate Risk

* If a cell is blank it implies there is 'No high or moderate risks' identified for this aspect of the project.

- Overall, the Non-physical Components : **insufficient information provided**
- The Transport Sector : **Slightly Reduces Impact**
- Overall, the Non-physical Components : **insufficient information provided**

3. Next Steps

By understanding which of your road project components is most at risk from climate change and other natural hazards on the basis of the screening, you can begin to take measures to avoid their impacts by:

- Enhancing the consideration of climate and disaster risks early in the design stage of the project.
- Using your risk screening analysis to inform follow-up feasibility studies and technical assessments.
- Encouraging local stakeholder consultations and dialogue to enhance resilience measures and overall success of the project.

Table 5A provides some general guidance based on the risk ratings for the Outcome/Service Delivery, and Table 5B lists some climate risk management measures for your consideration. Visit the "Next steps" page of the tool on the website for guidance and a list of useful resources.

Note: Please recall that that this is a high-level due diligence tool, and the characterization of risks should be complemented with more detailed work.

Table 5A: General Guidance Based on Risk Ratings for Outcome/Service Delivery

Insufficient Understanding	Gather more information to improve your understanding of climate and geophysical hazards and their relationship to your project.
No Risk	If you are confident that climate and geophysical hazards pose no risk to the project, continue with project development. However, keep in mind that this is a high-level risk screening at an early stage of project development. Therefore, you are encouraged to monitor the level of climate and geophysical risks to the project as it is developed and implemented.
Low Risk	If you are confident that climate and geophysical hazards pose low risk to the project, continue with project development. However, keep in mind that this is a high-level risk screening at an early stage of project development. Therefore, you are encouraged to monitor the level of climate and geophysical risks to the project as it is developed and implemented. You may also consider gathering additional information to increase your level of confidence in your rating.
Moderate Risk	For areas of Moderate Risk, you are encouraged to build on this screening through additional studies, consultation, and dialogue. This initial screening may be supplemented with a more detailed risk assessment to better understand the nature of the risk to the project.
High Risk	For areas of High Risk, you are strongly encouraged to conduct a more detailed risk assessment and to explore measures to manage or reduce those risks.

Table 5B: Types of Climate Risk Management Measures for typical Road Projects

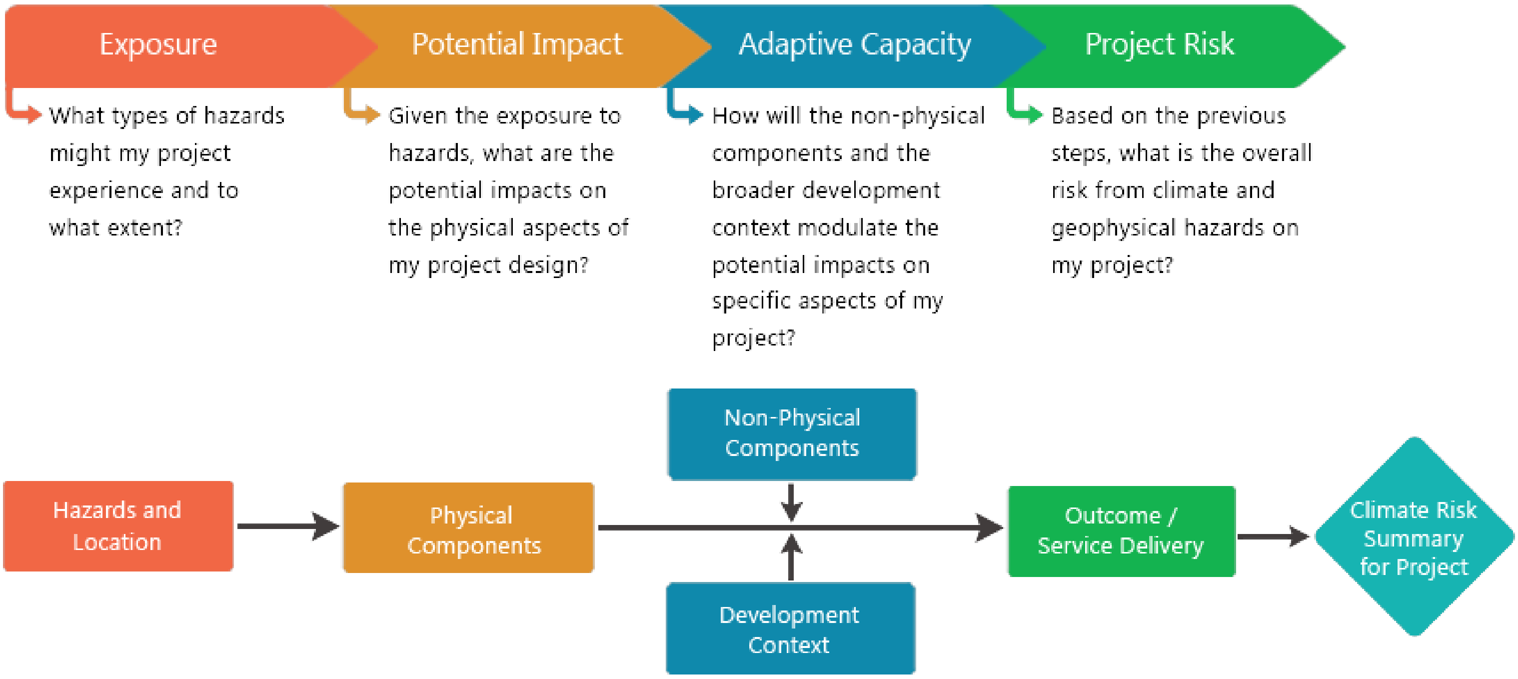
CATEGORY	PROS	CONS	EXAMPLES
Accommodate and Manage	• Flexible • Typically low-cost • Useful when risk is low, but projected to rise in the future	• Temporary solution • Can be insufficient in preventing losses	• Increasing repair and maintenance budgets • Instituting policies for proactive rerouting during severe weather
Protect and Harden	• Can be used for existing and new assets • Responds to immediate risks	• High cost • Inflexible • Effectiveness may decrease over time	• Elevating a roadway • Expanding buffer zones • Designing roads with larger drainage systems • Engineering bridges with elements of seismic-resistant design
Retreat and Relocate	• Long-term solution • Responds to immediate risk	• High cost • Inflexible	• Moving a road alignment away from a river • Moving infrastructure further inland or onto higher ground

Annex 1: Tool Approach

Tool Approach

The framework below describes the approach taken to screen the project. Climate and natural hazards information used to screen the project is most likely obtained from the World Bank's Climate Change Knowledge Portal, which houses numerous global data sets with historical records and future projections as well as country-specific adaptation profiles.

Figure A1: Project Level Climate and Disaster Risk Screening Tool: Approach for Roads Project



Annex 2: Notes

Table A2-1 summarizes the sub-national locations of high risk noted during the assessment, if the user entered these sub-national locations. Table A2-2 summarizes all the notes entered by user for each section while completing the assessment, if the user elected to enter notes. These notes can help shed light on specific ratings as well as considerations and limitations of the user's expertise.

Table A2-2 Summary of Comments by Section

Section		Notes
Hazards and Location	Extreme Temperature	High temperature could potentially damage the road pavement in highways.
	Extreme Precipitation and Flooding	Since the project is in the south, so the place is more affected by flooding and heavy rains. Thus, the rating.
	Sea Level Rise	The national highway is around 8-9 km from coast and the elevation of the closest point to the coast is around 30-50 m above see level. So, this hazard is deemed to be not exposed.
	Storm Surge	From the CCKP, the storm surge is not exposed in southern Mozambique. Plus, the project location has quite some distance from the the coast.
	Strong Winds	From CCKP
Physical Components	Extreme Temperature	This is based on the knowledge that some types of asphalt binder are sensitive when temperature reaches 42 C, particularly combined with truck traffic. There is an employee health and safety risk above 30 C and high risk above 40 C.
	Extreme Precipitation and Flooding	Historical facts show that the highway is often damaged by heavy rains and flooding. However, the project is to implement measures that are more climate-resilient, thus reducing the level of potential impact.
	Strong Winds	There has not been many incidents that show damage to roads due to wind.
Non-physical Components	Data gathering and information management system	The project's third component about capacity building of road administration, including improving administrative capacity of the relevant institutions at different levels to establish three critical data management systems: Road Safety, Highway Information; and financial management for O&M of the road networks.
	Emergency protocols	The project's third component about capacity building of road administration, including completing mapping of unclassified rural/district road network, and integrating the new mapping system into emergency response mechanism to road ruptures and bridge washouts.
Development Context: Transportation Sector	Development Context	Mozambique has recently formulated and approved a transportation sector strategy to improve road accessibility and maintenance nationwide. The strategy also calls for the establishment of an emergency response system (to be financed under this project).
Development Context : Social, Economic and Political Factors	Financial resources	Increased infrastructure spending as well as significant foreign investments flows in mega projects of mining and natural gas are likely to sustain economic growth over the medium term horizon. This would be a challenge to the transportation systems, given that the current road network condition is still poor.
Outcome / Service Delivery	Extreme Precipitation and Flooding	tb