#### **Appropriate Costing Options of Climate Change Adaptation in Infrastructure Development: Experimental Studies for Road and related Infrastructure Projects in Cambodia (CAMI)**

Project Implementor: Master of Science in Climate Change Program, Graduate School of Science, Royal University of Phnom Penh (MCC/RUPP)

Asian Institute of Technology, Thailand; University of Freiburg, Germany (Foreign); Ministry of Public Work and **Project Partners:** Transport (MPWT), Ministry of Rural Development (MRD) (Local) **Project Locations:** 

Kampong Thom and Pursat (Tonle Sap Lake), Kratie and Prey Veng (Mekong River), and Kampot (coastal zone)

### **Background and objectives**

Cambodia is one of the more disaster-prone countries in Southeast Asia, affected by floods and droughts on a seasonal basis. Weak adaptive capacity, poor infrastructure, limited institutions exacerbate the country's and vulnerability to climate variability and change. Indeed, floods and droughts are recognized by the government as one of the main drivers of poverty. During the 20 years from 1987 to 2007, a succession of droughts and floods resulted in significant loss of life and considerable economic loss. In September 2013, heavy rainfall triggered severe flooding in the North- western and South-eastern regions of Cambodia, causing extensive damage across 20 of the country's 24 provinces. Subsequently, it killed 188 people and almost 145,000 had been evacuated (UN, 2013). A flood event in October 2013 also resulted in damage to 440 km of national, provincial, and city roads and 64 drainage structure 2013 caused significant damage to all road types. The most calculate the cost of damages based on road types. affected provinces were determined to be: Battambang, Banteay Meanchey, Siem Reap, Kampong Cham, and Prey Veng (RGC, 2013). Therefore, the appropriate costing for climate adaptation of roads and related infrastructure projects needs to be comprehensively studied so that damages and losses caused by flood and other climate hazards can be properly incorporated from the economic and climate change standpoints.



Results

The assessment of climate change damages and losses for roads and infrastructure is a complex process that requires the use of various and mix techniques and methodologies. Hierarchical linkages are used for monitoring road damage and loss in Cambodia, with IAMF being the best. Multiple research methodologies are applied to ensure the accuracy of the results.

Overall, the evaluation of climate change damages and losses for roads and infrastructure requires the use of sophisticated tools and methods to ensure the reliability and robustness of the estimates. The "Integrated Assessment Models (IAM)" framework in Cambodia utilizes a combination of spatial and statistical analysis, as well as various tools, to provide a comprehensive evaluation of flood risks and their impact on locations managed by the Ministry of Public Works and roads and related infrastructure. Tools such as Flood Water Transport. It affected 1,557 km of rural roads and 555 Depth Estimation Tool (FwDET), ArcGIS, QGIS, Google Earth drainage structure locations managed by the Ministry of Engine, Open Street Map, simple Excel analysis, and Damage Rural Development. As a result, the flood event of October and Loss Assessment are used to identify damaged roads and



Change

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Depth Damage Curve of Flash Flood- All Types of Road from

The project goal is to enhance the climate resilience capacity of roads and related development sectors in Cambodia.

Impact: contribute toward building climate resilient transport and small-scale irrigation infrastructures in Cambodia by adopting the cost effectiveness methods of adaptation, and improving the national climate resilient capacity in order to save the national budget and optimize the economic growth.

Key project outcome: analyses of damages and losses and adaptation costing due to impacts of climate change incorporated into development planning of roads and



#### related infrastructure programs in Cambodia.



Result of inundation change in future 2031-2060 relative to baseline period under CMIP6 projection scenario

10 0.06 20% 17% 0.05 **RR001** 

Result of inundation absolute change in future 2031-2060 relative to the baseline period under CMIP6 projection scenario

# Scale up plan

# **Approaches and technology used**

The project approach will investigate the appropriate adaptation costing for infrastructure aspects through experimental studies on cost benefit analysis, and damages and losses.

Approaches to estimate Loss and	Adaptation Strategies	Cost Benefit Analysis
<ul> <li>Damage</li> <li>1. Historical data</li> <li>2. Projected data</li> <li>3. Aspects: Maintenance and performance of Development projects</li> </ul>	<ol> <li>Design parameters</li> <li>Choice of materials</li> <li>Maintenance</li> <li>Life-cycle costing</li> </ol>	<ol> <li>Adaptation Strategies with climate change scenario</li> <li>Adaptation Strategies without climate change scenario</li> </ol>



The next steps forward in addressing the issue of road damage caused by hazards in Cambodia could include implementing the most effective, efficient, and feasible policy options identified in the report.

- 1. Continue update tools and methods: Updating tools and methods for assessing damages and losses from climate change in Cambodia will help to accurately determine the impact of hazards such as floods and droughts on roads and other infrastructure projects based on historical data – recorded by Ministry. The report could use a mixed methods approach, combining literature review, primary data collection, and analysis to better understand the costs associated with loss and damage.
- 2. Utilize statistical analysis: Utilizing statistical analysis, spatial analysis, and policy analysis will help to understand the impact of hazards on roads in Cambodia, and to identify potential policy options for addressing these impacts. This analysis will provide a more comprehensive understanding of the situation and help to guide the implementation of effective policy solutions.
- 3. Address the need for a ministerial policy: Addressing the need for a ministerial policy on adaptation costing methods and the lack of plans for promoting the resilience of road infrastructure at the provincial level will help to ensure that the project is carried out most effectively and efficiently possible.
- 4. Adaptation guideline: The development of Adaptation Guideline is an importance scale up plan for reducing impacts of climate change on road infrastructures. This will help decision-maker addressing climate change and related issues.

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