CLIMATE AND ENVIRONMENT

Addressing Critical Issues for Building Climate Resilient Infrastructure

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Abstract

Infrastructure provides critical social and economic services towards meeting developmental needs of the economy. As infrastructure investments have an economic life expectancy of 30 years or more, infrastructure is sensitive to prevailing climate during construction and to future climate variations and these aspects need to be incorporated in the design. Considering an investment of around US $90 trillion is required for new infrastructure over the next 15 years, it is imperative to build infrastructure that is climate resilient. This brief looks at the key building blocks – adequate finance, enabling environment and technical solutions – for climate resilient infrastructure.

Challenge

The changing climate, manifested through weather anomalies and extreme weather events pose direct physical risks to infrastructure and assets and threaten vital infrastructure. During the occurrence of extreme climatic events, such as cyclones, extreme rainfall, etc., inundated roads, uprooted trees, and fallen electric poles block connectivity, affect traffic, and disrupt evacuation operations. Generally, a significant proportion of the economic loss of an extreme weather event is attributed to the direct physical loss and damage to infrastructure. Interruptions in infrastructure services have significant implications as it leads to severe negative economic impacts. Given that infrastructure investments have an economic life expectancy of 30 years or more, it should be realized that it is sensitive to climatic conditions prevailing during its construction and to future climate variations (UNDP, 2011).

Taking into account the vulnerability of infrastructure to climate change impacts, it is imperative that climate change concerns are a key consideration while designing infrastructure. Typically, infrastructure is designed to withstand the most extreme or close-to-the-most extreme events. However, studies indicate that the current design standards do not meet the demands of climate change and emphasize the need to introduce new design standards to accommodate future climate scenarios (Regmi and Hanaoka, 2009). Typically, civil engineering inherently requires the design of infrastructure to be in coalescence with the environment. However, the current challenge lies in upholding this practice while accounting for climate change.

The current practice only considers only past climate patterns, which are likely to be altered due to climate change (TERI, 2018)Typically, infrastructure is designed based on historic climate data; however, during their design life they could be subjected to a varying climate which may be different from past climate trends. The climate is projected to change at an increasingly rapid pace and is likely to alter long-term climatic averages and the frequency and severity of extreme weather events, all of which play an important role in the planning, design, operations, maintenance and management of infrastructure. The lack of climate related information for designing and adopting appropriate adaptation measures for infrastructure also poses a barrier. Further, there are no enabling

policies and environment to steer the current and future course of infrastructure management to ensure the mainstreaming of climate change concerns into infrastructure development. Apart from this, the existing literature suggests that climate proofing infrastructure will require additional financial costs.

A World Bank study estimates the price tag between 2010 and 2050 for adapting to an approximately 2 °C warmer world by 2050 will be in the range of $70 billion to $100 billion a year. Out of this, infrastructure sector accounts for the largest share of adaptation costs based on past studies (World Bank, 2010). Also, it is generally accepted that $1 of preventive measures equals to $5 of repairs (Pacific Region Infrastructure Facility, 2013). Therefore, to prioritize investment decisions for resilient infrastructure, there is a need for a comprehensive policy framework to integrate climate resilience, improve risk assessment and information and identify innovative financing mechanisms.

Proposal

Investing in climate resilient infrastructure makes good business sense as it can prevent inefficiencies and costly retrofitting of infrastructure while reducing the vulnerability of societies. Over the next 15 years, the world will require about US $90 trillion in new infrastructure to replace ageing infrastructure in advanced economies and to accommodate higher growth and structural change in emerging markets and developing countries. This will require concerted efforts to systematically leverage all sources of finance, expertise, and solutions to support sustainable and resilient growth.

As countries are coping to deal with climate variability and extreme weather events, there is a clear need for action and efforts to minimize the risks posed by climate change and incorporate climate change considerations in the infrastructure development goals of the country. To achieve this, climate-resilient development should be at the forefront of any development. The agenda for climate-resilient development should be multi-sectoral and should include strategies that integrate both the management of risk and the ability to respond to climate change and its impacts. Climate resilient infrastructure

development should look at addressing vulnerabilities, implementing climate change adaptation measures, and facilitating governance and financial mechanisms that provide an enabling environment for climate-resilient development. To this end, the strategies and means to implement these strategies has been proposed.

Proposal 1: G20 member countries should mainstream climate change concerns when planning and designing infrastructure to develop climate resilient infrastructure.

Rationale:

- Current construction and maintenance practices for infrastructure development are not sensitive to the changing climate. Also, the impacts of climate change on infrastructure vary across regions.
- There is a need to update climate thresholds in design standards, codes and guidelines for infrastructure development to account for climate variability. In light of the changing climate and increasing frequency and intensity of climate-induced extreme events, the existing design considerations fall short.
- On account of the unpredictability associated to extreme climate events, design parameters incorporating climate change concerns for infrastructure development is mostly not considered. Climate projections predict alterations in long-term climatic averages and the frequency and severity of extreme climate events which play a crucial role in planning, designing and management of infrastructure.

Suggestions for means to implement:

The climate change impacts on infrastructure vary across different regions in a country. Moreover, it is observed that appropriate maintenance practices and schedules will play an integral role in building resilience of infrastructure. Tailor-made region-wise construction and maintenance guidelines should be

formulated by relevant government authorities in the developing countries and should be implemented and enforced.

The set guidelines and codes that exists for infrastructure design and development in most developing countries are outdated and do not include state-of the-art technology options. They also do not address emerging concerns such as climate change. As a way forward it is recommended that climate thresholds be identified through detailed studies based on latest scientific knowledge on projected climate change and be incorporated in the infrastructure development standards, codes and guidelines for mainstreaming climate change concerns. The climate thresholds can be identified by a detailed analysis of design standards and based on the extent of loss and damage on infrastructure due to past extreme climate events. It is recommended that relevant regulations, codes and guidelines be updated by the relevant government authorities with technical assistance and handholding provided by sector experts and its provisions be made mandatory to be incorporated in construction and maintenance practices in light of climate change impacts. The revision of the guidelines and regulations should incorporate design parameters that accommodate projected change in climatic events and impacts, especially frequency and intensity of storm surges and wind speed in coastal areas. The regulations and guidelines when incorporating potential climate risks should at the least include a reliable framework that monitors the durability of the infrastructure in light of the changing climate.

Proposal 2: G20 member countries should strengthen an enabling environment to mainstream climate change concerns in planning and approval processes for infrastructure development and improve access to climate risk information, and capacity building for informed policy formulation.

Rationale:

- There is a need to strengthen the interlinkage of planning, design, construction, and maintenance of infrastructure and climate-resilience measures at the policy level. There is a need for a comprehensive climate mainstreaming plan and policy to steer the current and future course of

infrastructure development.

- Collection and integration of data for resilience building of the infrastructure is most often a challenging process. Climate risk information and data is mostly unavailable for planning and designing of infrastructure and for informed decision making.

- Technical and institutional capacity gaps at various levels poses as a challenge for integrating climate risk concerns in infrastructure development

Suggestions for means to implement:

In the absence of a comprehensive policy, there are no mandates and implementation mechanisms to ensure the mainstreaming of climate resilience for infrastructure development. Climate change considerations should be included as one of the key parameters during the planning and design stage of infrastructure projects. Identification and mapping of vulnerable areas at the regional scale and detailed risk assessment studies for high vulnerability regions should be made mandatory by relevant government authority as part of the planning and approval process for expansion and upgradation of infrastructure. To this end, it is recommended that vulnerability assessments should be included as part of the feasibility study conducted for infrastructure development. Based on the assessments, the Detailed Project Report (DPR) should include the cost of the climate adaptation interventions that need to be implemented for climate proofing the infrastructure.

Innovative data management tools and mechanisms that address climate resilience of infrastructure should be encouraged and adopted by the Government. It is recommended that climate risk information should be recorded and updated regularly by relevant government authorities with an objective of facilitating resilience planning efforts for infrastructure development. It is also strongly recommended that a national level exercise on data generation, management and analysis quantifying the impacts of climate change on efficiency of infrastructure operations in different regions should be conducted.

Improved access to climate information should be complemented by strengthening of technical and institutional capacity so that the information can be used for informed decision making. The national exercise on data generation, management and analysis should be consorted with capacity building programs for government agencies, industry, academia, and institutions, to build requisite knowledge base to assess climate vulnerability of infrastructure. Research and capacity development of relevant government departments is required to explore alternate construction materials and technologies and also to bridge knowledge and capacity gaps of engineers, practitioners, and consultants for building resilient infrastructure.

Proposal 3: G20 member countries should direct concrete efforts towards leveraging on innovative financial mechanisms for maximizing investment in the development of climate resilient infrastructure.

Rationale:

- Climate proofing infrastructure to make it resilient to future climate risks and uncertainties will require additional financial costs.
- Investing in resilient infrastructure makes good economic sense as it improves efficiencies and reduces vulnerabilities.
- Cost-benefit assessments for climate adaptation in the infrastructure sector are practically non-existent. Post-disaster assessments of loss and damage are typically limited to direct physical impacts and repair costs only, thereby limiting the estimation and understanding of the benefits and co-benefits of adaptation interventions.

Suggestions for means to implement:

Access to climate risk information for conducting cost benefit assessment should be improved. To assess risks, systems that capture and update comprehensive data on infrastructure and climate change impacts need to be established. It should be utilized to develop infrastructure plans which in turn

will help investors to prioritize their investment decisions. Concerned government departments handling public procurement process for construction of infrastructure should consider the value of climate resilience when evaluating competitive bids, i.e. bids which have accounted for the additional upfront cost or operational expenditures for developing climate resilient infrastructure should be incentivized. The public finance that is available for infrastructure development is limited. Reliable public finance mechanisms that support infrastructure recovery need to be in place. The Government should establish and promote innovative financing instruments that incentivize resilient infrastructure and provide efficient risk transfer mechanisms. Private finance should also be mobilized for developing climate resilient infrastructure. The government should ensure the availability of different types of risk transfer mechanisms such as climate risk insurance, resilience bonds etc., that protect the public and private sectors from huge financial losses due to disasters and climate change. Supporting policy reforms should also be in place to back these risk transfer mechanisms. Apart from this, value-for-money innovative engineering practices, including adaptive designs and nature-based solutions, should be adopted for enhancing resilience.

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