Climate Change and Natural Disasters

Full Description

The risk of natural disasters affects infrastructure projects and must be considered throughout the project cycle. Climate change introduces additional challenges by increasing uncertainty and the probability of extreme weather events. PPPs, as long-term contracts, require particular care in the identification, mitigation and allocation of risk. This section focuses on whether and how PPPs can be utilized when facing climate change and natural disaster-related risks.

Impacts of climate change on infrastructure are expected to worsen in the future. Therefore, climate change considerations should be factored into government decisions regarding infrastructure, irrespective of delivery or financing mechanisms. The scientific community predicts that the intensity and frequency of extreme weather conditions around the globe will increase in the medium term. Thus, the critical infrastructure at the foundation of basic economic activity is at risk. For example, in the energy sector, rising temperatures and extreme weather conditions can lead to unmet energy demand, rising costs for cooling and asset damage.

Traditionally, hazards from weather and disaster-related events were estimated through probability distributions of historic data and trends. However, today's changing climate is posing unpredictable risks. Incidence patterns of tropical storms, floods and heat waves cannot be extrapolated from past records nor can their severity. Many factors contribute to the uncertainty, including the path of future emissions and the sensitivity of the climate system to concentrations of atmospheric greenhouse gas (GHG) emissions. A changing climate not only represents a risk in terms of increased frequency and intensity of extreme weather events, but also through gradual, longer-term incremental changes.

As of 2017, the most sophisticated climate forecasting models are not reliable at the regional level, let alone the project level. For example, there remains a high degree of uncertainty regarding rainfall in western Africa; some models predict a significant increase, others a massive decrease. Faced with such uncertainty, governments need to build their infrastructure facilities to withstand scenarios that could derail their projects, rather than build for one specific scenario. The **World Bank report on Investment Decision-Making under Deep Uncertainty** (Hallegatte et al. 2012) outlines a path for practitioners to build robust infrastructure in the face of these highly uncertain outcomes, keeping the cost of being wrong about future events as low as possible.

A **World Bank study: The Costs of Adapting to Climate Change for Infrastructure** (WB 2010, 10) highlights how climate change poses a dynamic risk factor to multiple infrastructure investments. PPP policy frameworks and procurement processes need to be designed and managed to take account of climate-related uncertainties, especially in the case of large-scale infrastructure investments.

As PPP contracts are long-term and generally inflexible arrangements with lock-in effects, failure to address climate risks exposes stakeholders to long-term vulnerabilities over the life of the asset. If unaddressed at the beginning of the investment decision-making process, the public sector, by default, remains the party of last resort when an infrastructure asset delivering public services stops functioning properly because of a climate event. Private partners will seek redress from the public sector to compensate their losses unless the PPP contract stipulates otherwise.

Climate change and PPP policies

At the national level, good practice consists of incorporating climate change policies and commitments into PPP policy frameworks and/or Public Investment Management (PIM) guidelines. An **OECD policy paper** (OECD 2009) discusses how to mainstream climate change at the national, sectoral, project and local level.

This is a critical step towards building a systematic institutional approach to climate change. The lessons from national level efforts in the UK and Australia are summarized in a **World Bank study on alignment of climate change policies in the PPP policy frameworks** (WB-Risk)**.** They may provide guidance to policy makers in middle income and developing countries. Further, policy makers can utilize country-level climate change and disaster risk indices and screening tools to frame their sectoral infrastructure policies in line with the specific potential risks and impacts of their geographic zone.

Governments can seek policy, financial and technical support from multilateral institutions in many areas including screening for climate change and disaster risks. International financing instruments include the **Green Climate Fund** (GCF), which allocates resources to climate-resilient and low emission projects and programs. Also, several **Climate Investment Funds** (CIF) support governments at the development planning and project financing stages. These instruments can be used to finance infrastructure resilience and can potentially absorb the cost of adaptation.

Adaptation and mitigation measures

Mitigation and adaptation measures are needed when addressing climate change. **Adaptation** refers to the impact of climate change on infrastructure assets and what can be done to reduce their vulnerability, and enhance their resilience. **Mitigation** addresses strategies or actions taken to remove or reduce the level of GHG emissions. The **Intergovernmental Panel on Climate Change** (IPCC 2017) sets out strategic considerations for adaptation and global-scale mitigation, and presents near-term response options. **NASA** provides scientific data supporting this two-pronged approach. The **European Climate Adaptation Platform** (CLIMATE-ADAPT 2017) provides tools and methodology for addressing adaptation. Broad policy and institutional reforms integrating both mitigation and adaptation approaches into the PPP framework are critical to ensure that infrastructure projects are designed to consider costs and measures that provide a buffer from the consequences of extreme weather conditions and natural disasters, including the occurrence of stranded assets.

The traditional measures to address climate change risks such as relief and compensation Agreements, *force majeure*, asset insurance, and other contractual provisions that trigger renegotiations are generally enforced at the project level. They are discussed in detail in the **World Bank Report on Recommended Contractual Provisions** (WB 2017e). These measures are mainly ex-post reactive measures. They seek to redress the impacts and damages to the infrastructure after the event. However, parties involved in the PPP contracts may use legal and other contractual loopholes such as uninsurable events and *force majeure* clauses to disclaim responsibility for the cost of repairs/rebuilding and leave the government with the burden of shouldering these costs. Embedding the systematic adoption of some type of insurance in the national infrastructure or PPP policy will increase the cost of infrastructure but reduce the fiscal hardships caused by extreme climate events and natural disasters.

Chile has addressed this issue by stipulating that earthquakes are not considered *force majeure* in the country because of their frequency; indeed, earthquakes are evidently not unexpected events there. **Chilean PPP law** (CL 2010b) states that catastrophic risk must be covered by insurance—in practice exempting earthquakes from consideration as an event of *force majeure*. In the 1980s, Chile faced significant fiscal costs due to infrastructure damage following frequent earthquakes. However, in recent decades, Chile developed its road network utilizing PPPs, requiring mandatory insurance from private partners. As a result, the 8.8 magnitude earthquake in Chile in 2010, where infrastructure losses totaled $21 billion, had almost no fiscal impact on roads built through PPPs. This is good practice—the Chilean approach should be emulated wherever possible.

Countries where the incidence of natural disasters is high should require insurance protection for major events. For example, as earthquakes are common in Chile, so are hurricanes in the Caribbean. For projects where insurance is not available, governments could consider protecting against disaster-related *force majeure* events by obtaining catastrophic protection through a Catastrophe Deferred Third Party Risk

Mitigation and Credit Enhancement.

However, due to the unpredictability of low-probability, high-cost climate change-related events, this approach will not be feasible for such events as sea level rise or changing extreme weather patterns.

The costs of adaptation measures at the early stages of an infrastructure project are small compared to the future costs of rebuilding or repairing infrastructure. Retrofitting infrastructure, i.e. redesigning the asset after construction, is extremely expensive and sometimes impossible. A **World Bank study** (ESMAP, 5) estimates that adaptation measures cost no more than two percent of the total cost of infrastructure assets. This estimate may vary depending on the type of infrastructure, location, and other factors. However, preventive adaptation actions at an early stage of the project cycle can generally help avoid high future costs if climate conditions worsen. Moreover, the probability that an infrastructure asset will continue to provide its services over its intended lifespan is enhanced when it is financed and built with climate risk considerations. An academic study on **Climate Change and Infrastructure Impacts** (Schweikert et al. 2014) on roads shows how pro-active adaptation measures result in lower fiscal costs and higher connectivity rates as early as 2025. Examples of options, recommendations and best practices for adapting to climate change for infrastructure in the PPP context are set out further in this section.

Addressing natural disasters in PPP policy

Commercial insurance provides coverage for most natural disasters. However, some risks cannot be quantified and therefore priced by the private sector. In these circumstances, risks cannot be transferred to third parties and must be faced by governments—PPP operators will not assume those risks. They will be explicitly allocated to government in the contract, or implicitly through *force majeure* provisions. As PPP operators do not bear the consequences of extreme risk events, their incentives to design resilient infrastructure will be limited.

When procuring PPPs, governments usually transfer responsibility for asset design to the private sector, which will obey economic rationality to satisfy the contractually-defined project goals. When significant risks affect government rather than the private sector, the contracting authority needs to play a more active role in defining minimum project characteristics to protect the public sector and the users from extreme risk events, for example, prohibiting project construction in flood or landslide prone areas or defining strict construction standards. More generally, climate change-related risks need to be identified specifically throughout the procurement process. This is described in greater detail in Assessing Project Feasibility and Economic Viability.

Finally, if mitigation is likely to require a costly and uncertain process of adaptation over time, such as evolving specifications or maintenance standards, then a PPP may not be the optimal solution.

The Uruguay Weather Derivative

Uruguay’s state-owned public electric company, Administración Nacional de Usinas y Trasmisiones Eléctricas (UTE) relies on hydropower to generate more than 80 percent of its energy needs. When rainfall and/or accumulated water reserves is low, UTE must purchase alternative fuels (mostly oil and natural gas) as inputs. When the price of oil is high, generation costs become expensive, affecting UTE’s bottom line, and creating problems for both consumers and the national budget.

In 2012, water shortages increased UTE production costs to a record $1.4 billion, far exceeding the company’s original projections of $953 million. To cover the gap, UTE borrowed funds from the market, drew from the country’s $150 million Energy Stabilization Fund, and increased consumer rates. The government of Uruguay asked the World Bank for technical support to hedge UTE’s financial exposure to low rainfall and high oil prices.

On December 18, 2013, the World Bank executed a $450 million weather and oil price insurance transaction for UTE. The transaction insured the energy company for 18 months against drought and high oil prices. To measure the extent of a drought and potential insurance payouts to the company, the transaction measured and collected daily rainfall data at 39 weather stations spread throughout the two river systems on which Uruguay's hydropower is dependent: the Rio Negro and Rio Uruguay. If precipitation fell below the level set up as trigger of the contract, UTE would receive a payout of up to $450 million based on the severity of the drought and oil price levels.

Source: (WB 2014)

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