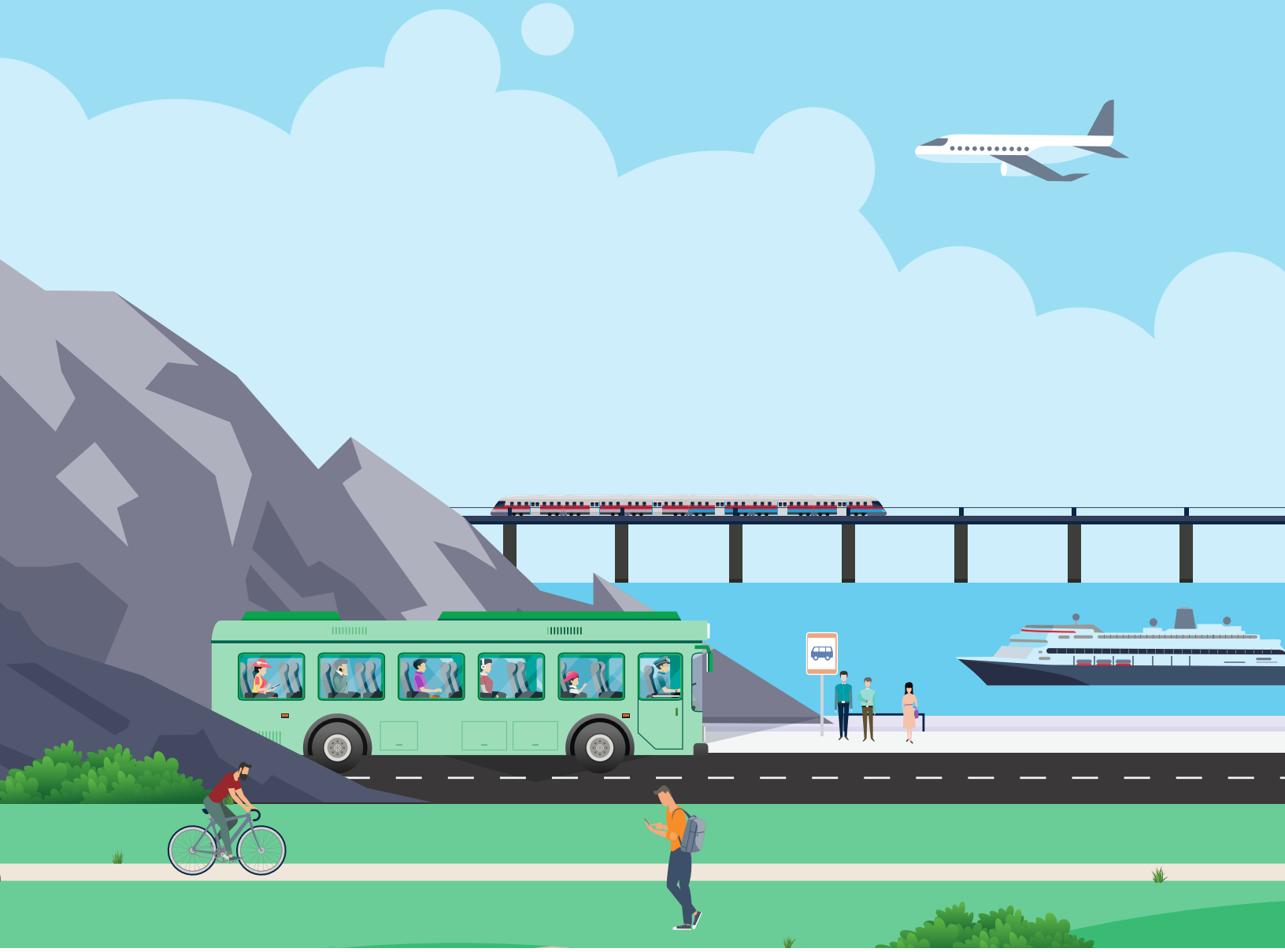
Mobility and Transport Connectivity Series

Transport Resilience Financing, Resources and Opportunities



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Transport Resilience Financing, Resources and Opportunities

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About PPIAF

PPIAF helps developing-country governments strengthen policy, regulations, and institutions that enable sustainable infrastructure with private-sector participation. As part of these efforts, PPIAF promotes knowledge-transfer by capturing lessons while funding research and tools; builds capacity to scale infrastructure delivery; and assists subnational entities in accessing financing without sovereign guarantees. Donor-supported and housed within the World Bank, PPIAF's work helps generate hundreds of millions in infrastructure investment. While many initiatives focus on structuring and financing infrastructure projects with private participation, PPIAF sets the stage to make this possible.

Foreword

Transport is a lifeline for economic growth, job creation, and access to essential services. As extreme weather events become more frequent, the resilience of transport systems has emerged as a critical development challenge — particularly for low- and middle-income countries. Roads washed away by floods, ports disrupted by storms, and rail lines cut off by landslides don't just delay journeys — they disrupt livelihoods, trade, and development itself.

This report delves into the evolving landscape of how we finance transport resilience — globally and nationally. It analyzes 42 global financing facilities, 33 public funds, and 29 tax measures, revealing a sobering reality: while the need for adaptation is urgent, the financing remains fragmented, underutilized, and often misaligned with long-term resilience goals.

But this report goes beyond identifying gaps. It offers a roadmap. With practical, innovative, and context-specific solutions, it outlines how countries and their partners can mobilize funding, embed resilience into national planning and budgets, and engage the private sector at scale.

The World Bank Group remains committed to supporting client countries in this endeavor. With our convening power, technical expertise, and financing instruments, we can help bridge the divide between ambition and implementation — ensuring transport systems not only support today's economic and social needs but also withstand the challenges of tomorrow.

Binyam Reja
Global Practice Manager for Transport
The World Bank

Executive Summary

Transport infrastructure and services are exposed to a wide range of climate and disaster risks. If these risks are not addressed, they can cause serious economic and social impacts — from damaged infrastructure and safety hazards for users to disrupted access to essential services, business centers, trade routes, and emergency corridors.

Investing in resilient infrastructure in low- and middle-income countries (LMICs) offers transformative potential and could help societies and economies adapt to these increasing impacts of climate change. World Bank Group estimates indicate that every US$ 1 invested could yield US$ 4 in benefits. For the transport sector — which spans railways, roads, urban transport, ports, and aviation — such investments are vital.

The World Bank's Country Climate and Development Reports (CCDRs) also highlight the urgent need for integrating resilience into transport infrastructure financing. They underscore that resilient transport systems are critical for sustaining economic productivity and social well-being. They also call for increased investment in climate-adaptive infrastructure to mitigate risks from extreme weather events, particularly in developing countries.

Transport resilience financing challenges

Developing countries increasingly understand the need to strengthen their infrastructure. However, individual projects struggle to secure funding as it is hard to measure the benefits of resilience. Adaptation efforts often come with extra costs, and limited financing options make these expenses a major challenge. A stark imbalance persists between mitigation and adaptation financing. In 2022, adaptation finance amounted to just one-eighteenth of mitigation finance. Climate mitigation, being a global priority, attracts more attention and funding, with donors from developed countries providing grants or purchasing carbon credits from developing countries to offset global emissions.

However, adaptation is predominantly a local challenge, requiring tailored solutions to address specific vulnerabilities. Among the 42 global climate financing facilities this report reviewed, adaptation is rarely a focus, placing the burden of resilience efforts largely on individual countries. Moreover, the transport sector often does not rank as a priority for these facilities. This is also evidenced by the climate finance landscape report, which indicated that the transport sector mobilized only 2 percent of the total adaptation finance in 2022.

The outlook at the country level is similarly concerning. This report analyzed 33 public funds across multiple regions, including road funds, national and sub-national climate funds, public infrastructure funds, and national development banks. Resilience is seldom explicitly identified as a priority. Additionally, significant gaps in data on funding contributions and utilization create major information barriers. These gaps make it difficult to understand how funds are currently used and how they could help finance transport resilience in the future.

In exploring funding sources for transport resilience, this report reviewed 29 tax measures, including infrastructure levies, carbon taxes, vehicle taxes, and fuel taxes. Among the countries that have established infrastructure levies, two-thirds no longer actively use them due to challenges such as economic downturns, insufficient revenue generation, and implementation risks related to

inefficiency or mismanagement. While vehicle and fuel taxes offer significant potential for resilience financing, it is essential to explore additional innovative tax measures in the context of e-mobility and other transport technologies transition.

Developing countries continue to rely heavily on multilateral development banks (MDBs) for adaptation financing. These MDBs account for over one-third of total adaptation financing. Bridging the financing gap for adaptation and improving the justification and implementation of resilient infrastructure are critical to achieving long-term climate goals.

Overall, financing remains insufficient to address the growing risks and vulnerabilities. Greater investment is needed to strengthen resilience across transport systems, ensuring they can withstand impacts while supporting sustainable economic growth. Expanding concessional finance, mobilizing private sector capital, and enhancing policy frameworks are key to closing this gap and advancing climate-resilient development.

Proposing innovative solutions to close the transport resilience finance gap

This report presents information on 42 global financing facilities, 33 public funds, and 29 tax measures, offering valuable insights into financing transport resilience in developing countries. It aims to support the World Bank transport team and policymakers in developing countries by providing a clearer understanding of current resilience financing resources and challenges.

It emphasizes the need for a combination of innovative approaches, strategic partnerships, and diverse funding sources to address this critical challenge effectively. It also proposes potential solutions to bridge the gap in transport resilience finance and implementation.

Here are some key recommendations:

1. Accessing International Climate Finance

MDBs: Advocate for increased MDB financing for adaptation projects, particularly in the most vulnerable countries in Africa and South Asia.

Global Climate Financing Facilities: Leverage existing funds supporting climate adaptation initiatives and advocate for including transport resilience as a priority. Increase awareness of the significant imbalance between mitigation and adaptation financing and push for a substantial rise in adaptation funding.

2. Mobilizing Domestic Public Resources

Dedicated Resilience Funds: Establish or reform national and sub-national public funds to prioritize transport resilience. Build transparency on reporting on funding contributions and utilization.

Harnessing Tax Revenue: Allocate portions of existing fuel and vehicle taxes for resilience-focused projects. Utilize carbon tax revenues from carbon trading schemes and introduce or reform infrastructure levies to generate dedicated revenue for resilient transport systems.

Additional Funding Sources: Reduce/reallocate subsidies from fuel or high-carbon or unsustainable transport options to fund resilient infrastructure projects. Explore non-road-based revenue options, such as land value capture and congestion pricing.

3. Addressing Financing Challenges

Quantify Benefits: Improve data collection and streamline tools to quantify the economic and social benefits of resilience projects to help justify investments. Having actionable climate data and climate risk information is essential to support decision making that supports resilience.

Incremental Cost Sharing: Share additional adaptation costs between governments, donors, and private investors to improve feasibility.

Better Spending: Ensure that available resources are allocated efficiently by prioritizing investments with high resilience impact. Governments should adopt a systematic approach to evaluate and rank resilience projects based on their cost-effectiveness, long-term benefits, and vulnerability reduction potential.

Role of Operations and Maintenance (O&M): Strengthen O&M practices as they are crucial for sustaining resilient infrastructure. Adequate funding should be allocated to maintaining roads, bridges, and transport networks to prevent deterioration and enhance resilience to climate events. Governments should incorporate resilience considerations into routine maintenance plans and adopt proactive maintenance strategies using risk assessments and emerging technologies.

4. Innovative Financial Mechanisms

Resilience Bonds: Issue bonds targeting investors focused on sustainable development to finance resilient transport projects.

Blended Finance: Combine public and private funds to share risks and enhance project bankability.

5. Private sector participation

Private sector participation (PSP) can play a transformative role in advancing transport resilience by harnessing their expertise, efficiency, and financial resources. However, to fully realize the potential of PSP, coordinated efforts are required across all levels of government and key functions. The second half of this report — from Chapter 5 onwards — outlines a comprehensive roadmap with actionable recommendations for governments to enhance policies, institutional capacity, project pipeline development, public funding, and financing mechanisms. This roadmap addresses the transport sector as a whole and is complemented by subsector-specific roadmaps for railways, roads, and urban transport in a separate report. A few key recommendations include:

Policy Integration: Embedding adaptation priorities into high-level national and sectoral policies, such as Nationally Determined Contributions (NDC), can elevate the importance of adaptive transport systems and send strong signals to private sector. For instance, Kenya's updated

NDC (2020) identifies prioritized adaptation programs including measures to enhance the resilience of at least 4,500 km of roads through improved designs and materials. It is also crucial to ensure that the resilience objectives outlined in NDCs are effectively translated into national strategies and planning documents, which is not consistently achieved at present. In fact, governments should include a dedicate resilience chapter in every transport masterplan on a regular basis, to identify priority investments, treating resilience with the same level of urgency as maintenance and new infrastructure development.

Innovative Contract Mechanisms: Contracts are critical to PSP as they define performance requirements and allocate risks, providing opportunities to integrate disaster resilience. Performance-Based Contracts (PBCs) offer a promising approach by emphasizing outcomes rather than inputs, improving the efficiency and effectiveness of resilient transport infrastructure and services. Contracting authorities should incorporate resilience considerations through specific contractual provisions, such as force majeure clauses, supervening events, contractual flexibility (e.g., hardship clauses, economic equilibrium provisions to allow adjustments in response to changing conditions), and risk-sharing mechanisms. These measures help systematically embed resilience into contractual frameworks, ensuring transport systems can adapt to and recover from climate-related challenges.

Country-Specific Adaptation: These recommendations must be tailored to country-specific contexts and market conditions. Piloting these approaches in countries with advanced experience in public-private partnerships (PPPs) and Performance Based Contracts — such as Brazil — can provide valuable insights and frameworks for broader implementation.

In conclusion, the World Bank Group is well-positioned to support client countries in delivering resilient transport through a full suite of solutions including technical assistance, transaction advisory services, and financing. The opportunities to collaborate range from upstream policy reforms for strengthening enabling environment and institutional capacity to midstream project pipeline preparation, and downstream financing and credit enhancement. By leveraging these resources, the World Bank Group can support its partners to achieve their climate ambitions as well as national development objectives by delivering transport infrastructure and services that are resilient to the impacts of climate change.

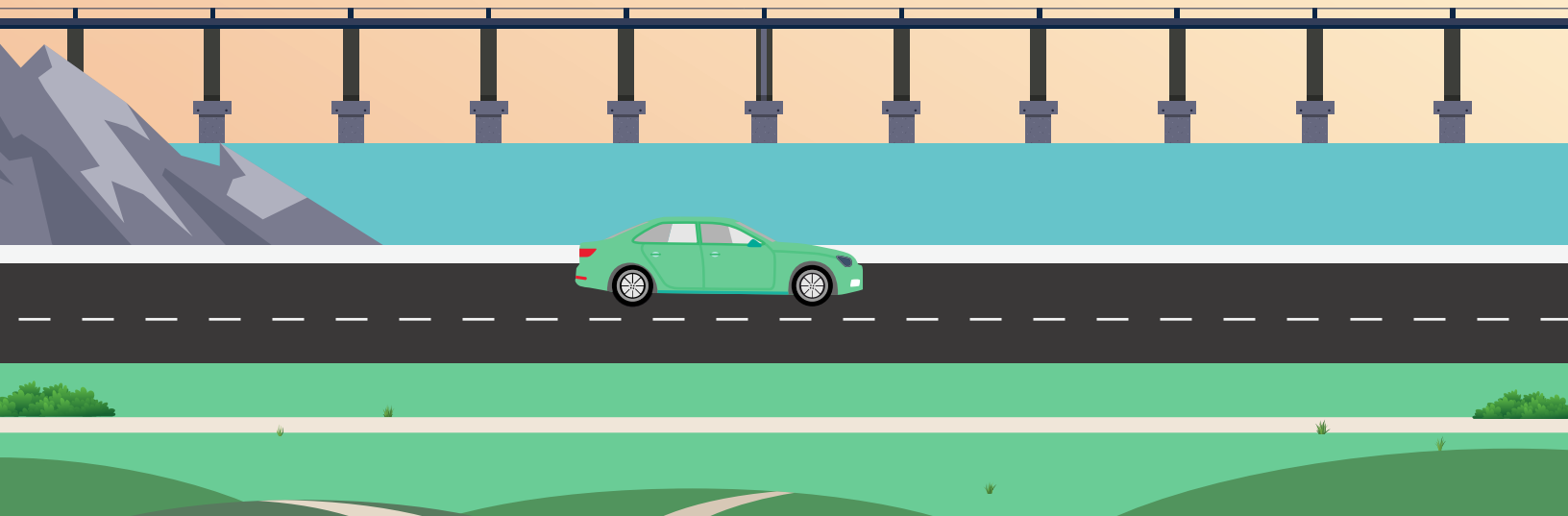
1

Introduction

As climate adaptation becomes increasingly important, thinking about the financing of such interventions is paramount. An analysis shows that developing countries need US$ 212 billion per year in adaptation finance up to 2030, and US$ 239 billion per year between 2031 and 2050. This annual financing need is more than 3 times higher than the US$ 63 billion of global adaptation finance tracked in 2022, indicating a substantial adaptation financing gap. Urgent actions are needed to address the adaptation financing gap.

Moreover, many reports show that financial resources for climate adaptation are far less available than for climate mitigation. In 2022, adaptation finance, which totaled US$ 63 billion, significantly lagged behind mitigation finance, which reached US$ 1,150 billion—making adaptation finance just 1/18th of mitigation finance. Reports from the Intergovernmental Panel on Climate Change (IPCC) suggest that delays in action to adjust this imbalance will increase the adaptation deficit in many parts of the world and further result in long term damages from climate change.

Out of the US$ 63 billion of global adaptation finance from 2022, the transport sector received one billion, accounting for only 1.6 percent. Sectors such as water, agriculture, and forestry are the priority areas: the water and waste sector accounted for US$ 31 billion (50 percent); cross-sectoral projects accounted for US$ 23 billion (37 percent); and agriculture, forestry and other land use accounted for US$ 7 billion (11 percent).



1.1. Motivations

'Transport and infrastructure' account for 12 percent of adaptation actions reported by developing countries in their adaptation commitments, typically through their National Adaptation Plans (NAPs). As such, 'transport and infrastructure' represent the third largest sectoral focus behind agriculture and livestock, and biodiversity and ecosystems. The importance of transport in adaptation policy may increase further, as countries increase their awareness of the criticality of the transport sector to the resilience of the overall economy and society, while being an emissions-intensive sector that also requires mitigation actions.

Moreover, quantifying the benefits of transportation resilience is challenging, which makes it difficult to justify investments. Countries face competing priorities to develop new infrastructure and fund improvements to aging infrastructure including resilience enhancement. The need to balance adaptation and mitigation investments with fiscal spaces is critical so investments can adhere to each country's capacity and promote resilient investments continuously. For instance, some countries might be able to afford roads with associated drainage for a 50-year flood event, while others might be limited to 30-year periods.

Public resources dominate the current adaptation financing but cannot continue to sustain this need on its own. Of the US$ 63 billion in adaptation finance, public sources including government and multilateral climate funds contributed 98 percent of this financing, and only the remaining 2 percent came from fragmented flows from the private sector.

The private sector could be a crucial source for transportation resilience. Climate uncertainty poses a significant challenge for private investors especially for projects with long time horizons, as unpredictable changes can affect project feasibility, costs, and returns over time. Large bridges, highways and toll roads may draw good attention from the private sector, as well as some well-packaged road maintenance contracts, such as output and performance-based road contracts. Investments in adaptation have high returns for country — analysis by the Global Commission on Adaptation identified US$ 1.8 trillion of investment opportunities that would yield benefits of US$ 7.1 trillion, but payouts occur more so in the medium to long term, the business case must still be made for returns in the short term to attract private investments.

The role of the private sector goes beyond resilience financing. It can provide services and products such as insurance products, bonds, etc. Private sector entities can also coordinate responses to shocks and disruptions that impact transportation systems. In fact, many governments flag that in disaster response, they do not have the capacity to respond alone, and they need the private sector.

1.2. Objective and Structure of the Report

The objective of this study is to identify pathways towards enabling and mobilizing private sector capital in tandem with maximizing the use of public resources towards the development of resilient transport systems. This angle is in line with the WBG's Maximizing Finance for Development strategy by addressing how scarce public resources can be optimized to promote PSP and investments in transport resilience, while limiting the fiscal burden of the public sector.

Chapter 2 reviews the state of play for current climate finance facilities that transport resilience financing could tap into.

Chapter 3 explores available public funding mechanisms and tax measures to be leveraged.

Chapter 4 discusses opportunities, barriers, and interventions in promoting PSP for resilient transport, and provides case studies.

Chapter 5 gives an overview of the Roadmap for Private Sector Participation (PSP) in Transport Resilience.

Chapters 6 to 9 go into detail about the policy and institutional capacity, project preparation, funding and financing aspects of the roadmap.

Chapter 10 lists recommendations on how governments and development partners can collaborate to mobilize PSP in delivering disaster resilient transport.

A related report — Sub-sectoral Roadmaps to Promote Private Sector Participation in Transport Resilience, Railways, Roads and Urban transport— includes roadmaps that summarize key information to help governments attract private sector investment. This financing scheme would complement public and concessional finance to close the climate adaptation financing gap for planning, building, and maintaining resilient transport systems using new contract methods.

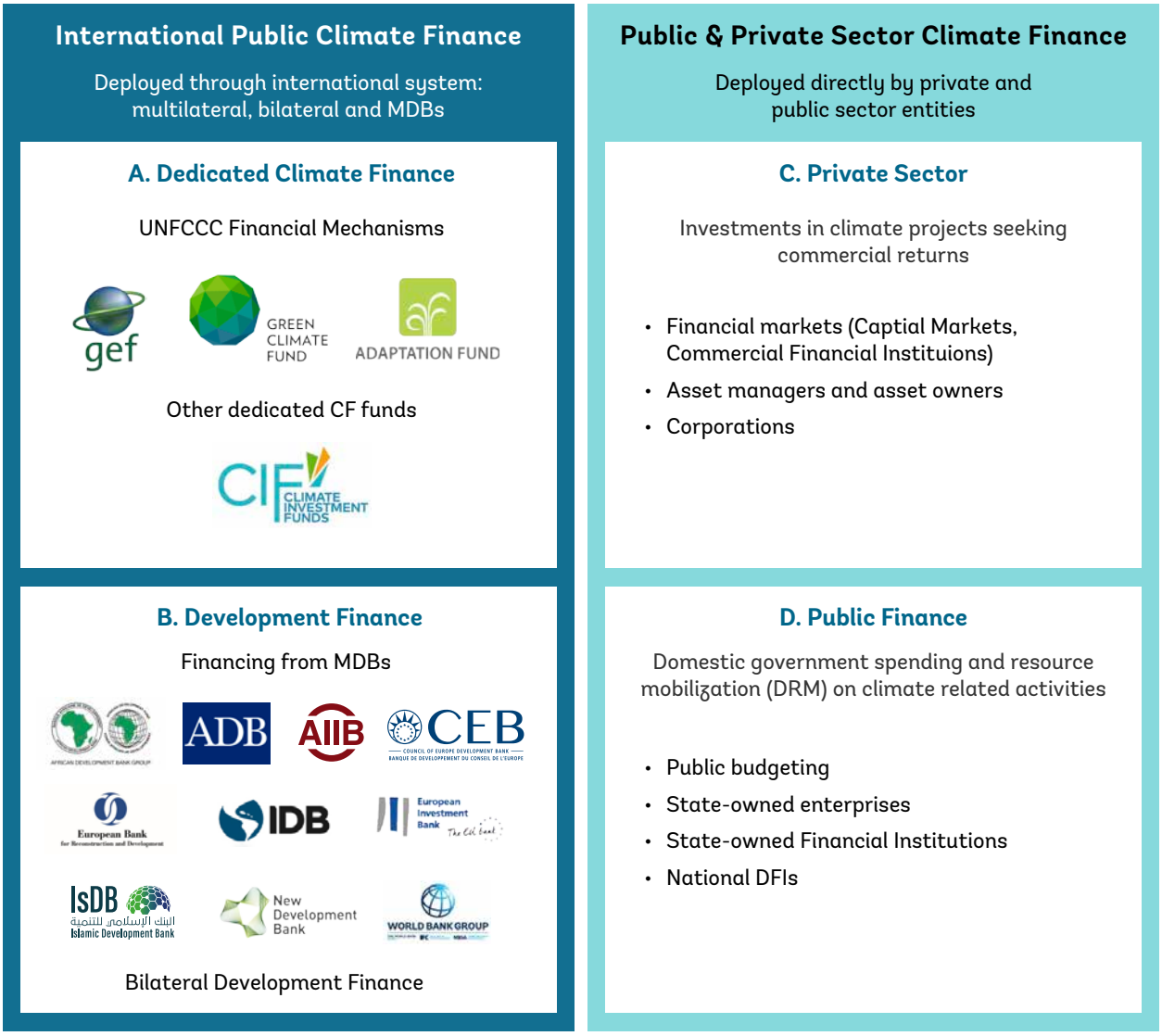


1.3. Climate Financing Framework

The "Climate Financing Framework" (Figure 1.1) presents a broad and intricate system that encompasses a range of tools and instruments in the climate financing space.

This report focuses specifically on "A. Dedicated Climate Finance" in Chapter 2 and "D. Public Finance" in Chapter 3, with most of the analysis centered around public-private partnerships (PPPs). "C. Private Finance" is beyond the scope of this work, while "B. Development Finance", particularly with respect to climate co-benefits, is an area with which the development community is most familiar, and thus is not focus of this study.

Figure 1.1. The Climate Financing Framework



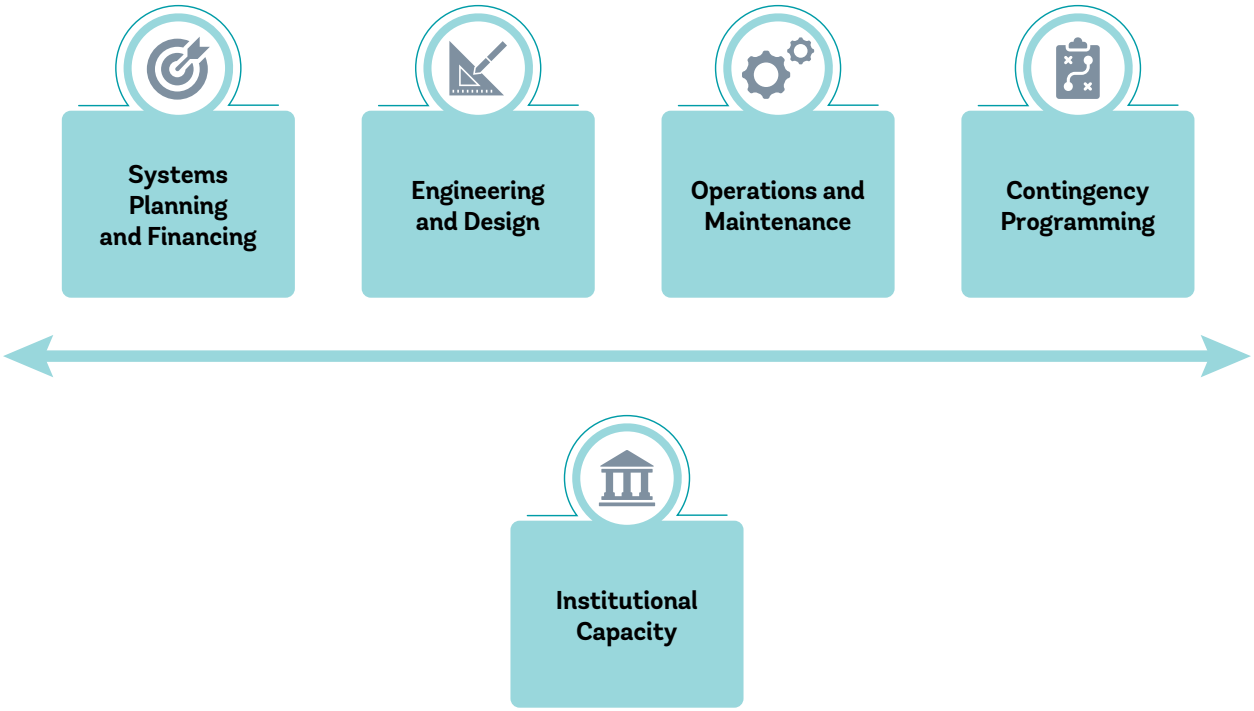
Source: World Bank.

1.4. Linking the Climate Financing Framework with the Lifecycle Approach

The Lifecycle Approach (Figure 1.2) proposed in the Disaster and Climate-Resilient Transport Guidance Note comprehensively addresses risk considerations across five pillars: system planning and financing, engineering and design, operations and maintenance, contingency planning, and institutional capacity.

Financing plays a critical role throughout this lifecycle, ensuring that resilience measures are embedded from the early planning stages to long-term maintenance and emergency preparedness. This aligns with the broader financing strategies outlined in this report, which emphasize the need for sustained investments and adaptive financial mechanisms to enhance transport resilience over time.

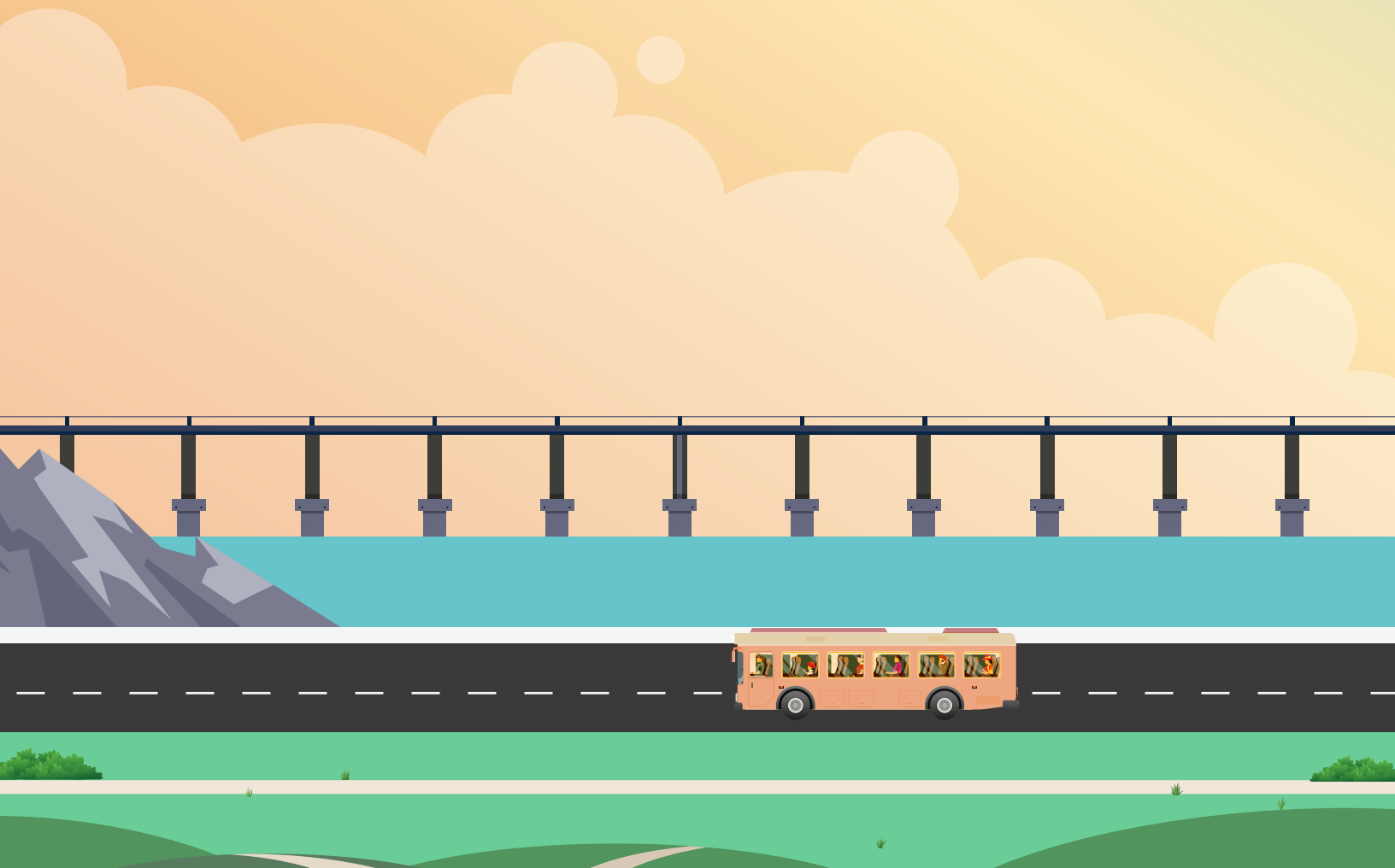
Figure 1.2. Five Pillars of the Life-Cycle Approach to Resilience



Source: World Bank.

2

Climate Finance Facilities



Climate finance facilities in this Report refer to concessional finance resources that could be utilized by the public and private sectors to promote transport resilience.

Forty-two (42) climate finance facilities were identified. These include 32 facilities that target both mitigation and adaptation actions as well as 10 facilities that are dedicated to adaptation only. Appendix A.1 has the full list.

Please note that significant additional information about the 42 facilities can be shared upon equest.

Key Insights

Insight 1: Climate finance facilities targeting both mitigation and adaptation rarely identify transport resilience as an explicit priority.

Out of the 32 facilities targeting both mitigation and adaptation, the WBG's Global Facility to Decarbonize Transport (GFDT) is the only facility that targets resilience of the transport sector, besides decarbonization.

Insight 2: Seven out of 10 existing adaptation-focused facilities include transport as an eligible sector.

The adaptation-focused facilities that cover transport are:

- Adaptation Fund
- Pilot Program for Resilience
- Small Island States Resilience Initiative (SISRI)
- Climate Services for Resilient Development Partnership
- CABEI Climate Change Investment Project Preparation Fund
- Caribbean Resilience Building Facility
- Africa Adaptation Acceleration Program



Insight 3: Six facilities specify eligible subsectors in transport.

Table 2.1. Climate finance facilities that identify transport subsectors

Climate finance facilities	Eligible transport subsectors
Smart Cities Program	Urban transport
Spanish Cooperation Fund for Technical Assistance (TAGF-SPA)	Rail
Eastern Europe Energy Efficiency and Environment Partnership (E5P)	Urban transport
Latin America and Caribbean Investment Facility (LACIF)	Road, Rail, Urban, Water and Air transport
Facility for Accelerating Climate Change Resilient and Sustainable Society (ACCESS)	Urban transport
PROBLUE	Water transport

Source: CPCS research of public information in February 2024

Insight 4: One third of facilities cover the full scope of activities, while the other two thirds cover only upstream and midstream activities

Only one-third (12 out of 42) of the identified finance facilities provide funding for the full scope of activities, covering readiness support, project preparation, and project investment.

Two thirds of these facilities specialize in funding upstream and midstream activities that strengthen the enabling environment, government capacity, and project preparation capabilities.

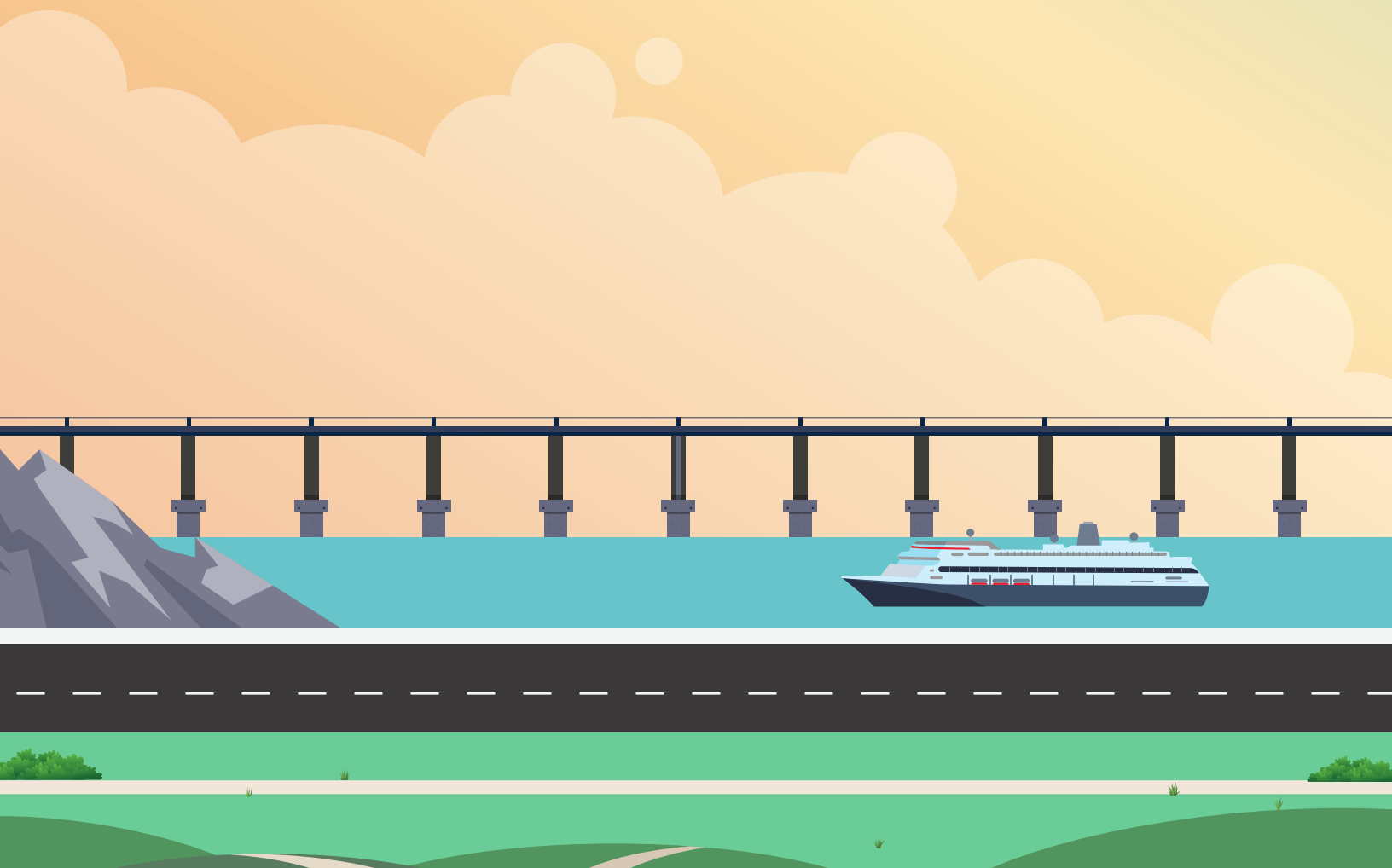
Directing resources toward upstream and midstream activities represents a key potential approach to developing a more robust pipeline of transport resilience investments.

Insight 5: Most of the identified climate finance facilities offer grants to their potential beneficiaries.

Twenty-nine (29) facilities offer grants, followed by 15 for loans, six for equity, and five for guarantees, confirming the understanding that adaptation finance has traditionally been reliant on grants as the main financing modality.

3

Public Funding Mechanisms and Tax Measures



Financing transport resilience in the face of growing climate risks remains a critical yet underdeveloped area within national and global financing strategies. While many countries have established public funds and tax instruments to support transport infrastructure and broader climate goals, these mechanisms often lack a clear mandate or structure to address resilience needs.

As climate-related disruptions to transport systems become more frequent and severe, the way public funds are mobilized, allocated, and tracked must evolve. Understanding the landscape of existing funding mechanisms — and the opportunities and gaps they present — is essential for shaping a more resilient transport sector that can sustain economic growth, protect vulnerable communities, and adapt to a rapidly changing environment.

3.1. Review of Public Funds

Thirty-three public funding mechanisms have been identified across multiple geographic regions. See Appendix A.2 for the full list of reviewed funds, which include:

- **National road funds (12):** These include funds established to administer and manage dedicated funds for the construction, rehabilitation, and routine maintenance of public roads.
- **National/subnational climate funds (8):** These are designed to crowd-in private financing for mitigation and adaptation activities, but do not include other climate funds focused on other thematic areas, such as biodiversity.
- **Public infrastructure funds (8):** These are funds that utilize public resources to leverage significantly larger private sector financing for infrastructure development.
- **National development banks (5):** These are mandated by the government to direct financial resources towards strategic sectors and projects vital for national development.

Key Insights

Insight 1: Overall 29 out of 33 (88 percent) public funding mechanisms support the transport sector. However, there is no explicit objective disclosed on support for transport resilience projects.

Although, some public funding mechanisms may already allocate funding to support resilience efforts (e.g., afforestation of highways by the Pakistan Road Fund).

Insight 2: National road funds' support for resilience is not clearly defined nor identified as part of their mandate.

While national road funds cover a wide range of activities, none have explicitly supported the funding of climate responses. Further details are presented in Table 3.1. The assessment alludes to the lack of implementation of principles across the lifecycle approach as priorities vary and activities funded tend to be reactive rather than anticipated due to poor maintenance planning. This results in backlogs and a continuous loss of road asset value due to investments being directed towards roads in worse conditions instead of those that are still maintainable, and other cases supporting other initiatives (e.g., road safety programs).

Table 3.1. Coverage of supported activities for 12 selected road funds

Activities supported by road funds	Number (out of 12)
Support construction	6
Support asset maintenance and repairs	12
Support asset rehabilitation	11
Support asset reconstruction/upgrade	7
Explicitly support climate response	0
Support the training of transport service staff	5
Support road safety programs	10
Support intelligent transport system	1
Support climate information services for the transport sector	0
Prioritize nature-based solutions in transport infrastructure	0
Prioritize the use of indigenous materials for civil works	0

Source: World Bank.

Insight 3: 50 percent of national/subnational climate funds support transport, but focus on urban transport for mitigation purposes.

Moreover, none explicitly address transport resilience within their publicly disclosed objectives.

Insight 4: Seven out of eight public infrastructure funds explicitly support the transport sector, with the road subsector as a common eligible sector. However, none include within their objective explicit support for resilience.

Funds from public infrastructure funds are utilized to develop long-term capital-intensive projects in sectors including transport. They can typically use public resources to leverage significantly larger private sector financing for infrastructure development. However, in the seven (7) identified funds, which support the transport sector, none include within their objective explicit support for resilience. This type of fund does not have a resilience mandate.

Insight 5: While some national development banks, as financiers of policy priorities, already promote transport resilience investments, their efforts remain insufficient. More institutions and countries should follow suit to scale up resilience financing and ensure long-term sustainability in the transport sector.

National development banks (NDBs) are typically mandated by the government to finance strategic sectors and projects vital for national development. In some instances, NDBs already explicitly support climate action in infrastructure projects. For example, the Development Bank of South Africa (DBSA) manages the Green Fund in South Africa, which provides capital for projects and programs that reduce climate change impacts. Bank Pembangunan Malaysia Berhad (BPMB)

in Malaysia has funded projects to improve road and rail infrastructure including projects that incorporate resilience. BPMB provided financing for the SMART Tunnel – a storm drainage and road structure that contributed to flood management and traffic management in Kuala Lumpur.

Public infrastructure funds and national development banks are typically capitalized by the host government with additional capital received from other sources such as international financial institutions or privatization proceeds. For instance, the India Infrastructure Investment Finance Company Limited (IIFCL) raises debt capital from international and domestic markets and also established lines of credit with several Multilateral and Bilateral Financial Institutions such as the ADB, the WBG, KfW, the European Investment Bank (EIB), and Japan International Cooperation Agency (JICA). Other sources of capital include proceeds from privatization. For instance, Fondo Fiduciario Federal para Infraestructura Regional (FFIR) from Argentina received the initial capitalization from privatization proceeds.

Insight 6: Transparency in reporting should be improved to enable better tracking of funding support.

There are extensive data gaps in how public funding mechanisms report funding contributions and utilization. This poses a significant information barrier in determining funding activities and how these sources could be used to fund transport resilience moving forward.

3.2. Tax Measures to Potentially Increase Public Funding

This report identified 29 tax measures that could potentially raise revenue for transport resilience investments, even though they are not specifically designed for that purpose. See Appendix A.3 for the full list, which includes:

Infrastructure levies (14): These instruments are imposed on property owners possessing land that has appreciated in value due to government-initiated infrastructure development and may include public transport and roads, green space, parking, and public utilities.

Carbon taxes (6): These instruments can take the form of a tax imposed on the carbon content of fossil fuels.

Vehicle taxes (5): These instruments can take various forms such as value-added tax, registration tax, and a road tax on passenger vehicles, at the time of vehicle acquisition or as recurring taxes during use.

Fuel taxes (4): These instruments are levied on the sale or consumption of fuels, and these taxes are relatively easy to administer and have a broad collection base.

Key Insights

Insight 1: Infrastructure levies, largely administered through local or sub-national governments, are an under-utilized instrument in most countries despite long-standing legal and policy frameworks.

Out of 14, 12 fund public roads whereas five also fund public transport. Thirteen of the identified infrastructure levies (93 percent) rely on local governments to implement and collect the infrastructure levies.

However, the use of infrastructure levies remains limited, and further exploration of implementation challenges is necessary to fully understand their potential and constraints. Of the 14 countries identified, only five (36 percent) — Colombia, the Dominican Republic, Ecuador, Egypt, and India — are actively employing this instrument. In contrast, countries like Argentina, Bangladesh, Brazil, Costa Rica, Ghana, Mexico, Morocco, Nigeria, and Peru are not currently utilizing it. The limited use of infrastructure levies may stem from various factors including economic downturns or crises, in-sufficient revenue generation, and implementation risks such as concerns over corruption, inefficiency, or mismanagement.

Insight 2: Various tax instruments, including carbon, fuel and vehicle taxes, may collect resources to support transport resilience investments.

Figure 3.1 provides further explanation of how these taxes may be allocated towards resilience efforts. These are key examples of tax instruments but may not be exhaustive.

Figure 3.1. Examples of transport-related taxes that may collect resources for transport resilience investments

 **Carbon Taxes**	Imposed on the carbon content of fossil fuels. In addition to incentivizing green transition, it represents a potential funding source for transport resilience projects. These taxes can be earmarked into dedicated funds to address climate change impacts on transportation networks.
 **Fuel Taxes**	Levied on the sale or consumption of fuels. These taxes are relatively easy to administer and have a broad collection base. Governments can allocate a portion of fuel tax revenue to support infrastructure and resilience initiatives.
 **Vehicle Taxes**	Collected at the time of vehicle acquisition or as recurring taxes during use. Can take on various forms such as value added tax, registration tax, road tax on passenger vehicle. Earmarking a portion for transport resilience projects can help address climate vulnerabilities.

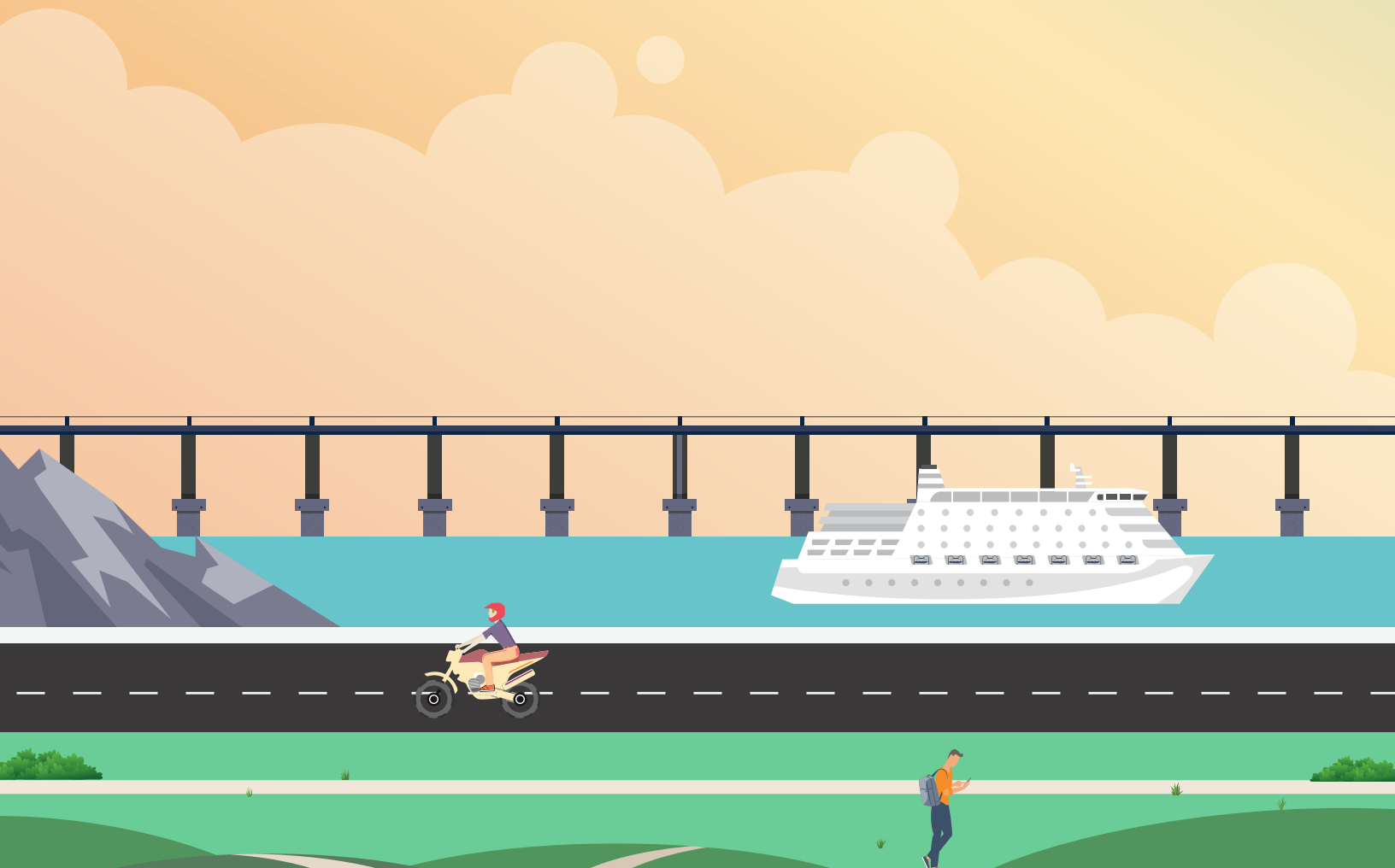
Note: These taxes are provided as examples and may not be exhaustive.
Source: Adapted from Benitez, Daniel Alberto, and Jyoti Bisbey. 2021. Financing Low Carbon Transport Solutions in Developing Countries. Ardila-Gomez & Ortegón-Sánchez (2015). Sustainable Urban Transport Financing from the Sidewalk to the Subway.

Insight 3: It is important to explore tax measures that don't rely mainly on road use and traditional transport technologies (e.g. EVs), as governments shift toward more sustainable transport modes and technologies.

Strategies to generate fiscal resources through tax measures should consider the long-term shifts towards sustainable transport modes. The decarbonization of transport systems would require shifting towards low-emission public transport, electrification, and other transformative measures. For example, land value capture (LVC) instruments may present additional funding sources for transport resilience investments. Including LVC in countries legislation will be the first step, and LVC is only feasible when countries have a good cadaster that records ownership and property characteristics.

4

Barriers, Opportunities, and Interventions for Promoting Private Sector Participation in Climate-Resilient Transport



4.1. An Overview of Barriers, Opportunities, and Interventions

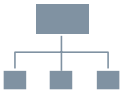
Our approach to understand barriers, opportunities, and interventions for PSP in climate-resilient transport includes stakeholder consultations and literature reviews. The stakeholder consultations included PPP units, transport authorities, private PPP contractors, financiers, legal advisors, insurers, development partners, and the World Bank Group. A total of 58 consultations spanning 39 entities were conducted. Refer to Appendix B.1 for detailed information. A literature review of over 90 relevant materials and publications were also conducted as shown in Appendix B.2.

The topics for both consultation and literature review, as detailed in Table 4.1, considered upstream (enabling environment), midstream (infrastructure pipeline development and preparation), and downstream (financing and credit enhancement) stages. The table further provides an overview of the barriers, opportunities, and interventions across these stages, as well as offers approaches to generate PSP in climate-resilient transport.

The upstream considerations refer to pillar 1 and 5, while midstream alludes to pillars 1 through 3 and pillar 5. Downstream may be interpreted as pillar 4 in the life cycle approach.

Table 4.1. Overview of barriers, opportunities, and interventions across upstream, midstream, and downstream

	Potential barriers	Potential opportunities	Potential interventions
Upstream: Enabling environment			
 **Policy and regulatory framework** Pillars 1 & 5	• Countries may lack high-level policy guidance specific to transport resilience. • Countries' economic development plans may not address transport resilience. • Countries' national plans for the transport sector and subsectors may not address resilience. • Countries' PPP legal and policy framework may not identify adaptation and resilience as an objective in general and for transport sector.	• Existing legislations and policies related to climate change and PPP as well as infrastructure masterplans provide entry points for highlighting the resilience in the transport sector. • Development partners such as multilateral development banks can provide specialized technical assistance to governments. • Knowledge assets from international transport organizations may be leveraged to identify good practices at the subsector level.	• Countries should integrate their transport resilience needs and policy priority in their high-level policy guidance. • Countries' economic development plans should address resilience in infrastructure including transport. • Countries' national plans for the transport sector and subsectors should address resilience. • Countries should identify climate change adaptation and resilience as an objective in their PPP legislative and policy frameworks. • Development partners can provide strategic technical assistance to governments to help address gaps in legislative and policy framework.

	Potential barriers	Potential opportunities	Potential interventions
 **Institutional framework and capacity** Pillar 5	• The mandate of a country's PPP Unit may not cover ensuring resilience in the PPP projects. • The current PPP processes may not adequately integrate resilience considerations throughout the whole PPP project lifecycle. • Capacity on resilience may be limited within the PPP Unit, planning and approving agencies, and transport authorities at various levels of governance.	• The growing body of reference materials developed by the development partners, governments, and private sector on resilience may be leveraged for local customization and adoption. • Government and private sector stakeholders have increasing awareness and interest about climate change in general, which may facilitate deeper capacity building on resilience for transport.	• The mandate of a PPP Unit should be expanded to cover supporting objectives related to climate actions including resilience through the PPP projects. • The PPP processes should be reformed to integrate resilience considerations throughout the whole PPP project lifecycle, especially for review and approval. • Training programs should be delivered to build capacity on resilience for existing staff of a PPP Unit, planning and approving agencies, and transport authorities. • Customized toolkits, templates, and project benchmarks should be developed to enable practical and lasting adoption of good practices by the relevant agencies. • The human resource management of key government agencies should address the needs for resilience expertise.



	Potential barriers	Potential opportunities	Potential interventions
 **Public funding Mechanisms** Pillar 1	• Fiscal resources to encourage for transport resilience investments are limited. • Current public funding mechanisms do not have a clear organizational mandate to support transport resilience investments. • Competing government priorities can reduce fiscal resources available for transport resilience investments.	• Existing public funding mechanisms may be repurposed or augmented for supporting transport resilience investments. • Some public funding mechanisms may already be formally empowered and have experience in funding projects that can contribute to transport resilience.	• Public infrastructure funds should be prioritized as a government funding vehicle to catalyze PSP in resilient transport. • National development banks should be given a clear organizational mandate for supporting transport resilience investments. • Land value capture instruments represent alternative funding mechanisms that raise funds from those who benefit from public investments land value capture. • Various tax instruments including carbon, fuel and vehicle taxes may collect resources to support transport resilience investments.
Midstream: Infrastructure pipeline development and preparation			
 **Project identification, appraisal, and structuring** Pillars 1, 2 & 3	• Good practices for identifying, appraising, and structuring PSP in resilient transport are relatively untested with limited references from actual projects. • There is a lack of investment-ready resilient transport project pipelines.	• Available publications and guidance documents for transport resilience can be localized for specific country contexts, and additional training can be provided on using the guidance documents. • Publicly available climate data and climate information products provided by development partners can be used to support climate risk screening and assessment for transport projects.	• Governments should deploy project preparation funding to facilitate and strengthen the preparation of resilient transport projects. • Governments should develop pilot projects for applying and demonstrating innovative good practices in resilient transport involving PSP. • Contracting authorities can stipulate the incorporation of resilience into project design, construction, operation, and maintenance during project development processes.

	Potential barriers	Potential opportunities	Potential interventions
 **Contractual Mechanisms** Pillars 2 & 3	• Existing legal requirements, precedents, and norms may not address issues related to climate risks. • Traditional contracting provisions may not address issues related to climate risks. • Contracts do not have measures to compensate for increased climate risks.	• There is an increasing awareness on the needs to improve contracting approaches to address climate risks. • Force majeure risks may be borne by a private party for user pays projects with high profitability.	• Governments should develop localized guidance on contracting clauses that address climate risks. • Performance-based contracting should be used to enhance resilience by linking related metrics to financial incentives or penalties. • Governments should pilot the use of innovative contracting clauses in transport and other infrastructure projects to create applied knowledge and experience.
 **Procurement** Pillars 2 & 3	• Existing legal requirements and procurement approaches that are silent on resilience needs can create a competitive disadvantage for bidders that incorporate resilience measures in transport projects. • Cost and quality benchmarks related to resilience measures in transport may be limited due to a lack of past procurement references. • Uncertainties in the local availability and cost of private sector expertise and solutions may constrain the governments in introducing innovative procurement requirements related to resilience in transport projects.	• Procurement processes that consider resilience as part of the evaluation criteria can serve to reshape markets, promote adoption of resilience practices and shift focus from short term cost savings to long term value. • The governments can use market sounding as a tool to gain market knowledge on the availability of private sector expertise and solutions for resilience in transport sector.	• Governments should pilot the use of innovative procurement requirements on resilience in transport projects to create applied knowledge and experience. • The PPP Unit and transport line agencies should develop a resilience-based procurement strategy that identifies a systematic approach to introduce resilience requirements. • Government capacity should be strengthened among the PPP Unit and transport line agencies to deliver resilience through procurement.

	Potential barriers	Potential opportunities	Potential interventions
Downstream: Financing and credit enhancement			
 **Concessional Financing** **Pillar 1**	• The project pipeline for transport resilience investment is limited among applications for concessional climate finance.	• Existing adaptation-focused facilities present opportunities for supporting transport resilience. • Funding upstream and midstream activities is key to closing capacity gaps. • Existing facilities that blend market and concessional capital can be repurposed to finance transport resilience investments	• Climate finance facilities should provide concessional resources to support project pipeline development and innovative pilot projects for demonstration of climate-resilient good practices in transport to private sector. • Governments and development partners should deploy blended finance to finance transport resilience investments • Governments and public financiers should consider providing liquidity financing (through grants, low-interest loans, guarantees, or emergency funds) that support private sector concessionaires in emergency and recovery actions to improve the resilience of transport projects during operations.
 **Private financing** **Pillar 1**	• Additional costs from transport resilience solutions and the lack of short-term financial benefits hinder transport resilience investments. • There can be a mismatch between the investment return horizons of private financiers and transport resilience investments. • Private financiers have limited guidance in terms of taxonomies, standards, and methodologies on transport resilience investments.	• Efforts have been made to promote a more robust approach in the financial sector to address climate risks and channel capital towards resilient infrastructure.	• Blended finance facilities should be used to finance transport resilience investments. • Governments may facilitate the use of innovative financial instruments such as use-of-proceeds instruments and sustainability-linked instruments to facilitate financing of resilient transport PSP projects. • The public sector should facilitate the development of taxonomies, standards, and methodologies by the stakeholders.

	Potential barriers	Potential opportunities	Potential interventions
Insurance Pillars 1 & 4	• Insufficient data and information on climate risks limit the development of insurance products. • Insurance products at reasonable costs may not be sufficiently available to meet the increasing needs for managing climate risks.	• Financiers can require the inclusion of climate insurance as part of the financing requirements.	• The stakeholders should collaborate to generate market demand from project sponsors in the transport sector. • Technical assistance and capacity building efforts should be provided to the public sector to increase knowledge on insurance features. • Governments should provide a clear regulatory framework for the insurance market, especially for innovative products such as parametric insurance.

4.2. Case Studies

Based on the findings of the literature review and stakeholder consultations, case studies, which promote PSP in resilient transport infrastructure were identified.

Box 4.1 presents the bus rapid transit project in Pakistan while Box 4.2 describes the performance based road rehabilitation and maintenance contract in Brazil.

More case study examples are detailed in Appendix C, including:

- Dakar Bus Rapid Transit Pilot Project, Senegal
- Aichi Toll Road Concession Project, Japan
- Samakhiali–Gandhidham Toll Road Project, India
- Roads and Bridges Management and Maintenance Project, Mozambique
- 4th Generation Toll Road Concession (4G) Program, Colombia



Box 4.1. Bus Rapid Transit (BRT) project in Karachi, Pakistan

Background

The BRT project is a 30km fully segregated state-of-the-art BRT including cycle lanes, a bike sharing system, last-mile connectivity, and improved pedestrian facilities, that aims to directly benefit 1.5 million residents of Karachi. The implementing agency is TransKarachi, a Public Sector Company wholly owned by the Government of Sindh. PSP was involved in the BRT operations through service contracts.

TransKarachi undertook the capital investment using government budget financed through loans from development partners such as the Asian Development Bank (ADB), Asian Infrastructure Investment Bank (AIIB), and the Agence Française de Development (AFD); while retaining full ownership of assets and the project. TransKarachi then turned over the assets to private operators which recover their operational costs with tariffs.

Key resilience actions

Robust climate risk and vulnerability assessment

- Conducted an initial climate risk screening, which identified the project as sensitive to rainfall and temperature. These risks were further analyzed through a detailed Climate Risk and Vulnerability Assessment (CRVA).
- To ensure robustness, the CRVA was guided by the ADB Guidelines for Climate Proofing Investments in the Transport Sector – Road Infrastructure Project (2011).
- The CRVA incorporated inputs from communities potentially affected along the proposed BRT route, addressing concerns related to urban flooding, traffic congestion, drainage, and solid waste.
- Historical climate data was accessed from official sources such as the Pakistan Meteorological Department (PMD) and the National Institute of Oceanography. The PMD's downscaled general circulation models were used to provide reliable climate projections for the CRVA.

Integration of resilience measures

The project optimized the use of nature-based solutions and grey infrastructure to improve resilience by increasing green space and designing the drainage system and the urban roads to adapt to flood risk. The following adaptation measures were integrated into the project design and costing to address priority climate risks: Improved urban water drainage system along the BRT corridor; bioswales and water retention measures; rainwater collection and grey water systems.

Box 4.1. Bus Rapid Transit (BRT) project in Karachi, Pakistan (Cont.)

Quantifying and financing the resilience investment

The incremental cost for road construction was estimated to be US$ 0.5 million per km, amounting to ~ US$ 10 million for the 18.9 km of the BRT. A grant of US$ 7 million was secured from the GCF to partially cover the total incremental cost of resilience investment for road construction.

The drainage system design included provisions for high levels of flooding from inception. The drainage system was designed from the outset to withstand high levels of flooding. As a result, the incremental costs of drainage were not specified, since no alternative designs.

Conclusion

This BRT project demonstrated good practices in climate risk assessment, integration of resilient measures, and the use of concessional finance from MDBs (i.e. ADB and AIIB), bilateral DFI (i.e. AFD) and concessional climate funds (i.e. GCF) to cover incremental costs of resilience investment. In addition, PSP was involved through service contracts for the BRT operations.

Box 4.2 summarizes the performance-based road rehabilitation and maintenance contract in Brazil using the CREMA mechanism. The World Bank's Brazil transport team created a framework for assessing road network resilience against climate impacts. This framework includes tools for identifying vulnerable road segments and determining risk levels. Key outputs include hazard maps and vulnerability assessments, supporting strategic planning.



Box 4.2. Design and implementation of the CREMA 2.0 Framework in Brazil

Background

The World Bank's Brazil transport team developed a novel approach for assessing the resilience of road networks, articulated in the Methodological Approach and Normative Framework for Road Infrastructure Resilience Performance Assessment. This comprehensive document outlines processes to identify and geolocate vulnerable road segments exposed to climate-related impacts such as flooding, landslides, and wildfires. It also provides tools for determining the risk levels to which CREMA (Contrato de Recuperación y Mantenimiento), a form of Output- and Performance-Based Road Contract projects, are subjected.

Key Outputs and Their Significance:

The application of the new framework yields critical outputs, including hazard exposure maps, fragility indices, vulnerability assessments, and criticality scores. These outputs provide essential data to support strategic planning and informed decision-making in resilience efforts. They form the foundation for the development of the Basic Climate Risk and Resilience Management Plan (Basic CRRMP), which outlines strategies for mitigating climate-related risks in road infrastructure.

Integration into CREMA 2.0 Contracts in Brazil

The new CREMA guidelines (CREMA 2.0) are the cornerstone of the World Bank's program for enhancing road infrastructure resilience. They establish a comprehensive framework that integrates climate risk management into road maintenance and development projects, ensuring consistency and effectiveness across all CREMA related initiatives.

A key innovation within this framework is the Basic CRRMP. This plan sets out a strategic roadmap and timeline for investments needed to reduce climate-related risks from high or very high to acceptable levels (moderate or low). It also mandates proactive, climate-resilient maintenance measures that contractors must implement consistently throughout the contract duration. This approach ensures continuous adaptation and resilience-building in response to evolving climate risks.

Furthermore, the Basic CRRMP serves as an integral reference document in the procurement and tender processes for new Performance-Based Contracts (PBCs), including concession contracts and Public-Private Partnerships (PPPs) in Brazil. It guides initial investment strategies, embeds resilience considerations into contractual obligations, and supports the long-term sustainability and adaptive capacity of Brazil's road infrastructure projects.

Box 4.2. Design and implementation of the CREMA 2.0 Framework in Brazil (Cont.)

Contractor Responsibilities and the Detailed CRRMP

Under CREMA 2.0, the awarded contractor must develop a Detailed CRRMP after restoring the operational conditions of the CREMA project within the first contract year. This living document, which requires approval from the contracting authority, is regularly updated by the contractor and serves as a reference throughout the contract's lifecycle.

The Detailed CRRMP includes: (1) The current state of conservation and maintenance of road infrastructure elements critical to resilience; (2) A comprehensive catalog of required actions with prioritization and investment schedules; (3) Proactive, resilience-focused maintenance obligations; (4) Emergency response protocols (Emergency Action Plan).

Moreover, it provides the basis for the contracting authority's supervision and auditing of resilience measures, supports the development of engineering projects, and facilitates continuous improvement activities, including resilience training and knowledge enhancement.

5

Overview of the Roadmap for Private Sector Participation in Transport Resilience



The transport sector is the backbone of every global economy and society. Governments should dedicate greater policy efforts and resources to urgently strengthen the resilience of transport systems against the impacts of climate change and natural disasters. This is crucial to avoid and reduce the severe economic and social damages that can otherwise materialize and impact wide-ranging stakeholders including users, transport companies and their staff members, investors and surrounding communities and businesses.

To this end, the umbrella Roadmap for Private Sector Participation in Transport Resilience lays out recommendations on how governments and development partners can collaborate to mobilize Public Sector Participation (PSP) and private capital in delivering resilient transport.

The Roadmap for Private Sector Participation in Transport Resilience aims to promote a systemic and long-term shift to resilient transport. It offers recommendations on the key actions governments can take to strengthen approaches across policy and institutional capacity, project pipeline development, project and public funding, and financing. It addresses the transport sector at large and it is complemented by a set of subsector roadmaps that focus on railways, roads, and urban transport, included in the report, 'Sub-sectoral Roadmaps to Promote Private Sector Participation in Transport Resilience'.

This roadmap is further intended as a resource for governments and development partners to assist in identifying approaches to mobilize private sector participation and private capital in delivering resilient transport.

5.1. Vision, objective, priorities, key action areas

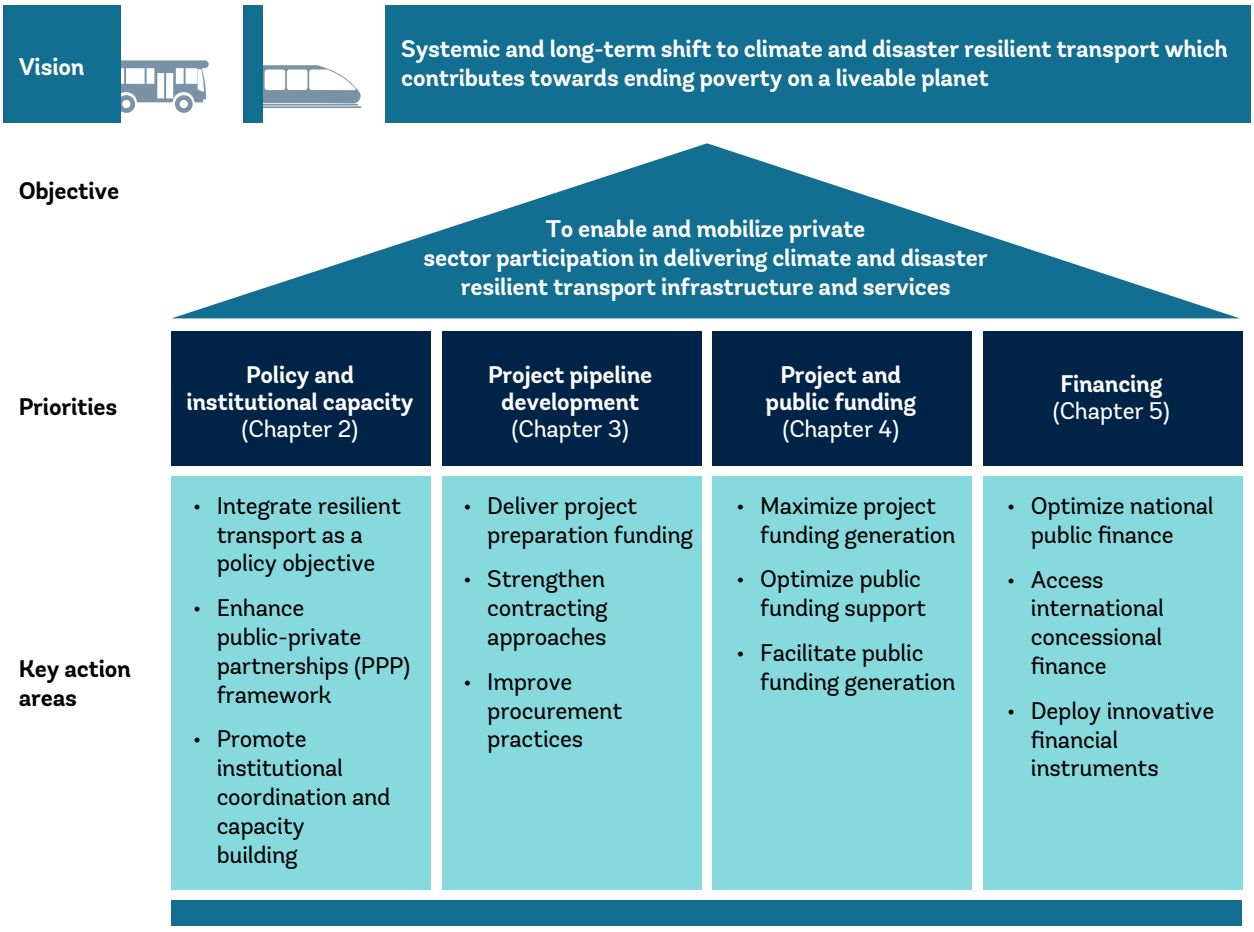
Achieving a resilient transport system requires a comprehensive approach. Figure 5.1 provides a structured overview of the key priorities and action areas for advancing resilient transport systems. At the core of this framework is the vision for a long-term, systemic shift towards sustainable transport solutions that contribute to poverty reduction and a livable planet.

The objective of the roadmap is to enable and mobilize private sector participation in building and maintaining resilient transport infrastructure and services. The framework is organized into four key priorities:

1. Policy and institutional capacity
2. Project pipeline development
3. Project and public funding
4. Financing

Each priority includes specific action areas aimed at strengthening governance, improving project preparation, optimizing funding mechanisms, and leveraging innovative financial tools to drive resilience in transport systems.

Figure 5.1. Overview of the Roadmap



Source: World Bank.

5.2. Navigating the roadmap

Users of this Roadmap can use the navigation questions in Figure 5.2 to determine which chapters are most relevant to their needs. By answering key questions related to policy, project development, funding, and financing, users can identify gaps and areas for improvement in their approach to resilient transport. If any answer is "no," the corresponding chapter provides guidance on strengthening strategies in that area. This structured approach ensures a step-by-step process for integrating resilience considerations into transport projects, helping governments and stakeholders make informed decisions.

Chapter 6 focuses on policy and institutional capacity. It explains how governments can incorporate resilient transport into broader policies that guide climate action, disaster management, economic growth, and the transport sector. Strengthening these policies will help improve the Public-Private Partnership (PPP) framework by ensuring that project priorities align with policy goals. Additionally, governments should enhance coordination and build the capacity of agencies responsible for delivering resilient transport projects, as these often involve multiple stakeholders.

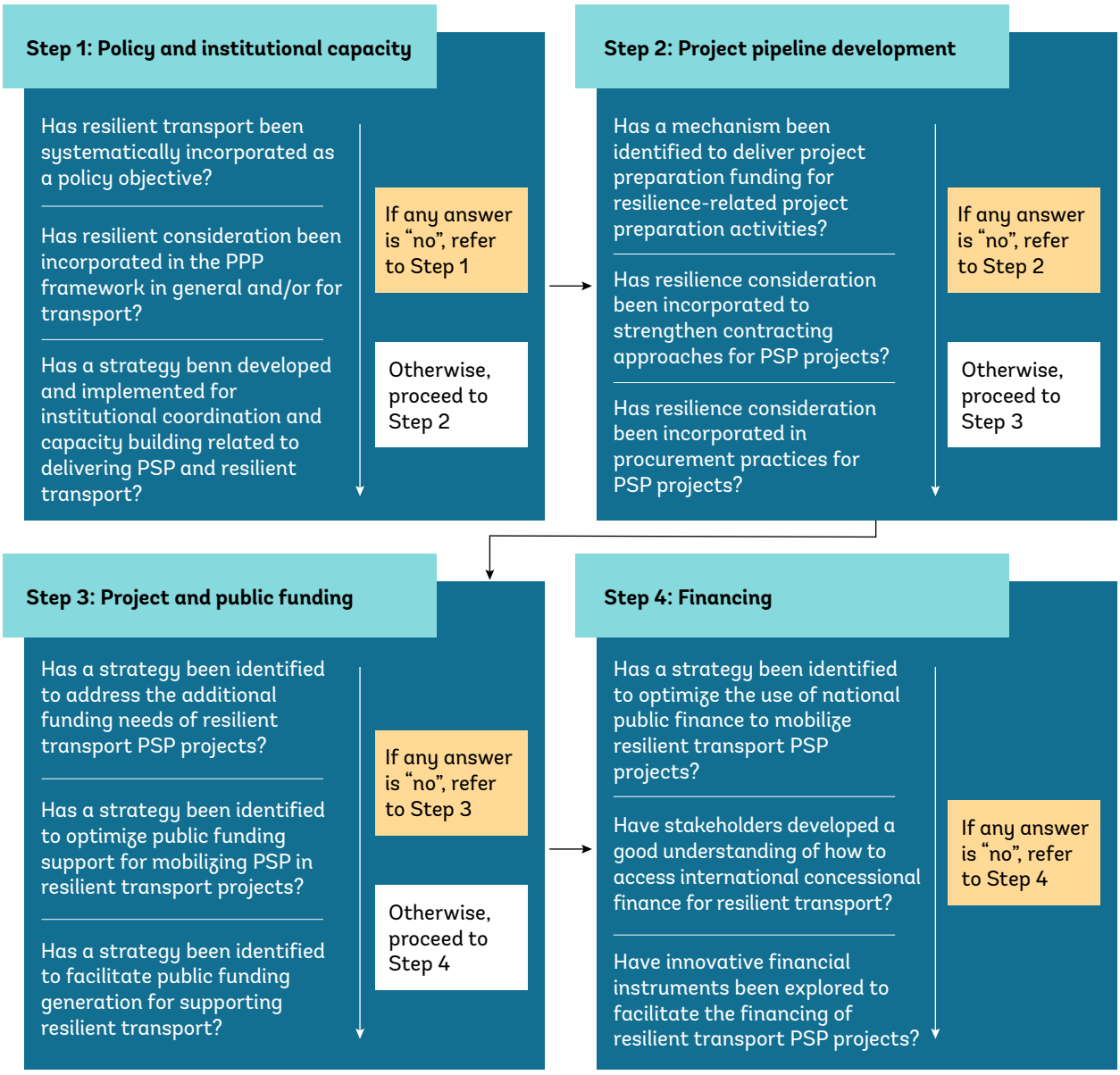
Chapter 7 highlights the need for governments to provide and encourage the use of funding for project preparation. This includes supporting activities like climate and disaster risk assessments. Governments should also ensure that resilience is systematically considered in procurement and contracting for resilient transport projects. Standardizing documents and launching pilot projects can help streamline this process.

Chapter 8 addresses funding challenges for resilient transport projects. Governments can bridge financial gaps by increasing user fees, supplemented by viability gap funding when necessary. Strengthening public infrastructure funds will allow for better allocation of resources throughout a project's lifecycle, including emergency needs during operation. Additionally, governments can explore alternative funding sources such as land value capture and tax revenues.

Chapter 9 focuses on making resilient transport projects financially viable. Governments should consider a mix of financing options, including public funding and partnerships with international development organizations that offer concessional financing. Innovative financial instruments — such as green bonds and sustainability-linked bonds — can also help fund well-structured resilient transport projects.



Figure 5.2. A step-by-step guide to identifying key focus areas for resilient transport development



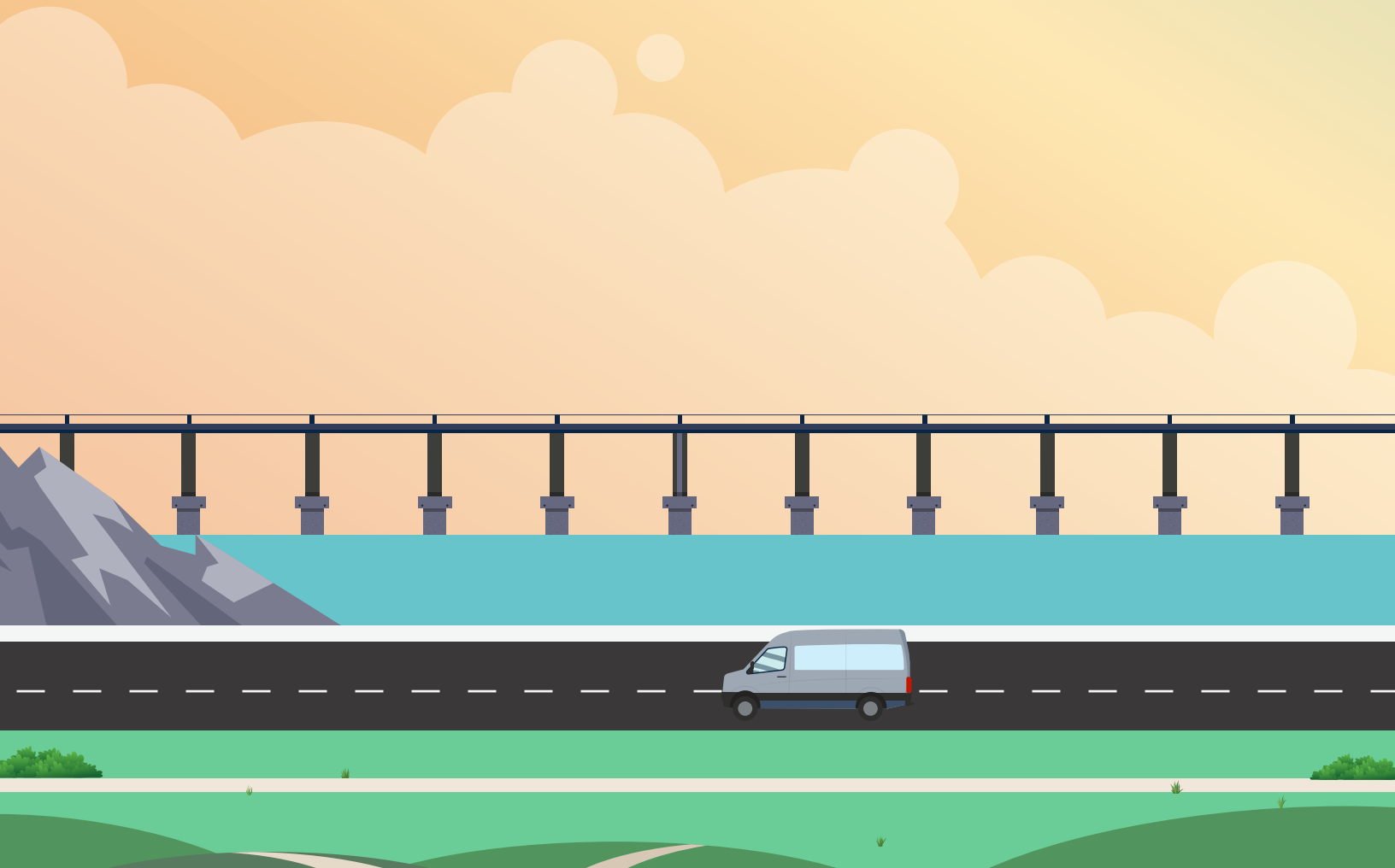
Source: World Bank.

These recommendations offer valuable opportunities for collaboration between governments in developing countries and development partners. Working together on key areas—such as policy reforms, capacity building, project preparation, and financing—can help governments secure the necessary investments in resilience. This collaboration is essential for shifting the approach to transport infrastructure and services, ensuring they can withstand climate change and natural disasters.

This roadmap can be read concurrently with the report 'Sub-sectoral Roadmaps to Promote Private Sector Participation in Transport Resilience' for a comprehensive approach to building transport resilience.

6

Policy and Institutional Capacity



The integration of resilient transport in policies has so far been limited in many countries. This presents significant opportunities for improvement. Overall, transport and infrastructure accounts for 12 percent of adaptation actions reported by countries in their adaptation communications behind agriculture and livestock (19 percent) and biodiversity and ecosystems (19 percent). An adaptation communication is a document that aims to raise the visibility and profile of adaptation and its balance with mitigation.

Only 16 countries address public transit adaptation actions out of the 78 countries that identified adaptation measures in their Nationally Determined Contributions (NDCs). Only around 25 percent of the Parties to the UNFCCC mention railways and only 10 percent have specific railway-related targets in NDCs. Where mentioned, railways are typically addressed for climate change mitigation.

6.1. Integrate resilient transport as a policy objective

Establishing resilient transport as a policy objective is an important first step to shaping a conducive environment that enables private sector participation (PSP) in resilient transport. This is because policies can influence decisions and practices in infrastructure investment by i) requiring government officials to prioritize resilient transport projects; ii) signaling government commitment and political will to the private sector; and iii) communicating resilience ambitions and finance needs to development partners.

Governments in different jurisdictions may rely on various types of policy instruments to emphasize the importance of resilient transport. For example:

- **Climate change policies:** NDCs, National Adaptation Plans (NAPs), Long-term Strategies (LTSs), climate change legislations, strategic action programs, and national climate-related regulations.
- **Disaster management policies:** National disaster risk reduction and management legislations, sector-level plans, regulations, and strategic action plans at national and subnational levels.
- **Economic development plans:** Long-term strategic plans that identify national transformation vision over decades and medium-term plans that set out development priorities every 5 years.
- **National transport policies:** Overarching policy framework for the whole transport sector, subsector-specific plans (e.g. for railways, roads, and aviation), and city-level transport masterplans.

These examples of policy serve as a reference for integrating resilient transport, whether at the sector or subsector level:

- **Kenya's updated NDC (2020)** has identified a list of prioritized adaptation programs for key economic sectors including transport. For the road sector, the government has identified prioritized adaptation programs that include i) upscaling the construction of roads to systematically harvest water and reduce flooding; ii) enhancing institutional capacities to climate proof vulnerable road infrastructure through vulnerability assessments; and iii) promoting the use of appropriate designs and building materials to enhance the resilience of at least 4,500 km of roads to climate risk.
- **Uganda's updated NDC (2022)** has identified a list of priority adaptation actions for key economic sectors including transport. The list includes building climate-resilient roads, bridges, water, and railway transport infrastructure systems, in which the government aims to build 482 km of climate-resilient railway roads by 2025.

- **Viet Nam's updated NDC (2022)** recognized the threat of climate risks on its transport sector, including the railways subsector. Particularly, the government identified that increased rainfall could create risks of landslides and flooding for about 20 percent of the total length of the railway network, potentially leading to disruptions that cause economic losses of US$ 2.3-2.6 million per day.

While creating adaptation plans, it is important to take advantage of the changes happening in the sector and look for ways adaptation and mitigation efforts can work together and bring added benefits. For example, the most popular strategy is the introduction of green, nature-based solutions, which often enhance resilience against multiple natural hazards, while contributing to the reduction of GHG emissions.

Recommendations for governments to establish resilient transport as a policy objective include:

- Incorporating climate and disaster resilience as a policy objective in the relevant policy instruments, including, but not limited to, climate change policies, disaster management policies, economic development plans, national transport policies, etc.
- Setting resilience targets for the whole transport sector and subsectors (e.g. railways, roads, aviation, maritime transport) as applicable.
- Identifying strategic actions to strengthen resilience in the transport sector and subsectors as applicable.



6.2. Enhancing the public-private partnership framework

6.2.1 Policy reforms

The entry points within a public-private partnership (PPP) framework for integrating resilience typically include PPP legislation, guidelines and policy, organizational mandates, and processes. The approach may be sector-agnostic at the legislative and policy levels. This reshapes the fundamental processes and principles that generate infrastructure PPPs.

Box 6.1 provides an example of a PPP Code with which the government of the Philippines integrates resilience as a policy objective and consideration in the PPP process.

Box 6.1. How the Philippines government emphasizes climate resilience in its PPP Code

The Philippines government has published the Implementing Rules and Regulations (IRR) of Republic Act No. 11966, also known as the Public-Private Partnership (PPP) Code of the Philippines in the Manila Bulletin on March 22, 2024. It came into effect on April 6, 2024.

The IRR formally identifies climate resilience as a consideration across the relevant sections that govern PPP project definition, preparation, and approval.

- **Section 2. Declaration of Policy:** "The State shall also ensure the integration of climate resilience, sustainability, and gender and development policies and programs in the planning, design, and implementation of PPP Projects."
- **Section 5. Infrastructure or Development Projects and Services:** "The Implementing Agency and the Private Partner may enter into a PPP for the following Infrastructure or Development Projects and Services, among others: (cc) Climate change adaptation and mitigation and disaster risk reduction and management infrastructure projects, biodiversity conservation projects, and related facilities."
- **Section 18. Guiding Principles in Developing PPP Projects:** "In developing PPP Projects, the following shall be considered, among others: (e) Climate resilience and sustainability"
- **Section 19. Scope and Depth of Feasibility Studies:** "A PPP Feasibility Study shall be developed following the identification and initial screening of PPP Projects by the Implementing Agency or Private Proponent. The scope and depth of the study may vary depending on the size, nature, and complexity of the PPP Project: Provided, that, at the minimum, the Feasibility Study shall contain the following information: Social and environmental analysis, including project safeguards with regard to, among others, environmental quality, natural resources sustainability, climate change and hazard, equity in development benefits, GEDSI, disability and accessibility, and health."
- **Section 28. Criteria for Approval of National PPP Projects:** "The Approving Body shall be guided by the following criteria in evaluating and approving PPP Projects, among others: The proposed project has an environment, climate change, and social safeguards framework including identified risks and mitigating measures."

6.2.2 Guidelines and working-level documents

Even after the PPP legislation and regulations are revised to explicitly address resilience, it is important to develop customized guidelines and other working-level documents to enable the practical and lasting adoption of good practices by the relevant agencies. Governments may integrate resilience consideration in various types of guidelines and working-level documents to address aspects such as:

- Preparing terms of reference (ToR) to require resilience-related analysis and measures in feasibility studies prepared by transaction advisors
- Assessing the adequacy and quality of climate risk and disaster assessment in feasibility studies
- Assessing the PPP suitability of the project to assess value for money and ability to meet the conditions for effective project implementation after accounting for climate and disaster risks
- Identifying the review and approval criteria relating to resilience measures including the methodology for assessing adaptation impact and cost-effectiveness
- Clarifying the approach for the allocation of climate and disaster risks in the risk matrix
- Integrating performance requirements and key performance indicators for climate and disaster resilience
- Reviewing the adequacy of insurance coverage for extreme climate and disaster events
- Preparing tender documents that include qualification and evaluation criteria which incentivize the provision of resilience expertise and measures
- Clarifying the responsibilities and protocols in monitoring and reporting the implementation of PPP projects during the construction, operations, and maintenance stages



Box 6.2 provides an example of efforts by the Government of Jamaica to develop a climate risk assessment methodology for supporting project appraisal.

Box 6.2. Government of Jamaica's climate risk assessment methodology

The Government of Jamaica has prioritized the strengthening of Jamaica's Public Investment Management System (PIMS), as part of its public financial management reform agenda.

The definition of public investment in Jamaica included investment carried out by any public entity within the specified public sector on its own, or by one or more such public entities in conjunction with one or more non-public entities through PPPs.

To promote good practices in climate risk assessment, the Government of Jamaica, through the Public Investment Appraisal Board (PIAB), has collaborated with the Inter-American Development Bank (IDB) to develop a climate risk assessment methodology for Jamaica's pre-investment appraisal process of the PIM system that is managed by PIAB.

The methodology is designed to ensure that public investment projects undertake progressively more sophisticated assessments of their climate risk as they progress through the PIMS. Projects with significant climate risk levels will need to undergo further analysis. Further, the methodology provides guidance on how to examine climate adaptation measures as part of separate economic (i.e., Cost-Benefit Analysis) and financial appraisal studies conducted for some projects.

Recommended resources



Climate Toolkits for Infrastructure PPPs by the World Bank Group for identifying resilience requirements to be integrated in their PPP framework. The toolkits outline a framework and identify good practices to support governments, development partners, and other stakeholders in incorporating climate actions in PPP projects. They cover subjects including:

- Project selection
- Technical feasibility assessment
- Commercial feasibility and bankability assessment
- Risk allocation
- Financial structure
- Procurement process and tender documentation

6.2.3 PPP project approval regime

If the project approval process does not incorporate resilience-related evaluation criteria, there could be a risk that the resilience requirements are being insufficiently addressed. Contracting authorities may prioritize other requirements to seek approval. A gateway process may help ensure that resilience requirements are effectively implemented in PPP projects. Where a gateway process is used, PPP projects are reviewed by finance ministries and other agencies from the early stages of the project cycle — for example, during the pre-feasibility and feasibility study — and continue to be reviewed at key stages until the projects are approved. Thus, the potential benefits of a gateway process in implementing resilience requirements may include:

- **Incorporating resilience measures at early stages of the project cycle.** Governments can ensure that good practices, such as conducting climate risk screening and assessment, are adhered to from the pre-feasibility and feasibility studies.
- **Promoting continuous collaboration and oversight on resilience requirements.** The gateway process involves key government stakeholders through all project stages. This is particularly helpful to manage the complexity of resilient transport PSP projects, which may be an unfamiliar subject for contracting authorities.
- **Bringing in independent experts to strengthen reviews and project preparation activities.** The gateway process may provide additional opportunities for governments to engage independent experts for informing approval decisions and improving the projects. Governments can thus benefit from more specialized resilience expertise to supplement internal capacities.



Table 6.1 illustrates a gateway process for PPP projects and the potential resilience considerations.

Table 6.1. Illustrative PPP gateway process that incorporates resilience considerations

Phase in project cycle	Objective	Resilience considerations
Phase 1: Pre-feasibility studies	Provide opinion about project	Is the project aligned with the National Adaptation Plan and other strategies related to resilience?
Phase 2: Feasibility studies	Approve/reject project	Have the relevant adaptation measures been identified and appraised based on a detailed assessment of climate and disaster risks facing the project?
Phase 3: Budget preparation	Approve/reject project to be included in budget proposal	Where public funding support is needed, have the costs and funding needs of adaptation measures been clearly identified and justified? Is there any implication on fiscal commitments and contingent liabilities due to climate and disaster risks?
Phase 4: Call for tender	Approve/reject call for tender	Do the qualification and evaluation criteria address the needs for resilience expertise and measures? How have climate and disaster risks been allocated in the contract draft?
Phase 5: Tender and contract definition	Approve/reject contract	Does the contract address the climate and disaster risks and resilience measures needed for the project?
Phase 6: Construction and operation	Approve/reject contract changes	Does the request for contract changes affect the project's resilience needs?

Source: Adapted from IMF (2021). Mastering the Risky Business of Public-Private Partnerships in Infrastructure; ADB (2023). Gateway Framework, a governance approach for infrastructure investment sustainability.

6.3. Promoting institutional coordination and capacity building

6.3.1 Clarify Responsibilities

PPP projects typically involve multiple government agencies. Conducting an institutional review may be beneficial to identify and coordinate the responsibilities of respective agencies for implementing resilience requirements. The outcomes of the institutional review can then form the basis for recommending any changes and/or confirming the responsibilities of respective agencies.

Given the focus on PSP, the PPP Unit or equivalent division may be the lead agency to conduct the institutional review. The process should involve consultations with other relevant government agencies to provide feedback and concurrence on the identified or envisioned responsibilities. Table 6.2 illustrates the potential responsibilities of various government agencies in implementing resilience requirements for PPP projects in the transport sector.

Table 6.2. Potential responsibilities in implementing resilience requirements for PPP projects in the transport sector

Levels of government	Potential institutional mandate and responsibilities		
	Project development	**Investment decision and regulatory approval**	**Project implementation**
Federal or central ministries, agencies, and/or authorities involved in:			
PPP	• Ensure robust processes for climate and disaster risk assessment and identification of resilience measures are followed • Support the incorporation of climate and disaster risks and resilience approaches into project cycles such as structuring, procurement, and contracting	• Review and approve the transport projects based on the broader decision framework including on resilience of transport projects, for both	• Support the line ministries in the monitoring and supervision of private partners' performance in ensuring resilience in transport infrastructure and services
Finance	• Support deployment of innovative financing mechanisms, such as concessional climate funds and green bonds	• Review and approve the transport projects, including their financing plan to invest in resilience measures	• Manage the funding and financing for transport projects, including ensuring sufficiency to support resilience investments and disaster response
Climate change and environment	• Advise on the process and policy to develop transport projects that address climate risk and resilience needs	• Advise on the process and policy to review and approve transport projects considering resilience measures	• Review and provide feedback on the monitoring and evaluation reports on transport projects under implementation including the effectiveness of resilience measures

Levels of government	Potential institutional mandate and responsibilities		
	Project development	**Investment decision and regulatory approval**	**Project implementation**
Line ministries, departments, and agencies involved in:			
Transport sector and subsectors (e.g. railways, roads, aviation, ports, public transport)	• Lead the identification of climate and disaster risks, resilience measures, and investment needs • Collaborate with private partners to incorporate resilience measures into transport project concept and design	• Submit and facilitate the processing of applications for investment decision • Develop and communicate the business case of resilience investment in transport	• Establish procedures for monitoring performance requirements related to resilience in transport projects • Support local governments in monitoring and supervising the performance of private partners in ensuring resilience
Levels of government			
Regional, state, city or other local governments	• Support project identification and needs validation, including the needs for resilience measures in transport projects • Engage local communities and stakeholders to provide feedback on project design including resilience measures	• Facilitate the decision-making process such as strengthening and endorsing the business case and benefits of resilience measures in transport projects	• Monitor and supervise the performance of private partners in ensuring resilience including collecting public feedback

Source: World Bank.

6.3.2 Human resource planning

Beyond policy and institutional changes, it is essential to ensure there is sufficient capacity among government officials involved in implementing resilience requirements. Governments should develop a human resource plan to guide capacity building in a systematic and well-coordinated manner.

- First, existing officers would benefit from foundational training to build a common understanding so further reforms can be implemented across different levels and units.
- Second, agencies such as the PPP Unit, ministry of transport and transport subsector agency may need resilience experts on staff and engage consultants on a project-by-project basis.
- Third, capacity building programs should cover both federal and sub-national levels including for regional, state, municipal, or city governments, especially where the transport projects may be originated and governed by sub-national authorities.

7

Project Preparation



Preparing for a project includes harnessing funds and choosing the appropriate contracting approach. For transport resilience projects involving PSP, this means identifying sustainable financing sources that can support both upfront investments and long-term maintenance needs. It also requires selecting contract structures that clearly define the roles, responsibilities, and risk-sharing mechanisms between partners. Careful preparation ensures that resilience measures are embedded from the start, making transport infrastructure better able to withstand climate risks while delivering value for money.

7.1. Deliver project preparation funding

Integrating resilience investments into transport projects requires additional costs for climate-related project preparation activities. These include climate risk and vulnerability assessment, feasibility studies that include identification of adaptation solutions, and developing resilience-focused procurement and contracting.

Therefore, it may be beneficial to systematize and create a dedicated pool of funding through the establishment of a Project Preparation Fund (PPF). In particular,

- The PPF can ring-fence resources to ensure they are consistently available for resilience-related activities instead of relying on budget allocations, which may be uncertain.
- The PPF can integrate measures to recycle funding for ongoing needs, such as using reimbursable grants, which require the private partners to reimburse the PPF when a resilient transport project involving PSP reaches financial close.

Governments may tap into any existing PPF aimed at supporting PSP and strengthen its mandate to support resilient transport projects. Alternatively, governments may establish a dedicated resilience-focused PPF for the transport sector (termed "Transport Resilience Project Preparation Fund" or TR-PPF) if the funding need is considered sufficient based on the expected size of project pipeline. The dedicated PPF may also take on a broader focus to cover climate actions in general, addressing both climate change mitigation and adaptation needs of transport PSP projects.

Irrespective of whether a dedicated TR-PPF is created or an existing PPF is used, the most important action is to make sure the PPF incorporates eligible resilience-related project preparation activities, for which the PPF may earmark specific envelopes of resources (See Table 7.1).

Table 7.1. Key resilience-related project preparation activities for the transport sector (Non-exhaustive)

	Brownfield assets	Greenfield assets
Development of asset register for a transport subsector	✔	
National and/or subnational climate and disaster risk analysis for transport networks	✔	
Project scoping and pre-feasibility studies for resilient transport projects	✔	✔
Feasibility studies for the resilient transport projects (covering technical, economic, commercial, financial, legal feasibility and any necessary other feasibility tests), including: • PSP suitability and model assessment • Formulation of adaptation plans • The use of adaptive planning	✔	✔
Climate and disaster risk assessment for specific transport projects, including stakeholder consultations	✔	✔
Transaction advisory services that integrate resilience considerations, including • Development of resilience-focused procurement package • Legal services to tailor contractual clauses for resilience considerations • Market sounding exercises	✔	✔
Training activities for government officials related to integrating climate and disaster resilience in transport PSP projects	✔	✔
Preparation of funding proposals to apply for concessional finance from climate finance facilities	✔	✔

Source: World Bank.

Recommended resources

Project Development Funds (PDFs) - Supporting Project Preparation to Structure Successful Public-private Partnerships (PPPs) : A Primer by the World Bank Group identifies lessons for public sector and other PPP practitioners related to how and why PDFs are established, and how best to enable them to contribute to the success of PPP programs.

7.2. Strengthen contracting approaches

7.2.1 Performance-based contracts

Performance-based contracts (PBCs) have been increasingly recognized as a valuable contracting framework for addressing climate change impacts. This recognition stems from PBCs' outcome-focused nature, which allows the integration of resilience and sustainability objectives into the contractual arrangements. PBCs refer to a range of contracts that involve significant PSP, as presented in Table 8.2, which highlights the diverse contracting approaches tailored to various infrastructure needs. Note that there is no single, internationally accepted, definition of Public-Private Partnership. The definition in Table 7.2 is provided in the PPP Reference Guide Version 3.0, dated April 2017 and reproduced in World Bank (2019) Guidance on PPP Contractual Provisions.

'Sub-sectoral Roadmaps to Promote Private Sector Participation in Transport Resilience' provides examples of PBCs specific to the road, railway, city bus operation, and bus terminal development.

Table 7.2. Types of performance-based contracts

	Term	Payment	
Design, build, operate, maintain (DBOM)	Long-term contracts, typically ranging between 20 to 40 years after completion of the construction, providing ample time for comprehensive project development and implementation.	Performance-based for ongoing maintenance and operational tasks, with lump sum payments for initial construction works. In some cases, unit price payments may be utilized to minimize Private Party risk.	Suited for large-scale transportation infrastructure projects, including highways, railways, and airports, aiming to improve connectivity and mobility. These contracts encompass various phases, from construction to operation, ensuring long-term performance and sustainability.
Operations and Maintenance (O&M)	Ranges from 3 to 10 years, allowing for efficient operational management and maintenance.	Predominantly performance-based, incentivizing Private Parties to achieve specified service levels and operational targets. Lump sum payments may cover initial setup costs, with ongoing payments tied to performance metrics.	Designed for ongoing operation and maintenance of infrastructure assets. These contracts prioritize efficient service delivery, reliability, and cost-effectiveness, ensuring continuous infrastructure functionality and performance.

	Term	Payment	
Rehabilitation & Operations	Extends over 7 to 15 years, encompassing rehabilitation activities and long-term operational management.	Hybrid payment structure, combining lump sum payments for initial rehabilitation works and performance-based payments for ongoing operation and maintenance tasks.	Tailored for aging infrastructure in need of rehabilitation and upgrades, such as roads, bridges, dams, and utility networks. These contracts address climate vulnerabilities by focusing on extending asset lifespans in a cost-effective manner. They aim to enhance functionality, ensure operational resilience, and promote sustainable infrastructure development and management. By integrating resilience measures, these contracts help mitigate future climate risks, making projects more attractive to developers and (where relevant, investors) and securing (long-term) financial sustainability.
Innovative Financing PBCs: Various types of PPPs including Design-Build-Finance-Operate and Maintain (DBFOM), Concession, etc. *Long-term agreement between the Contracting Authority and the Private Partner, for providing a public asset or service, in which the Private Partner bears significant risk and management responsibility, and remuneration is linked to performance.*	Long term contracts – Term varies depending on project complexity and financing arrangements.	Performance based and output-driven payments Two main payment mechanisms: ***User-pays*** where the Private Party is paid by the revenues associated with the public use of the infrastructure. ***Government-pays*** where payment of the Private Party is by the Contracting Authority based on the availability of the infrastructure and level of services. There are also other innovative payment mechanisms, such as revenue sharing and land value capture, to attract private investment.	The long duration of PPPs incentivizes the integration of resilience in the design of the infrastructure. Private Partner needs to ensure infrastructure continuity of service or to restore same quickly following a climate event Incorporate innovative financing models, such as public-private partnerships (PPPs), to leverage private sector expertise and resources for infrastructure development. These contracts aim to optimize funding sources, reduce financial risks, and deliver infrastructure projects efficiently, contributing to economic growth and development.

Source: World Bank.

When properly structured, PBCs should involve meticulous planning, rigorous risk assessments, and seamless integration of resilience considerations across all stages of the project lifecycle, from planning, procurement to contract execution and management and end of term provisions. The risk assessments should be integrated not only into the design and construction stages, but also into the operational and project closing stages, ensuring the resilience of both assets and services.

As such, PBCs can lead to cost savings on construction, rehabilitation, and recovery work which may arise from the ability of PBCs to incorporate the following contractual elements. These constitute innovative clauses and may require additional refinement based on market sounding for actual projects. The principle is that the private partner will be incentivized for achieving a better performance than a specific benchmark (rather than being penalized for the opposite, which would require third-party involvement for verification and significantly increase legal dispute risks). These clauses could include:

- **Specific monitoring requirements**, which aim to assess and ensure assets perform satisfactorily under the potentially changing climate risk landscape.
- **Functionality thresholds**, which may be incorporated in performance requirements that link the payment mechanisms with incentives and penalties as a function of specific measurable indicators.
- **Connectivity targets**, which require that any failures due to climate events do not result in loss of connectivity between nodes served by the network for incentivizing i) more robust design of fragile or sensitive segments or assets; ii) enhanced preparedness (e.g. by setting up instrumentation and early warning systems); iii) rapid recovery (e.g. by ensuring short duration of any repairs); and/or iv) redundancies (e.g. assist vehicles with alternative routes).
- **Reduction of accidents**, which may be incorporated as a performance objective to address the increase in the number of accidents due to extreme climate events. Such a benchmark could be the number of accidents during a disruption (e.g. in case of flood, disruption = rainfall over 15mm) vs the number of accidents on a normal day. Hence, projects achieving a good performance annually (e.g. increase of no more than 10 percent) would be entitled to an incentive in the payment mechanism.
- **Acceptable duration of disruptions for repairs and maintenance**, which identifies targets with respect to the maximum allowable duration of disruptions for either routine maintenance/ retrofitting or unplanned repairs of fixed infrastructure due to extreme climate-related events.
- **Attractive insurance instruments**, which promote the use of insurance to manage climate risks and may allow the parties to benefit from more affordable premiums when resilient measures are implemented through the PBCs. Subsequently, the availability of (affordable) insurance coverage can reduce financial risks, with positive impacts on the attractiveness of projects to the private sector.

7.2.2 Best practices

Despite their potential, mainstreaming resilience considerations into PBCs contracts remain a nascent field, characterized by a lack of comprehensive frameworks and established practices. To address these implementation challenges, governments could undertake good practices that include:

- **Enhance risk identification and assessment mechanisms**, thereby enabling stakeholders to navigate the complexities of climate uncertainty with confidence. This will guide Contracting Authorities in establishing adequate performance criteria, quality assessment parameters and financial incentives during the term of the project. This covers PBC involving construction (including rehabilitation), operation and maintenance or only operations and maintenance.
- **Develop commercially viable risk allocation frameworks**, thereby promoting an equitable distribution of responsibilities while safeguarding the long-term sustainability of resilient transportation systems projects via PBCs.
- **Foster innovation in contractual design and procurement practices**, for enabling stakeholders to embrace flexibility and adaptability as foundational tenets of resilient infrastructure development.
- **Adopt a tailored approach** that: i) considers both extremes and averages of potential climate events within the life of the transport project; and ii) focuses not only on the infrastructure itself but also cross-dependencies such as utilities (power, water, etc.), transport (of material, equipment), and the logistics chain.
- **Ensure that the private partner is selected based on their capacity to effectively assess and manage the climate risks allocated to them and meet the performance criteria**. This is key to ensure the successful implementation of resilient focused PBCs and other contractual mechanisms. These include the following consideration during the procurement:
- **Consider embedding climate risk management experience at the Request for Qualification Stage** via: (i) minimum requirements, (ii) evaluation criteria or (iii) a combination of both:
  - Disclose climate related risks during the procurement process;
  - Require proponents to propose Disaster Risk Management (DRM) measures at the RfP Stage including, *inter alia*, a project-related emergency preparedness and response plan (EPR Plan), which will be evaluated; and
- **Set minimum requirements respecting resilience in the RfP and/or include resilience as part of the evaluation criteria based on asset life costing.** This would require proponents to *"demonstrate how their proposals address resilience to risk, highlighting the costs as well as the benefits, and how they will manage the project when facing changes in the risk itself."*
- **Develop resilience-focused Dispute Resolution Mechanisms.** Specify how disputes will be resolved, possibly emphasizing independent expert determination or other alternative dispute resolution mechanisms, given the potential for disagreements over interpretations of climate-related clauses.
- **Develop monitoring requirements which are integrated with resilience-focused performance requirements and key performance indicators**, with good practices that include :
  - Offering training programs or courses to contracting authorities.
  - Imposing obligations of measurement, monitoring, management, risk reduction, and self-reporting on the private partner side.

  - Adopting an active management approach to climate risk to continuously collect, analyze, identify and assess the likelihood and impact of extreme events in order to take appropriate action.
  - Mandating maintenance history from the private partner during the project execution to identify trends in climate risks and inform the O&M plans and design of future projects.
- **Require the private partner to periodically update its climate risk management plans, operational and maintenance procedures and asset management plans**, to ensure they remain aligned with evolving climate risks, regulatory changes, and best practices in resilience planning.

7.3. Resilience Contracting Clauses

This section provides additional guidance on how to develop resilience-focused contracting clauses, covering:

- Force Majeure
- Supervening events
- Contractual flexibility provisions including Hardship Clauses, "Imprévision", and Economic Equilibrium Provisions
- Tools to promote dialogue between the parties on risk allocation events and adjustment events
- Innovative risk-sharing mechanisms

For clarity, "contracting authority" refers to the public party that owns the asset/infrastructure that is being built, rehabilitated, operated and/or maintained under, and the term "private partner" refers to the counterpart of the contracting authority.



7.3.1 Force Majeure

Force Majeure is a cornerstone of contract law, providing a legal mechanism for parties to excuse performance obligations when confronted with extraordinary circumstances beyond their control. Although there is no universal definition of what constitutes a Force Majeure event, the concept typically revolves around three key characteristics: external causation, unforeseeability, and unavoidability.

As such, Force Majeure Events are events that:

i. Are beyond the parties' control – *External force;*

ii. Could not have been foreseen by the parties at the time of contracting (or, in certain contracts, at the time of submitting a tender in response to a request for proposals for the relevant contract) – *Unforeseeability;*

iii. Which could not have been avoided by the parties (the event itself or its consequences) – *Unavoidability.*

Upon occurrence of a Force Majeure event, the affected party is excused from performing the obligations affected by the event. Force Majeure provisions are a key complement to the performance and incentive-based payments regimes of PBCs but are also commonly used in any contracts (whether or not PBC).

Historically, extreme weather events or natural hazards, such as hurricanes, floods, and tornadoes, were addressed through Force Majeure clauses in contracts – no mention was made to climate change as distinct from extreme weather events or natural hazards. In this traditional approach, the contracting authority often bears the responsibility for the impacts of unforeseen events, including covering repair costs for damages not covered by insurance. However, this model may not incentivize adequate action to manage the impacts of increasingly common climate events.

In the face of climate change and given the strict interpretation of the courts and arbitration tribunal of this concept, typically requiring unforeseeability and/or impossibility of performance, traditional definitions of Force Majeure events may become outdated.

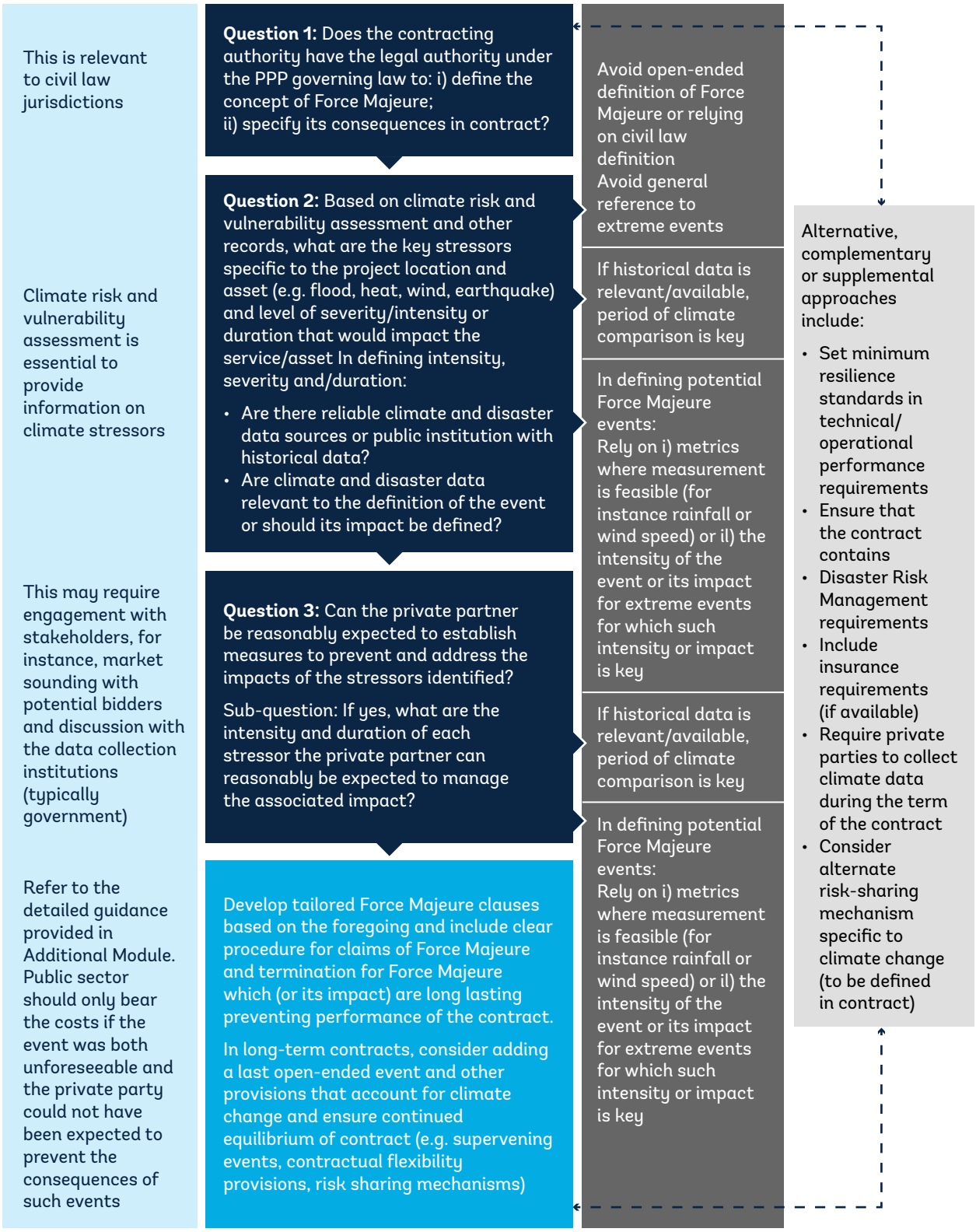
The increased familiarity with the unpredictability of weather patterns poses a significant challenge in determining what constitutes an "unusual" or "abnormal" weather event, complicating the application of Force Majeure clauses. Determining causation also becomes increasingly complex as weather patterns change due to climate change. As severe weather events increase in frequency and intensity, so does the expectation of precautionary risk reduction measures to minimize the impact of such events on contractual obligations.

Furthermore, parties relying on standard Force Majeure clauses may unintentionally assume unwanted risks, as these clauses may not adequately cover the impacts of climate change-related extreme weather events.

Adopting an open-ended definition of Force Majeure, which would include weather events that are likely to occur (even if unpredictable), should be avoided. Even in less advanced markets, the definition should provide a list of events distinguishing standard events (or events that are known to happen) from extreme weather events.

The guidance in Figure 7.1 provides the key questions that should be addressed to prepare for integrating resilience considerations in these contractual clauses.

Figure 7.1. Guidance to prepare for integrating resilience considerations in key contractual clauses



Source: World Bank.

Recommendations

- Parties should avoid relying on standard Force Majeure clauses. This applies to cases of only referring to the concept without listing the specific events that could constitute Force Majeure, or including a generic list of events which are not sector, asset or country/region specific.
- Instead, parties should tailor contractual provisions to address specific risks associated with climate change-related extreme weather events. Rather than broadly listing weather conditions as Force Majeure events, contracts should specify the intensity and duration of events that would excuse non-performance. For instance:
  - Define what would constitute unexpected "unusually severe" weather, or their consequences or impact (e.g. material damages).
  - Define abnormal weather conditions based on specific criteria, such as weather events that have not occurred within a certain timeframe or have a low likelihood of occurrence compared to historical data or that objectively are assessed as being extreme in nature.

By establishing clear parameters, parties can minimize ambiguity and streamline the process of determining whether weather-related delays qualify as Force Majeure events. However, given the limitations of historical weather data in predicting future weather patterns due to climate change, alternative approaches to incorporating weather predictions into contracts may be necessary.

It is worth noting that the PPIAF Guidance on PPP Contractual Provisions provides an in-depth review of Force Majeure provisions and the two approaches to such provisions: an open-ended catch-all definition and an exhaustive list of specific events under its Section 1.2.1.2 with drafting examples under its Section 1.5.

As regards climate change and the issue of foreseeability, it mentions that "the Parties may want to specify certain types of severe and extreme weather conditions in order to address risks relating to climate change (as they relate to their specific project),recognizing that, while the impacts of climate change may have become increasingly foreseeable, it would likely not be in the Affected Party's power to prevent, avoid or overcome those on its own in most cases. Nonetheless, it should be noted that there currently is no standardized approach for allocating responsibility in PPP Projects to manage Force Majeure versus severe and extreme weather risks. Equally, the Parties should carefully assess whether the legal system in the country, in which their PPP Project is located, allows for inclusion of such events under Force Majeure, and, if not, whether these may be covered by the Private Partner by taking out respective insurance."

Examples of Force Majeure provisions

While these examples are taken from road projects, they may be transferable to any transportation system.

Each approach has its strengths and challenges which are highlighted in the annotations below each example. It is recommended that an open-ended definition should be avoided, as in Approach 3. A focus on determining key climate stressors, their intensity and impacts as well as their foreseeability and the ability of private partners to prevent or reduce the impact of their occurrence is preferable.

Approach 1: Force Majeure with comparative period

Example 1(a): Extracts from the Canadian Tlicho All-Season Road (TASR) project

"Force Majeure Event" means the occurrence after the Effective Date of: (…)

(d) flood identified by Environment Canada (1) as a greater than 1 in 100 years (2) flood event (3), except to the extent that such flood arises or is contributed to, directly or indirectly, as a result of any willful misconduct, negligent act or omission or non-compliance with the terms of this Agreement by Project Co or a Project Co Person (4) (…)

Example 1(b): Extracts from the Outer Suburban Arterial Roads Program in Victoria, Australia

The occurrence of any of the following events after the date of this Deed:

(…)

(ii) winds (3):

(…) B. during the Maintenance Phase (…), producing sustained surface winds in excess of 118 km/h (5) and gusts in excess of 225 km/h (5), as recorded by the Bureau of Meteorology (1), Melbourne;

(iii) a flood (3) which might, at the date of this Deed, be expected to occur no more frequently than once in every 100 years (2);

Notes:

1. Recognized institutions with historical weather data.
2. Comparative period should be sufficiently long to target rare/unforeseeable events. The last 100 years can be a sufficiently long period, but a private partner may ask for a shorter period to be able to better price the risk.
3. Identification of specific events relevant to the sector/asset/infrastructure.
4. Force Majeure events should be limited to events that are beyond the control of the Parties. Project Co in this example is the concessionaire whereas Project Co Parties are its directors, officers, employees and subcontractors.
5. Specific severity thresholds should be based on climate data.

Approach 2: Force Majeure with severity thresholds

Example 2: Aichi Toll Road Project in Japan

Definition: Force Majeure includes a storm, torrential rain, flood, high tide, landslide, fall of ground, strike of lightning, earthquake, fire, other natural disaster, or uprising, riot, disturbance, act of war, epidemic, or other human-made disaster, of which the cause is not attributable to neither the government nor the concessionaire. This applies to the main project.

Type of disaster	Events for which additional costs are borne by the public sector
Earthquake	Damage based on normal social conventions
Heavy rain	Maximum rainfall of 80 millimeters or more in 24 hours Even if the rainfall is below the above standard, it is considered heavy rain if the hourly rainfall is significant (20 millimeters or more), provided that the hourly rainfall is observed at the nearest weather observation station (managed by the public corporation) from the damaged place
Storm	Maximum wind speed of 15 meters per second or more (average in 10 minutes)
High tide, storm surge, tsunami	Extraordinarily high tide, storm surge, or tsunami caused by a storm or its aftermath with relatively non-minor damage

Risk sharing policy: The public sector shall bear the cost if the concessionaire cannot foresee or cannot be reasonably expected to establish measures to prevent additional costs. Definition of disasters caused by heavy rain, storm, high tide, storm surge, and tsunami are shown in the summary table. Numerical standards are set for heavy rain and storms as a specific indicator of the disaster scope.

Notes:

This example is a variation of Approach 1 where the event is not defined with regards to its foreseeability based on historical data but in terms of the severity of the event itself (amount of rainfall within a certain period) and/or its consequences and impact (e.g. the high tide, storm surge or tsunami is assessed based on the material damages it cases).

What is interesting in this example is (i) the identification of specific climate stressors; (ii) the reliance on metrics where measurement is feasible (for instance rainfall or wind speed); and (iii) on the intensity of the event or its impact for climate events for which such intensity or impact is key. For earthquakes, the reference to social conventions is, we believe, to be understood as country and region specific i.e. what is foreseeable and can be prevented. These Force Majeure Events should also be read in conjunction with principles underlying the risk-sharing mechanism: not only should these events occur but the contracting authority will only bear the costs if the event was both unforeseeable and the private party could not have been expected to prevent the consequences of such events. What is interesting in this example is that it forces the private party to implement DRM.

Approach 3: Force Majeure with open-ended definition

Example 3: Concession

The expression "Force Majeure" shall include, but not be limited to, any of the following events or circumstances, provided, however, that such event or circumstance could not have been prevented, overcome or remedied, in whole or in part, by the affected party by means of appropriate measures:

a) natural phenomena of an unpredictable nature, including lightning, fire, earthquake, flood, storm, snowdrifts, tempest, flood and other extreme weather disturbances (…)

Notes:

The risk of such an open-ended provision is to determine what can be considered "unpredictable" as climate change events are more and more predictable or foreseeable.

As weather patterns change due to climate change, what is considered "foreseeable" may evolve. Contracts need to shift their focus from the foreseeability of specific events to the foreseeability of their effects or impacts as proposed by Approach 1 and 2. This approach would align contractual relief more closely with the actual impact of weather events, ensuring that parties are appropriately protected from the consequences of climate change-related extreme weather events. The 2017 PPP Reference Guide cites Chile, which no longer considers earthquakes as being Force Majeure events and its 2010 PPP Law required that catastrophic risk be covered by insurance, which helped build Chile's road network using PPPs.

In addition to providing a list of possible Force Majeure events, an open-ended Force Majeure event could be added to a specific list in common law contracts while "any other Force Majeure events" may suffice in civil law jurisdictions. The objective is to account for the evolving nature of climate change events and address the foregoing consideration of the foreseeability of the impacts rather than the occurrence of the event itself. For instance:

For the purposes of this Agreement, "Force Majeure event" means any event or circumstance which is beyond the reasonable control of the Party claiming relief; provided and to the extent that such event or circumstance has the effect of impacting, interfering with or preventing the performance of such Party's obligations under the Agreement. Notwithstanding the foregoing, in no event shall a Force Majeure event include, on the part of the Contracting Authority, its inability to perform due to its lack of financial resources or its financial condition.

Parties should carefully negotiate and incorporate their weather-related assumptions into the contract to eliminate potential sources of dispute. This may involve selecting reliable weather data sources, defining acceptable risk reduction measures, and establishing protocols for documenting and addressing weather-related delays. By proactively addressing climate change-related uncertainties in their contracts, parties can better navigate the complexities of Force Majeure provisions and adapt to evolving weather patterns.

Finally, although not specific to resilience, Force Majeure provisions should include a clear procedure following the occurrence of a Force Majeure event including: i) the notice period to inform the other party of the occurrence of such an event, ii) relief from contractual obligations following

the occurrence of Force Majeure, and iii) procedure for the parties to discuss the future of the contractual relationship and termination provisions if the Force majeure or its impacts have a long-term effect. Examples of such provisions can be found in the Guidance on PPP Contractual Provisions (2019).

7.3.2 Supervening events

Relief Events (e.g., time relief) and other supervening events are often used as an alternative to, or in addition to, Force Majeure provisions. With regards to climate-related events, Relief Events can include some less disruptive or minor, but more frequent natural disasters that are foreseeable and are typically insurable (see Table 7.3).

Table 7.3. The main differences between Relief and Force Majeure events

Force Majeure	Relief Events
Long term	Short lived
Events have catastrophic impacts and prevent the performance of all or an important portion of the contract scope	May only partially prevent such performance
The consequences are typically difficult to manage by either parties and insurance is generally unavailable	Insurance is available and risk reduction measures exist

Source: World Bank.

It is to be noted that if a Relief Event or its consequences last for a certain period of time (which generally ranges from 180 days to 360 days), such events will typically become Force Majeure events ultimately giving the Parties (or only the Contracting Authority) the right to terminate the Contract.

Relief events can thus act as contractual provisions which could be used in addition to Force Majeure events to address the resilience considerations.

For instance, events that constitute Relief Events may include the following:

For the purposes of this Agreement, "Relief Event" means any of the following events or circumstances to the extent, in each case, that it causes any failure by a Party to perform any of its obligations under this Agreement:

(i) fire, explosion, lightning, storm, tempest, hurricane, tornado, flood, ionizing radiation (to the extent it does not constitute Force Majeure), earthquake, (…);

Another example taken from a train operations franchise agreement in Australia, defines "Widespread Storm Event" which falls under the category of "Defined Events" distinct from "Operational Force Majeure Events" as follows:

Widespread Storm Event *means a severe storm that has a widespread impact on the metropolitan train rail network. For the purposes of this definition, evidence of the occurrence of a 'severe storm' will include extensive media coverage of the storm, the combined presence of two or more of lightning, heavy rainfall, localized flooding and high winds and the existence of records of the Australian Government Bureau of Meteorology showing that the rainfall levels or wind speeds experienced as part of the storm are at the higher end of the historical range.*

The occurrence of such an event would generally constitute a delay event for a project which includes a construction (or rehabilitation phase) if the event occurs during the performance of the construction or rehabilitation works. If it occurs during the operational phase of a project (such as during the term of an operations and maintenance contract), a Relief Event would only entitle the private partner to relief of the obligations affected by the event. For PBCs, it would not trigger deductions for failure to meet a performance criterion caused by such Relief Event. In a PPP, the lenders would however be reimbursed the senior debt amounts when due pursuant to their lending agreements.

Supervening events also include compensation events, which are events for which the private partner is placed in a "no better no worse" situation following the occurrence of an event. While supervening events constitute risk sharing mechanisms, they are reactive measures that are triggered once a specific event has occurred and the contracting authority typically bears the burden of compensating the Private Party.

7.3.3 Contractual flexibility provisions

Contracts often lack flexibility and lock parties in specific contractual terms subject to certain built-in risk-sharing mechanisms. This can create challenges in managing the uncertainties from climate change throughout the contract period.

In the context of climate change, this is a limitation. This is because the effects of climate change are long-term and ongoing, requiring more permanent solutions rather than just temporary suspension of obligations. While Force Majeure clauses and other supervening events provisions can excuse non-performance due to specific events, they do not address the need for economic adjustments within contracts that might be necessary due to the long-term impacts of climate change. Examples include cost increases in materials, labor and equipment; scarcity of materials, labor and/or equipment; supply chain disruptions; obsolescence (or lack of continued efficiency) of operational and maintenance procedure; or changes in project feasibility.

There are a number of contractual mechanisms, or provisions, that can enhance the flexibility of contracts. These include:

- Change procedure which is used in the Tlicho All-Season Road Project (see Box 7.1)
- Hardship provision such as the International Chamber of Commerce Hardship Clauses, which could be adapted to climate change events
- "Imprévision" in civil law country or economic equilibrium provisions

These mechanisms aim to re-establish contract balance where supervening and unforeseeable events fundamentally alters the contract equilibrium. This is because it dramatically increases the cost of performance for the private partner or negatively impacts the value of the performance received by a party (i.e. performance no longer brings value to the public sector).

A few sample provisions proposed for adapting the above concepts to climate change that could be used in projects across any sector, subject to any required sector-specific adaptations:

The Parties agree that should any significant changes in climate conditions materially affect the project costs or timeline, both parties will negotiate in good faith to adjust the contract terms to reflect the new reality, ensuring economic balance and project viability.

For projects where materials are sourced from regions vulnerable to climate change, a price escalation clause might be included similar to adjustments for inflation.

In the event of an increase of more than [5%] in the costs of (including the cost of transportation of) raw material, equipment or labor resulting from unforeseeable climatic events affecting the geographic location where material are sourced, equipment are manufactured, the labor force is located (or the transportation route therefore), prices set forth in this Agreement may be adjusted according to a predefined formula reflecting the proportionate increase in costs.

This provision would need to be adequately defined to ensure that the events are beyond the Private Party's control, and that the Private Party has implemented risk reduction measures to find alternative sources or transportation route.

This sample may be included in a change procedure or article:

Should statutory or regulatory changes adopted as a result of [climate change] adversely impact the operating conditions, or significantly increase the costs or revenues [expected under /set forth in] this Agreement, the Parties will negotiate in good faith to adjust the terms to restore the original economic equilibrium of the Agreement.

7.3.4 Innovative risk-sharing mechanisms

In the context of resilient infrastructure, a tailored risk-sharing mechanism could be implemented: with some risk borne by the private partner, some risk shared by the parties, and other risks borne solely by the contracting authority via a supervening event regime (compensation, relief and/or Force Majeure). This ensures that the private partner accounts for the possible occurrence of foreseeable climate change events and finds innovative ways to account for and reduce such risks. This also entails the use of disaster risk indices and screening or modelling tools during the planning of the project as part of the building of its risk assessment/allocation profile. The Canadian Tlicho All-Season Road Project provides an example of a fit-for purpose climate change risk-sharing mechanism (Box 7.1).

Box 7.1. Tlicho All-Season Road Project: An innovative climate change risk-sharing mechanism

The Tlicho All-Season Road is a 97 km all-season highway in the Northwest Territories (in Canada). The Project is being implemented as a 28-year Design-Build, Finance, Operate and Maintain (DBFOM) contract. This project is funded in part by a private developer (80 percent) and in part by the Tlicho Government. It is one of the first PPPs in North America to have an equity investment by an Indigenous Government.

One of the main risks of the project was climate change, especially due to its location on ice-rich permafrost, which is prone to thawing. To address this, an innovative climate change risk-sharing mechanism was implemented. The Contracting Authority used modeling tools to predict various climate outcomes, focusing on temperature, precipitation, and the percentage of precipitation falling as rain, which were identified as the most impactful metrics. These metrics were chosen for their potential adverse effects and their ability to be objectively measured throughout the project.

The Project Agreement contains various mechanisms related to climate change.

- First, the Private Party is required to incorporate the long-term effects of climate change on the design of the road and use vulnerability assessment methodologies and climatic information.
- Second, "Climate Change Events" are distinguished from other Supervening Events such as Force Majeure or Relief Event and were only relevant to the Operating Period. Climate Change Events occur when the 30-year average climate data for a month surpasses the Threshold Projection, as determined by climate model simulations.

The consequences or impacts of Climate Change Events are assessed from two angles:

- **Retrospective Impact.** The Impact of Climate Change on costs are subject to the cost sharing mechanism only where they exceed a certain monetary threshold (de minimis threshold). Above that threshold, the impact on costs are shared between the parties up to a maximum amount above which the risk is wholly born by the Contracting Authority.

  To the extent the impact of a Climate Change Event is the responsibility in whole or in part by the Contracting Authority according to the risk-sharing mechanism described above, such event is treated similarly to other Supervening Events.

- **Prospective Impact.** The change procedure includes the possibility for the Private Partner to propose amendments to the project (including the operations and maintenance or hand back works) for the purpose of responding to the impact and costs in any future 12 months period of a Climate Change Events. This can only be done once in any six months of the operating period (not during construction).

Key takeaways:

1. Adopt a tailored approach with the identification of specific climate risk early during the planning and procurement of the Project.
2. Involve the project proponents in the procurement in assessing/determining risks based on modelled scenario.
3. Incorporate resilience both in the design of the infrastructure and prospectively with innovation and value proposition being possible throughout the operating period.
4. Distinguish Climate Change Events from other Force Majeure or Relief Events (limited to the specific climate risk identified).
5. Ensure climate change risk is not borne by one Party but shared by both Parties.
6. Ensure Private Parties will be able to be compensated for the retrospective impact on costs of the occurrence of a Climate Change Event only if they have implemented and complied with the resilience-based criteria or mechanisms incorporated in the Contract (whether via design, performance criteria or DRM climate risk reduction measures, for instance). As such, in line with the contractual treatment of Climate Change, such risk-sharing enables both a proactive (enhancing resiliency) and reactive (addressing the consequences and compensation) approach to climate change.
7. Provide funding, access to modelling tools, data, and technical assistance to address the complexity of these mechanisms, which may be difficult to implement in developing countries.

The risk-sharing mechanism developed for the Tlicho All Season Road Project Agreement is applicable to other projects. It follows principles similar to specific contractual risk allocation mechanisms developed to address geotechnical conditions. These bear similarities with Climate Change Events in that:

- They are foreseeable in their occurrence (geotechnical conditions that are unknown or different from those described in geotechnical reports are common in underground linear projects such as transmission lines or tunnel for railway or urban transit transportation systems).
- They can impact project costs and work/performance means and methods and such impacts are difficult to quantify or will be priced via contingencies.

In geotechnical projects, geotechnical baseline reports have been developed as specific risk-sharing mechanisms to address geotechnical risks, limit disputes, and price contingencies. The Tlicho All-Season Road Projects proposes similar mechanisms adapted to climate change.

7.3.5 Tools to promote dialogue

The parties should confirm the relevant risk allocation and adjustment events during the procurement of the contract and contract negotiations. This dialogue would cover risk allocation, performance criteria, Force Majeure, or other supervening events (referred to collectively as "**Adjustment Events**") (etc.), which is based on:

- The specific infrastructure and infrastructure conditions (type of infrastructure and whether it is new or to be rehabilitated) or infrastructure side conditions (geotechnical and physical conditions)
- The infrastructure or infrastructure site cross-dependencies (such as access to power, water, or transport routes) and supply chain logistics
- The capacity of the Private Party to address the risk

As noted by PPIAF, to encourage Private Parties to incorporate resilient measures, key recommendations include "facilitating competitive dialogue between public and private parties before and during contract negotiation to establish standards and the definition of force majeure". This extends beyond Force Majeure and performance standards and includes, more generally, risk allocation.

To encourage resilient measures, request for proposals should include:

- Specific disaster relief tender specifications and evaluation criteria
- Allow for certain level of collaboration or dialogue during the procurement process via clarification periods for bidders, bidder conferences, and meetings with individual bidders.

Guidance on procuring climate smart projects can be found in the World Bank Climate Toolkits for Infrastructure PPP and other documents.

In addition to requiring qualifications and expertise in resilience, procurement documents could also mandate that bidders submit a comprehensive Climate Change Plan. This plan would outline the tenderer's strategy to meet the climate change and resilience requirements specified in the technical specifications or project outcomes. The Climate Change Plan should detail the methods for achieving these objectives, key milestones, the roles and responsibilities of all parties involved, and the engagement of any relevant stakeholders. Once approved (with or without amendments) by the Contracting Authority, the Climate Change Plan would become a binding contractual document, serving as a benchmark for assessing the Private Party's performance.

Alternatively, the Private Partner could be required to submit the Climate Change Plan within a defined period following commercial close. Moreover, the contract could include provisions for updated iterations of the Climate Change Plan to be submitted whenever there is a proposed scope change that affects climate change or resilience requirements, or after a specified period of time.

Notably, the NEC suite of contracts, developed by the UK Institution of Civil Engineers, includes a template provision (X29) for climate change obligations, which features a requirement for Climate Change Plans.

(1) If a climate change plan is not identified in the Contract Data, the [Private Partner] submits a first climate change plan to the [Contracting Authority] for acceptance within the period stated in the Contract Data.

(2) The Climate Change Plan shows how the [Private Partner] plans to meet the Climate Change Requirements.

(3) Within two weeks of the [Private Partner] submitting a climate change plan for acceptance, the [Contracting Authority] notifies the [Private Partner] of the acceptance of the climate change plan or the reasons for not accepting it. Reasons for not accepting a climate change plan include:

- *It does not comply with the Climate Change Requirements.*
- *It will not allow the [Private Partner] to provide the Service.*

(4) The [Private Partner] submits a revised climate change plan to the [Contracting Authority] for acceptance

- *Within the period for reply after the [Contracting Authority] has instructed it to and*
- *When the Private Partner chooses to.*

Another model which embeds collaboration into the contracting model is alliancing contracting (a form of alternative contracting based on collaboration) or Integrated Project Delivery, which is used for construction projects in advanced economies such as Canada and countries in the Middle East. These alternative contracting models are a form of PBC based on collaboration and risk sharing arrangements.

As an example, in British Columbia (Canada), Infrastructure BC — the province's infrastructure agency supporting public sector agencies and departments to procure complex capital projects — published a briefing on adjustment events for alliancing contracts. While alliancing is an alternative contractual framework largely based on the equal sharing of risks by both the private partner and the contracting authority, it nevertheless includes adjustment events which falls under the sole responsibility of the contracting authority. These events are exceptional and limited. As part of the procurement process for such contracts:

- The bidder and selected member of the contracting authority must complete a scenario questionnaire giving their individual (rather than corporate) views as to whether specific risks should be shared or retained by the contracting authority.
- A facilitation alignment workshop is then conducted with each bidder. If there are major differences in the risk tolerance or appetite between two or more bidders, then, guided by a third-party estimator, the contracting authority will make an allowance for such differences to be able to evaluate the proposals.

Although this process is not specific to climate change Adjustment Events, a modified version of the above process could be implemented during the procurement of climate-change resilient infrastructure projects. This process could also occur as part of the contract negotiations, more particularly in projects that are procured on a sole source basis.

7.3.6 Illustrative use case

The illustrative use in Box 8.2 demonstrates the potential application of the innovative mechanisms discussed in the previous sections to specific resilience challenges. While this example provides illustrative guidance in the context of a transport project, it cannot be applied as is in practice and should be informed by specific planning customization based on individual project needs.

Box 7.2. Illustrative use case for innovative contracting approaches

Context

A Contracting Authority plans to enhance the maintenance and operation of an existing freight railway in a region prone to frequent medium-magnitude earthquakes and heavy rains. These natural events have caused flooding of, and damages to, stations and tracks, leading to prolonged train service interruptions. Consequently, supply chains for certain key products have been disrupted. The project involves rehabilitating specific stations and railway segments that have been damaged over time due to these environmental challenges.

Key resilience actions

The key steps that the Contracting Authority should take to ensure that the rehabilitated stations and tracks incorporate resilience in their design, operation and maintenance could include the following:

- **The Contracting Authority should establish that an off-the-shelf solution for the project will not suffice, and incorporate additional resilience-related project preparation activities.** In the planning of the project, the Contracting Authority should conduct comprehensive environmental analysis, vulnerability assessment and risk assessment. It will need to be determined whether the increased frequency of medium-magnitude earthquakes and heavy rains are caused by, or are the manifestation of, underlying climate evolution and change and whether additional climate risks exist. This assessment would include the evaluation of the existing infrastructure to determine weaknesses that could lead to failures during the foregoing events.
- **The Contracting Authority should consider implementing PBCs as follows:**
  - Transferring to the Private Party the rehabilitation, maintenance and operation of the tracks and the stations. By being responsible for maintenance, the Private Party will be incentivized to incorporate high-quality, resilient materials and designs from the outset.
  - Linking payment to the achievement of resilience performance criteria (KPIs and/or services level). These could include:
    - The ability of the rehabilitated stations and tracks to withstand certain climate events (as defined by duration, volume, force, etc.): e.g earthquakes up to a certain magnitude, heavy rainfall up to a certain intensity.
    - Disruptions or damages caused by earthquake, heavy rain or other identified climate event have to be adequately addressed through DRM measures, resulting in minimal service disruption (i.e. setting out the maximum allowable unavailability of the stations or tracks after the occurrence of a specific event)
    - The Private Party being responsible for certain level of damages.

  Failure to meet the performance criteria will result in penalties, thus encouraging the Private Party to invest in resilient solutions.

Box 7.2. Illustrative use case for innovative contracting approaches (Cont.)

- **The distribution of climate-related risks between the Contracting Authority should not render the project non-viable financially, unduly limit or remove competition.** Further, the risk allocation should be adapted to the country's policy and legal frameworks, context, level of sophistication, and competition landscape.
- **Resilience components should be incorporated in the project design requiring Private Party to ensure that the rehabilitated infrastructure can address the identified risks.** Other relevant resilience components may include early warning systems and real-time monitoring for earthquakes and other identified climate conditions.
- **In allocating risks in the contract, the Contracting Authority should ensure that only foreseeable and/or quantifiable climate risks are transferred to the Private Party and should confirm such allocation prior to or during the procurement phase.**
  - Before the tender is launched, the Contracting Authority could conduct a market sounding with the potential bidders to better understand their levels of acceptance of the risk allocation and the impact of such allocation on the project`s bankability.
  - During the procurement process, the Contracting Authority could allow bidders to provide comments on climate risks or organize a workshop facilitated by a third-party expert.

    The findings of the above exercise should assist the Contracting Authority in refining the risk allocation and the resulting contractual mechanisms. The Contracting Authority.
- **In more mature markets, climate risks could be modelled and a more complex risk-sharing mechanisms implemented in the contract.** In any jurisdiction, the Contracting Authority should incorporate mechanisms to address climate change. In most contracts through Force Majeure for the more extreme and unpredictable climate risks. Other supervening events provisions could relieve the Private Party of performance for less disruptive events. For long-term contracts, hardship or economic equilibrium provisions could be included.
- **The procurement documents should contain specific criteria focusing on the bidders' experience with resilient infrastructure projects in the rail and freight sectors in similar environments.** The Contracting Authority should collaborate with local communities, experts, and industry stakeholders to ensure that the project meets the policy and legal framework, regional needs and leverages local knowledge.
- **The Contracting Authority should inquire whether the insurance market has available insurance products covering earthquakes and flooding and other climate-related events identified during the vulnerability assessment at reasonable prices and, if so, require Private Party to obtain such insurance.** If a specific risk or specific risks are not insurable, are frequent, and their impact on the infrastructure or the services potentially major, the Contracting Authority should consider retaining those risks under public responsibility, developing contingency plans, or introducing risk-sharing mechanisms—such as force majeure clauses, compensation events, or government guarantees—to ensure project resilience and financial viability.

Box 7.2. Illustrative use case for innovative contracting approaches (Cont.)

Key takeaway

- **Tailored solutions are essential:** Customization based on thorough planning and vulnerability/risk assessments is crucial. This process should be informed by best practices, where possible, stakeholder engagement and be aligned with the local policy and legal landscapes.
- **Integrated approaches to climate risks:** Addressing climate and disaster risks in contracts relies on a combination of performance-based resilience technical criteria, incentive-based payment, and contractual measures adapted to the project and the market.
- **Balanced risk allocation enhances bankability:** A balanced distribution of risks will enhance competition and ensure the project's bankability, making it more attractive to potential private partners, and where relevant, lenders.
- **Complementary risk and contract management:** Proactive risk management and effective contract management are complementary tools that together contribute to the project's success
- **Importance of capacity-building:** Capacity building is important to enable effective implementation and to foster confidence. Implementing innovative contracting approaches typically demands a greater degree of capability from both Contracting Authorities and Private Partners.

Governments can facilitate the adoption of innovative contracting clauses by developing standardized documents to support officials in drafting and implementing resilience-related provisions. Resilience-related clauses such as performance requirements, KPIs, and any thresholds incorporated in Force Majeure would have qualitative and quantitative differences according to the climate hazards and conditions of a specific infrastructure asset. In certain innovative clauses, Force Majeure may be triggered only when a hazard exceeds a certain level, with the private party assuming potential risks below that threshold level. However, efforts to standardize and simplify the contractual framework and language for these clauses can help to facilitate implementation and acceptance of private partners.

Given that innovative contracting clauses may have limited to no precedence and familiarity among government officials and the private sector, governments should explore introducing their applications in pilot projects. It would be important to dedicate sufficient resources in terms of funding for transaction costs and requesting technical assistance from development partners to address any capacity gaps. By doing so, governments can generate lessons learned and good practices tailored to local context.

7.4. Improve procurement practices

7.4.1 Resilience-focused performance requirements

Contracting authorities for transport PSP projects should incorporate resilience requirements into their procurement approaches in line with the government priorities on delivering climate and disaster resilient transport. Otherwise, procurement approaches that are silent on resilience needs can create competitive disadvantage for bidders that incorporate resilience measures in their proposals. An effective procurement package for transport PSP projects should incorporate and optimize the potential drivers of value for resilience measures. These potential drivers include:

- **Resilience measures in design and construction.** Contracting authorities should require resilience measures during the planning and design phases to be included in bid documents.
- **Plans for recovery from extreme climate events and natural disasters.** This is key to ensure both proactive and reactive resilience measures during the operational phase of projects.
- **Relevance, quality, and comprehensiveness of the Operations and Maintenance (O&M) Plan.** Contracting authorities should require bidders to outline resilience measures in operations and maintenance plans, and where possible, linked with performance-based payment mechanisms.
- **Insurance coverage and emergency funding.** Contracting authorities can incorporate as part of the RFP criteria, the evidence of sufficient insurance against potential climate and disaster risks in addition to technical qualifications. Contractors could also be requested to demonstrate the availability of emergency funding to deal with costs arising from extreme events as part of the bid documents.

However, contracting authorities should take caution in ensuring the procurement requirements remain within the technical capabilities and risk appetite of potential bidders. In doing so, the authorities should consider the relevant operational contexts related to resilient transport including technologic aspects (e.g. experience with implementing the required technical solutions) and economic aspects (e.g. ability to attract international bidders). The development of an optimal procurement approach would be critical to support the authorities in attracting sufficient bidders to enable a competitive bidding process.

Recommended resources

Climate Toolkits for Infrastructure PPPs (2023) provides comprehensive guidance on the overall approach to integrate climate considerations into procurement, including the preparation of tender process and documents.

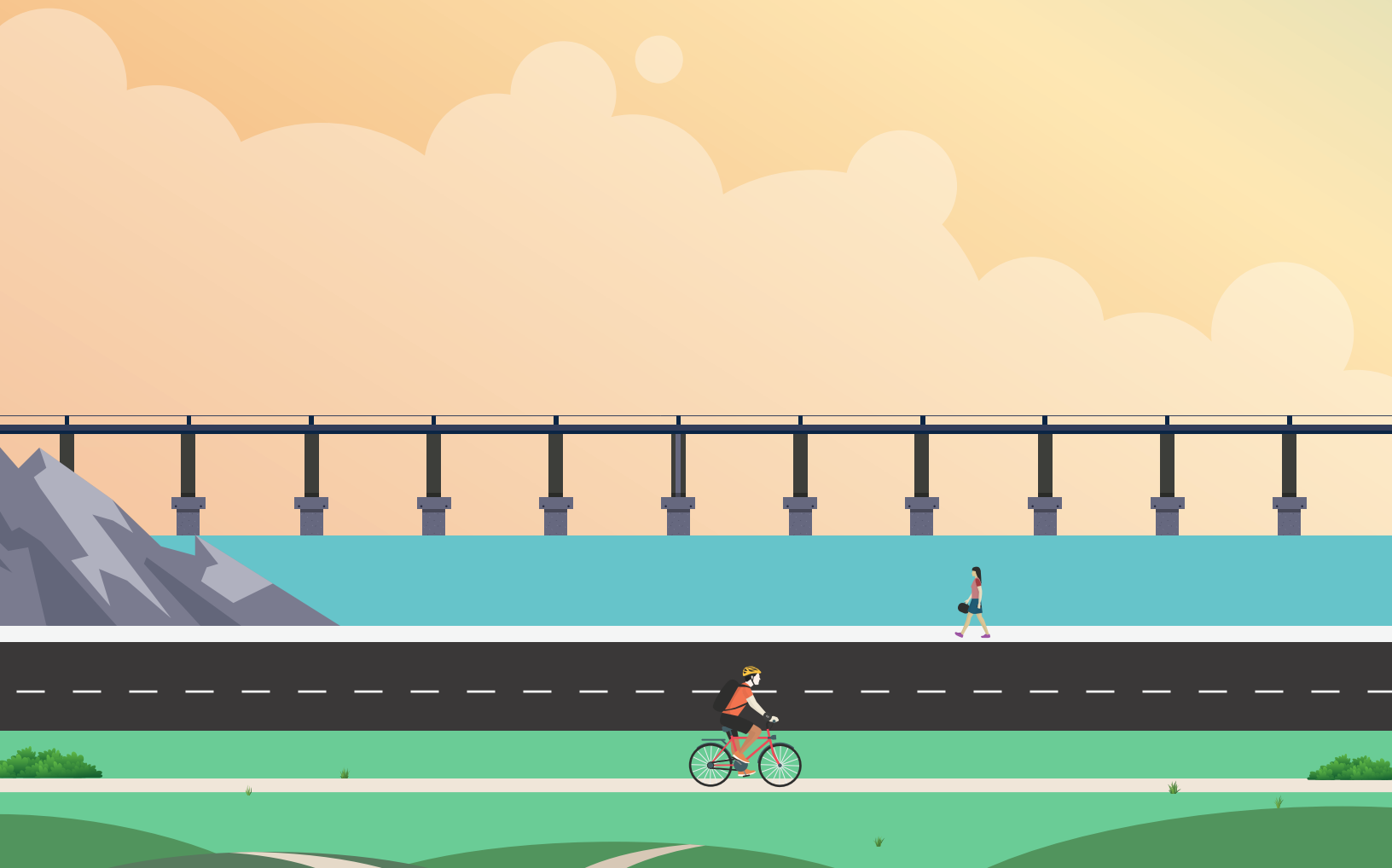
7.4.2 Procurement strategy

The transition in procurement practices for transport PSP projects should take place gradually, considering the readiness of both public and private sectors. To facilitate the process, governments should develop a procurement strategy to achieve these objectives:

- **Setting implementation priorities.** Governments may indicate the prioritized types of transport projects (e.g. projects with an investment size above a certain monetary threshold) where the resilience requirements should be first introduced. Over time, the requirements can be gradually broadened to cover more projects.
- **Market sounding.** The market sounding exercise would allow governments to learn about available technologies, good practices, and innovative solutions related to resilience for the specific transport subsector. Further, governments may gather preliminary cost and quality benchmarks for resilience measures, which may help the governments to develop well-defined resilience requirements in the bid documents and evaluate the cost and quality of bids received.

8

Project and Public Funding



As climate risks intensify and place increasing pressure on transport systems, the need for resilient investments has never been more urgent. Developing resilient transport infrastructure not only requires significant upfront capital but also long-term planning to manage climate risks that will evolve over the lifespan of these assets. Without practical and adaptable financing tools, resilience measures are often overlooked, leaving critical transport assets exposed to future climate shocks.

This chapter explores how innovative funding mechanisms, better-designed public support, and smarter use of relevant tools can improve the financial viability of resilient transport PSP projects. The aim is to ensure that resilience becomes a core part of transport investment strategies rather than an afterthought.

8.1. Maximize project funding generation

8.1.1 Resilience investment charge

A transport PSP project may collect the revenue and involve government funding to varying extents. Nevertheless, effective funding generation is key to improving the commercial and financial viability of the project. **Table 8.1** provides examples of funding sources for transport PSP projects in transport subsectors.

Table 8.1. Examples of funding sources for transport PSP projects

Subsectors	Potential project funding sources
Roads	• **Toll revenue:** Usage charges collected from road users • **Congestion charges:** Fees levied on users to alleviate traffic congestion • **Commercialization revenue:** Generated from advertising or leasing roadside spaces
Ports	• **Container handling fees:** Charges for loading and unloading containers • **Storage charges:** Levied for storing goods at the port • **Lease revenue:** Generated from leasing port space to businesses • **Logistics service fees:** Fees for additional services provided by the port.
Railways	• **Farebox revenue:** Revenue generated from passenger fares • **Access charges:** Charges paid by operators to use tracks and stations. • **Non-fare revenue:** Revenue from non-fare sources, such as advertising and property rental
Airports	• **Aeronautical revenue:** Income from services such as landing fees • **Non-aeronautical revenues:** Revenue from non-aeronautical sources, such as retail, parking, or rental income

Source: Adapted based on: Benitez, Daniel Alberto, and Jyoti Bisbey. 2021. Financing Low Carbon Transport Solutions in Developing Countries.Ardila-Gomez & Ortegón-Sánchez (2015). Sustainable Urban Transport Financing from the Sidewalk to the Subway.

Governments may assess the possibility of recovering the additional costs of resilience investments by incorporating a tariff component within the user tariffs, noting that users' willingness and ability to pay should be carefully studied and considered. The tariff components can be split into:

- **Base facility charge:** Covers capital costs, operating costs, debt repayment and returns to equity.
- **Resilience investment charge:** Covers the additional costs associated with resilience investments.

It is important to note that the implementation of resilience investment charges in the transport sector may require the governments to address the potential challenges such as political sensitivity, difficulty in quantifying and communicating resilience benefits, equity and affordability concern, and the lack of legal and regulatory frameworks.

When the resilience investment charges are not feasible or can only recover part of the costs, governments may provide viability gap funding to close the funding gap. This, however, needs to be applied with caution and be reserved for cases where all other funding instruments have been proven inadequate. Otherwise there is a risk that private partners may implicitly pass a large portion of resilience investment cost to the contracting authorities through the viability gap funding.

8.1.2 Climate contingency account (CCA)

A CCA can be defined as a reserve account that reserves a portion of the project's cash flows for resilience-related costs from the beginning of a transport project up to a pre-determined amount. This is similar to how maintenance reserve account is typically used to reserve funds for future major maintenance works. A CCA can be used for two purposes:

- Dealing with climate-related costs such as loss of revenue due to service disruptions, improvements to assets against physical damage from extreme events, and implementation of emergency responses.
- Reserving funding resources for adaptation works that will be implemented in multiple phases as part of an adaptive plan based on whether pre-defined targets related to climatic conditions are met. An adaptive plan designs the projects for a mild scenario at the present time to minimize upfront costs, while allowing for adaptation to more adverse scenarios based on relevant indicators that may appear in the future.

A CCA can provide certain benefits such as cash flow certainty and risk management, which should be assessed against the costs of maintaining such an account including the opportunity costs of unutilized funds and how it affects payments to investors.

Overall, CCA remains relatively untested in PSP projects within the transport sector. The challenge lies in defining and agreeing upon the events during which the drawdown of the CCA can be made. These events should be identified specifically for a transport project based on a proper climate and disaster risk assessment, with the involvement of resilience experts, financial and legal advisors.

8.2. Optimize public funding support

Public infrastructure funds, as a vehicle to manage the deployment of public support in infrastructure PPPs, may catalyze resilience investment in urban transport. Examples of public infrastructure funds include Fondo Fiduciario Federal de Infraestructura Regional (FFFIR), Argentina; Fondo de Desarrollo Nacional (FDN), Colombia; Ghana Infrastructure Investment Fund (GIIF); Development Bank of South Africa/Infrastructure Investment Programme (DBSA/IIPSA); India Infrastructure Finance Company Limited (IIFCL); Infrastructure Development Company Limited (IDCOL), Bangladesh; Indonesia Infrastructure Guarantee Fund (IIGF)

These funds may improve the deployment of public funding by centralizing and managing a range of government support for functions such as project preparation support, viability gap funding, and management of fiscal liabilities. Through these functions, they are key to project pipeline generation and improving the commercial viability of projects that deliver substantial economic benefits but may suffer from revenue or funding shortfalls while ensuring fiscal exposure is properly managed. Public infrastructure funds, thus, have important roles to support resilient transport PSP projects, given the cost of resilience investments may widen funding gaps in transport PSP projects.

8.2.1 Project preparation support

With respect to project preparation funding, the need for project preparation support is substantial for resilient transport PSP projects (refer to chapter 3 for more details). This starts from upstream work to conduct national climate and disaster risk analysis for transport projects, project identification, through to resilience-focused procurement and contracting.

Such need is heightened by the importance of managing the complexity associated with developing PSP projects including the extensive market sounding required to test innovative procurement and contracting requirements with potential bidders and their financiers.

Setting up a dedicated fund is a potential option but not a must, as it would be beneficial to consider whether any existing entities can act as a suitable vehicle.

In this regard, public infrastructure funds can serve as an important vehicle with the added advantage of not only managing the funding, but also potentially providing the necessary technical expertise through their in-house infrastructure financing experts and resilience specialists (which may be hired, if not available) to provide technical assistance and ensure the project preparation support is designed and delivered effectively for resilience purposes.

8.2.2 Viability gap funding

Public infrastructure funds can be a centralized vehicle to manage viability gap funding for resilient PSP projects in transport (and potentially other sectors). This funding can be delivered as:

- **Upfront Capital Grant**, including but not limited to construction expenditure, cost of purchasing equipment, and other capital-intensive project components
- **Operational Grant**, to meet the shortfall between project revenues and the operational expenditure of the transport project

Payments to the private party may take various forms, such as:

- **Service Payments**, based on meeting pre-defined service quality standards;
- **Availability Payments**, linked to the infrastructure being available and properly maintained; and
- **Demand- or Output-Based Payments**, which depend on actual service use or the achievement of specific performance targets.

Public infrastructure funds can generate additionality for resilience investments in the transport sector by:

- Earmarking specific envelopes of resources for resilient transport PSP projects
- Promoting good practices by potentially incorporating conditionality on transport PSP projects to integrate resilience investments or related activities (at least climate and disaster risk assessments, and other follow-on activities if significant risks are identified)

8.2.3 Contingent funding support

Public infrastructure funds can also act as a vehicle to manage and monitor contingent liabilities from transport PSP projects, including those that may arise from climate change and natural disasters.

Such unforeseeable events can fundamentally alter the contract equilibrium when they dramatically increase the cost of performance for the private partner of a PSP project or negatively impact the value of the performance received by a party (i.e., performance no longer brings value to the public sector). To restore the economic equilibrium of PSP contracts, the government may have to provide public funding support to address any such contingent liability.

The potential benefits of making contingent funding support available include:

- **Providing assurance to the private sector of the governments' funding commitment to support resilience in transport PSP projects.** It helps with risk management of the private partners related to unforeseen funding needs from climate and disaster risks which are beyond the reasonable control of the private partners, thereby facilitating greater interest for PSP.
- **Supporting timely emergency recovery by private partners.** Emergency recovery may sometimes require capital-intensive rehabilitation works which may go beyond the scope of the emergency response plan, contracted performance requirements, and the current funding capacity of the project company. While it may be possible to fund these works through additional budget appropriations, insurance payouts, and/or future tariff adjustments, the resource mobilization process will take time. Contingent funding support can thus help meet the immediate funding need to restore the transport infrastructure availability and ability to generate revenue.

The provision of such contingent funding support should, however, be clearly defined and circumscribed to ensure it does not affect the private partners' incentives to undertake proactive resilience investments, and that its intended objectives to deal with residual and uncontrollable risks are met.

8.2.4 Subsidies for insurance against climate and disaster risks

Public infrastructure funds may also support transport PSP projects to deal with contingency funding needs by providing subsidies for insurance against climate and disaster risks. Such subsidies can partially cover the insurance premium private partners need to pay insurers for specific types of climate and disaster risk coverage.

Climate and disaster risks may affect the financial viability of transport PSP projects when they manifest and result in additional costs to the projects, or on an ex-ante basis, the need for adaptive works to deal with such risks can raise project costs to the extent bankability may be reduced.

As emphasized in this Roadmap, resilience investments are key to addressing such climate and disaster risks. Nevertheless, it is important to recognize the importance of dealing with the residual risks after adaptive works have been factored in, which can be achieved through insurance.

Insurance and resilience investments are two actions that are mutually reinforcing and facilitative for PSP:

1. **Resilience investments would reduce the vulnerability of transport projects towards extreme events.** This can lower the projects' risk premium, thereby increasing insurability and reducing the costs of insurance. This can improve the bankability of transport projects for PSP.
2. **Insurance can help to address residual risks that are beyond the control of the private partners.** Such risks include those arising from broader systems (e.g. failure of electricity grids or any adjacent or interconnected infrastructure). In other cases, it may be because it is neither feasible nor cost-effective to over-specify and over-invest in resilience measures that aim to prevent all identified climate and disaster risks. In these situations, insurance can transfer the residual risks faced by the private partners to insurers, allowing the private partners to receive financial protection for recovery.

Therefore, the case to provide subsidies to transport PSP project companies for insurance against climate and disaster risks can be established, subject to the condition that the private partners have incorporated the reasonable resilience investments in the projects.

If a transport project is uninsurable or too expensive due to a project design that lacks resilience, the first best action is to require the private partners to strengthen the project design. Therefore, the private partners must be able to demonstrate that resilience investments have been incorporated adequately to qualify for this support.

Recommended resources



Global Review of Public Infrastructure Funds - Volume I by the World Bank Group presents the findings of a global review of a cross-section of public infrastructure funds in Argentina, Bangladesh, Canada, Colombia, Ghana, India, Indonesia, and South Africa. This may be useful reference for governments as they consider approaches to use public infrastructure funds to support resilient transport PSP projects.

8.3. Facilitate public funding generation

8.3.1 Land value capture

Land value capture may mobilize additional sources of public funding that can be used to support resilience investments in the transport PSP projects. Land value capture relies on "indirect benefit instruments" such as infrastructure levies, special assessments and betterment charges, land pooling/readjustment, and development rights, which seek to monetize and capture the increase in land value and associated economic value due to public investment. Box 9.1 shows the potential of land value capture to generate funding for resilient transport projects.

Box 8.1. Land Pooling/Readjustment (LP/R) Pilot, Tra Vinh, Viet Nam

Background

Tra Vinh city in Viet Nam conducted a pilot for land pooling/readjustment approach to redevelop a centrally located low-income neighborhood, with the objective of addressing flooding risks and a lack of access roads and drainage network. As the city government has a limited budget, LP/R was considered the only viable approach by sharing development cost with local residents.

Land value capture approach

With technical assistance from the WBG, the government approved a new decree that included LP/R provisions in January 2017, which became the first legal framework for LP/R in Viet Nam. Based on the LP/R plan, about 70 percent of the total investment cost was to be covered from the city's budget. The remaining 30 percent of the total cost was to be covered by the sale of surplus land.

Future revenue from land in the project area, such as land transaction tax, land use conversion fee (from agricultural to residential), and land tax, is expected to increase significantly because of the project.

Conclusion

This example demonstrates that land value capture may be used for projects that expand and enhance road networks together with investments that address climate risks such as flood mitigation. Public roads were involved in this case, but there may be potential to use land value capture to help fund roads and other types of transport projects delivered with PSP.

Studies have shown that the implementation of land value capture has varying level of traction in different countries and localities for various reasons.

- Many countries lack a legal definition of or justification for land value capture, which is important to reduce legal disputes and promote citizen support.
- Developing countries tend to provide less discretion to local officials for implementing land value capture, mainly due to corruption concerns and lack of trust in local governments.

- The most prevalent obstacle in land value capture is resistance by property owners.
- Another key obstacle is the lack of administrative capacity, especially in lower-income countries, which complicate instruments that require negotiations with private developers.
- Legal disputes can be common for the infrastructure levy in the form of fees charged for public works initiated by the public sector.

Therefore, governments should address the challenges so they can effectively deploy land value capture in funding resilient transport projects, potentially through technical assistance and partnerships with development partners.

Recommended resources

Sustainable Urban Transport Financing from the Sidewalk to the Subway (2015) by Ardila-Gomez & Ortegón-Sánchez provides an analytical framework to support the design of comprehensive urban transport financing including land value capture and tax revenues.

Global Compendium of Land Value Capture Policies (2022) by OECD-Lincoln Institute of Land Policy reviews the full landscape of land value capture (LVC) instruments, how they are configured and deployed across the globe in OECD countries and non-OECD economies.

8.3.2 Tax revenue resources

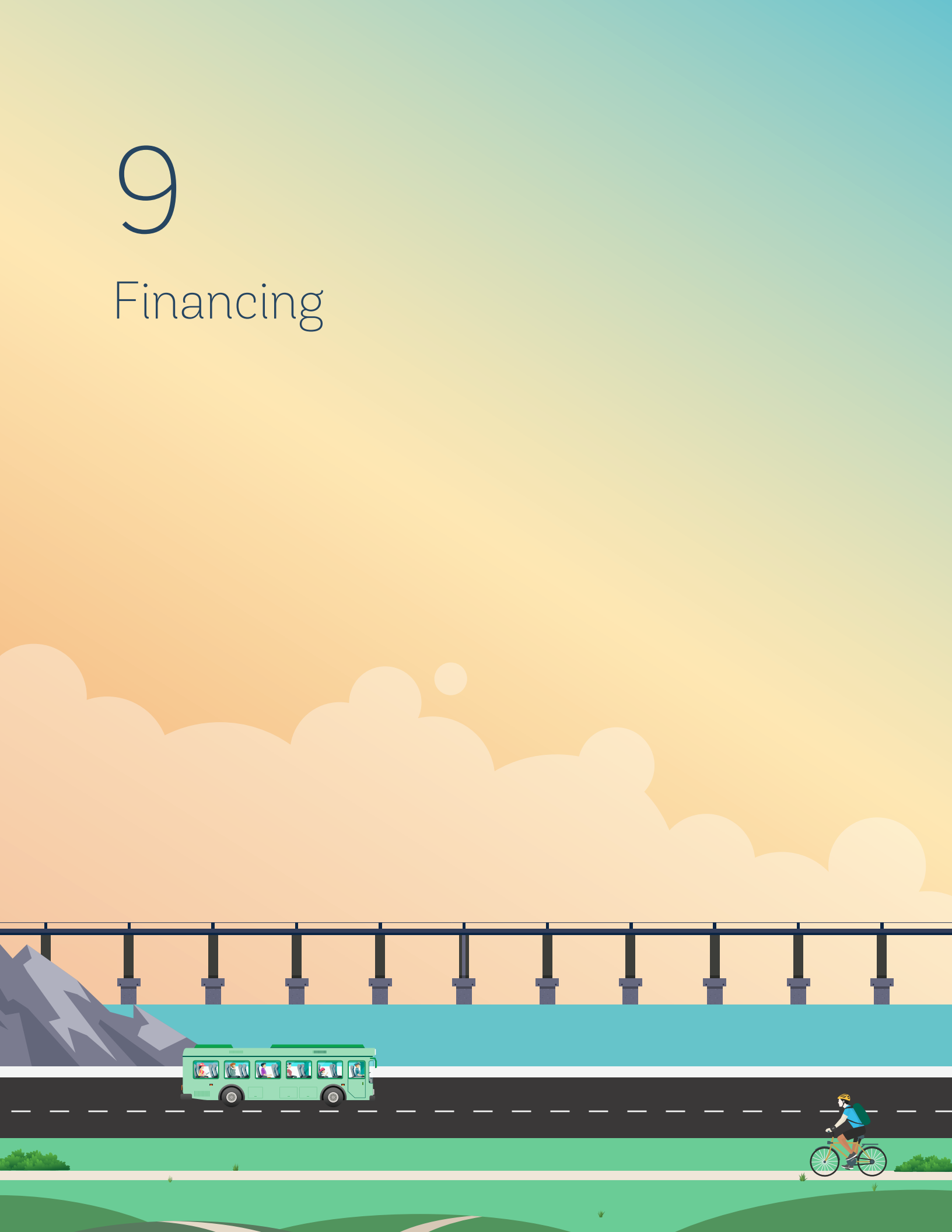
Tax revenue resources such as vehicle taxes, fuel taxes, and more recently, carbon taxes, are often earmarked for specific purposes. In the road sector, road funds are commonly established for funding public road maintenance and rehabilitation in many countries, which may draw upon various sources such as vehicle and fuel taxes to replenish the road funds. Examples of road funds include Road Budget Trust Fund, Azerbaijan; The Road Fund, Kyrgyz Republic; The State Road Fund, Mongolia; Road Maintenance Account (RMA), Pakistan; Republican Road Fund, Uzbekistan; The Road Fund, Lesotho; Uganda Road Fund (URF), Uganda; National Road Fund Agency, Zambia; Tanzania Roads Fund (TRF), Tanzania; Kenya Roads Board (KRB) Funds, Kenya; Roads Fund administration, Malawi; and Road Fund Administration (RFA), Namibia.

While less common, rail funds have been set up in some countries to systematically provide public funding for the operations and maintenance, renewal, and modernization of existing rail infrastructure, and further expansion in the railway sector. Examples include Rail Infrastructure Fund, Switzerland; Local Rail Development Fund, United Kingdom (Scotland); and The Freight Fund, United States (Virginia).

Governments can consider earmarking tax revenue resources to help fund these specialized entities which can then support the mobilization of PSP in resilient transport projects. It is, however, important for governments to assess and ensure that any additional taxes do not lead to undue economic burden on the public and they should be properly communicated. Where existing tax revenue resources are redirected, governments should ensure that this does not lead to a lack of funding for other public priorities.

9

Financing



As climate risks escalate, building resilient transport infrastructure demands not only technical solutions but also robust and innovative financing approaches. Public and private actors alike must rethink how to fund and deliver infrastructure that can withstand future shocks, from extreme weather events to long-term climate shifts.

For many developing countries, limited fiscal space, high upfront costs, and market uncertainties make PSP in resilient transport projects challenging. Addressing these barriers requires strategic mobilization of national public finance, international concessional resources, and innovative financial instruments that can de-risk investments and attract private capital.

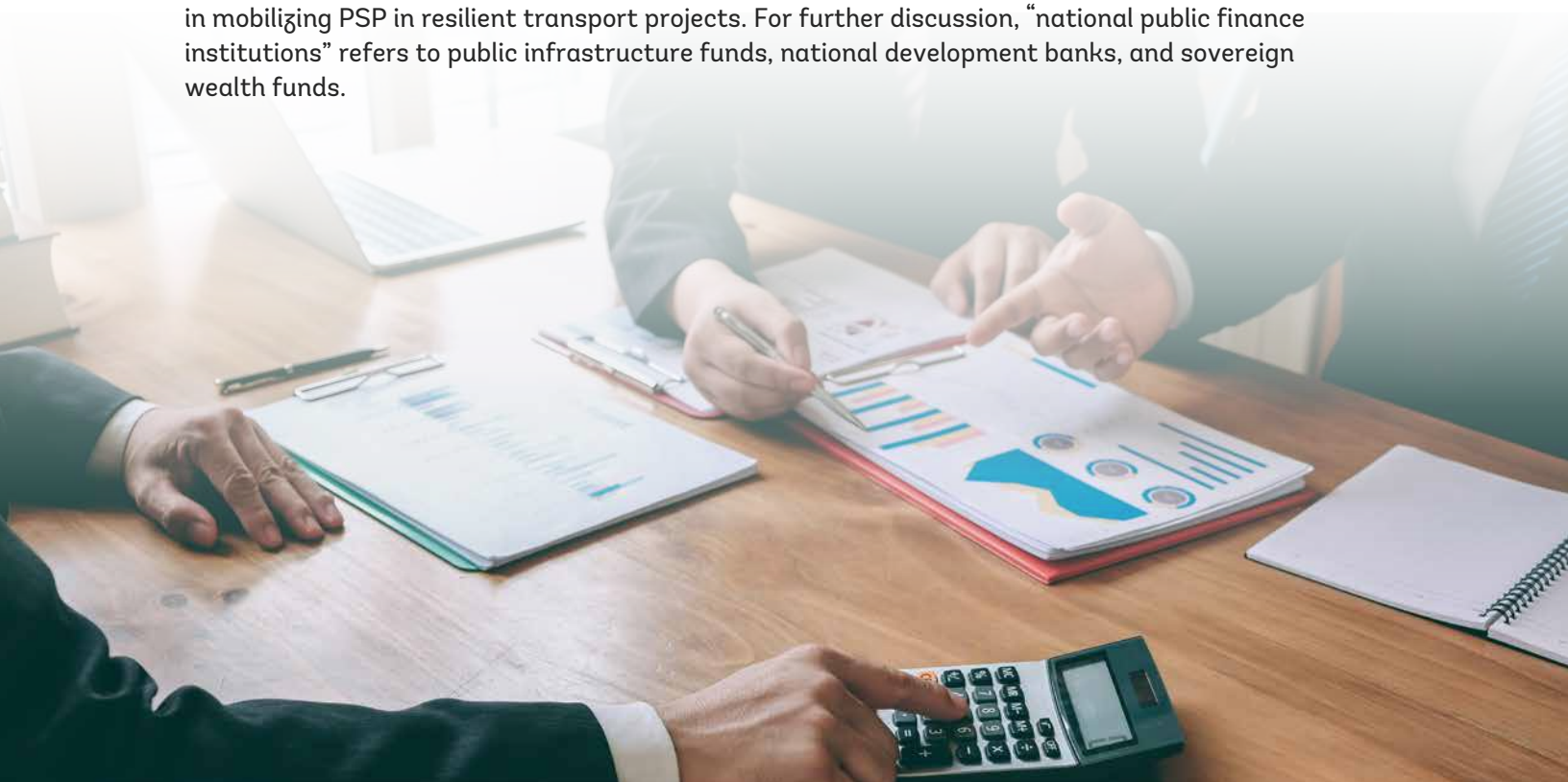
This chapter examines how governments can optimize public finance tools and develop creative financial solutions to unlock private investment for transport projects that are not only functional but future-proof.

9.1. Optimize national public finance

Governments can use public finance to provide concessional financing to local governments, state-owned transport enterprises, and when investments are delivered through PPPs, to private project companies. This approach is key to help mitigate the risks associated with resilient transport PSP projects, making them more attractive to private investors. National public finance is particularly important when:

- Financial return of a PSP project is not commercially attractive sans concessional financing support
- A transport PSP project is subject to investment risks which private financiers are unwilling to take on, such as climate and disaster risks, as well as the risk associated with unfamiliar innovative project design and technologies for increasing resilience

To address these challenges, governments should strengthen the roles of sovereign and municipal financing, public infrastructure funds, national development banks, and sovereign wealth funds in mobilizing PSP in resilient transport projects. For further discussion, "national public finance institutions" refers to public infrastructure funds, national development banks, and sovereign wealth funds.



9.1.1 National public finance institutions

National public finance institutions can facilitate greater private investment in resilient transport PSP projects.

1. **Incentivize private partners to integrate resilience investments in transport projects.** These institutions can offer more favorable costs of capital to transport projects with robust adaptation plans on the basis that higher climate and disaster resilience also lowers investment risks, thereby incentivizing private partners to raise their standards.

2. **Crowd-in additional private finance from profit-driven investors**. These institutions can provide blended finance using instruments such as concessional loans and guarantee to improve the risk-return profile and de-risk the investments to the acceptable level for private financiers such as institutional investors and commercial banks. When private finance is mobilized in this approach, the private financiers provide financing directly to the private partners, taking on full or partial project performance risks depending on the blended finance approach.
   This approach also provides increased market discipline as the private financiers would need to price in the applicable risks to the transport project's creditworthiness and provide lender oversight directly on the project. Importantly, this would not add to public debt and thus represents a key approach to mobilize an additional pool of capital, without causing further strain on fiscal sustainability.

3. **Support the implementation of resilience requirements for PSP projects.** These institutions can provide additional scrutiny during investment to ensure that transport projects integrate proper resilience measures and project monitoring by demanding regular resilience-related reporting for lenders' oversight.

Box 9.1. Stormwater Management and Road Tunnel (SMART) project in Kuala Lumpur, Malaysia

Bank Pembangunan Malaysia Berhad (BPMB), a national development bank in Malaysia, provided financing for the SMART Tunnel – a storm drainage and a road structure which contributed to flood management and traffic management in the capital city, Kuala Lumpur. There are two components to this tunnel: the stormwater tunnel and motorway tunnel.

The project was undertaken through a joint venture pact between MMC Corp Berhad and Gamuda Berhad with the Department of Irrigation and Drainage Malaysia and the Malaysian Highway Authority as the executing government agencies.

Since 2007, the stormwater tunnel has diverted floodwaters on more than 40 occasions, saving an estimated RM 1.4 billion in potential public damage. The motorway tunnel also helps to ease traffic congestion by providing an alternative route for motorists from the Southern Gateway entering and exiting the city center, reducing traffic congestion and shortening the travel time significantly.

Governments may take actions to ensure national public finance institutions can more effectively contribute to mobilizing private finance for resilient transport PSP projects:

1. **Provide explicit strategic mandate to mainstream resilience in investments.** These institutions are typically mandated to support investments that contribute to national priorities, which should be clarified to also emphasize climate and disaster resilience in railway investments (or other sectors).
2. **Facilitate capacity building and the development of resilience-related expertise.** Resilience considerations should be systematically integrated in the investment strategy and processes of these institutions, which may also require a staffing plan to acquire resilience-related expertise through training and hiring.
3. **Foster the use of a blended finance approach to mobilize private finance**. The national public finance institutions should be encouraged to increase the use of blended finance and emphasize private finance mobilization. They can provide direct financial support (e.g. equity and debt) and contingent support (e.g. guarantees and other credit enhancements as shown in Box 10.2) to help viable private sector participation projects in overcoming financial market failures. These failures include limited long-term local-currency financing due to underdeveloped capital markets; liquidity constraints; relatively high interest rates; and poor access to global financial markets, which may be exacerbated for resilience projects which are relatively unfamiliar to the market.

Box 9.2. Credit guarantee to mobilize private finance for railway system

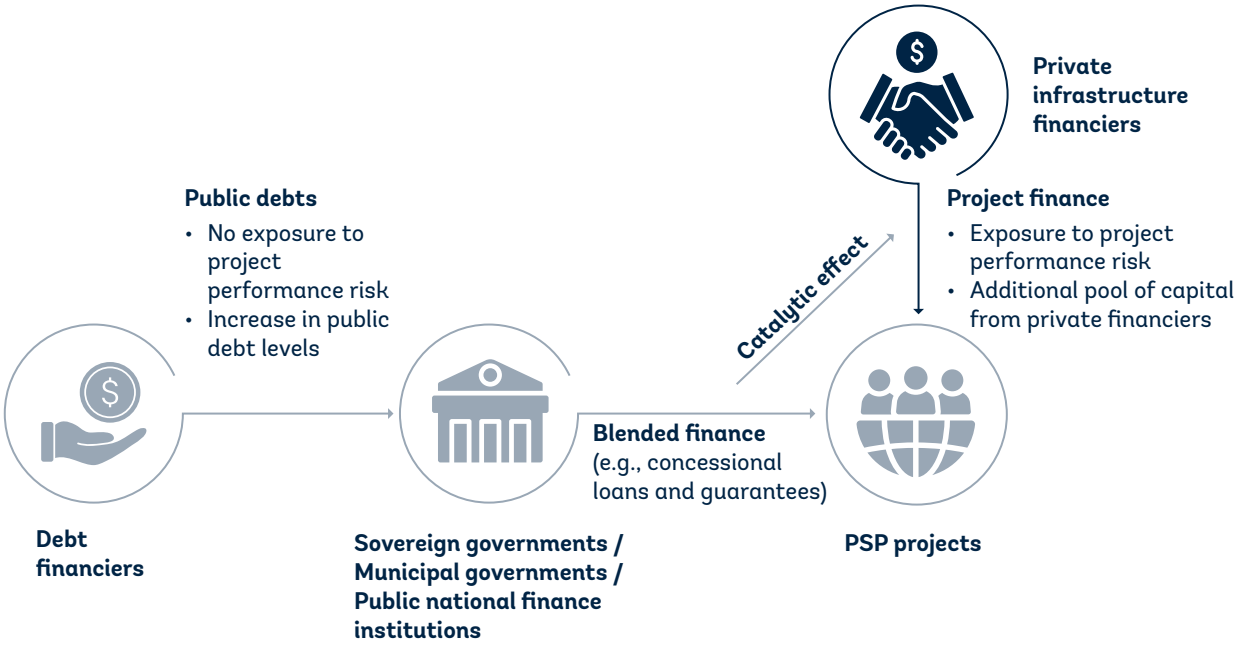
GuarantCo, part of the Private Infrastructure Development Group (PIDG), has provided a USD 24 million guarantee for an innovative dual tranche bond issued by Royal Railway Cambodia, the exclusive national railway operator in Cambodia. PIDG is an infrastructure project developer and investor, funded by the governments of the United Kingdom, the Netherlands, Switzerland, Australia, Sweden, Germany and the IFC. Two institutional investors, Prudential (Cambodia) Life Assurance Plc and Manulife (Cambodia) Plc were the key subscribers of the bond.

The bond proceeds, rated AAA by Rating Agency of (Cambodia) Plc, will be utilized to purchase new trains and finance renewal, and upgrades of the country's railway network. The transaction is aligned with Sustainable Development Goal 9.1 and 9.4: Develop sustainable, resilient and inclusive infrastructures and upgrade all industries and infrastructure for sustainability.

9.1.2 Public financing through capital markets

Sovereign governments, municipal governments, and national public finance institutions may issue public debts and channel the proceeds to provide blended finance to resilient transport PSP projects. Blended finance approaches such as concessional loans and guarantees can improve the risk-return profile and de-risk the projects for crowding in private finance (see Figure 9.1).

Figure 9.1. Using public debts to mobilize private finance for resilient transport PSP projects



Source: World Bank.

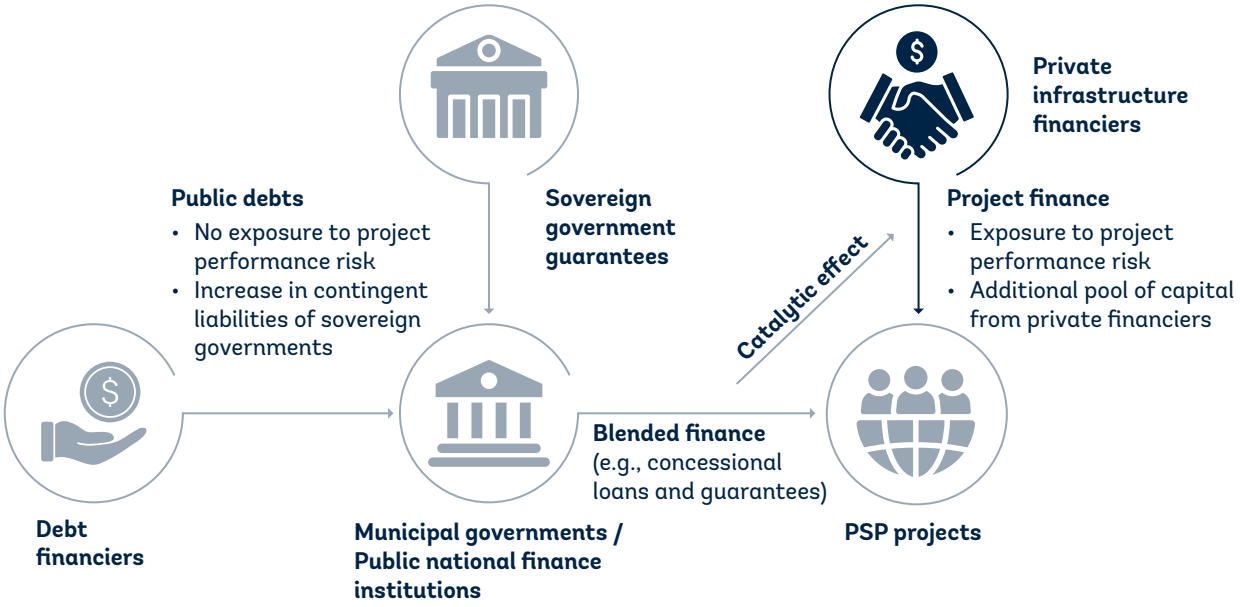
Public debt, however, does not share any project performance risks with the debt financiers, as the recourse goes to the sovereign and municipal governments and national public finance institutions which borrow on their own credit.

As such, this approach could add to the liabilities of the governments (whether direct or contingent) and represent an option that should be carefully examined based on fiscal sustainability and whether other options are plausible.

Public debt may be labelled as green instruments to take advantage of additional liquidity and potentially more favorable costs of capital. Alternatively, sovereign governments may issue a guarantee in favor of municipal governments and national public finance institutions, which then issue public debt. In developing countries, the access of public sector entities to the financial markets is often challenged by unfavorable credit ratings and high cost of capital, in addition to other potential constraints such as insufficient capital market development.

Where creditworthiness is concerned, credit enhancement by sovereign governments (or development partners) can help reduce the cost of borrowing for the municipal governments and national public finance institutions. Further, credit enhancement can also facilitate their access to the capital markets where the entities had limited to no prior borrowing capabilities and track record. These entities can then provide blended finance to resilient transport PSP projects to mobilize additional private finance. This can add to the contingent liabilities of the governments which should be properly monitored and managed, in addition to safeguarding against moral hazard risks (see Figure 9.2). Broad or excessive guarantees may create a moral hazard scenario, whereby the incentive for private investors to be efficient in performing their obligations (e.g., investment due diligence and monitoring) is reduced because they no longer have as much at stake.

Figure 9.2. Using public debt to mobilize private finance for resilient transport PSP projects (with sovereign guarantee)



Source: World Bank.

Recommended resources

Government Guarantees for Mobilizing Private Investment in Infrastructure (2019) by Lu, Chao, and Sheppard (the World Bank Group) provides guidance to government officials in emerging markets and developing economies (EMDEs) on when government guarantees for PPP projects might be desired; how they could be best utilized; the structure and scope of guarantees and guarantee programs; the costs and risks entailed; and how to manage these risks.

9.2. Access international concessional finance

Multilateral development banks (MDBs), bilateral development finance institutions (DFIs), and concessional finance funds (collectively termed as "international development partners") are key sources of international concessional finance which may be tapped to promote PSP in resilient railway projects.

- These entities can provide additional resources for project preparation, which is especially critical given integrating resilience considerations into PSP railway projects requires further resilience-related activities such as climate risk and vulnerability assessments, and the tailoring of procurement and contracts.

- They can also provide concessional finance to complement national public finance in de-risking and improving risk-return profile of railway projects that are commercially viable but deemed financially unattractive by private sector (possibly due to additional costs of resilience investments), thereby mobilizing private finance.
- Technical assistance is another major potential contribution, as these entities, especially MDBs, may be able to provide leading technical expertise to support national stakeholders to improve their organizational capacities and process related to climate and disaster resilience in the railway sector. Examples include Green Climate Fund, Global Environment Facility, and Adaptation Fund.

9.2.1 Concessional climate funds

Concessional climate funds may support the financing of resilient transport PSP projects by lowering the cost of capital through instruments such as low-interest loans and grants to cover the incremental adaptation costs. In addition, their concessional financing may also support upstream actions such as sector-wide climate risk analysis as well as project preparation by supporting the necessary studies such as detailed project-specific climate risk assessment and feasibility studies for adaptation solutions. Governments should identify a pipeline of projects that are most suited to be supported by concessional climate funds based on the aspects such as:

- **Commercial and financial feasibility**. Resilient transport projects may not necessarily need concessional finance. The projects that have demonstrated robust commercial and financial feasibility (e.g., roads or rail lines with high usage and profitability) may be more suitable to be delivered through private resources, particularly through PSP, followed by national public resources (if needed). In other cases, projects may require additional support, whether in the form of more concessional financing, technical assistance for project development, or a combination. These projects should be prioritized, in line with the objectives of international development partners to generate additionality by supporting projects that cannot be delivered through private and national resources only.
- C**limate mitigation and adaptation impact.** As previously noted, transport projects have different levels of potential to contribute to emissions reduction and resilience. Transport projects that can generate the most mitigation and resilience benefits should be prioritized for efforts to apply for concessional financing. Importantly, while both development and climate impacts would be relevant for MDBs and DFIs, the investment case for concessional climate funds should prioritize climate impact, while development co-benefits may be presented together.
- **Project delivery approach and timeline.** Accessing concessional climate finance facilities would typically require the completion of procedures such as seeking the no-objection of national authorities and meeting the requirements of accredited entities. Further, the processing of applications may take multiple years to secure full approval. Thus, it is important to carefully weigh the benefits and costs of accessing these facilities, bearing in mind aspects such as timeliness and the predictability of financing process, which are important for projects involving private partners and private financiers.

Box 4.1 shows how a resilient transport project involving PSP may incorporate resilience good practices and use concessional financing from various sources to deliver investment.

Recommended resources



Climate Toolkits for Infrastructure PPPs (2023) provides additional detailed guidance on accessing concessional climate finance funds, which may be applicable for resilient transport PSP projects.

9.3. Deploy innovative financial instruments

9.3.1 Use-of-proceed instruments

Use-of-proceed instruments, such as green or sustainable loans and bonds, can be used to raise financing for resilient transport PSP projects that contribute to climate change mitigation and adaptation. These instruments can help the issuers (e.g. PSP project companies) to demonstrate their commitment to climate actions. This may potentially enable the issuers to reach a broader investor base and achieve more favorable costs of capital.

Sovereign and municipal governments may issue sovereign or sub-sovereign green bonds to raise public debts, and then use the proceeds in a blended finance approach to support the project companies of resilient transport PSP projects. This of course would depend on a country's public financial management framework that governs whether these entities have the legal ability to borrow, and meet the necessary requirements (e.g. ring-fencing of proceeds).

For green bonds, the sovereign and municipal governments would have to ensure the proceeds are only used for the climate mitigation and/or adaptation investment projects (e.g. implementing enhanced flood protection using nature-based solutions for roads or railway lines).

The example in Box 9.3 demonstrates green bond issuances by a sovereign government where the use of proceeds supported railway projects by state-owned railway companies. While the project delivery approach may be different under a PSP, there is potential for governments to use green bonds to raise financing that can be used to support PSP projects involving resilience investments in railway and other transport subsectors.

Box 9.3. Sovereign Green Sukuk issuance by Indonesia, with railway-related use of proceeds

To support Indonesia's commitment in climate actions, the Indonesian government has issued sovereign Green Sukuk, an innovative financial instrument guided by the Green Bond and Green Sukuk Framework. Sukuk is an interest-free bond that generates returns to investors without infringing the principles of shari'ah (Islamic law) which prohibits the payment of interest. It is a shari'ah-compliant security backed by a specific pool of underlying assets. The proceeds of a green sukuk can only be used to fund environmentally-friendly projects.

The issuances included:

- 2018: Indonesia global green sukuk amount of US$ 1.25 billion with a tenor of 5 years
- 2019: Green Sukuk amount of US$ 750 million with a tenor of 5.5 years
- 2020: Green Sukuk amount of US$ 750 million with a tenor of 5 years
- 2021: Green Sukuk global amount of US$ 750 million with a tenor of 30 years (the first Green Sukuk in the world with a length tenor of 30 years).

The 2020 Green Sukuk supported the financing of the double track line in South Line Java Railways Network upgrade. The multi-year project aims to upgrade from single to double track, connecting Cirebon City in West Java Province to Jombang Regency in East Java Province.

The government continues to improve the railway transport to facilitate a shift from the usage of private modes of transportation (e.g. cars and motorcycles) to public railways transport, providing both socio-economic and climate benefits.

- The Greater Jakarta Commuter Line is expected to reduce GHG emission by 172,001 tCO2e (2020), 557,522 tCO2e (2019), and 564,345 tCO2e (2018).
- The South Java Double Track line (activated in 2020) is expected to reduce GHG emission by 121,850 tCO2e, increase passenger km by 1.3 times (or 2,547,965,852 passengers are expected to shift from bus/ private car/ motorcycle) and reduce travel time by 30 minutes on average compared to the existing road transport modes.

The other potential groups of entities which may issue green or sustainability bonds to support transport projects that contribute to climate change mitigation and/or adaptation include:

- **State-owned transport companies.** Central Nippon Expressway Co. Ltd. (NEXCO Central), a public company fully owned by the Japanese government, issued a green bond in 2020 to upgrade aging road infrastructure to withstand climate and disaster risks, including through renovation of bridges, slope reinforcement, and porous asphalt pavement.
- **Municipal governments.** The city of Johannesburg has issued the first municipal green bond in South Africa to raise financing to support its investment to address climate change and enable sustainable management of resources. In 2014, the city issued green bonds worth ZAR1.5 billion (or US$ 143 million) to finance projects in wide-ranging sectors including 150 new dual fuel buses and conversion of 30 buses to biogas.

- **National development banks.** In November 2022, Nacional Financiera (NAFIN), one of Mexico's leading national development banks issued a sustainability bond in two tranches (a 5-year note of US$ 63 million; and a second tranche of US$ 313 million). The issuance was based on the Sustainability Bond Framework, which includes a variety of eligible projects including study, design, construction, acquisition, substitution, maintenance, and operation of clean transportation with no direct or low emissions and dedicated infrastructure.
- **Companies involved in transport services.** In 2023, Via Mobilidade placed the largest sale of green bonds in the local market as part of a US$ 885 million financing package. Its green bond framework supports eligible activities including investment projects in the 'Clean Transport' category as aligned with Climate Bonds Initiative's Taxonomy and the European Union's Sustainable Finance Taxonomy. Via Mobilidade CCR, together with Grupo Ruas, holds the concession of Lines 8 and 9 of Sao Paulo Metropolitan Trains for 30 years. It is estimated they will inject BRL 3.2 billion (US$ 650 million) in private capital expenditures for upgrading the train system.

The use of such innovative financial instruments to finance resilient transport projects is a relatively nascent practice. It has significant opportunities for greater adoption as the emphasis on resilience gradually increases in the transport sector.

Recommended resources



Green Bonds for Climate Resilience – A Guide for Issuers (2021) of the Climate Bonds Initiative and Global Center on Adaptation, in cooperation with the European Bank for Reconstruction and Development (EBRD), provides practical guidance to issuers of all types — sovereigns, sub-sovereigns, financial institutions, and corporates — on how to raise capital in the green bond market for investment in climate adaptation and resilience.

Green Bonds for Cities: A Strategic Guide for City-level Policymakers in Developing Countries (2016) by Climate Policy Initiative offers a strategic guide for cities in developing countries to access green bond market flows, a potential source of finance for cities in developing countries looking to secure investment in low-carbon, climate-resilient infrastructure to meet the water, energy, housing and transportation needs of their expanding urban populations.

9.3.2 Sustainability-linked instruments

Sustainability-linked instruments, such as sustainability-linked loans and bonds, represent another innovative approach in that issuers explicitly commit to future improvements in sustainability outcomes with a predefined timeline. When the set targets are met, the issuers may benefit from a reduction in interest payment. Thus, these instruments can provide financial incentives for positive sustainability outcomes, including resilience, besides promoting good practices such as target setting and monitoring.

The issuance of these instruments involves a set of well-defined procedures as identified in international voluntary process guidelines and various regulatory standards or guidance at the regional and national levels. The markets for these instruments may be relatively nascent and at different stages of development in various countries.

Sovereign governments

Sovereign governments may issue sustainability-linked bonds, which would allow the proceed to be used for general purposes including for providing blended finance for resilient railway projects. In this case, the use of proceed is not limited to specific eligible projects, providing great flexibility. The issuance of sovereign sustainability-linked bonds is relatively nascent but has seen notable transactions in developing countries.

The example in Box 9.4 demonstrates how sustainability-linked bonds can be issued by sovereign governments, linking financial structure with the country's Nationally Determined Contributions (NDCs). Although the example focuses on transport decarbonization, the use of sustainability-linked bonds can potentially be extended to support resilient transport projects and integrate adaptation or resilience-focused objectives and targets as aligned with NDCs and NAPs.



Box 9.4. Uruguay's sovereign sustainability-linked bonds

In 2022, the Government of Uruguay issued its first sustainability-linked bonds (SLB) that links the coupon to compliance with the climate and environmental goals that the country set in its first Naturally Determined Contribution (NDC). The SLB incorporates a step-down mechanism that reduces the coupon if the country reaches pre-defined environmental targets.

The total demand for the bond was US$3.96 billion, greatly exceeding the US$1.5 billion the government decided to issue. The issue attracted 188 investors from Europe, Asia, the United States, and Latin America, of whom 21 percent are new holders of the country's sovereign debt.

The SLB Framework incorporates the following two Sustainability Performance Targets (SPTs).

- **NDC commitment:** Achieve at least 50 percent reduction in GHG emissions intensity by 2025 from the 1990 reference year.
- **Outperformance compared to NDC commitment:** Achieve more than 52 percent reduction in GHG emissions intensity by 2025 from the 1990 reference year.

The Government of Uruguay intends to achieve these SPTs through strategies that prioritize multiple key economic sectors including transport. For instance:

- Uruguay is supporting the development of energy efficiency and renewable energy projects for its transportation system.
- An inter-institutional group on energy efficiency in transport as well as a working group on sustainable urban mobility have been established, and their recommendations are being implemented.
- Uruguay is also expanding the charging infrastructure for electric vehicles in key transport corridors.

National public finance institutions

National public finance institutions may issue SLBs, but their Sustainability Performance Targets may need to be devised differently than those of sovereign SLBs. For instance, the SLBs by national public finance institutions may have to prioritize objectives that are more directly influenced by these institutions' activities, in contrast with a sovereign SLB that takes a national focus.

- In 2023, the Development Bank of Rwanda (BRD) launched its inaugural Sustainability-Linked Bond (SLB) on the Rwanda Stock Exchange, supporting BRD's commitment to mainstreaming environmental, social, and governance (ESG) for partner financial institutions, increasing women-led business loans, and financing affordable housing.
- The SLB was partially credit-enhanced via a World Bank lending operation to the Government of Rwanda through the Access to Finance for Economic Recovery and Resilience Project (AFIRR), has a seven-year maturity and is targeting 30 billion RWF (US$ 24.8 million).

Transport service companies

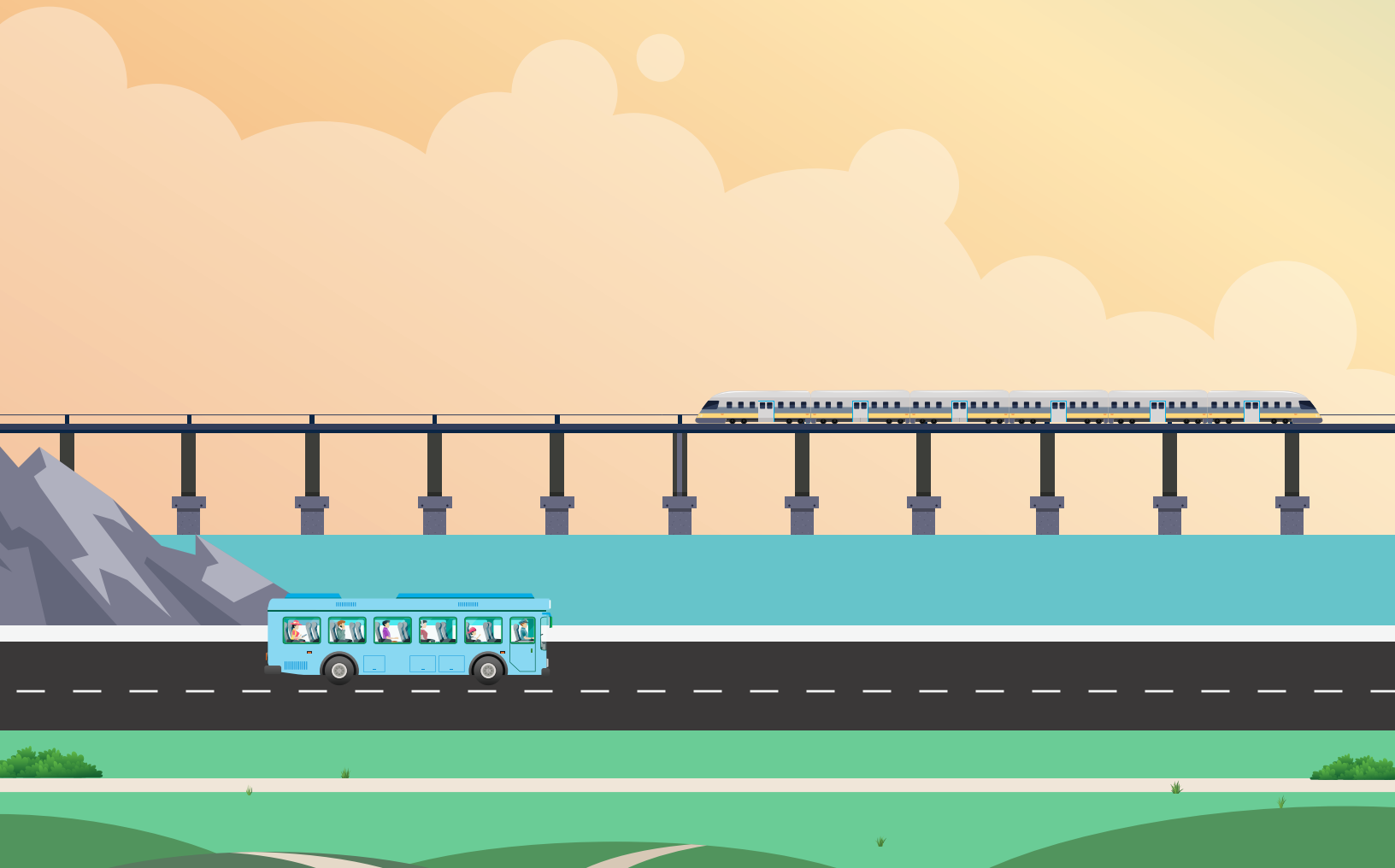
Transport service companies represent another group of potential issuers of sustainability-linked loans or bonds.

- In 2022, Knorr-Bremse AG, a global leader in rail braking systems, issued its sustainability-linked bond worth EUR 700 million, with an annual coupon rate of 3.25 percent. The coupon rate is also linked to the achievement of a specific sustainability target by the company, as defined within its Sustainability-Linked Bond Framework.
- The sustainability objective is to achieve a Scope 3 emissions reduction target, which focuses on the company's value chain. In case the sustainability target is not met, the bond's coupon rate will increase by 20 basis points per annum until the bond reaches its maturity.
- An external reviewer, ISS Corporate Solutions (ISS), confirmed the framework's alignment with Knorr-Bremse's ambitions and market standards. The funds raised through this issuance are intended for general corporate purposes and do not need to be ringfenced for specific projects

Currently, in the market of sustainability-linked instruments issued by private companies, climate change mitigation-related objectives, particularly emissions reduction, are the typical focus of the targets defined in most transactions. There is a significant potential for sustainability-linked instruments to incorporate targets related to climate change adaptation and resilience. Such instruments can be used to incentivize transport service companies in undertaking robust resilience measures.

10

Recommendations



The transport sector is the backbone of our economies and societies. Governments should dedicate greater policy efforts and resources to urgently strengthen the resilience of transport systems against the impacts of climate change and natural disasters. This is crucial to avoid and reduce the severe economic and social damages that can otherwise materialize and impact wide-ranging stakeholders including users, transport companies and their staff members, investors and surrounding communities and businesses. It should emphasize a combination of innovative approaches, strategic partnerships, and diverse funding sources to address this critical challenge effectively. Here are some key strategies:

1. Accessing International Climate Finance

- **MDBs:** Advocate for increased MDB funding for adaptation projects, especially in most vulnerable countries in Africa and South Asia.
- **Global Climate Financing Facilities:** Tap into existing funds that support climate adaptation initiatives. Advocate for more facilities to include transport resilience as a priority. Increase awareness of the significant imbalance between mitigation and adaptation financing and advocate for a substantial increase in adaptation funding.

2. Mobilizing Domestic Public Resources

- **Dedicated Resilience Funds:** Establish or reform national and sub-national public funds to prioritize transport resilience. Build transparency on reporting on funding contributions and utilization.
- **Harnessing Tax Revenue:** Allocate portions of existing fuel and vehicle taxes for resilience-focused projects. Utilize carbon tax revenues from carbon trading schemes to fund adaptation in transport. Reintroduce or reform infrastructure levies to generate dedicated revenue for resilient transport systems.
- **Additional funding sources:** Reduce/reallocate subsidies from fuel or high-carbon or unsustainable transport options to resilient infrastructure projects. Explore non-road-based revenue options, such as land value capture.

3. Addressing Financing Challenges

- **Quantify Benefits:** Improve data collection and streamline tools to quantify the economic and social benefits of resilience projects, aiding in investment justification.
- **Incremental Cost Sharing:** Share additional adaptation costs between governments, donors, and private investors to ensure feasibility.
- **Better Spending:** Ensure that available resources are allocated efficiently by prioritizing investments with high resilience impact. Governments should adopt a systematic approach to evaluate and rank resilience projects based on their cost-effectiveness, long-term benefits, and vulnerability reduction potential.

- **Role of Operations and Maintenance (O&M):** Strengthen O&M practices, which is crucial for sustaining resilient infrastructure. Adequate funding should be allocated to maintaining roads, bridges, and transport networks to prevent deterioration and enhance resilience to climate events. Governments should incorporate resilience considerations into routine maintenance plans and adopt proactive maintenance strategies using climate risk assessments and emerging technologies.
- **Lifecycle Approach:** All five pillars of resilience need to be considered in the design of transport resilience activities.

4. Private Sector Participation (PSP)

- **Private sector participation (PSP):** Can play a transformative role in advancing transport resilience by harnessing private sector expertise, efficiency, and financial resources. To this end, this Umbrella Roadmap lays out recommendations on how governments and development partners can collaborate to mobilize PSP and private capital in delivering climate and disaster resilient transport. These recommendations present significant opportunities for collaboration between governments in developing countries and development partners across critical aspects, from policy reforms to capacity building and project preparation to financing. Such collaboration is critical to support the governments in mobilizing the necessary resilience investment and promoting a paradigm shift in how transport infrastructure and services are delivered in the face of climate change and natural disasters. This chapter includes a complete list of recommendations.

1. Policy and institutional capacity

Integrate resilient transport as a policy objective

- Incorporate climate and disaster resilience as a policy objective in the relevant policy instruments including but not limited to:
  - Climate change policies
  - Disaster management policies
  - Economic development plans
  - National transport policies
- Set resilience targets for the whole transport sector and subsectors (e.g. railways, roads, aviation, maritime transport) as applicable.
- Identify strategic actions to strengthen resilience in the transport sector and subsectors as applicable.

Enhance public-private partnerships (PPP) framework

- Integrate climate and disaster resilience requirements in PPP laws and regulations.
- Integrate transport sector-specific resilience requirements in guidelines and working documents for the PPP process.
- Integrate resilience requirements in PPP project approval regime.

Promote institutional coordination and capacity building

- Conduct an institutional review to establish the responsibilities in implementing resilience requirements in PPP process and projects for the transport sector among government agencies.
- Develop a human resource plan for resilience-related capacity building and talent acquisition in government agencies involved in PPP projects for transport.

2. Project pipeline development

Deliver project preparation funding

- Review existing mechanisms for funding project preparation activities for transport PSP projects to identify potential for supporting resilience-focused activities.
- Conduct a feasibility review on establishing a new resilience-focused project preparation fund or a dedicated funding window within existing fund(s) for the transport sector.
- Support the definition of eligible activities, other eligibility criteria, and operational guidelines for resilience-focused project preparation activities.
- Identify public funding sources and strategies for generating reflows to ensure the financial sustainability of supporting resilience-focused project preparation activities in the transport sector.

Strengthen contracting approaches

- Explore the use of performance-based contracts (PBCs) in strengthening resilience performance of transport infrastructure and services.
- Develop standardized sample legal documents specific to the national jurisdiction for facilitating the adoption of innovative resilience-focused contractual clauses.
- Implement innovative resilience-focused contractual clauses in pilot projects that involve PSP in the transport sector.

Improve procurement practices

- Develop or update procurement guidelines for transport PSP projects to provide guidance on how contracting authorities can develop resilience-focused requirements and tenders.
- Develop a procurement strategy for transport PSP projects to set out the actions and objectives related to the introduction of resilience-focused procurement.
- Implement pilot projects that incorporate resilience-focused requirements and criteria in procurement.

3. Project and public funding

Maximize project funding generation

- Examine the feasibility of using resilience investment charge to recover part of the additional resilience investment cost in resilient transport PSP projects.
- Explore the use of climate contingency account in resilient transport PSP projects.
- Implement pilot projects that integrate resilience investment charge and/or climate contingency account in resilient transport PSP projects.

Optimize public funding support

- Update the strategic mandates of existing public infrastructure funds to support resilient transport PSP projects, including mainstreaming resilience requirements in transport investment.
- Enhance the eligibility criteria of public infrastructure funds to fund and require resilience-related project preparation activities in transport PSP projects.
- Enhance the requirements to access viability gap funding from public infrastructure funds by requiring the applicable transport PSP projects to meet resilience objectives.
- Explore the set-up for contingent funding support window through public infrastructure funds to support resilient transport PSP projects.
- Explore the provision of subsidies by public infrastructure funds for insurance against climate and disaster risks to private partners involved in resilient transport PSP projects.

Facilitate public funding generation

- Review if any land value capture instruments are currently or historically used for transport projects and identify the implementation challenges.
- Conduct detailed feasibility review on the use of land value capture for resilient transport PSP projects under development.
- Review if any tax revenue streams may be earmarked to fund entities that can support resilient transport PSP projects.

4. Financing

Optimize national public finance

- Strengthen the mandate of public infrastructure funds, national development banks, and sovereign wealth funds in supporting resilient transport PSP projects.
- Explore the issuance of green bonds by sovereign and municipal governments to raise financing that can be used to mobilize PSP in resilient transport projects.

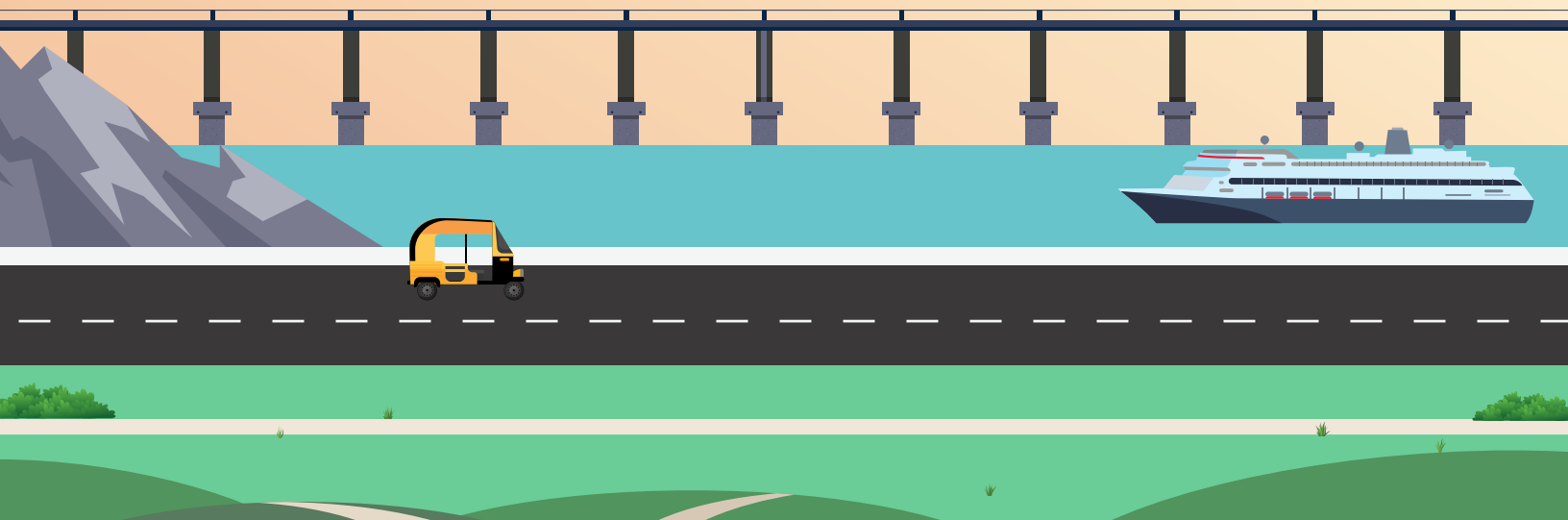
Access international concessional finance

- Improve project prioritization and preparation approach to prioritize resilient transport PSP projects.
- Identify a pipeline of projects that need and qualify for international concessional finance.

Deploy innovative financial instruments

- Develop a strategic plan for facilitating and capacitating sovereign and municipal government entities, national public finance institutions, and other potential issuers to tap into the green bond market to raise financing for transport resilient PSP projects.
- Conduct a feasibility review of the benefits, potential, and challenges to promote the market for sustainability-linked instruments that integrate adaptation and resilience objectives and involve infrastructure companies in the transport sector.

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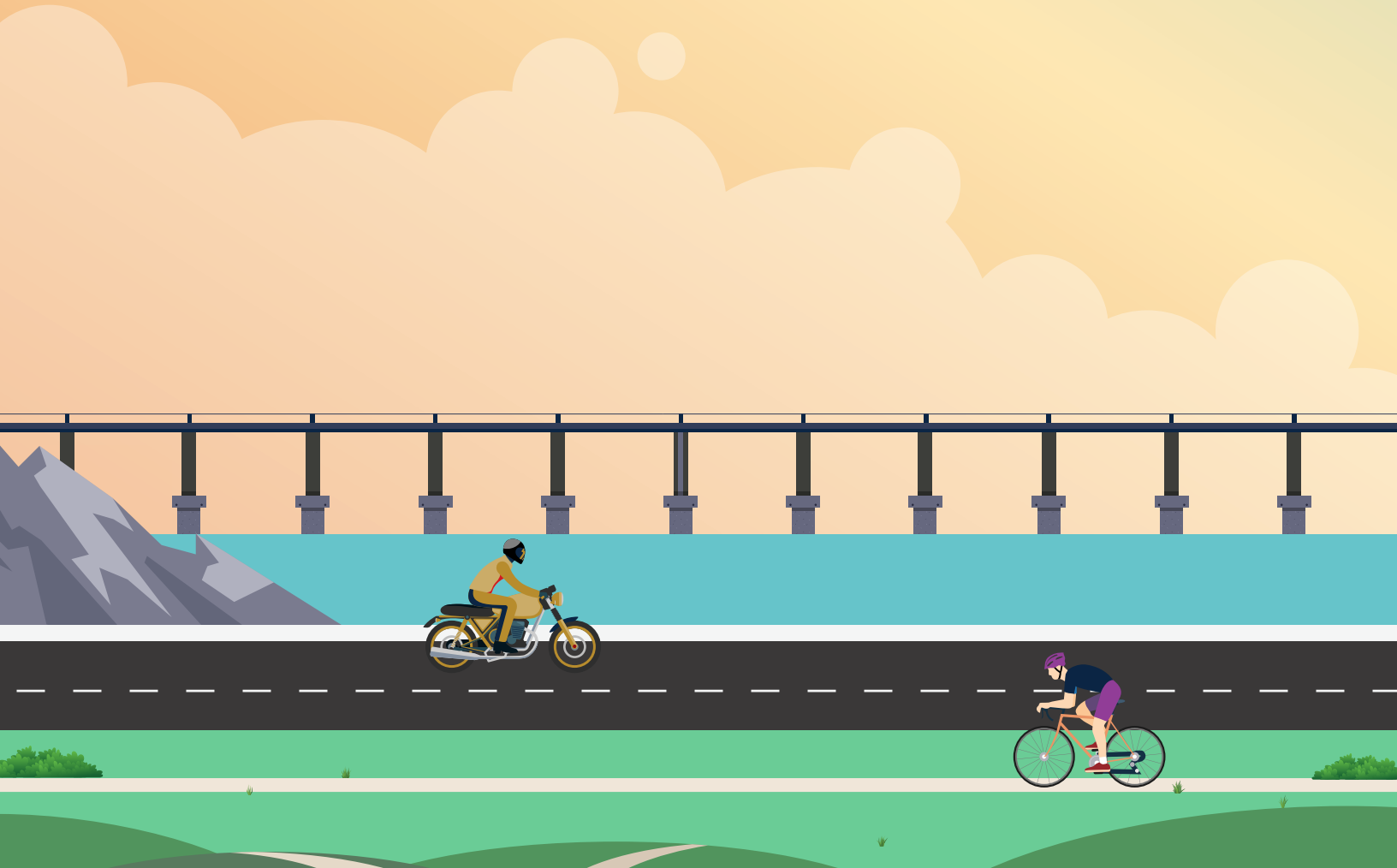
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Appendix



Appendix A
Master list of climate financing and funding options

Table A.1. Climate Finance Facilities as reviewed and discussed in Chapter 3. Those highlighted in red denote the adaptation-focused facilities that cover transport and could contribute towards transport resilience activities.

Climate Finance Facilities	Target climate actions
Green Climate Fund	Mitigation and Adaptation
Adaptation Fund	Adaptation only
Global Environment Facility	Mitigation and Adaptation
Pilot Program for Climate Resilience	Adaptation only
Smart Cities Program	Mitigation and Adaptation
ASEAN Catalytic Green Finance Facility (ACGF)	Mitigation and Adaptation
Australian Climate Finance Partnership (ACFP)	Mitigation and Adaptation
Climate Innovation and Development Fund (partnership with Bloomberg Family Foundation Inc. and the Goldman Sachs Charitable Gift Fund) (CIDF)	Mitigation and Adaptation
Canada AfDB Climate Facility (CACF)	Mitigation and Adaptation
International Climate Initiative (IKI)	Mitigation and Adaptation
Danish Climate Investment Fund	Mitigation and Adaptation
InfraCo Africa – Sub Sahara Infrastructure Fund	Mitigation and Adaptation
High-Level Technology Fund (HLTF)	Mitigation and Adaptation
Spanish Cooperation Fund for Technical Assistance (TAGF-SPA)	Mitigation and Adaptation
Canadian Climate Fund for the Private Sector in Asia II	Mitigation and Adaptation
The Nordic Development Fund (NDF)	Mitigation and Adaptation
Asia-Pacific Project Preparation Facility	Mitigation and Adaptation

Climate Finance Facilities	Target climate actions
Republic of Korea e-Asia and Knowledge Partnership Fund (EAKPF)	Mitigation and Adaptation
The Global Innovation Lab for Climate Finance	Mitigation and Adaptation
Africa Climate Change Fund (ACCF)	Mitigation and Adaptation
NEPAD Climate Change Fund	Mitigation and Adaptation
Climate Change Fund	Mitigation and Adaptation
Small Island States Resilience Initiative (SISRI)	Adaptation only
Climate Services for Resilient Development Partnership	Adaptation only
Eastern Europe Energy Efficiency and Environment Partnership (E5P)	Mitigation and Adaptation
Local Climate Adaptive Living Facility	Adaptation only
Global Climate Change Alliance	Mitigation and Adaptation
Latin America and Caribbean Investment Facility (LACIF)	Mitigation and Adaptation
Fond Francaise pour l'Environnement Mondial (FFEM)	Mitigation and Adaptation
Facility for Accelerating Climate Change Resilient and Sustainable Society (ACCESS)	Mitigation and Adaptation
UK's International Climate Finance	Mitigation and Adaptation
Global Resilience Partnership	Adaptation only
Global Facility to Decarbonize Transport Multi-Donor Trust Fund	Mitigation and Adaptation
Global Facility for Disaster Reduction and Recovery	Mitigation and Adaptation
Sustainable Urban and Regional Development	Mitigation and Adaptation
PROBLUE	Mitigation and Adaptation
The Global Program on Nature-Based Solutions (NBS) for Climate Resilience	Adaptation only
City Climate Finance Gap Fund	Mitigation and Adaptation

Climate Finance Facilities	Target climate actions
CABEI Climate Change Investment Project Preparation Fund	Adaptation only
Caribbean Resilience Building Facility	Adaptation only
DBSA-GCF Climate Finance Facility	Mitigation and Adaptation
Africa Adaptation Acceleration Program	Adaptation only

Table A.2. Public funding mechanisms (i.e., road, national/subnational, or public) as reviewed and discussed in Chapter 4. All but those denoted with an asterisk provide funding for transport infrastructure and services, but none *explicitly* identify support for transport resilience projects.

Name	Country of Implementation	Type of Fund
Road Budget Trust Fund	Azerbaijan	Road fund
The Road Fund	Kyrgyz Republic	Road fund
The State Road Fund	Mongolia	Road fund
Road Maintenance Account (RMA)	Pakistan	Road fund
Republican Road Fund	Uzbekistan	Road fund
The Road Fund	Lesotho	Road fund
Uganda Road Fund (URF)	Uganda	Road fund
National Road Fund Agency	Zambia	Road fund
Tanzania Roads Fund (TRF)	Tanzania	Road fund
Kenya Roads Board (KRB) Funds	Kenya	Road fund
Roads Fund administration	Malawi	Road fund
Road Fund Administration (RFA)	Namibia	Road fund
Rwanda Green Fund (FONERWA)	Rwanda	National/Subnational climate fund
Climate Adaptation Financing Facility*	Saint Lucia	National/Subnational climate fund

Name	Country of Implementation	Type of Fund
Brazil's National Fund on Climate Change (Fundo Nacional sobre Mudança do Clima, FNMC)	Brazil	National/Subnational climate fund
Green Fund South Africa	South Africa	National/Subnational climate fund
Shandong Green Development Fund	China	National/Subnational climate fund
People's Survival Fund (PSF)*	Philippines	National/Subnational climate fund
Climate Resilience Green Economy Facility	Ethiopia	National/Subnational climate fund
Environmental Investment Fund of Namibia*	Namibia	National/Subnational climate fund
Infrastructure Fund by Infrastructure South Africa*	South Africa	Public infrastructure fund
Indonesia Infrastructure Guarantee Fund (IIGF)	Indonesia	Public infrastructure fund
Bangladesh Infrastructure Finance Fund Limited (BIFFL)	Bangladesh	Public infrastructure fund
Fondo Nacional de infraestructura (FONADIN)	Mexico	Public infrastructure fund
Financiera De Desarrollo Territorial S.A. (Findeter)	Colombia	Public infrastructure fund
India Infrastructure Investment Finance Company Limited (IIFCL)	India	Public infrastructure fund
Fondo Fiduciario Federal para Infraestructura Regional (FFIR)	Argentina	Public infrastructure fund
Ghana Infrastructure Investment Fund (GIIF)	Ghana	Public infrastructure fund
Infrastructure Project Development Facility -(renamed Private Partnership Authority (P3A))	Pakistan	Public infrastructure fund

Table A.3. Identified infrastructure levies that support the transport sector as reviewed and discussed in Chapter 4. Those only to be considered in active use are Colombia, Dominican Republic, Ecuador, Egypt, and India.

Tax and other collection measures	Country of Implementation
Infrastructure levy locally known as betterment contribution (Contribucion por mejora)	Argentina
Infrastructure levy locally known as betterment fees	Bangladesh
Infrastructure levy locally known as contribuição de melhoria	Brazil
Infrastructure levy locally known as contribución de valorización	Colombia
Infrastructure levy locally known as contribución especial	Costa Rica
Infrastructure levy locally known as Cuota Parte*	Dominican Republic
Infrastructure levy locally known as contribuciones especiales por mejoras	Ecuador
Infrastructure levy locally known as Betterment Levy	Egypt
Infrastructure levy locally known as betterment charges*	Ghana
Infrastructure levy locally known as Betterment Fee	India
Infrastructure levy locally known as contribuciones de mejoras	Mexico
Infrastructure levy locally known as value added compensation	Morocco
Infrastructure levy locally known as Betterment Levy/Premium	Nigeria
Infrastructure levy locally known as contribución especial de obras públicas	Peru

Appendix B.1. Stakeholder consultation list

Stakeholder Entity	Target number of entities consulted	Number of entities and WBG staff members consulted	Number of interviews
PPP units	5	4	4
Transport authorities	5	5	5
Private PPP contractors	5	4	4
Financiers	5	4	4
Legal advisors	5	2	3
Insurers	5	5	7
Development partners	10	14	16
World Bank Group staff	10	15	15
Total	**50**	**53**	**58**

Organization name	Country/Region	Type of organization
Pakistan PPP Unit	Pakistan	PPP Unit
Ghana PPP Unit	Ghana	PPP Unit
South Africa PPP Unit	South Africa	PPP Unit
DRC PPP unit	DRC	PPP Unit
India Ministry of Transport	India	Transport authorities
Philippines Ministry of Transport	Philippines	Transport authorities
Lagos Metropolitan Area Transport Authority	Nigeria	Transport authorities
Kenya Urban Roads Authority	Kenya	Transport authorities
Ministry of Communications and Transportation	Mexico	
Mota-Engil	International	Private PPP contractors
Mota-Engil	International	Private PPP contractors
Mota-Engil	International	Private PPP contractors
Keolis	International	Private PPP contractors
Egis	International	Private PPP contractors
IJM	Regional, Southeast Asia	

Organization name	Country/Region	Type of organization
IJM	Regional, Southeast Asia	
IJM	Regional, Southeast Asia	
BNP Paribas	International	Financiers - Funds
Natixis	International	Financiers - Banks
Adaptation Fund	International	Development partners
Green Climate Fund	International	Development partners
Green Climate Fund	International	Development partners
Green Climate Fund	International	Development partners
Global Environmental Facility	International	Development partners
African Development Bank/Africa Climate Change Fund	Africa	Development partners
Caribbean Development Bank	Caribbean	Development partners
Inter-American Development Bank	Latin America and the Caribbean	Development partners
Inter-American Development Bank	Latin America and the Caribbean	Development partners
EBRD	Europe and Central Asia	Development partners
EBRD	Europe and Central Asia	Development partners
Climate Policy Initiative	International	Development partners
Climate Policy Initiative	International	Development partners
Climate Policy Initiative	International	Development partners
Financiera de Desarrollo Nacional (FDN)	Colombia	Financier
Banco Nacional de Obras y Servicios Públicos (Banobras)	Mexico	Financier
Global Center for Adaptation	International	Development partners
Climate Bonds Initiative	International	Thematic bond certification
Climate Bonds Initiative	International	Thematic bond certification
World Association of PPP Units and Professionals	International	Industry association
World Bank	Global	WBG
World Bank	Global	WBG
World Bank	Latin America and the Caribbean	WBG
World Bank	Nigeria/Eastern Africa/ Eastern Europe & Central Asia	WBG

Organization name	Country/Region	Type of organization
World Bank	Middle East and North Africa	WBG
IFC	Global	WBG
World Bank	East Aisia and Pacific	WBG
World Bank	Global	WBG
IFC	Global	WBG
IFC	Global	WBG
MIGA	Global	WBG
World Bank	Global	WBG
World Bank	West Africa	WBG
World Bank	West Africa	WBG
World Bank	Global	WBG
Professional Risk Managers International Association (PRMIA)	N/A	Development partners
Former Chief Operating Officer at the Global Infrastructure Hub and Lead Lawyer at the World Bank	N/A	Development partners
AXA	International	Insurers
Berkshire Hathaway Specialty Insurance	International	Insurers
Swiss Re	International	Insurers
Swiss Re	International	Insurers
Swiss Re	International	Insurers
Howden Group	International	Insurers
Howden Group	International	Insurers
Guy Carpenter	International	Insurers
Societe du Grand Paris (SGP)	France	Transport infrastructure company
Societe du Grand Paris (SGP)	France	Transport infrastructure company
Regional Center for Sustainable Finance and Climate Change, Universidad de Los Andes	Colombia	Development partners
Regional Center for Sustainable Finance and Climate Change, Universidad de Los Andes	Colombia	Development partners
Regional Center for Sustainable Finance and Climate Change, Universidad de Los Andes	Colombia	Development partners

Appendix B.2. Literature review list

The following Table B.2 identifies the literature reviewed, including the key materials shared by the WBG, as well as briefly indicates their contribution to the topics in this report.

No.	Relevant Literature	Year	Source/Author	Upstream: Enabling Environment	Midstream: Infrastructure Planning, Pipeline Identification, Project Definition and Structuring, Procurement, Contracting and Monitoring	Downstream: Financing and Credit Enhancement
1.	Landscape of Guarantees for Climate Finance in EMDEs	2024	CPI			✓
2.	Mobilizing Climate Finance for Railways	2024	WBG			✓
3.	Decision Support Tool for Optimizing Investments to Enhance Resilience of Transport Networks	2023	GRID Advisors		✓	
4.	Development of Climate-Smart PPP Framework in the Philippines	2023	CPCS		✓	
5.	Integrating Climate Resilience in Ports PPP Guidelines for Southeast Asia	2023	CPCS		✓	
6.	Climate Toolkits for Infrastructure PPPs – Road Sector	2023	WBG and GRID Advisors		✓	

No.	Relevant Literature	Year	Source/Author	Upstream: Enabling Environment	Midstream: Infrastructure Planning, Pipeline Identification, Project Definition and Structuring, Procurement, Contracting and Monitoring	Downstream: Financing and Credit Enhancement
7.	Global Landscape of Climate Finance 2023	2023	Climate Policy Initiative			✓
8.	Transport Network Planning and Analysis Model for South Asia	2023	GRID Advisors		✓	
9.	Are transport networks in low-income countries prepared for climate change? Barriers to preparing for climate change in Africa and South Asia	2023	Greenham, S., Workman, R., McPherson, K. et al.	✓	✓	✓
10.	Internal list prepared for the 2023 Infrastructure Financing, PPPs and Guarantees Practice Group Learning Week	2023	WBG			✓
11.	Financing Climate Action for Transportation in Developing Countries	2023	WBG	✓		✓
12.	Climate Action Plan	2023	AIIB			✓

No.	Relevant Literature	Year	Source/Author	Upstream: Enabling Environment	Midstream: Infrastructure Planning, Pipeline Identification, Project Definition and Structuring, Procurement, Contracting and Monitoring	Downstream: Financing and Credit Enhancement
13.	Incorporating climate resilience in PPPs in Colombia - Transport Sector	2023	PPIAF			
14.	Climate Change 2023 Synthesis Report	2023	Intergovernmental Panel on Climate Change	✓		
15.	Blended Concessional Finance for Private Sector Projects	2023	DFI Working Group (IFC, AfDB, AsDB, AIIB, EBRD, EDFI, EIB, IDBG & ICD)	✓		
16.	African Economic Outlook Chapter 2 - Private Sector Financing for Climate Action and Green Growth in Africa	2023	AfDB	✓	✓	✓
17.	Climate adaptation - How private investors can participate in evolving investment opportunities as cities adapt to climate risks	2023	JP Morgan Asset Management	✓	✓	✓

No.	Relevant Literature	Year	Source/Author	Upstream: Enabling Environment	Midstream: Infrastructure Planning, Pipeline Identification, Project Definition and Structuring, Procurement, Contracting and Monitoring	Downstream: Financing and Credit Enhancement
18.	Guidebook on How to Access Climate Finance for Member States of the Association of Southeast Asian Nations	2023	UN Framework Convention on Climate Change		✓	
19.	Climate Finance Report 2022-June 2023	2023	Santander	✓		
20.	Climate Finance Cheat Sheet	2023	WBG			✓
21.	Annex III: Strategic Plan for the Green Climate Fund 2024–2027	2023	GCF			✓
22.	Financing Climate Action for Transportation in Developing Countries	2023	WBG			✓
23.	Assessing Economic Efficiency of Long-Term Road Asset Management Strategies (Full study); Performance-based contracts: Promoting quality road maintenance and economic efficiency (Blogpost)	2022	WBG		✓	

No.	Relevant Literature	Year	Source/Author	Upstream: Enabling Environment	Midstream: Infrastructure Planning, Pipeline Identification, Project Definition and Structuring, Procurement, Contracting and Monitoring	Downstream: Financing and Credit Enhancement
24.	Climate Finance Approaches and Actions for Sustainable Landscapes	2022	WBG			
25.	Sustainable Development Goal (SDG) 9 - Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	2022	UN	✓		
26.	Evaluation of World Bank Group Support to Creating an Enabling Environment for PSP in Climate Action, Fiscal Years 2013–22	2022	WBG			✓
27.	Mobilizing Private Climate Financing in Emerging Market and Developing Economies (Staff Climate Notes)	2022	IMF	✓		✓

No.	Relevant Literature	Year	Source/Author	Upstream: Enabling Environment	Midstream: Infrastructure Planning, Pipeline Identification, Project Definition and Structuring, Procurement, Contracting and Monitoring	Downstream: Financing and Credit Enhancement
28.	Global Landscape of Climate Finance. A Decade of Data: 2011-2020	2022	Climate Policy Initiative	✓		
29.	Finance for climate action - Scaling up investment for climate and development	2022	Independent High-Level Expert Group on Climate Finance			✓
30.	Accelerating Private Sector Engagement in Adaptation in Asia and The Pacific	2022	ADB		✓	✓
31.	Policy Brief No. 126 - Partnering with the Private Sector towards a Future of Sustainable Transport	2022	UN DESA	✓		
32.	Climate Finance Funding Flows and Opportunities: What Gets Measured Gets Financed	2022	The Rockefeller Foundation & BCG			✓
33.	Scaling Private Sector Climate Finance in the MENA Region	2022	UNEP FI	✓		

No.	Relevant Literature	Year	Source/Author	Upstream: Enabling Environment	Midstream: Infrastructure Planning, Pipeline Identification, Project Definition and Structuring, Procurement, Contracting and Monitoring	Downstream: Financing and Credit Enhancement
34.	Tracking Investments in Climate Resilient Infrastructure: Building Resilience Against Floods and Droughts	2022	Climate Policy Initiative		✓	
35.	ISO 14093:22 "Mechanism for financing local adaptation to climate change — Performance based climate resilience grants — Requirements and guidelines",	2022	UN Capital Development Fund		✓	
36.	Development of Climate Resilient PPP Infrastructure Investment Criteria	2021	CREST Support Consultancy	✓		✓
37.	Unlocking Private Climate Finance in Emerging Markets: Private Sector Considerations for Policymakers	2021	Climate Finance Leadership Initiative	✓		✓

No.	Relevant Literature	Year	Source/Author	Upstream: Enabling Environment	Midstream: Infrastructure Planning, Pipeline Identification, Project Definition and Structuring, Procurement, Contracting and Monitoring	Downstream: Financing and Credit Enhancement
38.	Leveraging Private Sector Investments in Adaptation: The evolving role of climate finance in enabling a paradigm shift	2021	Climate Markets and Investment Association (CMIA)	✓	✓	✓
39.	Joint Report on Multilateral Development Banks' Climate Finance	2021	AfDB, ADB, AIIB, CEB, EBRD, EIB, IDBG, IsDB, WBG and NDB			✓
40.	Transport Trends in National Recovery and Resilience Plans	2021	European Parliamentary Research Service	✓		
41.	Global Landscape of Climate Finance 2021	2021	Climate Policy Initiative	✓		
42.	Adapting Urban Transport to Climate Change Module 5f - Sustainable Transport: A Sourcebook for Policymakers in Developing Cities 2nd Edition	2021	GIZ	✓	✓	
43.	Climate-Resilient Infrastructure Officer Handbook	2021	Global Center on Adaptation		✓	

No.	Relevant Literature	Year	Source/Author	Upstream: Enabling Environment	Midstream: Infrastructure Planning, Pipeline Identification, Project Definition and Structuring, Procurement, Contracting and Monitoring	Downstream: Financing and Credit Enhancement
44.	Climate Change Action Plan 2021-2025	2021	WBG			✓
45.	Financial Innovation for Climate Adaptation in Africa	2021	Global Center on Adaptation	✓		✓
46.	Mobilizing private adaptation finance: lessons learned from the Green Climate Fund (Article)	2021	Climatic Change		✓	
47.	Climate Finance and the Promise of Fake Solutions to Climate Change	2021	Bracking S.			✓
48.	Investing in Transportation Resilience: A Framework for Informed Choices	2021	National Academies Pres		✓	
49.	Enabling private investment in climate adaptation and resilience	2021	WBG	✓		
50.	The six-sector solution to the climate crisis	2020	UNEP			✓

No.	Relevant Literature	Year	Source/Author	Upstream: Enabling Environment	Midstream: Infrastructure Planning, Pipeline Identification, Project Definition and Structuring, Procurement, Contracting and Monitoring	Downstream: Financing and Credit Enhancement
51.	Increasing private sector investment into sustainable city infrastructure	2020	PwC and Global Infrastructure Facility		✓	
52.	Low-carbon and climate-resilient transport infrastructure development	2020	World Bank			✓
53.	Delivering on the $100 Billion Climate Finance Commitment and Transforming Climate Finance	2020	The Independent Expert Group on Climate Finance			✓
54.	The Adaptation Principles: A Guide for Designing Strategies for Climate Change Adaptation and Resilience	2020	WBG	✓		
55.	Climate Finance Markets and the Real Economy	2020	Boston Consulting Group			✓
56.	Strengthening Resilience in the Transport Sector	2020	WBG	✓		
57.	Emissions Gap Report	2020	UNEP	✓		
58.	Private Markets for Climate Resilience	2020	IDB	✓	✓	✓

No.	Relevant Literature	Year	Source/Author	Upstream: Enabling Environment	Midstream: Infrastructure Planning, Pipeline Identification, Project Definition and Structuring, Procurement, Contracting and Monitoring	Downstream: Financing and Credit Enhancement
59.	How Investing in Resilient Transport Infrastructure Affects Economic Growth	2019	TRIMIS Digest	✓		
60.	Incorporating Resilience into Transportation Planning and Assessment	2019	Sarah Weilant, Aaron Strong, Benjamin M. Miller	✓		
61.	Financing the Low-Carbon Future: A Private-Sector View on Mobilizing Climate Finance	2019	Climate Finance Leadership Initiative			✓
62.	Climate change and financial risk	2019	IMF			✓
63.	Incorporating Climate Risk in PBC Contracting Recommendations, 2018	2018	WBG		✓	
64.	Transport Sector Recovery Opportunities to Build Resilience	2018	WBG			✓
65.	Infrastructure Sustainable Design Guidelines Version 4.0	2017	Transport for New South Wales	✓		

No.	Relevant Literature	Year	Source/Author	Upstream: Enabling Environment	Midstream: Infrastructure Planning, Pipeline Identification, Project Definition and Structuring, Procurement, Contracting and Monitoring	Downstream: Financing and Credit Enhancement
66.	Prioritizing Climate Resilient Transport Investments in a Data-Scarce Environment: A Practitioners' Guide	2017	WBG		✓	
67.	Climate Change 2014: Impacts, Adaptation and Vulnerability - Chapter 14. Adaptation Needs and Options	2014	Intergovernmental Panel on Climate Change	✓		
68.	Climate Change 2014: Impacts, Adaptation and Vulnerability - Cities and Settlements by the Sea	2014	Intergovernmental Panel on Climate Change	✓		
69.	Climate Proofing ADB Investment in the Transport Sector	2014	ADB	✓		
70.	Performance-based Contracting: Climate Risk Adaption Task 2 State of the Industry Review	2017	WBG		✓	

No.	Relevant Literature	Year	Source/Author	Upstream: Enabling Environment	Midstream: Infrastructure Planning, Pipeline Identification, Project Definition and Structuring, Procurement, Contracting and Monitoring	Downstream: Financing and Credit Enhancement
71.	Green and Resilient Transport Infrastructure Investment	Feb 2012	David Banister, University of Oxford		✓	
72.	Performance-based Contracting for Preservation and Improvement of Road Assets	2009	WBG			
73.	Climate Resilient Roads - Cambodia Rural Roads Improvement Project: Results from Climate Change Adaptation	n.d.	Nordic Development Fund		✓	
74.	Accessing Climate Finance for Urban Transport	n.d.	MobiliseYourCity		✓	
75.	Resilience Point of View Series - Transport	n.d.	100 Resilient Cities	✓		
76.	Resilience 2050	n.d.	Baltimore Metropolitan Council	✓		
77.	Private Participation in Infrastructure (PPI), Half Year (H1) Update 2023	2023	The World Bank	✓		
78.	PPP Reference Guide (Version 3)	2017	Joint MDB Working Group	✓		

No.	Relevant Literature	Year	Source/Author	Upstream: Enabling Environment	Midstream: Infrastructure Planning, Pipeline Identification, Project Definition and Structuring, Procurement, Contracting and Monitoring	Downstream: Financing and Credit Enhancement
79.	Raising awareness on adaptation of transport	2019	UNFCCC	✓		
80.	Transport and Climate Change: How Nationally Determined Contributions Can Accelerate Transport Decarbonization	n.d.	NDC Partnership	✓		
81.	Funding Proposal for Karachi BRT Project	2018	GCF		✓	
82.	Karachi Bus Rapid Transit Red Line Project - Climate Change Assessment	2018	ADB		✓	
83.	Resilient Infrastructure PPPs, Contracts and Procurement, the Case of Japan	2017	WBG		✓	
84.	Revitalising toll roads in Japan's Aichi prefecture	n.d.	Macquarie		✓	
85.	Second-Party Opinion on Green Framework for SGP	2024	Sustainable Fitch			✓
86.	Colombia 4G Toll Road Program	2016	WBG		✓	

No.	Relevant Literature	Year	Source/Author	Upstream: Enabling Environment	Midstream: Infrastructure Planning, Pipeline Identification, Project Definition and Structuring, Procurement, Contracting and Monitoring	Downstream: Financing and Credit Enhancement
87.	UNECE PPP and infrastructure award compendium of case studies	2023	UNECE		✓	
88.	Report on the 2017 forum of the Standing Committee on	2017	UNFCCC		✓	
89.	Barriers to Climate-Resilient Infrastructure Financing	2017	WBG			
90.	Recommendations of the Task Force on Climate-related Financial Disclosures	2017	TCFD			✓
91.	Principles for Resilient Infrastructure	2022	UNDRR	✓	✓	
92.	Infrastructure for a Climate-Resilient Future	2024	OECD	✓	✓	
93.	Guidance on PPP Legal Frameworks	2022	WBG		✓	

Appendix C Additional Case Studies

This section presents case studies that were identified through literature review and stakeholder consultation as relevant to promoting PSP in climate-resilient transport.

Dakar Bus Rapid Transit Pilot Project, Senegal

The city of Dakar, Senegal, launched its 18.3-kilometer, fully electric Bus Rapid Transit (BRT) in 2024, which was the first for this type of system in the Africa region.[i] A climate and disaster risk screening found that the BRT project will be increasingly vulnerable to flooding and extreme temperatures. To address the challenges, the project design incorporated enhanced drainage system as well as supporting infrastructure such as green spaces and pedestrian lanes.[ii]

Background

The city of Dakar planned to invest in the Dakar BRT project, which would benefit residents across the Greater Dakar Area (GDA), especially low-income and vulnerable groups such as women or the elderly. Once operational, the BRT will serve up to 300,000 passengers daily, providing benefits such as i) reduction in corridor travel times from 95 to just 45 minutes; ii) increased accessibility to jobs and other opportunities by public transport; and iii) mitigation of greenhouse gas (GHG) emissions and local pollutants emissions.

The region faces flooding risks, due to urban run-off and the insufficient capacity of the stormwater network. These floods lead to adverse impacts including asset destruction, mortality, economic burden to households and businesses, school disruption, and insecurity. For instance, in 2009, flooding impacted 360,000 people and caused over US$100 million in economic losses in Dakar. Further, severe floods also occurred in 2022.

By 2039, the mean annual temperature in Dakar is projected to increase by 0.3°C to 0.8°C, with increasing frequency and intensity of extreme temperatures in future decades.

Key resilience actions

- A Climate and Disaster Risk Screening was conducted for the project which identified the vulnerabilities of the Dakar BRT project to the impacts of climate change, particularly flooding and extreme temperatures. As a result, the project design incorporated country-specific lessons and international best practices in terms of resilience and adaptation.
- The BRT infrastructure and the adjacent urban roads were designed to be resilient to flooding and to contribute to making the project area flood-proof. Higher standards were used to calculate the drainage system, taking into account the flooding vulnerability. Further, technical studies were conducted to integrate several aspects such as analysis on measures to reduce flood risks around the BRT corridor, and supporting urban infrastructure of pedestrian lane, bicycle lanes and green spaces.

Roads and Bridges Management and Maintenance Program, Mozambique

The roads and bridges project in Mozambique highlights how collaboration with development partners – the World Bank, in this case – can support a country in strengthening resilience planning in the road sector through enhanced design standards and pilot projects.

Background

Mozambique experiences continuous and increasing vulnerability to the impacts of climate change, including long dry spells, severe floods and frequent coastal storms. Climate scenarios project that the levels of climatic variability affecting the country will further increase further, necessitating a proactive approach to manage climate and disaster risks.

The Roads and Bridges Management and Maintenance Project was a World Bank-funded transport project with the objective to improve access of the population to all-season roads through maintenance, rehabilitation, and upgrading of the classified road network. The project addressed key barriers for transport adaptation projects such as policies and enabling environment, strategic planning and programming, project preparation, technical design, and financial structuring.

Key resilience actions

Establishing robust standards and climate data supports transport resilience projects.

- The project supported development of national road design standards and specifications to ensure that future roads are improved to a resilient standard. The technical standards include nine manuals, covering (1) Site Investigations, (2) Geometric Design, (3) Pavement Design Manual, (4) Rehabilitation Design, (5) Hydrology and Drainage Manual, (6) Specification for Bridge Loads, (7) Standard Specification for Roads and Bridges, (8) Standard Details for Roads and Bridges (9) Guidelines for Performance Specifications.

Piloting resilient measures enable better prepare projects.

- The project implemented pilot civil works for resilient road designs for rural unclassified roads and associated hydraulic structures. As part of the pilot, 265 km of climate-resilient roads were constructed in the lower Limpopo Road network in Gaza Province.

Aichi Toll Road Concession Project, Japan

The toll road concession by the Aichi Prefecture was the first toll road privatization in Japan. The project established a risk allocation arrangement through a detailed definition of force majeure for climate-related and other disaster events.

Background

In 2015, the Aichi Prefectural Road Public Corporation (APRPC) published a Request for Proposals for the concession, which became the first ever toll road privatization in Japan. The purpose of the project was to improve the overall quality of government services for the roads, to increase profitability, and to achieve regional revitalization by promoting private sector activities.

In July 2016, the APRPC selected a consortium led by Maeda Corporation for a concession to operate eight brownfield toll roads spanning a total length of 72.5 km. The consortium – including Maeda Corporation, Mori Trust, Daiwa House Group – established Aichi Road Concession, Inc. for the operation, maintenance, collection of toll charges, and traffic administration of the eight roads in the Aichi prefecture of Japan. The road assets were structured into five separate concessions with a weighted average concession term of 28 years.

Key resilience actions

The Aichi Toll Road Concession Project provides an important example of a risk allocation arrangement through the definition of force majeure.

In this regard, force majeure included "storm, torrential rain, flood, high tide, landslide, fall of ground, strike of lightning, earthquake, fire, other natural disaster, or uprising, riot, disturbance, act of war, epidemic, or other human-made disaster", of which the cause is not attributable to either the government or the concessionaire.

However, a key point of innovation was that certain climate-related events were defined in a more detailed manner for such events to be considered as force majeure:

- **Rainfall:** Maximum rainfall of 80 mm or more in 24 hours. Even if rainfall is below the above standard, it is considered heavy rain if hourly rainfall is significant (20 mm or more), provided that the hourly rainfall is observed at the nearest weather observation station (managed by the public corporation) from the damaged place.
- **Storm:** Maximum wind speed of 15 meters per second or more (average in 10 minutes).
- **High tide, storm surge, and tsunami:** Extraordinarily high tide, storm surge, or tsunami caused by a storm or its aftermath with relatively non-minor damage.

The project agreement established that additional costs resulting from force majeure would be borne by the public sector if:

- the resulting disaster recovery aligns with the National Government Defrayment Act for Reconstruction of Disaster-Stricken Public Facilities, or
- the public sector determines that the event was unforeseeable so the concessionaire could not be reasonably expected to undertake preventive measures.

Samakhiali-Gandhidham Toll Road Project, India

The Samakhiali–Gandhidham Toll Road project highlights the importance of proactively addressing operational inefficiencies and implementing necessary upgrades to mitigate damages and losses from climate-related incidents.

Background

The Samakhiali–Gandhidham Toll Road project involved the construction and operation of a six-lane, 56.17 km stretch of National Highway 8A (NH8A) between Samakhiali and Gandhidham in Gujarat state. The project was designed under a design, construction, financing, and operations model (DBFOT basis) and commenced commercial operations in 2010 with a concession period of 24 years.

The National Highways Authority of India (NHAI) awarded the project to the concessionaire L&T Samakhiali Gandhidham Tollway Ltd (L&T SGTL), an SPV wholly owned by L&T Infrastructure Development Projects Limited (L&T IDPL), which is a major road developer in India. The contracting authority appointed an independent engineer to ensure the private developer's compliance with technical standards in the design and construction of the asset.

In 2015, shortly after the commencement of operations, the project incurred revenue losses of US$ 68,000 and toll plaza damages worth US$ 400,000, due to severe rainfall and flooding at the project site. As a result of the climate event, the toll plaza was closed for over 24 hours, preventing toll collection, and the concessionaire subsequently invoked the force majeure clause.

Key resilience actions

Assuring quality through the employment of an Independent Engineer (IE)

- A key lesson for contracting authorities for PPP projects is the utilization of an IE to review claims. Following the incident, the IE was consulted to review the claim. The IE determined that the damages & losses associated with the disaster resulted from the concessionaire's operational inefficiency in following the IE's earlier suggestions for upgrades to facilities before the start of monsoon season. Therefore, the authority did not provide an extension in contract period and the private developer bore the entire effect of revenue losses.

Proactively addressing operational inefficiencies to mitigate damages from climate related incidents

- A key lesson for private operators is the importance of proactively addressing operational inefficiencies and implementing necessary upgrades suggested by regulatory bodies to mitigate damages and losses from climate-related incidents, as failure to do so may result in bearing the full financial burden of revenue losses without contract extensions or compensation from authorities.

4th Generation Toll Road Concession (4G) Program, Colombia

The 4th Generation Toll Road Concession (4G) program in Colombia highlights the crucial role of clearly defining responsibilities in contractual agreements to address climate risks in transport resilience projects.

Background

The Government of Colombia (GoC) established the 4th Generation Roads Concession (4G) program to support the construction of a nationwide toll road network through public private partnerships. The project received funding from international development finance institutions such as the World Bank Group (WBG) and Inter-American Development Bank (IDB). The program also received technical assistance and advisory support from the WBG and IDB including support for creating new regulations for issuing and investing in infrastructure bonds, and improving existing PPP legal, regulatory, and institutional frameworks.

In 2010-2011, the La Niña floods damaged some roads under the concession, resulting in economic losses of about US$ 88 million. This led to disputes between private concessionaries and contracting public authorities on who bore the liability for climate risks. In response to the ensuing dispute, the government revised the insurance requirements under concession contracts to effectively allocate climate risks to the private party and reduce the government's liability for climate risks. Concessionaires must now hold sufficient insurance to cover their expected probable maximum loss.

Key resilience actions

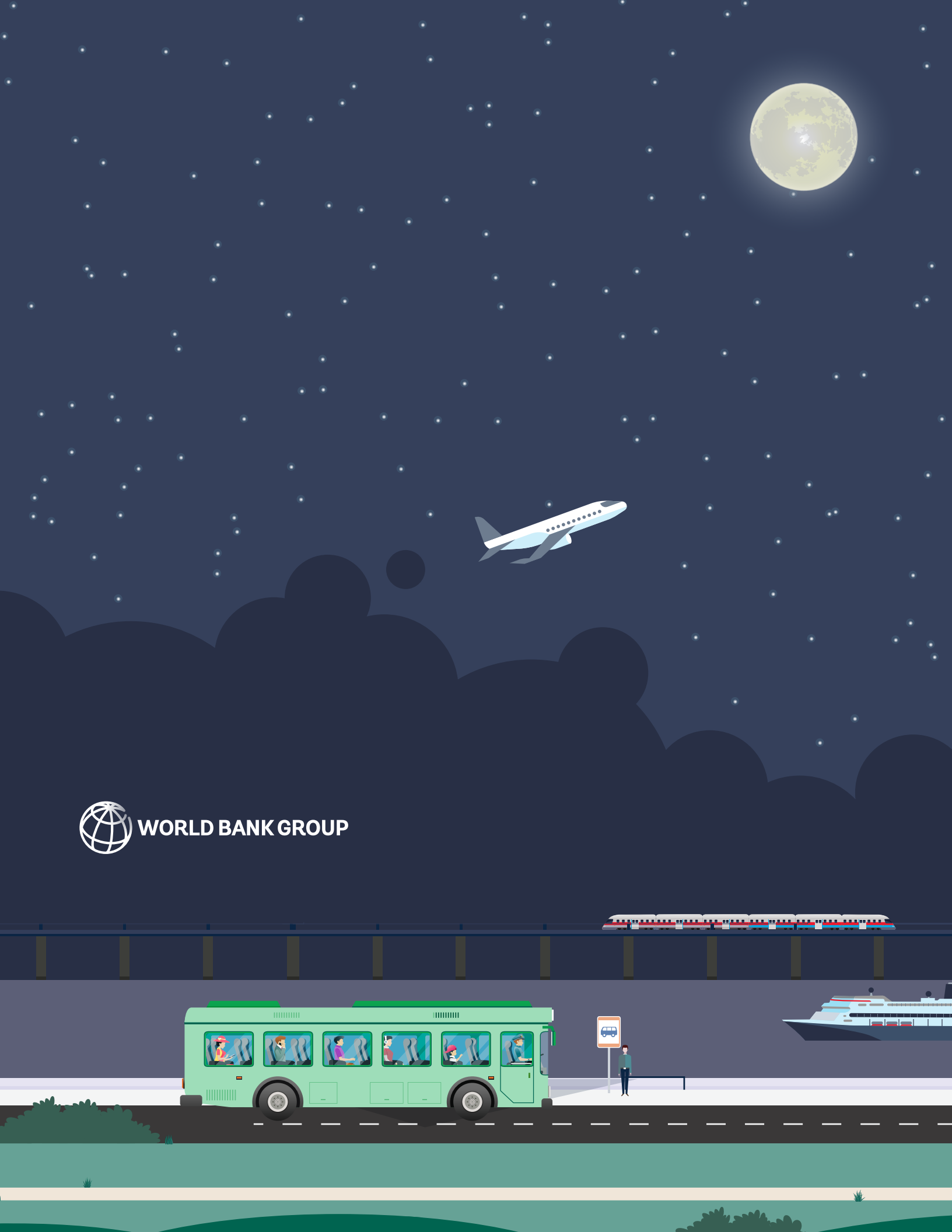
The 4G program offers valuable lessons for the private sector, including clarity in contractual agreements, understanding of risks and mitigation measures, and financial preparedness.

- **Ensuring clarity in contractual agreements:** Clearly defining liability for climate risks in concession contracts ensures that all parties understand their obligations and can adequately prepare for potential climate shocks.
- **Understanding of risks and mitigation measures:** The private sector should understand how liability for climate risks is allocated in concession contracts. Furthermore, private concessionaires should incorporate climate risk mitigation strategies into project planning and management to help minimize potential damages and disruption.
- **Ensuring adequate financial preparedness:** Private sector participants should maintain financial reserves or secure appropriate insurance coverage to manage potential climate-related losses.



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