



UNDERSTANDING RISK  
GLOBAL FORUM 2024

TRADITION • INNOVATION • RESILIENCE

## ***Combining Big Data and Private Financing to Achieve Transport Resilience***

### **Speakers:**

**Moderator:** Jane Jamieson, Program Manager – QII Partnership, World Bank

#### ***Part 1: Climate Risk and Economic Assessments for Enhanced Transport Resilience***

Frederico Ferreira Fonseca Pedroso, GFDRR, World Bank

#### ***Part 2: Private Capital Enabling for Resilient Transport Infrastructure***

Sanae Sasamori, University of Tokyo

Guillermo Diaz-Fanas, Transport AFW, World Bank

#### ***Part 3: Putting Theory into Practice: Big Data for Resilience in Urban Mobility:***

##### ***Case Studies in Mozambique***

Dr. Marianna Loli, GRID Engineers

Guillermo Diaz-Fanas, Transport AFW, World Bank



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PPIAF  
Enabling Infrastructure Investment



GRID  
ENGINEERS



# Part 1: *Climate Risk & Economic Assessments for Enhanced Transport Resilience*



## Speakers:

Federico Ferreira Fonseca Pedroso, DRM Specialist,  
World Bank

## With special thanks to:

Jing Xiong, Sr. Transport Specialist, World Bank

Simona Sulikova, Consultant, World Bank



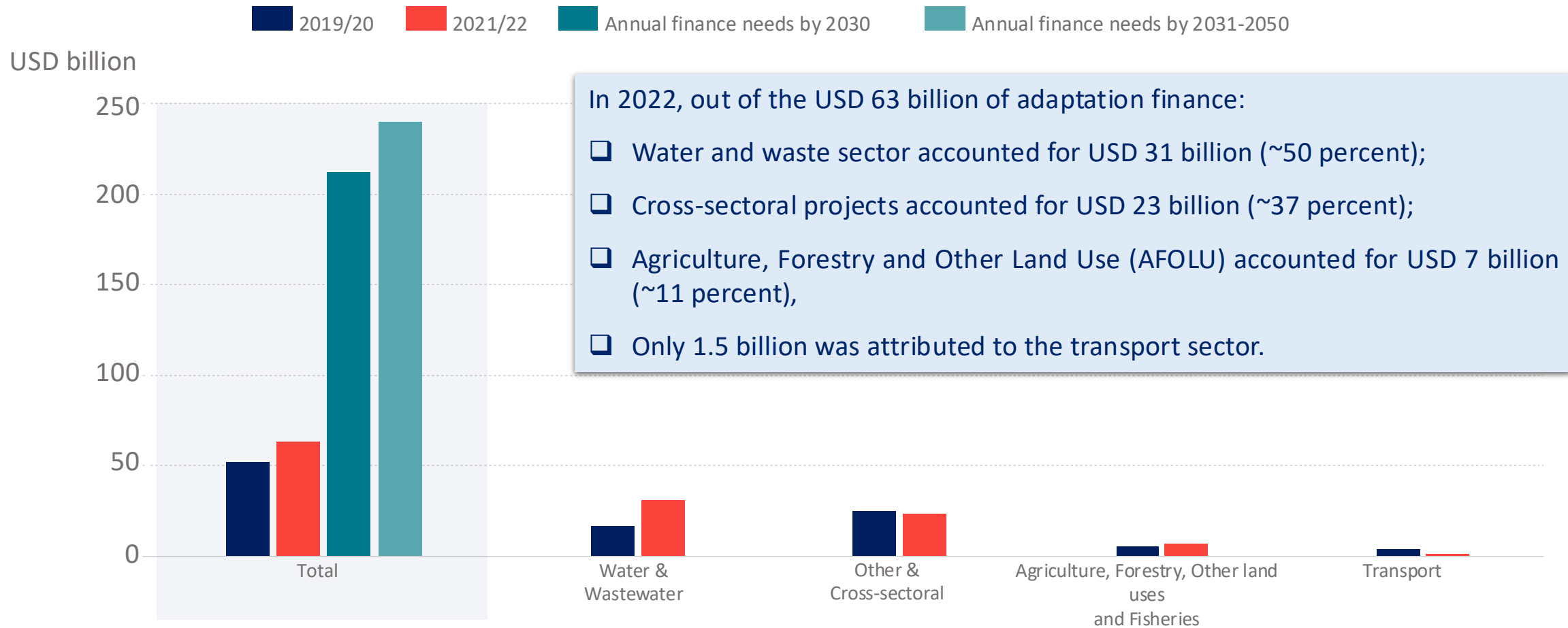
# Climate change poses a significant threat to development

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Photo Credit: Ministry of Transport Argentina

# Adaptation Finance Use and Needs



Source: CPI (2023). Global Landscape of Climate Finance

# The Objective: Mainstream climate resilience in transport



**Mitigate  
Disaster  
Risks**



**Adapt to  
Climate  
Change**



**Allocate  
resources  
effectively**



**Expand  
asset  
lifespan**



**Reduce  
negative  
impacts**

# *Achieving resilience mainstreaming*

1

Review country climate risk and economic assessment for transport resilience

2

Establish a methodology for economic assessment for transport resilience

3

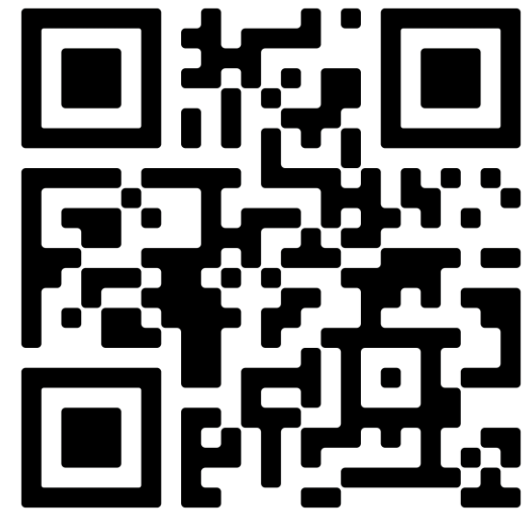
Integrate with internal WBG processes, and client countries' national planning and investment decisions

# Step 1: Review of past practices

## WBG Transport projects and studies

No resilience assessment	60%
Hazard exposure quantification	40%
Vulnerability assessment	40%
Risk assessment	40%
Criticality	20%
Adaptation evaluation	35%
Resilience economic analysis	37%

Argentina detailed methodology



# Step 2: Methodology for resilience analysis

## Systems planning tool

- **Consistent methodology:**
  - Global datasets
  - Mapping of networks
  - Systems-level assessment for redundancy
- **Cost-effective**
- **Maximize climate co-benefits**



Climate Change Knowledge Portal  
For Development Practitioners and Policy Makers



100-year flooding risk in Argentina/Uruguay  
and the transport network

Source: <https://global.infrastructureresilience.org/>

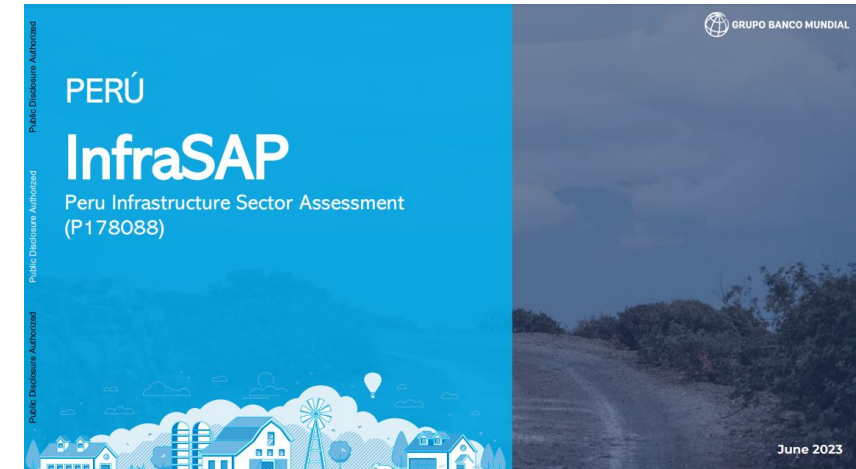


# Step 3: Integration into WBG workstream

Country Climate  
Development Reports

Infrastructure Sector  
Assessment Programs

Project development



# Step 4: Integration into national planning



Budget and resources go to maintenance



Prioritization of most vulnerable assets



Transport engineering design standards to consider climate risks

This Streamlined Analysis will be Integrated with the Highway Development Model version 5 (HDM-5)

# Part 2: *Private Capital Enabling for Resilient Transport Infrastructure*



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## Speakers:

**Sanae Sasamori**, PhD Candidate, Department of Civil Engineering University of Tokyo

**Guillermo Diaz-Fanas**, Transport Specialist, Transport AFW, World Bank



# Resilient Infrastructure PPPs

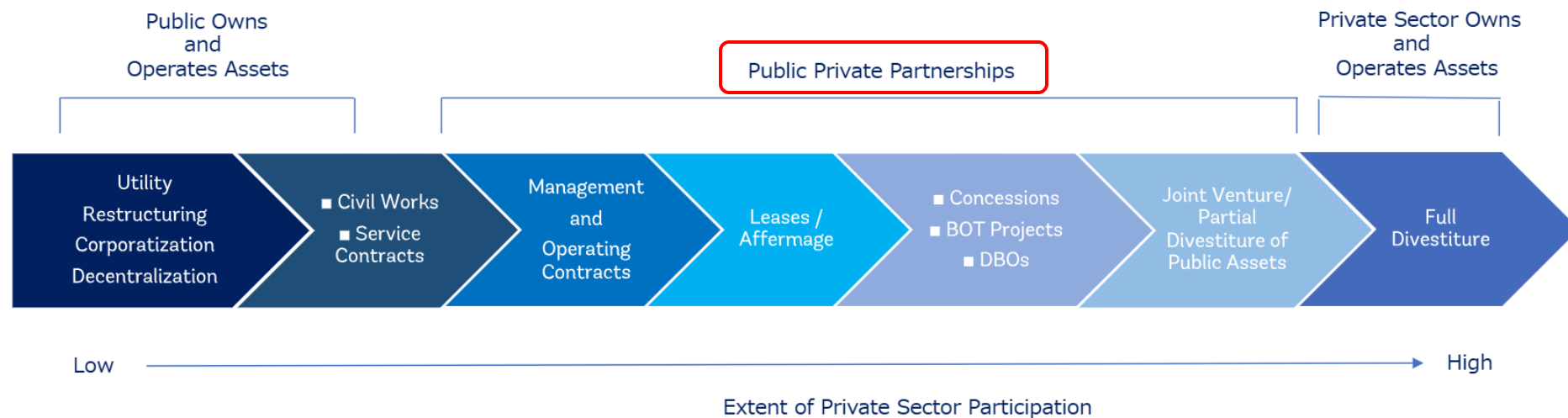
## Disaster Risk Sharing between the Public and Private Sectors

Sanae SASAMORI

PhD Candidate, Department of Civil Engineering,  
University of Tokyo

# Public-Private Partnerships for Transport

- Mobilizing private capital through **public-private partnerships (PPPs)** is a key measure to support development challenges.
- A measure to procure and implement public infrastructure and/or services, using the financial resources and expertise of the private sector.
- PPPs for transport sector: airports, ports, rail, roads, urban transport



Source: Public-Private Partnership Legal Resource Center

# Risk Sharing Is a Key for Success

- Risk sharing means which party will bear the cost arising from the risks.
- Transferring to the private the risks that is better able to control is a key.
- **Disaster risks** are categorized as ***Force Majeure*** and need to be identified, evaluated, and shared between a government and a private operator.

PPP risk categories	PPP risk categories
Site	Change in legal or regulatory framework
Design, construction and commissioning	Default
Operation	Economic or financial
Demand, and other commercial risk	<b>Force Majeure</b> (risk that external events beyond the control of the parties, e.g. natural disasters)
Regulatory or political	Asset Ownership

Source: Public-Private Partnership Legal Resource Center

# Disaster Risk Identification



- Define ***Force Majeure*** as clearly as possible

## Case: Definition of *Force Majeure* - Sendai International Airport Project-

Force Majeure is a factor that affects the performance in this contract directly and adversely, and any of the phenomena listed below (limited to those that exceed the criteria that have been determined in advance...), which are **not attributable** to both the central government and the business operator... and **can be foreseen** by neither... even if it was possible to foresee it , **no reasonable means** of preventing the occurrence of losses, damages, or failures due to the factor can be expected.

- Extreme weather:** storm, lightning strike, torrential rain, strong wind, hurricane, typhoon, cyclone, abnormal heat wave, and abnormal cold wave, which are more extreme than those that usually or regularly occur in or around this airport.
- A natural disaster:** a flood, high tide, landslide, lightning strike, earthquake, fire, tsunami, and any other natural disaster that cannot be avoided or foreseen, which brings significant and inevitable damage to this airport.

(source: World Bank, 2017. Underlined and highlighted by the author.)

# Disaster Risk Evaluation



- Assess additional costs expected to be required if disaster risks materialize
- Check the availability and costs associated with insurance or other disaster risk mitigation measures

## Risk Evaluation Measures

- Hazard maps
- Disaster databases

## Risk Mitigation Measures

- Insurance
  - Fire insurance with earthquake rider
  - Profit insurance



**Big Data can be useful**



# Disaster Risk Allocation



## Basic approach to risk sharing

Risks in PPP projects are to be assumed by the entity that can control the risks in the most efficient and effective manner.

## Points to consider

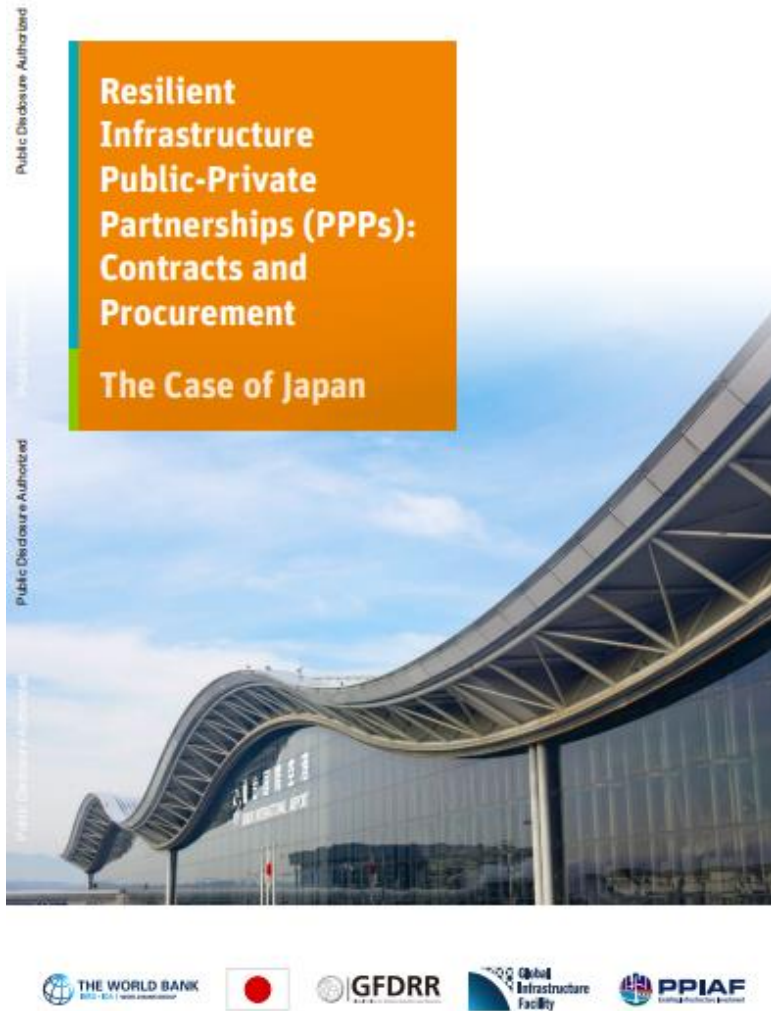
1. The degree of the importance of this service and how much disruption is acceptable.
2. Provide incentives for private operator to minimize damage from disasters by transferring certain risk.

# Case: Kansai International Airport Project

Status	Definition	Risk Allocation Policy
Occurrence of Force Majeure	<p>Definition of <b>Force Majeure</b>:</p> <ul style="list-style-type: none"> <li>• Extreme weather</li> <li>• Natural disaster</li> <li>• Civil conflict or hostile action</li> <li>• Epidemic</li> <li>• Radioactive contamination</li> </ul>	<ul style="list-style-type: none"> <li>• Additional costs shall be borne by the concessionaire (=private operator).</li> <li>• If the costs required to recover the airport facilities exceed <u>¥ 10 billion</u>, the portion that exceeds ¥ 10 billion shall be compensated by the public.</li> </ul>
Occurrence of Emergency situations	<p>Definition of <b>emergency situations</b>:</p> <ul style="list-style-type: none"> <li>• Any situation that may significantly prevent the concessionaire from conducting operation safety etc.</li> </ul>	<ul style="list-style-type: none"> <li>• The public can decide whether to order the suspension of the operating right for the period and scope necessary.</li> <li>• <b>The public can operate the obligatory services based on the suspended operating right....</b></li> <li>• If the operating right is suspended due to emergencies, additional costs or damages incurred by the operator shall be compensated by the public.</li> </ul>

Source: World Bank, 2017. Underlined and highlighted by the author.

# Reference:



## **The World Bank, 2017. Resilient Infrastructure Public- Private Partnerships (PPPs): Contracts and Procurement- The Case of Japan**

[ResilientInfrastructurePPPsContractsandProcurementJapanCase.pdf \(worldbank.org\)](https://www.worldbank.org/publicdisclosure/ResilientInfrastructurePPPsContractsandProcurementJapanCase.pdf)

# Innovative Financing for Transport Resilience

April 25, 2024

## **Presenters:**

Guillermo Diaz-Fanas (Transport Specialist, World Bank).

## **Co-authors:**

Jing Xiong (Sr. Transport Specialist, WB), Helen D. Gall (M&E Specialist, WB)



# Cross-cutting Barriers for Transport Climate Resilience



## Policy and Strategy

- Policy and strategic planning do not address climate resilience.
- Inconsistent ambition and goals on climate resilience across counterparties limit collaboration.
- Mismatch in timescales between key actors limits complicate coordination.



## Organizational capacity

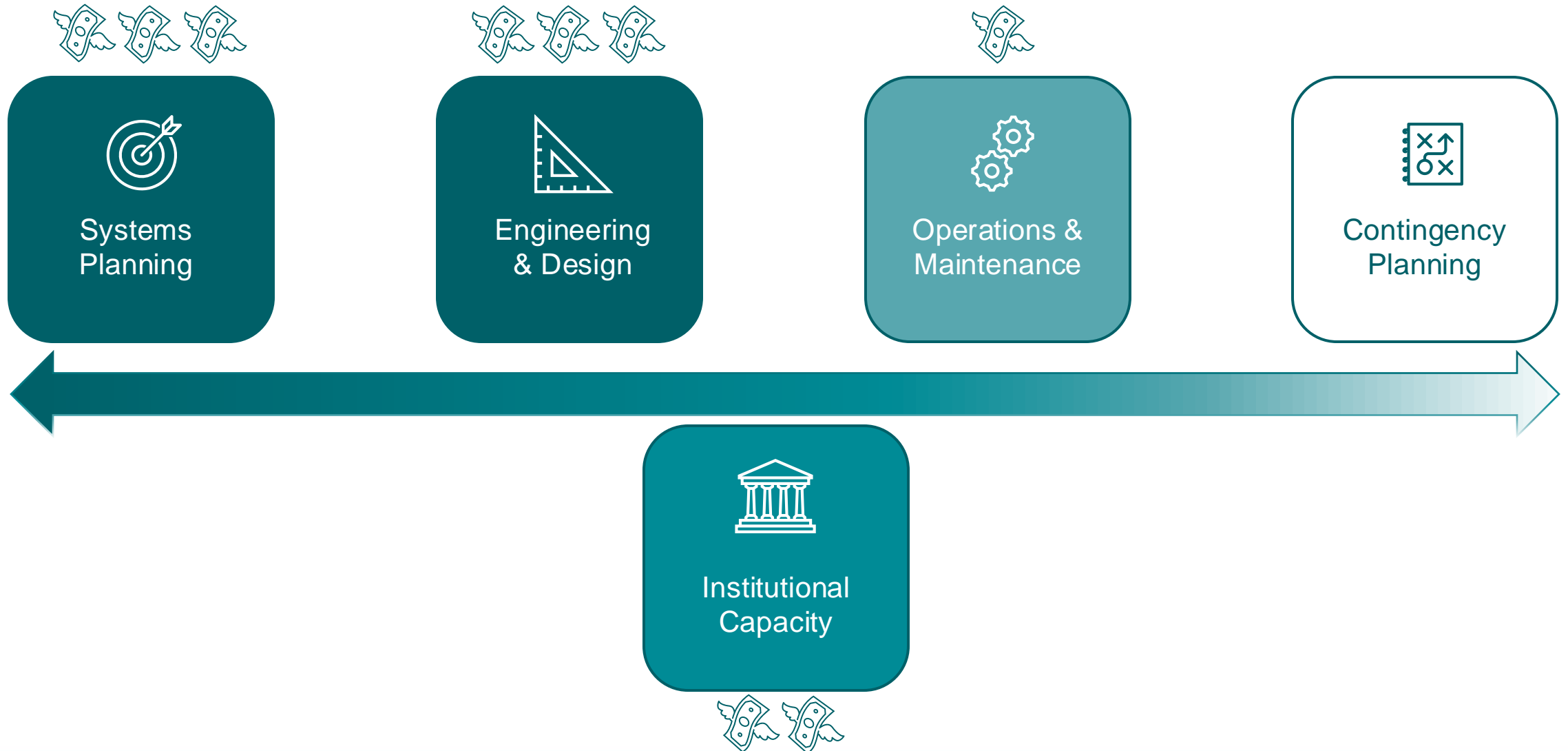
- Organizational mandate is silent or inadequate on climate change resilience to justify significant behavioral shifts.
- Knowledge and human resources on climate resilience is limited or unavailable.
- Existing processes, templates, and toolkits do not address climate resilience.



## Project-level conditions

- Data and information gaps on climate resilience at various levels are prohibitive (even where data are available, usability gaps limit utility for decision-making).
- The definition and methodology to evaluate climate resilience measures is unclear and/or unavailable.
- Building the financial and business case for costly adaptation measures is complicated by the difficulty to quantify resilience benefits (e.g. uncertainty in timing, no counter-factual for avoided damage).

# Adaptation Finance Use and Needs



# Connecting Private Sector with Climate-Resilient Transport

Private sector participation spectrum	Public Ownership		Public-Private Partnerships		Privatization	
	Risk transfer to private sector Ownership to private sector Contract term					
Categories	Works and services contracts	Management and maintenance contracts	Operations and maintenance concessions	Build-Operate-Transfer Concessions	Joint venture / Partial divestiture	Full privatization
Types	DB, DBB	Management contract, performance-based contract	O&M, Lease, Affermage	DBFOM, BOT, BOOT, BOO		
Design	Private by fee contract	Private by fee contract		Private by concession contract	Private	Private
Build						
Operations and maintenance	Public	Private by fee contract or performance-based contract	Private by concession contract			
Finance	Public	Public	Public		Shared	
Own	Public	Public	Public	Public after contract (DBFOM, BOT, BOOT) or private (BOO)	Shared	

Climate resilience potential may be further influenced by resilience-related contractual design

# Example of Concessional, Climate and Private Sector Finance in South Asia

Green BRT Karachi, Pakistan



## Financiers



ADB

Source:  
GCF (2018). Funding Proposal for Karachi BRT Project.

## Project highlights



This Bus Rapid Transit (BRT) project demonstrated good practices in climate risk assessment, integration of adaptation measures, and use of concessional finance to cover incremental adaptation costs.



GCF grant finance of **USD 7 million** was secured to cover the total incremental cost of **adaptation investments**.



Private sector participation was incorporated through service contracts for the BRT operations.

## PROJECT SIZE

USD **583.50M**



The project has a very strong potential for replication not only in Pakistan but also in other cities worldwide.



# Key Take-aways



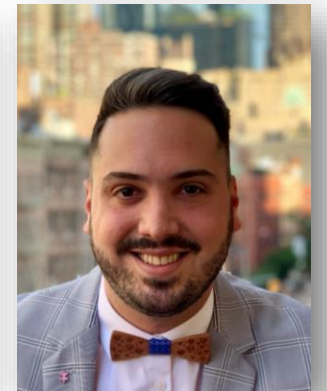
- Transport climate resilience is currently underserved. There is the need for action.
- Private sector finance plays an important role to overcome the adaptation finance gap. WB Transport Group is currently developing a PSP roadmap for climate resilience in transport.
- WB Transport Group should take advantage of existing climate funding and finance facilities to mainstream climate resilience across resilience life-cycle approach.
- The next phase will provide a roadmap for three sub-sectors in transport to incentivize PSP for transport resilience.

# Part 3: *Putting Theory into Practice:* *Big Data for Resilience in Urban Mobility: Case Studies in Mozambique*

## Speakers:

**Dr. Marianna Loli**, Principal Consultant, GRID Engineers

**Guillermo Diaz-Fanas**, Transport Specialist, Transport AFW,  
World Bank



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## Understanding flood risk in data-poor environments: Maputo, Mozambique

Speaker:

Marianna Loli

Co-authors:

Leon Kapetas, Guillermo Diaz-Fanas, and Fatima Arroyo Arroyo



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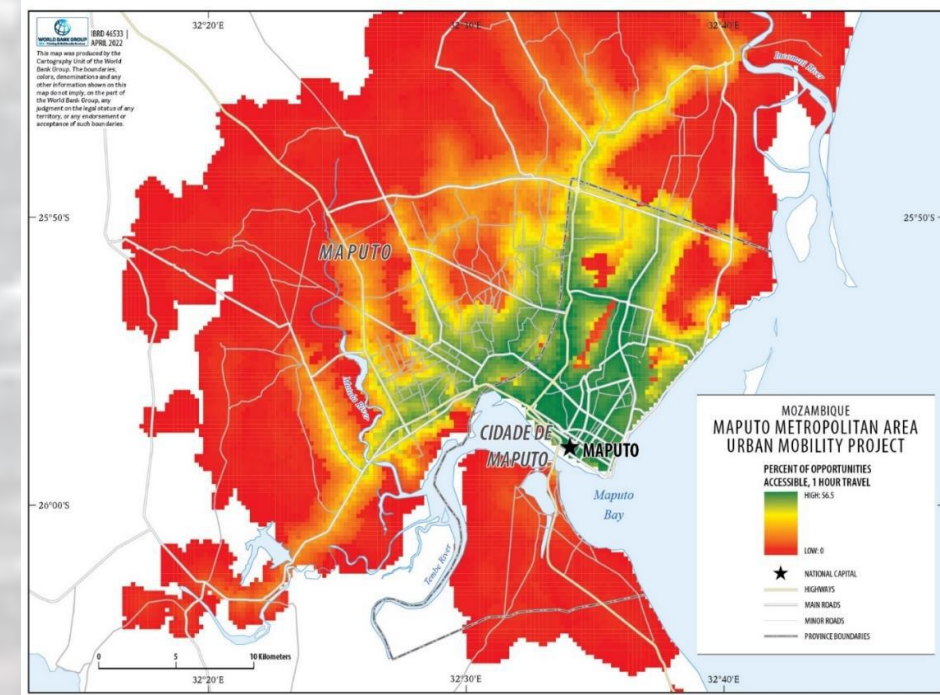
# *Mozambique:* How digital technologies support urban mobility and mobilize the private sector

## The Challenge

The urban transport system in Maputo, the capital of Mozambique, is struggling to keep up with the city's growing population, leading to mobility challenges that **limit access to jobs, increase costs for businesses, and fuel urban poverty**

## WBG Response

- The WB approved the **\$250 million Maputo Metropolitan Area (MMA) Urban Mobility Project** to improve mobility and accessibility along one selected corridor in MMA.
- Key project components include building the first Bus Rapid Transit (BRT) system and associated facilities in MMA.
- The project will provide resilient and safe infrastructure and accessible public transport services.
- It will also address mobility barriers for women and vulnerable groups to create an inclusive transportation system.



*Percentage of Employment Opportunities Accessible by Public Transport within 1 Hour Travel*

# QII Partnership support to the Maputo Metropolitan Area Urban Mobility Project

QII developed two grant-funded activities to support the WB Operation:

## 1) *Enhancing Sustainable Mobility and Accessibility in Maputo* (complete)

During preparation, QII task teams collaborated with the University of Tokyo to develop an **innovative methodology using cell phone data to estimate traffic demand in real time**, conduct accessibility analysis and diagnose transport demand and supply.

- **QII support promoted:** Cost effective approach to provide granular understanding of travel patterns and transport demand, including response to major events (e.g., flooding, COVID-19)

## 2) *Innovation for Better Infrastructure in the first mass transit project of Maputo* (ongoing)

During implementation, QII is supporting the data collection and technical advisory that enables PSP in public transport operations and infrastructure development.

- **QII support promotes:** (i) TOD concept in the design of the BRT; (ii) formalization of individual paratransit operators to be part of the BRT system; (iii) viable business model for PSP.



# Outcomes of QII Support to the Maputo Metropolitan Area Urban Mobility Project

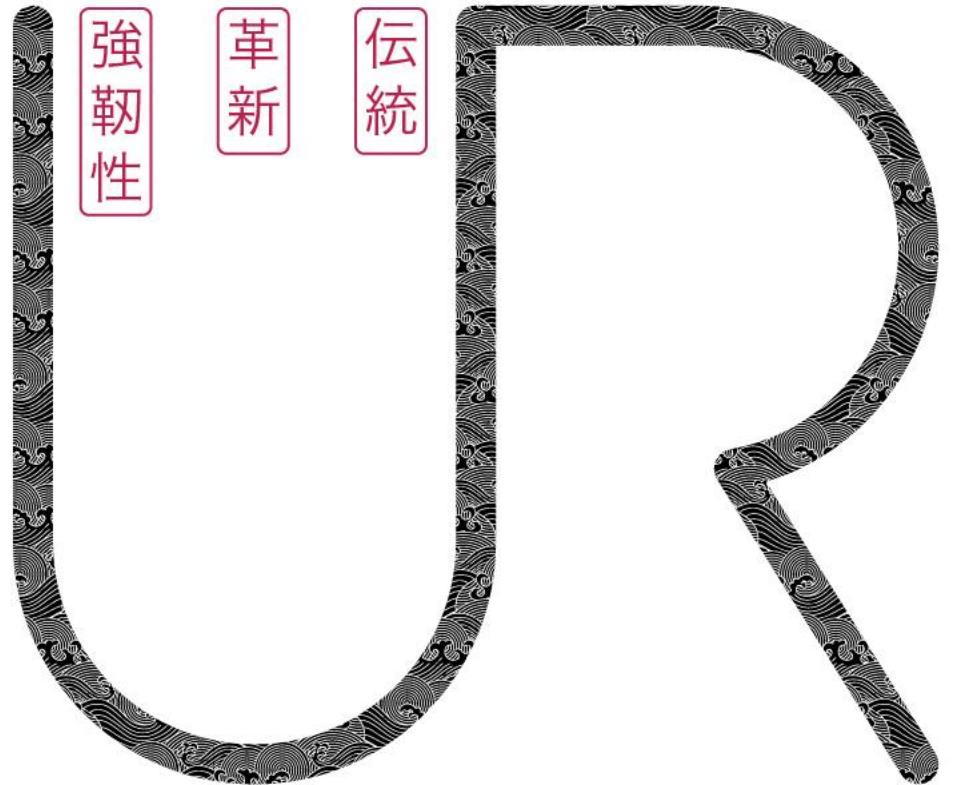


## IMPACT of QII:

- **Informed transport policy, planning, and emergency responsiveness** for the city and provided analytical foundation for the WB-funded operation in Maputo
- Through using **Big Data**, QII was able to deliver on scope that is helping Maputo grow from a **congested, vehicle-oriented city to a resilient, people-oriented city**

## Building on the success of 1st grant, 2nd grant is currently delivering on:

- Strengthening public transport policies/regulations and building capacity in the public and private sectors to maximize benefits of infrastructure investment
- Continuing to provide better transport planning and more resilient and resource-efficient transport infrastructure in Maputo
- Promoting private sector participation to deliver high-quality public transport services and invest in transport infra such as terminals, depots, parking facilities.



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# Thank you! Questions?

*To learn more on resilient infrastructure investments, please come to our additional sessions:*

**Wednesday, 4:45-5:30pm Plenary**

***Risky Business: Attracting Private Finance for Adaptation***

**Thursday, 9am-1pm Room 402**

***How Much Resilience? Tools for Disaster Risk Assessment to Promote Resilience in Infrastructure Investments***

**Friday, 9am-11am Room 409**

***Accounting for Climate Risks and Identifying Opportunities in Infrastructure PPPs: A New Suite of Toolkits***

