Executive Summary of the Disaster and Climate Change Risk Assessment Methodology for IDB Projects

A Technical Reference Document for IDB Project Teams

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Climate Change and Sustainable Development (CSD)

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ACRONYMS

CC	Climate Change
CCS	Climate Change and Sustainability Division
CPR	Community of Practice on Resilience
DFID	Department for International Development from the United Kingdom
DRA	Disaster Risk Assessment
DRMP	Disaster Risk Management Plan
ESG	Environmental and Social Safeguards Unit
GIS	Geographic Information System
IDB	Inter-American Development Bank
IDBG	IDB Group (includes BID Invest)
IGOPP	Index of Governance and Public Policy in Disaster Risk Management
IPCC	Intergovernmental Panel on Climate Change
KIC	Knowledge, Innovation and Communication Sector
LAC	Latin America and the Caribbean
MDBs	Multilateral Development Banks
RND	Environment, Rural Development and Disaster Risk Management Division
UNISDR	United Nations for Disaster Risk Reduction
WRI	World Resources Institute

CONTENTS

Introduction

The effects of climate change and disasters triggered by natural hazards pose a significant threat to sustainable development in the Latin America and the Caribbean (LAC) region. According to the Bank's document What is Sustainable Infrastructure: A Framework to Guide Sustainability Across the Project Cycle (IDB & IDB Invest, 2018), the region is one of the most vulnerable to the impacts of a changing climate: in 2017, for example, floods in Peru resulted in economic losses of US$3.1 billion and floods in Colombia resulted in 329 fatalities. When adding climate change, damages may cost the region US$100 billion a year by 2050.

Considering disaster and climate change risks in the design and construction of projects is important to increase their resilience. The Bank has developed a methodology to facilitate the identification and assessment of disaster and climate change risks and resilience opportunities in all relevant projects during their identification, preparation and implementation phases. This provides a valuable opportunity to align existing policies, procedures and methodologies to generate tangible benefit for the Banks' client countries, beneficiaries and end users, as well as potential private sector investors.

Rooted in the existing Disaster Risk Management Policy (IDB, 2007) and Guidelines (IDB, 2018), this Methodology builds upon and strengthens the current screening process and provides guidance for project teams to conduct disaster and climate change risk assessments in relevant operations, ensuring added value to projects.

The approach included in this Methodology is intended to have broader applicability but is particularly relevant for projects with infrastructure components and is aligned with the Bahamas Resolution of 2016 (IDB, 2016) and the Bank's Sustainable Infrastructure for Competitiveness and Inclusive Growth Strategy (IDB, 2013). In the Bahamas Resolution, the Board of Governors welcomed the Management's objective to improve the assessment of climate risks and to identify opportunities for resilience and adaptation measures at the project concept stage. The Sustainable Infrastructure Strategy states that providing access to transport, electricity, water, and sanitation services improves quality of life through its direct impact on health, education, and economic opportunities. In addition, the Bank's Sustainable Infrastructure Framework includes resilience in its definition of Sustainable Infrastructure, noting that sustainable infrastructure projects are (or should be) sited and designed to ensure resilience to climate

and natural disaster risks[1]. Hence, by promoting resilience in projects, the Bank is furthering its commitment to improving lives in the region.

The Methodology is also aligned with the climate change and environmental sustainability cross-cutting theme and the productivity and innovation development challenge of the Update to the Institutional Strategy 2010-2020 (AB-3008), with the IDBG Climate Change Action Plan 2016-2020 (GN 2848-4) and the Climate Change Sector Framework Document (CSD, 2015).

In order to test and validate its concepts and approach, this Methodology was piloted through the analysis and completion of risk assessments in seventeen (17) Bank-financed projects in preparation and/or execution from 2016 to 2018, which was instrumental to feed the process[2]. Furthermore, the lessons learned from a close review of the disaster and climate change risk assessments done to date have proven a valuable contribution to this Methodology. Some key lessons learned include the importance of supplementing hazard and climate change (CC) information with project vulnerability and criticality data, and the need for risk assessments to include not only quantitative, but also qualitative approaches.

This document summarizes the Disaster and Climate Change Risk Assessment Methodology developed and piloted during 2017 and 2018. While the Methodology is the result of the work done by specialists of the Climate Change and Sustainability Division (CSD/CCS), the Environment, Rural Development and Disaster Risk Management Division (CSD/RND) and the Environmental and Social Safeguards Unit (VPS/ESG), collaboration with sectors has been critical throughout the process of piloting and further developing the Methodology.

Along with the accompanying methodology document, which individualizes each step and explains different types of hazards, as well as sector and structure-specific issues that need to be addressed, this document provides practical support to project teams in different sectors, executing agencies, technical experts, and external consulting and design firms, on how to integrate disaster and climate change risk considerations into project preparation and implementation, where relevant.

1 IDB Group defines sustainable infrastructure as follows: “Sustainable infrastructure refers to infrastructure projects that are planned, designed, constructed, operated, and decommissioned in a manner to ensure economic and financial, social, environmental (including climate resilience), and institutional sustainability over the entire life cycle of the project.” Disaster and climate change risk is embedded in the environmental sustainability (including climate resilience) principle for project preparation and design, which includes the following sustainability criteria: 1) assessment of climate risks and project-resilient design, and 2) project design and systems optimization for disaster risk management.

2 The following activities have been conducted: (a) analysis of disaster and climate change risk assessments or equivalent elaborated for projects from 2014 to 2017; (b) focused meetings with sector specialists to arrive at vulnerability and criticality aspects of projects in respective subsectors; (c) elaboration of proposed methodology, including peer review; (d) piloting phases of the methodology in IDB projects with a high or moderate risk classification in preparation or with relevant disaster and climate change risk aspects during supervision; (e)capacity building of sector specialists on disaster and climate change risk assessment.

Background and Context

The impacts of disaster and climate change risk are growing concerns as they reduce the predictability of future infrastructure needs and increase the vulnerability of populations and assets (Reyer et al., 2017). As part of sustainable planning, development projects should consider current and future risk and resilience opportunities in the design, construction, and operation phases (IDB & IDB Invest, 2018).

In 2007, the Bank incorporated disaster risk (including hazards emanating from climate variations) within the project cycle as part of the **Disaster Risk Management (DRM) Policy (OP-704) – Directive A2 – Risk and Project Viability**, to provide guidance to project teams in Bank-financed public and private sector projects. The DRM Policy Guidelines (GN-2354-11) of 2008 define a procedure to assess project disaster risk that includes: (i) project screening and classification integrated in the safeguards system (policy filter and screening form); and (ii) a Disaster Risk Assessment (DRA) and Disaster Risk Management Plan (DRMP) if the project is classified as high risk[3], or a more limited DRA if the project is rated as moderate risk.

The DRM Policy Guidelines explicitly mention climate change. The Natural Hazards and Climate Change section states that the Guidelines apply to all-natural hazards, including the hydro-meteorological hazards – windstorms, floods and droughts – that are associated with both the existing climate variability and the **expected change in long-term climate conditions.**

3 In the Identification and Reduction of Project Risk section, Policy Directive A-2 on Risk and Project Viability points out that "Bank-financed public and private sector projects will include the necessary measures to reduce disaster risk to acceptable levels as determined by the Bank on the basis of generally accepted standards and practices. The Bank will not finance projects that, according to its analysis, would increase the threat of loss of human life, significant human injuries, severe economic disruption, or significant damage related to natural hazards."

The Community of Practice on Resilience (CPR) is currently integrated by specialists of the Environment, Rural Development and Disaster Risk Management Division (CSD/RND), Climate Change and Sustainability Division (CSD/CCS) and the Environmental and Social Safeguards Unit (VPS/ESG). It is open to participation from other divisions and aims at mainstreaming resilience across sectors and projects within the IDB.

It mentions that climate change is expected to alter some countries' disaster risk (their probable damages and losses) by changing the characteristics of hydro-meteorological hazards. It also notes that climate change is likely to influence weather-related hazards, and thus probable losses, in three principal ways: (i) by altering the intensity and frequency of extreme climatic events, i.e., hurricanes, tropical storms, droughts, heat waves and cold snaps; (ii) by shifting the average weather conditions and climate variability, e.g. precipitation levels; and (iii) by originating hazards that might be new to a certain region, such as sea level rise and glacial melt, which can worsen storm surge and coastal flooding, as well as floods and droughts in watersheds.

In 2016, a **Community of Practice on Resilience** (CPR) was established by the IDB.[4] The CPR is currently integrated by specialists of the Environment, Rural Development and Disaster Risk Management Division, the Climate Change and Sustainability Division, and the Environmental and Social Safeguards Unit. It is open to participation from other divisions and aims at mainstreaming resilience across sectors and projects within the IDB. The objectives of the CPR are (i) to contribute to a better understanding of the factors that determine resilience and, thus, the sustainability of programs that promote the development of the Latin America and the Caribbean region; (ii) to harness existing knowledge and lessons learned to improve the resilience of IDB-financed projects;

4 The CPR had been holding informal meetings since 2012. Prior the development of this methodology, other Technical Notes were published – e.g. "Addressing climate change within disaster risk management: a practical guide for IDB Project Preparation", 2015, and, previously, "Climate Change Data and Risk Assessment Methodologies for the Caribbean", 2014. This document includes some of the findings of those previous publications, but also proposes new actions based on a review of the current practice.

and (iii) to strengthen the Bank's and its clients' capacities to mainstream resilience into development programs. To achieve these objectives, and in line with the Bank's international commitments on resilience, the CPR has proposed a three-year Work Plan focused on formulating a methodology proposal that can serve as a resource to (i) implement the A2 Directive of the OP-704 Disaster Risk Management Policy related to the integration of risk assessments (including CC) in Bank-financed operations; and (ii) meet the Management's objective of improving the assessment of climate risks and the identification of opportunities for resilience and adaptation measures at the project concept stage (Bahamas Resolution). The CPR has been working with focal points and focus groups across the IDBG to gather sector knowledge and propose an approach that is relevant to the different sectors. As a result of this consultative process, the **Disaster and Climate Change Risk Assessment Methodology** was jointly crafted in 2017 and fine-tuned through pilot projects during 2018, as already mentioned.

This Methodology is in line with the disaster and climate change risk assessment approaches adopted by other Multilateral Development Banks.[5] These efforts also include the formulation of resilience indicators that can feed into a project's results matrix. The Climate Change Division in cooperation with a group of sectors within the Bank is currently working on this by developing a conceptual Resilience Framework for operationalizing climate resilience at the project and sector levels. The Bank aims to apply this Methodology in projects in 2019.

5 Multilateral Development Banks and the Paris Agreement: Ensuring alignment with the global climate goals, (WRI, Germanwatch and NCI) – 2018.

Objective and audience

» **How should a project be screened and assessed for disaster and climate change risk?**

» **Once risks have been identified during the screening phase, what are the next steps in their analysis?**

» **What should be done and why? Why should we care? (see Box 1 below)**

» **How should disaster and climate change risk be integrated at different project stages?**

The objective of the proposed Methodology is to respond to these questions and, therefore, provide a technically and operationally robust framework that serves as guidance for assessing disaster and climate change risk in projects. This document provides an overview of a more detailed accompanying Methodology.

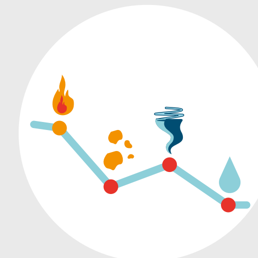
Box 1. Why should we care?

Exposure

Because the Latin America and the Caribbean (LAC) region is exposed to several natural hazards, and their impacts have already been felt. In 2017, the region was impacted by a variety of events including landslides in Colombia, floods in Peru, earthquakes in Mexico, hurricanes in the Caribbean region and wildfires in Chile, among others, leaving thousands of casualties and countless damages.

Human & economic losses hinder development

Although the most severe impact of a disaster is the number of fatalities, physical losses are also extremely important because they affect connectivity, basic services and facilities - such as hospitals, schools and other critical infrastructure - and, in the worst-case scenario, they could eventually result in indirect fatalities. Inoperative infrastructure as a result of an event might in the medium and long term also impair national and regional economic development.



Fulfillment of project objectives is compromised

Disregarding disaster and climate change risk during project preparation, design and implementation increases exposure and vulnerability to natural hazards and could hinder the fulfillment of project objectives. It might shorten a project's lifespan, or even result in fatalities or economic losses, as well as incremental economic costs for a country given the regular investments required to repair structures or replace them, depending on the frequency and severity of the damage.

To reduce disaster and climate change risk in projects, the IDB has committed to systematically integrating these considerations across its portfolio by assessing those risks throughout the project cycle, thereby enabling project teams to implement any adaptation measures necessary to cope with the identified risks.

The objective of the proposed Methodology is to respond to these questions and, therefore, provide a technically and operationally robust framework that serves as guidance for assessing disaster and climate change risk in projects. This document provides an overview of a more detailed accompanying Methodology.

Audience

This Methodology is intended as a practical resource that team leaders across sectors, executing agencies, technical experts, and external consulting and design firms can use to integrate disaster and climate change risk considerations at the project preparation and implementation phases, when and if necessary.

Scope of Application

Risk assessments are by nature solution oriented. Risk assessments seek to find the most appropriate measures to reduce and/or manage risks. They provide a diagnosis that enables arriving at resilience opportunities. Conducting a disaster and climate change risk screening and assessment process is one of several approaches used by the Bank to reduce risks and increase resilience. Other approaches include: (1) production of disaster and climate change risk management knowledge through, for instance, country risk assessments, climate change country profiles, and indicators such as the Index of Governance and Public Policy in Disaster Risk Management (iGOPP), (2) advising country programing, (3) emergency response operations and post-disaster rehabilitation projects, (4) preparation and execution of reconstruction projects, including loan reformulation, , (5) Policy reforms for strengthening DRM framework through Policy Based Loans (PBLs) (6) financial protection instruments, such as parametric contingent credit facilities, and (7) mainstreaming of DRM and CC directly into sector projects.

This Methodology applies mostly to projects with infrastructure components[6] at the preparation stage, across a variety of sectors financed by the IDB. It can be used to help projects comply with OP-704, to support the mainstreaming of resilience efforts, and as a good practice for project teams. The Methodology has been conceived and designed for medium to large projects (both single structures and systems) including varying interventions in urban settings. It is a living document that will continue to be updated as new data and methods emerge in disaster and climate change risk management. The CPR is available to provide comprehensive support to project teams, including in the preparation of terms of reference and in the supervision of studies.

6 For multiple-works operations, the extended methodology document will have a specific annex that includes three main aspects: 1. Classification of the entire program based on a project sample, 2. The applicable DRA for the sample, if applicable, and 3. A Disaster Risk Framework for the entire program commensurate with the risk classification, following this methodology.

Disaster & Climate Change Risk Overview

According to the United Nations International Strategy for Disaster Risk Reduction (UNISDR, 2017), disaster risk refers to "the potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society or a community in a specific period of time, determined (...) as a function of hazard, exposure, vulnerability and capacity". In other words, disaster risk is a possibility that exists only in the intersection of its three components, and it cannot be described by any single one of these factors.

The hazard component in this context refers to events from a natural origin that pose a threat to population or property, and that could thus cause damages, economic losses, injuries and loss of lives; mand-made hazards are not included in this definition, as they are out of the scope of this Methodology.

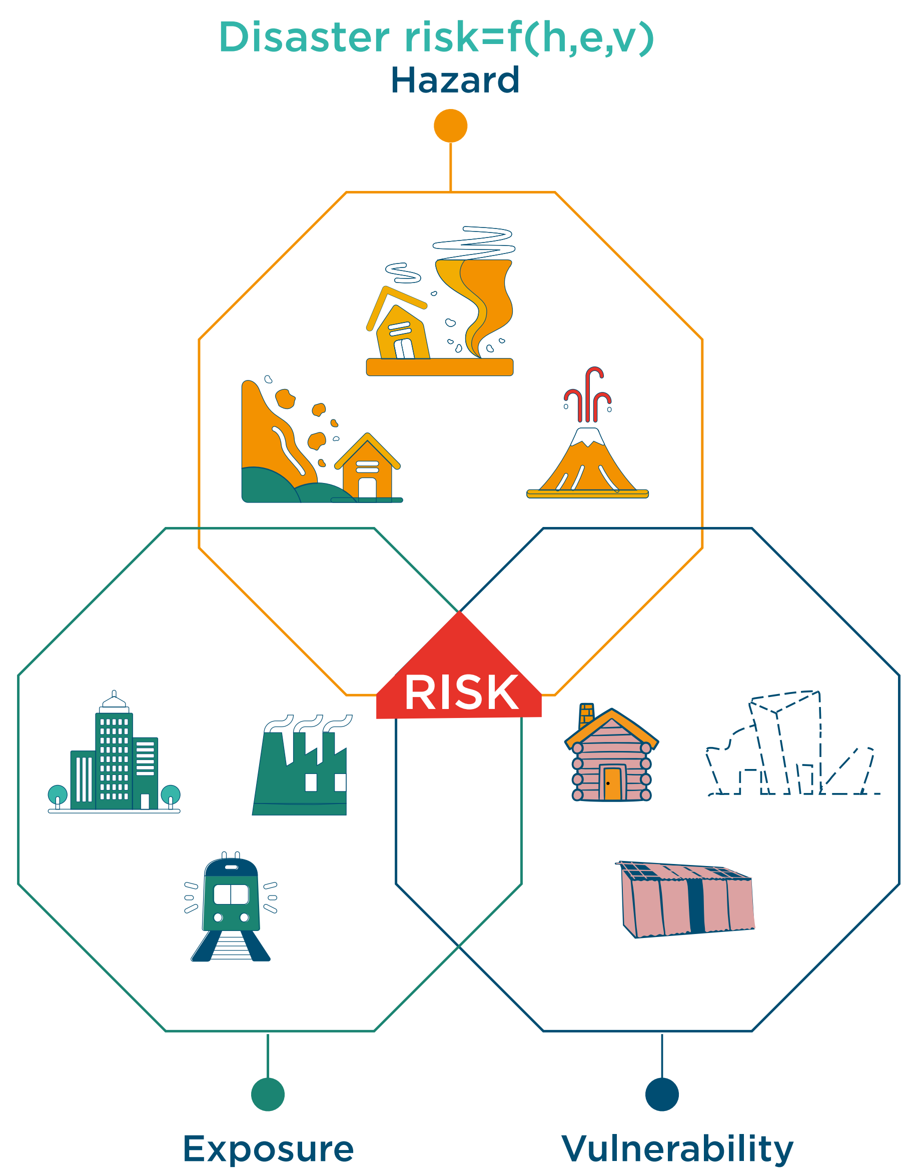


Figure 1. The composition of climate change & disaster risk. Source: IDB.

This Methodology considers both geophysical hazards - including earthquakes, landslides, volcanic eruptions and tsunamis - and climate-related hazards - including wildfires, hurricanes, flooding (inland and coastal), heatwaves and droughts.

The exposure component refers to the coincidence in space and time of people or assets (both physical and environmental) and threats posed by natural hazards. Hence, communities,[7] assets, services or population that are located within the area of influence of natural hazards are said to be exposed to these hazards and to potentially suffer damages.

The vulnerability component refers to the susceptibility of an entity to be harmed or damaged. For assets, systems and people, it is their intrinsic and internal, individual and aggregated characteristics that give them an inherent proneness (or conversely, a resistance) to suffer harm. In this context, vulnerability is defined in terms of the potential of being affected by natural hazards only.

Disaster and climate change risk, in the context of this Methodology, is thus the result of the simultaneous existence of a hazard (influenced by climate change slow and rapid-onset impacts, if applicable) and an asset or population that is not only exposed to this hazard, but that is also vulnerable to be damaged by it. Finally, it is worth highlighting that disasters are the materialization of risk (the consequence), and that the absence of disasters does not imply a corresponding absence of risk.

Box 2: Where does climate change risk fit into disaster risk?

As stated by the Intergovernmental Panel on Climate Change - IPCC - (2012) in its special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation - or SREX - climate change refers to a lasting modification of the state of climate that "may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use". This definition becomes pertinent in the context of this document as it serves to highlight that the focus on climate change in this Methodology is not on investigating its drivers and causes, but rather on examining the effects that climate alteration (regardless of its origin) has on already existing conditions, particularly related to disaster risk.

Despite the strong links between disaster risk and climate change science and adaptation, there has been a misperception that these are unrelated disciplines, mainly because climate change also includes climate mitigation (emission reduction) issues, and because disaster risk also addresses geophysical risk. Climate change adaptation has gained more prominence as governments and institutions have realized that the world needs to adapt to changes in climate. This intersection of disaster risk and climate change adaptation has been recognized by both the IPCC and the United Nations International Strategy for Disaster Risk Reduction (UNISDR), and resulted in the report entitled Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX) (IPCC, 2012).

Hence, the influence of climate change on disaster risk is what is referred to in this Methodology as climate change risk. This translates mainly into adding a component of change and variability (and uncertainty) to the otherwise stationary treatment of hydrometeorological-related hazards (in the future) in disaster risk. In a way, climate change may be considered as a disaster risk modification - and possibly exacerbation - factor.

7 Please see Unbreakable: Building the Resilience of the Poor in the Face of Natural Disasters.

What is a Disaster Risk Assessment at the project level?

A Disaster and Climate Change Risk Assessment[8] (DRA) in the context of this methodology refers to the evaluation of the disaster and climate change risks for a particular project (see Guidelines – paragraph 3.17 for the complete DRA definition). Following the definition of disaster and climate change risk discussed above, a DRA is thus a "qualitative or quantitative approach to determine the nature and extent of the disaster risk by analyzing potential hazards and evaluating existing conditions of exposure and vulnerability that together could harm people, property, services, livelihood and the environment" (UNISDR, 2017). For the purposes of the IDB methodology, the DRA includes a Disaster and Climate Change Risk Management Plan (DRMP) that includes specific measures to be implemented to reduce the risk identified in the assessment.

8 For the purposes of this document, the term DRA is used interchangeably with Natural Hazard Risk Assessment, Disaster Risk Assessment, and Disaster and Climate Change Risk Assessment. Likewise, the term DRMP is used interchangeably with Disaster Risk Management Plan and Disaster and Climate Change Risk Management Plan.

Diagnosis of the Current Practice

The Disaster Risk Management Policy approved in 2007 and its corresponding Guidelines of 2008 constitute a very important conceptual and operational framework that represents a commitment to a modern way to conceive, design and implement projects. The piloting of disaster and climate change risk assessments in projects under this framework has resulted in several findings and lessons learned (see Box 2 below) that are worth highlighting, as they inform the Methodology in this document incorporating solutions. The Methodology also takes into account significant advances in the analysis of disaster and climate change risk in the last ten years. It provides additional support to project teams in applying the Policy and its Guidelines.

Table 1. Diagnostic and Solutions for IDB DRA Practice

Finding	Lessons	Solutions
 Inconsistent application of the Policy	Although the Disaster Risk Policy has existed for more than ten years, it has not always been consistently applied across the universe of operations backed by sovereign and non-sovereign guarantees throughout the project cycle.	The IDB has been working on a process to facilitate the application of the Policy, to pilot it in projects and receive feedback from sectors. The proposed Methodology serves as a practical document for project teams to facilitate the consistent application of the Policy.

Finding	Lessons	Solutions
 Distinction between risk types	Under Directive A.2 of the Disaster Risk Policy, there are two distinct "risk scenarios": **TYPE 1:** "The project is likely to be exposed to natural hazards due to its geographic location". **TYPE 2**: "The project itself has a potential to exacerbate hazard risk to human life, property, the environment or the project itself". In practice, this distinction poses some challenges to those in charge of managing risks. In fact, according to the Policy Guidelines, the Type 2 risk scenario must be addressed under B.3 of the Safeguard Compliance Policy (OP-703).	Although the impacts from disaster and climate change risk on operations may lead to two types of consequences (impacts on the operation itself and its viability, and impacts on surrounding communities), from a technical stand point risk must be analyzed as a whole. This Methodology has been designed to enable in most cases[9], a unified assessment of risk and generates outputs that are useful to all the different actors involved, including both project team leaders and the VPS/ESG
 Risk classification biased towards hazard	The hazard component has been historically given a higher weight than risk as a whole, without sufficient consideration of the vulnerability component. Moreover, the screening is usually performed early in the project cycle, often with limited information about the details of the project. This has resulted in risk classifications that are biased towards hazard versus a more integrated understanding of risk.	To address this, the Methodology proposes a second layer for classification to review the classification by including a preliminary vulnerability and criticality analysis of the operation in order to obtain a more balanced analysis. Additionally, the Methodology has a step by step approach, and vulnerability is included throughout the rest of the Methodology and the corresponding project cycle stages.

9 Should any of the impacts of Type 2 be not included in the DRA, the Type 2 risk scenario could be addressed under the Safeguard Compliance Policy (OP-703).

Finding	Lessons	Solutions
Lack of methodological process in past DRAs	An analysis of past DRAs reveals that they lacked a consistent methodological process defining a standard and clear way to carry out these assessments. Thus, quality varied greatly, there was a strong disconnect between projects' specific characteristics and risk calculations, modelling efforts were not consistent with risk levels and project scope, and the recommendations and risk reduction measures proposed were too broad. Additionally, given that a quantitative risk assessment is technically complex and expensive, and that the risks to which a project may be exposed to are numerous, the scope of this type of assessments needs to be narrowed down.	The proposed Methodology aims to close this gap by providing a robust process that clearly defines and compiles standard methods and techniques to carry out DRAs, offering various options according to the project types, the risk level and the level of detail needed. **Additionally, the Methodology includes a qualitative risk analysis to be conducted prior to a full quantitative risk assessment that serves as a filter** to focus on the aspects that really require a quantitative treatment. The minimum criteria to be considered for a qualitative risk analysis is included in Step 3.
Climate change uncertainty	There are considerable uncertainties when it comes to incorporating climate change into the risk assessment at the project level.	The Methodology provides guidance to understand climate change concepts and includes techniques to incorporate climate change projections into risk assessments.

Finding	Lessons	Solutions
Limited data availability in LAC countries	Conducting a quantitative risk assessment is fundamental if we are to include disaster risk in the cost/benefit and project viability analyses, but the availability of information at the project level is a major challenge. Many countries in the LAC region have insufficient data to conduct quantitative assessments. Moreover, gathering the information necessary to carry out this type of assessments can be extremely expensive, or may extend beyond the project preparation period. This leads to burdensome studies that are not commensurate with the scope of the project or, conversely, to projects where no risk assessment is done at all because of a lack of information.	The proposed Methodology includes conducting a qualitative risk assessment that will serve as a basis for establishing the scope of a subsequent quantitative assessment, when necessary. Additionally, the Methodology provides guidance on how to carry out robust quantitative analyses that can be adapted to different conditions of information availability in projects. Furthermore, sensitivity analyses can be a less complex option that can supplement cost/benefit analyses in relevant projects.

Disaster & Climate Change Risk Assessment Methodology for IDB Projects

Methodology Structure

The methodology proposed here for the assessment and management of disaster and climate change risk in projects takes into consideration the level of information depending on each of the project stages, the variety of projects and operations that the IDB finance, and the availability of information depending on the country and type of hazard. This has been done in such a way that the methodology serves as a resource that offers a consistent and viable process that adds resilience, sustainability, and value to projects.

Following the main conclusions from diagnosis presented above, the fundamental principles that inspire this proposal are:

- Compliance with the essential Policy mandate not to finance projects that increase social, economic or environmental risk in absolute terms with respect to the baseline.
- Clarification of the implications of considering two types of risk "scenarios" (Type 1 and Type 2), aligning the provisions of the Disaster Risk Management Policy with processes, and guaranteeing the indivisibility of risk based on its conceptual definition, treatment and study.
- Improvement of the processes and outputs that result from the screening and classification - the disaster and climate change risk assessments (DRA) and the disaster and climate change risk management plans (DRMP) - by strengthening the conceptual framework, making the process scalable, developing concrete tools and recommendations, and piloting the approach together with Bank sectors.

The proposed Methodology involves a number of phases and steps where efforts and resources are commensurate with the levels of risk, as shown in the following figure:

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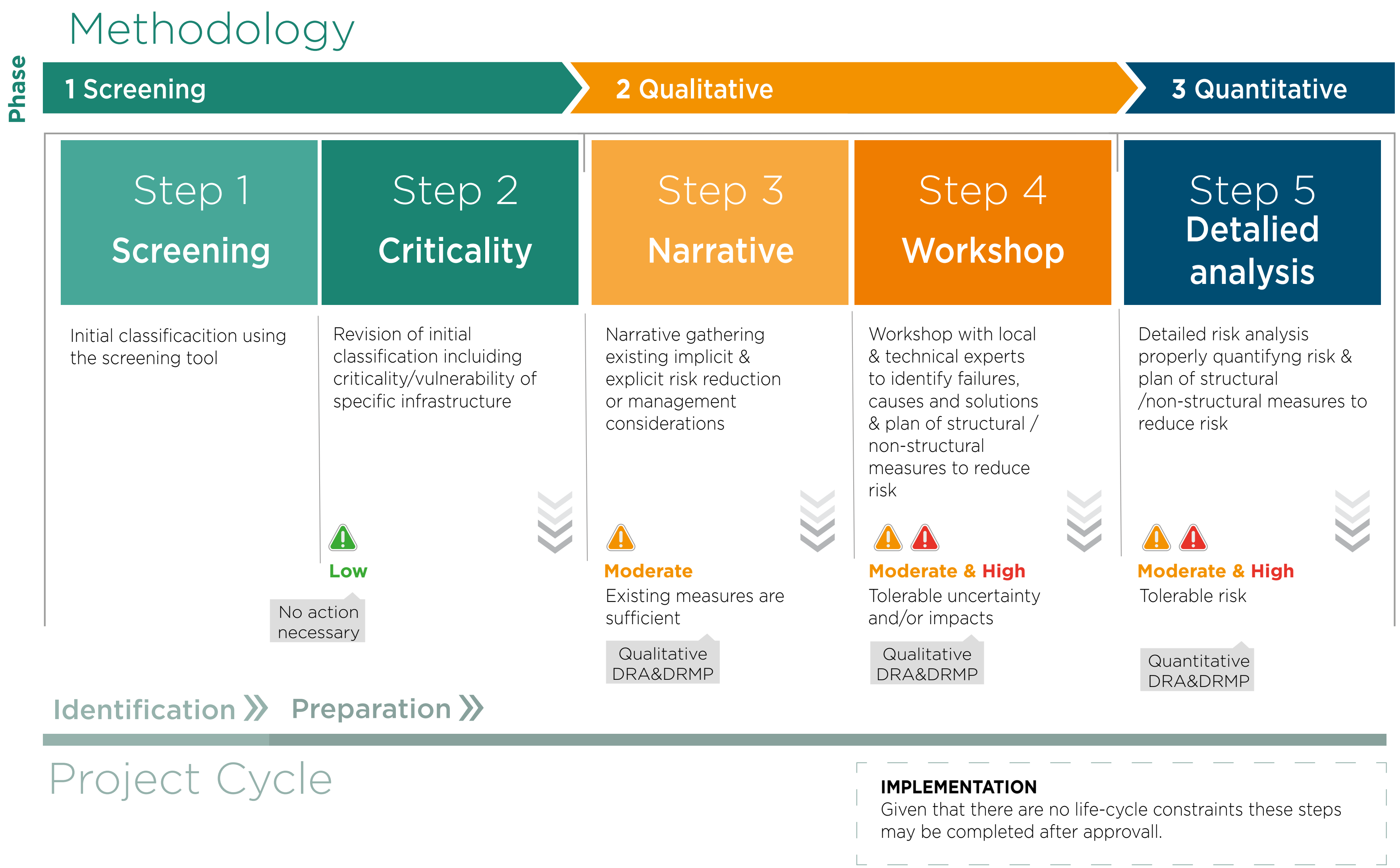


Figure 2. Disaster & Climate Change Risk Assessment Methodology[10]

10 Should the Assessment be carried out after Board approval, a condition might be included for it to be conducted.

Phase1

Screening

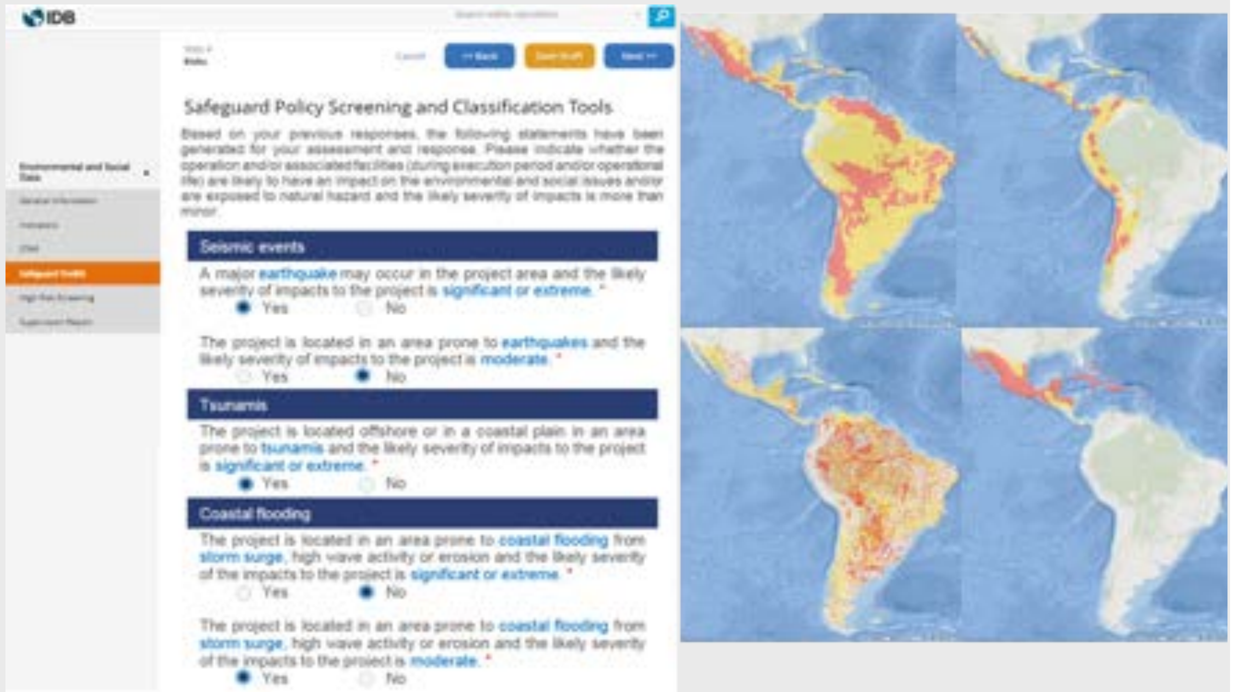
It applies to all IDB projects and involves two steps:

STEP 1[11]: Preliminary classification based on location and hazards.

The first step involves using the current Screening Toolkit[12] in IDB's central operation management system (Convergence) – see Box 3. This toolkit is used by IDB specialists to identify whether a project triggers the Disaster Risk Management Policy (OP-704) by considering the potential hazards that might affect the project. The toolkit is based on a series of project-specific questions and is supported by a geographic information system (GIS) platform to enable specialists to accurately fill out the toolkit. The outcome is an initial risk classification for the operation. This classification is included in the Safeguards Screening Form.

Box 3: Screening

The Screening toolkit automatically provides an initial Disaster & Climate Change Risk Classification for the operation, as either Low, Moderate or High-Risk, based on the answers to the questionnaire. The questionnaire, which is embedded in the IDB's central operation management system, includes a link to a GIS platform which includes a total of 21 hazard maps to help answer the questions of exposure to natural hazards. Of the 21 maps, 10 relate to natural hazards with no consideration of climate change, including geophysical hazards (seismic, tsunami, landslide, wildfire, volcanic, cyclonic wind, cyclonic storm surge, riverine flooding, drought and heatwave hazards), and the remaining 11 relate to hydrometeorological hazards considering climate change (sea level rise, drought, water scarcity, two heatwave projections and five precipitation projections - all for the end of the century).



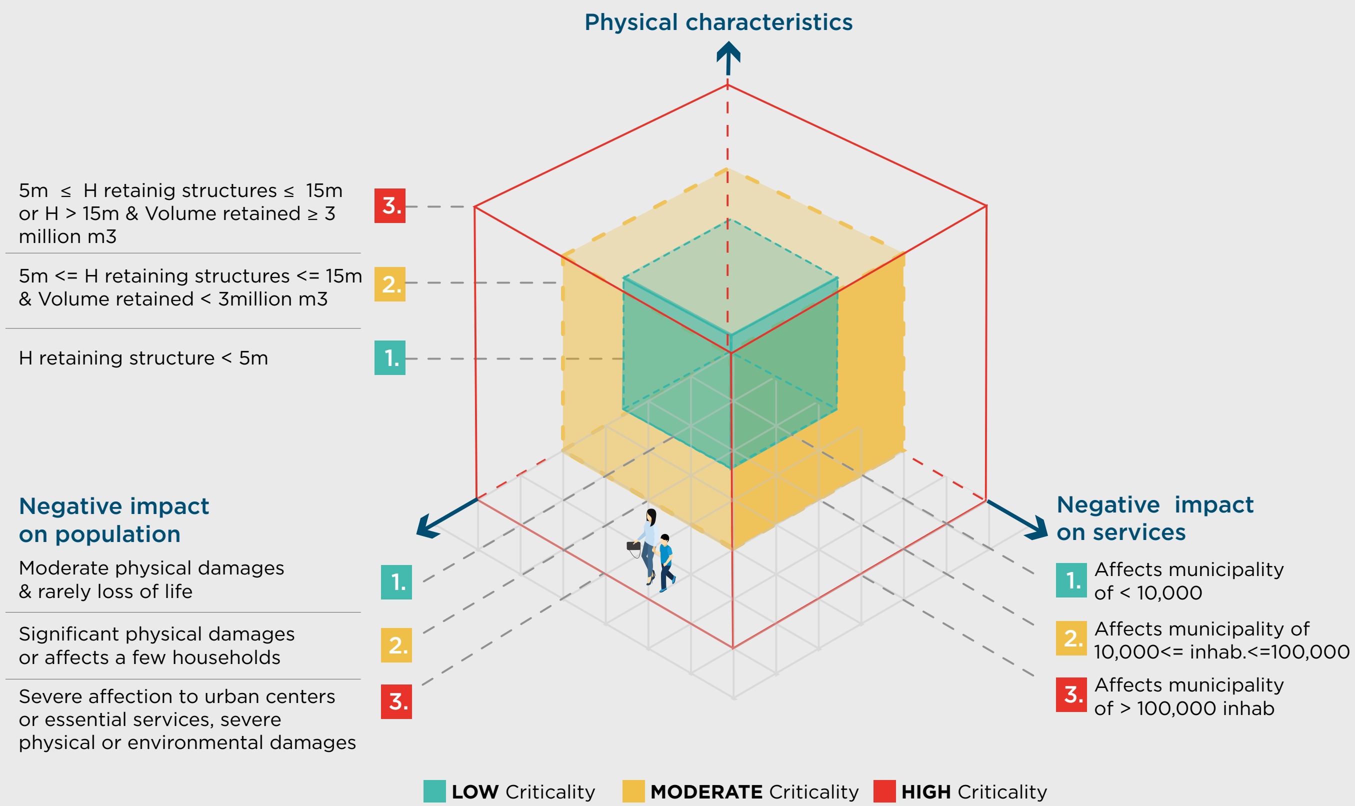
11 The following link shows the descriptions and sources of the hazard maps: https://idbg-my.sharepoint.com/:w:/r/personal/danielazul_iadb_org/_layouts/15/Doc.aspx?sourcedoc=%7Bd-d8934d1-a8fe-417e-8185-b561f3626b6d%7D&action=default

12 The questionnaire related to Disaster and Climate Change Risk was included in the Safeguard Screening Toolkit for the first time in 2012.

STEP 2: Classification based on criticality and vulnerability. The second step in the proposed methodology is designed to reflect upon the project's own criticality and vulnerability levels, and to complement the result from the previous step to obtain a Disaster and Climate Change Risk Classification that is representative of the operation itself and not merely of the hazards. Vulnerability refers to the inherent qualities that determine a structure's (or a system's) susceptibility to suffer damage. Criticality refers to the degree of significance that a structure or system holds within a larger context due to the type and scale of services or functionality it provides. Both concepts lead to a better understanding of the potential consequences (physical impacts on the structure and on population and services) that a failure of the operation due to natural hazards would create (see Box 4). This step aims to help specialists better define the scope of the operation, identify critical project characteristics,

Box 4: Project criticality and vulnerability

To facilitate the process of recognizing what features make a structure or system more or less critical and vulnerable, general guiding questions concerning physical characteristics, level of service provided and magnitude of potential negative effects on third parties, are provided. In addition to this, three subsector-specific charts that illustrate this concept for roads, water & sanitation systems and hydroelectric dams, were developed in cooperation with sector specialists. These charts reflect both the most universal and the technically pertinent attributes for each type of infrastructure that are the source of the sector's main concerns. The following chart is the example developed for water and sanitation infrastructure.



complement the initial operation risk classification based on hazards, and decide (according to the resulting classification) if further investigation of risk is needed.

As a result of this phase projects are classified as low, moderate or high-risk (if as a result of Step 2 there is a new classification, the safeguards screening form needs to be updated accordingly). If an operation is categorized as low-risk, it may exit the process at this point; all others must move to Phase 2.

Phase2

Qualitative disaster and climate change risk assessment

It applies to all IDB projects classified as moderate or high-risk and involves two steps. Certain projects classified as moderate-risk may skip Step 4 and any further steps if Step 3 gathers sufficient information.

STEP 3: Simplified qualitative risk assessment (risk narrative) and risk management plan.

The third step applies to all moderate and high-risk projects and involves gathering all valuable data regarding studies, documents and design considerations that may already exist for the operation. The aim is to document how and to what extent thought has been given to disaster and climate change risk management issues (see Box 5). This step also operates as a first filter to identify the moderate-risk operations that (along with high-risk operations) must move on to the following step, and those that may exit the process at this point due to having adequately proven - based on the narrative - that risk issues have been sufficiently addressed.

Box 5. Disaster & Climate Change risk narrative

When gathering data and beginning to assess what risk considerations have been included in the design of an operation, questions should be asked at the level of the specific project and should be tailored to its circumstances. In general, these should address past event occurrences, existing studies, if and how specific hazards, climate change and vulnerabilities have been (or are planned to be) assessed, and what gaps exist. There follows an example for a road rehabilitation where mudslides, earthquakes and landslides have been preliminarily identified as potential threats:

Existing studies

- Are there any previous risk studies for the existing assets? (Have the impacts from hazards on the operation, and from the operation on the risk conditions in the area, been assessed?)

Hazard evaluation

- Has the local meteorology, hydrology and climate change been studied, and how? (Is there gauge data? Have Global/Regional Climate Models been consulted? Are there official standards for the use of climate projections?) Have the existing climate projections been verified?
- Has the local geology and seismicity been characterized and how? (Have the existing slopes been studied? Does the road cross active faults? It there a seismic catalogue for the area?)

Design considerations

- Has climate change been considered in the pavement design of the road, and how?
- What are the hydrologic and hydraulic parameters used for the designs of the bridges, culverts and longitudinal drainage? (Analysis methods, design return periods, flood frequency analysis, climate change?)
- Have slope stabilization measures been studied for the mountainous section of the road?
- What seismic design standard has been used for the bridge design? (Is there a local design code?)

Response systems

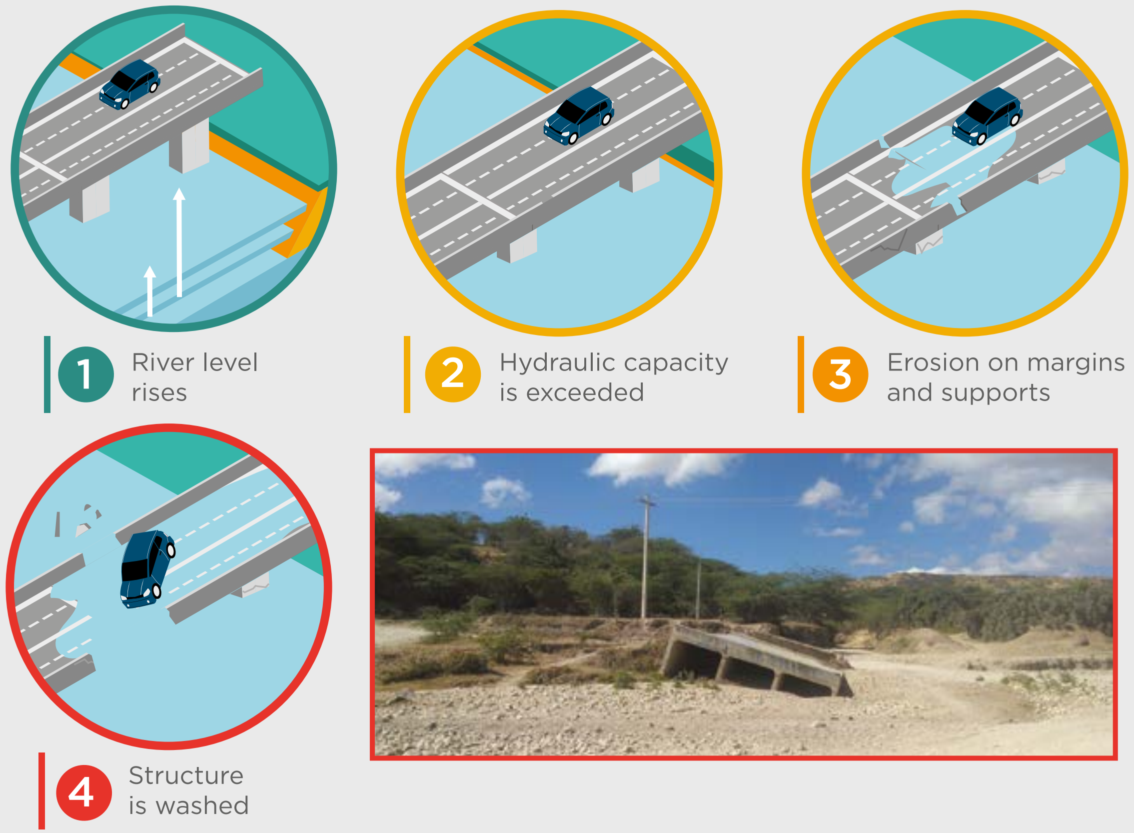
- Is there an Early Warning System in place in the city or is one planned for mudslides and rains?
- Has a contingency plan been developed to ensure the continuation/rapid recovery of the service provided? Is there redundancy?

STEP 4: Complete qualitative risk assessment.

The fourth step consists of performing a complete qualitative risk assessment and an accompanying disaster risk management plan for all high-risk projects, as well as for those moderate-risk projects that were determined to need it in the previous step. This, for instance, could involve conducting a failure modes analysis with subject and sector experts to qualitatively evaluate all the ways in which the project may fail as a consequence of the occurrence of a natural event, the causes of failure, and the consequences for both the structure and surrounding environment and communities, including an estimation of the order of magnitude of those impacts that would not be possible without the existence of the project. By first qualitatively evaluating all risks, the need for a detailed quantitative assessment can be easily determined and targeted no focalized to cover only the specific parts of the operation and topics that really require it. This step also includes a disaster and climate change risk management plan for those features of the operation that are deemed to not compromise the technical and/or economic viability; those that may compromise the operation's viability must continue to Phase 3 (see Box 6).

Box 6. Qualitative Disaster and Climate Change Risk Assessment

A qualitative assessment can be done through a workshop where disaster and climate change risk experts work with technical personnel from the design/construction firms and the operation's executing agency to discuss and gauge all possible risks, contributing factors, potential consequences and intervention measures. Other qualitative techniques include formally using the Delphi method for consulting expert opinion (consensus building method of performing group surveys or interviews with a select panel of experts – see Hallowell & Gambatese, 2010 and Garson, 2012) or using risk matrices that rate risks based on qualitative estimations of frequency and magnitude of impacts. In all cases, local professionals and technicians must be involved to make sure local knowledge is mined. The following figures show an example of a schematic mode of failure for a road identified through a failure-mode workshop, and its realization.



Phase3

Quantitative disaster and climate change risk assessment

It applies to all specific features of an operation that require a quantitative assessment according to the results of STEP 4.

STEP 5: Quantitative disaster and climate change risk assessment.

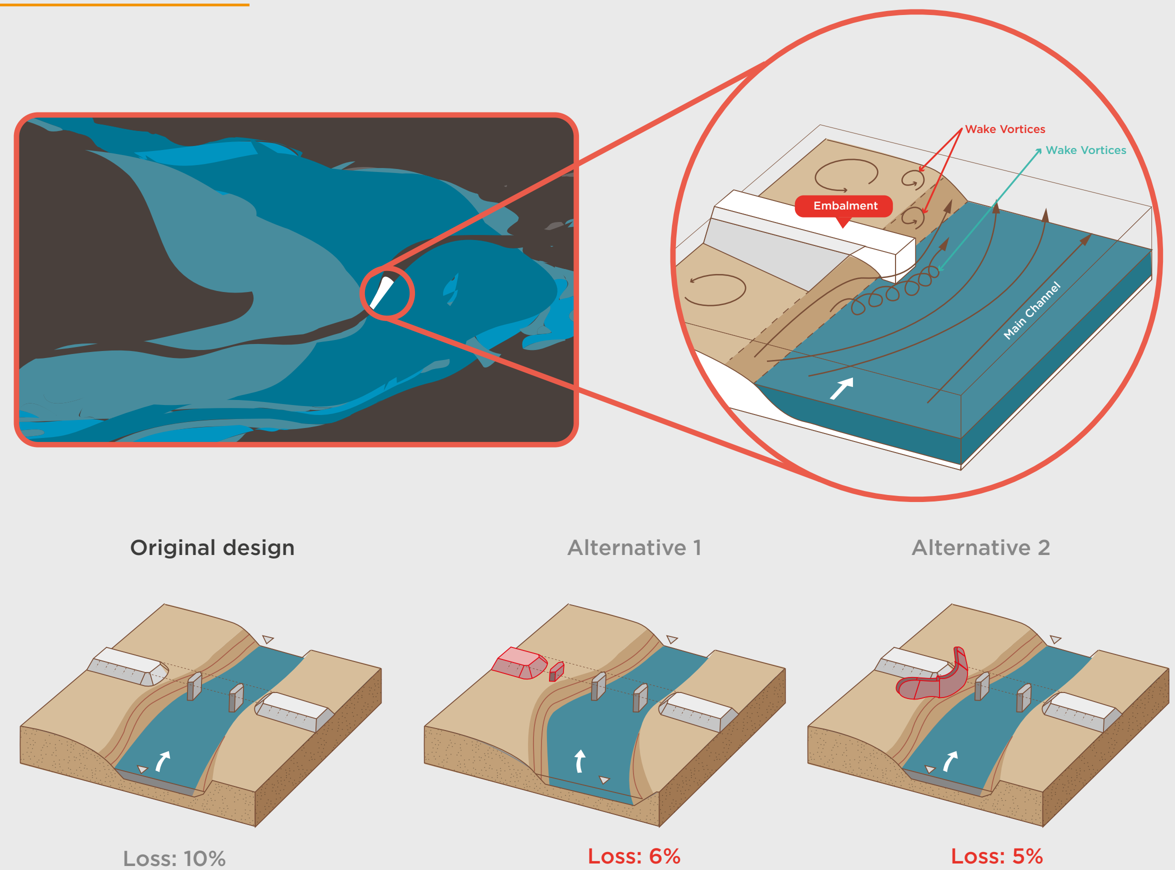
The fifth step involves performing a quantitative risk assessment and accompanying disaster and climate change risk management plan (DRMP) for the high or moderate-risk operations that were determined to need it in the previous steps. This involves quantitatively modeling the aspects (that can be tied to specific physical attributes, structures, modes of failure or hazards) that were found to require further investigation, and it entails scientifically and mathematically evaluating the vulnerability, hazard and risk for those selected aspects for both the structure itself and the surrounding environment and communities, including an estimation of the impacts that would not occur if the project did not exist.

Box 7. Quantitative Disaster and Climate Change Risk Assessment

A quantitative risk assessment is a mathematical and/or physical model used to quantify risk in economic terms (expected economic losses).

Methods to calculate risk range from simple "exposure" methods (where only the number of people and assets exposed to a hazard is calculated), to fully probabilistic methods (where modeling is done following strict probability theory to obtain the full range of possible losses). Intermediate options include deterministic methods, where one or more discrete hazard scenarios (may be simulated or historically recreated - design or worst-case scenarios, for example) are modeled, and vulnerability and expected losses are calculated for those scenarios.

The following figures show a hypothetical example of a risk model and calculation (including modeling of the hazard and vulnerability) and the related quantitative evaluation of the proposed measures to reduce risk.



Modified from Barkdoll et al. (2007)

An evaluation of risk tolerability and of technical and economic viability must be also performed to ensure compliance with the Bank's policy (to not increase risk with respect to the current situation and follow the best tolerability standards of each sub sector). The Methodology offers a range of methods, techniques and models to calculate risk for both individual structures and systems according to types of hazards, structures and level of detail required.

In addition to the above, innovative methods such as Robust Decision Making (RDM) for systems involving significant uncertainty are gaining increasing relevance. This method differs from standard cost-benefit analyses, which seek to predict the costs and benefits of a set of initial projects or project designs and then select the optimal option - all contingent on a thorough characterization of the uncertainties. Instead, RDM first uses simulation models to stress test one or a few select actions (policies and/or investments) across a large set of plausible futures (Groves and Lempert, 2007; Lempert et al., 2003, 2006) according to a list of several metrics for success. It has been widely used in the water sector in the last decade.

The DRMP might include different types of measures such as recommendations on i) the design: gray measures (structural or engineering-based solutions) such as building retention ponds or other structures such as retaining walls, or green measures - ecosystem-based adaptation; ii) construction: emergency response plan during construction works, and iii) operation: measures related to changes in processes and procedures for the operation and maintenance of a project (e.g. adjust frequency of cleaning of drainage canal to ensure maximum capacity), business continuity and/or contingency planning, early warning systems, financial protection schemes (including insurance); or it could be a hybrid combination of the aspects listed above. The measures set forth in the DRMP must include an indicator of the cost-benefit, as well as the level or priority.

It can be used to help project teams comply with OP-704, to support the mainstreaming of resilience efforts, and as a good practice for project teams.

Use of the Methodology

The Methodology applies mostly to projects in preparation across a variety of sectors financed by the IDB. It can be used to help project teams comply with OP-704, to support the mainstreaming of resilience efforts, and as a good practice for project teams.

The proposed Methodology is intended to serve first, as a robust conceptual framework that merges both a technical and an operational logic and, second, as a resource that specialists can use whenever they have an operation where the topic of disaster and climate change risk is important. The Methodology enables assessing risk from both a safeguards perspective (as projects need to be in compliance with the policy) and a resilience perspective (seeking to improve projects and attain sustainability). Apart from supplementing the Policy and its Guideline, this Methodology also provides an opportunity to incorporate disaster and climate change risk and resilience at the project design and implementation phases, therefore contributing to the development of sustainable infrastructure.

Early identification is essential for project teams to be able to effectively incorporate disaster and climate change risk reduction and resilience opportunities into project design.

Concluding Remarks

Disaster and climate change risk assessment at the project level is a relatively new topic, but the science and technical knowledge is growing. Countries in the region have identified the need for clear methodologies and resources to undertake risk studies to better understand and address vulnerability and resilience while accounting for uncertain variables as part of project decision-making processes. In most countries, projects should undergo a risk screening to comply with the national public investment system standards. Practical experience with detailed disaster and climate change risk assessments during project preparation is limited due to funding and expertise limitations and a lack of understanding of needs and benefits. There is a need to support these processes

Box 8. Resilience and disaster risk reduction pay off.

According to Resource for the Future (RFF) (Kousky, 2017), in the US the vast majority of federal funding for flood risk reduction is appropriated after disasters strike; this is also the case in most Latin American countries. There are several downsides to this. First, funds are spent during emergency and reconstruction phases in the areas flooded, but these are not necessarily the most high-risk area, or where benefits can be provided to the most people and where most of the assistance is needed. Also, there is less time to spend funds with care. Allocating a greater share to pre-flood programs could improve the effectiveness of spending (RFF, 2017), because with ex-ante activities there is more time for careful planning and program development. Also, this is more efficient, since resources can be targeted in the riskiest areas and to the most cost-effective projects.

Keeping in mind the fact that the LAC region's disaster losses have increased from approximately US$13,500 Million to US$59,000Million from 1960 to 2015 (EM-DAT, Bureau of Labor Statistics, and IDB personnel calculations), that according to the report Natural Disaster Hotspots: a global risk analysis (The World Bank, 2005), 7 out of the 15 counties most exposed to multiple hazards are in LAC, and that climate change adds another layer of risk, the circumstances of the region become critical. However, it has been shown that resilience and disaster risk prevention yield benefits of about four (4) to seven (7) times the cost, in terms of avoided and reduced losses (MMC, 2005; Moench et al., 2007; EIRD, 2011; Kull et al., 2013; Micheler, 2015). Consequently, in light of this context it is clear that financing ex-ante resilience measures is key, and while risk assessments might be initially perceived as requiring additional resources during project preparation, in the end they will pay off by better informing risk reduction efforts and thus estimations of the funding required for ex-post emergency response, and by helping prioritize measures based on relevance and availability of resources.

13 Numbers from previous disasters in LAC include: Hurricane Mitch in Central America (Oct 1998) resulted in US$5 billion losses and 10,000 deaths, Venezuela landslide (Dec 1999) resulted in US$1.79 billion losses and 30,000 deaths, Haiti earthquake (Jan 2010) resulted in US$ 7.8 billion losses and over 200.000 deaths. Chile earthquake (Feb 2010) resulted in US$ 30.0 billion losses. Colombia Floods (Nov-Dec 2010) resulted in US$5.0 billion losses and 389 deaths, the Buenos Aires floods (Apr 2013) resulted in US$100 million losses and 100 deaths, Hurricane Matthew in The Bahamas (Oct 2016) resulted in US$600 million losses.

and to increase capacity building on risk assessment at the executing agency level[14]. Acting before disaster strikes can actually be more economical (See Box 8).

The development of this Methodology arises from a need to consolidate a conceptual framework for the management of disaster and climate change risk that is applicable to all projects. While this Methodology has been initially developed focusing on projects with infrastructure components, it will eventually include other relevant projects. An Experiential Learning approach has been critical to arrive at the current Methodology, which will improve as progress is made in its application and new lessons are learned. To date, some of the most important lessons learned include: (a) the need for the methodology to be sequential and gradual, but at the same time aligned and in compliance with the existing policy, with projects going through a qualitative analysis, before assessing the need for a more complex quantitative analysis; (b) the need for time flexibility in the development of the DRA - the point in the project cycle when it is most appropriate to perform a DRA, whether qualitative or quantitative, to derive more appropriate and specific recommendations will depend on the nature of the project; (c) that it is highly beneficial to have a methodology that is rooted in the OP-704 Policy, but which can also be applied through regular project mainstreaming as a good practice to achieve resilience; (d) the relevant role that supervision plays in identifying and evaluating disaster and climate change risk management by executing agencies (maintenance is a key aspect in this regard, see Box 9);

The development of this methodology arises from a need to consolidate a conceptual framework for the treatment of disaster and climate change risks that is applicable to all projects.

14 Efforts at the Bank to start addressing this issue include two training courses on disaster risk assessment (including the effects of climate change) held in 2016 and 2017, the Small Private Online Course (SPOC) and the Massive Open Online Course (MOOC) currently being developed by KNL, RND, CCS and ESG, on disaster risk assessment (including the effects of climate change) for public investment systems, which will further strengthen capacities in the LAC region.

(e) the importance of involving project counterparts to ensure that disaster and climate change risk assessments can influence project design, construction, and operation, as applicable, and that risk reduction measures are maintained to ensure sustainability; (f) the need to acknowledge that applied experience in conducting disaster and climate change risk assessment at the project level is growing but is still not standardized, even when considering leading international engineering firms, and thus the importance of working on methodological documents, piloting, and capacity building.

The application of this Methodology is a key investment. Together with the Bank's Sustainable Infrastructure Framework and The Bahamas Resolution Commitments, the OP-704 provides an opportunity for the Bank and its client countries to reduce risks and add value to projects. In a context of global change, this can make a difference for vulnerable countries to successfully achieve sustainable development

Box 9. Maintenance is critical to better manage disaster and climate change risk

A critical action to reduce project risks is to invest in operation and maintenance tasks, in order to meet a project's life and development objectives as set forth in the project design, and to ensure project resilience to long term changes in precipitation and temperature. Infrastructure cannot be resilient if it is poorly maintained. As already discussed, disasters result from a combination of hazards, exposure and vulnerability, and adequate maintenance directly helps reduce vulnerability. A report by Gallego-Lopez and DFID makes the case for increasing the resources required to pay for adequate maintenance, and to adapt maintenance and operation schemes to new climate patterns. They also make a strong case for the importance of having a certain degree of redundancy in projects and mechanisms to quickly recover after a shock. Said report recommends bridging the gap from modelling to engineering designs by, for example, identifying sections of a road that are most vulnerable to flooding using drainage risk models with different flood severities and roads. In many countries, lack of maintenance and poor drainage are already critical issues affecting the road network.

The IDB is addressing this issue through a series of Blue Spot Analyses, and by conducting risk assessments in relevant projects. Note that this document also points out that climate screening mechanisms are necessary, but not sufficient, because they follow investment decisions, rather than precede and set the context for taking them (Gallego-Lopez, 2016).

15 The Blue Spots model is a method to identify flood sensitive areas, specifically in road networks. A blue spots is defined as a stretch of road where the likelihood of flooding is relatively high and where its consequences are significant. The Blue Spot methodology is applicable to any country if the required data are available.

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Executive Summary of

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A technical reference document for IDB project teams

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