Technical Summary: Project Climate Change and Disaster Risk Assessment Methodology

Objective

The development of this methodology[1] arises from a need to consolidate a conceptual framework for the treatment of disaster and climate risks that is applicable to all types of infrastructure projects, where the infrastructure's response to natural hazards and potential consequences are taken into consideration. This entails starting with risk identification prior to the project's execution and moving gradually towards more specific and detailed risk assessments. Following a robust conceptual framework will allow risk assessments to effectively add value to the design, construction and operation of the project by targeting the truly critical aspects and proposing concrete measures to improve the project.

Thus, the objective of the proposed methodology is to provide a clear and technically and operationally robust framework that provides guidance for the process of screening for and assessing climate change and disaster risk in the Bank's operations.

Structure of the methodology

The general framework proposed here for the management of disaster and climate risk is aligned with the Disaster Risk Policy OP 7.04 and its respective guidelines, the Bahamas Resolution of 2016, as well as with the Bank's commitment to move towards sustainable infrastructure, in such a way that the products that result from the application of this methodology form a consistent and viable set with high added-value for the Bank's projects, ultimately adding resilience and sustainability. Furthermore, it has been developed taking into consideration the level of available information depending on each of the project stages, the variety of infrastructure projects and operations that the IDB finances, and the availability of information depending on the country and type of hazard.

The content of the proposed conceptual framework is presented next; the framework is divided into a series of phases and steps by reason of completeness and scalability of each one of the processes, as follows (Figure 1):

Phase 1: Screening

STEP 1: The first step involves using readily available large-scale hazard data to identify the potential hazards that might affect the different locations. Usually hazard maps are used for this; the IDB currently possesses a GIS platform containing 21 hazard maps for Latin America including climate change for this purpose, but additional external sources may be used as well.

[1] This methodology was elaborated under TC RG-t2644: Strengthening Climate Change Risk Assessments of IDB Operations, including its application in 4 projects (two in preparation, two in supervision), and a peer review. The methodology will be published in December 2018.

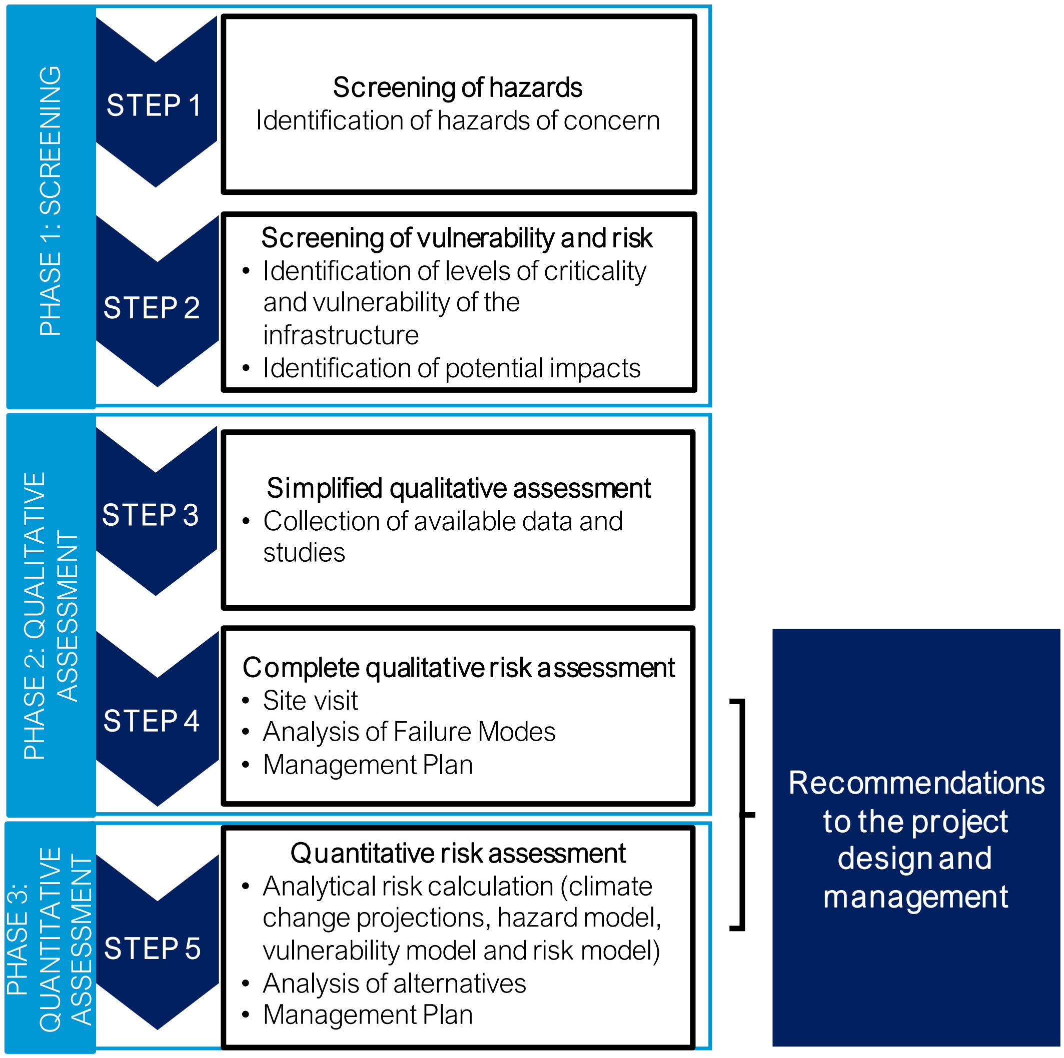

Figure 1. Disaster & Climate Risk methodology

STEP 2: The second step in the methodology is designed to reflect upon a project's own criticality and vulnerability levels and to complement what was found in the previous step and thus obtain a risk overview that is more representative of the project itself and not merely 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 of these concepts lead to a better understanding of the potential consequences (physical structural affection and affection to population and services) that a failure of the operation due to natural hazards would create.

As a result of this phase (comprising Step 1 and Step 2), projects are classified as low, moderate or high-risk. If an operation is categorized as low, it may exit the process at this point; all others must move to Phase 2.

Phase 2: Qualitative Disaster & Climate Risk Assessment

STEP 3: The third step applies to all moderate and high-risk projects, and serves to gather all valuable data regarding studies, documents and design considerations that may already exist for the operation, so as to document how and to what extent thought has been given to disaster and climate risk management issues. This step also functions as a first filter to select those moderate-risk operations which must continue (along with high-risk operations) to the following step, and those that are able to adequately substantiate through this narrative that the risk has been sufficiently addressed, and thus may exit the process at this point.

STEP 4: The fourth step consists of performing a complete **qualitative risk assessment** and an accompanying **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, the causes of failure, and the consequences for both the infrastructure 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 focalized to cover only the specific parts of the operation and topics that require it.

This step also includes a risk management plan for those features of the operation that are deemed to not condition the technical and/or economic viability; those that may condition the operation's viability must continue to Phase 3.

Phase 3: Quantitative Disaster & Climate Risk Assessment

It applies to all failure modes of a project that require a quantitative assessment according to the results of STEP 4.

STEP 5: The fifth step consists of performing a **quantitative risk assessment** and accompanying **risk management plan** for the high or moderate-risk operations that were determined to need it in the previous step. This involves conducting a quantitative model for those aspects (that can be tied to specific physical attributes, infrastructures, 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 these selected aspects for both the infrastructure itself and the surrounding environment and communities, including an estimation of the impacts that would not be possible without the existence of the project. An evaluation of risk tolerability and of the technical and economic viability in relation to the compliance with the Bank's policy (to not increase the risk with respect to the current situation and follow the best tolerability standards of each sub sector), must also be performed. Within the methodology a series of methods, techniques and models to calculate risk for individual infrastructures as well as for systems, are offered according to the type of hazard, infrastructure and level of detail needed.

Pilots for the application of the methodology

In the period from 2016 until 2018 the three divisions of CCS, ESG and RND have started piloting he application of this methodology in real IDB operations. In total over the three years, 17 operations have received some type of support where different parts of the methodology have been piloted (Table 1). These

cover the countries of **Haiti, Argentina, Chile, Brazil, Ecuador, Paraguay, Panamá, Surinam and Dominican Republic** and the sector of **transport, water and sanitation, urban development, energy, agriculture and tourism**.

Code	Summary	Sector	Year the support was provided	Classification
HA-L1104	Rehabilitation RN no.5	Transport	2018	Moderate
PN-L1147	Rehabilitation of roads	Transport	2018	Moderate
JA-L1084	Urban intervention Montego Bay	Urban	2018	High
HA-L1106	Interventions in Limonade	Water & Sanitation	2017	Moderate
BR-L1497	Urban interventions in Vitória	Urban	2018	Moderate
PR-T1243 & PR-L1152	Urban interventions in Asunción	Urban	2018	Moderate
SU-L1046	Urban rehabilitation in Paramaribo	Urban	2016	High
AR-L1199	Rehabilitation of road no.19	Transport	2016	Moderate
DR-L1128	Transmission lines and substations	Energy	2018	High
AR-L1140	Tourism program with a road component	Tourism	2018	Moderate
AR-L1293	Rehabilitation of road RP no.83 in Mendoza	Transport	2018	Moderate
EC-L1111	Metro Quito	Transport	2018	Moderate
EC-L1219	Transmission lines post-earthquake reconstruction	Energy	2018	High
PN-L1146	Urban rehabilitation	Urban	2017	Moderate
RG-L1116 & RG-01655	Agua Negra tunnel	Transport	2017	Moderate
HA-L1081	PIC	Urban	2016	Moderate
HA-L1107	PITAG	Agriculture	2017	Moderate

Table 1. Operations supported to date on climate change and disaster risk at the project level in the framework of the Bank's OP 7.04 and/or the climate mainstreaming process.[2]

Support has been given in different forms: for some, a stand-alone disaster and climate risk studies (DRA) was conducted, for others DRA equivalent analyses were performed as part of the Environmental and social Impact Assessment (ESIA), for others climate risk considerations have been included in a specific climate change annex of the POD, for others specific technical accompaniment has been provided directly to design firms, and for others technical site inspections have been carried out to evaluate pressing situations. The following links show examples of some of these:

- HA-L1104 "Transport and Departmental Connectivity":
  https://www.iadb.org/Document.cfm?id=EZSHARE-69529135-44 (Methodological technical note)
  https://www.iadb.org/Document.cfm?id=EZSHARE-69529135-59 (Loan Proposal)

- PN-L1147 "Support to the development of territorial connectivity of Panama's central and western regions":
  https://www.iadb.org/Document.cfm?id=EZSHARE-1721999455-53 (Climate change annex)

[2] Of this list, projects supported with a DRA or equivalent (either in supervision or implementation) through RG-T2644 include: RG-L1116 & RG-01655, HA-L1106, EC-L1111, and AR-L1140. Project HA-L1104 has also been supported with this methodology through CCS mainstreaming. The Team suggests that companies that have conducted the DRA or equivalent in these projects have SSS clearance. However, depending on the sector being supported, the team would need to reach out to other companies with relevant sector expertise in addition to risk assessment expertise. We would advise SSS contracting for studies in Component 1 to be able to realistically support projects in their project cycle process.

- **AR-L1293 "Proyecto de mejora del corredor de la ruta provincial No.82, Provincia de Mendoza":** https://www.iadb.org/Document.cfm?id=EZSHARE-2054103160-21 (Annex to the ESIA)

A Learning by Doing Approach

The development of this methodology arises from a need to consolidate a conceptual framework for the treatment of disaster and climate risks that is applicable to all projects. The process of developing this methodology has begun focusing on infrastructure projects, and will eventually include all relevant sectors, including non-infrastructure projects. A **learning by doing approach** has been critical to arrive to the current methodology, which will itself be improved by a continuation of this lessons learned process. To date, some of the most important lessons learned include: (a) the need to have a methodology that is sequential and gradual, where projects first go through a qualitative analysis phase, before assessing the need for a more complex quantitative analysis during project preparation. If for example the Project does not have sufficient specification and designs, conducting an assessment should be postponed until that information is available; (b) the need for the timing of a DRA requirement needs to be flexible. The moment in the project cycle during which it is most appropriate to perform a DRA - whether qualitative or quantitative, to obtain more appropriate and specific recommendations will depend on the nature of the project; (c) the methodology is supported by policy OP-704, however it can also be applied through regular project mainstreaming as good practice to achieve resilience; (d) supervision plays an important role in identifying and evaluating the management of climate change and disaster risk by executing agencies. Involvement of the project counterparts is critical to ensure that climate change and disaster risk assessments are able to influence project design, construction, and operation as relevant, and that risk reduction measures are maintained to ensure sustainability; (e) there is little experience in practice on conducting climate change and disaster risk assessment at the project level, even when considering leading engineering international firms; therefore, the importance of working on methodological documents, piloting, and capacity building.

Conclusion

Climate change and disaster risk assessment at the project level is a relatively new topic; the science and technical knowledge is growing, but there has been limited experience in practice with detailed climate risk assessments (in the context of climate change and disaster risk management) during project preparation, partly due to funding and expertise limitations and lack of understanding of the needs and benefits. There is limited rigorous experience in practice on conducting climate change and disaster risk assessment at the project level, even when considering leading engineering international firms. To address this challenge, countries in the region have identified the need for clear methodologies and resources to undertake risk and resiliency studies to better understand and address vulnerability while accounting for uncertain variables as part of project decision-making processes[3]. The Bank, through its Community of Practice on Resilience, has designed a methodology to identify and conduct these assessments on relevant projects.

The general framework proposed here for the management of disaster and climate risk is aligned with the Disaster Risk Policy OP 7.04 and its respective guidelines, the Bahamas Resolution of 2016, as well as with

[3] Decision Making Under Uncertainty (DMDU) is also one additional element of this methodology in cases in which a resource planning exercise requires a complex multicriteria analysis with many uncertain variables. Deep uncertainty means that, unlike risky variables, these variables cannot be credibly quantified by probability distributions for use in a standard expected value analysis. It has been already successfully applied to the water sector (Brown et al., 2012; Groves et al., 2013, 2017; Groves and Lempert, 2007; Kalra et al., 2015); energy sector (Cervigni et al., 2015; Popper et al., 2009); transportation sector (Cervigni et al., 2017; Lempert et al., 2012a); and others.

the Bank's commitment to move towards sustainable infrastructure, in such a way that the products that result from the application of this methodology form a consistent and viable set with high added-value for the Bank's projects, ultimately adding resilience and sustainability.