



Technical Assistance Consultant's Final Report

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Regional: Developing a Disaster Risk Transfer Facility in the Central Asia Regional Economic Cooperation Region

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For the Asian Development Bank

ABBREVIATIONS

AAL	–	Average Annual Loss
ADB	–	Asian Development Bank
ADF	–	Asian Development Fund
ARC	–	African Risk Capacity
CAREC	–	Central Asia Regional Economic Cooperation
CCRIF SPC	–	Formerly the Caribbean Catastrophe Risk Insurance Facility
CDF	–	Contingent Disaster Finance
CRF	-	CAREC Risk Facility
CTL	–	Controllers Department
CoV	–	Coefficient of Variation
CWRD	–	Central and West Asia Department
DMC	–	Developing Member Country
DRB	–	Disaster Relief Bond
DRF+	–	Expanded Disaster Response Facility
DRF	–	Disaster Risk Financing
DRR	–	Disaster Risk Reduction
DRMI	–	Disaster Risk Management Interface
ESG	–	Environmental, social, and corporate governance
GMTN	–	Global Medium-Term Note
ILS	–	Insurance-Linked Securities
ISDA	–	International Swap and Derivatives Association
ORM	–	Office of Risk Management
OGC	–	Office of the General Council
PCRIC	–	Pacific Catastrophe Risk Insurance Company
PEF	–	Pandemic Emergency Financing Facility
SEADRIF	–	South-East Asian Risk Insurance Facility
SME	–	Small and Medium Enterprises
SPD	–	Strategic, Policy and Partnership Department
SPV	–	Special Purpose Vehicle
TA	–	Technical Assistance

GLOSSARY

Average Annual Loss	–	The modelled loss resulting from flooding / earthquake shaking that is expected on average for a given year.
Catastrophe Bond	–	An insurance linked security that has been issued in the form of a note or bond. Strictly speaking this is a bond, the principal of which is at risk from an earthquake, hurricane, flood, or some other natural catastrophe.
Coefficient of Variation	–	The ratio of standard deviation to the average annual loss. It is a means to judge the relative volatility of risks (in this report mainly concerning pay-outs from Disaster Relief Bonds).
Disaster Relief Bond	–	A financial instrument proposed to be offered by ADB. A DRB is based upon the same principles as a catastrophe bond but seeks to further incentivize disaster risk reduction and climate adaptation measures. DRBs can fill a gap in a layered disaster risk financing framework, sitting above contingent risk financing instruments and providing cover for less frequent but more severe disaster events while reducing the cost of the insurance purchase.
Insurance Linked Security	–	Tradeable financial instrument usually in the form of a bond, note or a derivative. It is designed to securitize insurance cash flows (premium and claims) so that investors that are not licensed or regulated to sell insurance can participate in the risk and rewards of insurance.
Return Period	–	A given event's return period is calculated by dividing a time interval (such as one year) by the probability of an outcome (that event occurring) within that time. If the probability of an event which exceeds a given severity occurring in any one year is 1%, the event has a return period of one hundred years (one divided by 0.01).
Standard Deviation	–	A statistical measure of volatility.

NOTE

In this report, "\$" refers to US dollars

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I. Introduction

1. The Central Asia Regional Economic Cooperation (CAREC) region is highly exposed to severe disaster events causing significant economic losses. Furthermore, recent economic development is increasing the value-at-risk. Observed trends and current modeling indicate an intensification of the atmospheric and hydrometeorological natural hazard risk, associated with climate change.
2. The Asian Development Bank (ADB) is supporting CAREC member countries¹ to strengthen their disaster risk management strategies and public sector budget resilience. This Technical Assistance (TA) forms part of such support by profiling earthquake, flood and infectious diseases risk to inform the development of comprehensive regional disaster risk financing (DRF) solutions.
3. The TA achieved the following outputs: (i) development of disaster risk assessments and modeling in all CAREC countries; (ii) design of a regional disaster risk transfer pilot scheme; and (iii) capacity building, awareness raising and regional coordination activities to sensitize key public and private stakeholders in all CAREC countries about the benefits of disaster risk reduction (DRR), risk retention and risk transfer solutions, in close coordination and building synergies with ongoing DRR / DRF initiatives in the region. To support CAREC countries' efforts to respond to the COVID-19 pandemic, an additional output was approved and added to the project in June 2020: (iv) development of comprehensive and innovative regional pandemic / epidemic risk finance solutions.
4. This final report summarizes the main results and outcomes of the TA, outcomes of the capacity building activities, and conclusions, recommendations, and next steps for the implementation of the proposed regional disaster risk solutions.
5. The structure of this final report is as follows:
 - (i) Section II describes the main milestones achieved, deliverables produced, and activities conducted under each of the four main outputs.
 - (ii) Section III considers overall lessons learned from the TA project and suggests next steps to continue this work going forward.

¹ CAREC member countries are Afghanistan, Azerbaijan, Georgia, Kazakhstan, Kyrgyz Republic, Mongolia, Pakistan, People's Republic of China (Inner Mongolia Autonomous Region, and Xinjiang Uygur Autonomous Region), Tajikistan, Turkmenistan, and Uzbekistan. ADB placed on hold its assistance in Afghanistan effective 15 August 2021.

II. Milestones and Deliverables

6. This TA was awarded in May 2020 to the consortium led by Willis Towers Watsons (UK), in association with JBA Risk Management Limited (UK), Global Earthquake Model (GEM) Foundation (Italy) and the Overseas Development Institute (UK). The initial contract award covered the first three outputs of the TA. For the implementation of the fourth output, WTW, as consortium lead, entered into association with Metabiota (US).

7. The milestones and deliverables completed at key stages of this TA are summarized in Table 1 below. This section of the final report describes each milestone in detail and is structured around the four main outputs of the TA described in Section 1 above.

Table 1: Milestone and key deliverables completed as part of this TA

Milestone	Deliverable(s)
A. Disaster Risk Assessments and Modeling	
A.1. Disaster risk profiles	<ul style="list-style-type: none"> Interim report on disaster risk profiles for all CAREC countries, assets at risk, stochastic risk modeling analysis and aggregated exceedance probability curves. Reports (11) on disaster risk profiles for all CAREC countries, assets at risk, stochastic risk modeling analysis and aggregated exceedance probability curves.
A.2. Quantification of the protection gap	<ul style="list-style-type: none"> Report on quantification of the protection gap in all CAREC countries and development of capability to conduct cost-benefit analysis of disaster risk reduction, retention and transfer measures.
A.3. Disaster risk modeling interface	<ul style="list-style-type: none"> Disaster risk modeling interface alpha version. Disaster risk modeling interface.
B. Regional Disaster Risk Transfer Solutions	
B.1. CAREC Disaster Risk Transfer Facility	<ul style="list-style-type: none"> Report on potential risk financing options for CAREC countries, including considerations for a layered-risk approach to disaster risk finance and the rationale for a regional risk transfer facility in the CAREC region. Report on the roadmap for the development of a regional risk transfer facility for CAREC, including a review of best practice and lessons learned from other regional pools and key considerations and next steps regarding the facility's creation and operation (definition of triggers, premium and coverage per country, payout process, administrative, institutional, governance and legal structure, and transaction documentation).
B.2. Disaster relief (cat) bonds feasibility assessment	<ul style="list-style-type: none"> Interim report on opportunities and options for the issuance of a disaster relief (cat) bond in the CAREC region taking into consideration best practices in other regions. Report on feasibility assessment on the issuance of a pilot disaster relief (cat) bond by ADB for selected CAREC countries.

C. Infectious Disease Risk Models and Sustainable Financing Mechanisms	
C.1. Infectious disease modeling	<ul style="list-style-type: none"> Report on the frequency-severity distribution of outbreaks of infectious diseases in CAREC countries, the likely trajectory of the COVID-19 outbreak and the benefit of effective emergency response and risk management plans.
C.2. Infectious disease risk response and financing instruments	<ul style="list-style-type: none"> Report on recommendations for the design of effective infectious disease risk response and financing instruments for CAREC countries.
C.3. Compound Risk Analysis and Model Alignment	<ul style="list-style-type: none"> Report on the quantification of the interaction of outbreaks of infectious diseases with other perils and the benefit of effective emergency response and risk management plans. Final Report including the alignment of the infectious disease risk modeling with the disaster risk assessment and modeling produced under Output 1.
D. Capacity Building, Awareness Raising and Regional Coordination	
D.1. Capacity building, awareness raising and regional coordination	<ul style="list-style-type: none"> Virtual, hybrid and in-person capacity building, awareness raising and regional coordination activities to sensitize key public and private stakeholders in all CAREC countries both about the benefits of disaster risk reduction, risk retention and risk transfer solutions, in close coordination and building synergies with ongoing DRR / DRF initiatives in the region.

A. Disaster Risk Assessments and Modeling

8. The first main output focused on the development of disaster risk assessments and modeling in all CAREC countries.

9. **Milestone A1: Disaster Risk Profiles.** [Disaster risk profiles](#) for each CAREC country² were completed in October 2021 and published in 2022. The risk profiles collate information on flood, earthquake and infectious disease exposure, hazards, physical and social vulnerability, coping capacity, historical losses and impacts, and risk analysis for each country on a regionally consistent basis.

10. **Milestone A2: Quantification of the Protection Gap.** The report “[Narrowing the Disaster Risk Protection Gap in Central Asia](#)” was prepared during 2021 and published in September 2022. It quantifies the difference between the estimated losses from earthquake and flood risk and the existing ex-ante financing tools in all CAREC countries - the “protection gap” - as well as the cost-benefit analysis methodologies of disaster risk reduction, retention and transfer measures.

11. The assessment concluded that there is a lack of robust risk financing for flood and earthquake risk across the region. Four broad categories of countries are identified according to the estimated size of the countries’ protection gap (Table 2), and potential product options for the various groups are proposed. The categories can be described as follows:

² The following disaster risk profiles have been published in the CAREC website: Azerbaijan, Georgia, Kazakhstan, Kyrgyz Republic, Mongolia, Pakistan, People’s Republic of China (Inner Mongolia and Xinjiang Uygur Autonomous Regions), Tajikistan, Turkmenistan, Uzbekistan. A disaster risk profile for Afghanistan was prepared by the consortium based on information available as of 30 July 2021, but not published.

- (i) Critically insufficient financing (Pakistan, and Tajikistan), where an estimated 80% or more of average annual losses are not covered by ex-ante mechanisms. This group of countries would likely benefit from an emergency response cover attaching at a 1 in 5-year event;
- (ii) Weak financing (Kyrgyz Republic, Mongolia, and Uzbekistan), where it is estimated that between 0% and 80% of average annual losses are not covered by ex-ante mechanisms. This group of countries could instead seek a cover at a 1 in 20-year level;
- (iii) Modest financing (Kazakhstan, Azerbaijan, and Georgia), where response costs of the most frequent events are covered by existing mechanisms and the greatest need and opportunity may be for risk transfer instruments that support reconstruction costs for events of greater severity. Risk transfer could be sought at the 1 in 50-year or higher level;
- (iv) A final group comprising of countries where data are insufficient (Turkmenistan) and/or the analysis required to estimate the protection gap goes beyond the scope of this TA (Inner Mongolia Autonomous Region and Xinjiang Uyghur Autonomous Region) as government support for disasters is centralized in the People's Republic of China

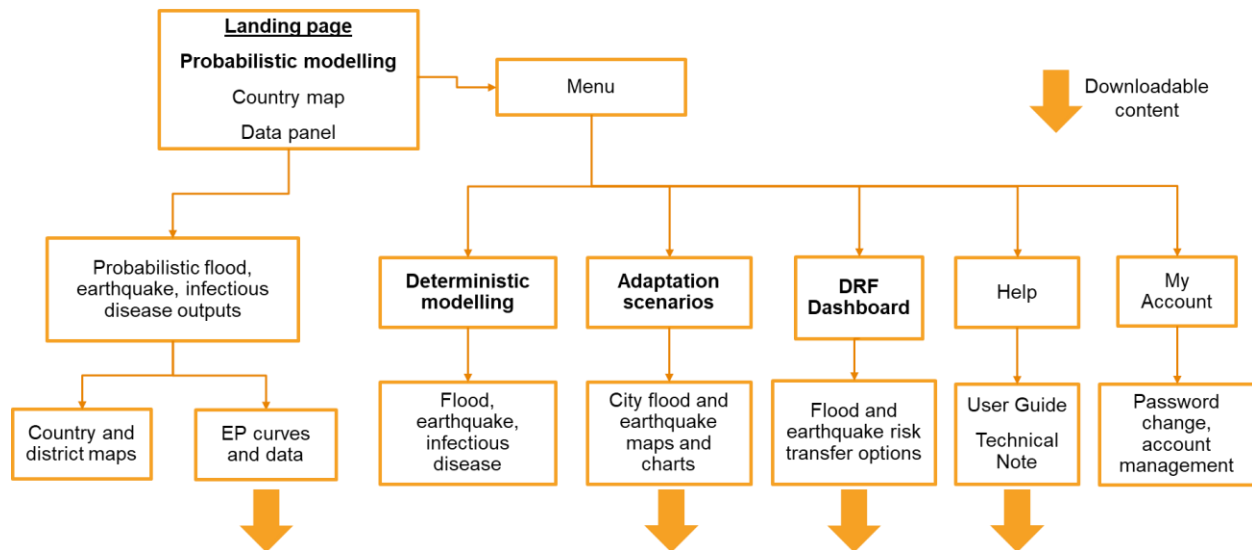
Table 2: The protection gap across CAREC countries

Group Name	Countries
Critically Insufficient Financing (80% or more of AALs from floods and earthquakes are not covered by ex-ante mechanisms)	Pakistan Tajikistan
Weak Financing (~0%-80% of AAL not covered by ex-ante mechanisms)*	Kyrgyz Republic Mongolia ³ Uzbekistan
Modest Financing (AALs from flood and earthquakes are covered)	Azerbaijan Georgia Kazakhstan
Insufficient data	PRC, Inner Mongolia Autonomous Region PRC, Xinjiang Uyghur Autonomous Region Turkmenistan

12. **Milestone A3: Disaster Risk Modeling Interface.** The analytical modelling work was made accessible through the Disaster Risk Modeling Interface (DRMI), an interactive online platform. This milestone included both the Alpha and final version of the DRMI. A user guide has been produced which explains the structure, output and operation of the DRMI (see Figure 1). Users also have the functionality to download data for further analysis.

³ The analysis finds that ex-ante mechanisms in Mongolia are just large enough to cover the AALs associated with flood and earthquake events. However, it is in this category due to its qualitatively different macroeconomic content compared to Modest Financing group, and because analysis of past events suggests that not all ex-ante finance budgeted for disaster events has been used for this purpose.

Figure 1: DRMI content from User Guide



13. The DRMI includes the following key components:

- a) Risk metrics quantifying impacts to people, property and the economy from flood, earthquake and infectious disease are available on the interface, with an option to adjust exposure. Historic impacts are also available (Figure 2);
- b) Climate adaptation scenarios inform on the costs and benefits of implementing different hazard mitigation mechanisms. These are modelled for current conditions, as well as future climate scenarios and for future economic growth scenarios (Figure 3);
- c) A disaster risk financing dashboard allows testing of parameters of risk financing programmes, drawing on the risk modeling results to understand the extent and indicative costs of risk financing (Figure 4).

14. The DRMI has been socialized with CAREC member countries through several engagement and capacity building sessions (see Section 2.4). The DRMI will be handed over to the ADB after project completion. A full technical manual will be provided to facilitate that handover.

Figure 2: Example Country Risk Analysis

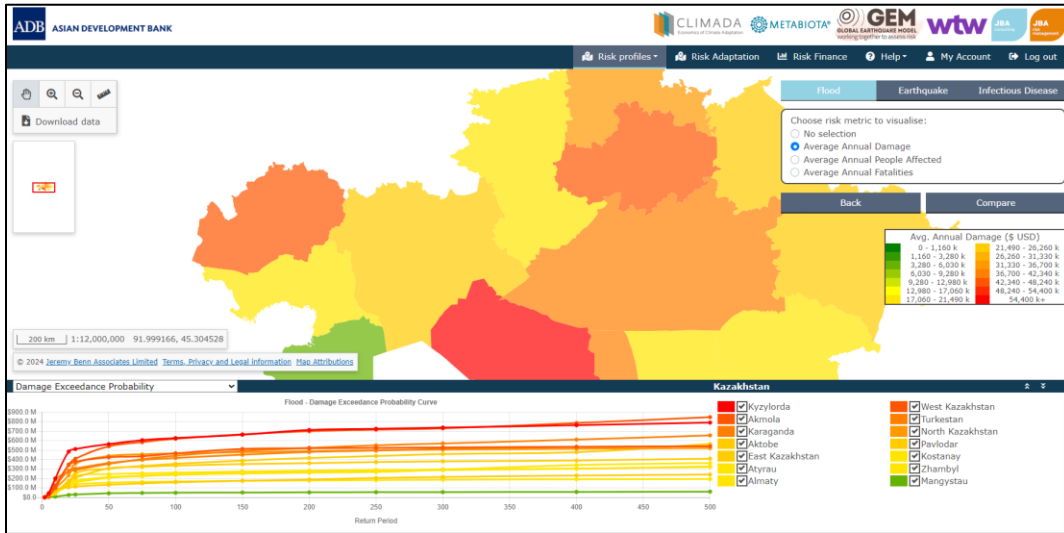


Figure 3: Screenshot of the DRMI interface for risk adaptation

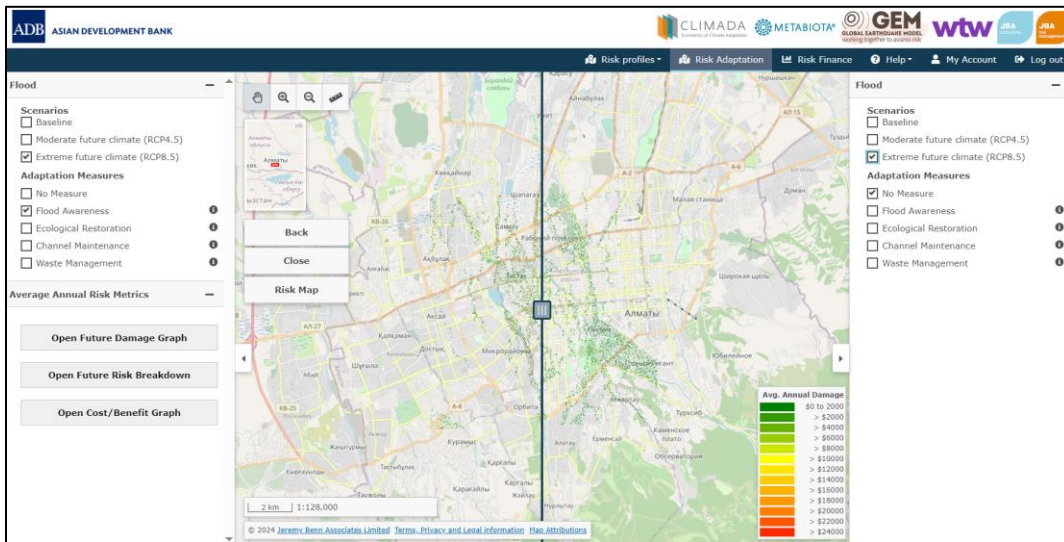


Figure 4: Disaster Risk Financing Tool Interface

Disaster Risk Financing Tool

Based on outputs from the probabilistic flood and earthquake models, this tool allows you to model different risk transfer options at the country level for both hazards individually or combined, based on the selection of parameters that determine the structure of the risk transfer. To use the tool, either adjust the parameters or simply click "Update dashboard" to view the modelled damage and the insurance coverage (recoveries) that your chosen selections provide. More information on using this screen is available in the [User Guide](#) (a [Russian version version](#) is also available).

Dashboard type

Fixed sum insured ▼

Country

Kazakhstan ▼

Flood risk transfer options

Event sum insured (Fixed)	<input type="text" value="\$1,000,000"/>	USD
Minimum Recovery (as a percentage of sum insured)	<input type="text" value="30"/>	%
Minimum Recovery (absolute)	<input type="text" value="\$300,000"/>	USD
Return period attachment	<input type="text" value="15"/>	RP
Return period exhaustion	<input type="text" value="100"/>	RP
Number of reinstatements	<input type="text" value="0"/>	

Earthquake risk transfer options

Event sum insured (Fixed)	<input type="text" value="\$0"/>	USD
Minimum Recovery (as a percentage of sum insured)	<input type="text" value="0"/>	%
Minimum Recovery (absolute)	<input type="text" value="\$0"/>	USD
Return period attachment	<input type="text" value="1"/>	RP
Return period exhaustion	<input type="text" value="2"/>	RP
Number of reinstatements	<input type="text" value="0"/>	

Update dashboard

Download current dashboard data (CSV)

Flood —

Average Annual Premium (USD)		\$30,414
Average Annual Recovery (USD)		\$419,245,820
Event Sum Insured (USD)		\$1,000,000

Return Period	Economic Damage (OEP)	Economic Damage (AEP)	Recoveries by EVENT	Recoveries by YEAR
5	\$564,434,752	\$657,194,664	\$0	\$0
10	\$1,014,558,208	\$1,298,090,906	\$0	\$0
15	\$1,246,131,840	\$1,448,186,414	\$300,000	\$300,000
20	\$1,331,700,992	\$1,518,129,369	\$406,727	\$406,727

B. Regional Disaster Risk Transfer Solutions

15. The second main output was to design and assess the feasibility of regional pilot disaster risk transfer solutions, leveraging the international reinsurance and/or insurance linked securities (ILS) markets (e.g., via catastrophe bonds). This output is based on the disaster risk assessments and modeling conducted under the first output and builds on best practices and lessons learned from existing regional disaster risk pools around the world.

16. **Milestone B1: CAREC Disaster Risk Transfer Facility.** This milestone focused on exploring options and designing an initial framework for the development of a regional disaster risk transfer facility based on international best practices. Regional collaboration on risk transfer

can provide efficiencies in the cost of financing. It can also support greater risk responsibility and ownership, producing services and solutions developed in consultation with member countries. At the same time, a regional facility must be sufficiently flexible to meet the different priority needs of CAREC countries.

17. An initial report on potential risk financing options for CAREC countries was completed in 2022. Taking into account the estimated protection gap, the report includes considerations for a layered-risk approach to disaster risk finance and the rationale for a regional risk transfer facility in the CAREC region. It provides initial guidance on key points that need to be answered and agreed upon to design and structure such regional facility, including countries and types of assets to be covered, form of the cover, associated costs and options for member contributions, and institutional and regulatory considerations.

18. The report "[Road Map to Developing a Disaster Risk Transfer Facility for CAREC](#)", completed in November 2023, outlines key considerations and next steps for establishing a regional risk pool in CAREC. The report explores insights from creating and operating existing regional risk facilities in Africa, the Caribbean and Central America, the Pacific islands, and Southeast Asia and offers lessons for the development of a CAREC Risk Facility (CRF).

19. Two key actions were identified as critical to the success of a CRF: (i) ensuring the facility's products' affordability and overall sustainability, and (ii) promoting country stakeholders' ownership over the regional initiative.

20. The road map provides an overview of the different types of functions that a CRF can serve, including:

- Underwriter of risks, offering insurance coverage to countries and pooling their disaster risks.
- Risk clearing house, acting as a fronting agent facilitating insurance and capital markets placements for the participating countries.
- Issuer of Insurance Linked Securities (ILS), providing a platform that allows the issuance of Disaster Relief Bonds (DRBs) without a Special Purpose Vehicle (SPV).
- Provider of other related value-adding services, such as capacity building to support member countries in developing DRM and DRF strategies.

21. The road map also highlights the need to determine the facility's lead implementation advisor early on –this could be ADB– given that this entity will orchestrate the immediate next steps necessary to move forward with decision-making on the facility's creation and operation. The implementation advisor can then organize more detailed risk modeling in coordination with participating countries, obtaining countries' formal confirmation to participate in the facility, establishing a facility's steering committee, and holding the first steering committee meeting to discuss key decision points related to the facility creation and operation. These include:

- a) Facility Creation: the facility's country of domicile, legal nature, ownership structure, corporate governance structure, sources of initial capitalization and initial product offering.
- b) Facility Operation: determining the facility's operational structure, evolution of its products, country engagement and capacity building program, and alternative sources of capital required for longer-term financial sustainability.

22. Existing regulations, laws and institutional structures related to disaster risk financing were reviewed with a view on feasibility and attractiveness. Countries with regulations potentially favorable for a CRF were identified as:

- i. Hong Kong: This jurisdiction is ideal for entities in the business of financial services (e.g., issuing ILS) and is aiming to create catastrophe bond incentive programs. At this point, however, it needs to be confirmed if an entity that would be "supra-national", not a typical commercial insurance company or captive insurer, could be established in Hong Kong.
- ii. Kazakhstan: In July 2018, the government of Kazakhstan officially opened the Astana International Financial Center (AIFC), which aims to offer foreign investors an alternative jurisdiction for operations. Modeled on the Dubai International Financial Center, the AIFC would provide tax holidays, flexible labor rules, a common law-based legal system with a separate court and arbitration center, and flexibility to carry out transactions in any currency. In April 2019, the government announced its intention to use the AIFC as a regional investment hub to attract foreign investment to Kazakhstan.
- iii. Singapore and the Malaysian territory Labuan: these are "neutral" jurisdictions of domicile which may be considered to have favorable regulatory environments for the set-up of captive insurance companies, which are suitable for a CRF. Singapore could recognize the CRF as a supra-national program that is not regulated as a typical insurance company if aligned with Singapore's foreign affairs and international relations objectives in the CAREC region.

23. The legal nature of the facility would be determined mainly by its function as agreed by the countries. This decision point is critical since, ideally, the entity should be one in which the CAREC member countries can engage and legally participate under their current laws and international relations frameworks.

24. However, participation in CRF programs should not be constrained by commercial laws and regulations. All sovereign states participating in CAREC have the legal authority to enter into financing transactions with development finance institutions under international law and therefore not subject to national laws that apply to commercial companies and transactions with capital markets.

25. It was noted that, whilst a CAREC Risk Transfer Facility similar to CCRIF SPC in the Caribbean and Central America, Africa Risk Capacity in Africa and the Pacific Catastrophe Risk Insurance Company, would be optimal, it will take time and donor support to create and operate. In the short-term, a Disaster Relief Bond could be issued, which would provide regional disaster risk financing and increased collaboration on disaster risk management. This is considered further in milestone B2.

26. **Milestone B2: Disaster Relief (Cat) Bond Feasibility Assessment.** A feasibility assessment on the issuance of a disaster relief bond (DRB) by ADB for selected CAREC countries was conducted. This included an assessment of financial, modeling, structural, legal and documentation requirements. Results and recommendations were presented across two deliverables: an interim report (prepared and presented to member countries in November 2022) and a final report (finalized in February 2024).

A catastrophe bond (commonly known as cat bond) is a means to transform an insurance transaction into a financial instrument placed in the capital markets. A DRB is based upon the same principles as a catastrophe bond but seeks to further incentivize disaster risk reduction

(DRR) measures.⁴ The purpose of the bond would be to cover emergency response and provide rapid pay-outs following a disaster event. A DRB can be designed to complement other ADB financing products and modalities such as Policy-Based Loans (PBLs), Contingent Disaster Financing (CDF), and ex-post emergency assistance loans and grants. DRBs can fill a gap in a layered disaster risk financing framework, sitting above contingent risk financing instruments and providing cover for less frequent but more severe disaster events while reducing the cost of the insurance purchase. ADB's Global Medium-Term Notes (GMTN) Program could be adapted for a potential pilot DRB issuance (

27. Figure 5).

Figure 5: Proposed structure of a DRB



28. The focus is to capture the benefits of the ILS markets to meet the disaster risk financing (DRF) needs of CAREC member countries. Flooding, earthquakes and infectious disease outbreaks rank highly in terms of frequency and/or severity and are common to all CAREC members. A DRB could be structured and/or marketed for any of these hazards individually or in combination for a single country or for multiple countries.

29. Issuing the DRB via the GMTN brings several benefits. The structuring process is greatly simplified which reduces setup costs and, because ADB acts as an intermediary between the developing member countries as the sponsor, investors' credit risk exposure is very low. All these technical and financial efficiencies can be passed onto the CAREC facility to reduce the cost of risk financing. The DRB could be domiciled in various locations, with Singapore and Hong Kong amongst candidate jurisdictions.

30. A part of this milestone, financial risk modeling was conducted to provide illustrative pricing for either insurance or DRB for both flood and earthquake hazards. A model of each individual country allows bond pay-out structures and pricing assumptions to be tested and modelled quickly and easily. These models calculate a full set of statistics and results, including expected recoveries and cost benefit analysis for earthquake and flood risk. Expected (or average) recoveries is a measure of bond value, but it is also important to understand how the bond responds to extreme events and/or combinations of events ("return period" statistic were included to illustrate these effects). Results were presented as cumulative totals over the typical 3-year period of a DRB. In this way, the potential implications of pricing and/or market appetite and attractiveness can be preliminarily assessed.

31. The modeling undertaken also allows assessing the implications of adding countries and perils to a single regional bond placement. Combining countries and perils should yield reductions

⁴ For example, grants to subsidize countries' participation in a DRB can be made conditional to the implementation of DRR and climate adaptation measures. Likewise, use of the pay-outs when a triggering event occurs can be linked to the implementation of emergency relief and rehabilitation activities specifically targeting vulnerable populations based on pre-arranged response plans.

in costs associated with the deals as well as the price of issuance collectively and individually. DRB investors are often insurers or reinsurers and so will favor investments that are diversified within themselves and with other insurance risks that they hold.

32. The final report proposes a pilot DRB targeting flood and earthquake risk for the Kyrgyz Republic and Tajikistan.⁵ Three options for the design and structure were modelled: (i) single country, single hazard; (ii) single country, multi-hazard, and (iii) multi-country, multi-hazard. The costing for a single country, single hazard bond is shown in Table 3 below.⁶ The table shows annual numbers for a three-year bond. The modelled annual insurance premium is \$1.9 million per hazard per country (7.5% of the bond limit). Further savings could be achieved through lower combined limits across hazards within each country (single country, multi-hazard option) as well as across both countries (multi-country, multi-hazard).

33. Whilst optimal on theoretical grounds, combining hazards may diminish the appeal of a DRB to some investors if, for example, they have an appetite for infrequent earthquake risk rather than more frequent flood risk. It also presents additional challenges, as the political impact of one country being denied a full recovery if another country had already experienced an event and drawn down on the limit is too profound. As a result, and taking on board feedback from DMCs, this option has not been explored in more detail.

34. DRB options have been estimated using pricing relationships observed and reported by the specialist ILS database Artemis.⁷ In the run-up to issuance of a DRB, pricing will need to be tested and validated in the market.

Table 3: Example Single country, Single Hazard Pricing

Base Option: Step Trigger: Event Return Period Payments (units USD)					
1 in 25 1 in 50 1 in 75 1 in 100	\$6.25m \$12.5m \$18.75m \$25m	Tajikistan		Kyrgyz Republic	
		Earthquake	Flood	Earthquake	Flood
Bond Limit		25,000,000	25,000,000	25,000,000	25,000,000
Annual Expected Loss		517,708	511,875	512,500	511,667
Annual Expected Loss / Bond Limit		2.07%	2.05%	2.05%	2.05%
Risk Margin Multiplier		3.63	3.65	3.65	3.65
Annual Estimated Premium		1,881,819	1,869,619	1,870,928	1,869,182
Annual Estimated Premium / Bond Limit		7.53%	7.48%	7.48%	7.48%

⁵ As group A DMCs, both countries are eligible for grant support under the Asian Development Fund's (ADF's) Crisis Response Window (CRW), which provides grant assistance for relief, early recovery and reconstruction following severe disaster events and emergencies. As part of the ongoing ADF 14 replenishment cycle, it is proposed to allow the use of CRW funds for ex-ante disaster risk financing instruments. Subject to the approval of this proposal, CRW funds could be used to finance the premiums of group A countries on a pilot DRB. Group B and Group C DMCs are not eligible for assistance under the ADF's CRW and, as such, may currently find it challenging to self-finance the premiums.

⁶ The modelled structure assumes a budget of \$15-20 million to fund the pilot over a three-year term. The base structure used to demonstrate the value of combined placement attaches for a 1 in 25 -year event and detaches for a 1 in 100 event, with steps at 1 in 50 and 1 in 75. An alternative structure was also modelled at individual country and hazard level, to demonstrate how a cover which attaches at 1 in 50 and detaches at 1 in 200, with steps at 1 in 100 and 1 in 150 would provide for a similar budget.

⁷ <https://www.artemis.bm/>

35. The report emphasizes that there is space and value for ADB to be innovative, offering an integrated approach to disaster risk management with an expanded suite of climate and DRF operations. By designing a bond with explicit links to and incentives for DRR actions, ADB is advancing the possibilities for disaster risk financing. Such as DRB helps target the most vulnerable whilst underpinning improved response planning. Further, such a structure should be highly donor friendly as well as attractive to environmental, social, and corporate governance (ESG) and climate-action focused investors.

36. At a future stage, the DRB could be extended to a broader group of DMCs and perils, subject to resources and funding. This concept is flexible in its application, and so DMCs may be added in the future, either on an individual or a regional basis, self-funded or subsidized. Infectious disease could be added as another peril as modeling performed for this TA and, subject to further update, it would provide a suitable modelling framework to develop an appropriate product in the future.

C. Infectious Disease Risk Models and Sustainable Financing Mechanisms

37. The next output of was the development of a comprehensive and innovative regional infectious disease risk finance solutions for the CAREC countries.

38. **Milestone C1: Infectious Disease Modeling:** The TA assessed and modelled infectious disease risk profiles of all CAREC member countries, individually and at the regional level, using both scenario and probabilistic approaches. This included epidemics and pandemics of various pathogens and various sources, as well as the medium- to long-term outlook for the COVID-19 pandemic.

39. Analysis of historical outbreak data from Metabiota's Human Epidemic Database found that the CAREC region experiences substantial risk from respiratory pathogens such as pandemic influenza and epidemic coronaviruses. A review of habitat suitability maps for these diseases found high levels of risk in key geographies that are highly connected with CAREC countries through both travel and trade, notably east and southeast Asia, suggesting pathogens may be introduced to the CAREC region via these routes. Strong disease surveillance and response systems capable of disseminating information rapidly and supporting policy and operational coordination across the region will be required to mitigate these risks.

40. The workstream also drew on epidemiological catastrophe and extreme events modeling to quantify expected impacts of viral pathogens that might pose a substantial risk to health and economic development. Table 4 below shows the estimated potential impacts of a 1 in 100-year event across key viral pathogens salient to the region. A key finding is that expected mortality is substantial but highly uneven across CAREC member countries, being concentrated in countries with higher population density and higher levels of air travel, connectivity, and population mobility.

Table 4: Estimated number of reported deaths expected for a 1 in 100-year event (1% annual probability) based on a multi-pathogen catalogue containing pandemic flu, novel coronaviruses, and viral haemorrhagic fever epidemic and pandemic events.

Region	Deaths	Deaths per 100,000
Afghanistan	113,000	335
Azerbaijan	21,000	218
Georgia	9,000	242
Kazakhstan	123,000	701
Kyrgyz Republic	14,000	27
Mongolia	6,000	202
Pakistan	817,000	431
Tajikistan	18,000	211
Turkmenistan	11,000	198
Uzbekistan	60,000	192
Inner Mongolia Autonomous Region, People's Republic of China	47,000	186
Xinjiang Uygur Autonomous Region, People's Republic of China	48,000	193

41. In November 2020, a set of scenarios simulating the potential progression of the COVID-19 pandemic across the CAREC region were produced and presented to member countries through a series of workshops. The scenarios were designed to explore the impact of a “winter surge” in disease transmission, the impact of vaccination campaigns starting at various timepoints in spring of 2021, and the combination of these two factors.

42. **Milestone C2: Infectious Disease Risk Response and Financing Instruments.** Existing pandemic insurance and risk financing mechanisms were reviewed to provide recommendations on infectious disease risk financing options for CAREC member countries. Lessons learned included:

- i. There must be clarity about what use the financing mechanism is being designed for (e.g., response, recovery, etc.). The specific use case will dictate the structure of the mechanism as well as the trigger and other key design aspects.
- ii. It is important to link any financing instrument to the specific infectious disease risk facing the CAREC region. For example, if importation risk is identified as an important issue, then a financing mechanism should take this into account.

- iii. Simple, transparent triggers are critical to stakeholder acceptance and understanding, given infectious disease risk financing is already specific and not well understood.
- iv. Prior to creating an infectious disease risk financing mechanism, certain key health and financial systems must be in place:
 - Adequate health systems preparedness;
 - Financial institutions with absorptive capacity;
 - Risk modeling / metrics to allow for full scoping of the need as well as technical pricing and transfer of risk to the capital markets;
 - Political will; and
 - Donor / funding mechanism, especially if premiums need to be subsidized.

43. Three potential infectious disease risk financing instruments for CAREC countries were developed and substantiated in a report "[Building Resilience to Future Outbreaks: Infectious Disease Risk Financing Solutions for the CAREC Region](#)":

- i. Spark risk cover – fast-paying cover for immediate response costs. This type of financing instrument would help fund and therefore incentivize very early action by a country to effectively recognize a threat and control its early spread.
- ii. Containment financing – contingent financing available for the implementation of agreed response plans. Under this financing instrument, neighboring countries to a country claiming under the spark risk cover would receive financing to shore up their defense mechanisms and to further strengthen the initial early response, with the focus on preventing the development of a regional or global outbreak.
- iii. SME business interruption – financing for SMEs required to shut or suffering from consumer behavior changes associated with infection control measures (e.g., a stay-at-home order). Such a mechanism could cover loss of profits, loss of revenue, and additional expenses.

44. Each of the instruments should be seen as complementary and are just a starting point for the possibilities of infectious disease risk financing cover. The specific implementation is customizable to regional or national needs, to tailor the design of the policy structure, and to provide indicative pricing.

45. The first two instruments are focused on fast response and overreacting to an outbreak, rather than a slow response. The SME business interruption cover is likely to require some form of public-private partnership as this is broader in scope of the risks it covers.

46. **Milestone C3: Compound Risk Analysis and Model Alignment.** The final milestone involved integrating infectious disease risk analysis with the earthquake and flood activities to provide CAREC countries with a consistent view of risk on earthquake, flood, and infectious disease, in a transparent and accessible form.

47. An [analysis of the potential impacts of compound risk](#) between natural hazards and infectious disease outbreaks in the CAREC region was completed in April 2022. Representative 1 in 200-year earthquake and flood events impacting key population areas were modelled and outputs were incorporated into simulations of pandemic influenza events. Previous work for CAREC countries identified pandemic influenza as the largest infectious disease risk. This

modelling methodology reveals how the disruption and damage from a natural hazard may affect the ability of a country to manage their ongoing response to the outbreak and so disease spread.

48. Analysis showed that the greater spatial extent of earthquake impacts relative to those from a flood event leads to a more significant impact on disease spread. Timing of the disaster event relative to the phase of the pandemic influenza outbreak is also a key driver of infectious disease outcomes, in particular a rapidly rising or just peaked infection wave. Empirical evidence from natural hazard shocks occurring during the COVID-19 pandemic supports this conclusion.

49. The intensification of pandemic influenza impacts following a natural hazard is, however, generally small. In some locations there is a sizable uptick in infections and cases across CAREC countries in compound scenarios, however these are tail risk events that induce large-scale impacts on a stand-alone basis. In this context, the increase in influenza spread is moderate.

50. The information from this workstream can be used to conduct scenario planning exercises and develop operational plans for compound risk response, as well as to refine existing operational plans for natural hazards to reduce risk compounding. There is a need for dedicated contingency and crisis planning which focuses on the joint effects of a range of natural hazards and infectious disease risk. This should occur at the regional, country, and subnational level, considering the infectious disease risks exposures are salient to each geography as well as the specific natural hazards of concern.

D. Capacity Building, Awareness Raising and Regional Coordination

51. Several capacity building and knowledge sharing events were conducted as part of this TA to improve countries' understanding of disaster risk modeling and the need to adopt a layered approach to disaster risk financing, combining national and regional solutions. The workshops built on best practices and lessons learned from other regions as well as emerging lessons from other regional initiatives.

52. **Country Seminars (October–November 2021).** A series of country workshops were conducted virtually in October and November 2021 to provide a review of the overall project implementation progress to-date and discuss next steps. During these workshops, the initial findings and recommendations from the country risk profiles, protection gap assessment and the compound risk analysis were presented and discussed. The seminars set the ambition for the TA and ensured attendees had a sound understanding of the current project progress and plans for further development of pilot regional risk financing solutions.

53. **DRMI Training (March–April 2022).** Training sessions with were held virtually with CAREC countries to present and build their capacity on the use of the DRMI. The training sessions cover the main functionalities of the DRMI, namely: (i) risk profile functionality (including output from probabilistic modelling, a set of deterministic scenarios and a tool for applying updated exposure estimates); (ii) risk adaptation, to visualize the costs and benefits of implementing different disaster risk reduction measures under different climate and economic growth scenarios; and (iii) risk finance to enable testing of different parametric insurance options at a country level for flood and earthquake individually or combined.

54. Participants from various government agencies explored risk modeling information relevant to their countries, and how disaster risk modeling contributes to a better understanding of the economic benefits of (i) investments in disaster risk reduction and climate adaptation

measures contributing to overall risk management, as well as (ii) various risk financing options including structure and pricing of risk transfer for earthquake and flood into a regional risk pool or to the capital market. During the seminars, participants also provided information regarding national datasets that could be used to improve and refine the modelling undertaken to date.

55. [CAREC Disaster Risk Engagement Meeting \(November 2022\)](#). This event was the first physical meeting to be convened under this TA. The purpose of the 3-day event was to present and discuss the disaster risk profiling and risk transfer work developed under the first phase of this TA to provide clear direction for future development over the second phase of work. This purpose was achieved through the following objectives:

- i. present work on disaster risk profiling and disaster risk transfer already delivered;
- ii. discuss existing best practices on regional disaster risk transfer solutions and options for the CAREC region; and
- iii. conduct individual discussions and consultations with CAREC countries.

56. Delegates included government officials from the Ministries of Finance, Disaster/Emergency Management, and Health. Other development partners active in the region were invited to join and present either virtually or in person, to ensure coordination for officials. Representatives from the United Nations Office for Disaster Risk Reduction (UNDRR), United Nations Development Programme (UNDP), World Bank (WB), World Health Organisation (WHO), European Centre for Disease Prevention (ECDC) and The Global Fund were all present.

57. Representatives of proven regional risk pool initiatives, in the Caribbean and Central America were also invited to share their lessons learned and experience. These proved highly popular and successful with participants by bringing the concepts and theory to life. These sessions easily had the most interaction with delegates and confirms the value of sharing successful case studies and bringing practitioners and leaders together.

58. Overall, this event demonstrated a keen interest of many CAREC countries in the results, methods and tools developed during the TA project and further development of potential regional disaster risk finance solutions, including a pilot DRB.

59. Following the event, ADB requested written feedback from countries, their expectations for future development as well as expressions of interest in participation in a pilot regional risk financing solution. Building upon this feedback, a road map for the establishment of a CAREC Disaster Risk Transfer Facility (in the mid- to long-term) and a pilot DRB issuance (in the short-term) was outlined.

60. [Second CAREC Disaster Risk Engagement Workshop \(July 2023\)](#). Building upon outcomes of the first in-person engagement event, the aim of the second engagement workshop was to present the final deliverables of the TA project and agree on the next steps.

61. The project team outlined the roadmap for a CAREC Disaster Risk Transfer Facility and a proposal for an ADB-sponsored DRB based on the tools and methodologies developed during the project. The workshop also provided further capacity building on the use of the DRMI, which had been revised based on the feedback received during the training seminars and engagement events in early 2022.

62. In recognition of the importance and relevance of the TA in enhancing the financial capacity of member countries to address the impacts of disaster events, country delegates drafted

a [joint statement](#) requesting that ADB continues to support this work beyond 2023 to help countries further advance the design and implementation of the proposed DRF solutions. The joint statement was endorsed during the 22nd CAREC Ministerial Conference in November 2023.

III. Lessons Learned and Recommendations

A. Disaster Risk Assessments and Modeling

64. **Lessons learned.** All CAREC countries have a deficit of robust risk financing for flood and earthquake disaster risk. This TA has demonstrated that, whilst levels of financing vary across countries, even where governments have arranged financial protection the amount is usually modest, meaning it is likely to be exhausted quickly. To add to this, rates of economic development are increasing value-at-risk over time and an intensification of rainfall patterns consistent with climate change predictions increases the potency of the hazard. Without a committed response, the protection gap is likely to widen further.

65. The budget for this project, though substantial, covered 11 CAREC countries and three hazards. Stochastic catastrophe risk models are well established in the (re)insurance markets, but largely unknown in government. A stochastic catastrophe risk model uses the best science and experience to understand the hazard, what and who is exposed to the hazard and their vulnerability. Many thousands of possible events are modelled, and their impact assessed.

66. This TA required a common modelling approach to provide a visibly fair and consistent view of disaster risk and support collaboration between member countries on disaster risk. This helps set the precedent for assessment and rating of insurance products.

67. However, there was insufficient time and budget to engage with all country stakeholders and national experts in-depth to make them comfortable with the modelling concepts and assumptions. This was further exacerbated by COVID-19, preventing in-person contact until near the end of the project.

68. **Recommendations.** Earthquake, flood, and infectious disease modelling conducted as part of this TA provides a solid starting point to further develop the proposed regional disaster risk financing solutions. However, if models are to be accepted by CAREC member countries, assumptions within the models will need to be validated with local experts. This may be due to new assessments of the hazard, due to scientific discover or climate change, changes to exposure due to population shift and/or and changes to vulnerability due to risk reduction activities.

69. Similarly, successful disaster risk financing is always context specific. Deeper engagement with government officials is required to better understand and agree on the financial and practical ability of governments to react to and fund disaster response. This supports where DRF products should operate and helps determine an optimal mix of disaster risk financing instruments alongside wider disaster risk reduction measures. It is worth noting that two additional workshops with governments, Kazakhstan, and Pakistan, were undertaken at the request of those governments following the regional consultations. These workshops were outside of the initial scope of this project but proved to be effective in allowing deeper discussion on the application of the modeling work and regional DRF solutions to the country context and in building capacity of and strengthening coordination with several government agencies (not only the ministry and/or agency in charge of DRM). These two examples provide a template for future, more detailed country engagement in any successor project.

B. Regional Pilot Disaster Risk Financing Solutions

70. **Lessons learned** This TA has demonstrated that a regional approach to disaster risk management and financing could benefit many countries simultaneously. With common risks faced from floods and earthquakes, regional cooperation solutions can help narrow the protection gap in a cost-effective manner. A CRF, as targeted under this TA, is a feasible, long-term goal for risk transfer and regional cooperation between CAREC countries. It can provide sustainably priced insurance capacity for countries and so increase the amount of ex-ante financing for disaster events.

71. There are commonalities of interest across all CAREC member countries, but also differences in resources, capacity, and scale of impacts. The existence of such differences does not prevent the creation of a regional risk transfer facility but do mean that the needs of the member governments, collectively and individually, must carefully considered and met. These issues require further consideration before the form and location of the CRF is confirmed.

72. In the shorter- to medium-term, a DRB offers a viable solution to bridging the protection gap. Opportunities and options for DRB issuance in the CAREC region have been developed and discussed over the course of this TA, including the potential hazards that may be covered, DRB structure, types of triggers, and how to optimize the cost of such an instrument. Illustrative pricing options and potential benefits for countries to collaborate have been presented to key stakeholders as part of virtual and in-person engagement events.

73. During project implementation, COVID-19 impacted both individual engagement with countries but also collective interaction. Towards the end of the project, after COVID-19 subsided and allowed travel again, two very successful workshops were held in Istanbul and Islamabad. The success of these workshops demonstrated that there is great value in being part of a larger group of countries to share experiences, challenges and learnings. This was particularly true where much of the content was new to most, including stochastic risk modeling, parametric insurance and disaster relief bonds. The workshops confirmed the potential value of a CRF to act as a continuing platform to catalyze such interactions and extend discussions into areas of practical coordinated disaster risk response across the region and/or neighboring countries.

74. **Recommendations.** The project demonstrated the value of a CRF, both in terms of its potential ability to provide affordable, secure, and appropriate DRF funding for all member countries, but also to act as a catalyst for regional cooperation and information sharing in the disaster risk management and disaster risk reduction space. Such facilities are donor attractive, evidenced by the recent launch of the Global Shield Programme for Resilient Risk Pools⁸, with donors increasingly open to both operational (e.g. capitalization of the pool and expense/set-up support), and premium subsidy.

75. Whilst the creation of CRF presents an optimal solution, it will require time and resources to realize. However, the need for additional disaster risk financing is immediate. A pilot DRB issued by ADB would provide a means to bridge the protection gap in the short-term. Given that this would be a new instrument for ADB, donor funding is limited, and countries have varying levels of capacity and needs, it is recommended to start with a simple structure and trail an initial bond offering for two countries in the first instance, with others added once the platform is established.

⁸ <https://global-shield-solutions.org/risk-pools/>

76. A key outcome of this TA has been to show how, together, a CRF and DRB could open new avenues to cover disaster risks. To build upon this learning, recommended next steps include arranging additional consultations to reconfirm the financing needs of each country and to deepen understanding of their legal and regulatory frameworks, as well as the selection of an independent modeling agent and structuring agent.

C. Infectious Disease Risk Models and Sustainable Financing Mechanisms

77. **Lessons Learned.** This TA has shown the complexity but also importance of the design and potential implementation of DRF mechanisms, and the value of risk models to help understanding of what can happen and what responses and resources are required. This can and should include the development of contingency plans, additional investment in preparedness, and facilitating engagement of different government stakeholders in planning activities; putting DRF mechanisms in place can underpin wider efforts for preparedness and resilience.

78. It demonstrated that modelling of both the potential frequency and severity of future infectious disease events and events and the potential development of active outbreaks is possible, albeit heavily dependent upon assumptions of government and societal actions, medical resources and preparedness, and unknowns such as the speed of development and effectiveness of vaccines. COVID-19 proved to be a case study in such issues, but each outbreak has different characteristics, and future outbreaks may not follow the same pattern. COVID-19 also demonstrated that, in many cases, there was a lack of clarity between the overlapping responsibilities of ministries within governments, for example between ministries of Finance, Health, and Emergency Management. It was also clear that a deeper, earlier engagement with the CAREC Health Working Group would have been beneficial, particularly in a fast-developing pandemic situation.

79. The World Bank's Pandemic Emergency Financing Facility (PEF) catastrophe bond illustrated both the problems and benefits of a risk transfer solution for infectious disease. The bond was widely seen as too expensive and complicated, leading to some criticism when it failed to pay-out for the Congo Ebola outbreak. But it did pay-out for COVID-19 and, as such, could be deemed as successful. Its non-payment for the Congo Ebola outbreak was as it was designed to pay for a regional event, not one largely confined within the borders of one country. The process and reaction confirmed the need for any future bond and/or insurance to be simplified, transparent and targeted to need.

80. **Recommendations.** Actions to further develop regional infectious disease risk financing solutions include:

- i. Country consultations to identify financing gaps and ensure that proposed solutions are embedded into wider health-related investments led by ADB and other organizations;
- ii. Data collection and design of trigger, indicative pricing, and payout structures; and
- iii. Donor coordination and market engagement for financial support and capitalization of with other groups including the CAREC Health Working Group.

81. The lessons of the PEF bond issuance need to be learned. Any DRF instrument must be simple to understand, totally transparent, appropriate for purpose and able to pay quickly when needed. The need for coordination, both internally within countries, and externally with other governments is even clearer when considering infectious disease. A new CRF can be part of such a system but will need to closely engage with other groups including the CAREC Health Working Group.

D. Capacity Building, Awareness Raising and Regional Coordination

82. **Lessons learned.** COVID-19 affected this project, preventing in-person meetings and collective workshops for over two years. Whilst it also demonstrated that remote meetings and workshops are possible, they are not as effective, particularly where concepts are new and complex. A continuous challenge was getting officials from the right ministries and at the right level on virtual calls.

83. The in-person workshops that were possible, in Istanbul and Islamabad, were very valuable but clearly demonstrated how much more effective they would have been earlier in the project as originally envisaged, setting a baseline for knowledge of the aims and ambitions of the project and its content. They also showed how much more effective face-to-face meetings are to get the right people involved and engaged. COVID-19 has shown that remote meetings have a place, but perhaps this format may be more suitable for follow up meetings at working level on specific agreed topics rather than meetings with higher senior officials.

84. A tangible benefit of this work is the DRMI, an interface into the modeling work undertaken by the project team and a tool to assess and estimate the price of a risk transfer DRF solution. However, it is difficult to train people on such products remotely, especially when the underlying concepts are new to most. It seemed during remote training that most found it difficult to engage with the training and the project. It was therefore encouraging and surprising when perhaps the most successful element of the Istanbul workshop post COVID was the training on and use of the DRMI. Ideally this would have been followed up by in-person training in each interested country, but the limited budget of the project coupled with the large geographical coverage did not allow for such additional engagement.

85. **Recommendations.** Capacity building, awareness raising, and regional coordination remain essential to the success of any risk financing solution and should be incorporated into any next steps. This needs to be a mix of collective regional workshop sessions at the start and end of any successor project, with in-person meetings and workshops at the country level.

86. There will need to be a focus upon the underlying risk modeling and understanding of government financial and technical capacity to respond to events. It will need to be acknowledged that such interaction will drive queries about model results and likely changes to model data and functionality. Both the interaction, and necessary modelling changes, will require budget.

87. The interaction with countries about the DRMI has demonstrated both its strengths and development needs. Its strengths are its relatively simplicity of operation and speed of response, its development needs include more granular data, more ability to vary assumptions and a greater integration between modeling and data on DRR with the DRF tool. Financial resources will need to be allocated for further development of the tool in any future project.

88. There is also a clear requirement from some countries for access to the underlying catastrophe models themselves, rather than, like the DRMI, a window into the model results with an ability to amend some assumptions (e.g. climate condition, total exposure, etc.). This is a large topic area, covering issues of the intellectual property of modelling firms and the need for expertise to run, operate and interpret detail catastrophe models and their output within governments. Donor funding is available for these types of projects, for example the Global Risk Modelling Alliance (GRMA)⁹ but, aside from the cost of model development, funding and advice on model update and maintenance would also need to be secured.

⁹ <https://grma.global/>