Financing Resilience against Natural Disasters
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Summary Report

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Overview

One of the most discussed issues of modern times is that of problems related to the scarcity of funds in dealing with the increasing catastrophic events due to volatile climatic conditions. Disaster Risk Resilience (DRR) can be interpreted as global policies working for improving disaster risk reduction and building efforts for resilience worldwide. The report analyses the applicability of popular instruments for emerging economies, the role of the private sector, and challenges to implementation of resilience framework. The Sendai Framework for Disaster Risk reduction (SFDRR) is the guiding principle for disaster risk reduction policies and efforts to improve resilience worldwide. The SFDRR synergises risk reduction efforts with sustainable development goals. Our report links global efforts for disaster risk reduction with resilient infrastructure. With the increased frequency of disasters, the economic burden of the states is rising not just with respect to ‘build back better’, but also regarding creation of resilience. Infrastructure network and asset creation have to be seen in the context of efforts to combat climate change, reduce disaster risk, and promote sustainable development. Infrastructure creation should account for climate and disaster resilience (OECD, 2018). Hence this report tries to compile a set of problems and preventive measures surrounding disasters in India.

Vulnerability profile of India

The numbers of disasters are increasing globally. According to a report by Intergovernmental Panel on Climate Change (IPCC), the number was recorded to be 991 in 2001, while it had reached 1100 in 2010 (IPCC, 2012). A country prone to multiple disasters to a varying degree, India has a very diverse vulnerability profile. According to NDMA (2016), “more than 58.6 per cent of the landmass is prone to earthquakes of moderate to very high intensity; over 40 million hectares (12%) of its land is prone to floods and river erosion; close to 5,700 km, out of the 7,516 km long coastline, is prone to cyclones and tsunamis; 68% of its cultivable area is vulnerable to droughts; and, its hilly areas are at risk from landslides and avalanches”. Table 1 shows the disaster profile of India from 2004 to 2019, covering earthquakes, cyclones, floods, storms, etc. and the risk profile. Table 2 presents the targeted schemes.

Field trip to Odisha
Table 1: Disaster profile of India (2004-19)

<table>
<thead>
<tr>
<th>Year</th>
<th>Occurrences</th>
<th>Injured</th>
<th>Affected</th>
<th>Homeless</th>
<th>Total affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>7</td>
<td>6913</td>
<td>33748599</td>
<td>105000</td>
<td>33860512</td>
</tr>
<tr>
<td>2005</td>
<td>31</td>
<td>6803</td>
<td>28196813</td>
<td>464000</td>
<td>28667616</td>
</tr>
<tr>
<td>2006</td>
<td>20</td>
<td>478</td>
<td>3234000</td>
<td>4150000</td>
<td>7384478</td>
</tr>
<tr>
<td>2007</td>
<td>20</td>
<td>33</td>
<td>38143000</td>
<td>0</td>
<td>38143033</td>
</tr>
<tr>
<td>2008</td>
<td>11</td>
<td>50</td>
<td>11589018</td>
<td>2400000</td>
<td>13989068</td>
</tr>
<tr>
<td>2009</td>
<td>17</td>
<td>118</td>
<td>11092521</td>
<td>4000</td>
<td>11096639</td>
</tr>
<tr>
<td>2010</td>
<td>18</td>
<td>305</td>
<td>3372183</td>
<td>907000</td>
<td>4279488</td>
</tr>
<tr>
<td>2011</td>
<td>13</td>
<td>250</td>
<td>12504069</td>
<td>325000</td>
<td>12829319</td>
</tr>
<tr>
<td>2012</td>
<td>10</td>
<td>0</td>
<td>4280860</td>
<td>0</td>
<td>4280860</td>
</tr>
<tr>
<td>2013</td>
<td>12</td>
<td>4547</td>
<td>16704280</td>
<td>0</td>
<td>16708827</td>
</tr>
<tr>
<td>2014</td>
<td>16</td>
<td>84</td>
<td>5503980</td>
<td>650200</td>
<td>6154264</td>
</tr>
<tr>
<td>2015</td>
<td>22</td>
<td>1695</td>
<td>346502337</td>
<td>54097</td>
<td>346558129</td>
</tr>
<tr>
<td>2016</td>
<td>15</td>
<td>313</td>
<td>1816500</td>
<td>200000</td>
<td>3816813</td>
</tr>
<tr>
<td>2017</td>
<td>18</td>
<td>44</td>
<td>22335051</td>
<td>60100</td>
<td>22395195</td>
</tr>
<tr>
<td>2018</td>
<td>22</td>
<td>719</td>
<td>32137579</td>
<td>223050</td>
<td>32361348</td>
</tr>
<tr>
<td>2019</td>
<td>7</td>
<td>510</td>
<td>12400000</td>
<td>0</td>
<td>12400510</td>
</tr>
</tbody>
</table>

Source: EM-DAT: The Emergency Events Database - Université Catholique de Louvain (UCL) - CRED, Brussels, Belgium.
Figure 1: Risk Profile of India

Risk Profile

INFORM

Hazard & Exposure

- Physical exposure to earthquake: 7.9
- Physical exposure to flood: 8.4
- Physical exposure to tsunami: 8.1
- Physical exposure to tropical cyclone: 7.2
- Drought probability and historical impact: 6.1
- Projected Conflict Risk: 9.1

Vulnerability

- Current Highly Violent Conflict Intensity: 0.0
- Development & Deprivation: 5.6
- Inequality: 4.7
- Aid Dependency: 0.1
- Uprooted People: 6.5
- Health Conditions: 6.5
- Children U5: 6.5
- Recent Shocks: 0.9
- Food Security: 4.3
- Uprooted People: 6.5
- Health Conditions: 6.5
- Children U5: 6.5
- Recent Shocks: 0.9
- Food Security: 4.3

Lack of Coping Capacity

- DRR: 1.8
- Governance: 5.4
- Communication: 5.0
- Physical Infrastructure: 5.2
- Access to Health Care: 5.6

## Financing Resilience against Natural Disasters

### Table 2: Targeted schemes in India

<table>
<thead>
<tr>
<th>Name of the Scheme</th>
<th>Year of initiation</th>
<th>Objectives</th>
<th>Organisational Head</th>
</tr>
</thead>
</table>
| National Cyclone Risk Mitigation Project (NCRMP)       | 2011               | • Mitigating the effect of cyclones in India.  
  • Two phases  
  Phase 1 - Odisha and Andhra Pradesh  
  Phase 2 - Goa, Gujarat, Karnataka, Kerala, Maharashtra, and West Bengal  
  • Four major components  
  1. Early warning dissemination system  
  2. Cyclone risk mitigation infrastructures  
  3. Providing technical assistance for cyclone hazard mitigation  
  4. Project management and implementation support | National Disaster Management Authority, National Institute for Disaster Management (NIDM).                                                                                                             |
| Flood management and flood forecasting programmes      | Eleventh Five Year Plan | • Financing the resilience activities to reduce the losses from floods  
  • Work related to river management, flood control, anti-erosion, drainage development, flood proofing works | Ministry of Water Resources                                                                                                                      |
| Integrated Coastal Zone Management Programme           | 2004               | • Four components  
  I. National Coastal Management Programme  
  II. ICZM-West Bengal  
  III. ICZM-Orissa  
  IV. ICZM-Gujarat  
  • Building national capacity for implementation of a comprehensive coastal management approach  
  • Aim of rehabilitation of 223 existing dams and strengthening the system | Ministry of Environment and Forests (MoEF)/Society of Integrated Coastal Management (SICOM)                                                          |
| Disaster Management Support programme                   |                    | • Natural Disasters - Monitoring/Damage Assessment  
  • National Database for Emergency Management (NDEM)  
  • VSAT based VPN for emergency communication  
  • Strengthening Early Warning Systems for tsunami, floods, cyclone, drought, landslides  
  • Development of Hydro-met. networks, DSS  
  • Capacity Building on DMS Exclusive Training Programme  
  • Key Developmental Efforts - Airborne SAR, communication equipment, support to IOTWS, constellation of EO satellites | ISRO - DMS Decision Support Centre (DSC) at NRSC in association with Nodal Agencies MHA, MOA, Cabinet Secretariat, NDMA, State Agencies, NGOs¹                                                                 |
| Tsunami and Storm Surge Warning System                  | 2007               | • Will issue alerts for the killer waves within 30 minutes of an earthquake  
  • Enables early warning centre to disseminate warnings to the MHA, as well as to the state emergency operations centres  
  • Gives information about magnitude, location, and depth at which an earthquake occurs | Ministry of Earth Sciences Department of Science and Technology  
  Department of Space and the Council of Scientific and Industrial Research                                                                         |

Source: Authors’ compilation

Insurance and reinsurance in India

Insurance and reinsurance markets in India are underdeveloped, placing India among the underinsured economies. According to a report published by Kotak India, the penetration of insurance in India in only 0.7% of the GDP, compared to 2.8% for the rest of the world. Life insurance dominates the insurance markets, whereas the reach of general insurance is limited. Catastrophic insurance has not been able to acquire a separate market, because its value is not yet realised by the consumers and the insurance providers. It is a product that is offered as an embedded benefit under the home insurance policy in our country. Ironically, even the penetration of home insurance in India is low, which pushes the percentage of catastrophic insurance to almost nil. Home insurance is mostly purchased by people if they are taking home loans. The lackadaisical attitude of the insurance industry and lack of proactive measures by the distribution channels delays the claims and reduces the incentives for consumers to buy home insurance. Table 3 shows a list of disasters up to 2015 that were uninsured.

Table 3: Extent of uninsured losses in recent catastrophe events in India

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Place of event</th>
<th>Economic Loss USD (billion)</th>
<th>Insured Losses (USD billion)</th>
<th>Uninsured loss of total loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec 2015</td>
<td>Floods</td>
<td>Tamil Nadu and Andhra Pradesh</td>
<td>2.2</td>
<td>0.8</td>
<td>66%</td>
</tr>
<tr>
<td>Oct 2014</td>
<td>Cyclone ‘Hudhud’</td>
<td>Odisha and Andhra Pradesh</td>
<td>7.1</td>
<td>0.6</td>
<td>91%</td>
</tr>
<tr>
<td>Sept 2014</td>
<td>Severe monsoon floods</td>
<td>Jammu and Kashmir</td>
<td>6.0</td>
<td>0.2</td>
<td>96%</td>
</tr>
<tr>
<td>Sept 2014</td>
<td>Severe monsoon floods</td>
<td>Assam, Bihar, Meghalaya, Uttar Pradesh, West Bengal</td>
<td>6.1</td>
<td>0.2</td>
<td>96%</td>
</tr>
<tr>
<td>Oct 2013</td>
<td>Cyclone ‘Phailin’</td>
<td>Odisha</td>
<td>4.5</td>
<td>0.1</td>
<td>98%</td>
</tr>
<tr>
<td>Jun 2013</td>
<td>Floods</td>
<td>Uttarakhand</td>
<td>1.1</td>
<td>0.5</td>
<td>54%</td>
</tr>
<tr>
<td>Sept 2013</td>
<td>Floods</td>
<td>Andhra Pradesh and Karnataka</td>
<td>5.3</td>
<td>0.1</td>
<td>99%</td>
</tr>
</tbody>
</table>

Source: ICICIdirect.com, Research 2017
## Table 4: Crop Insurance in India

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Parameters</th>
<th>National Agriculture Insurance Scheme (NAIS)</th>
<th>Modified National Agricultural Insurance Scheme (MNAIS)</th>
<th>Pradhan Mantri Fasal Bima Yojana (PMFBY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Year</td>
<td>1999-2017</td>
<td>2010-16</td>
<td>2016-Present</td>
</tr>
<tr>
<td>2</td>
<td>Primary Feature</td>
<td>Sharecroppers were included for insurance cover</td>
<td>Private sector participation encouraged. Immediate partial payment to affected farmers introduced</td>
<td>Premium rates lowered. Use of technology emphasised. No capping on premium rates and farmers will get claim against full sum insured without any reduction.</td>
</tr>
<tr>
<td>3</td>
<td>Farmers Covered</td>
<td>All farmers, including sharecroppers and tenant farmers growing the notified crops in the notified areas, were eligible for coverage. Scheme was compulsory for farmers availing crop loans and voluntary for others.</td>
<td>Same as NAIS</td>
<td>Same as NAIS</td>
</tr>
<tr>
<td>4</td>
<td>Claim Liability</td>
<td>In case of food crops and oilseeds, claim liability of up to 100 per cent of premium collected was to be borne by the AIC. Thereafter, the Centre and state governments shared the liability equally. In the case of annual commercial/horticultural crops, claim liability beyond 150 per cent of premium in the first three or five years and beyond 200 per cent thereafter, equally shared by Centre and state governments.</td>
<td>All claims were to be borne by the IAs. To protect IAs against overall loss exceeding 500 per cent of gross premium, a Catastrophe Fund at national level was to be set up with contributions from Centre and state governments.</td>
<td>All claim liabilities on insurer and claim liability beyond 350 per cent of premium collected or 35 per cent of sum insured at national level to be shared equally by the Centre and state governments</td>
</tr>
</tbody>
</table>
| 5      | Premium Rate            | a. Kharif season 3.5 per cent  
b. Oilseeds and bajra 2.5 per cent  
c. Cereals, millets, and pulses  
d. Rabi season 1.5 per cent  
e. Wheat 2 per cent  
Other food and oilseeds crops Actuarial premium for annual commercial/horticultural crops | Actuarial premium as well as net premium rates (premium rates actually payable by farmers after premium subsidy) for each notified crop through standard actuarial methodology in conformity with provisions of IRDA | a. Maximum premium of 2 per cent of sum insured for Kharif (food and oilseed) crops.  
b. 1.5 per cent of sum insured for Rabi (food and oilseed) crops; and  
c. 5 per cent of sum insured for Annual commercial/horticultural crops. |
| 6      | Premium Subsidy         | Ten per cent to small and marginal farmers only, to be shared equally between Centre and states | Actual premium with subsidy up to 75 per cent to all farmers, to be shared equally between Centre and states | The difference between the Actuarial Premium Rate (APR) and insurance charges payable by farmers shall be provided by Governments as subsidy, and shall be shared equally by the Centre and states. |
| 7      | Use of better technologies for yield estimation | Yield estimation through traditional CCEs. | Pilot studies for yield estimation through use of Remote Sensing Technology (RST) | Provision for adoption of RST, drone, and other technologies in yield estimation and categorisation of number of CCEs after validation by pilot studies. Use of smartphone apps for accurate and fast transmission of CCE data to facilitate early settlement of claims |

Source: CAG, Report No. 7, 2017

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2 https://www.researchgate.net/publication/319643499_Impediments_to_the_Spread_of_Crop_Insurance_in_India
WBCIS was launched in 2007 and restructured in 2016 as RWBCIS

Features of WBCIS/RWBCIS

- Covers parametric weather risks, on account of anticipated crop loss from adverse conditions.
- Provides payout against rainfall incidence (both excess and deficit). It is not a yield guarantee insurance.
- Claim settlement is faster; an area approach is used, as opposed to individual approach.
- Needs up to 25 years’ historical weather data. Hence, technical challenge in correlating weather challenges with yield losses.
- Claims arrive when there is deviation from actual temperature within a specified time period, leading to a crop loss.
- Premium Rates
  - Kharif - 2%
  - Rabi - 1.5%
  - Rabi and Kharif Annual - 5%

# International Examples

**USA** - Heavily subsidised, 70% of premium subsidy paid by the government.

**CHINA** - Heavily subsidised, revamped in 2007, covering 75% of cultivated land. Decentralised power, shared by all levels.

**TURKEY** - Restructured in 2005, agriculture insurance pool (Public Private partnership).
Noteworthy illustrations from selected countries

Natural disasters leave in their wake a trail of tremendous economic losses, which are more often than not funded via budget allocations or government resources. The rising frequency of disasters and their increasing severity thus calls for ex-ante financial protection solutions that can reduce the fiscal impact of disasters. Prudently designed and efficiently implemented financial instruments can increase the disaster resilience of an economy, along with complementing risk reduction and mitigation efforts. Table 5, Table 6 and Box 1 present a snapshot of notable examples of financial instruments for disaster risk reduction that have been implemented in different countries and regions.

Table 5: Insurance, reinsurance, and catastrophe pools

<table>
<thead>
<tr>
<th>Country</th>
<th>Programme</th>
<th>Key details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spain</td>
<td>Insurance programme by Consorcio de Compensación de Seguros (CSS)</td>
<td>CSS, a state-owned enterprise, cooperates with the private insurance industry to provide coverage against natural catastrophes and manmade events (OECD, 2015).</td>
</tr>
<tr>
<td>Turkey</td>
<td>Compulsory Earthquake Insurance (CEI)</td>
<td>The programme is managed by the Turkish Catastrophe Insurance Pool, a non-profit legal entity built through public private collaboration. The programme has been acclaimed for its low-cost structure and well-designed public private partnership program. It seeks to privatise part of the potential risk by exporting it to the international reinsurance and capital markets. In addition, the government bolsters the pool through reinsurance, premium subsidies, and technical and organisational support.</td>
</tr>
<tr>
<td>USA</td>
<td>National Flood Insurance Program (NFIP)</td>
<td>The programme is managed by the Federal Emergency Management Agency (FEMA), through its subcomponent the Federal Insurance and Mitigation Administration (FIMA) (CRS, 2019). It seeks to provide affordable insurance for decreasing the impact of flooding on private and public structures (FEMA, 2019a) and risk reduction via flood management practices. It runs on a community basis and not on an individual basis. It serves as a classic example of a state backed insurance programme where affordability is primarily achieved through subsidisation.</td>
</tr>
</tbody>
</table>

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3 “A community, as defined for the NFIP’s purposes, is any state, area, or political subdivision; any Indian tribe, authorized tribal organization, or Alaska native village; or authorized native organization that has the authority to adopt and enforce floodplain management ordinances for the area under its jurisdiction. In most cases, a community is an incorporated city, town, township, borough, or village, or an unincorporated area of a county or parish” (FEMA, 2011).
Table 6: Regional risk pools

<table>
<thead>
<tr>
<th>Risk pool</th>
<th>Key Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caribbean Catastrophe Risk Insurance Facility (CCRIF)</td>
<td>This is a parametric insurance programme for the Caribbean governments to limit the financial impact of catastrophic events. Nineteen Caribbean countries and two Central American countries have become a part of it. The major advantage of CCRIF is that it mitigates the short-term cash flow problems of a small economy in the event of a catastrophe (OECD, 2015) and transfers the risks to international markets at a lower cost.</td>
</tr>
<tr>
<td>Pacific Disaster Risk Financing and Insurance (PDRFI)</td>
<td>PDRFI was launched under the Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI). A joint initiative of the Pacific community, the World Bank, and the Asian Development Bank, it received financial support from the Government of Japan, GFDRR, and other international agencies. Under the programme, five of the Pacific island nations risk financed their exposure to earthquake, tsunami, and cyclone catastrophes in the international reinsurance market (ESCAP, 2017) and thus ensured more budget flexibility and reduced contingent liability in the event of a disaster. The pilot programme came to an end in 2015 and is now continued under the Pacific Resilience Program (PREP).</td>
</tr>
</tbody>
</table>

Source: Authors' compilation
Box 1: Catastrophe Bonds and Insurance Linked Securities (ILS)

The most successful examples of Cat bonds and ILS come from the USA, where they are widely used by the government and the insurance and reinsurance industry. These include the California Earthquake Authority, Texas Insurance Windstorm Association, and Citizens Florida (CPIC), among others. It has been reported that the total outstanding volume of the global market reached its highest level at USD 30 billion in the first half of 2018 (Aon Securities, 2018). Another notable policy development regarding ILS can be traced to the UK. In order to provide for an ILS friendly legal framework, a parliamentary committee in the UK passed Risk Transformation Regulations, 2017 and the Risk Transformation (Tax) Regulations, 2017 (Aon Securities, 2018).

The Case of Odisha

Odisha is spread over an area of 1,55,707 sq. km on the eastern seaboard of India and is constituted of four geographical regions, namely the Northern Plateau, the Central River Basins, the Eastern Hills, and the Coastal Plains. The idiosyncratic topography of the state of Odisha has rendered it extremely vulnerable to various natural calamities, such as cyclones, storm surges, floods, tsunamis, drought, heat wave, lightning, and landslides. Keeping this in view, the vulnerability of the districts of Odisha to cyclones has been assessed based on the occurrences of four major cyclones that hit Odisha from 1999 to 2019. The four major cyclones considered for the present purpose are the Super Cyclone of 1999, Cyclone ‘Phailin’ of 2013, Cyclone ‘Hudhud’ of 2014, and Cyclone ‘Fani’ of 2019.

The vulnerability mapping of the state has been done by utilising the information pertaining to the occurrences of these cyclones in various districts. The frequency of cyclones in a particular district has been used as a basis to establish the vulnerability of a district. The criteria employed for classifying the districts under different categories are enumerated in Table 7.

Table 7: Criteria for classification of districts on the basis of vulnerability to cyclones

<table>
<thead>
<tr>
<th>Colour code</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow</td>
<td>Low vulnerability</td>
</tr>
<tr>
<td>Orange</td>
<td>Moderate vulnerability</td>
</tr>
<tr>
<td>Red</td>
<td>High vulnerability</td>
</tr>
<tr>
<td>Green</td>
<td>Very high vulnerability</td>
</tr>
</tbody>
</table>

Source: Authors’ compilation

Figure 2: Timeline of the four major cyclones in Odisha from 1999 to 2019

Source: Authors’ compilation
Table 7: Criteria for classification of districts on the basis of vulnerability to cyclones

<table>
<thead>
<tr>
<th>Category</th>
<th>Classification</th>
<th>Colour code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very high vulnerability</td>
<td>Districts that have been hit by all the four cyclones</td>
<td>Red</td>
</tr>
<tr>
<td>High vulnerability</td>
<td>Districts that have been hit by any three cyclones</td>
<td>Orange</td>
</tr>
<tr>
<td>Moderate vulnerability</td>
<td>Districts that have been hit by any two cyclones</td>
<td>Yellow</td>
</tr>
<tr>
<td>Low vulnerability</td>
<td>Districts that have been hit by one cyclone</td>
<td>Lime Yellow</td>
</tr>
</tbody>
</table>

Source: Authors’ analysis

Figure 3: Vulnerability map of districts in Odisha

Source: Authors’ analysis
Note: The districts in the map have been shaded on the basis of the districts reported to be affected by the four cyclones under consideration.
The vulnerability map (Figure 3: Vulnerability map of districts in Odisha) for the districts in Odisha classifies the districts into different categories of vulnerability. As expected, the coastal districts are the most vulnerable to cyclones and fall into the category of very high and high vulnerability. Puri, Khordha, Jagatsinghpur, Kendujhar, Kendrapara, and Mayurbhanj districts have been hit by all the four cyclones under consideration and are classified under districts with very high vulnerability. Further, the vulnerability decreases as we move away from the coast and towards the non-coastal districts. The districts of Balangir, Kalahandi, Nabarangpur, Rayagada, Debagarh, and Malkangiri have been classed under districts with low vulnerability, as these districts have been hit by only one cyclone.

Property loss and damage of infrastructure facilities is an impediment in the development of a completely disaster resilient Odisha. Cyclone ‘Fani’, which recently hit the state, crippled its economy by inflicting damage on electricity lines, houses, summer crops and plantations, road networks, and telecom infrastructure.

The post-disaster situation is made worse by the depressed levels of insurance penetration, particularly of general insurance. The challenge of underinsurance, if resolved, can alter the present dynamics of disaster risk mitigation to some extent. Therefore, the transition from excessive reliance on ex-post recovery towards ex-ante risk mitigation involves building of disaster resilient infrastructure, increase in insurance and reinsurance cover, and taking into account the vulnerability profile of different districts while formulating disaster management and financing strategies.
References:


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UN ESCAP. (2017). Disaster risk transfer mechanisms: Issues and considerations for the Asia-Pacific region. Note by the secretariat. Economic and Social Commission for Asia and the Pacific Committee on Disaster Risk Reduction

