

Ray, Saon; Jain, Samridhi; Thakur, Vasundhara

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## Financing India's disaster risk resilience strategy

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## **Financing India's**

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# Disaster Risk Resilience Strategy

SAON RAY

SAMRIDHI JAIN

VASUNDHARA THAKUR

February 2021



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## Abstract

In this paper, we try to cover a whole range of policies and schemes that have been undertaken in India to finance disaster risk resilience (DRR). This paper tries to emphasise the importance of DRR in dealing with natural catastrophes by integrating DRR and climate change adaptation strategies for the purpose of mainstreaming them into centrally sponsored schemes. It briefly talks about synergising risk reduction efforts with sustainable development goals through the Sendai Framework. This framework calls for all-inclusive collective action from private stakeholders and local governments, while unambiguously stating the primary role of a state. The paper reflects briefly on the gaps since the advent of these policies and suggests methods for financing based on experiences of other countries. Then the focus of the paper shifts towards insurance and reinsurance mechanisms used in other countries for financing these catastrophes. It underlines a concept that resilience can be attained only through building better infrastructure for reducing shocks and these instruments can be financed by introducing new financial tools which deal with climate change from its very inception. Infrastructure creation is an ineluctable component of economic growth and development. It points out that the success of any economy is heavily dependent on its infrastructure network and assets – existing and planned – and ignoring the ‘resilience’ aspect in infrastructure management and investment would mean additional vulnerabilities and serious negative impacts on efforts towards sustainable development and a low carbon future. Scaling up resilient infrastructure will also bring numerous co-benefits by diffusing development across sectors. Despite the suite of reforms that have been initiated in shifting towards resilient infrastructure and disaster funds, implementation of these reforms has been poor. These reforms are stalled by the weakness in execution and layers and sub-layers involved in delivering these services.

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**Keywords:** Q54, G22, G32

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**Authors’ email:** *Sray@icrier.res.in, jsamridhi94@gmail.com, and vthakur@icrier.res.in*

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# Financing India's Disaster Risk Resilience Strategy<sup>1</sup>

Saon Ray, Samridhi Jain, and Vasundhara Thakur

## 1. Introduction

One of the most discussed issues of modern times is the problems related to the scarcity of funds in dealing with the increasing catastrophic events. Disaster Risk Reduction (DRR) can be interpreted as global policies formulated for improving the procedures for accounting for losses from catastrophes and building efforts for resilience against natural disasters worldwide. The UNDRR defines a formal definition for DRR, as ‘an aim to reduce the damage caused by natural hazards like earthquakes, floods, droughts and cyclones, through an ethic of prevention.’<sup>2</sup> Reducing exposure to hazards, reducing vulnerability of people and property, wise management of land and the environment, and improving preparedness and early warning for adverse events fall under the ambit of DRR.

Around the globe, increased frequency of disasters has been observed: in 2000 it was 991, while in 2010 it was 1100. The IPCC notes this increasing frequency of disasters, and that is likely to continue in future (IPCC, 2012). According to the UN International Strategy for Disaster Reduction and Centre for Research on the Epidemiology of Disasters (UNISDR and CRED) (2018), between 1998 and 2017 climate-related and geophysical disasters killed 1.3 million people and left a further 4.4 billion injured, homeless, displaced, or in need of emergency assistance. Associated with this, the cost inflicted by disasters is also increasing. The real cost to the global economy from disasters every year is estimated to be about US\$ 520 billion, which pushes more than 26 million people into poverty every year (Hallegatte et al., 2017). The Global Assessment Report on Disaster Risk reduction suggests that if indirect losses and small-scale losses are included, the costs could be 50 per cent higher. Over the last 26 years, the rate of growth of economic losses has outpaced the growth of insured losses. In terms of 10-year rolling averages, insured losses grew by 5.4 per cent between 1991 and 2017, and economic losses by 5.9 per cent (Swiss Re, 2018).

One of the biggest pandemics in human history saw a loss of 1.38 million people last year. With the world approaching recession due to the unexpected pandemic which resulted in lockdowns and crippled health infrastructure, this paper points to the shifting global dialogues on the issue of disaster risk management (DRM). One of the major things that was reported in the press repeatedly during the pandemic was the increase in health insurance among the middle class due to increased medical bills. What about other natural disasters that take place every year in different parts of the country but get no attention? “In the period between 2000 and 2007, of more than 230 million people affected annually by disasters, about 98% were due to climate related hazards, predominantly floods and windstorms, followed by droughts” (IIHS, n.d.). These need to be addressed using tools of financial

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<sup>1</sup> The authors would like to thank the reviewers Dr. Divya Sharma and Ms. Shailly Kedia for their extensive comments on the earlier draft. The paper has benefited immensely from their suggestions. The authors also thank Sandeep Paul for his contribution to the report on which this paper is based.

<sup>2</sup> <https://eird.org/esp/acerca-eird/liderazgo/perfil/what-is-drr.html>

security that act as a shield of resilience against any unprecedented situation. Hence, this calls for discussion on resilience strategies and financing disaster resilience.

In the Indian context, the pandemic was coupled with floods, cyclones, and earthquake shocks in different parts of the country. In the last two decades, India has experienced an increased frequency and intensity of disasters whose economic impact has caused great monetary losses. According to the National Disaster Management Authority (NDMA), “around 40 million hectares of land in India is exposed to floods (around 12 per cent of the total land area), 68 per cent of land is vulnerable to droughts, landslides and avalanches, 58.6 per cent landmass is earthquake-prone, and tsunamis and cyclones are a regular phenomenon for 5,700 km of the 7,516-km long coastal line.” Between 1971 and 2009, India experienced 371 natural disasters which killed 1,51,000 people and affected 1.86 billion people. The most recurrent disaster prevalent in India is floods, which account for more than 50 per cent of the calamities (Parida and Goel, 2020).<sup>3</sup>

This paper analyses India’s overall approach in dealing with disasters, as section 2 of this paper gives a quick background on the consolidation of the concept of Climate Change Adaptation (CCA) and DRR. It introduces the Sendai Framework via Sustainable Development Goals (SDGs). Section 3 of this paper shifts towards explaining the relevance of the Sendai Framework and how this 2015 treaty has helped in shaping India’s disaster policy with different acts and management. Section 4 of this paper discusses in detail disaster risk financing in India, covering the targeted schemes with a quick critical analysis of these schemes. These schemes were selected based on discussions among Ministry of Home Affairs (MHA) and National Disaster Management Authorities<sup>4</sup> (NDMA, 2016) regarding policies which aimed at disaster prevention, mitigation, and capacity building. Following this, a section on financial protection against natural disasters presents notable examples of disaster risk financing from different countries. The next section covers insurance and reinsurance sector in India from a disaster point of view, as these markets are still not developed. This section tries to initiate dialogues in building insurance policy by providing alternative policy plans adopted around the world. Section 7 discusses crop insurance in India and this section is followed by concluding remarks.

## **2. Background**

### **2.1 Interlinkages between DRR and CCA**

In its 4th Assessment Report, the Inter-governmental Panel on Climate Change (IPCC) suggests that rising global temperature will lead to frequent occurrence of catastrophic events. It has been observed that overall, two thirds of disaster events are due to volatility in weather dynamics which creates uncertainties in the policy dimension (ProAct Network,

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<sup>3</sup> <https://www.thehindubusinessline.com/opinion/india-is-not-prepared-for-natural-disasters/article30463153.ece>

<sup>4</sup> <https://www.mha.gov.in/sites/default/files/National%20Disaster%20Management%20Plan%20May%202016.pdf>



2008).<sup>5</sup> Resilience<sup>6</sup> strategies call for a collaborative effort for DRR and CCA in combating disasters, which would help in reducing people's vulnerability to rising insecurities.

IPCC defines DRR as a policy goal and a strategy employed for anticipating future disaster risk, which works with mechanisms to reduce the exposure, vulnerability, and loss, thereby improving the resilience, while CCA is a strategy that accommodates both human and natural systems. It is a process defined as an "adjustment to actual or expected climate and its effects in order to moderate harm or exploit beneficial opportunities" (Lavell et al., 2012).<sup>7</sup>

There is a consensus that disaster risk is bound to increase in coming decades on account of climate variability, climate change, and environmental degradation. A UNDP report explains that DRR involves policies for geographical hazards as well as hydro-metrological hazards, but CCA is a concept which is associated only with hydro-metrological hazards (MHA, UNDP, n.d.). Both DRR and CCA involve multiple stakeholders and different perceptions about risks. DRR accommodates all types of risks and hazards, such as economic, political, and financial, to the community affected by disasters. CCA is mainly linked with aims to reduce vulnerability due to climate change/variability risk through adaptation to gradual changes in climate over a long period. The UNESCAP Guidebook 2017 points out that there is a very close connection between DRR and CCA, as they are two separate entities with interrelated aims: disasters erode the gains of development, while deficits in development create risks of disasters and development creates new risks of disasters that compound the existing layers of risk. There is a bidirectional causality between these two concepts, which are individually defined with intertwined goals (MHA, UNDP 2019).

Climate adaptation and disaster risk reduction seek to manage uncertainty by reducing susceptibility and building resilience for communities at risk. Since the disadvantaged sections of the society are most vulnerable, mainstreaming DRR into flagship programmes and working towards development of social infrastructure can help achieve the goal of resilience. According to UNICEF, adaptation to climatic variations and risk reduction fall within the purview of sustainable development goals and should be viewed holistically through that lens. These systems need to permeate to all levels of policy and planning, not just the national level (UNICEF, 2012).<sup>8</sup>

Climate change ensures that risk reduction measures reflect the change in baseline needed for developmental measures. Disasters are often undermined, because the purpose of any disaster-stricken government is immediate relief and rehabilitation (R&R). But the idea of mitigation is lost in this process, and the reconciliation of the idea of R&R into the thematic scheme of development can be achieved by mainstreaming adaptations of changing climatic conditions into the developmental policies. Complex interactions of social, economic, and

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<sup>5</sup> [https://www.unisdr.org/files/8877\\_drrcaapolicypaper.pdf](https://www.unisdr.org/files/8877_drrcaapolicypaper.pdf)

<sup>6</sup> Resilience 'refers to the capacity of an individual, household, population group or system to anticipate, absorb, and recover from hazards and/or effects of climate change and other shocks and stresses without compromising (and potentially enhancing) long term prospects.' (Turnbull et al. 2013)

<sup>7</sup> [https://www.ipcc.ch/site/assets/uploads/2018/03/SREX-Chap1\\_FINAL-1.pdf](https://www.ipcc.ch/site/assets/uploads/2018/03/SREX-Chap1_FINAL-1.pdf)

<sup>8</sup> <https://www.unicef.org/cfs/files/UNICEF-ClimateChange-ResourceManual-lores-c.pdf>

environmental factors operating on different spatial and temporal scales give rise to vulnerability, which, along with unplanned urbanisation, population density, inappropriate land use, and environmental mismanagement, are the major determinants for unpreparedness and huge economic losses during a disaster. Policies need to stress challenges for poverty reduction by increasing the coping capacity of the bottom-most set. These challenges need to be addressed in a holistic and integrated manner at all scales and including all sectors (Thomalla et al., 2006).

## **2.2 Interlinkages between DRR and SDGs**

DRR mainstreaming into CCA and the shift of focus began in 2005, when the Hyogo Framework for Action for DRR was endorsed by 168 countries, including India. This was considered the first global covenant for unambiguously underlining the link between DRR and sustainable development while stating its central priority, that is, building the resilience of nations and communities to disasters in order to substantially reduce disaster losses by 2015. This was followed by its successor, the Sendai Framework which was adopted for 2015-2030 in the third UN World Conference on Disaster Risk Reduction by India along with 187 countries. While these efforts have given the much-needed attention and impetus for action, a more concentrated action is warranted from major economies to realise the planned outcomes and goals.

The Sendai Framework for Disaster Risk Reduction (SFDRR), adopted in March 2015, was in many ways a game changer and continues to be the guiding principle for disaster risk reduction policies and efforts to improve resilience. Conceived to carry forward the disaster reduction efforts initiated through the Hyogo Framework for Action, SFDRR targets to achieve “the substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries” (UNISDR, 2015) by 2030.

Another notable aspect of the Sendai Framework is that it promotes resilience as a priority and highlights the primacy of state action in DRR efforts. While the primary role of the state comes across as a major theme, the framework does not restrict the responsibility to a single actor that is, the state, but encourages responsibility sharing with other stakeholders, including local governments, the private sector, etc. Through this, the framework has gone beyond the traditional disaster risk reduction community to promote broader collaborations. The major drawback of the Hyogo framework was that its implementation failed to invoke efforts where government and other stakeholders could come together to support and complement each other. The guiding principles of Sendai address this very concern, as it calls for an all-inclusive collective action while unambiguously stating the primary role of the state. With infrastructure investment across the world no longer a monopoly of the state, this approach in a way reminds us that the state cannot divorce itself from the responsibility of ensuring a resilient and inclusive developmental pathway. At the same time, it attempts to check unilateralism by emphasising that the risk reduction efforts need to follow “a multi-hazard approach and inclusive risk-informed decision-making process.” The stakeholders involved for the roles and responsibilities of the Sendai Framework are National

Government, Local and Sub National Government, Private Sector and professional organisations, Nongovernmental and Civil Society Organizations (NGOs and CSOs), Education and Research Institutions, Individuals and Households, Media, Regional Organisations including IGOs, the UN, International Organisations (IGOs), and International Financial Institutions (IFIs).

One of the most noteworthy aspects of SFDRR is that the framework synergises risk reduction efforts with sustainable development goals and Post 2015 climate change agreement under the UNFCCC. It is in this context that the Sendai Framework becomes crucial for global efforts to promote creation of resilient infrastructure. Strong parallels can be found between the SDGs and SFDRR with respect to creating resilient infrastructure. This can be seen from Table 1.

**Table 1: Common Goals between SDGs and Sendai Framework**

<b>Common Goals between SDGs and the Sendai Framework</b>	
<b>SDGs Indicators</b>	<b>Sendai Framework</b>
<b>Goal 1: End poverty in all its forms everywhere</b>	
1.5.1 Number of deaths, missing persons, and directly affected persons attributed to disasters per 100,000 populations.	A1 and B1
1.5.2 Direct economic loss attributed to disasters in relation to global gross domestic product (GDP)	C1
1.5.3 Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015-30	E1 E2
1.5.4 Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies	
<b>Goal 11: Make cities and human settlements inclusive, safe, resilient, and sustainable</b>	
11.5.1 Number of deaths, missing persons, and directly affected persons attributed disasters per 100,000 population	A1 and B1
11.5.2 Direct economic loss in relation to global GDP, damage to critical infrastructure and number of disruptions to basic services attributed to disasters	C1, D1, D5 E1
11.b.1 Number of countries that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies 2015-30	E2
11.b.2 Proportion of local government that adopt and implement local disaster risk reduction strategies	
<b>Goal 13: Take urgent action to combat climate change and its impact</b>	
13.1.1 Number of deaths, missing persons, and directly affected persons attributed disasters per 100,000 population	A1 and B1
13.1.2 Number of countries that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies 2015-30	E1 E2
13.1.3 Proportion of local government that adopt and implement local disaster risk reduction strategies	

Source: <https://www.preventionweb.net/sendai-framework/sendai-framework-monitor/common-indicators>

Infrastructure creation is an ineluctable component of economic growth and development. The success of any economy is heavily dependent on its infrastructure network and assets – existing and planned. The issue becomes more important in the current era of climate responsible action and sustainable development. The infrastructure creation must account for expected impacts of climate change, including extreme weather events. The increased frequency of extreme weather events increases the economic risks, as they could destroy and damage the infrastructure or impede their operations, affecting essential services. Ignoring the ‘resilience’ aspect in infrastructure management and investment means additional vulnerabilities and serious negative impacts on efforts towards sustainable development and a low carbon future. “Just as today’s development decisions will influence tomorrow’s climate, so too will tomorrow’s climate influence the success of today’s development decisions.” (ADB, 2005).

As Table 2 shows, it is clear that there has been a sharp reduction in indicators like mortality, affected people, and damage to critical infrastructure, but what has not been controlled is the growing economic losses. Also, there has been adaptation to policies at national level, but implementation of DRR strategies at local level is still weak. The increasing economic losses can be controlled by adopting preventive measures of building resilient infrastructure and bringing catastrophe financial tools to the market space for the huge loss wrought by disasters.

**Table 2: Review of the Sendai Framework – Global Review**

Target A-D	Baseline 2005-2014	Change?	Decade 2010-2019	Previous Year 2018	Change?	Selected Year 2019								
<b>MORTALITY</b> A-1: Number of deaths and missing persons attributed to disasters, per 100,000 population	1.77	-56.53%	0.77	0.45	-28.03%	0.32								
<b>PEOPLE AFFECTED</b> B-1: Number of directly affected people attributed to disasters, per 100,000 population	2,893	-41.68%	1,687.21	2,438.05	-64.88%	856.33								
<b>ECONOMIC LOSS</b> C-1: Direct economic loss attributed to disasters in relation to global gross domestic product	3.6	+4553.12%	167.69	2.67	-99.92%	2.26e-3								
<b>CRITICAL INFRASTRUCTURE &amp; SERVICES</b> D-1: Damage to critical infrastructure attributed to disasters	20.7	-16.68%	17.3	20.25	-96.24%	0.76								
D-5: Number of disruptions to basic services attributed to disasters (compound indicator)	24,206.8	-25.4%	18,076.3	5.79	93.7%	0.36								
<b>DISASTER RISK REDUCTION STRATEGIES</b> E1: National average score for the adoption and implementation of national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015-2030	0.45 35/195 <b>Countries</b>	0.57 46/195 <b>Countries</b>	0.74 42/195 <b>Countries</b>	<table border="1"> <caption>National Level DRR strategies</caption> <thead> <tr> <th>Year</th> <th>Implementation Score</th> </tr> </thead> <tbody> <tr> <td>2015</td> <td>0.45</td> </tr> <tr> <td>2018</td> <td>0.57</td> </tr> <tr> <td>2019</td> <td>0.74</td> </tr> </tbody> </table>			Year	Implementation Score	2015	0.45	2018	0.57	2019	0.74
Year	Implementation Score													
2015	0.45													
2018	0.57													
2019	0.74													
E2: Percentage of local governments that have adopted and implemented local disaster risk reduction strategies in line with national strategies	66.02% 34/195 <b>Countries</b>	56.48% 43/195 <b>Countries</b>	62.05% 40/195 <b>Countries</b>	<table border="1"> <caption>Local govt implementation</caption> <thead> <tr> <th>Year</th> <th>Local govt implementation (%)</th> </tr> </thead> <tbody> <tr> <td>2015</td> <td>66.02%</td> </tr> <tr> <td>2018</td> <td>56.48%</td> </tr> <tr> <td>2019</td> <td>62.05%</td> </tr> </tbody> </table>			Year	Local govt implementation (%)	2015	66.02%	2018	56.48%	2019	62.05%
Year	Local govt implementation (%)													
2015	66.02%													
2018	56.48%													
2019	62.05%													

Source: <https://sendaimonitor.undrr.org/analytics/global-targets/15>

### 3. Disaster risk financing in India

A combination of national experience, international interactions, and global initiatives through the 1990s to 2005 acted as a catalyst for a shift in India's perspective on disaster management. This shift emphasised legislation, policy, and prevention and mitigation. After the second Asian Ministerial Conference on DRR, the Government of India highlighted a 10-point roadmap on DRR, which concisely encompasses the issues, tools, and approaches towards critical challenges in achieving SDGs for a resilient structure. The Prime Minister enunciated the agenda which was to be incorporated with NDMP.

1. All development sectors must imbibe the principles of disaster risk management.
2. Risk coverage must include all, starting from poor households to SMEs to multinational corporations to nation states.
3. Women's leadership and greater involvement should be central to disaster risk management.
4. Invest in risk mapping globally to improve global understanding of nature and disaster risks.
5. Leverage technology to enhance the efficiency of disaster risk management efforts.<sup>9</sup>
6. Develop a network of universities to work on disaster-related issues.
7. Utilise the opportunities provided by social media and mobile technologies for disaster risk reduction.
8. Build on local capacity and initiative to enhance disaster risk reduction.
9. Make use of every opportunity to learn from disasters and, to achieve that, there must be studies on the lessons after every disaster.
10. Bring about greater cohesion in international response to disasters.<sup>10</sup>

#### 3.1 Shifts in approaches towards DRR

*Linking resilient infrastructure and global efforts for disaster risk reduction – Relevance of the Sendai Framework and India DRR strategies*

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<sup>9</sup> [https://www.preventionweb.net/files/51313\\_51304pmagenda10paper.pdf](https://www.preventionweb.net/files/51313_51304pmagenda10paper.pdf)

<sup>10</sup> India's Disaster Response Force is based in the Ministry of Home Affairs. India considers disasters to be an issue of internal security as well. India is also part of the Coalition of Disaster Resilient Infrastructure, which is a 'global partnership aims to promote resilience of new and existing infrastructure systems' Link: <https://cdri.world/>

**Table 3: Sendai Global Targets, SDGs, COP21, and Relevance in the Indian Case**

S. No	Sendai – Global Targets	Sustainable Development Goals	COP21 – Paris Agreement on Climate Change	India’s National Initiatives Relevant to DRR
1	Substantially reduce global disaster mortality by 2030 (2020-2030 compared to 2005-2015)	SDG 1, 2, 11, 13	<ul style="list-style-type: none"> <li>•Changes in the pattern of extreme events require enhanced disaster resilience and adaptation</li> <li>•Addressing GACC risks is crucial for eliminating poverty and reducing economic losses from disasters</li> </ul>	Multiple schemes and initiatives for DRR, economic development, GACC migration, and adaptation.
2	Substantially reduce the number of disaster-affected people by 2030 (2020-2030 compared to 2005-2015)	SDG 1, 11, 13	Stresses the need for accelerated action to build resilience through risk-sensitive planning and implementation of DRR	<ul style="list-style-type: none"> <li>• Allocation of resources and funds for disaster prevention and to develop capacities for DRR</li> <li>• Strengthening of the DRR at all levels</li> <li>• Promoting disaster resilient development</li> <li>• Mainstreaming DRR and adaptation to GACC in development</li> </ul>
3	Substantially reduce direct disaster economic loss	SDG 1, 11	The Paris Agreement aims to hold global average temperature increase to well below 2°C above pre-industrial levels and to pursue efforts to limit it to 1.5°C, recognising that this would significantly reduce the risks and impacts of climate change	National commitment to DRR evident from the PM Ten Point Agenda for DRR National commitments for migration of and adaptation to GACC as per Intended Nationally Determined Contributions (INDC)
4	Substantially reduce damage to crucial infrastructure and disruption of basic services (health, education, etc.)	SDG 1, 4, 9, 11	Global adaptation goals for enhancing adaptive capacity, strengthening resilience, and reducing vulnerability to ensure adequate adaptation response in the context of the global temperature goal	Enhance the resilience of national health systems by integrating DRR into primary, secondary, and tertiary health care, and by promoting and enhancing training capacities in the field of disaster medicine. The substantial reduction of disaster damage to critical infrastructure and disruption of basic services is essential to ensure healthy lives and promote well-being.

<b>S. No</b>	<b>Sendai – Global Targets</b>	<b>Sustainable Development Goals</b>	<b>COP21 – Paris Agreement on Climate Change</b>	<b>India’s National Initiatives Relevant to DRR</b>
5	Substantially increase disaster risk reduction strategies	SDG 1, 3, 6, 11, 13	Addressing GACC risks that are crucial for reducing economic losses from disasters along with a well-integrated approach to adaptation, sustainable development, environmental management, and disaster risk reduction	• NAPCC for migration of and adaptation to GACC • National Mission on Sustainable Agriculture (NMSA) • National Initiative on Climate Resilient Agriculture (NICRA)
6	Substantially increase international cooperation to complement national actions	Close international cooperation to achieve SDGs	Firm commitments by countries to the global response to GACC based on INDCs and international cooperation for achieving the COP21 goals	India is a pro-active member in the implementation of the Post-2015 and other global frameworks
7	Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments	SDG 3, 13	Emphasis on improving early warning systems, risk assessment, and management	National investments to improve the early warning and information systems in different sectors and for multi-hazards.

Source: <https://ndma.gov.in/sites/default/files/PDF/ndmp-2019.pdf>



Table 3 shows India's approach in linking resilient infrastructure in its DRR strategies. Though climate adaptation and disaster risk reduction are the most compelling arguments for scaling up investment in resilient infrastructure, it should be also noted that such efforts bring in numerous co-benefits. They help create resilience against catastrophic events, but also diffuse benefits across sectors at macroeconomic level. For instance, protecting coastal regions, towns, and business districts with flood protection infrastructure will foster economic activity, long-term planning, and capital investments. It will disseminate benefits which are not related to extreme weather events. For example, the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) addresses the issue of rural livelihoods for the section of the society below poverty: it reduces the impact of catastrophic events which would have emerged due to lack of physical access to structural instruments such as ponds, embankments, and roads, among others. For example, in Odisha, the evacuation shelters are used as shelters during floods or cyclones and as schools and government buildings otherwise. Flood protection infrastructure can create source of reliable water supply and hydroelectricity. Installation of dedicated irrigation systems for overcoming the water scarcity during droughts will eventually help farmers in increasing productivity and output, while at the same time reducing soil erosion and deforestation by optimising inefficient farming practices. DRR techniques are wholesome for an overall evolution of the society. Efforts in this direction can be observed at national levels also.

### *3.1.1 Structure of Disaster Financing in India*

Disaster management is one of the most rapidly evolving topics in the Indian public policy realm. With rising frequency of large-scale natural hazard events, the issue has rightfully caught the attention of policymakers. The biggest turnaround came with the establishment of the Disaster Management Act of 2005. Currently, disaster management is one of the few areas which have a robust institutional infrastructure that integrates both government and non-governmental stakeholders. While much progress has been made in most of the sub domains, disaster risk financing is still centred on post disaster relief and recovery. Much of the funding in this respect comes from the National Disaster Response Fund (NDRF) and the State Disaster Response Fund (SDRF). Here, states are the primary agents responding to the disasters, while the union government plays a supportive role.

Much of the funding comes from the union government through general budgetary resources. Under the current arrangement, 75 per cent of SDRF allocation for general category States/UTs and 90 per cent for special category States/UTs is provided by the union government. SDRF is used only for meeting the expenditure for immediate relief activities and the annual contribution from the union government is released in two equal instalments (as per the recommendation of the Finance Commission).<sup>11</sup> NDRF is largely supplementary

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<sup>11</sup> The Fifteenth Finance Commission in its report has stated that "XVFC has recommended six earmarked allocations for a total amount of Rs. 11,950 crore for certain priority areas, namely, two under the NDRF (Expansion and Modernisation of Fire Services and Resettlement of Displaced People affected by Erosion) and four under the NDMF (Catalytic Assistance to Twelve Most Drought-prone States, Managing Seismic and Landslide Risks in Ten Hill States, Reducing the Risk of Urban Flooding in Seven Most Populous

in nature and is made available when the scale of disaster is severe and adequate funds are not available in the SDRF. The quantum of assistance from NDRF is “subject to adjustment of 50 per cent of the balance in SDRF as on April 1 of the current financial year” (Standing Committee on Finance: Sixteenth Lok Sabha, 2019).<sup>12</sup>

Evolved out of recommendations of finance commissions, these remain the primary tool for disaster financing in India. Though the scheme has evolved over the period, it remains relief centric. The initial thoughts in this direction came from the Second Finance Commission which introduced the margin money scheme – a separate fund to states decided on the average annual expenditure of the previous decade (Kamepalli, 2019). Central assistance will come into the picture if the states exceed the margins. This largely remained the basic structure until the Ninth Finance Commission, which recommended an alternate system. Accordingly, a calamity relief fund was set up in each state, with 75 per cent of funds from the union and 25 per cent from the state (Kamepalli, 2019). Interestingly, the commission inquired into the feasibility of a national insurance fund and believed it was unviable given the operational difficulties. The National Fund for Calamity Relief, a corpus fund recommended by the Tenth Finance Commission and the National Calamity Contingency Fund recommended by Eleventh Finance Commission were the subsequent changes brought in, until the DM Act of 2005 brought in the current arrangement.

The most striking aspect of these arrangements is that the risk financing strategy is still largely dominated by relief and recovery. Additionally, the quantum of funds depends on past expenditure and not the vulnerability of the state. This is of concern, since different states have different vulnerabilities and hence different requirements for funding. The delay in the assessment process and uniform norms of funds utilisation are other commonly raised concerns.

As recovery and relief becomes the focus, disaster mitigation and resilience building efforts tend to remain dispersed and uncoordinated. The current scope of NDRF does not include reconstruction and mitigation. The National Disaster Mitigation Fund envisaged by the Disaster Management Act is yet to be formed. Though some states like Kerala<sup>13</sup> have set up a State Disaster Mitigation Fund (SDMF), a similar approach has not been adopted at the central level. The view is that the purpose of mitigation is currently served by centrally sponsored schemes/Central Sector (CS) Schemes such as the Pradhan Mantri Krishi Sinchai Yojana, the Krishonnati Yojana, the National Mission on Sustainable Agriculture, the MGNREGA, major irrigation projects, Namami Gange-National Ganga Plan, River Basin Management, the National River Conservation Plan, and Water Resource Management (PIB, 2016). Additionally, the Ministry of Finance (MoF) has made a provision of 10 per cent of total outlay for all CSS schemes except those emanating from legislation (PIB, 2016). The flexi funds can be used by the states to:

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Cities and Mitigation Measures to Prevent Erosion” Link:  
<https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1693868>

<sup>12</sup> [http://164.100.47.193/lssccommittee/Finance/16\\_Finance\\_71.pdf](http://164.100.47.193/lssccommittee/Finance/16_Finance_71.pdf)

<sup>13</sup> <http://sdma.kerala.gov.in/wp-content/uploads/2018/12/SDMF-Kerala.pdf>

- a) “Provide flexibility to States to meet local needs and requirements within the overall objective of each programme or scheme;
- b) Pilot innovations and improve efficiency within the overall objective of the scheme and its expected outcomes;
- c) Undertake mitigation/restoration activities in case of natural calamities in the sector covered by the CSS” (NDMA, 2018)

A few targeted schemes which differ from the above approach also exist. The major ones in this regard are schemes like strengthening of Fire and Emergency Services by the Ministry of Home Affairs; financial assistance to ATIs and other training institutions for disaster management and integrated coastal zone management programme of the Ministry of Environment, Forest and Climate Change; flood management and flood forecasting programmes of the Ministry of Water Resources; disaster management support programme by the Department of Space; project on Tsunami and Storm Surge Warning System by the Ministry of Earth Sciences, and the National Cyclone Risk Mitigation Project with World Bank support.

### *3.1.2 National Cyclone Risk Mitigation Project (NCRMP)*

Initiated by the Government of India in 2011, NCRMP addresses the risk posed by cyclones to Indian coastal states. The overall objective of the project was to undertake suitable structural and non-structural measures to mitigate the effects of cyclones in the coastal areas of India. This project is carried out under the supervision of the Ministry of Home Affairs and was implemented by the National Disaster Management Authority in coordination with participating authorities such as the State Government and National Institute for Disaster Management (NIDM).

Phase I of the project was implemented in two states – Andhra Pradesh and Odisha. Initially, under the scheme, a total of Rs. 1496.71 crore was approved. The amount was subsequently revised and more funds were allocated to accommodate increased demand owing to cyclone “Phailin” and additional requests from state governments. The total project cost was finally revised to Rs. 2541.60 crore with Central share of Rs. 1985.68 crore and state share of Rs. 555.92 crore (NCRMP, n.d.). Phase II saw addition of new states, namely Goa, Gujarat, Karnataka, Kerala, Maharashtra, and West Bengal. The approved cost of Phase II stands at Rs. 2361.35 crore, with Central share of Rs. 1881.20 crore and a state share of Rs. 480.15 crore. The central bank share is financed by the World Bank.

The project has identified the 13 cyclone prone states and classified them into high and low vulnerability based on parameters like the frequency of occurrence of cyclone, size of population, and the existing institutional mechanism for disaster management (NCRMP, n.d.). The scheme has four components. Under the first component, the scheme builds an early warning dissemination system and promoted capacity building of local communities. Under the second component, the scheme focused on cyclone risk mitigation infrastructure. Improving access to emergency shelters, investment in multipurpose cyclone shelters,

upgrading of existing roads and bridges suitable for evacuation, drainage improvement, etc. were the major activities taken up under this component. The third component focused on providing technical assistance for cyclone hazard mitigation, along with capacity building and knowledge creation, and the last component dealt with project management and implementation support. While the first, third, and fourth components were fully funded by the central government through World Bank assistance, the second component was divided between the central and state governments in the ratio of 75:25 (NCRMP, n.d.).

The project has certainly contributed to improved resilience through the implementation of its various subcomponents discussed above. The impressive management of cyclone Phailin in 2013 is evidence of the improved resilience. The event saw successful evacuation of more than 1 million people from low-lying coastal areas, bringing down the severe loss of human life that used to occur in similar events. The project has been instrumental in creating much needed critical infrastructure required in the event of cyclone like shelters, evacuation roads, and bridges. While much progress has been made in Odisha, the progress in other states was relatively slower. Delay in awarding of contracts and funds utilisation has been reported at various stages of the project. For example, the World Bank Mission Report for Phase II in 2017<sup>14</sup> rated the overall implementation progress as moderately unsatisfactory, primarily due to negligible rate of progress in Kerala and Maharashtra at that time (World Bank, 2017). As per the latest monitoring and evaluation reports, all the states have initiated tenders and works are underway to create shelters, embankments, underground cabling, etc. Meanwhile, the Phase I states, Odisha and Andhra Pradesh, continue to enhance their capacity and as the recent experience from cyclone Fani shows, the programme had a positive impact, especially with respect to successful evacuation and prevention of loss of life.

### *3.1.3 Flood management and flood forecasting programmes of the Ministry of Water Resources*

Devastation by floods is a common and recurrent phenomenon in India. According to the flood forecasting monitoring directorate of the Central Water Commission, the cost of damage to crops, houses, and public utilities has increased by a massive amount from Rs. 52 crore in 1953 to Rs. 5675 crore in 2016 (CWC, 2018).<sup>15</sup> The financial assistance to states largely came from centrally sponsored schemes where assistance was provided in flood management and anti-erosion works for critical reaches (MoWR, 2018). The Flood Management Programme (FMP) is a state sector scheme launched during the Eleventh Plan and continued during the Twelfth Plan. The programme provides central assistance to states in financing the resilience activities to reduce the losses from floods. The programme included work related to river management, flood control, anti-erosion, drainage development, flood proofing works, restoration of damaged flood management works, and anti-sea erosion. In the first phase of the programme, the states with special status (North Eastern States, Sikkim, Himachal Pradesh, Jammu & Kashmir, and Uttarakhand) received 90

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<sup>14</sup> <https://ncrmp.gov.in/wp-content/uploads/2013/04/WBPH-II.pdf>

<sup>15</sup> Flood Forecasting Monitoring Directorate, Central Water Commission Report – 10 May 2018, [http://www.indiaenvironmentportal.org.in/files/file/statewise\\_flood\\_data\\_damage\\_statistics.pdf](http://www.indiaenvironmentportal.org.in/files/file/statewise_flood_data_damage_statistics.pdf)

per cent of the allocation from the centre and for the other states, the central share stood at 75 per cent and the rest came from state funding. For the restoration of damaged flood works, the costs were shared 90:10 between the centre and the states. In the second phase of the programme, the share of allocation from the centre was reduced. During this phase, the share of central funds was brought down to 70 per cent and 50 per cent for special category states and others, respectively (MoWR, 2018).<sup>16</sup> As of August 2018, a total of 522 projects costing Rs. 13238.37 crore were approved and included under FMP (PIB, 2018). During the Eleventh Plan, 420 projects with an estimated cost of Rs. 7857.08 crore were approved, while during the Twelfth Plan 102 projects with an estimated cost of Rs. 5381.29 crore were approved under the programme.

As flood management comes under the responsibility of the states, the schemes are planned, designed, and implemented by state governments with limited role for the union government. The results have been mixed, with heavy criticisms arising often with respect to implementation of the programme. According to the Report of the Comptroller and Auditor General of India (CAG, 2017), the schemes for Flood Control and Flood Forecasting have often experienced inordinate delays and implementation problems. It has been pointed out that the excessive time gap between detailed project reports and actual funding has often made the technical designs obsolete. Delayed release of funds, diversion of project funds, not taking up flood management works in an integrated manner across the river or tributary or along its major segments, non-availability of scientific assessment of flood prone areas, delays in enactment of Flood Plain Zoning Act, etc. were some of the drawbacks pointed out (CAG, 2017). It was reported that during the nine years of the XI and XII Plan periods, only 57 per cent of approved works were completed (CAG, 2017). CAG report also points out serious faults with respect to flood forecasting and implementation of the recommendations of the Review and Oversight Committee for Flood Control Measures. Huge delays in completion of long-term projects in highly flood prone areas like Assam, North Bihar, and Eastern Uttar Pradesh, inadequate upkeep of dams, emergency action plans, and hydrological studies were also among the issues pointed out.

#### *3.1.4 Integrated Coastal Zone Management Programme*

In July 2004, the Ministry of Environment and Forests (MoEF) constituted an expert committee under the chairmanship of Professor M S Swaminathan, which carried out a comprehensive review of the Coastal Zone and its vulnerability to disaster. Based on the recommendations of the expert committee, MoEF made efforts to implement Integrated Coastal Zone Management (ICZM) at the national and state level by establishing a Society of Integrated Coastal Management (SICOM). The programme has four components, namely, (i) National Coastal Management Programme; (ii) ICZM-West Bengal; (iii) ICZM-Orissa; and (iv) ICZM-Gujarat (PIB, 2015).<sup>17</sup> The ICZM framework is a paradigm shift from the traditional approach of sectoral management of the coastal resources to a more comprehensive, integrated approach aimed at better governance and management (World

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<sup>16</sup> <http://mowr.gov.in/sites/default/files/fmp-11th-plan5817362359.pdf>

<sup>17</sup> <http://pib.nic.in/newsite/PrintRelease.aspx?relid=115996>

Bank, 2019). The major objective of the programme is to assist the Government of India in building national capacity for implementation of comprehensive coastal management in the country. This includes a pilot application of integrated coastal zone management approach in states of Gujarat, Odisha, and West Bengal (World Bank, 2019).<sup>18</sup> The project also undertakes demarcation of hazard zones, mapping of coastal ecosystems, and supporting the establishment of a national institute for Sustainable Coastal Zone Management. The project is also characterised by targeted state specific objectives with concentrated action in certain areas. For example, the Gulf of Kutch in Gujarat and Paradip-Dhamra and Gopalpur-Chilika in Odisha are a few such areas. In West Bengal, the project aims to stop environmental degradation of coastal areas, especially of Digha-Sankarpur area and to regulate the non-functioning of solid waste management and sewage treatment systems (ICZMP WB, 2012).<sup>19</sup> Along with finance and credit, the World Bank also supports the programme with international expertise, sharing of knowledge, and supporting demonstration of ICZM processes and benefits (ICZMP WB, 2012).<sup>20</sup>

While the programme brought about notable developments, the progress was observed to be not uniform in all states. For example, while State Project Management Units were developed in all the participating states, it became a permanent feature only in Odisha. Similarly, the procurement process and pilot implementation process started in West Bengal only by 2015, while it was done much earlier in the other two states (World Bank, 2015).<sup>21</sup> The fund utilisation has been improving steadily over the period. According to the audit reports, the fund utilisation under the project has improved from 45 per cent in 2012 to almost 82 per cent in 2016.

### *3.1.5 Disaster management support programme, Department of Space*

The Disaster Management Support (DMS) programme aims to utilise the space research capacity of the country for disaster management and mitigation. Through the programme, satellite communication and navigation systems are utilised in a better way to support disaster management and improved risk awareness. DMS supports states and agencies involved in disaster management and risk reduction by providing real-time data derived from satellites and aerial survey data. The information provided includes impact of certain natural disasters, such as flood, cyclone, earthquake, and landslide; assessment of the severity of agricultural drought; and areas affected by forest fires.<sup>22</sup> Additionally it also supports emergency communication during natural disasters through satellite based fixed networks as well as mobile devices. Information dissemination through portals like Bhuvan, MOSDAC, and National Database for Emergency Management, etc. are some of the other notable initiatives.

The programme has also been contributing much to forecasting and risk reduction efforts. Preparation of flood hazard mapping for rivers using historical data, establishment of early

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<sup>18</sup> <http://projects.worldbank.org/P097985/integrated-coastal-zone-management?lang=en>

<sup>19</sup> [http://www.iczmpwb.org/main/iczm\\_project\\_profile.php](http://www.iczmpwb.org/main/iczm_project_profile.php)

<sup>20</sup> [http://www.iczmpwb.org/main/world\\_bank\\_iczm\\_project.php](http://www.iczmpwb.org/main/world_bank_iczm_project.php)

<sup>21</sup> [http://sicom.nic.in/sites/default/files/Aide\\_memo\\_nov\\_15.pdf](http://sicom.nic.in/sites/default/files/Aide_memo_nov_15.pdf)

<sup>22</sup> <https://idsa.in/resources/parliament/Q575DISASTERMANAGEMENTSUPPORTPROGRAMME>

warning systems for flood using hydrological modelling of satellite and ground based hydro-meteorological inputs and digital elevation model for selected river reaches in flood prone areas like Andhra Pradesh (Godavari), Odisha (Mahanadi), and Assam (Brahmaputra) are some efforts in this direction.<sup>23</sup> ISRO is also part of many international disaster management efforts. For example, it is a signatory of the International Charter on “Space and Major Disasters” and provides support to other authorised users of the charter.<sup>24</sup> It also supports disaster management efforts of UNESCAP and APRSAF initiative Sentinel Asia in the spirit of regional cooperation.<sup>25</sup>

### *3.1.6 Project on Tsunami and Storm Surge Warning System*

The Indian Tsunami Early Warning System (ITEWS) was established after the Indian Ocean tsunami that resulted in the loss of lives of more than 230,000 people across fourteen countries and economic loss worth US\$ 19.9 billion (Down to Earth, 2018). Established in 2007, ITEWS is operated by the Indian National Centre for Ocean Information Services (INCOIS), Hyderabad and is an integrated effort of different organisations, including the Department of Space, Department of Science and Technology, the Council of Scientific and Industrial Research, Survey of India, and National Institute of Ocean Technology (UN, n.d.). It is operational round the clock, and the ITEW system helps to detect, locate, and determine the magnitude of earthquakes in the Indian Ocean Basin that could potentially cause tsunamis and provide timely advisories (Kumar et al., 2010). INCOIS holds tsunami mock drills to assess the efficiency of the system in place and the readiness of the disaster management programme and the local community to handle any emergency at regular intervals (Somasekhar, 2016). According to the reports, the system is performing well as per international standards and is highly successful in giving early warnings. One such instance was the tsunami that occurred on 11 April 2012, off the coast of Sumatra. The event proved the end-to-end performance of capabilities of this warning system, as it was not only able to detect the earthquake timely and follow the standard operating procedure, but also used its capabilities to assess the threat level accurately (Kumar et al., 2012). It was noted that the system’s efficient performance helped to avoid false alarms and unnecessary public evacuations in the mainland part of the India region (Kumar et al., 2012).<sup>26</sup>

## **4. Financial protection against natural disasters – notable examples from countries**

This section introduces some of the policy steps adopted all around the world for financing disasters. It discusses different insurance and reinsurance programmes that were implemented globally and helped to create a layer of resilience over recurrent disasters. These programmes were picked from OECD’s report on disaster risk financing.<sup>27</sup>

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<sup>23</sup> <https://www.isro.gov.in/floods-new>

<sup>24</sup> <https://disasterscharter.org/documents/10180/14622/18thAnnualReport.pdf>

<sup>25</sup> Disclaimer: Financial Analysis of this scheme was a constraint due to unavailability of data on its implementation.

<sup>26</sup> Disclaimer: Financial Analysis of this scheme was a constraint due to unavailability of data on its implementation.

<sup>27</sup> <https://www.oecd.org/finance/disaster-risk-financing.htm>



#### 4.1 State sponsored insurance programmes

State sponsored insurance programmes come into the picture usually when the private market is either underdeveloped or unwilling to provide sufficient coverage for some or all hazards. This could be due to a variety of reasons specific to locale or country (OECD, 2015). The level of engagement of private players varies from case to case. The scope of schemes also varies. While some countries have programmes that cover all major hazards, most programmes target a smaller set of threats. The insurance programme by Consorcio de Compensacion de Seguros (CCS) of **Spain** is a notable example of the first kind. CCS is a state-owned enterprise and cooperates with private industry in the operation of a system to provide coverage for natural catastrophe and manmade events (OECD, 2015). In Spain, catastrophe insurance is compulsory and the whole country has uniform premium rates. The major difference of the programme from similar schemes in other countries is mostly with respect to reinsurance laws.

The second type, where coverage is limited to a subset of hazards, is more common and widespread. Other notable examples include the Turkish Catastrophe Insurance Pool (TCIP) of **Turkey**, The National Flood Insurance Program and California Earthquake Authority of the **US**, and residential storm and flood coverage in **South Korea**. The Compulsory Earthquake Insurance (CEI) of Turkey is managed by the **Turkish Catastrophe Insurance Pool**, a non-profit legal entity built through public-private collaboration. The earthquake insurance scheme is compulsory in Turkey and is applicable to all residential buildings within municipal boundaries. Established in 2000, the scheme sought to privatise part of the potential risks from earthquakes, reducing the financial liability of the government. This is largely achieved by exporting the risk to international reinsurance and capital markets. The government support for the pool comes in the form of reinsurance, premium subsidies, and technical and organisational support. The scheme provides cover to homeowners against losses due to earthquakes and against risks of fire, explosion, landslides, and tsunami that could follow a seismic event. To ensure affordability, there is a cap on maximum indemnification that is reviewed periodically. Additional coverage may be purchased from non-life insurance companies if wished (OECD, 2015). While growth and penetration were slow in the initial years, the programme has been registering an impressive growth in recent years and has reported a penetration rate of 43 per cent nationally as of 2016. The programme has garnered much praise over the years for its low-cost structure and well-designed public private partnership.

Established in 1968, **The National Flood Insurance Program (NFIP)** in the **US** came up as a response to private insurance companies, when they failed to provide adequate cover in vulnerable areas owing to potential adverse selection (Lamond and Penning-Rowell, 2014). The programme aims to provide affordable insurance to reduce the impact of flooding on private and public structures (FEMA, 2019a) and reduce risk through flood management practices. The NFIP is managed by the Federal Emergency Management Agency (FEMA), through its subcomponent the Federal Insurance and Mitigation Administration (FIMA) (CRS, 2019). The scheme is a classic example of a state-backed insurance programme where



affordability is largely achieved by subsidisation. The programme also seeks to encourage floodplain management activities to reduce and limit future damage. The flood insurance rates are decided according to risk mapping undertaken by the agency. The programme is run on a community basis<sup>28</sup> and not on an individual basis. The property owners can buy flood insurance only if the community participates in NFIP. While the decision of communities to join NFIP is voluntary, not joining would lead to loss of federal grants, loans, disaster assistance, and federal mortgage insurance for the acquisition or construction of structures located in the floodplain as shown on the NFIP maps (FEMA, 2019b). By agreeing to join NFIP, the communities must adopt minimum regulatory standards prescribed by NFIP to manage flood hazard areas. The rationale put forth by FEMA for having the insurance on a community basis is that communities may be able to better regulate and coordinate building practices or establish construction priorities that individuals cannot. To reduce the flood damage, everybody in the community should collectively follow hazard mitigation efforts (FEMA, 2011). As FEMA (2011) notes, “Without community oversight of building activities in the floodplain, the best efforts of some to reduce future flood losses could be undermined or nullified by the careless building of others. Unless the community as a whole is practicing adequate flood hazard mitigation, the potential for loss will not be reduced sufficiently to affect disaster relief costs.” Such an approach could counter the information asymmetry problem that could arise if the focal point is an individual. Even if information is there about flood risks and actions required to mitigate the efforts, incentivising private action is yet another challenge. Though one of the oldest insurance programmes, NFIP has run into issues several times and has been revamped multiple times. Controlling the cost continues to be a major issue. According to Lamond and Penning-Rowsell (2014), “political pressure and legal challenges have limited actuarial pricing and the scheme has not prevented high-risk development”. The deficiency is partly because the scheme also covers hurricane-induced storm surge in addition to riverine flooding. While NFIP has caused a high percentage of local authorities to take up floodplain management, some have also raised questions regarding the extent to which it has inhibited construction activity in flood-hazard areas and the impact of federal disaster relief costs (McAneney et al., 2015). The rise in damage from areas outside the official hazard zones and less affordable private markets are the other major issues FEMA faces. Though FEMA is a federal programme, the catastrophe insurance market is generally controlled by individual states (McAneney et al., 2015).

## **4.2 Industry led insurance programmes**

While the programmes discussed above are state sponsored or led by state agencies in partnership with private players, there are also many economies where disaster losses are covered solely by private insurers. The risk coverage and penetration often depend on the level of risk and the level of insurance penetration in the society. In countries that have a low level of risk, disaster insurance is not often available as a distinct product but can be bought

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<sup>28</sup> “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).”

at an additional premium. **Malaysia** is an example where insurance against natural perils is offered as an add-on to property insurance, fire and motor insurance, etc. (OECD, 2015). **Germany** is another such economy where private insurance provides varying levels of risk coverage and penetration (OECD, 2015). German private insurance companies usually provide catastrophe insurance as supplementary products for building or content insurance. Participation is voluntary and premiums could differ based on the vulnerability and risk profile of the area, as in the case of flood insurance. However, it has been reported that market penetration remains low (OECD, 2015), possibly due to issues of adverse selection. **Australia** is another market with an established private insurance industry. The disaster risks are generally covered as a part of property and contents insurance and cover natural perils like fire, windstorms, and flooding in some cases. The insurance industry's approach to natural perils had come under extensive scrutiny around 2011-12. The preceding year, 2010-11, saw a series of natural disasters in Australia, causing huge economic losses. The Queensland flood, Cyclone Yasi, and Victorian bush fires caused extensive economic losses and damage. The event brought to public notice the issue of underinsurance for natural perils and widespread absence of flood insurance. The event also brought into light the ability of the insurers' then current arrangement to deal with a high level of concentrated losses in a short period. The National Disaster Insurance Review (NDIR) was set up in response to these concerns and was followed by several policy measures to address the drawbacks. For example, in 2012, policy changes were initiated to raise service standards and claim management in the insurance industry. Following the changes in the general insurance code of practice, companies are now required to resolve claims from catastrophes in the same time frame as other claims, unlike the earlier scenarios where deviations were allowed in extreme event cases (OECD, 2015).

Table 4 summarises the key points made with respect to the state sponsored programmes and Table 5 presents details of the regional risk pools.

**Table 4: Notable examples from different countries**

Country	Programme	Key details
<b>State sponsored insurance programmes</b> – When the private market is underdeveloped and unwilling to provide sufficient coverage, there is a shift to state sponsored programmes.		
Spain	Insurance programme by Consorcio de Compensacion de Seguros (CSS)	CSS, a state-owned enterprise, cooperates with the private insurance industry to provide coverage against natural catastrophes and manmade events (OECD, 2015)
Turkey	Compulsory Earthquake Insurance (CEI)	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 programme. 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.
USA	National Flood Insurance Program (NFIP)	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 <sup>29</sup> 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.
<b>Reinsurance programmes and catastrophe pools</b>		
France	Caisse Centrale de Réassurance (CCR)	CCR is a public sector reinsurer that provides insurers cover against natural catastrophes and uninsurable risks. While bringing in stability, it also comes with state guarantee in order to avoid any failure of the system. Additionally, CCR does not have a monopoly by law, thus offering flexibility to the primary insurers in choosing their risk management strategy.
UK	Flood Re	Through a collaboration of the government and private industry, this provides affordable insurance for properties facing flooding risk through reinsurance support to industry. It was conceived as a transient solution and is due to run until 2039.
Florida, USA	Florida Hurricane Catastrophe Fund (FHCF)	Structured as a tax-exempt state trust fund, FHCF provides reinsurance coverage to insurers. It reimburses part of the losses to residential property insurers through the reinsurance programme at a cost less than market rates in case of a hurricane loss.
California, USA	California Earthquake Authority (CEA)	This is a not-for-profit, publicly managed, and privately funded entity that provides earthquake insurance policies (CEA, 2019). The policyholder premiums, along with insurers' contribution and own investment returns, form the base of CEA finances. It also invests in mitigation by providing financial incentives.

Source: Ray et al. (2019)

<sup>29</sup> “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).

### 4.3 Reinsurance programmes and catastrophe pools

Economic losses owing to a disaster can be very huge. The large-scale events can cause economic disruption well beyond the ability of society to cope. As we saw before, a well-crafted insurance scheme can be an excellent line of defence in such a scenario, providing pay-outs and limiting the economic disruption. Reinsurance is another key mechanism in risk financing which helps the economy to absorb economic shocks.

An insurer of insurers, reinsurance is critical to any disaster risk management strategy. An ex-ante measure, it provides a predictable stream of funds in the event of a loss. Here the risk itself gets insured, reducing the fiscal burden of both the government and insurance companies. Reinsurers often work on a global scale and diversify their risk by taking on board a mix of insurable risk (GRF, 2014). As most primary insurers have their business concentrated in certain markets or products, buying reinsurance allows them to reduce their exposure to peak losses and risk concentration (GRF, 2014). The Global Reinsurance Forum maintains that up to 40-60 per cent of the losses from large disasters can be borne by reinsurers, depending on the insurance penetration and reinsurance buying behaviour (GRF, 2014). For example, after Hurricane Sandy, reinsurers paid 40 per cent of the total claims of US\$ 18,750 million, excluding the US\$ 800 million under NFIP (GRF, 2014).

Reinsurance for disaster risk is also an area that has witnessed much government involvement. This is most common in those economies where the private reinsurance market is not well developed enough to cover the entire spectrum of risk. This may also come into the picture when private sector exposure is limited by institutional arrangement or law in order to protect insurers' solvency or macroeconomic stability (OECD, 2015). A notable example is **Caisse Centrale de Réassurance (CCR) in France**. A public sector reinsurer, it provides insurance companies coverage against natural catastrophes and uninsurable risks. Though it deals with other products also, natural catastrophes are its main focus and expertise since France launched the much-discussed Natural Disaster Compensation Scheme in 1982 (CCR, 2015). Through this scheme, the government made natural catastrophes a compulsory part of all property and casualty insurance policies in the country. The additional premium rates are set by the government, irrespective of the level of risk exposure, and guarantee cover for everyone at affordable prices (CCR, 2015).<sup>30</sup> The CCR, as the state-run reinsurer, brings in much stability to the picture. CCR is also backed by a state guarantee in order to avoid any failure of the system. It is to be noted that CCR does not have any monopoly by law and primary insurers are free to choose their risk management strategy. However, as OECD (2015) notes, it stands out in the sector for the range of reinsurance solutions with unlimited cover. According to McAneney et al. (2016), the insurers usually transfer 50 per cent of their natural disaster risk to CCR through a quota-share-like arrangement and pay 50 per cent of their related premiums. The scheme is notable on many levels; it has succeeded in extending

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<sup>30</sup> [https://www.ccr.fr/en/-/indemnisation-des-catastrophes-naturelles-en-france?redirect=http%3A%2F%2Frecette.ccr.fr%2Fcherche%3Fp\\_p\\_id%3D3%26p\\_p\\_lifecycle%3D0%26p\\_p\\_state%3Dnormal%26p\\_p\\_mode%3Dview%26p\\_p\\_col\\_id%3Dcolumn-1%26p\\_p\\_col\\_pos%3D2%26p\\_p\\_col\\_count%3D3%26\\_3\\_keywords%3Dindemnisation%26\\_3\\_struts\\_action%3D%252Fsearch%252Fsearch&inheritRedirect=true](https://www.ccr.fr/en/-/indemnisation-des-catastrophes-naturelles-en-france?redirect=http%3A%2F%2Frecette.ccr.fr%2Fcherche%3Fp_p_id%3D3%26p_p_lifecycle%3D0%26p_p_state%3Dnormal%26p_p_mode%3Dview%26p_p_col_id%3Dcolumn-1%26p_p_col_pos%3D2%26p_p_col_count%3D3%26_3_keywords%3Dindemnisation%26_3_struts_action%3D%252Fsearch%252Fsearch&inheritRedirect=true)

the coverage to a large number of clients at affordable prices. While the flat rate ensures solidarity in the scheme, the scheme brings in responsibility through an extensive system of deductibles and risk prevention plans. Run on a public-private partnership model, it makes effective use of the know-how of insurers and their distribution and loss adjustment networks to facilitate speedy and efficient compensation (CCR, 2015).<sup>31</sup>

**Table 5: Notable examples from different countries – Regional risk pools**

<b>Regional risk pools:<sup>32</sup></b>	
<b>Risk pool</b>	<b>Key Details</b>
Caribbean Catastrophe Risk Insurance Facility (CCRIF)	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.
Pacific Disaster Risk Financing and Insurance (PDRFI)	PDRFI was launched under the Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI). This is a joint initiative of the Pacific community, the World Bank, and the Asian Development Bank, and 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).

Source: Ray et al. (2019)

**The Flood Re programme in the United Kingdom** is another innovative risk financing project. A joint initiative by the government with the private industry, it primarily aims to provide affordable insurance for properties at the risk of flooding through reinsurance support to industry. Flood Re is basically a targeted reinsurance scheme established as a not-for-profit fund, owned and managed by the insurance industry (ABI).<sup>33</sup> Conceived as a transient solution, Flood Re is expected to run until 2039, by which time it aims to establish an affordable insurance market for households who may not be able to procure insurance from the market otherwise. The arrangement allows insurers to provide cover to households for the flood risk they are exposed to. This is made possible as insurers cede their risk to the reinsurance provided by Flood Re at a lower rate. The costs of Flood Re are met by an annual levy on home insurers. Also, the insurer must pay a fixed premium when ceding a risk and a fixed excess for each policy. This levy is essentially coming from other homeowners whose flood risk is priced at market rates (McAneney et al., 2016). Flood Re, through reinsurance,

<sup>31</sup> [http://ec.europa.eu/finance/consultations/2013/disasters-insurance/docs/contributions/non-registered-organisations/ccr\\_en.pdf](http://ec.europa.eu/finance/consultations/2013/disasters-insurance/docs/contributions/non-registered-organisations/ccr_en.pdf)

<sup>32</sup> In smaller countries with high disaster risk, there exist constraints from demand and supply side and hence such schemes become important.

<sup>33</sup> <https://www.abi.org.uk/products-and-issues/topics-and-issues/flood-re/flood-re-explained/>

passes this risk to global reinsurance markets. Extreme flooding with annual return intervals (ARI) remains the responsibility of the government (McAneney et al., 2016). Now more than 60 insurers are part of the scheme, covering 90 per cent of the home insurance market and more than 150,000 policies are ceded to the scheme (Flood Re, 2018).<sup>34</sup> It was also reported that “that following the introduction of the scheme, four out of five householders with a prior flood claim saw price reductions of more than 50% and 100% of these households could get quotes from at least two insurers” (Flood Re, 2018). The most notable aspect of the Flood Re programme is that it acknowledges the importance of resilient infrastructure. Here the insurance products are not seen as a complete solution in themselves. As the transition plan document of Flood Re acknowledges, for the cost of premiums to come down, the risk posed by the floods and cost of damage needs to come down. This essentially warrants “limiting the risks of flooding; reducing the damage caused by and costs associated with flooding; and ensuring that an effective market for household insurance exists” (Flood Re, 2018). At the same time, the criticism is that Flood Re is not directly related to resilience building efforts and the current design of the scheme does not incentivise households enough to improve the resilience of their buildings or avoid the possibility of flooding and damage (Oakley, 2018).<sup>35</sup> Currently, the onus is on the government to act on mitigation, as they will be responsible for losses in extreme flood events. To aid the transition programme, Flood Re was not made available to homes constructed after January 1, 2009, forcing homeowners to adopt resilient building practices and dis-incentivise construction on floodplains.

Other notable examples for risk pooling are from the US and include the **Florida Hurricane catastrophe fund (FHCF)**, the **California Earthquake Authority (CEA)**, and the **Texas Windstorm Insurance Association**. The FHCF is structured as a tax-exempt state trust fund to provide reinsurance solutions to insurers in the state. All the insurers in Florida are mandated by law to enter into a reimbursement contract with FHCF.<sup>36</sup> In the event of a hurricane loss, it reimburses part of the losses to residential property insurers through the reinsurance programme at a cost less than market rates. This is largely possible as FHCF does not include a profit factor or risk load in its rates and is exempt from federal taxes (FHCF, 2018).<sup>37</sup> The fund for FHCF largely comes from the premiums paid by the insurers for the coverage, but it also uses revenue bonds, insurance-linked securities, and other risk transfer activities. The major point to be noted is that FHCF is only one part of Florida’s property insurance system to manage wind risk. In addition to private insurers, Florida has three public risk financing entities to support the industry, namely, the Citizens Property Insurance Corporation (Citizens), the Florida Hurricane Catastrophe Fund (FHCF), and the Florida Insurance Guaranty Association (FIGA). Citizens, created in 2002, is a not-for-profit, tax-exempt, government entity formed with a mission to cover those policyholders who are entitled to but are unable to find property insurance coverage in the private market.<sup>38</sup> The

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<sup>34</sup> [https://www.floodre.co.uk/wp-content/uploads/2018/07/Flood\\_Transition2018\\_AW.pdf](https://www.floodre.co.uk/wp-content/uploads/2018/07/Flood_Transition2018_AW.pdf)

<sup>35</sup> [https://www.floodre.co.uk/wp-content/uploads/2018/03/SMF-Incentivising-household-action-on-flooding\\_web.pdf](https://www.floodre.co.uk/wp-content/uploads/2018/03/SMF-Incentivising-household-action-on-flooding_web.pdf)

<sup>36</sup> Except for insurers that are exempt by virtue of *de minimis* Florida exposures and non-admitted insurers

<sup>37</sup> [https://www.sbafla.com/fhcf/Portals/FHCF/Content/Reports/Annual/20190418\\_2018\\_FHCF\\_Annual\\_Report.pdf?ver=2019-04-18-115849-467](https://www.sbafla.com/fhcf/Portals/FHCF/Content/Reports/Annual/20190418_2018_FHCF_Annual_Report.pdf?ver=2019-04-18-115849-467)

<sup>38</sup> <https://www.citizensfla.com/who-we-are>

Florida market is also characterised by the presence of Florida based domestic insurance companies which have been consistently improving their market share.

**The California Earthquake Authority (CEA)** is another much discussed US insurance programme. Structured as a not-for-profit, publicly managed, privately funded entity, CEA accounts for two thirds of residential earthquake insurance policies in California (CEA, 2019).<sup>39</sup> CEA was also a response to the behaviour of private insurers. In a region with a high risk of earthquakes, it is compulsory for insurance companies selling home insurance to offer earthquake insurance. This in turn led to a scenario of insurance companies limiting homeowners' policies. Also, the take-up of insurance by households was very low, jeopardising the business of insurers. It is reported that by 1995, the market had almost ceased to exist, as companies representing 93 per cent of the California homeowners insurance market had either restricted or stopped writing homeowners' policies altogether (CEA, 2019). It is at this juncture that CEA was established to improve the earthquake insurance coverage. It provided insurers the option of "paying an exit tax and offering the cover or transferring funds and participating in the pool" (McAneney et al., 2016). With more than one million policies in force, CEA is the largest provider of residential earthquake insurance in the US and receives more than US\$ 630 million in premiums (CEA, 2019). These policyholder premiums, along with insurers' contribution and own investment returns, form the base of CEA finances. CEA also invests in mitigation. This includes offering financial incentives to promote retrofitting, lead and promote development of building codes and guidelines to reduce the damage and increase safety, etc.

#### **4.4 Parametric insurance products**

While traditional insurance products quantify pay-outs based on actual losses, parametric insurance products refer to an alternative arrangement, where insurance pay-outs are based on predefined physical parameters. Much popular in disaster risk financing, parametric products link payments to a weather or geological observation or index such as average rainfall or temperature or intensity of earthquake or hurricane. In these instruments, a predetermined threshold is defined for all selected parameters and the payments are initiated when the limit is crossed. The settlement is as per agreed contract and may or may not reflect the actual losses. Though susceptible to such 'basis risks' – a scenario where there is a mismatch between claims settlements and actual losses, parametric products cover risks that were not easily insurable. These insurances are more effective in developing countries, as they do not require loss adjustment on the ground and payments can be made rapidly in the event of a disaster. It also results in lower claims' management costs and makes lines of business commercially viable that were not possible previously (Brook, 2018).<sup>40</sup> Parametric insurances are useful when there is capacity lag from the conventional insurances, especially for risks that are underinsured or uninsured (Markovic and Harry, 2018).

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<sup>39</sup> <https://www.earthquakeauthority.com/About-CEA/CEA-History>

<sup>40</sup> <https://resilience.clydeco.com/articles/the-advantages-of-parametric-insurance>



One of the most notable applications of parametric insurance is in insurance schemes for agricultural risks. The Weather Based Crop Insurance Scheme (WBCIS) in India is an example of this. It is also widely applied in reinsurance programmes, regional risk pools, and targeted catastrophe insurances.

#### **4.5 Catastrophic Bonds and Insurance Linked Securities**

With the rapid increase in disaster risks and quantum of potential economic loss, demand for innovative risk transfer solution has increased considerably across the globe. The traditional models of insurance and reinsurance solutions may not be enough in these circumstances. Hence, risk transfer mechanisms like catastrophe bonds and Insurance Linked Securities (ILS) assume importance. These instruments allow transferring risk of disaster to the capital market. The Catastrophic (CAT) bonds are issued by governments, insurers, or reinsurers against the likelihood of occurrence of a disaster. It typically involves a pre-defined trigger like wind speed or earthquake intensity and releases rapid pay-outs in the event of catastrophe meeting these conditions. Other than diversifying sources of capital, they are preferred due to their structural features that the traditional markets have difficulty providing in size at the right price<sup>41</sup> (aggregate, second event, etc.) (Swiss Re, 2012). These bonds are disassociated from economic shocks and are linked with disasters of higher intensity which have less probability of occurrence. These bonds are riskier, since the occurrence of even a single event can lead to investors facing the risk of losing all or part of the principal or interest (if losses are greater than the threshold specified in the bond offering) (III, 2019). Due to this risk, these bonds are generally pegged at much higher rates and hence the yields of these bonds are much higher than standard products. Low volatility (when compared to other asset classes), high risk adjusted returns, and strong collateral structures are some of the other motivations for investors (Swiss Re, 2012).

The most successful examples of CAT bonds and ILS come from the **US**, where they are widely used by government and the insurance and reinsurance industries. Huge financial costs severely threatened both insurance and reinsurance industry, forcing them to look for innovative risk transfer mechanisms. Currently it is widely used by many, including the famed 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 has reached its highest level at US\$ 30 billion in the first half of 2018 (Aon Securities, 2018). The market continues to be dominated by North American bond issuances, as 18 of the 32 catastrophe bonds in the 12 months period ending June 2018 covered US property risks (Aon Securities, 2018).

A notable policy development from the **United Kingdom**, where the parliamentary committee passed a Risk Transformation Regulations 2017 and the Risk Transformation (Tax) Regulations 2017 to allow for an ILS friendly legal framework in the UK (Aon Securities, 2018). This is expected to once again establish London as a hub for the

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<sup>41</sup> <https://www.casact.org/community/affiliates/CANE/0912/Cat-Bond.pdf>



reinsurance market.<sup>42</sup> The Asia-Pacific market is also fast developing and currently accounts for 12 per cent of the market outstanding volume.

Though the CAT bond and ILS market is witnessing a lot of activity globally, the debate regarding the utility of these instruments continues. The complexity of these financial instruments, and the constraints on access to international capital markets, continues to limit the broad use of these instruments in many emerging markets (OECD, 2015). Though the structural constraints that used to complicate CAT bond issuance in emerging markets is declining rapidly, the returns for investors are getting negatively impacted owing to rising frequency in large-scale extreme events. There is also fear that as the market matures, the spread might thin out, with reduction in average yield and increase in expected losses. Ultimately, the success of any such instrument depends on how well the involved parties can comprehend and compute risk and the financial robustness of the capital debt market. Also, it needs to be ensured that it does not negatively impact non- or lightly regulated investors, given their limited knowledge of long-tailed risks (OECD, 2015).

#### **4.6 Multilateral disaster risk finance initiatives**

The **Global Risk Financing Facility (GRiF)** and **InsuResilience Global Partnership** are two other noteworthy multilateral partnerships. Newly established by the United Kingdom and Germany with the support of the World Bank group, GRiF aims to strengthen the resilience of vulnerable countries to climate disaster shocks. The strategy is to establish or scale up pre-arranged risk financing instruments which allow faster, more cost-effective response and recovery, but can also drive greater disaster preparedness and resilience.<sup>43</sup> The planned interventions include financing of insurance premiums, contingent financing, risk financing investments, integrating risk transfer with loans to pilot new approaches to support debt sustainability in the face of extreme events, risk financing mechanisms that promote parallel improvements in country systems for crisis response and recovery, and technical assistance and capacity building.<sup>44</sup> InsuResilience Global Partnership, launched in 2007, was born out of G7 and G20 efforts and has been actively engaging with countries across the globe to strengthen the resilience of developing countries. The partnership views insurance as an integral part of DRM approaches and aims to promote and enable the adoption of DRF and insurance, especially among the poor and vulnerable in developing nations.

In India, InsuResilience is currently undertaking two major projects; the first one is related to insurance market development and the second is a crop monitoring initiative. The Insurance Market Development project has three streams. Under the first stream, it aims to roll out a product bundle innovation in cooperation with NBFC-MFIs. Through the Self-Regulatory Organization of NBFC-MFIs, a multi-peril natural catastrophe index-insurance is being planned to be linked to the group loans handed out by MFIs. The objective of the second stream is to develop a concept for a satellite-based flood index insurance, and the last one

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<sup>42</sup> Post Brexit this is uncertain: <https://insuranceday.maritimeintelligence.informa.com/ID1132874/Brexit-threatens-Londons-role-as-reinsurance-hub>

<sup>43</sup> <http://www.worldbank.org/en/topic/disasterriskmanagement/brief/global-risk-financing-facility>

<sup>44</sup> <http://www.worldbank.org/en/topic/disasterriskmanagement/brief/global-risk-financing-facility>

aims to pilot a Blockchain technology based Farm Income Protection Plan.<sup>45</sup> The crop monitoring initiative, RIICE – remote sensing-based information and insurance for crops in emerging economies, provides real-time monitoring and forecasting that enables government authorities to take action and implement emergency measures long before harvests fail.<sup>46</sup>

While there is development of the insurance industry and market-based risk financing, only a part of efforts to build disaster resilience (and not a risk reduction mechanism in the exact sense), it should be noted that this holds much scope as an instrument of social policy. The key challenge here is that the social goal of affordable coverage of insurance and other mechanisms which would incentivise creation of resilient infrastructure is not often in sync with the market motivations. Currently, natural catastrophe insurers are not only unable to keep the premiums down but also are often unable to accurately price the risk. Exit of private insurers from disaster financing has been a notable feature in developed countries. As pointed out earlier, many of the notable initiatives have a strong public involvement. This was in response to the inability of private industry to provide affordable and efficient solutions. But the fiscal burden of such programmes is quite large and can be problematic even in large countries. The risk transfer solutions like risk pools which have been brought in to address this issue have had mixed results (McAneney et al., 2016). If these schemes are not rolled out properly, they could end up creating huge liabilities for government and sometimes encourage property development in risky solutions. At the same time, leaving it to the market could exclude the high-risk areas. This eventually would mean more damage in the event of disaster, forcing the government to step in with financial assistance.

The situation poses multiple dilemmas for policy makers. Insurance can be a useful tool to incentivise risk reduction. But the experience shows that left to the market, the risk reflective insurances most often are unaffordable and exclude the most vulnerable. The government support to insurance through risk transfer mechanisms like pools or reinsurance, if not implemented properly, can bring in fiscal liability and aggravate moral hazard issues. The success of any programme is dependent on how well the conflicts between affordability and high risk can be resolved. Even in long standing programmes in developed countries, the problem remains largely unresolved. The US government stepping in to support NFIP during hurricanes Katrina and Sandy is a notable example. The government guarantee and increased borrowing from the US Treasury was crucial in continuation of the NFIP programme in the aftermath of these disasters. On the other hand, a policy of generous assistance for reconstruction after disaster not only strains fiscal capacity but could disincentivise property owners from investing in retrofitting or risk reduction.

The need for multilateral initiatives comes from inefficiencies like limited risk absorption capacity and a lack of avenues for risk transfer and diversification. While risks arising out of natural hazards are regional, the financing solutions are increasingly getting global. Access to international markets becomes essential in this scenario, as the capital market solutions

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<sup>45</sup> <https://www.insuresilience.org/insurance-market-development-india/>

<sup>46</sup> <https://www.insuresilience.org/riice-remote-sensing-based-information-and-insurance-for-crops-in-emerging-economies/>

available nationally may not be enough to effectively manage the risk reduction. The international pooling of risk exposures not only provides broader coverage but allows more efficient deployment of pooled capital for risk transfer (Pollner, 2001). The potential benefits also include lower premiums and shared transaction costs. The role of multilateral institutions becomes important at this juncture, as they might be able to better broker and assist in “arranging the requisite inter-country and market collaboration, while setting the basis for ex ante regulatory requirements to ensure financial solvency and risk reduction” (Pollner, 2001). The success of CCRIF and the Pacific PCRAFI insurance program demonstrates the additional utility brought in by the multilateral initiatives. Both the programmes were heavily aided and guided by various global partnerships and multilateral development banks. The overarching role of such initiatives could also bring in some unintended consequences like crowding out investment by national governments and dis-incentivising risk reduction efforts. Projects of this nature are also highly susceptible to top-down solution centric models. Further mechanisms should be put in place to ensure that efforts follow a transparent governance model which fosters accountability and inclusiveness.<sup>47</sup>

#### 4.7 Applications of DRM in the Indian case

**Global Facility for Disaster Reduction and Recovery (GFDRR)**, a grant-funding mechanism managed by the World Bank, supports disaster risk management efforts across the globe. Formed in 2006, this initiative is supported by 37 countries and 11 international organisations, and works with over 400 sub-national, national, regional, and international partners (GFDRR, 2018).<sup>48</sup> In particular, “GFDRR supports technical assistance and analytical work that enables financing by international financial institutions – including IBRD, IDA, the Climate Investment Funds, and other international financial institutions – to ensure that investments enhance resilience and reduce risks” (GFDRR, 2018). ***Disaster Risk Financing and Insurance Program*** is a targeted initiative of GFDRR for promoting disaster risk financing. The programme, started in 2010, focuses on four main areas, namely, Sovereign Disaster Risk Finance, Market Development, Analytics and Knowledge Management, and Global Partnerships. This programme brings together Analytical and Advisory, Financial, and convening services of the World Bank Group<sup>49</sup> and has been making important contribution to many notable DRF efforts across the globe.

In the Indian context, GFDRR involvement has been mostly related to DRM service delivery and resilience building measures. This included improving the capacity to understand damage and loss after major disaster events and strengthening efforts to mitigate the risks of flooding and cyclones, technical and financial support to help implementation of the US\$ 255 million World Bank National Cyclone Risk Mitigation Project in Odisha and Andhra Pradesh, the post disaster needs assessment of the 2008 flooding of the Kosi River in the state of Bihar,

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<sup>47</sup> Disaster risk financing in Japan has been discussed in the Annexure.

<sup>48</sup> <https://www.gfdrr.org/sites/default/files/publication/gfdrr-strategy-2018%E2%80%932021.pdf>

<sup>49</sup> <http://www.worldbank.org/en/programs/disaster-risk-financing-and-insurance-program#4>

and the US\$ 170 million World Bank financed project that followed to build long-term resilience, etc. The following table shows the ongoing GFDDR engagements in India.<sup>50</sup>

**Table 6: GFDDR projects in India**

<b>Name of project</b>	<b>Amount</b>	<b>Duration</b>
Open Data for Resilience Initiative: Tools and Capacity Building	\$400,000	08/2018 – 12/2019
Promoting Resilient Infrastructure in South Asia – Phase 2	\$1,000,000	04/2018 – 11/2019
Technical assistance to build capacities for scaling up DRM investments in SAR	\$500,000	04/2018 – 12/2019
Enhancing Knowledge and Effectiveness of DRM in South Asia:	\$300,000	04/2018 – 09/2019
Multi-hazard Risk and Governance Assessment in India	\$1,250,000	12/2017 – 12/2019
Business Continuity Planning for Climate Resilient Industries	\$500,000	10/2017 – 10/2019
Capacity Building and Knowledge Creation and Exchange in Financial Resilience	\$400,000	10/2017 – 03/2019
Improving Resilience and Resilience Impact of National Land and Geospatial Systems	\$500,000	09/2017 – 07/2019

Source: GFDRR

#### **4.8 Flood management programme**

The flood management programme has faced much criticism for the lack of progress, inordinate delays, and implementation problems. Management of dams to control floods and add resilience has been a major component of the programmes. For example, the programme was augmented with a scheme for Dam Safety Studies and Planning and was later subsumed in another scheme titled Dam Rehabilitation and Improvement Project. This was initiated with the aim of rehabilitation of 223 existing dams and strengthening the system (Upadhyaya, 2018). The progress on such initiatives has been minimal. The issue of how effective flood management projects have been has surfaced again with the recent Kerala floods.

One of the highest impact events in recent years, the Kerala floods were reported to be the worst in the state since 1924. The state received high persistent rains over a short period. WMO (2018) reports that “rainfall for the state for August was 96% above the long-term average, with weekly totals for the weeks 9-15 August and 16-22 August 255% and 219% above average respectively.” The report of the Central Water Commission (CWC) also cites high intensity rainfall and severe storm occurrences during 8-9, August 2018 and 15-17, August 2018 (CWC, 2018). The state government reported more than 435 deaths and displacement of more than 1.4 million people. The estimated economic losses were to the tune of Rs. 267.18 billion. The draft Post Disaster Need Assessment (PDNA) on Kerala floods prepared by UN agencies has quoted that the state may need about Rs. 310 billion for recovery and reconstruction. The event has led to a discussion on the efficiency of flood management practices in the state. To what extent did the flood forecasting and dam management contribute to the disastrous event? The debate largely revolved around the effectiveness of dams as a flood prevention measure. The Central Water Commission on its report argues that “dams in Kerala neither added to the flood nor helped in reduction of the flood as most of the dams were already at FRL or very close to FRL on 14 August 2018, due

<sup>50</sup> <https://www.gfdr.org/en/india>

to more than normal rainfall in the months of June to July 2018” (Aggarwal, 2018).<sup>51</sup> At the same time, a few reports like the one by South Asia Network on dams, rivers, and people (SANDRP) maintains that the incessant flow of water from the dams was an added burden, causing large-scale destruction that could have been avoided. The argument is that the Kerala dams ignored the Rule Curve,<sup>52</sup> though all the dams were full by the end of July (and end of July is just halfway through the South West Monsoon). If this is the case, the potential of dams to be used for flood protection was not fully utilised. The associated issues such as the lack of emergency plans, outdated inundation maps, and reservoir management practices complicate the situation. It has also been reported that the two largest reservoirs in Kerala – Idukki and Idamalayar – have been operating for years without any emergency action plans (Reuters, 2018).<sup>53</sup>

While the exact role of dams in aggravation of flood impact remains a question for further research, the event has certainly highlighted the shortcomings of our current flood management programmes. It has to be noted that discussions of similar nature arose earlier with respect to flood events in Uttarakhand (June 2013), Tehri (September 2010), Hirakud (2009, 2011, 2014), Damodar dams (many years), Krishna basin dams (2006, October 2009), Ukai (August 2006), Chennai floods (December 2015), Bansagar Dam (August 2016), Ranganadi (2017, others), and Doyang (2018), among others.<sup>54</sup> As the many reviews and assessments of flood management programmes in India pointed out, much more proactive action is required to improve resilience capacity against floods.

## 5. Insurance and reinsurance markets in India

For India, the average annual reported economic losses from natural catastrophe stand at around US\$ 4.7 billion from 2000 to 2019 (OECD, 2020). Further, floods account for a staggering 64 per cent of the reported economic damage, followed by storms (23 per cent) and earthquake (7 per cent) (from 2000 to 2019) (OECD, 2020). Moreover, economic losses resulting from Cyclone Amphan (May 2020) have been pegged at US\$ 13 billion (Swiss Re, 2020). Mitigating the financial damage inflicted by any adversity is one of the many advantages that insurance offers. A well-developed insurance sector is critical for cushioning the financial impact of natural disasters.

According to Lloyd’s global underinsurance report, the insurance penetration (level of written non-life insurance premiums each year compared to the GDP of the country in the same year) in India is very low compared to other major economies, placing it among underinsured economies. Development of the insurance sector is crucial for increasing the safety nets during disasters and reducing the after effects. A study at Cambridge University found out that “1% rise in insurance penetration translates into a 13% reduction in uninsured losses and

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<sup>51</sup> <https://india.mongabay.com/2018/09/cwc-report-on-kerala-floods-dams-not-to-be-blamed/>

<sup>52</sup> Rule Curve: How the dam is supposed to be filled during the monsoon, to optimise flood moderation for the downstream area, while ensuring that the dam is filled up only closer to the end of the monsoon

<sup>53</sup> <https://graphics.reuters.com/INDIA-FLOOD/010080MF18N/index.html>

<sup>54</sup> <https://sandrp.in/2018/10/04/role-of-dams-in-keralas-2018-floods/>

a 22% reduction in taxpayers' contribution following a disaster and increased investment equivalent to 2% of national GDP" (TheCityUK, 2016).<sup>55</sup>

Around 60 per cent of Indian land is vulnerable to earthquakes and other natural catastrophes, and at least 38 Indian cities lie in a high-risk seismic zone. Most Indian cities are densely populated and do not follow the architectural layout defined by NDMA. Hence, the vulnerability to disasters in India is higher and needs coverage by insurance companies (Khanna, 2017).<sup>56</sup> China and the UK mandate purchase of insurance, ensuring participation by all citizens, whereas there is no such mandatory insurance policy in India.

Catastrophe insurance in India is essentially a combination of many types of insurance products. Types of insurance that have been identified for helping individuals weather the financial blow of natural disasters are motor insurance, life insurance, home insurance, and personal accident cover (Chakraborty, 2020). These insurance types cater to the protection of both lives as well as livelihoods, since both are threatened by natural catastrophes. Life insurance and personal accident insurance can be taken up for defending damage to lives. For protecting livelihoods against the damage from natural perils, home insurance and motor insurance can be resorted to.<sup>57</sup>

The penetration of life insurance in India is very low (Ray et al., 2020). Life insurance policy holders dominate the insurance space in India, but even life insurance is not mandatory. In 2017, Ayushman Bharat was launched by the Government of India as a flagship scheme with the aim of achieving universal health coverage (UHC). It was designed to meet sustainable development goals (SDGs). The two schemes launched under this scheme were Health and Wellness Centres (HWCs) and Pradhan Mantri Jan Arogya Yojana (PM-JAY). On 23 September 2018, PM-JAY was launched in Ranchi, Jharkhand. "This was launched to be the largest health assurance scheme in the world which aimed at providing health cover of Rs 5 lakh per family per year for secondary and tertiary care hospitalisation to over 10.74 crore poor and vulnerable families (approximately 50 crore beneficiaries) that form the bottom 40% of the Indian population" (Pradhan Mantri Jan Arogya Yojana, Government of India, n.d.).<sup>58</sup> This programme aims to provide cashless access to health care services for the beneficiary at the hospital that covers up to 3 days of pre-hospitalisation and 15 days post-hospitalisation expenses, that is, diagnostics and medicines. This programme can be used by one or all members of the family and there is no cap on family size or age of the members.

Motor insurance has been made compulsory by the Government of India under insurance policy for vehicles but almost 40 per cent of cars on the road are not insured. Given the fragile condition of infrastructure and the poverty rate, the brunt of economic losses is much higher on the insurance providers, despite diversifying the risk. Hence, the resulting cost of capital is much higher for insurers. The Government of India introduced Index Based

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<sup>55</sup> <https://www.thecityuk.com/assets/2016/Reports-PDF/a21844cb7a/IUKFP-Development-of-the-reinsurance-industry-in-India.pdf>

<sup>56</sup> <https://www.asiainsurancereview.com/Magazine/ReadMagazineArticle?aid=39698>

<sup>57</sup> For a discussion of life insurance and non-life insurance in India, refer to Ray et al. (2020).

<sup>58</sup> <https://pmjay.gov.in/about/pmjay>



Insurance. It was believed that the insurance was bought less by masses due to its limited scope, as it provided coverage only for earthquakes.

Surrounded by water bodies on three sides, India is prone to floods and cyclones, which are not covered as perils in this policy. Due to lower insurance penetration, the loss from natural catastrophes falls solely on Indian businesses, taxpayers, farmers, and the government. Insurance for natural catastrophes is still not a sought-after product in the Indian insurance market. Catastrophe insurance is an underdeveloped sector whose importance has not been realised yet. It does not come as a package in India for households, but something which comes along with property insurance (KaleidoFin, 2019).<sup>59</sup> According to reports, “Home insurance penetration in India is just about 1%. Barely 3% of houses in India are insured. Countries like US, UK, France, Australia and China have home insurance penetration in the range of 90-97%” (Khanna, 2017). The incentives for consumers to buy home insurance is reduced to the apathetic attitude of the insurance industry and lack of proactive measures by the distribution channels which delays the claim. Most people who have bought home insurance have taken home loan insurance where the loan taken to buy the property is insured. Where the applicant is unable to repay the loan, home loan insurance cover helps the family in repaying the outstanding amount. Perils such as ‘storm, typhoon, cyclone, tempest, tornado, hurricane, and flood or inundation’ are covered by the ‘Standard Fire and Special Perils’ insurance policies that are offered to commercial or industrial and residential policyholders in India (OECD, 2020).<sup>60</sup> These policies provide an option to the policyholders with regard to obtaining the coverage for these perils (OECD, 2020). Further, earthquake coverage is provided as a ‘standard inclusion or an add-on coverage’ (OECD, 2020). In the Indian case, OECD (2020) observes that a usual practice among a major share of policyholders<sup>61</sup> is not to opt out of the storm or flood coverage and to avail the additional cover for earthquakes (OECD, 2020). Property insurance also suffers from low penetration. Estimates by the OECD (2020) reveal that the penetration and density of property insurance in India stand at an extreme low of 0.06 per cent penetration, with the density being a mere US\$ 1.27 for 2017. In comparison, estimates for the OECD countries stand at 0.62 per cent for penetration and US\$ 241.43 for density (OECD, 2020). This low penetration and density of the market is consequential when looked at in terms of economic impact of natural catastrophes.

The property insurance market is well developed, with very few products that comprehensively cover risks from natural peril. For example, even during the Kerala Floods of 2018 which were among the major global disaster events of that year, insurance companies reportedly bore less than 10 per cent of the actual losses.<sup>62</sup> The biggest catastrophe exposure for the Indian general insurance industry were the Chennai floods, which resulted in claims of

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<sup>59</sup> <https://kaleidofin.com/natural-catastrophe-insurance/>

<sup>60</sup> Indian insurers are relatively cautious when it comes to covering risks in the Himalayan region, which is vulnerable to earthquakes, and the area bordering the east coast, which is susceptible to cyclones as compared to other regions (OECD, 2020).

<sup>61</sup> Commercial policyholders as well as residential policyholders (OECD, 2020).

<sup>62</sup> Personal interviews with representatives of reinsurance companies in Mumbai, 2019.

over Rs. 5,000 crore.<sup>63</sup> Currently the motivation for insurance uptake itself is largely driven by commercial banks who specify it as part of loan obligations. This often leads to problem of underinsurance, as the sum insured may not reflect the actual risk exposure and value of the assets. The ability of the Indian insurers to efficiently price the risks is a question that often comes up in relation to this. Table 7 below shows a list of disasters up to 2013 which were uninsured.

**Table 7: Extent of uninsured losses in recent catastrophic events in India**

Date	Event	Place of event	Economic Loss US\$ (bn)	Insured Losses (US\$ bn)	Uninsured loss of total loss
Dec, 2015	Floods	Tamil Nadu and Andhra Pradesh	2.2	0.8	66%
Oct, 2014	Cyclone Hudhud	Odisha and Andhra Pradesh	7.1	0.6	91%
Sept, 2014	Severe monsoon floods	Jammu and Kashmir	6.0	0.2	96%
Sept, 2014	Severe monsoon floods	Assam, Bihar, Meghalaya, Uttar Pradesh, West Bengal	6.1	0.2	96%
Oct, 2013	Cyclone Phailin	Odisha	4.5	0.1	98%
Jun, 2013	Floods	Uttarakhand	1.1	0.5	54%
Sept, 2013	Floods	Andhra Pradesh and Karnataka	5.3	0.1	99%

Source: *ICICIdirect.com, Research 2017*

From the table it can be clearly concluded that during disasters more than 50 per cent of the losses were left uninsured, because the concept of insuring for calamities has not entered the Indian markets distinctly.<sup>64</sup>

## 5.1 Reinsurance in India

Reinsurance markets aid in augmenting insurance markets' capacity in handling risks associated with natural catastrophes. A discussion of Indian reinsurance has been presented in Ray et al. (2020). The share of reinsurance premium for non-life insurance is more than that of life reinsurance. In comparison to other non-life insurance, property insurers have a higher cessation ratio (OECD, 2020). Recent years have seen primary insurers in India cede a considerable part of their property premiums to reinsurers (OECD, 2020).<sup>65</sup> In case of property risks, public-sector insurance companies use reinsurance less as compared to their private counterparts (OECD, 2020). A domestic reinsurer in India holds on to a considerable amount of property insurance risk: GIC Re kept an average of 55 per cent of property

<sup>63</sup> <https://www.hdfcsec.com/Blog/Details/kerala-floods-insurance-industry-braces-for-impact>

<sup>64</sup> Refer to the paper [http://icrier.org/pdf/Working\\_Paper\\_394.pdf](http://icrier.org/pdf/Working_Paper_394.pdf) for further discussions on challenges in the Indian insurance sector

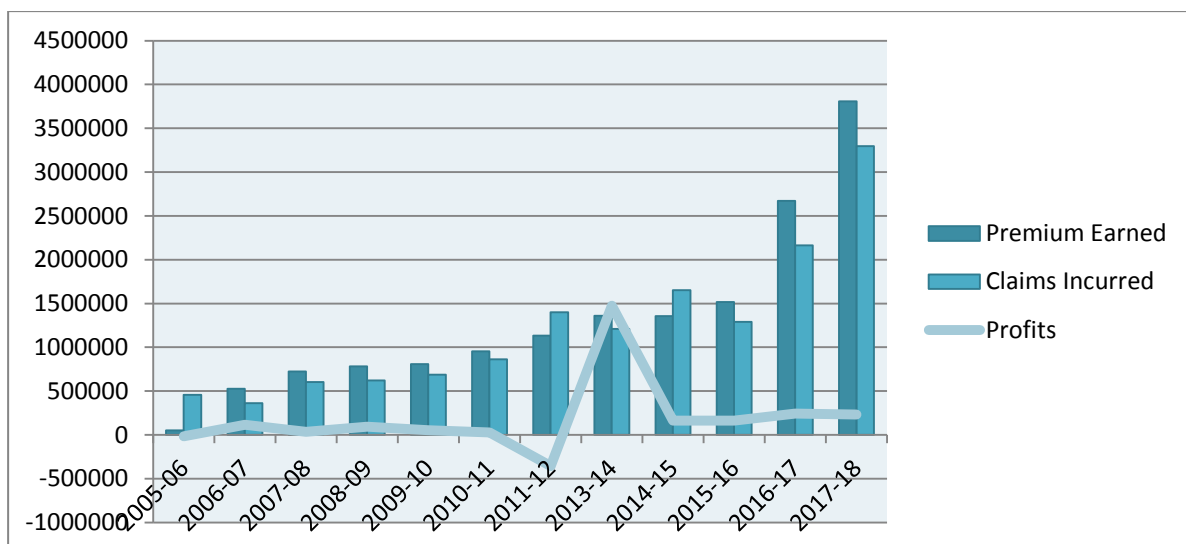
<sup>65</sup> Roughly 73 per cent in 2017-18 and 65 per cent in 2018-19 (OECD, 2020)



insurance premium from 2014 to 2017 (OECD, 2020).<sup>66</sup> Furthermore, reinsurance for property risks is more utilised in India, Indonesia, and the Philippines vis-à-vis cedants in most of the OECD economies (OECD, 2020). The reinsurance markets have developed over time, but the process of dissemination in different fields is slow.

The graph below clearly captures that though the profits have remained stagnant, the premium amount has been increasing steadily until 2016 but declined after 2016, due to the increase in competition because of entry of foreign reinsurers in 2016-17. The overall picture that can be captured from this graph is a steady increase in the reinsurance access of GIC to market space from 2012 to 2015, but expansion of foreign players led to slowdown in growth prospects for GIC. At the same time, according to reports by IRDA, growth in premiums was visible for foreign reinsurance players.

**Figure 1: Trend line for GIC, RE (2005-2018), figures in lakh**



Source: *Indiastat*<sup>67</sup>

Additionally, the reinsurance market for catastrophic losses is underdeveloped in India. It is believed that reinsurance can provide a wide spectrum of risk coverage and technical services to direct life insurers and non-life insurers. It can quote for more accurate risk pricing with an additional guidance to technical value to the products, which helps in managing products efficiently. Reinsurers offer capacity for covering mass market insurance schemes and bring international experience to domestic markets. For micro insurance schemes, insurers that are less experienced can offer coverage in tandem with reinsurance companies by uniformly sharing the risks. A variety of products can be covered along with more sums insured, since larger risks can be enveloped by reinsurance companies that give space to insurance providers to try newer products. This helps in increasing insurance penetration in the country (IRDAI,

<sup>66</sup> OECD (2018a) states that “international property catastrophe reinsurance markets can make an important contribution to increasing primary insurance market capacity, managing catastrophe risk and reducing economic and insurance market disruption in the aftermath of catastrophe events”.

<sup>67</sup> <https://www.indiastat.com/banks-and-financial-institutions-data/3/financial-institutions/99/general-insurance-corporation-gic/113/stats.aspx>

2019). Moreover, reinsurance markets provide loss absorbing capacity and reduce underwriting risks across class of business or catastrophic exposures.

Reducing or controlling catastrophe exposure is yet to be a significant driver in reinsurance buying decisions for Indian insurance companies. The major reason for underdeveloped reinsurance markets has been the non-existent general insurance market in our country. GIC Re was the sole reinsurer in the Indian markets for many years and received compulsory cession of 5 per cent from all the insurance companies. In 2015, the Insurance Laws (Amendment) Act 2015 was implemented, which is responsible for allowing the setup of branch offices in India by foreign companies engaged in reinsurance business (TheCityUK, 2016).<sup>68</sup> The foreign investment cap was increased to 49 per cent from 26 per cent for reinsurance markets. In fact, Lloyd's India was allowed to set up a branch in India and operate within the country (Raghavan, 2018).<sup>69</sup> But even after these amendments, entry of foreign reinsurers was difficult. MS Amlin, a syndicate of Lloyd's India, announced its exit from the Indian reinsurance market in 2019.<sup>70</sup> The absence of a level playing field with GIC and introduction of **order of preferences**<sup>71</sup> for placing **facultative and treaty reinsurance**<sup>72</sup> are some of the causes of restrictive entry. In the reinsurance sector, the other most cited challenge is the availability of risk information and comprehensive datasets for Nat Cat modelling. The process of setting up offices in India is cumbersome. Even though the reinsurance market is growing in areas like Life Insurance and Crop Reinsurance, a huge market for catastrophic insurance remains untapped, as it is yet to be recognised as an independent sector within insurance markets (Acharya, 2019).<sup>73</sup>

## 5.2 Challenges and Suggestions

The Indian insurance sector faces various challenges highlighted by Ray et al. (2020). Addressing these challenges for further growth and development of the Indian insurance market is likely to bode well even for the Indian catastrophe insurance market, since this market is a subset of the Indian insurance market. One of the challenges for the Indian insurance sector is that of 'low penetration and density rates' (Ray et al., 2020). What this means in the case of natural disasters is that the onus of the financial impact of the natural calamities rests on individuals. Higher insurance penetration and density would have implied that insurers shared in the financial burden. India's vulnerability to natural disasters

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<sup>68</sup> <https://www.thecityuk.com/assets/2016/Reports-PDF/a21844cb7a/IUKFP-Development-of-the-reinsurance-industry-in-India.pdf>

<sup>69</sup> <https://www.thehindubusinessline.com/opinion/reinsurance-proposed-regulations-by-irda-debate/article22881461.ece>

<sup>70</sup> [https://www.business-standard.com/article/companies/global-reinsurers-miffed-at-pro-gic-bias-seek-level-playing-field-in-india-119071500968\\_1.html](https://www.business-standard.com/article/companies/global-reinsurers-miffed-at-pro-gic-bias-seek-level-playing-field-in-india-119071500968_1.html)

<sup>71</sup> "Order of Preference: Every Indian insurer shall obtain the best terms from Indian reinsurer as well as from three entities granted certificates of registration retaining 50% of premium in India followed by foreign reinsurers which are supposed to retain 30% of premium in India. The remaining can be offered to Indian insurers and overseas reinsurers."

<sup>72</sup> Treaty reinsurance: In treaty reinsurance, the cedent seeks reinsurance for certain type of insurance or class of risks insured under a direct contract of insurance or specific risks within a certain period.  
Facultative reinsurance: A separately negotiated contract of reinsurance with respect to each original contract of insurance.

<sup>73</sup> [https://www.business-standard.com/article/companies/global-reinsurers-miffed-at-pro-gic-bias-seek-level-playing-field-in-india-119071500968\\_1.html](https://www.business-standard.com/article/companies/global-reinsurers-miffed-at-pro-gic-bias-seek-level-playing-field-in-india-119071500968_1.html)

accentuates the significance of enhancing insurance penetration and density, particularly for insurance products that cater to disaster-specific needs.

Khanna (2017) holds lack of knowledge accountable for very low penetration of home insurance. Sharma (2017) points out that absence of awareness regarding home insurance, along with the belief that premiums are high and the process is cumbersome, has contributed towards less uptake of the product in India. This points towards the need to enhance awareness of disaster insurance products and how they will help mitigate the disaster-related financial impact. The realisation of the benefits that insurance brings to the table is likely to enhance the take up of disaster insurance in India. OECD (2020) underlines the significant role that insurers and insurance intermediaries play in building awareness regarding the role of insurance in mitigating catastrophic risks.

In determining the insurance penetration and density, price is an instrumental variable. Thus, adequately pricing risks is beneficial for both the insurer as well as the insured. Appropriate pricing is reliant on availability of data and required analytical tools for quantifying risks. In the context of measuring catastrophe risks, OECD (2020) has encouraged increased usage of catastrophe models to handle catastrophic risk exposure. Further, OECD (2020) has identified incorporating the catastrophe models in their primary coverage underwriting as the source of the key challenges. Leveraging these models and data will help the insurers reach appropriate pricing and will also facilitate transfer of risks to reinsurers (OECD, 2020).

## **6. Crop Insurance in India**

The only vertical which is fast evolving and improving the coverage is crop insurance. A large majority of Indian agricultural producers are small farmers and much of agriculture is rain-fed, making it a risky venture highly dependent on uncertainties of the weather cycle. Though the system of crop insurance was in place since 1972, it was not successful in risk mitigation owing to lack of transparency, high premiums, delay in conducting crop cutting experiments, and non-payment/delayed payment of claims to farmers. The government started with schemes like Comprehensive Crop Insurance Scheme (CCIS), which was later replaced by National Agriculture Insurance Scheme (NAIS) in 1999-2000. During the 'Rabi' season of 2010-11, the NAIS scheme was further modified and was renamed Modified National Agricultural Insurance Scheme (MNAIS). The following period also saw various pilot projects to improve the existing arrangements, such as Seed Crop Insurance (1999-2000), Farm Income Insurance Scheme (Rabi 2003-04), and Weather Based Crop Insurance Scheme (Kharif 2007) (Gulati et al., 2018). In April 2016, Pradhan Mantri Fasal Bima Yojana (PMFBY), an area-based scheme and Restructured Weather Based Crop Insurance Scheme (RWBCIS), was introduced (Gulati et al., 2018).

PMFBY brought in improved features to counter such issues. A blend of yield index insurance working on unit area and traditional peril insurance aimed at individual farm-based damage assessment (Poddar, 2018), PMFBY addresses both widespread calamities and localised losses. The scheme attempts to use mobile technology for faster assessment/settlement of claims, smart Crop Cutting Experiments (CCEs), and digitised land records. To better understand the shifts in different schemes for crop insurance, refer to Table 8.

**Table 8: Crop Insurance Schemes in India**

S. No.	Parameters	National Agriculture Insurance Scheme (NAIS)	Modified National Agricultural Insurance Scheme (MNAIS)	Pradhan Mantri Fasal Bima Yojana (PMFBY) <sup>74</sup>
1.	<b>Year</b>	1999–2017	2010–16	2016–Present
2.	<b>Primary Feature</b>	Sharecroppers were included for insurance cover	Private sector participation encouraged. Immediate partial payment to affected farmers introduced.	Premium rates lowered. Use of technology emphasised. No capping on premium rates and farmers will get claim against full sum insured without any reduction.
3.	<b>Farmers Covered</b>	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.	Same as NAIS	Same as NAIS
4.	<b>Claim Liability</b>	In the 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.	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 the Centre and state governments.	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.
5.	<b>Premium Rate</b>	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.	<b>Premium Subsidy</b>	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.

<sup>74</sup> <https://www.researchgate.net/publication/319643499> Impediments to the Spread of Crop Insurance in India

7.	<b>Use of better technologies for yield estimation</b>	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.
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Source: CAG, Report No. 7, 2017

Though PMFBY has covered major shortcomings in the previous schemes, it ended up creating some of its own. During the implementation year in 2016-17, an increase in cultivated land from 23 per cent to 29 per cent was seen, but the scheme remains much lower than its own target of 50 per cent (Alexander, 2019). The schemes used before PMFBY were funded by government insurance agencies where premiums were collected and claims were paid by the end of the season without any subsidy. PMFBY, on the other hand, introduced a subsidy in the premium based system. The premiums are subsidised by state and central governments in order to reduce the pressure on the farmers. One of the major bottlenecks for this programme had been the unavailability of land documents and land records to avail insurance.

PMFBY became a flagship scheme under the Government of India, where participation by farmers was made voluntary. But this voluntary participation resulted in states opting out of crop insurance schemes. For example, Telangana and Jharkhand opted out due to lower participation rate by farmers. The lower participation resulted in lower premium collection and greater burden was borne by states. Many of the private insurance companies have also exited due to higher probability of claims, but there have been questions raised with regards to profits earned by these companies, as these companies were paid premiums by the government and farmers, and they exited within three years. Hence, there is a need to create a pool for crop insurance where each entity puts in their share and the payment of the claims is not privatised. There were some concerns with the new scheme as the total area covered declined.

**Table 9: Overview of PMFBY**

Year	Farmers Applications Insured (Lakh)	Area Insured (Lakh)	Sum Insured	Farmers Share in Premium	Gross Premium	Reported Claims	Paid Claims	Farmer Applications Benefitted (Lakh)
2016	583.6	567.2	201,266	4,046	21,769	16,768	16,749	156.2
2017	533.0	508.3	202,243	4,204	24,651	22,118	22,113	170.4
2018	576.1	522.9	230,036	4,852	28,498	29,347	27,319	215.3
2019	431.3	335.7	148,605	3,010	24,057	20,805	17,197	150.8

Source: PMFBY, Ministry of Agriculture and Farmers' Welfare<sup>75</sup>

<sup>75</sup> <https://pmfby.gov.in/stateWiseDataPage>

As can be seen from the table above, farmers' applications have reduced over the years, even though the reported claims have increased. It is a clear indication of declining trends, which calls for big ticket changes in the implementation of this flagship scheme. Considering the concerns that arose in the first two years of implementation, efforts are underway to improve the programme. For example, the revised operational guidelines were effective from 2018-19 'Rabi' crop season to ensure "timely release of subsidy by the government to insurance companies and timely settlement of claims by eligible farmers by concerned insurance companies" (PIB, 2019). Hence, crop insurance is a programme which was improved continuously and has been working ceaselessly in covering maximum number of farmers.

## **7. Conclusion**

The occurrence of catastrophic events is rapidly growing, and the need for financing resilience is ever increasing. In this paper, we try to cover the gamut of policies and schemes that have been undertaken in India. We emphasise the importance of DRR in dealing with natural catastrophes by integrating DRR and climate change adaptation strategies for the purpose of mainstreaming them into centrally sponsored schemes. This paper briefly talks about synergising risk reduction efforts with sustainable development goals through the passage of the Sendai Framework, which has been globally acclaimed as an all-inclusive collective action from private stakeholders and local governments while unambiguously stating the primary role of the state. While infrastructure investment across the globe is no longer under the monopoly of the state, this approach reminds us that the state cannot divorce itself from ensuring resilient and inclusive development pathways. It points out that the success of any economy is heavily dependent on its infrastructure networks and assets – existing and planned – and ignoring the 'resilience' aspect in infrastructure management and investment would mean additional vulnerabilities and serious negative impacts on efforts towards sustainable development and low carbon future. Scaling up of resilient infrastructure will also bring numerous co-benefits by diffusing development across sectors at macroeconomic levels.

India has taken a shift towards DRR after a series of natural catastrophic events along with an increase in global initiatives and international experience from 2005. The DRM Act was formulated and in later years various targeted schemes were put in place along with a roadmap for DRR strategies. This paper has critically analysed five schemes, some of which were funded by international organisations. We concluded that though these schemes have managed impressive progress in reducing the death count, there is still a lot more to put in place, as the targeted number of states is still very low. Then the focus of the paper shifts towards insurance and reinsurance mechanisms used in other countries for financing these catastrophes. It underlines a concept that resilience can be attained only through building better infrastructure to reduce shocks and these instruments can be financed by introducing new financial tools which deal with climate change from its very inception. The insurance sector of India was studied carefully, and it was deduced that the penetration levels are very low in India; in fact catastrophe insurance as a product has not yet been introduced: it comes as an embedded product under property insurance. To this end, various tools and mechanisms

for successful pooling of resources has been suggested by explaining briefly the financing done in various countries. Various ideas for regional pools, private government partnerships, community based programmes, etc. have been examined.

The paper highlights the gaps in the policy formulations and their implications in our country. As outlined earlier, risk financing strategy in India is still largely dominated by relief and recovery. However, resilience is more about preventive measures than enduring losses and then recovering. Therefore, disaster policies need to shift towards mitigation rather than just focusing on recovery. This paper provides a range of products and tools for beginning dialogue focusing on financing DRR and shifting attention towards serious repercussions from climatic changes. The findings of this paper suggest that India can facilitate the process of catastrophe bonds and insurance linked securities in financial markets which are less risky than capital bonds and have greater pay-outs. Despite the suite of reforms that have been initiated in shifting towards resilient infrastructure and disaster funds, there is a huge lack in implementation of these reforms. These reforms are stalled by the weakness in execution and layers and sub-layers involved in delivering these services.

## References

- ABI (Association of British Insurers). n.d.** Flood Re explained. Accessed from <https://www.abi.org.uk/products-and-issues/topics-and-issues/flood-re/flood-re-explained/>
- Acharya, N. 2019.** *Global reinsurers miffed at pro-GIC bias, seek level-playing field In India.* Business Standard, Kolkata. Accessed from [https://www.business-standard.com/article/companies/global-reinsurers-miffed-at-pro-gic-bias-seek-level-playing-field-in-india-119071500968\\_1.html](https://www.business-standard.com/article/companies/global-reinsurers-miffed-at-pro-gic-bias-seek-level-playing-field-in-india-119071500968_1.html)
- ADB. 2005.** *Climate proofing: a risk-based approach to adaptation.* January.
- Adelekan, I. O., Johnson, C., Manda, M. A. Z., Matyas, D., Mberu, B., Parnell, S., Pelling, M., Satterthwaite, D., Vivekananda, J. 2015.** Disaster risk and its reduction: an agenda for urban Africa. *International Development Planning Review*, 1-11. Accessed from: [https://www.researchgate.net/publication/273280417\\_Disaster\\_risk\\_and\\_its\\_reduction\\_An\\_agenda\\_for\\_urban\\_Africa](https://www.researchgate.net/publication/273280417_Disaster_risk_and_its_reduction_An_agenda_for_urban_Africa).
- ADPC. 2013.** *Integrating Disaster Risk Management into Climate Change Adaptation.* Disaster Risk Management Practitioner's Handbook Series. Bangkok.
- Aggarwal, M. 2018.** CWC report on Kerala floods: dams not to be blamed. *Flood and Drought.* Accessed from <https://india.mongabay.com/2018/09/cwc-report-on-kerala-floods-dams-not-to-be-blamed/>
- Alexander, S. 2019.** Crop insurance schemes need better planning. *Livemint.* Accessed from <https://www.livemint.com/industry/agriculture/why-crop-insurance-needs-to-be-better-designed-1562741755465.html>
- Aon Securities. 2018.** Insurance-linked securities: alternative capital fortifies its position. Accessed from <http://thoughtleadership.aonbenfield.com/Documents/20180905-securities-ils-annual-report.pdf>
- APEC (2017).** Report: Financial Risk Management of Public Assets Against Natural Disasters in APEC Economies. Accessed from: [http://mddb.apec.org/Documents/2017/MM/FMM/17\\_fmm\\_009.pdf](http://mddb.apec.org/Documents/2017/MM/FMM/17_fmm_009.pdf)
- Banham, R. 2018.** Catastrophe Bonds – A to Z. *Insurance Journal*, August 7, 2018. Accessed at <https://www.insurancejournal.com/news/national/2018/08/07/497273.htm>
- Bach, C., Bouchon, S., Fekete, A., Birkman, J., Serre, D., Ducheim, E., and Barroca, B. 2013.** Adding value to critical disaster risk management disaster risk management: the resilience concept. *S.A.P.I.E.N.S.*, 1-13. <https://journals.openedition.org/sapiens/1626>.



- Bennet, N. 2016.** *Learning from deaths in disasters: the case of Odisha*. Middle East Institute. Accessed from <https://www.mei.edu/publications/learning-deaths-disasters-case-odisha-india>
- Bera, S. 2019.** Crop insurance flaws fuel farm distress. *Livemint*. Accessed from <https://www.livemint.com/news/world/crop-insurance-flaws-fuel-farm-distress-11574185759756.html>
- Birkmann, J., and von Teichman, K. 2010.** Integrating disaster risk reduction and climate change adaptation: key challenges—scales, knowledge, and norms. *Sustain Sci* 5, 171-184. <https://doi.org/10.1007/s11625-010-0108-y>
- Brasor, P., and Tsubuku, M. 2018.** Abuse is the norm for Japan’s hometown tax donation system. *The Japan Times*, Dec 7, 2018. Accessed from: <https://www.japantimes.co.jp/news/2018/12/07/business/abuse-norm-japans-hometown-tax-donation-system/>
- Brook, N. 2018.** The advantages of parametric insurance. Accessed from <https://resilience.clydeco.com/articles/the-advantages-of-parametric-insurance>
- CAG (Controller and Auditor General of India). 2017.** Schemes for flood control and flood forecasting. Performance audit by Ministry of Water Resources, River Development and Ganga Rejuvenation. Accessed from [http://www.indiaenvironmentportal.org.in/files/file/Performance\\_audit\\_Union\\_Government\\_Schemes\\_for\\_Flood\\_Control\\_and\\_Flood\\_Forecasting.pdf](http://www.indiaenvironmentportal.org.in/files/file/Performance_audit_Union_Government_Schemes_for_Flood_Control_and_Flood_Forecasting.pdf)
- CCR (Caisse Centrale de Réassurance). 2013.** Response of Caisse Centrale de Réassurance to the European Commission’s Green Paper on natural and man-made disasters. Accessed from [http://ec.europa.eu/finance/consultations/2013/disasters-insurance/docs/contributions/non-registered-organisations/ccr\\_en.pdf](http://ec.europa.eu/finance/consultations/2013/disasters-insurance/docs/contributions/non-registered-organisations/ccr_en.pdf)
- CCR. (Caisse Centrale de Réassurance). 2015.** Natural disasters compensation scheme. Accessed from <https://bit.ly/2WzW8Lx>
- CEA (California Earthquake Authority). 2019.** It all started with a quake. California Earthquake Authority, California. Accessed from <https://www.earthquakeauthority.com/About-CEA/CEA-History>
- Chakraborty, N. 2020.** Are you prepared for natural disasters? *Livemint*. Accessed from <https://www.livemint.com/money/personal-finance/are-you-prepared-for-natural-disasters-11590342120518.html>
- CMA (Center for Management in Agriculture). 2018.** Performance evaluation of Pradhan Mantri Fasal Bima Yojana (PMFBY) Part I - Governance Analysis. Indian Institute of Management Ahmedabad. Accessed from [https://www.iima.ac.in/c/document\\_library/get\\_file?uuid=ae2019ae-6e67-4ad8-964b-93c464f2223b&groupId=62390&f](https://www.iima.ac.in/c/document_library/get_file?uuid=ae2019ae-6e67-4ad8-964b-93c464f2223b&groupId=62390&f)

[ilename=PMFBY%20\(Part-I\)%202018%20-%20Final%20Report%20-%20sent%20to%20MoA](#)

**CPIC (Citizens Property Insurance Corporation). 2002.** Who are we? Citizens Property Insurance Corporation, Florida. Accessed from <https://www.citizensfla.com/who-we-are>

**CRS (Congressional Research Service). 2019.** Introduction to the National Flood Insurance Program (NFIP). Accessed from <https://fas.org/sgp/crs/homsec/R44593.pdf>

**CSO. 2019.** EnviStats-India 2019, Vol. I: Environment Statistics, Central Statistics Office, Ministry of Statistics & Programme Implementation, Government of India, New Delhi.

**CWC (Central Water Commission). 2018.** State wise flood damage statistics. Flood Forecasting Monitoring Directorate, Central Water Commission Report. Accessed from [http://www.indiaenvironmentportal.org.in/files/file/statewise\\_flood\\_data\\_damage\\_statistics.pdf](http://www.indiaenvironmentportal.org.in/files/file/statewise_flood_data_damage_statistics.pdf)

**DACFW (Department of Agriculture, Cooperation & Farmers Welfare). 2018.** Annual report 2017-18. Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare Government of India. Accessed from <http://agricoop.nic.in/sites/default/files/Krishi%20AR%202017-18-1%20for%20web.pdf>

**Das, R. 2018.** Crop insurance and technology intervention – Odisha experience. *IRDAI Journal*, Vol. XVI, No. 1, Quarterly April – June 2018.

**DFS (Department of Financial Services). 2019.** Restructured Weather Based Crop Insurance Scheme (RWBCIS). Department of Financial Services, Ministry of Finance, Government of India. Accessed from [https://financialservices.gov.in/insurance-divisions/Government-Sponsored-Socially-Oriented-Insurance-Schemes/Restructured-Weather-Based-Crop-Insurance-Scheme-\(RWBCIS\)](https://financialservices.gov.in/insurance-divisions/Government-Sponsored-Socially-Oriented-Insurance-Schemes/Restructured-Weather-Based-Crop-Insurance-Scheme-(RWBCIS))

**Down to Earth. 2018.** Is India better prepared if a 2004-like tsunami strikes again? Accessed from <https://www.downtoearth.org.in/news/natural-disasters/is-india-better-prepared-if-a-2004-like-tsunami-strikes-again--62054>

**FEMA (Federal Emergency Management Agency). 2011.** Answers to questions about the National Flood Insurance Program, FEMA F-084/March 2011. Accessed from [https://www.fema.gov/media-library-data/20130726-1438-20490-1905/f084\\_atq\\_11aug11.pdf](https://www.fema.gov/media-library-data/20130726-1438-20490-1905/f084_atq_11aug11.pdf)

**FEMA (Federal Emergency Management Agency). 2019a.** National Flood Insurance Program. Accessed from <https://www.fema.gov/national-flood-insurance-program>

- FEMA (Federal Emergency Management Agency). 2019b.** Homeowners: Frequently Asked Questions. Accessed from <https://www.fema.gov/homeowners-frequently-asked-questions>
- FHCF (Florida Hurricane Catastrophe Fund). 2018.** Florida Hurricane Catastrophe Fund 2018 Annual Report. State Board of Administration of Florida. Accessed from [https://www.sbafla.com/fhcf/Portals/FHCF/Content/Reports/Annual/20190418\\_2018\\_FHCF\\_AnnualReport.pdf?ver=2019-04-18-115849-467](https://www.sbafla.com/fhcf/Portals/FHCF/Content/Reports/Annual/20190418_2018_FHCF_AnnualReport.pdf?ver=2019-04-18-115849-467)
- Flood Re. 2018.** Securing a future of affordable flood insurance. Accessed from [https://www.floodre.co.uk/wp-content/uploads/2018/07/Flood\\_Transition2018\\_AW.pdf](https://www.floodre.co.uk/wp-content/uploads/2018/07/Flood_Transition2018_AW.pdf)
- G20. 2014.** G20 Note on the Global Infrastructure Initiative and Hub, November 14, 2014, Brisbane Summit. Accessed from [http://www.g20.utoronto.ca/2014/g20\\_note\\_global\\_infrastructure\\_initiative\\_hub.pdf](http://www.g20.utoronto.ca/2014/g20_note_global_infrastructure_initiative_hub.pdf)
- G20. 2017.** G20 Hamburg Climate and Energy Action Plan for Growth, July 8, 2017, Hamburg Summit. Accessed from <http://www.g20.utoronto.ca/2017/2017-g20-climate-and-energy.html>
- G20. 2018.** G20 Leaders' Declaration: Building consensus for fair and sustainable development December 1, 2018, Buenos Aires Summit. Accessed from <http://www.g20.utoronto.ca/2018/2018-leaders-declaration.html>
- GFDRR (Global Facility for Disaster Reduction and Recovery). 2018.** Global Facility for Disaster Reduction and Recovery Strategy 2018–2021: Bringing resilience to scale. Accessed from <https://www.gfdr.org/sites/default/files/publication/gfdr-strategy-2018%E2%80%932021.pdf>
- GFDRR. 2019.** *India*. Washington, DC: GFDRR. Accessed from <https://www.gfdr.org/en/india>
- GFDRR. n.d.** *Global Facility for Disaster Reduction and Recovery Strategy 2018-21*. GFDRR. Accessed from <https://www.gfdr.org/sites/default/files/publication/gfdr-strategy-2018%E2%80%932021.pdf>
- Field, C.B., Barros, V., Stocker, T.F., Qin, D., Dokken, D.J., Ebbi, K. L., Mastrandrea, M. D., Mach, K. J., Plattner, G.-K., Allen, S. K., Tignor, M., and Midgley, P. M. (Eds.) 2012.** Managing the risks of extreme events and disasters to advance climate change adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK, and New York, NY, USA.

- Forino, G., Medinga, J.v., Brewer, G., and Gajendran, T. 2014.** Disaster risk reduction and climate change adaptation policy in Australia. *ScienceDirect*, 10. Accessed from: <https://www.sciencedirect.com/science/article/pii/S2212567114009654>
- Government of Odisha. 2013.** *India Cyclone Phailin in Odisha Rapid Damage and Needs Assessment Report*. Accessed from <https://ncrmp.gov.in/wp-content/uploads/2014/03/Odisha-Phailin-report-Final.pdf>
- Government of Odisha. 2017.** State Disaster Management Plan. OSDMA, Odisha. Accessed from: [http://www.osdma.org/Download/State\\_Disaster\\_ManagementPlanLatest.pdf](http://www.osdma.org/Download/State_Disaster_ManagementPlanLatest.pdf)
- GRF (The Global Reinsurance Forum). 2014.** Global Reinsurance: strengthening disaster risk resilience. Accessed from [http://www.grf.info/images/Publications/GRF2014-Global\\_reinsurance-strengthening\\_disaster\\_risk\\_resilience.pdf](http://www.grf.info/images/Publications/GRF2014-Global_reinsurance-strengthening_disaster_risk_resilience.pdf)
- Gulati A., Terway P., and Hussain S. 2018.** Crop insurance in India: key issues and way forward. ICRIER Working Paper No. 352. Indian Council for Research on International Economic Relations, New Delhi.
- Gupta, A.K., Chopde,S., Singh, S., Shiraz A Wajih, S. A., Katyal, S.** Prime Minister's Agenda 10: India's Disaster Risk Management Roadmap to Climate Resilient and Sustainable Development. Accessed from: [https://www.preventionweb.net/files/51313\\_51304pmagenda10paper.pdf](https://www.preventionweb.net/files/51313_51304pmagenda10paper.pdf)
- Hallegatte, S., Bangalore, M., Bonzanigo, L., Fay, M., Kane, T., Narloch, U., Rozenberg, J., Treguer, D. and Vogt-Schilb, A. (2016).** Shock waves: managing the impacts of climate change on poverty. *Climate Change and Development*, World Bank, Washington, DC. Accessed from <https://openknowledge.worldbank.org/handle/10986/22787> License: CC BY 3.0 IGO
- Hallegatte, S., Vogt-Schilb, A., Bangalore, M., and Rozenberg, J. (2017).** *Unbreakable: building the resilience of the poor in the face of natural disasters*. *Climate Change and Development Series*. Washington, DC: World Bank. doi:10.1596/978-1-4648-1003-9. License: Creative Commons Attribution CC BY 3.0 IGO
- ICICIdirect.com. 2017.** *General Insurance Cooperation of India*.
- ICZMP WB (Integrated Coastal Management Project Government of West Bengal). 2012.** Integrated Coastal Management Project: World Bank and ICZM Project Report by ICZM Project, SPMU, IESWM, Dept. of Environment, Government of West Bengal. Accessed from [http://www.iczmpwb.org/main/iczm\\_project\\_profile.php](http://www.iczmpwb.org/main/iczm_project_profile.php)
- IIHS. n.d.** *A Framework of Urban Resilience Planning*. UNDP-IIHS Working Paper on Integrated Planning for Development. Accessed from [http://iihs.co.in/knowledge-gateway/wp-content/uploads/2017/11/A-Framework-for-Urban-Resilience-Planning\\_Final.pdf](http://iihs.co.in/knowledge-gateway/wp-content/uploads/2017/11/A-Framework-for-Urban-Resilience-Planning_Final.pdf)

- III (Insurance Information Institute). 2019.** Facts + Statistics: Catastrophe bonds. Accessed from <https://www.iii.org/fact-statistic/facts-statistics-catastrophe-bonds#Catastrophe%20Bonds,%20Risk%20Capital%20Outstanding%20And%20Annual%20Issued,%202008-2017>
- IMF (International Monetary Fund). 2014.** World Economic Outlook: Legacies, Clouds, Uncertainties, October 2014. World economic outlook: a survey by the staff of the International Monetary Fund, Washington, DC
- InsuResilience GlobalPartnership India. 2019.** InsuResilience GlobalPartnership. Accessed from <https://www.insuresilience.org/insurance-market-development-india/>
- InsuResilience GlobalPartnership India. n.d.** *RIICE – Remote Sensing-Based Information and Insurance for Crops in Emerging Economies.* Accessed from <https://www.insuresilience.org/riice-remote-sensing-based-information-and-insurance-for-crops-in-emerging-economies/>
- IRDAI (Insurance Regulatory and Development Authority of India). 2019.** *IRDA Journal Quarterly*, March-2019 (Vols. XVI, No. 2). IRDAI.
- ISDR. 2008.** *Climate change and DRR.* Geneva. Accessed from <https://eird.org/publicaciones/Climate-Change-DRR.pdf>
- Jayan, T. 2019.** 50 districts out of 600 account for half of all crop-cover claims: Official. *The Hindu Business Line.* Accessed from <https://www.thehindubusinessline.com/economy/agri-business/50-districts-out-of-600-account-for-half-of-all-crop-cover-claims-official/article28880961.ece#>
- KaleidoFin. 2019.** *The need for affordable insurance cover against natural catastrophe.* Chennai, India. Accessed from <https://kaleidofin.com/natural-catastrophe-insurance/>
- Kamepalli, L.B. 2019.** Disaster relief financing: a journey from margin money to state disaster response funds. *Economic & Political Weekly* Vol. LIV no 20(16)
- Khanna, A. 2017.** Home insurance: Indians are not at home with it! *Asia Insurance Review*, New Delhi. Accessed from <https://www.asiainsurancereview.com/Magazine/ReadMagazineArticle?aid=39698>
- Kumar, T.S., Kumar, C.P., and Nayak, S. 2010.** Performance of the Indian Tsunami Early Warning System. *International Archives of the Photogrammetry, Remote Sensing and Spatial Information Science*, XXXVIII (Part 98), 271-274.
- Kumar, T.S., Nayak, S., Kumar, C.P., Yadav, R.B.C., Kumar, B.A., Sunanda, M.V., Devi, E.U., Kumar, N.K., Kishore, S.A., and Sheno, S.S.C. 2012.** Successful monitoring of the 11 April 2012 tsunami off the coast of Sumatra by Indian Tsunami Early Warning Centre. *Current Science*, 102(11), 1519-1526.

- Lamond, J., and Penning-Rowsell, E. 2014.** The robustness of flood insurance regimes given changing risk resulting from climate change. *Climate Risk Management*, 2, 1-10.
- Lavell, A., Oppenheimer, M., Diop, C., Hess, J., Lempert, R., Li, J., Muir-Wood, R., and Myeong, S. 2012.** Climate change: new dimensions in disaster risk, exposure, vulnerability, and resilience. In C.B. Field, V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.), *Managing the risks of extreme events and disasters to advance climate change adaptation* (pp. 25-64). A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change (IPCC). Cambridge University Press, Cambridge, UK, and New York, NY, USA.
- Lloyd's. 2018.** A world at risk: Closing the insurance gap. Lloyd's.
- Lok Sabha, Parliament of India. 2012.** Disaster Management Support Programme, Starred Question No. 575 answered on 16.05.2012. Ministry of Space, Government of India. Accessed from <https://idsa.in/resources/parliament/Q575DISASTERMANAGEMENTSUPPORTPROGRAMME>
- Lok Sabha, Parliament of India. 2019.** Functioning of PMFBY, Unstarred question no: 235 answered on: 05.02.2019. Ministry of Agriculture and Farmers Welfare, Government of India. Accessed from <http://164.100.47.194/Loksabha/Questions/QResult15.aspx?qref=78477&lsno=16>
- Mahul, O. 2016.** *Toward a regional approach to disaster risk finance in Asia*. GFDRR. Accessed from <http://pubdocs.worldbank.org/en/622001465500604140/DRF-Rockefeller-FINAL-002.pdf>
- Markovic, T. and Harry, S. n.d.** Parametric Insurance: a tool to increase climate resilience. Financial tools to increase climate resilience. Marsh and McLennan Insights. Accessed from <http://www.mmc.com/insights/publications/2018/dec/parametric-insurance-tool-to-increase-climate-resilience.html>
- McAneney, J., McAneney, D., Musulin, R., Walker, G., and Crompton, R. 2016.** Government-sponsored natural disaster insurance pools: A view from down-under. *International Journal of Disaster Risk Reduction*, 15, 1-9.
- Mehta, K. (2018).** Four reasons why Indians buy such little general insurance. *Livemint*, Mumbai. Accessed from <https://www.livemint.com/Opinion/mZXyBE4ywQZQag12KzY7TO/Four-reasons-why-Indians-buy-such-little-general-insurance.html>
- Mohanty, A. n.d.** *Study on supercyclone in Odisha 1999 with special reference to early warning system*. Accessed from <http://www.indiaenvironmentportal.org.in/files/file/NCAR%20-Super%20Cyclone-99%20Final.pdf>



**MoFA (Ministry of Foreign Affairs of Japan) n.d..** Disasters and disaster prevention in Japan Accessed from: <https://www.mofa.go.jp/policy/disaster/21st/2.html>

**Ministry of Finance, Japan. n.d.** Outline of Japan's Earthquake Insurance System. Accessed from: [https://www.mof.go.jp/english/financial\\_system/earthquake\\_insurance/outline\\_of\\_earthquake\\_insurance.html](https://www.mof.go.jp/english/financial_system/earthquake_insurance/outline_of_earthquake_insurance.html)

**MoWR (Ministry of Water Resources River Development and Ganga Rejuvenation) 2018.** Flood Management Programme, XIth Plan. Accessed from <http://mowr.gov.in/sites/default/files/fmp-11th-plan5817362359.pdf>

**NCRMP (National Cyclone Risk Mitigation Project) n.d.** National Cyclone Risk Mitigation Project, Website. Accessed from <https://ncrmp.gov.in/about-ncrmp/>

**NDMA (National Disaster Management Authority). 2016.** Vulnerability Profile. Accessed from <https://ndma.gov.in/en/vulnerability-profile.html>

**NDMA (National Disaster Management Authority). 2018.** National Disaster Management Plan (NDMP) Revised/ Draft-1/2018. National Disaster Management Authority, Ministry of Home Affairs, Government of India

**Oakley, M. 2018.** Incentivising household action on flooding. FloodRE. Accessed from [https://www.floodre.co.uk/wp-content/uploads/2018/03/SMF-Incentivising-household-action-on-flooding\\_web.pdf](https://www.floodre.co.uk/wp-content/uploads/2018/03/SMF-Incentivising-household-action-on-flooding_web.pdf)

**OECD (Organization for Economic Co-operation and Development). 2015.** Disaster Risk Financing: a global survey of practices and challenges, OECD Publishing, Paris. <http://dx.doi.org/10.1787/9789264234246-en>

**OECD (Organization for Economic Co-operation and Development). 2018a.** *The contribution of reinsurance markets to managing catastrophe risk.* Accessed from [www.oecd.org/finance/the-contribution-of-reinsurance-markets-to-managing-catastrophe-risk.pdf](http://www.oecd.org/finance/the-contribution-of-reinsurance-markets-to-managing-catastrophe-risk.pdf)

**OECD (Organization for Economic Co-operation and Development). 2018b.** Resilient infrastructure for a changing climate. Input Document for the G20 Climate Sustainability Working Group under the Argentine G20 Presidency

**OECD (Organization for Economic Co-operation and Development). 2020.** *Leveraging the role of property catastrophe reinsurance markets: the case of India.* Accessed from <http://www.oecd.org/daf/fin/insurance/Leveraging-the-Role-of-Property-Catastrophe-Reinsurance-Markets.pdf>

**OECD (Organization for Economic Co-operation and Development). n.d.** *India – Terrorism Risk Insurance Programme.* OECD. Accessed from <https://www.oecd.org/daf/fin/insurance/India-Terrorism-Risk-Insurance.pdf>

- Parida, Y., and Goel, P.A. 2020.** India is not prepared for natural disasters. *The Hindu Business Line*. Accessed from <https://www.thehindubusinessline.com/opinion/india-is-not-prepared-for-natural-disasters/article30463153.ece>
- Parliament of India. 2015.** *Devastations caused by natural disaster, Hudhud Cyclone in Andhra Pradesh and Odisha*. Parliament of India Rajya Sabha. Accessed from <http://164.100.47.5/newcommittee/reports/EnglishCommittees/Committee%20on%20Home%20Affairs/195.pdf>
- PIB (Press Information Bureau). 2015.** Protection of Coastal Areas from Rising Sea Level press release on 26-Feb-2015. Press Information Bureau, Government of India, Ministry of Earth Sciences. Accessed from <http://pib.nic.in/newsite/PrintRelease.aspx?relid=115996>
- PIB. (Press Information Bureau). 2016.** National Disaster Mitigation Fund. Accessed from <https://pib.gov.in/newsite/PrintRelease.aspx?relid=148287>
- PIB. (Press Information Bureau). 2018a.** Flood Control Schemes, press release on 02-August-2018. Press Information Bureau, Government of India, Ministry of Water Resources. Accessed from <http://pib.nic.in/newsite/PrintRelease.aspx?relid=181412>
- PIB. (Press Information Bureau). 2018b.** Decline in number of beneficiaries under PMFBY. Press Information Bureau, Ministry of Agriculture & Farmers Welfare, Government of India. 03 August 2018. Accessed from <http://pib.nic.in/newsite/PrintRelease.aspx?relid=181469>
- PIB. (Press Information Bureau). 2019.** Non-Settlement of Claims Under PMFBY. Accessed from <https://pib.gov.in/PressReleasePage.aspx?PRID=1559074>
- Planning Commission. n.d.** *Evaluation study of rehabilitation & reconstruction process in post super cyclone Orissa*. Government of India. Accessed from [http://planningcommission.nic.in/reports/sereport/ser/study\\_of\\_reh.pdf](http://planningcommission.nic.in/reports/sereport/ser/study_of_reh.pdf)
- PMFBY. n.d.** State Wise Business Statistics. Accessed from Pradhan Mantri Fasal Bima Yojana, Ministry of Agriculture & Farmers' Welfare: <https://pmfby.gov.in/stateWiseDataPage>
- Poddar, K.M. 2018.** Pradhan Mantri Fasal Bima Yojana (PMFBY) – Issues inhibiting its big success and probable way forward. IRDAI Journal, Volume XVI, No. 1, Quarterly April–June 2018. Published by Insurance Regulatory and Development Authority of India, Hyderabad
- Pollner, J.D. 2001.** Managing catastrophic disaster risks using alternative risk financing and pooled insurance structures. World Bank technical paper no. 495. The International Bank for Reconstruction and Development/The World Bank, Washington, DC.



- Pradhan Mantri Jan Arogya Yojana (PM-JAY), Government of India. n.d.** *About Pradhan Mantri Jan Arogya Yojana (PM-JAY)*. Accessed from Pradhan Mantri Jan Arogya Yojana (PM-JAY), Government of India: <https://pmjay.gov.in/about/pmjay>
- ProAct Network. 2008.** Climate change adaption and disaster risk reduction, policy paper. UNISDR, United Nations Secretariat, Geneva, Switzerland. Accessed from [https://www.unisdr.org/files/8877\\_drrcaapolicypaper.pdf](https://www.unisdr.org/files/8877_drrcaapolicypaper.pdf)
- Raghavan. R. 2018.** *Reinsurance goes Make in India*. Business Line. Accessed from <https://www.thehindubusinessline.com/opinion/reinsurance-proposed-regulations-by-irda-debate/article22881461.ece>
- Rai, R. 2019.** *Pradhan Mantri Fasal Bima Yojana: an assessment of India's crop insurance scheme*. ORF Issue Brief No. 296. May. Observer Research Foundation. Accessed from <https://www.orfonline.org/research/pradhan-mantri-fasal-bima-yojana-an-assessment-of-indias-crop-insurance-scheme-51370/>
- Ray, S., Jain, S., and Thakur, V. 2019.** *Financing resilience against natural disasters*. Report. September. Indian Council for Research on International Economic Relations, New Delhi.
- Ray, S., Thakur, V., and Bandyopadhyay, K. 2020.** *India's insurance sector: challenges and opportunities*. ICRIER Working Paper 394. July. Accessed from [http://icrier.org/pdf/Working\\_Paper\\_394.pdf](http://icrier.org/pdf/Working_Paper_394.pdf)
- Reuters. 2018.** How Kerala's dams failed to prevent catastrophe. Reuters. Accessed from <https://graphics.reuters.com/INDIA-FLOOD/010080MF18N/index.html>
- RMA (Risk Management Agency). 2016.** RMA Quick Facts July 2016. Risk Management Agency, United States Department of Agriculture. Accessed from <https://www.rma.usda.gov/Fact-Sheets/National-Fact-Sheets/RMA-Quick-Facts>
- Rockefeller Foundation and DFRIP. (2016).** *Toward a regional approach to disaster risk finance in Asia*. Discussion Paper. May. Accessed from <http://pubdocs.worldbank.org/en/622001465500604140/DRF-Rockefeller-FINAL-002.pdf>
- Rydge, J., Jacobs, M., and Granoff, I. 2015.** Ensuring new infrastructure is climate smart. Contributing paper for seizing the Global Opportunity: Partnerships for Better Growth and a Better Climate. New Climate Economy, London and Washington, DC.
- Sagar, U. 2016.** *Cyclone Hudhud path and affected area map*. Maps of India. Accessed from <https://www.mapsofindia.com/mapinnews/cyclone-hudhud/>

- Sharma, A. 2017.** Home insurance under-purchased product in India. *ET Realty*. January 30. Accessed from <https://realty.economictimes.indiatimes.com/news/allied-industries/home-insurance-under-purchased-product-in-india/56873132>
- Somasekhar, M. 2016.** New network buoys up India's tsunami warning system. *The Hindu Business Line*. December 25. Retrieved from <https://www.thehindubusinessline.com/news/new-network-buoys-up-indias-tsunami-warning-system/article9443459.ece>
- Standing Committee on Finance, Sixteenth Lok Sabha. 2019.** Central assistance for disaster management and relief, Seventy-First Report of Standing Committee on Finance (2018-2019) (Sixteenth Lok Sabha) Ministry of Home Affairs & Ministry of Finance. Lok Sabha Secretariat, New Delhi.
- Swiss Re. 2012.** What are Insurance Linked Securities (ILS), and why should they be considered? Presentation to the CANE Fall Meeting, September 2012 Swiss Re Capital Markets. Accessed from <https://www.casact.org/community/affiliates/CANE/0912/Cat-Bond.pdf>
- Swiss Re. 2018.** sigma 1/2018: Natural catastrophes and man-made disasters in 2017: a year of record-breaking losses. Swiss Re Institute. Accessed from <https://www.swissre.com/institute/research/sigma-research/sigma-2018-01>
- Swiss Re. 2020.** Swiss Re Institute estimates global insured catastrophe losses of USD 31 billion in first half of 2020, mostly from secondary perils. August 11. Accessed from <https://www.swissre.com/media/news-releases/nr-20200811-swiss-re-institute-estimates-global-insured-catastrophe-losses-usd-31-billion-mostly-from-secondary-perils.html>
- TARSIM (Turkish Agricultural Insurance Pool). 2018.** About Corporation. TARSIM Agricultural Insurance pool. Accessed from [https://web.tarsim.gov.tr/havuz/subPageEng?\\_key\\_=6D7415BE31795E0576A7CE18FEDB4F2E406252491HL36S36S61K2H28ER24062015](https://web.tarsim.gov.tr/havuz/subPageEng?_key_=6D7415BE31795E0576A7CE18FEDB4F2E406252491HL36S36S61K2H28ER24062015)
- Thakkar, H. 2018.** Role of dams in Kerala's 2018 floods. South Asia Network on Dams, Rivers and People. Accessed from <https://sandrp.in/2018/10/04/role-of-dams-in-keralas-2018-floods/>
- The Hindu Business Line. 2020.** PM Fasal Bima Yojana changes, a reply to criticism over insurance firms. February 20. Accessed from <https://www.thehindubusinessline.com/opinion/editorial/pm-fasal-bima-yojana-changes-a-reply-to-criticism-over-insurance-firms/article30873158.ece>
- TheCityUK. 2016.** *Development of the reinsurance industry in India*. Kotak Bank, New Delhi Accessed from <https://www.thecityuk.com/assets/2016/Reports-PDF/a21844cb7a/IUKFP-Development-of-the-reinsurance-industry-in-India.pdf>

- Thomalla F., Downing T., Spanger-Siegfried E., Han G., and Rockström, J. 2006.** *Reducing hazard vulnerability: towards a common approach between disaster risk reduction and climate adaptation.* UK: Blackwell Publishing.
- Tiwari, R. 2020.** Two more states opt out of PM crop insurance scheme. *The Economic Times*. May 27. Accessed from <https://economictimes.indiatimes.com/news/economy/agriculture/two-more-states-opt-out-of-pm-crop-insurance-scheme/articleshow/76048343.cms>
- Turnbull, M., Sterrett, C. L., and Hilleboe, A. 2013.** *Toward Resilience: A Guide to Disaster Risk Reduction and Climate Change Adaptation* was released on the International Day for Disaster Reduction, 2012. <https://reliefweb.int/sites/reliefweb.int/files/resources/ECB-toward-resilience-Disaster-risk-reduction-Climate-Change-Adaptation-guide-english.pdf>
- 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.
- UN. n.d.** *The Indian Tsunami Early Warning System (ITEWS) by INDIA (Government).* Accessed from United Nations Ocean Conference Lisbon: <https://oceanconference.un.org/commitments/?id=20596>
- UNDP, MHA. 2019.** Mainstreaming disaster risk reduction and climate change adaptation in the national flagship programmes. New Delhi, India: Government of India. Accessed from [https://www.ndmindia.nic.in/images/pdf/Mainstreaming%20Report\\_Final\\_sept7.pdf](https://www.ndmindia.nic.in/images/pdf/Mainstreaming%20Report_Final_sept7.pdf)
- UNGA (UN General Assembly). 2015.** Transforming our world: the 2030 Agenda for Sustainable Development. UN General Assembly seventieth session, agenda items 15 and 116, 21 October 2015.
- UNICEF. 2012.** Climate Change Adaptation DRR in the education sector. New York: UNICEF Division of Communication. Accessed from <https://www.unicef.org/cfs/files/UNICEF-ClimateChange-ResourceManual-lores-c.pdf>
- UNICEF. 2019.** Cyclone Fani Situation Report #2 (national). Accessed from <https://reliefweb.int/sites/reliefweb.int/files/resources/UNICEF%20India%20Humanitarian%20Situation%20Report%20No.%202%20%28Cyclone%20Fani%29%20-%2012%20May%202019.pdf>
- UNISDR (UN International Strategy for Disaster Reduction). 2015.** Sendai Framework for Disaster Risk Reduction – UNISDR
- UNISDR and CRED. 2018.** Economic losses, poverty & disasters: 1998–2017. United Nations Office for Disaster Risk Reduction (UNDRR) and Centre for Research on the

Epidemiology of Disasters (CRED). Accessed from <https://www.unisdr.org/we/inform/publications/61119>

**Upadhyaya, H. 2018.** Kerala floods: What to expect when none of the 61 dams have any emergency plan? *Down to Earth*. August 20. Accessed from <https://www.downtoearth.org.in/news/natural-disasters/kerala-floods-what-to-expect-when-none-of-the-61-dams-have-any-emergency-plan--61416>

**WMO. 2018.** The State of the Global Climate in 2018.

**World Bank. n.d.** Disaster Risk Financing and Insurance (DRFI) Program. Washington, DC: The World Bank. Accessed from <http://www.worldbank.org/en/programs/disaster-risk-financing-and-insurance-program#4>

**World Bank. 2015.** India Integrated Coastal Zone Management Project: Eighth Implementation Support Mission, August 31 – November 9, 2015, Aide Memoire. World Bank, Washington DC. Accessed from [http://sicom.nic.in/sites/default/files/Aide\\_memo\\_nov\\_15.pdf](http://sicom.nic.in/sites/default/files/Aide_memo_nov_15.pdf)

**World Bank. 2017.** National Cyclone Risk Mitigation Project, Phase-II (NCRMP- II), Implementation Support Mission. The World Bank, Washington, DC. Accessed from <https://ncrmp.gov.in/wp-content/uploads/2013/04/WBPH-II.pdf>

**World Bank. 2018.** Global Risk Financing Facility. Washington, DC: The World Bank. Accessed from <http://www.worldbank.org/en/topic/disasterriskmanagement/brief/global-risk-financing-facility>

**World Bank. 2019.** Integrated Coastal Zone Management. A survey by World Bank, Washington, DC. Accessed from <http://projects.worldbank.org/P097985/integrated-coastal-zone-management?lang=en>

## Annexure

### Disaster risk financing in select countries – Japan

Japan has a very high-risk profile. The country frequently experiences large-scale loss and damage due to natural hazards like earthquakes, typhoons, active volcanoes, and tsunami. The high incidence is attributed to several factors. The country is situated in the Pacific earthquake belt and has a complex coastline highly vulnerable to tsunamis (MoFA, 2014). Located in the circum-Pacific zone, it has about 83 active volcanoes, accounting for one tenth of the world total. Japan also experiences extreme climate variations like seasonal rain fronts and typhoons (MoFA, 2014).<sup>76</sup> The rugged topography, with many faults and steep inclines, further adds to the vulnerability. It has been reported that between 1998 and 2017, the country incurred an absolute loss of US\$ 376.3 billion (UNISDR and CRED, 2018). The most notable event during this period was the 2011 Great East Japan Earthquake and Tsunami, with the consequent shutdown of the Fukushima nuclear energy plant, causing losses to the tune of US\$ 228 billion (UNISDR and CRED, 2018).

The high incidence of disasters has also bolstered disaster management efforts in the country. The country has aligned its disaster risk management strategy and measures with the Sendai framework and has been demonstrating high efficiency in disaster prevention, preparedness, and response. For example, 4,377 Seismic Intensity Observation Points are located throughout Japan, which enable the Japan Meteorological Agency (JMA) to estimate the intensity of earthquakes for Early Warning of tsunami and analysis of the risks (APEC, 2017). Such efforts, combined with an efficient governance system, have helped Japan to increase resilience and build back better in case of extreme events. The initial response and post disaster action during the 2016 Kumamoto Earthquake is a case in point.<sup>77</sup> The earthquakes which occurred on April 14 and 16, 2016 recorded a maximum seismic intensity of 7 on the Richter scale and caused immense damage, including 228 fatalities. Considering the scale of damage, the recovery is laudable. While the initial response came from the contingency reserve (US\$ 23 million), the government later compiled a supplementary budget of US\$ 7,780 million to support its operations (APEC, 2017). Reduction of planned interest payments and the prevailing low interest rate environment was used to mobilise financial resources (APEC, 2017). Constant update and periodic revision of disaster risk reduction plans in light of lessons learned during the disaster is also a notable Japanese characteristic. Considering repeated exposure to disaster events, Japan is now actively investing and promoting creation of resilient infrastructure. Strengthening the building codes, development of DRM cycle, including regular maintenance, inspection, and repair, and creation of resilient infrastructure with multiple functions<sup>78</sup>, etc. are some of the initiatives in this direction (APEC, 2017).<sup>79</sup>

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<sup>76</sup> <https://www.mofa.go.jp/policy/disaster/21st/2.html>

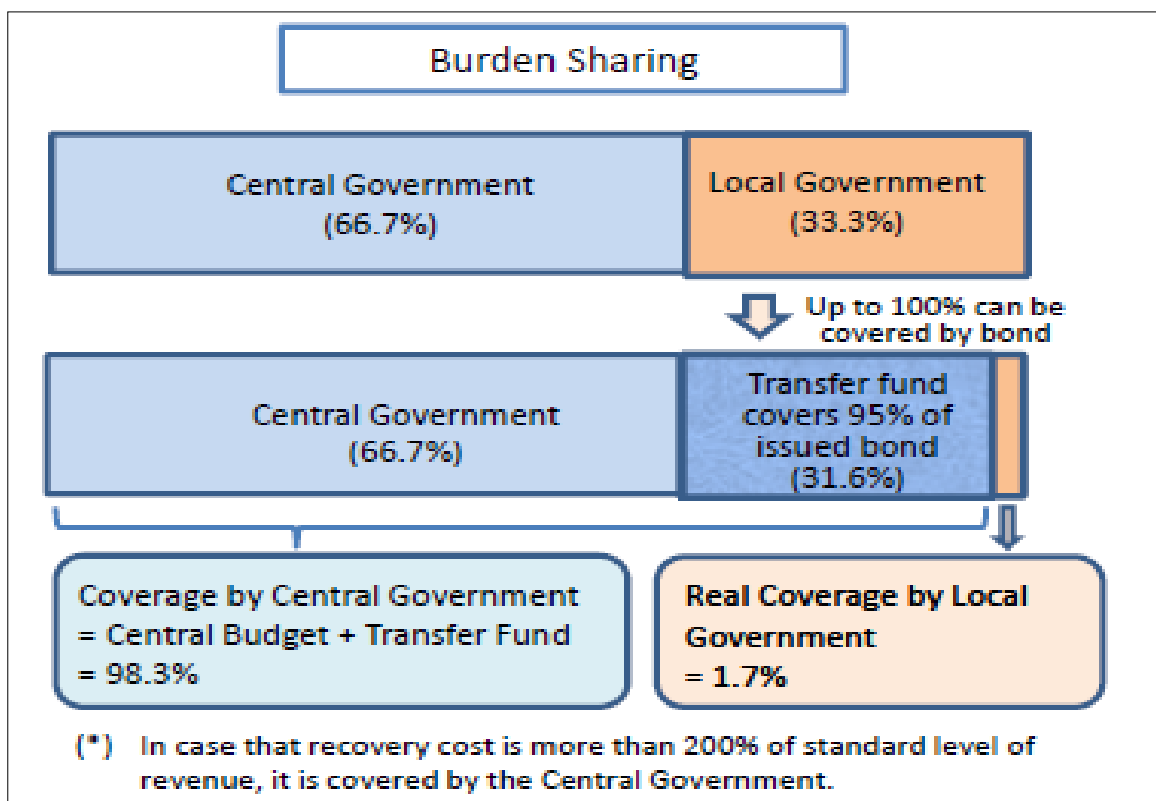
<sup>77</sup> See [http://www.bousai.go.jp/kyoiku/panf/pdf/WP2017\\_DM\\_Full\\_Version.pdf](http://www.bousai.go.jp/kyoiku/panf/pdf/WP2017_DM_Full_Version.pdf) for a detailed discussion.

<sup>78</sup> For example, quake-resistant roads and expressways with parking areas can perform multiple functions such as evacuation routes, base stations of recovery operations, and shelters for residents in case of a disaster event.

<sup>79</sup> [http://mddb.apec.org/Documents/2017/MM/FMM/17\\_fmm\\_009.pdf](http://mddb.apec.org/Documents/2017/MM/FMM/17_fmm_009.pdf)

With respect to risk financing, Japan follows a state led approach, with active involvement of the private sector. The pattern of risk coverage of assets and infrastructure varies depending on the ownership. The recovery costs of government assets – both central and local – are usually met by supplemental budgets. This burden is shared between the central government and local governments in a 2:1 ratio (APEC, 2017). However, as APEC (2017) points out, the central government takes up much of the burden if the local governments are unable to cover the potential damage. The local government can issue bonds to finance itself in such circumstances, where 95 per cent of the interest and redemption of the bond can be covered by the central government through the Transfer Fund to the local government (APEC, 2017).

**Figure 1A: Disaster risk finance for public assets**

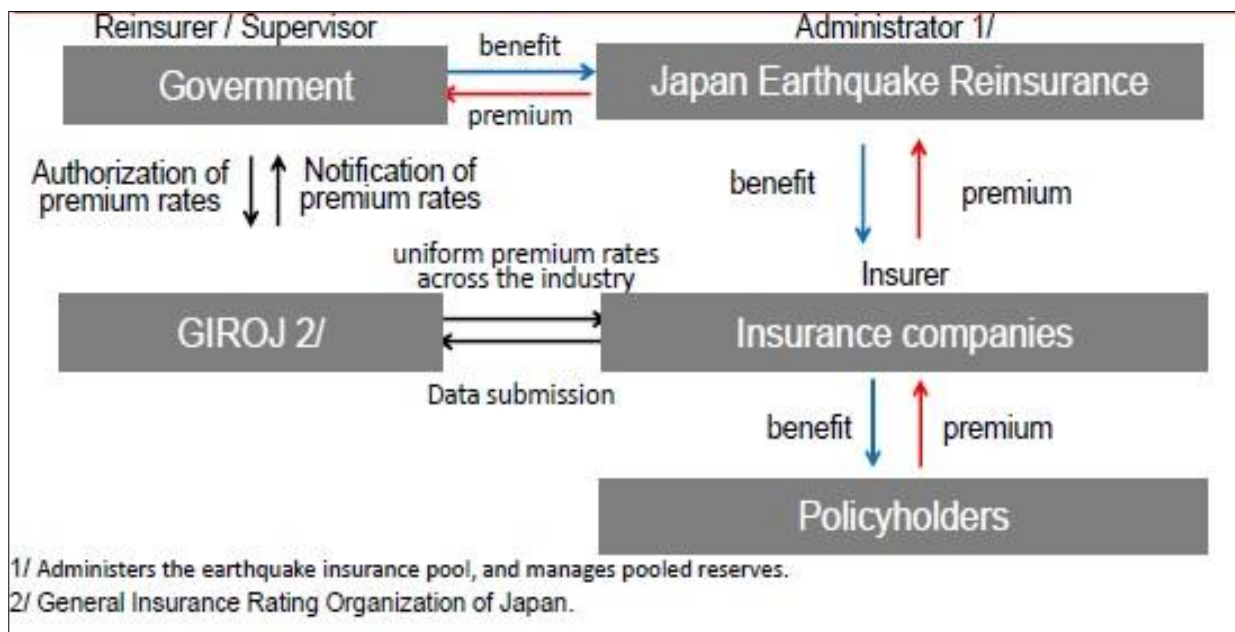


Source: APEC (2017)

The risk financing of private infrastructure or quasi-public infrastructure is usually covered by insurance from the private sector. Subscription of group insurance, where the policyholder is the industry association, is also another preferred route, as this tends to reduce and stabilise the premium associated (APEC, 2017). The most notable risk related finance instrument in Japan is the earthquake insurance facility available for households. The programme is essentially a targeted state-sponsored reinsurance programme for earthquake related damage. Introduced in the aftermath of the Niigata earthquake in 1964, the law established Japan Earthquake Reinsurance Co., Ltd. (JER) as the administrator and reinsurer for the private insurance companies. Through this arrangement, JER retains a portion of the liability and cedes the rest back to private insurers (based on their market share) and to the Japanese

government through reinsurance treaties (OECD, 2015). The Japanese government holds a Special Account for earthquake reinsurance for pooling reserve (APEC, 2017) and pays out reinsurance claims to private insurers in the event of a major earthquake. The total limit of the pay-out has been decided based on losses during the Great Kanto Earthquake of 1923 and has so far covered all the past major earthquakes. This scheme devolves risk along three layers – the Government, JER, and private companies. The insurance is now provided as an optional rider to fire insurance, which covers buildings for residential use and/or personal property, and the coverage includes loss or damage of buildings for residential use and personal property through fire, destruction, burial, or flooding caused directly or indirectly by an earthquake, volcanic eruption, or resulting tsunami (OECD, 2015). Premiums are calculated according to the structure and location of the insured buildings and of the buildings accommodating the insured household goods.<sup>80</sup> The scheme also has an elaborate premium discount in accordance with age of construction and earthquake resistance performance. This also incentivises creation of resilient infrastructure, as earthquake resistance rating, seismic retrofitting, etc. brings in considerable discount to premiums. To support independent efforts of the people, the government also allows a special tax deduction for earthquake insurance premiums (MoFJ, n.d.).<sup>81</sup>

**Figure 2A: Earthquake financing for Japan for households**



Source: APEC (2017)

<sup>80</sup> [https://www.mof.go.jp/english/financial\\_system/earthquake\\_insurance/outline\\_of\\_earthquake\\_insurance.html](https://www.mof.go.jp/english/financial_system/earthquake_insurance/outline_of_earthquake_insurance.html)

<sup>81</sup> [https://www.mof.go.jp/english/financial\\_system/earthquake\\_insurance/outline\\_of\\_earthquake\\_insurance.html](https://www.mof.go.jp/english/financial_system/earthquake_insurance/outline_of_earthquake_insurance.html)

**Table 1A: Risk sharing in the Japanese earthquake insurance scheme**

	<b>Share of Liability: Government</b>	<b>Share of Liability: JER and private sector</b>
Liabilities up to JPY 100 billion		100%
Over JPY 100 billion and up to JPY 362 billion	50%	50%
From JPY 362 billion to JPY 7.0 trillion	99.95%	0.5%

*Source: Compiled from OECD (2018)*

The interministerial fund for promoting emergency projects for DRR is another support programme for reconstruction of disaster struck public infrastructure. The scheme provides additional fiscal support for the restoration if required funding exceeds a certain amount of the tax revenue of the affected local governments. In addition, there is also an interministerial fund for project coordination to facilitate recovery work, as well as pre-disaster infrastructure development to increase resilience (APEC, 2017). The fund is budgeted at the start of the fiscal year without specifying the targets and disburses necessary funds without waiting for the annual budgeting process for the succeeding fiscal year (APEC, 2017). The scheme allows more coordinated action and close collaboration between ministries, as the recovery process often spills over to the jurisdiction of multiple ministries.

The Hometown Tax donation system (Furusato Nozei) started in 2008 is another notable scheme in Japan to support local governments. Acknowledging the financial burden of local governments, it allows “residents to divert a proportion of their income tax payments to other prefectures or municipalities of their preference, which could be their own hometown or another place they love. Taxpayers living in metropolitan areas could thus contribute to their hometown” (APEC, 2017). The scheme, though, has attracted much criticism in the past. According to some reports, the scheme has resulted in unhealthy competition among local governments to attract funds (Brasor and Tsubuku, 2018).



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