Disaster Risk Reduction in India

Status Report 2020

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About this report

The disaster risk reduction (DRR) status report provides a snapshot of the state of DRR in India under the four priorities of the Sendai Framework for Disaster Risk Reduction 2015-2030. It also highlights progress and challenges associated with ensuring coherence among the key global frameworks at the national level; and makes recommendations for strengthening overall disaster risk management (DRM) governance by government institutions and stakeholders at national and local levels.

As this report is based on information available as of the end of the year 2019, an update on the COVID-19 impact, response and recovery using a risk-informed approach by countries is provided at the beginning of this report. This report has been prepared by the Asian Disaster Preparedness Center (ADPC) on behalf of the United Nations Office for Disaster Risk Reduction (UNDRR) through country consultations and a desk review of key documents, including legal instruments and DRR policies, plans, strategies and frameworks, etc.

UNDRR and ADPC acknowledges the government, international organizations and stakeholder representatives who contributed their valuable input and feedback on this report. The list of people and agencies met is enclosed at the end of this report.

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This report serves as a reference document for the implementation and monitoring of the Sendai Framework. The findings, interpretations, and conclusions expressed in this document are those of the author(s) and do not necessarily represent those of the United Nations, including UNDRR, or its Member States. The presentation of the material in this report concerning the legal status of any country or territory or of its authorities or concerning the delimitations of its frontiers or boundaries, as well as the text and the tables, is intended solely for statistical or analytical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. While every effort has been made to ensure the accuracy of the information, the document remains open for any corrections in facts, figures and visuals.

UNDRR (2020). Disaster Risk Reduction in The Republic of India: Status Report 2020. Bangkok, Thailand, United Nations Office for Disaster Risk Reduction (UNDRR), Regional Office for Asia and the Pacific

India's Response to COVID-19 and Disaster Risk Reduction

The first case of COVID-19 in India was reported on January 30, 2020, and the number of cases continued to rise. Prime Minister Modi announced on March 24, 2020, that the entire country will go under lockdown, with localized lockdowns in containment zones extended to September 30, 2020. Prior to the March announcement, numerous containment measures had already been imposed, varying in intensity across the country, including travel restrictions; closing educational establishments, gyms, museums, and theatres, ban on mass gatherings, and encouraging firms to promote remote work.

The economic impact of COVID-19 has been substantial and broad-based. The GDP contracted sharply in the fiscal second quarter, Q2 2020, due to the unprecedented lockdowns to control the spread of COVID-19. In its fight against the pandemic, India faced unique challenges with multiple land, sea and air entry ports including open land borders; large amounts of international and domestic tourists; high population density, particularly in urban areas; inadequate public health infrastructure; and socio-economic and cultural practices that require mass gatherings.

At an early stage, steps were taken to induct eminent experts to analyse possible scenarios and prepare a medical emergency plan, which helped with a systematic and effective response to the crisis. Given the large population, even if a small percentage of infected persons require hospitalization or critical care, it would overwhelm the country's already stretched healthcare system. This meant that India needed to 'flatten the curve' so as to allow sufficient medical attention for those who contracted COVID-19.

The government constituted eleven Empowered Groups in exercise of the powers conferred on it under the Disaster Management Act, 2005. The "Empower Group" led by a Secretary-level officer from the relevant ministry was tasked to contain and manage this pandemic in collaboration with state governments, Union Territory administrations, Civil Society Organizations (CSOs) and all other stakeholders including citizens of the country. These groups were empowered to identify problem areas and provide effective solutions.

1. Introduction

The Republic of India is a country located in South Asia, sharing borders with Pakistan, China, Nepal, Bhutan, Bangladesh and Myanmar. In terms of land area, it is the seventh-largest country in the world, occupying major portion of the South Asian subcontinent, and extending over 3,287,263 square kilometres. Due to its vastness, the country comprises numerous ecological systems from the Himalayan mountain regions to tropical rainforests and delta plains in the south (Government of India, 2019). The climate is broadly considered as tropical, but given the geographic diversity, regional climate varies depending on the topography.

With regards to administration, the country has been divided into 29 states and 9 union territories, grouped into six zones with an Advisory Council which is intended to improve the cooperation and communication among states across India. States are further divided into districts, and these into local districts which are habitually referred to with various names depending on the locality (such as tehsils of Uttar Pradesh, or mandals of Andra Pradesh), which also share some regional characteristics in terms of the extent of their administrative powers over villages. Still, it is a federal form of government, wherein the central government has greater powers in relation to the states.

Also, the country has seen stellar economic growth over the past decades, and has reached the status of the world's third largest economy in purchasing parity terms. Following ascending trends, poverty decreased rapidly - between 2011 and 2015, over 90 million people escaped from extreme poverty (World Bank, 2019). One of the most important contributing sectors is agricultural production with a share of 14 percent of the GDP, and it also provides employment to more than 50 percent of the population (Sharma, 2019). However, the service industry holds the largest share of the GDP with 60 percent, alongside manufacturing with 25 percent (Sharma, 2019). Opening up the economy to international investors and stakeholders has also supported the growth, transfer of technology and knowledge, combined effects of which have sustained positive development trajectory. Yet, while performance has been strong, its associated gains have been distributed unevenly. Access to services and opportunities varies drastically among population groups and demographic areas, and as of 2019, over 176 million were living in poverty despite the impressive gains (World Bank, 2019).

Moreover, hazards continue to strain not only the country's economy, but the wellbeing and happiness of its people. India is exposed to range of natural hazards from flooding, cyclones, droughts to extreme heat, wildfire and earthquakes (GFDRR, 2019). Anthropogenic hazards from chemical, biological, and nuclear threats are also a concern given the high population densities and rate of industrial development (NDMA, 2019). In this context, it should be acknowledged that climate change, potentially having an exacerbating effect to hydrometeorological hazards, may also further compromise already achieved development gains, availability of safe water and agricultural output. Due to the fact that 68 percent of the country's cultivable area is vulnerable to droughts (NDMA, 2019), considerations for synergized sectoral disaster and climate risk reduction efforts are increasingly necessary to protect productive industries, the population and their wellbeing.

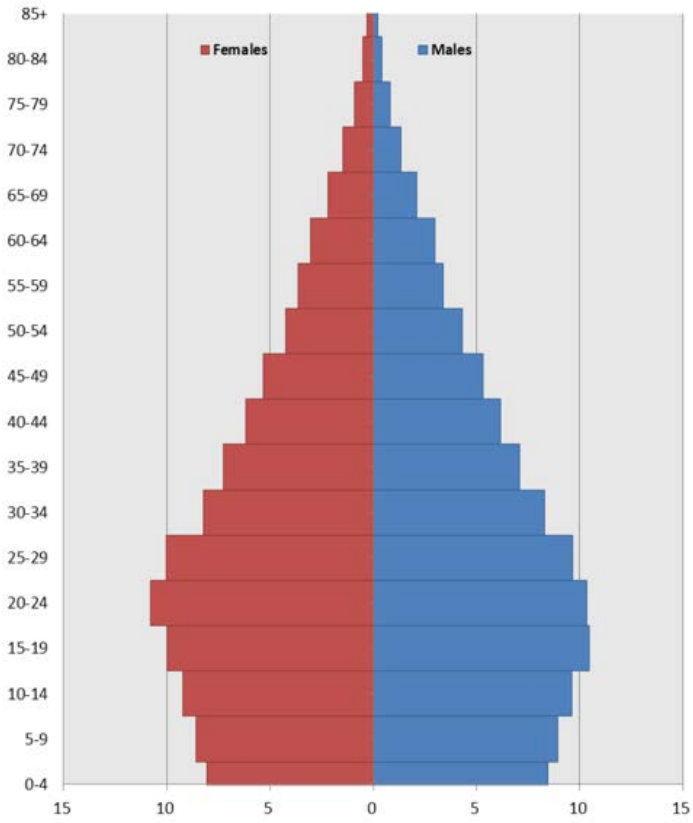
1.1 Demographic Characteristics

The population census of 2011 reported the total population to be 1,210,854,977 people, with an average density of 382 persons per square kilometre (CSO, 2019). In 2017, the population was estimated to have reached 1,339 billion people, of whom approximately 31.6 percent reside in urban regions (National Disaster Management Authority, 2019). However, rates of urbanization depend on the state. For example, following rapid rural to urban migration in Kerala, the population residing in cities has reached 47.7 percent just within a decade from 25.9 percent, and the territories of Delhi and Chandigarh remain most urbanized with 97.5 percent and 97.25 percent respectively (Ministry of Housing and Urban Affairs, 2019). Yet, some areas such as the Himachal Pradesh have a rate of urbanization resting at 10 percent.

In 2018, India also climbed from the spot of 131 to 129 in the human development rankings measuring 189 countries and territories, thus placing the country into a medium human development category (UNDP, 2018). It is indeed a remarkable achievement in lifting millions out of poverty, increasing the access to education and increasing well-being of the population with the support of the flourishing economy. Average literacy rates have reached 74.04 percent, with Kerala having the highest rates in the country (93.91 percent) (Oxfam India, 2019). Yet, it must be noted that 26.8 percent of the HDI value is lost on inequalities (which is greater than most for other South Asian countries) (UNDP, 2018). Disparities in the rate of development across states and territories is among the country's most important challenges to tackle during the upcoming decade, addressed by increasing equity and access to opportunities for its population. Still, 28 percent of the world's poor reside in the country, and disparities are prevalent especially in terms of gender equality. For example, 59 percent of the illiterate in India are women, and gaps remain in women's representation in attaining higher education, decent employment and equal pay (Observer Research Foundation, 2019).

In terms of sustaining its demographic dividend, India is on track on sustaining the growth of working-age populations until 2055. Currently, the country's share of working-age populations (people aged between 15-64) vastly outweighs the number of dependents (children below 14 and elderly above 65 years). In 2017, those working-aged represented 68.4 percent of the population, seen in figure 1 (Ministry of Home Affairs, 2017). This signifies a significant potential for achieving a rapid economic boost to support overall development, as the number of tax-paying productive individuals increases vis-à-vis those dependent on services and support. However, achieving the gains associated with the dividend requires significant investments in the economy to increase the availability of employment opportunities, supported by expanding the coverage of services including healthcare and schooling. Firstly, the population must be healthy and educated to enter the markets, and the available opportunities must match their skills. Secondly, economic benefits depend on the global competitiveness of the created jobs. Thus, sustaining such trajectory represents a significant challenge for a country posed to surpass China in terms of its population during the upcoming decade.

Figure 1. India's population pyramid as of 2017, age vis-à-vis percent of the total population (Ministry of Home Affairs, 2017)



1.2 Economic Impact of Disasters

Disasters may have severe negative impacts on short and long-term economic development in various sectors. Future economic growth may also be compromised due to lost assets, productivity or seeds, for example, all of which would hinder growth prospects. Combined losses and damages, in consideration of the cost of reconstruction and recovery, may rapidly exceed a government's budget especially at the sub-national levels. However, very few comprehensive studies about the economic impact of disasters have been conducted in India.

Between 1991 and 2005, disasters have already reduced India's GDP by a total of 2 percent as a result of 431 major disasters and other more frequent hazards – especially those of hydrometeorological origin (Ministry of Home Affairs, 2011). As one of the most disaster-prone countries in the world, catastrophic-scale events are also possible, such as the Indian Ocean tsunami of 2004. While its impacts to the economy were expected to be relatively minor due to the fact that the affected areas were not heavily industrialized, thousands of people still lost their livelihoods (mainly low-income households reliant on fishing and subsistence agriculture) and the estimated funding support needs for infrastructure repairs were exceeding US$ 300 million (IMF, 2005). Also, the tourism sector suffered heavy losses in the year following the tsunami due to cancellations and lost assets along the coastlines.

More recently, the Kerala floods and landslides of 2018 affected over 5.4 million people, and caused severe damages to housing, transport networks, power supplies and other infrastructure, alongside destroyed crops and lost livestock. The initial post disaster needs

assessment estimated recovery needs of US$ 4.4 billion, which illustrates the massive damaging potential of localized disasters as well (UN, ADB & The World Bank, 2018). Most heavy damages and losses were concentrated to infrastructure (38 percent), followed by cross-cutting sectors (27 percent)[1] and productive industries (17 percent) (UN, ADB & The World Bank, 2018). Conservative estimates projected Kerala's GDP to drop by 2.6 percent due to the vast scale of impacts, which would translate to significantly hindered economic growth for the year 2018-2019 (UN, ADB & The World Bank, 2018). Such events highlight the need for holistic integration of disaster risk reduction (DRR) and climate change adaptation (CCA) considerations to avoid massive-scale losses and economic slowdown. This is especially important given that urban regions are now contributing to 63 percent of the national GDP while still being increasingly exposed and vulnerable to a range of hazards (National Disaster Management Authority, 2019). A good example of this vulnerability is the city of Chennai, wherein most reservoirs ran dry during the drought conditions of 2019, leaving the city with a GDP of US$ 78 billion without water for months following two years of deficient monsoon seasons (Kumar-Rao, 2019).

1.3 Social Impact of Disasters

Alongside the economy, disasters also affect people, their health and wellbeing, livelihoods and the ability to sustain themselves and their families. In the case of Kerala flooding, 1.4 million people had to be evacuated from the flood waters, the access to piped water was disrupted to more than 6.7 million persons, and more than 3 million shallow wells became inoperable or contaminated across the six worst affected districts (UN, ADB & The World Bank, 2018). While no substantial epidemic outbreaks were recorded, it should be noted that such events may have the potential to significantly exacerbate the prevalence of diarrheal diseases, especially cholera, due to washed up waste and contamination of water sources. Also, given the lost livelihoods, economic impacts to households were severe and contributed to worsened instability for many, especially for those living in poverty with little access to risk transfers and assets. Such was the case of the 2004 tsunami as well. Immediate job losses were estimated to reach around 2.7 million in India due to lost coastal fisheries and agricultural production, irrigation fields and massive scale erosion that followed the event (Sugiyarto & Hagiwara, 2005). Thus, for those poorest, the impacts only worsened their conditions due to high reliance on activities that are dependent on the ecological system and are vulnerable to external environmental shocks.

In this context, it must be noted that poverty correlates with education. Low socio-economic status and rural setting (characterized by poor quality infrastructure, lack of schools or teachers) share a connection to higher rates of poverty in India (Chandra, 2019). Also, disasters tend to exacerbate the already inequitably distributed schooling services, wherein lost contingency in schooling and education may follow either a significant, catastrophic disaster or frequent, lower-impact events such as flooding. For example, in the case of Kerala flooding in 2018, over 1,700 schools were used as relief camps during the event, and even when they reopened, attendance was as low as 20 percent due to trauma, stress and heightened family needs (UN, ADB & The World Bank, 2018). These dimensions must be considered when addressing the social impacts of disasters, in the light of the knowledge that education correlates with higher incidence of poverty, and when disasters have a significant potential in disrupting education. Thus, disasters and frequent hazards may

1 The cross-cutting sector in the Kerala Post Disaster Needs Assessment covers environment; employment and livelihoods; disaster risk reduction; gender and social inclusion; and local governance.

contribute to a formation of cycles of poverty in a context where children's access to schooling is frequently disrupted, leading to a wide-scale rural poverty in the long-term.

Disaster events may also have an impact on the delivery of health services due to lost critical infrastructure, or because the number of affected exceeds the capacities to provide care. For example, the Indian Ocean Tsunami caused US$ 30 million in reconstruction costs to the health infrastructure and overwhelmed many areas in terms of their ability to provide care. Today, 40 million people are affected daily by water-borne diseases (even when not accounting in disasters) and vector-borne diseases continue to stress the healthcare delivery in India (Krishnan & Patnaik, 2018). The aforementioned cause not only significant financial burdens to the Government, but also endanger productivity and wellbeing, especially in the aftermath of disasters when healthcare needs often rapidly increase.

Furthermore, these social impacts are not affecting the population equally. Rather, they are distributed following distinct boundaries determined by hierarchies of power, social context, marginalization and other factors. Those with disabilities, women and girls, the elderly and ethnic or religious minorities may face exacerbated marginalization and discrimination in the aftermath of disasters, thus worsening their disposition. For example, it has been illustrated how gender-based violence tends to worsen following disaster events, trafficking of women and girls often spikes, and child marriages experience an ascending trend due to families seeking to lessen their financial burdens through maladaptive practices (Le Masson, et al., 2016). Thus, when discussing the social impacts of disaster events, one must consider dimensions and hierarchies of power and influence which contribute to the socio-economic stratification of society, where in some are always worse off than others.

2. Disaster Risk Profile

2.1 Hazards and Climate Change

India is exposed to a wide range of sudden and slow-onset natural hazards, from hydrometeorological threats such as flooding (riverine and coastal), cyclones, droughts, landslides and extreme temperature to wildfires, earthquakes and epidemics. Furthermore, hazards may also originate from anthropogenic sources when human systems have the potential to fail. Overall, approximately 60 percent of the total landmass is prone to earthquakes of various intensities, over 40 million hectares of the country is exposed to flooding, 8 percent is exposed to cyclones and 68 percent of India is susceptible to severe drought impacts (Ministry of Home Affairs, 2005).

Droughts, especially, are among the key concerns in India. Despite precipitation which has high regional variability, ranging from plentiful 11,000 mm annually in Cherrapunji, to parts of Jaisalmer with an annual rainfall of only 90 mm, droughts may affect most of the country (National Disaster Management Authority, 2010). The impacts also depend on local availability of resources to mitigate the drought conditions, and thus highly correlate with water resource management as well, as became evident during the 2019 Chennai water crisis. Following the drought conditions, all of the city's main reservoirs – which only provided 35 percent of the city's water needs to begin with – ran dry, and left 11 million people dependent on groundwater, accessible through privately dug borewells or tankers bringing in water (Kumar-Rao, 2019).

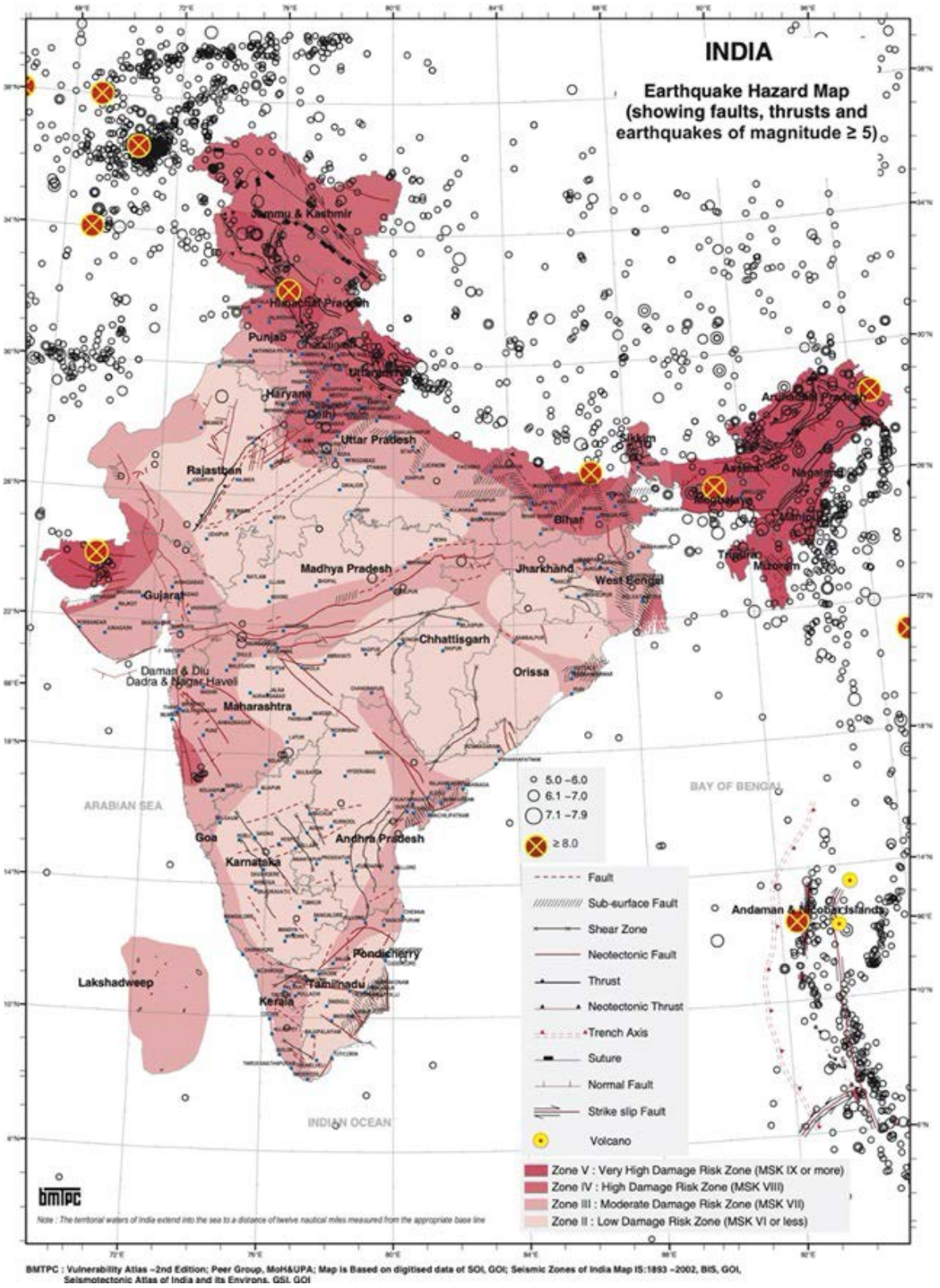
The Indian subcontinent is also exposed to nearly 10 percent of all tropical cyclones occurring globally (NCRMP, 2019). Usually they occur during the months of May to June, and October to November, with a primary peak in November and May. Often associated with high precipitation and storms, flooding is also a grave concern for the populations of India given the high rates of coastal urban development, settlements located on delta plains or in the vicinity of rivers. Annually, millions of people are exposed to extreme precipitation events, of which localized incidents such as the Uttarakhand flooding of 2013, or Chennai floods of 2015 have caused billions in losses and damages, not to mentions thousands of people affected by them (Ali, et al., 2019).

Often associated with high precipitation (or alternatively, seismic or volcanic activity) landslides are also common to India, and pose threat to life and livelihoods. Their impacts range from mild disruptions to normal activities to large-scale destruction of property or lost lives, especially in the mountainous parts of the country (National Disaster Management Authority, 2019). About 12.6 percent of the total land area (covering 19 states and union territories) is prone to landslides, affecting more than 65,000 villages, seen in figure 2. (National Disaster Management Authority, 2019).

Earthquake risks also vary depending on the region. Most of the very high damage risk-zones are located in the northern regions of the country, wherein the Himalayan orogeny is driving significant and intense seismicity (figure 3). Due to high regional variability, the country has been grouped into four seismic zones of II, III, IV and V. Broadly, the highest-risk zone comprises entire north-eastern India, parts of Jammu and Kashmir, Himachal Pradesh, Uttaranchal, Rann of Kutch in Gujarat and North Bihar (Ministry of Earth Science, 2017). Also, soft sediments exacerbate earthquake impacts in the country, as most severe damages to buildings and infrastructure in the past have been found in such areas (Parvez, 2013).

Figure 2. Areas affected by landslides in India (National Disaster Management Authority, 2009).

Figure 3. Seismic zones of India (BMTPC, 2002).



Climate change is also likely to exacerbate the impacts of hydrometeorological hazards in India, by potentially worsening flooding and heavy rainfall, increasing the impact of storms and by prolonging periods of droughts. These impacts further compromise livelihoods of millions (especially those dependent on subsistence agriculture), degrade environmental systems and are likely to lessen the availability safe water across the country. Over the past decades, an increase of 0.4 degrees Celsius has been observed in the mean annual surface temperature, rainfall has increased by up to 12 percent over the past 100 years in some regions, and sea level is rising at a rate consistent to the estimates of the IPCC (Government of India, 2008). By the end of the century, temperature rise could exceed 5 degrees Celsius under a high emissions scenario, and the intensity of the summer monsoon could increase by further 10 percent (Government of India, 2008). Already, extreme high precipitation and flood events have been increasing over the past two decades in majority of the country's river basins, and it has been estimated that under a high-emission scenario, frequency of multi-day flooding is expected to surge significantly towards the end of the century (Ali, et al., 2019).

2.2 Exposure

Despite the prevalence of plethora of disaster risks, their impacts vary depending on the regional climate, topography, proximity to the ocean and floodplains among other factors. Generally, 27 states and union territories out of 36 are deemed disaster prone. According to some estimates, India is first among the 10 most exposed nations to natural hazards in South Asia, with a population of over one billion (82 percent) residing in exposed areas of the country (Maplecroft, 2016). For instance, the country has a coastline of about 7,516 kilometres, whole of which is affected by cyclones with varying frequency and intensity. It has been estimated that coastal West Bengal, Orissa, Andhra Pradesh and Tamil Nadu are most exposed, and are within high to very-high risk impact categories (Mohapatra, et al., 2012). Also, approximately 40 percent of the country's population reside within 100 kilometres from the coastline, and on an average, over 370 million people are exposed to cyclones annually, seen in figure 4 (NCRMP, 2019). In terms of flooding, highest exposure in the country (measured on an 8-year return period) are in Ganga, Yamuna, Godavari, Krishna, Pennar, Cauvery, Mahanadi, Narmada, Tapi, Mahi and Sabarmati river basins (RMSI , 2015).

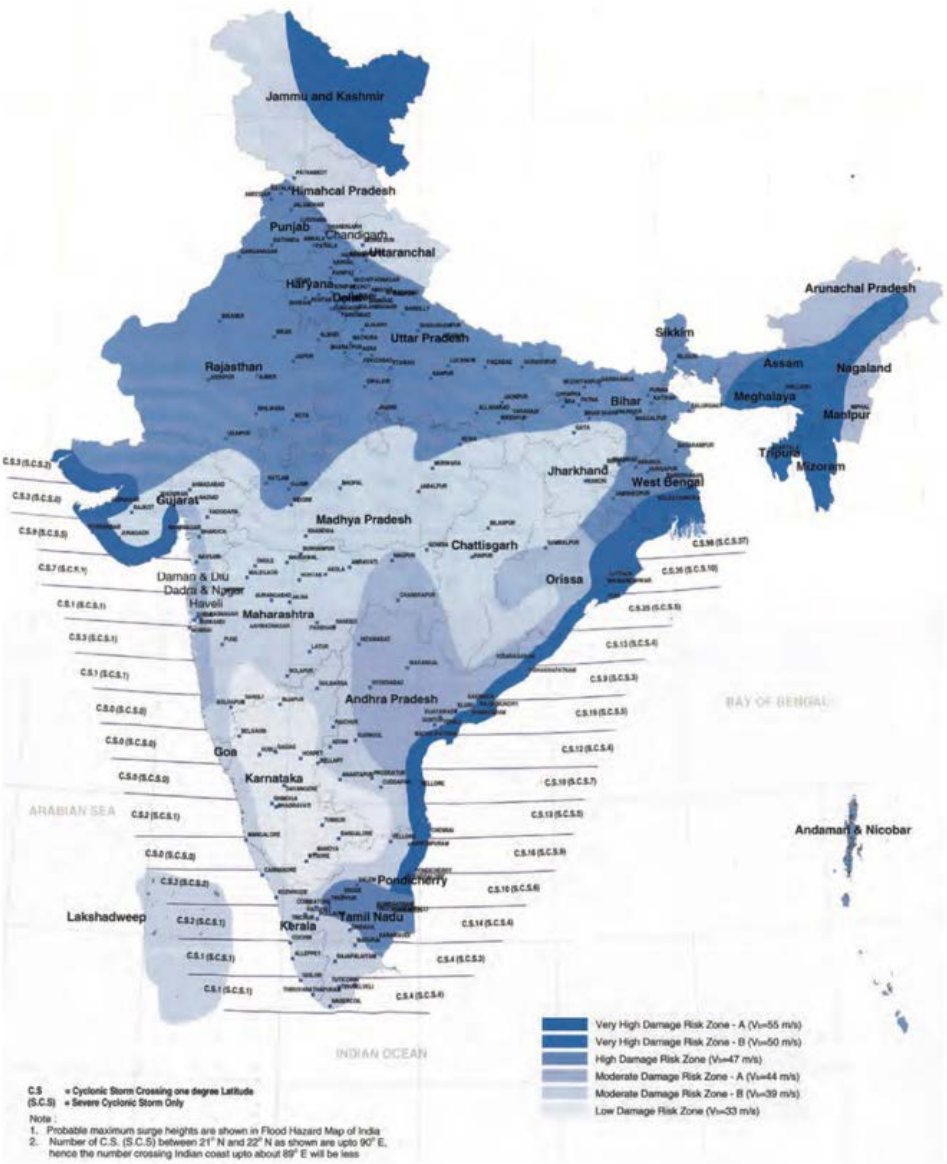
In terms of seismic exposure, 58.6 percent of the landmass is susceptible to earthquakes from medium to very high intensity (zones III-V), and the risks are highest in the Himalayan region, or in areas where high population densities mix with poor construction design and weak regulatory mechanisms (Ministry of Home Affairs, 2005). Similarly, landslide risks are highest in the Himalayan region, Nilgiri range, and in the western ghats of the country. Annually, an average of two landslides per square kilometre affect the Sikkim and Garhwal regions in the Himalayas, and the total estimated rate of land loss due to mass movement is exceeding 120 meters for every square kilometre in said areas (Ministry of Home Affairs, 2005).

Exposure to diseases is also a grave concern in the country, especially given that the ***Aedes aegypti*** mosquito – acting as a host for dengue and chikungunya – has been adapting particularly well to urban environments. The annual number of new dengue cases is estimated to vary from 7.5 to 32.5 million rates which are considered to be highest in the world (Bhatt, et al., 2013). Additionally, all of India's population is susceptible to contracting malaria (except those residing in areas 1,700 meters above the sea surface), and more than a million chikungunya cases were reported between 2005 and 2013, which is also

attributable to the spread of the Aedes mosquito (Dhara, et al., 2013). Recent studies have also estimated that the epidemics are largely hidden, because in the absence of a disease monitoring system, the prevalence is evaluated based on reported cases only. In a survey conducted among 1,010 individuals, of whom only 1% reported history of dengue, 93 percent were seropositive to the virus, indicating that in a randomly picked group, nearly all had had dengue without their knowledge (Rodriguez-Barraquer, et al., 2015). This suggests a much higher prevalence of the disease than is currently known.

In the context of exposure, one must also recognize the potential adverse health impacts of air pollution which is becoming increasingly common in the country's megacities. In 2017, most states (76.7 percent of the population) were exposed to PM 2.5 concentrations higher than 40 µg/m3, which is the recommended safety limit by the National Ambient Air Quality Standards of India (Balakrishnan, 2018). Delhi, Uttar Pradesh, Bihar and Haryana in northern India all shared mean values exceeding the safe pollution concentrations limits by threefold, which contributes to an average of 2 years in lost life-expectancy in the worst affected areas (Balakrishnan, 2018).

Figure 4. Wind and cyclone zones in India (National Disaster Management Authority, 2009).



2.3 Socio-Economic Vulnerability

Disasters never affect population groups equally. Often, their impacts are distributed following socio-economic or cultural boundaries, wherein hierarchies of power, marginalization, unequal distribution of services and opportunities, or discrimination affect an individual's ability and capacity to cope with external shocks. Factors such as gender, age, ethnicity, religion, caste or disability may contribute to one's poverty and vulnerability, for example, alongside their marginalized status in a society depending on the social context. Exposure is also affected by these social dimensions of vulnerability: people rarely choose to inhabit dangerous locations (such as slums, floodplains or unstable hillsides), but rather they are forced to reside in such areas due to cheap price of land, or by the necessity to generate income.

In India, subsistence farmers are among the most vulnerable populations given their dependence on ecological systems, exposure to natural hazards, lack of access to services and infrastructure, alongside inadequate risk transfers (such as assets, wealth and insurance) which could mitigate disaster impacts (Shinde & Modak, 2013). In the event of disasters which affect productivity, crops and assets of subsistence farmers (including droughts and flooding), livelihoods of thousands to millions may be endangered, which may also contribute to worsened poverty in the country. For example, vulnerability to poverty after flooding has been evidenced to increase in Assam, but the scope of impacts is also determined by a household's specific characteristics, such as their networks and access to social capital. Those with access to borrowing supplies from neighbours, for example, are more resilient than those without such support (Mahanta & Das, 2017). This suggests that those experiencing marginalisation in the country are more vulnerable due to lack of social support networks as well.

Also, even without the impacts of disasters, those facing social discrimination based on tribes or castes are likely to face more challenges in their efforts to climb out of poverty (Shepherd, et al., 2013), which indicates that the struggle to manage vulnerabilities originating from poverty in India will prevail throughout the upcoming decade. Caste-based discrimination has long historical legacy in the country, and Schedule castes often face social exclusion or 'untouchability' despite such discrimination being a punishable offence (National Disaster Management Authority, 2019). As a result of their pariah status, many Scheduled Tribes and Scheduled Castes tend to inhabit marginal lands which are highly hazard prone, they often lack land tenure, and suffer from chronic poverty or other adverse effects of their disadvantaged predicament.

Gender is also an important dimension of vulnerability, due to the fact that in a society where women's role is inferior to that of men, they are likely to experience exacerbated impacts of poverty and disaster-related losses due to lack of access to opportunities, land ownership or other mechanisms which have been evidenced to be precursors of financial and physical resilience against external shocks. In some areas (and income groups), women are less likely to hold property or land rights, have less political representation, fewer educational opportunities and are less socially mobile due to cultural restrictions (Bhadra, 2017). Thus, women are more susceptible to poverty in the aftermath of disasters, alongside being increasingly exposed to gender-based violence, exploitation and trafficking, which then renders women and girls disproportionately vulnerable to disaster impacts in India (Bhadra, 2017). Similarly, children are more vulnerable to trafficking and being recruited as child labourers, and often experience exacerbated psychological impacts of disasters as well (National Disaster Management Authority, 2019).

Impacts of hydrometeorological hazards and epidemics are also affecting different population groups differently. As established before, most of the poor in India reside in rural regions, wherein lack of access to sanitation and infrastructure may contribute to higher prevalence of water-borne diseases, including typhoid fever, cholera, leptospirosis as well as hepatitis A and E. The risks of an epidemic are then heightened when people come into contact with polluted waters, and outbreaks are indeed associated with flooding or droughts when the availability of safe water decreases (Ministry of Health and Family Welfare, 2016). Those without access to good quality healthcare and sanitation infrastructure suffer from these impacts the most, and are vulnerable to severe disruptions in their quality of life, wellbeing and livelihoods.

2.4 Physical Vulnerability

Vulnerability is also dependent on the quality of infrastructure and housing, the extent of integrated protective measures, and other conditions which may affect the state of physical human systems in India. These considerations are elemental given that the country is now characterized by high economic growth, rapid rate of urbanization and development which may be endangered due to the plethora of natural and anthropogenic hazards.

For example, significant amounts of coastal infrastructure, facilities and settlements are vulnerable to the impacts of inundation, cyclones and sea-level rise. The cyclone Fani in 2019 alone damaged more than 500,000 houses, 6,700 healthcare facilities and electricity infrastructure, and the recovery of the affected coastal states was estimated to take five to ten years (Roy, 2019). A home to more than 260 million people, the 130 towns and 77 cities in the country's 84 coastal districts also have significant economic importance given the high value of assets, critical infrastructure, transport networks, industrial facilities and ports which support the national economy and growth, and receive 60 percent of the country's foreign direct investment inflows (Roy, 2019). Thus, protecting these areas from disaster impacts is increasingly important given that the existing lack of resilient planning (or failure to adhere to Coastal Zone Regulations) may compromise essential infrastructure and lead to catastrophic losses and damages in times of large-scale disasters (Roy, 2019). (Roy, 2019). Equally important is to take proactive measures to address emerging risks due to the interplay of newly built environment and hazards.

As a result of rapid urbanization and growth, the risks of metropolitan cities are also growing alongside development at an equal pace. Growing concentrations of people render many growth centres vulnerable to localized impacts of storm surges, flooding, droughts, earthquakes and fires. Also, given the proliferation of informal settlements, poor access to basic services, poor quality housing and limited employment opportunities, multidimensional urban vulnerabilities have begun to form. Thus, the physical elements (lack of sanitation, poor quality housing, high densities) are only one aspect of the problem (Jain & Bazaz, 2017). Yet, vulnerability of infrastructure and housing in urban areas characterized by low-income populations are often at the most risk. For example, in terms of seismic vulnerability, most of the housing in Delhi are not designed in consideration of earthquake resistance, and there are numerous illegal settlements located throughout the metropolitan area. It has been estimated by the Municipal Corporation of Delhi that approximately 90 percent of the buildings in the area are at risk in an event of a medium to large-scale earthquake (Rajkhowa, 2019). Addressing these issues is of paramount importance, given the fact that the urban areas contribute to approximately 62 percent of the GDP, and because the future growth of the economy is largely correlated with the well-being of cities (Bhagat, 2011).

In this context, it should also be noted that environmental degradation contributes to, and may exacerbate physical vulnerability and exposure. For example, loss of natural buffers such as mangrove forests may significantly increase flooding impacts in coastal regions, and loss of vegetation cover in hilly areas increases landslide risks. Uncontrolled urban expansion, poor waste management, poverty (or, the need to generate income at the expense of the environment) and agricultural expansion all contribute to degradation in India, alongside other factors (Rambabu, 2010). Also, according to the World Bank, this damage comes with a cost of US$ 80 billion every year, which was equivalent of 5.7 percent of the annual GDP in 2009 (World Bank, 2013).

2.5 Future Disaster and Climate Risk

As briefly mentioned before, climate change will exacerbate the impacts and frequency of hydrometeorological hazards in the country. The effects are likely to translate into regionally worsened damages and losses to infrastructure, and may further compromise human health and wellbeing. At worst, deteriorating conditions may derail the national development aspirations, plunge millions into poverty as agricultural productivity decreases, worsen food insecurity and decrease the availability of safe water, all of which would have detrimental impacts to the wider society. The Global Climate Risk Index (CRI) places India as 14th of the 15 most affected countries by climate change (Germanwatch, 2019), which is largely as a result of the country's high reliance on environmentally sensitive industries, exposure to hydrometeorological hazards, high prevalence of poverty and lack of local adaptive capacities. Higher precipitation could lead to worsened landslides and flooding, drought conditions may grow more severe, rapidly melting glaciers may compromise the availability of fresh water in the Himalayan region, and overall the impacts of hazards may compromise productive industries and the GDP. Additionally, unprecedented spells of hot weather are predicted to become more common and cover much larger areas (leading to significant heat stress in urban areas), changing rainfall patterns may worsen droughts and the loss of snow cover in the Himalayas could compromise the stability of northern India's glacier-fed rivers (World Bank, 2013).

For example, over 60 percent of the crops are rain-fed, thus increasing the vulnerability of the agricultural sector. Also, lost agricultural output creates the risk of food insecurity which has the potential to affect 63 million people (Nagaveni & Anand, 2016). Impacts on agriculture are especially important given the fact that half of the population rely on it, and in economic terms, India is considered as one of the central rice cultivating nations with an output of nearly US$ 40 billion in 2010, produced from fields covering over 44 million hectares (Gupta, et al., 2012). The expected decline of yield could vary from 0.92 percent to 1.21 percent depending on the region due to adverse weather and changes in annual precipitation (Gupta, et al., 2012). Also, every 1 degree rise in temperature could reduce wheat production by 4 to 5 million tonnes, alongside severe impacts to fruit, vegetable, tea and coffee plantations which are strongly dependant on temperature and humidity (Government of India, 2008).

Also, the mean sea level rise is projected to exceed 15 to 38 centimeters along the India's coasts by mid-century, and could reach 59 centimeters by the end of the century (Government of India, 2008). Thus, increasing numbers of people and infrastructure are exposed and affected by the rising seas, mitigation of which will require massive investments during the upcoming decades. Resilient infrastructure and protective measures such as embankments and natural buffers (reefs and mangrove forests) are required to avoid the

most serious disruption to the society. In Mumbai alone, without accounting the needs for protective infrastructure investments, the potential costs of climate change due to flooding, material damages, diseases and tourism losses could exceed US$ 41 million by 2050 according to some estimates (Kumar, et al., 2008).

Climate change may also alter the distribution and prevalence of important vector species (such as malarial mosquitoes). For example, an increase of 3.8 degrees Celsius and a 7 percent increase in relative humidity would prolong the potential transmission windows, or months during which mosquitoes are active, to full 12 months at least in nine states of India (Government of India, 2008).

3. Disaster Risk and Climate Action Interventions

As evidenced by the previous chapters, disasters impact at different scales with implications as a result of the changing climate becoming paramount in India, thus calling for greater efforts and coherent disaster and climate risk management actions across levels, sectors, and broad spectrum of stakeholders. This section of the report intends to illustrate the current government's capacities in managing risks and sustainable development vis-à-vis the mandates of the post-2015 Development Agenda, namely the priorities as identified in the Sendai Framework for Disaster Risk Reduction (SFDRR), Sustainable Development Goals (SDGs) and the Paris Climate Agreement. Furthermore, suggestions will be made based on the collated evidence in efforts to identify the most pressing challenges for the next decade, and appropriate priority actions to respond to them.

Priority 1. Understanding Disaster Risk Analysing, collecting and managing disaster and climate risk-related data is the cornerstone for achieving a comprehensive understanding of disasters. Data is required to support the processes of conducting risk and vulnerability assessments, in prioritizing investments for resilient development, as well as for achieving sustainable and risk-informed land use planning. Data should also be categorized as well as appropriately disaggregated to facilitate disaster trend projections and identification of impacts to different demographics, and all the information should be accessible to the public and authorities at all levels, stored within well-managed disaster information management systems. This would be the first step to facilitate disaster and climate risk management from a whole-of-society perspective, wherein governments, the private sector, communities, households and individuals are aware of the risks and their responsibilities in societal risk management. Access to reliable information can also improve coordination among various agencies providing relief and recovery assistance, and can support rapid recovery by providing information on geographic distribution of sectoral damages in post-disaster phases (Nair, et al., 2013).

The Government of India has highlighted the importance of building a robust information database to inform land use and risk-informed infrastructure development at all levels, evidenced by most current knowledge about climate and disasters (Ministry of Home Affairs, 2005). For example, the India Meteorological Department hosts various hazard and disaster data products covering hydrometeorological events, and converts them to detailed maps of regional precipitation, temperature, and humidity vis-à-vis vulnerabilities and exposure. The IMD is also maintaining a country-wide network of 82 seismological stations, providing information about seismic activity and potential tsunamis resulting from undersea earthquakes. It also state-of-the-art facilities for data collection, analysis, and dissemination which allows cross-agency information sharing efficiently (Nair, et al., 2013). Such facilities include district and sub-division based weather data, analysis and seasonal forecasts for hazard alerts (including hail storms, heat waves, thunderstorms and lighting, among others) and coordinated actions for mitigation and response. Similarly, the Central Water Commission operates a network of 945 hydrological observation stations, having the capacity to collect, compile and storage data covering river-related hazards and flood forecasting across the country. Inventory of landslide incidences is maintained by the Geological Survey of India, which also comprises information about glacial and periglacial geomorphology, snow-cover studies and other related information under its Glaciology Division (Nair, et al., 2013).

Yet, despite these initiatives and stakeholders involved, risk and disaster information in India has remained fractured across various agencies, ministries and administrative levels, with little cross-compatibility and harmonization which limits comprehensive analysis of risks in the country. As of 2018, in efforts to improve Sendai Framework compliance, the government aimed to launch a uniform, nation-wide disaster database collating information about disaster impacts, damages and losses which could support trend projection and prioritization (Thakur, 2018). Thus far, the country has relied on external evaluations about disaster impacts in the absence of national database.

Priority 2. Strengthening Disaster Risk Governance to Manage Disaster Risk Effective disaster management and climate change adaptation also require robust legislative and policy frameworks and operating procedures which support activities under all of the phases in the disaster management cycle from preparedness to mitigation, response and recovery. In India, the National Disaster Management Authority (NDMA), established as per the Disaster Management Act in 2005, serves as the main organization coordinating and governing all disaster-related activities. Its vision is to build a safer and resilient India through holistic, pro-active and technology driven development which involves all stakeholders to build a culture of prevention and preparedness (CFE-DM, 2018). The NDMA is also responsible for all national-level policy development related to disaster management, as well as for coordinating all implementation and enforcement disaster management measures and/or activities. The NDMA further coordinates with State Disaster Management Authorities (SDMAs) to ensure policies and guidelines are implemented. At the state levels, State Disaster Management Authorities are responsible over regional activities, which includes coordinating and monitoring the implementation of National Policy and National Plan, alongside the State Plan, supported by District Disaster Management Authorities operating under them (Ministry of Home Affairs, 2011). For undertaking disaster research, the DM Act of 2005 also mandates the formation of National Institute of Disaster Management which is responsible over training programmes, study courses, research and publication of journals, papers and books.

While many of the essential functions related to disaster risk governance are rooted in the Disaster Management Act of 2005, the scope of legislative provisions was expanded by the implementation of the 2009 National Policy on Disaster Management, intended to enforce an enabling environment for all in recognition of the importance of State and District level authorities, former of which have the primary responsibility over disaster management (Ministry of Home Affairs, 2015). These provisions are further supported by the Five-year Plans which often address disasters as a key concern threatening national development (Das, 2013).

In 2016, the National Disaster Management Plan was also released to further align the institutional frameworks and mechanisms with the Sendai Framework for Disaster Risk Reduction (SFDRR). The NDMP was further updated in 2019 with the intention to further coherence with the whole of post-2015 development agenda by integrating not only the SFDRR but also the Sustainable Development Goals (SDGs) and the Paris Agreement into the country's disaster and climate risk reduction framework. Alongside these considerations, the plan has four other main pillars which focus on conforming to national legal mandates (DM Act of 2005 and the NPDM of 2009), the Prime Minister's Ten Point Agenda for DRR, social inclusion as a cross-cutting principle for all activities and mainstreaming DRR as a cornerstone of all development (National Disaster Management Authority, 2019).

For climate change concerns, the National Action Plan on Climate Change (NAPCC) was established in 2008, it the intention to kickstart climate action at all levels in the country. It is guided by principles focusing on protecting those poor and most vulnerable, by achieving growth through sustainable development, by improving the use of technology in risk management, and by welcoming cross-agency, transboundary cooperation on related matters (Government of India, 2008). The agenda was complemented by the Nationally Determined Commitments (NDC) submitted to the United Nations Framework Convention on Climate Change (UNFCCC) in 2015, and the Prime Minister's Council on Climate Change has been revived to streamline the climate action objectives into the existing legislative framework (Saryal, 2018). It has been estimated that the NDC targets set in 2015 are currently attainable, and India is likely to achieve its 40 percent target in energy generated from non-fossil fuels, and 50 percent reduction in its emissions intensity by 2030 (Climate Action Tracker, 2019).

Table 1. India's legislative plans and policies intended to improve disaster risk reduction and climate resilience

IMPLEMENTATION	PLAN/POLICY	SCOPE	PURPOSE
NATIONAL DISASTER MANAGEMENT AUTHORITY	Disaster Management Act (2005)	National, States, Union Territories, Districts	Legal foundation for all disaster-related activities. Includes provisions for disaster preparedness, mitigation and risk reduction to be implemented at all levels of government.
NATIONAL DISASTER MANAGEMENT AUTHORITY	National Policy on Disaster Management (2009)	National, States, Union Territories, Districts	Expanding the scope of disaster management activities to build resilient and safe India through proactive and holistic multi-hazard strategy, in consideration of cooperation, partnerships and technological interventions.
NATIONAL DISASTER MANAGEMENT AUTHORITY	National Disaster Management Plan (2019)	National, States, Union Territories, Districts	Framework and directions for all government agencies to mainstream responsibilities and intervention strategies in consideration of all phases of the disaster management cycle. Founded on the DM Act and the NPDM (2009), and integrates mandates from Sendai Frameworkt, Sustainable Development and The Paris Agreement.
PRIME MINISTER'S COUNCIL ON CLIMATE CHANGE, RELEVANT STAKEHOLDERS	National Action Plan on Climate Change (2008)	Whole-of-Society	Incorporates the vision for ecologically sustainable and green development in all of the national development domains from industry to agriculture, urban spaces and ecological systems.

Priority 3. Investing in Disaster Risk Reduction for Resilience Since the implementation of the DM Act of 2005, the Government has devised the National Disaster Response Fund, and mandated the formation of State Disaster Response Fund by the state and union territory authorities (Das, 2013). The National Disaster Response Fund can support States in large-scale disaster recovery and reconstruction. Additionally, National Disaster Mitigation Funds have been established for the purposes of DRR and risk mitigation activities, and they are to be replicated at each level of governance. This may be supported by the setup of National and State Disaster Management Funds (N/SDMF) to strengthen local-level mitigation activities focused on mitigation (20 percent) and response (80 percent) as outlined in the 15th Commission's framework for sector-specific (PRS Legislative Research, 2020).

Efforts have been made to strengthen infrastructural resilience, including adoption and revision of seismic building codes following the 2001 Gujarat earthquake. However, as of now, no specific allocations are being made by the government for DRR and CCA, apart from few specific projects for which funding is acquired through the Public Funded Schemes, specific to various ministries and departments (National Disaster Management Authority, 2019). Sector specific investments, particularly within the health sector, has also been lagging behind due to the greater emphasis being placed on strengthening the disaster-response gaps within existing infrastructure (Krishnan & Patnaik, 2018).

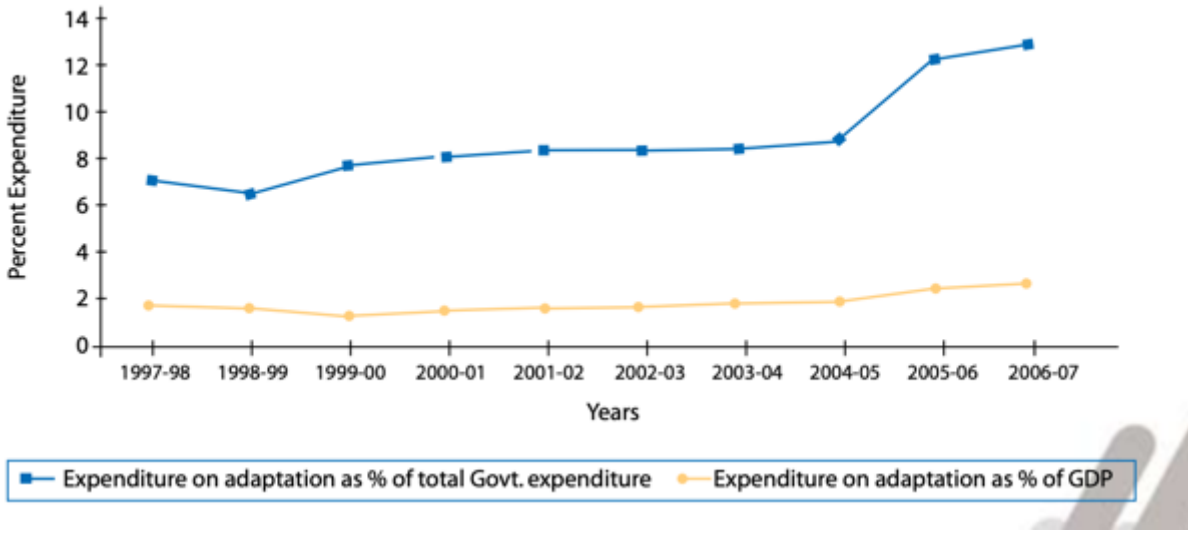
A more centralized approach has been undertaken to mainstream DRR into the education sector through structural and non-structural provisions. This includes the National School Safety Program, launched in 2011 by the NDMA with the vision to promote a culture of safety within school environment, focusing on building the capacity of children and school communities, as well as ensuring measures are implemented to strengthen structural resilience of education facilities. Additional efforts have been supplemented by various NGOs that are also working to address education resilience (Singh & Girdhar, 2017).

Further mainstreaming of DRR and CCA to finances and governance budget as a part of the wider development planning is necessary to increase resilience of the country (National Disaster Management Authority, 2019). However, the importance of climate adaptation and risk reduction has been recognised. The expenditure to programs intending to reduce climate vulnerability and risks has gradually increased (figure 5) and by 2009, it had exceeded the national defence budget (UNDP, 2009). In terms of risk transfers, however, the Government of India is acting as its own self-insurer for the purposes of maintaining available relief funds. Further risk transfer instruments are required at the national level and by private sector agencies.

Climate-resilient development is a significant challenge to the Government given the enormous funding requirements for climate change adaptation. One way in which the Government has attempted to balance economic development with enhancing investment in resilient infrastructure is through the Checklist for Natural Disaster Impact Assessment which requires all new projects costing over one billion rupees to undergo an evaluation of both the estimated effects of hazards on the project alongside the risks of new hazard-related impacts as a result of the project (United Nations ESCAP, 2017). This is further supported by the Ministry of Finance's Guidelines (2009) which highlight the need for all projects that involve structural assets, including any changes to existing land-use plans, require additional costs to be allocated towards prevention or mitigation of natural and/or man-made hazards (Singh & Girdhar, 2017).

While low-cost public finance has a vital role, the mobilisation of private capital for investing in resilient infrastructure is extremely important. Yet, given that private investors make decisions based on cost and benefit analyses, many coastal regions (classified as high-risk zones) may avert investment due to potentially low returns to investment following frequent impacts of hydrometeorological hazards (Roy, 2019). Thus, innovative financing options are required, with the support of long-term partnerships with multilateral development banks which could provide resilient and sustainable infrastructure investments jointly with the private sector.

Figure 5. Annual Central Government Expenditures to Address Climate Variability as a percent of the GDP (UNDP, 2009).



Priority 4. Enhancing Disaster Rreparedness for Effective Response to "Build Back Better" in Recovery, Rehabilitation and Reconstruction For disaster response, the DM Act of 2005 mandates the formation of National Disaster Response Force, which comprises 144 special teams trained in response for events originating from natural hazards, with 72 teams specializing in chemical, biological, radiological and nuclear calamities (Ministry of Home Affairs, 2011). In the event of a disaster, the Ministry-level Disaster Management Committee (MDMC) will direct Disaster Management Task Forces to carry out response and recovery-related activities, and the MDMC is also responsible over activating or deactivating urgent disaster response based on available information (Ministry of Corporate Affairs, 2017). The flexible response system allows prompt and effective delivery of relief and support to states and union territories affected by disasters in the case their capacities are exceeded, and the Central Government supplements their efforts through logistical and financial support if and when requested by the state governments (National Disaster Management Authority, 2019).

However, despite robust mechanisms and frameworks enforcing cooperative emergency management, limited capacity of the stakeholders may undermine the planning (World Bank, 2017). Also, while detailed operational guidelines exist for the management of earthquakes, floods and cyclones, specific guidelines for tsunamis, droughts and technological accidents remain to be fully developed. Furthermore, lack of clarity over roles and responsibilities may also limit response operations, and even though various recommendations were made in the DM Act of 2005 to establish a working arrangement for stakeholders with roles in

response, gaps exist due to limited human capital and resources (Ministry of Home Affairs , 2016). Some of these issues were sought to be mitigated in the 2017 Disaster Management Plan, which outlines a multi-tiered institutional system comprising the NDMA and SDMAs, and mandates the creation of State disaster management plans.

In terms of operational Early Warning Systems, numerous mechanisms have been established across India, hosted by different stakeholders. For example, Cyclone hazard warnings are the responsibility of the India Meteorological Department, Regional Specialized Meteorological Centre and the Tropical Cyclone Warning Centres for various regions. For earthquakes, the India Meteorological Department maintains the seismological monitoring network, and Central Drought Relief Commissioner are reporting on droughts. Landslides, on the other hand, are reported by the Geological Survey of India, and tsunamis by the India National Centre for Oceanic Information Services. These agencies will provide inputs to the Ministry of Home Affairs, which will issue alerts and warnings through its communication channels (National Disaster Management Authority, 2019), including dissemination across administrative levels and divisions, as well as through developed mobile applications such as MAUSAM, providing user-friendly access to weather products and forecast, and Damini Lightning App, for lighting alert, which enable prompt access to accurate and timely risk information for the public. Advanced mechanisms equipped with automated Early Warning Dissemination System (EWDS) is expected to significantly increase ability to reach the last mile.

For Building Back Better (BBB), the NDMP of 2019 outlines considerations for rehabilitation and reconstruction to facilitate clear and structured transfer from response to sustained and sustainable recovery, in consideration of the needs to integrate DRR. It is based on the NPDM of 2009, in which Paragraph 9.1.1 states that the approach to reconstruction must integrate BBB based on project impact assessment needs vis-à-vis social and cultural requirements of the affected populations (National Disaster Management Authority, 2019). Reconstruction and recovery must also be participatory processes, aiming to restore not only physical infrastructure, but also socio-economic viability, livelihoods and 'ways of life' through an owner-driven approach. However, achieving these aspirations is immensely complex. Lack of coordination among stakeholders, inadequate funding mechanisms and lack of provisions which tangibly support the transition from response to recovery limit the opportunities for BBB, alongside lack of capacities which may hinder activities led by local authorities (Duryog Nivaran, 2016).

4. Coherence with Sustainable Development Goals and the Paris Climate Agreement

Disaster risk management, climate change adaptation and sustainable development share similar characteristics, overlapping strategic objectives and synergies which should be harmonized across various policies to guarantee maximum efficacy. Separate legislative provisions, institutional arrangements, strategies, frameworks and plans targeting DRR, CCA and sustainable development constitutes to redundancies, repeated efforts and thus, wasted resources. Existing DRM frameworks should be revised in accordance with the post-2015 development agenda to identify how countries could best prioritize and synchronize their domestic efforts vis-à-vis on-going projects, available funding, risks and vulnerabilities to utilize the highest potential for holistic disaster risk management. Also, it is increasingly necessary to incorporate environmental and sustainability concerns into every phase of development cycle, with the support of well implemented and institutionalized DRR and CCA measures.

Understanding of these complexities is well illustrated in the Prime Minister's Agenda 10 on Disaster Risk Management, wherein it was highlighted that disaster risk management must encompass issues from sheltering India, its economy and people from not only disasters, but also climate change by investing in holistic risk reduction and sustainable development within all sectors of industry and planning (Gupta, et al., 2016). Against this background, the SFDRR, SDGs and considerations for climate in the form of CCA and reduction of GHG emissions have been integrated into the national development priorities and disaster management infrastructure to guarantee equitable, inclusive, resilient, sustainable and green development leading up to the year 2030. The National Disaster Management Plan of 2019 also encompasses all these dimensions from sustainable and green development to managing resource use, sheltering them from the impacts of climate change and disasters, and is rooted into the post-2015 development agenda with a clear vision to enhance risk reduction in the country (table 2). The Prime Minister's Agenda 10 also outlined the plan for mainstreaming these dimensions to achieve disaster and climate-risk informed development (figure 6), and further emphasized the integration of CCA, capacity building and DRR, for resilient building in key development domains including safe and resilient infrastructure, people's livelihood resources (agriculture, ecosystems and forests/plantation based occupations) and business establishments.

For implementing the SDGs, the Government of India has devised the National Indicator Framework, comprising 306 national indicators, with the support of Ministry of Statistics and Program Implementation to estimate the effectiveness and progress towards graduation by 2030 (Khan, 2019). Resource mobilization has also been highlighted as one of the key strategic considerations, alongside the elimination of poverty and achieving gender equality which match the country's long-running development priorities (Government of India, 2017). The country has also committed to minimizing its emissions and focuses on creating additional carbon sinks by expanding forest cover during the upcoming decades (Government of India, 2017). Most importantly, these aspirations are reflected in policy. Acts such as Rural Employment Guarantee Act (to reduce poverty), National Health Policy (includes targets for universalizing primary health care), the Beti Bachao Beti Padao[2] initiative (increasing girls'

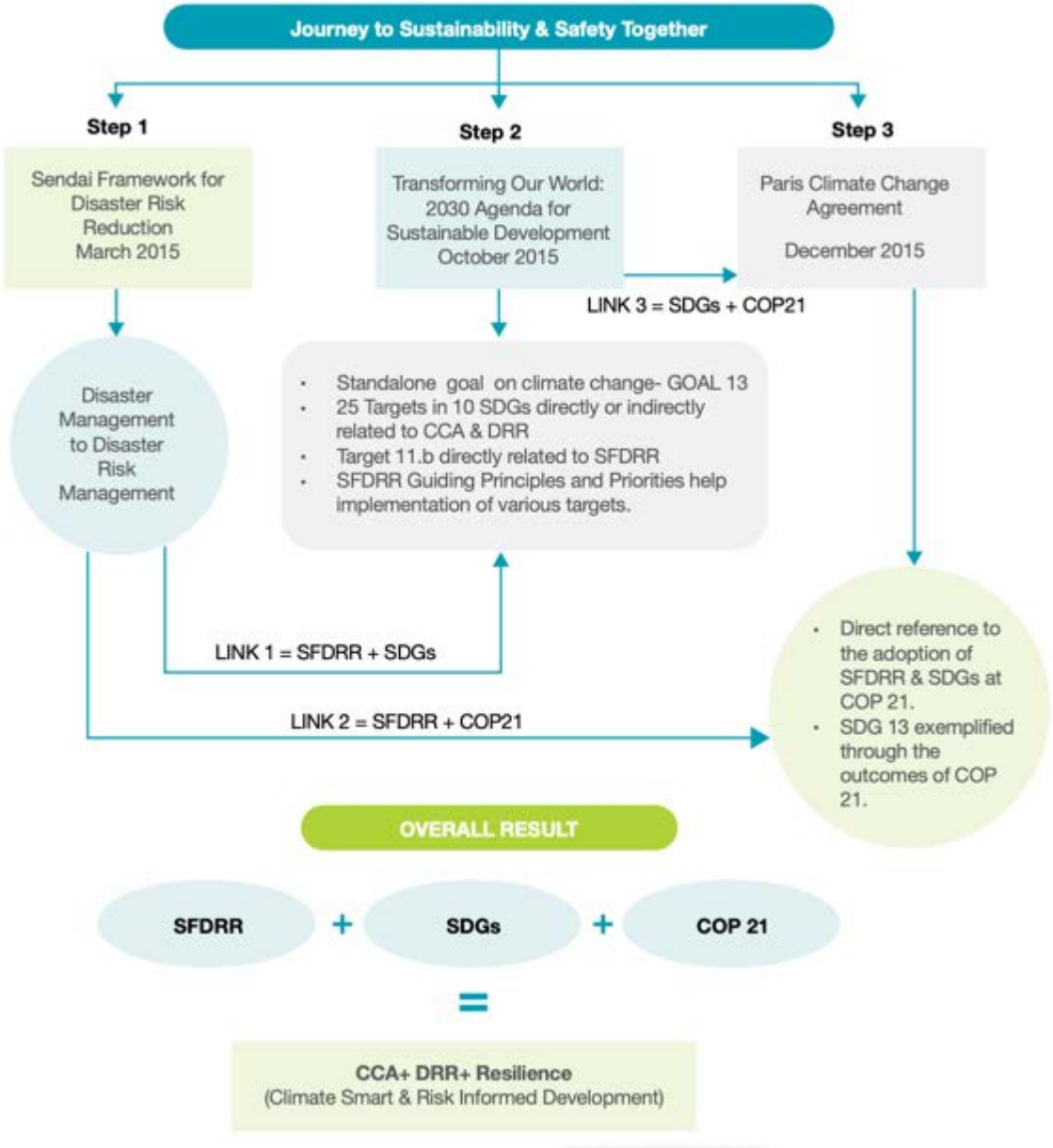
2 Save the Girl Child, Educate the Girl Child

participation in schooling), alongside other institutionalized measures to address the SDGs and green development are stellar examples of tangible action taken by the Government. Similarly, the National Manufacturing Policy seeks to create 100 million jobs by 2025, and focuses on green growth, technological innovation, as well as skills development. In term of CCA, frameworks for action are well laid out in the National Disaster Management Plan (2019), mandated to central, state and district level agencies, focusing on agriculture and water sector, local coping mechanisms and needs, local adaptation strategies, pilot projects on site-specific adaptation, and green and blue infrastructure approach, which are complimentary to achieving the sustainable development pathway.

Table 2. Some of the synergies between international agreements and different policies and commitments of India in various sectors.

Sectoral Aim	Policies/programs with potential links to Sendai Framework for Disaster Risk Reduction	Policies/programs with potential links to Sustainable Development Goals	Policies/programs with potential links to the Paris Climate Agreement or Environment
National Development	National Policy on Disaster Management (2009) Prime Minister's Agenda 10	Prime Minister's Agenda 10 (2016)	Prime Minister's Agenda 10 (2016) National Action Plan on Climate Change (2008)
Agriculture and Resource Management	National Disaster Management Plan (2019)	National Water Policy (2012) National Policy on Marine Fisheries (2017) National Forest Policy (2018 update)	National Action Plan on Climate Change (2008)
Disaster and Climate Risk Reduction	National Disaster Management Plan (2019) Prime Minister's Agenda 10 (2016)	National Disaster Management Plan (2019) Prime Minister's Agenda 10 (2016)	National Disaster Management Plan (2019) National Action Plan on Climate Change (2008)
Vulnerability Reduction	National Disaster Management Plan (2019)	National Health Policy (2017) National Manufacturing Policy (2017)	National Action Plan on Climate Change (2008)
Urban Development	Urban Development Strategy (2016) National Disaster Management Plan (2019)	Urban Development Strategy (2016)	Urban Development Strategy (2016) National Action Plan on Climate Change (2008)

Figure 6. Plan for harmonizing the post-2015 development agenda in India to support resilient, sustainable and risk-informed development (Gupta, et al., 2016).



5. Issues in the Implementation of Disaster Risk Reduction and Climate Policy

Yet, numerous challenges hinder effective implementation of policies as envisaged at the national level. For example, lack of comprehensive and contextualized disaster information, available to planners and disaster managers at all levels of governance, makes prioritization impossible, and limits the potential scope of any policy devised at the national level. Also, and most importantly, lack of administrative capacities at the local level may contribute to situations where the intended impact is not reached, especially in the case of environmental protection. For example, there is no authority assigned to implement the Environment Protection Act of 1986, and the local governments may not have the required financial and human resources to further tangible implementation of such provisions (Rahmat, 2015; Bhatt, 2012). Similarly, misutilization of funding, corruption, poor working conditions and low motivation may contribute to challenges faced at the sub-national level. The most effective method for mitigating these concerns would be to guarantee adequate support in the form of funding and capacity building, as well as by establishing a comprehensive monitoring and evaluation plan for programs and initiatives vis-à-vis policy provisions to estimate whether the change is achieved (Rahmat, 2015).

Poor coordination among the implementing agencies, ministries or other authorities is also hindering the effectiveness of the governmental institutional machinery. Shortcomings arise from situations where understanding of nationally determined goals and targets are not shared among all stakeholders. This is evident within the efforts to implement the SDGs by aligning the National Development Agenda and other key policy documents to match the vision for 2030. While some state governments have mapped out schemes and programs which could support the process, no framework has been prepared at the levels of districts or local governments operating below them as of 2019 (Khan, 2019). Localization of the agenda is not evident at State level planning or at local government levels, and the budget of LGUs for their respective areas is often too limited to advance the guidelines in reality.

Lack of public finance is not only a concern at the local levels either. Massive investments are also required to fully reach the aspirations for sustainable and climate resilient development. Globally, approximately US$ 6 trillion is required to be invested in infrastructure every year until 2030 to meet the current demands for protection, but given that resources are stretched thin on many fronts of public governance in India (and numerous other countries across the world), sustaining proactive disaster finance is likely to face significant troubles during the upcoming decades (Roy, 2019).

6. Stakeholder Analysis

Stakeholders often play a crucial role in supporting disaster risk management activities. They may be national operators (such as state institutions, the police or fire departments), international multilateral partners (World Bank, ADB, United Nations, other INGOs), or bilateral partners (other countries' governments) providing relief supplies, funding for reconstruction or for long-term resilient development planning. Also, communities have an important role as a stakeholder – after all, it is at the grass-root levels where change must begin.

At the national level in India, numerous agencies and ministries support the national government in their efforts to manage disaster and climate risks. For example, the Fire Services are responsible over response of fire-related incidents, but their organization varies depending on the state or union territory with unique administrative setups, funding mechanisms and equipment (Ministry of Home Affairs, 2011). Also, ministries such as Ministry of Earth Sciences, Ministry of Water Resources and the Central Weather Commission have a central role in supporting the government in monitoring hydrometeorological hazards, and they also support hazard mapping, database generation, flood zonation and flood plain management (Ministry of Home Affairs, 2011).

Numerous non-governmental organizations and civil societies have also an important role in DRM in India. ActionAid India, for example, has dedicated its work to fight poverty and injustice in partnership with more than 400 local NGOs, reaching five million people across the country. CARE India, based in New Delhi, also fights to mitigate poverty and improve the conditions of women and girls by working in the sectors of education, health and disaster management with an experience of over 65 years on the ground (CFE-DM, 2018). Indian Red Cross Society also shares a partnership with the government and has been incorporated into institutionalized frameworks by an act of parliament. Today, it extends over a network of over 700 branches in the country. International non-governmental organizations, including Oxfam, International Monetary Fund, International Labour Fund and Food and Agricultural Organization of the United Nations also have a strong presence and history in supporting the government in their efforts to build resilience against shocks and disasters.

The Prime Minister's Agenda also recognizes the importance of involving research institutions and the wider academia in advancing understanding of disasters, by combining education, practice and research through networks of institutions (Gupta, et al., 2016). While NIDM is currently the only research institute involved in the national setting, it has been outlined that the national disaster management operations would greatly benefit from the involvement of plethora of high-profile institutions currently operating independently and separately in India (Gupta, et al., 2016).

Regionally, India also has significant importance as a contributor to South Asian disaster risk management, including through participating in and being the host country of the South Asian Association for Regional Cooperation (SAARC) Disaster Management Centre (DMC) which acts as a regional hub for strengthening disaster risk management through information exchange, policy advice, capacity building and system development. An additional critical initiative is also the recent establishment of the International Coalition for Disaster Resilient Infrastructure (CDRI) to support in funding technical and research projects focused on strengthening infrastructural resilience over the next five years.

India has opened its space technology resources and has extended its support to capacity building and emergency response for countries in the South Asia Region. While unified regional response strategy remains to be operationalized, India has an important leading role in the development of harmonized response infrastructure which could significantly increase the regional capacities to manage transboundary disasters and catastrophic events requiring international support (Gupta, et al., 2016).

7. Future Priorities

Against the evidence as presented in this report, it is evident that India is still facing significant challenges in managing disaster and climate risks now, and during the upcoming decade despite its apparent strengths. This section intends to provide a brief and concise overview of the most pressing challenges, vis-à-vis recommended priority actions, in recognition of the fact that issues addressed here do contain a level of subjectivity and may change from sector to sector.

7.1 Challenges

To facilitate prioritization of investments, and to support mainstreaming of risk informed DRR and CCA into sectoral development, availability of risks and disaster information should be rapidly expanded to cover authorities and stakeholders at all levels, even within communities. As of now, while national level disaster database is under development, no comprehensive platform exists for compiling disaster-related data under one umbrella. Standalone initiatives hosted by various governmental agencies and research institutions are excelling within their field, but fragmentalization of initiatives hinders developing a comprehensive understanding of disaster and climate risks in India.

Lack of funding for DRR also contributes to the challenges faced by (especially) the local governments. As a part of their mandate, disaster management authorities of the state are required to finance their own operations based on budget provisions. Due to high level of autonomy, much of municipal revenues are sourced from taxes, shared revenues, charges and fees alongside loans and grants, which leaves many of the local authorities with limited funds to integrate further DRR and CCA into development given that maintaining public utilities absorb much of the available resources (Nallathiga, 2008). State level legislation determines the local tax raising powers, which varies depending on the region.

Similarly, lack of local capacities to implement activities as envisaged at the national level hinders the realization of not only resilient development, but also sustainable planning and green growth. Even if state and union territory authorities are up to par on knowledge and capacity to integrate necessary considerations into planning, the leading stakeholders at the lowest levels of governance, such as within districts, must be able to not only implement DRR and CCA, but also to do so with limited budgets and by utilizing contextual knowledge to guarantee tangible impacts. Thus, further localization of the post-2015 development agenda through capacity building is increasingly necessary now to reach the goals and objectives set for 2030. Among the key challenges considered in many growing cities is making new infrastructures and urban development disaster and climate-risk informed and resilient.

Also, given the high degree of environmental degradation and pollution, the Government must be very careful in managing growth in a manner which does not sacrifice biodiversity and ecological systems as a trade-off for economic success and poverty reduction. As it is prevalent in most of high-income countries, industrial proliferation has had detrimental impacts to nature, marine environments, forests, natural space and air quality, a situation which is continuously worsening over time. India, nor the world, cannot afford such mistakes in leaving growth unmanaged, wherein sustainability and 'green growth' are integrated later on in efforts to band-aid catastrophically haemorrhaging wounds now carved into natural

spaces. When building nations, the 'developing' world must utilize this opportunity to do growth right, which is something much of the industrialized world missed, and for which the world now suffers.

7.2 Priority Issues

As mentioned before, establishing a robust Disaster Information Management System is, and should be among the government's highest priorities to facilitate risk-informed development, comprehensive and contextual urban development and hazard mapping vis-à-vis vulnerabilities and capacities of any given district. However, without addressing capacity gaps, increased knowledge will not achieve its intended impact. Indeed, building local capacities of communities and local authorities is elemental, also due to the fact they are always the first responders in any given disaster, and local knowledge – when combined to scientific data – will be hugely beneficial for advancing the understanding of contextual climate and disaster risks, and more importantly, potential adaptation strategies which are suitable for the locality (Gupta, et al., 2016). Community Based Disaster Risk Management should be increasingly highlighted as a driver for resilient development in the DRM infrastructure of India, especially given that the DDMAs are already established and could be utilized in steering further localization of the wider DRM and CCA agenda at the community levels (Gupta, et al., 2016).

Secondly, identifying sustainable and holistic financing mechanism for the integration of DRR and CCA into wider development is necessary given the pressures caused by climate change and disasters. While local governments continue to struggle with their budgets, more innovative mechanisms should be focused on bridging the gaps between funding needs and available revenue from taxation or loans. While response funds have been established, their cover is unlikely to reach to proactive disaster and climate risk management especially now that disaster impacts (continuously absorbing recovery and reconstruction funding) are increasingly felt in the country.

Water management is among the key concerns requiring investments as has been evidenced by the recent catastrophic drought events. Even without climate change, 15 percent of the country's groundwater resources are overexploited, and given that climate change is likely to affect availability of water, efficient water resource management must be prioritized rapidly across the country (World Bank, 2013). Given the potential scale of droughts and decreased water availability, major investments should be targeted to public water storage and irrigation capacity to mitigate the impacts on decreased river flow rates or lost reservoir volumes. Similarly, the agriculture sector (even at a household levels) must start exploring options for crop diversification and more efficient water use to avoid major crop losses in the future which may contribute to increasing prevalence of poverty, food insecurity and malnutrition.

Also, given the high exposure of many of India's major cities to flooding and sea level rise (such as Kolkata and Mumbai), building codes must be rapidly enforced in these areas in consideration of necessary integration of DRR and CCA into urban planning at all levels to minimize the potential adverse economic and human impacts of climate change (World Bank, 2013). Risk-informed planning should not stop there either. It must become a whole-of-society issue from the national to household levels, especially now that most of the country could be experiencing impacts of worsening hydrometeorological hazards with increasing regularity.

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