Disaster Risk Reduction in Thailand

Status Report 2020

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UNDRR UN Office for Disaster Risk Reduction

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About this report

The disaster risk reduction (DRR) status report provides a snapshot of the state of DRR in Thailand 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.

The report has benefited from inputs by the Department of Disaster Prevention and Mitigation (DDPM) and Thai Network for Disaster Resilience (TNDR). The international organizations including UN Agencies, Asian Development Bank, The World Bank (WB) Group, the United States Agency for International Development (USAID), and a number of non-government organizations were consulted. UNDRR and ADPC acknowledges the government, international organizations and stakeholder representatives who contributed their valuable input and feedback on 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 Thailand: Status Report 2020. Bangkok, Thailand, United Nations Office for Disaster Risk Reduction (UNDRR), Regional Office for Asia and the Pacific

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

The first confirmed COVID-19 case was reported on January 13, 2020. Daily new COVID-19 cases had been in rising then on. The situation was brought under control in July-November, yet lately in 2020, daily new cases have increased significant. A state of emergency was declared on March 26, 2020 and has been extended to February 2021. International flights transporting Covid-19 passengers are banned from transiting through Thailand and the government has stepped up border surveillance to stop the import of COVID-19 cases from neighboring countries. The Government has approved a fiscal package of THB 1.5 trillion (around 9.6 percent of GDP) for health emergency related spending.

The Thai response so far has combined strong public health interventions, community engagement, and effective governance, which in turn has limited local transmission of the SARS-CoV-2 in the country. The country's response was built on 40 years of investment in, and political commitment to, strong primary health services, universal health coverage and public health preparedness for pandemics. The key interventions for COVID-19 response and recovery involved functions under multiple laws, namely the Communicable Diseases Act, the State Administration Act, and the Disaster Prevention and Mitigation Act.

The Ministry of Public Health (MoH) led the national response efforts in collaboration with a number of Ministries and Department including the he Ministry of Interior's Department of Provincial Administration, and Department of Disaster Prevention and Mitigation. The MoH in collaboration with the World Health Organization (WHO) and other stakeholders conducted a joint review focusing on the 9 pillars of the national COVID-19 pandemic response including 1) Country-level Coordination, Planning and Monitoring, 2) Risk Communication and Community Engagement, 3) Surveillance, Rapid Response Teams, Case Investigation, 4) Points of Entry and Migrant Health, 5) National Laboratory Systems, 6) Infection Prevention and Control in the Community and Healthcare Facilities, 7) Clinical Management, 8) Operational Support and Logistics in Supply Chain and Workforce Management, and 9) Maintaining Essential Services during the COVID-19 Outbreak.

Thailand was praised by the review team for its effective and successful prevention and control of COVID-19 in many of the key pillars, including timely detection of the situation and reporting of confirmed cases, an integrated whole-of-government and whole-of-society approach including engagement of the private sector, surveillance of travelers in quarantine facilities, public health infrastructure, village health volunteers and more than 1,000 disease investigation teams, efficient communication, a variety of two-way communication channels with the public to encourage and measure compliance and delivery of targeted messages, as well as providing surge capacity in health care facilities, i.e. preparation of facilities, beds, wards, equipment and supplies.

Although the intra-action review has highlighted many of Thailand's successes, there remain gaps that need to be addressed in order to better prepare for a possible future outbreak. An advanced integrated digital data system will be required to ensure efficiency in managing the situation. The MoPH need to strengthen the Emergency Operations Centres (EOC) with established and tested SOPs. Hands on training in the Incident Command System (ICS) to improve operational efficiency between EOCs at national and sub-national levels in close collaboration with the DDPM has been identified as one of the priority area.

1. Introduction

Located in the center of the South-East Asian peninsula, Thailand extends through an area of 514,000 square kilometers, sharing borders with Myanmar to the north and northwest, Lao People's Democratic Republic to the north and northeast, Cambodia to the east, and Malaysia to the south (Thailand Board of Investment, 2019). Furthermore, Thailand has diverse typography, characterized by mountain ranges and tropical forests, high plateaus of the northeast, and fertile rice fields alongside vast flood plains. Also, the country has a 2,420-kilometer coastline.

Located in the tropical climate zone, the country is affected by two monsoonal seasons - southwest monsoon and northeast monsoon. As a result, warm humidity arising from the Indian Ocean during the southwest monsoon brings abundant rainfall over the country starting from May. Conversely, cold and dryer conditions brought by the northeast monsoon, starting in October, causes temperatures to drop in higher latitude, but also facilitates abundant rain along the eastern coastline of the Southern region. Largest amounts of rainfall are usually brought by the Inter Tropical Convergence Zone (ITCZ), and tropical cyclones could be expected from May onwards (Thai Meteorological Department, 2015). However, mean annual rainfall (measured between 1981-2010) has high spatial variability; it can range from 2,717.2 mm in southwest, to 1,230.9 mm in north (Thai Meteorological Department, 2014).

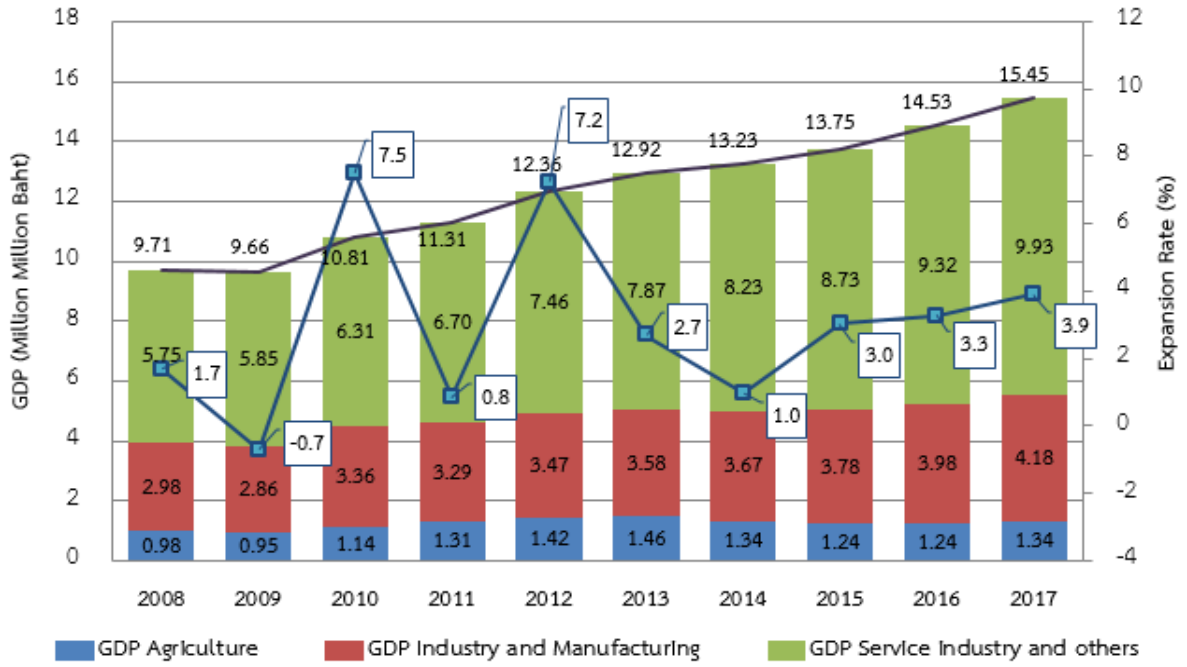
In terms of administration, Thailand is a constitutional monarchy, governed by democratic system. His Majesty the King acts as the head of state, supported by the Prime Minister as the head of the government and country administration. At the sub-national levels, administration comprises three tiers: central, provincial (and districts) and local administration (or sub-districts). National government, which is coalition of elected representatives from the multiparty system, serves as the national governing body, while the Parliament (comprising members of the House of Representatives from the election) performs as the legislative body to oversee the administration of the government.

Thailand is divided into 76 provinces, and the Bangkok Metropolitan Region as a special administrative unit. They are clustered into 6 distinct regions: North, East, West, South, Central and Northeast. Each province is headed by provincial governor, an appointed position under the Ministry of Interior (MoI), while the Bangkok Metropolitan Administration, the authorized body for Bangkok administration, is headed by Bangkok governor, elected with a popular vote by registered Bangkok's population. Finally, each province is further divided into districts and Tambons (sub-units of districts), governed by district mayors (a bureaucratic position under MoI). Local administrative units (LGUs), established as per the Decentralization Act of 1999, comprises Provincial Administrative Organizations (PAOs), Tambon Administrative Organizations (TAOs), and municipal bodies.

With regards to its economy, Thailand is now a middle-income country due to its flourishing industrial sector, especially electronic products and manufacturing. Commercialization, exports and country's potential to become a logistic hub in the region have increased business competitiveness of Thailand (Board of Investment, 2018). Furthermore, tourism and service industries have an important role in the economy; between 2008 and 2018, said sector had the highest share contributing to the national GDP, followed by industry, manufacturing and agriculture (figure 1). In terms of employment, however, agriculture remains the backbone of the country's labor force. In 2017, out of the 37.2 million persons

engaged in employment, 10.63 million were working in agriculture (National Statistical Office, 2017). While the share of agricultural employment has decreased significantly since 2012 - during which 14.87 million were in the sector (National Statistical Office, 2012) – agriculture still remains as the unofficial safety-net for many, and helps to absorb those unemployed during financial crises and times of lower demand. Also, labour force mobility is common in Thailand, and those engaged in self-employment (or those dependent on seasonal wages) often switch to farm work in cropping and harvesting season.

Figure 1. GDP by sector and expansion rate 2008-2017 (Office of the National Economic and Social Development Board (NESDB), 2017)



Yet, despite economic growth in the past decades, Thailand is considered to suffer from economic stagnation that limits development (Jitsuchon, 2012). While major causes behind such hindrances vary depending on the perspective, there are critical factors that contribute to the issue. They include lack of skilled labor, limited research and development (R&D), lack of enabling environment for small and medium enterprises, as well as the unequally distributed benefits of the growth as a result of highly concentrated (high-value) economic activities, mainly to the Bangkok Metropolitan region (Kanapathy, 2014). Economic well-being, and attainment of high-income status, and addressing development disparities across the country constitute to the challenges for Thailand to overcome.

Furthermore, disaster and climate risks add to these burdens. Currently, prevalent hazards affecting the country range from flooding, cyclones, landslides and wildfires to extreme heat, associated water scarcity, as well as seismic activity (GFDRR, 2020). Technological hazards, including large-scale industrial accidents, are also potentially high-risk hazards, especially in areas characterized by widespread industrial activity (ADRC, 2011). Adding to the challenges, climate change is likely to worsen the impacts of hydrometeorological hazards, and has the potential to endanger future economic development, human safety and wellbeing as well. Already, Thailand has undergone observed changes in the seasons, characterized by the delayed onset of rainfall, which has further exacerbated the prevalence of flashfloods and

landslides in some regions due to heightened precipitation, now concentrated to a shorter time period. Moreover, environmental problems induced by anthropogenic stressors, from air pollution and environmental degradation to poor management of wastewaters and waste, further contribute to the immediate risks faced by the society and the ecological systems.

1.1 Demographic Characteristics

As of 2019, the population in Thailand was estimated at 66.56 million people (Board of Investment, 2019). While nearly half of the total population are of working age, due to reduction in the average birth and mortality rates, as well as the increased lifespan in both male and female populations (at 71.9 and 78.5 years, respectively), increasing proportion of aging peoples has become the prevalent trend (Board of Investment, 2019). This pathway is shifting the balance of the population structure towards one characterized by a higher number of dependents (aged 60 years and over) in Thailand. Those elderly, accounting for only 6.8 percent of the population in 1994, has increased to 16.7 percent in 2017; and by 2021, the numbers are expected to exceed 20 percent of the total population (National Statistical Office, 2018). An aging society will have implications on the wider economic development, given that the costs of managing public services and healthcare are likely to increase on par with the needs of those growing older. At the same time, those working aged must then manage higher tax burdens while the overall numbers of younger people are likely to reduce. Unless managed, this pathway may severely hinder growth prospects in the longer term.

However, Thailand has prospered over the past decades in terms of education and employment of its people, having reached 93 percent literacy rate, and with the government placing its highest priority on the development of human capital (Board of Investment, 2019). Also, the rate of underemployment remains low at 0.9 percent, accounting for just over 355,000 people in 2019 (Office of the National Economic and Social Development Council, 2019). As a result of the investments made in human capital, the Human Development Index of Thailand was measured at 0.765 in 2018, and the country was positioned at 77th out of 189 measured countries and territories (UNDP, 2019). Yet, when adjusted to inequalities, all three dimensions of the HDI (long, healthy life, access to knowledge and decent standard of living) suffers a significant loss. When Thailand's value is discounted for inequality, the HDI falls to 0.635, representing a loss of 16.9 percent due to unequal geographical distribution of the HDI dimensions (UNDP, 2019). Widening income gaps, socio-economic inequalities, uneven development and challenges in terms of achieving gender equality all contribute to these problems. For example, traditional attitudes, stereotypes and socially determined roles of women often underpin domestic violence and violence against women in the country. Women's participation is also lower in politics and decision-making positions, and women of ethnic rural background may face heightened vulnerabilities whilst experiencing discrimination, or due to their higher likelihood to be engaged with the informal working sectors (UNWomen, 2019). Thus, and besides the regional inequalities, a lot of work is also required to address the vulnerabilities arising from demographic pressures to safeguard gains from future disaster and climate risks.

Furthermore, it must be noted that the rapid urbanization trend is also affecting Thailand. Its main drivers are the increasing rates of domestic migration of people who are gravitating towards urban regions in the search of employment opportunities and services. Today, most densely populated regions in the country are found in the Bangkok Metropolitan, and other major urban centers. As a result, these trends are also contributing to a growing population

of unregistered populations – for example, Bangkok is now a home to approximately 2.04 million unregistered people (National Statistical Office, 2017), who may struggle to secure legal employment, or are unable to access services from schooling to healthcare due to their disposition.

1.2 Economic Impact of Disasters

When assessing the economic costs of disasters affecting Thailand, it becomes apparent that flooding, droughts and storms are causing the highest combined damages and losses in the country. The most recent, costly disaster occurred in 2011, as the flooding triggered by the tropical storm Nock-ten (colloquially known as the Great Flood) spread throughout the northern, northeastern and central Thailand, also inundating large parts of Bangkok Metropolitan region. The estimated damages at the time were projected to reach US$ 46.5 billion, and the resulting disruptions to industries caused the GDP growth to drop from the projected 4 percent to 2.9 percent by the end of the year (The World Bank, 2012). Manufacturing accounted for the largest damages and losses, followed by housing, transport, finance and banking, as well as the agricultural sector (The World Bank, 2012). The latter is especially important in terms of household-level economies given the high reliance on subsistence-agriculture still prevalent in the country. The loss of output had significant impacts of numerous households living in poverty due to widespread inundation that damaged farmlands for weeks (Poaponsakorn & Meethom, 2013). Similarly, it was estimated that 666,000 jobs were affected by November 2011, which also heightens the risks for those already vulnerable to poverty as well (Poaponsakorn & Meethom, 2013).

Drought is another hazard causing significant disruptions to the economy in the country. Extremely low precipitation and sharp drops in water levels in groundwater aquifers of water catchment areas have caused severe shortages affecting agriculture, consumption and ecological systems. For example, the persistent drought event during 2015 - 2016, (considered to be the worst drought in 20 years in the country) resulted in considerable losses exceeding US$ 2.5 billion, affecting the agriculture (especially rice paddies) heavily (Office of Agricultural Economics, 2016). Similarly, the drought of 2019 was estimated to cause losses of US$ 312 million due to lost crops from rice, maize and sugar cane to tapioca (NNT, 2019). At the macro-levels, the implications of such events yet again instigate the decline of purchasing power among farmer households and cause an increase in debt burdens which contribute to challenges experienced at macro-scales as well.

Moreover, these events have implications to future growth and fiscal stability due to the financial resources required for on-going reconstruction and recovery of catastrophic events. Annually, the government has to bear considerable fiscal burdens due to its role in providing financial assistance, to mitigate crop losses or damaged infrastructure, or in reconstruction of critical facilities and transportation networks. Comprehensive review of the public expenditure vis-à-vis actual fiscal capacities and risk financing mechanisms could provide substantive information about the future outlook of fiscal risks (when contrasted to disaster and climate risk data), which would support Thailand in its efforts to prepare and adapt to the accumulating losses. However, as of today, such information remains sparse.

Yet, considering the potential future of climate risks affecting Thailand, increasing the availability of risk information in consideration of the levels of economy is of paramount importance. For example, as the agricultural sector tends to suffer the worst impacts of

hydrometeorological hazards, low-income farming households, agriculture-based SMEs and the wider industry are exposed and vulnerable to an extent which may compromise the whole sector. The total economic impact of climate change on the agriculture is predicted to cause significant losses in yields of rice, maize and sugarcane, leading to losses ranging between US$300 million to US$420 million by 2050 (FAO, 2019). Thus, exploring the interconnectedness of agricultural employment, output, poverty, food insecurity and wider macroeconomic conditions vis-à-vis the immediate risks is critical to widen the understanding of the nexus of disasters and economy in Thailand. This would also support in prioritizing adaptation options and risk-informed decision-making.

1.3 Social Impact of Disasters

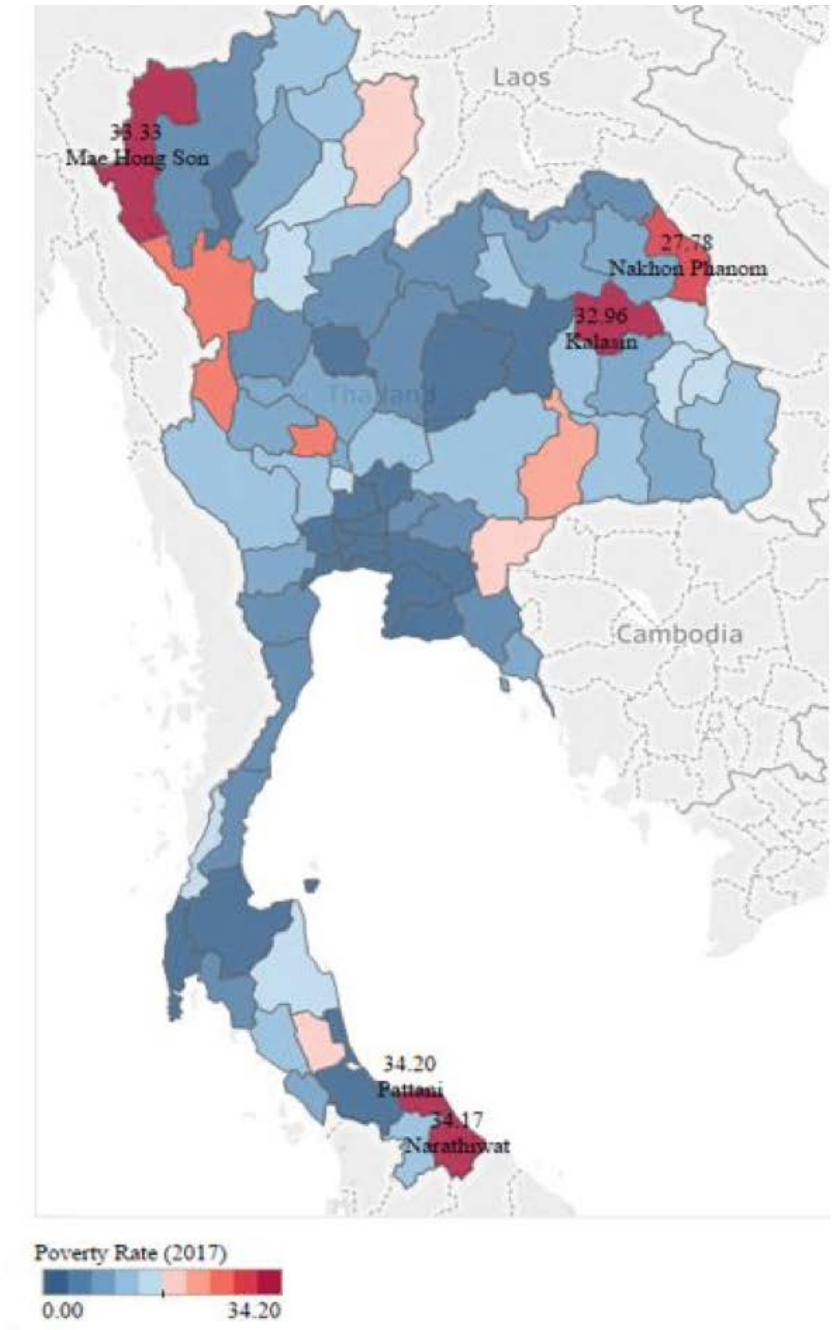
Alongside the economy, disasters also have social impacts. Indirectly, the loss of livelihoods, assets and employment may not only instigate poverty, but also lead to psychosocial suffering, anxiety and stress, or cause disruptions in the ability to return to the markets due to lost wealth. Similarly, human capital (from education to accessing healthcare) may be disrupted due to lost facilities, or following discontinuities in providing care and schooling, or due to the fact that those poor may be forced to undertake negative adaptation behavior which leads to pulling children out of schooling to support family needs, for example. All these compounding impacts may have long-term consequences to wellbeing and happiness, especially in areas which already struggle behind the national rate of development.

It must also be acknowledged that disaster impacts, affecting socio-economically stratified society disproportionately, often widen gaps in development in the longer term. Especially when specific issues, such as those affecting certain groups from the poor to underprivileged and marginalized, are likely to receive inadequate attention in the aftermaths of disasters, problems tend to become chronic. This further aggravates vulnerability, and contributes to cycles of poverty and malaise. For example, droughts and flooding occurring during 2010 in Thailand had significant impacts on community welfare (measured based on data sourced from nearly 70,000 villages), and affected not only household incomes, but also wellbeing depending on the levels of education (Garbero & Muttarak, 2013). It was estimated that while communities were generally resilient in coping with the hazard impacts, those with higher levels of education were benefitting more from the government's financial aid, and could recover more rapidly due to the ability to estimate, assess and respond to shocks (Garbero & Muttarak, 2013). This suggests that education indeed plays a key role in overall resilience against disasters and climate change, lack of which constitutes to higher vulnerabilities in areas wherein levels of education remain lower either due to financial difficulties, or because schooling is affected by recurrent hazards which lowers enrolment rates. Unless managed, areas which suffer from lack of education also begin creating cycles of poverty and vulnerability that are difficult to escape from. Poverty in Thailand exhibits high spatial variability (figure 2), which also renders many areas more vulnerable to external shocks over those highly-developed such as the Bangkok Metropolitan region.

Similarly, disasters may have detrimental impacts on the ability to guarantee contingency and delivery of healthcare services. For example, the Indian Ocean tsunami of 2004 caused significant strain on healthcare systems across the affected region due to loss of workers, lost facilities and the number of victims that required care. In Thailand, healthcare facilities of the coast suffered severely, and resorted to transferring patients to hospitals inland (Carballo, et al., 2005). While patient loads were successfully managed at the time, it is clear how major events causing strain on regional capacities may hinder the efficacy of medical

response, and how interdependencies (such as reliance on electricity infrastructure) may further endanger national abilities to guarantee care. Those affected by disasters may also suffer from long-term physical impairment, limiting their ability to work, or experience mental health problems due to trauma and stress. Both of the associated social phenomena require attention long after the immediate response is subsided.

Figure 2. Rates of poverty in Thailand by province as of 2017. NESDB, cited in World Bank (2019)



2. Disaster Risk Profile

2.1 Hazards and Climate Change

Thailand is exposed to a wide range of hazards, including flooding, storms and droughts alongside forest fires, landslides and extreme temperatures. However, their impacts vary; the hilly areas in the north and south, with a number of communities located in steep and mountainous terrains, are highly susceptible to landslides triggered by heavy precipitation. Conversely, the northern regions are more susceptible to forest fires occurring during the dry season, which illustrates the high spatial variability of disasters that may occur in the country. Adding to the pressures, anthropogenic stressors from improper land-use, organic urban expansion and changes in land use contribute to high risks in areas which are undergoing changes in the protective environment and ecosystems. Human-induced hazards, particularly technological accidents, are also a concern, especially in regions characterized by industrial activities. Sometimes, massive catastrophes and unique events, such as the Indian Ocean tsunami of 2004, may affect the country as well. The 2004 event was triggered by a strong earthquake in the Andaman Nicobar Island, but still caused severe damages and approximately 5,000 casualties in six provinces on the Andaman coastline (Department of Disaster Prevention and Mitigation, 2005).

Aside from major disasters, the more common hazards are often more detrimental due to their accumulating impacts over a long-term period. Firstly, the high risks of flooding are related to the complex river systems extending throughout the country. Riverine flooding, for example, is common given that vast central region of Thailand is largely developed on on a flood plain, a so-called Chao Praya river basin. Major other river systems include the Ping, Yom, Nan basins in the northern region, as well as the Chi, Mun and Chao Praya rivers which instigate seasonal flooding which also correlate with storms. From February-March, different areas across the country could experience local storms (or summer storm) - a localized hazard covering an area of 10 -20 square kilometers (Thai Meteorological Department, 2015). They are characterized by strong winds, thunder, and rainfall lasting for hours.

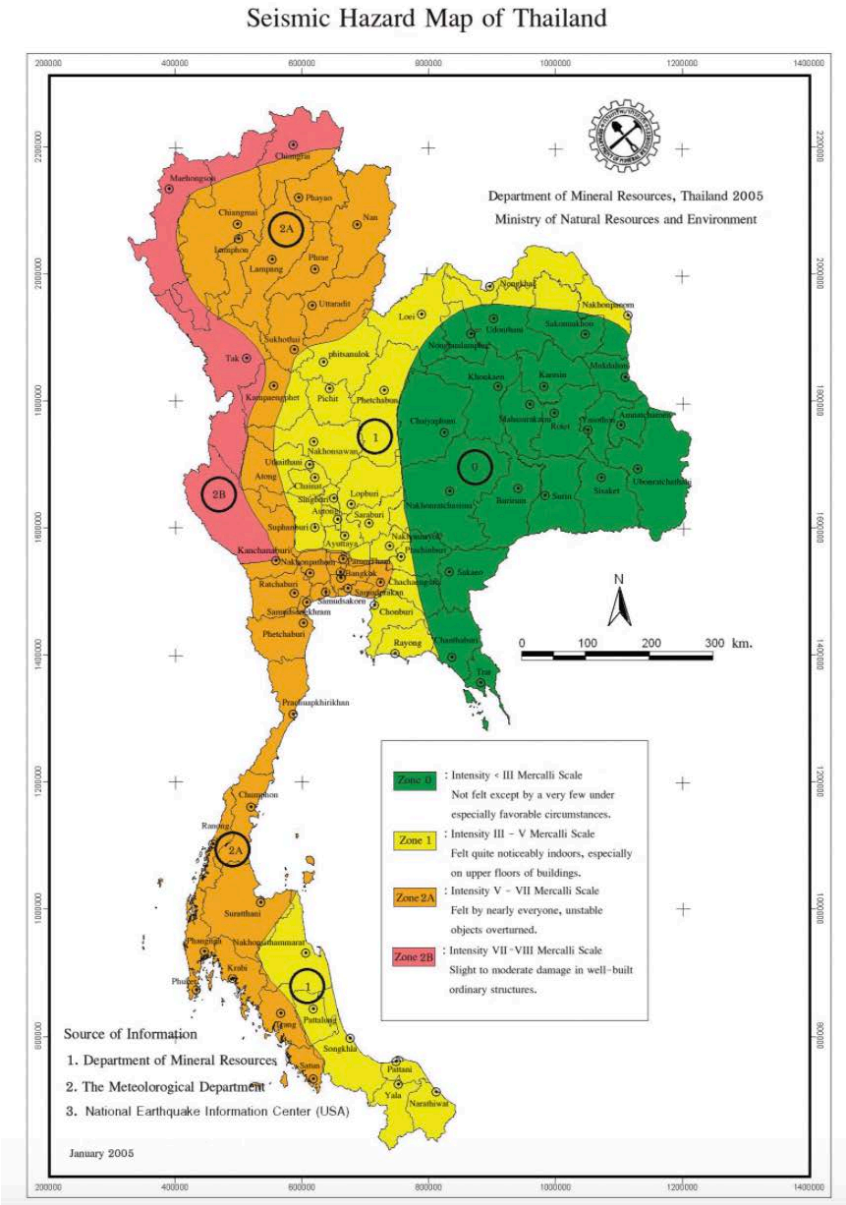
In fact, most landslide incidents in Thailand occur during extremely incessant rainfall, causing fluidized movement of land masses, rocks, and debris in the mountainous or hilly areas. While rainfall, soil types and geological characteristics are key factors determining landslide occurrence, anthropogenic stressors from land-use to land clearing, cultivation and deforestation also contribute to damages in soil surfaces and reduced absorption capacity. As a result, landslide risks are higher in regions which have higher rates of on-going soil erosion and loss of vegetative cover (Department of Mineral Resources, 2019).

In terms of drought hazard, the phenomenon is not new to the country – rather, it has only become among the most severe in the past years. Droughts in Thailand often occur in two distinct periods: between June and September following delayed onset of rainfall, or due to low precipitation during the dry season between October and May. Droughts may instigate severe water shortages, and their occurrence is increasing in association with El Niño conditions. Dry conditions also correlate with forest fires, usually occurring between December and May, often caused by human activities such as land clearing and gathering of forest products (Forest Fire Control Division, 2018).

Furthermore, Thailand is located on 14 active fault lines which extend through 22 provinces. While seismic activity is possible in many parts of the country, especially in the northern provinces classified as high-risk zones (figure 3), there have been no major events recorded in the past. However, an earthquake affecting the northernmost province of Chiang Rai in May, 2014, promptly raised awareness about the threats of earthquakes Thailand is exposed (Soralump, et al., 2014).

One must also address diseases and epidemics in the context of hazards affecting Thailand. At the time of writing, the new pandemic caused by the COVID-19 coronavirus has made landfall to most nations, affecting Thailand as well. While undoubtedly serious and unpredictable, it does not diminish the threat of other diseases either. The country is also exposed to vector-borne diseases from MERS to Zika virus, alongside re-emerging communicable diseases such as tuberculosis. Malaria risks are also high at the borders of Myanmar, Malaysia, Cambodia and Lao PDR.

Figure 3. Seismic hazard map of Thailand (Department of Mineral Resources, 2005)



Finally, the threat of climate change and its exacerbating effects to hydrometeorological hazards requires thorough inspection. Already, observed changes in the regional climate have magnified the risks. Between 1955 and 2009, average annual temperatures in Thailand have increased by 0.95° C, significantly more than the global average of 0.69° C. (Naruchaikusol, 2016). Furthermore, sea levels in the gulf of Thailand has risen approximately 3-5 millimeters annually, compared to the global average of 0.7 mm per year between 1993-2008. While precipitation has not shown significant change over the period of 1955-2014, Bangkok, northeastern provinces and the Gulf region have experienced increased rainfall (Naruchaikusol, 2016).

These changes translate to higher hazard risks. For example, between 2006-2010, Thailand experienced longer dry spells in the middle of the rainy season, and more intense rain afterwards, exacerbating seasonal stress due to changes in the regional weather patterns. Similarly, between 2015 and 2016, data from the National Hydroinformatics and Climate Data Center indicated a series of recurring, prolonged droughts which caused water levels to drop to critical levels in reservoirs nationwide (Open Development Initiative, 2018). Impacts of such events are particularly severe on the agricultural sector, and also threaten the environment and stability of the ecological systems. Furthermore, sea-level rise is likely to increase the vulnerability of not only coastal agriculture and critical infrastructure located at low-lying coastal areas (including industrial parks and road networks), but also mangrove forests and coral reefs (Open Development Initiative, 2018).

2.2. Exposure

Hazards affect different regions in Thailand at varying intensity depending on a number of factors including altitude, proximity to river basins, topography, geomorphology, seismicity, livelihoods, as well as economic activities. For example, the country comprises 25 river basins, flood plain areas and canal networks, rendering people and infrastructure located near water bodies regularly exposed to flooding. In the past, flooding was considered to be a seasonal phenomenon, and a natural part of ecological cycle which brings in fertile sediments to support agrarian livelihood activities. However, the expansion of settlements and human systems, as well as the changes in land-use and the environment due to anthropogenic stressors, have significantly reduced absorption capacities in many regions, and may obstruct (or divert) water flows which heightens flood risks.

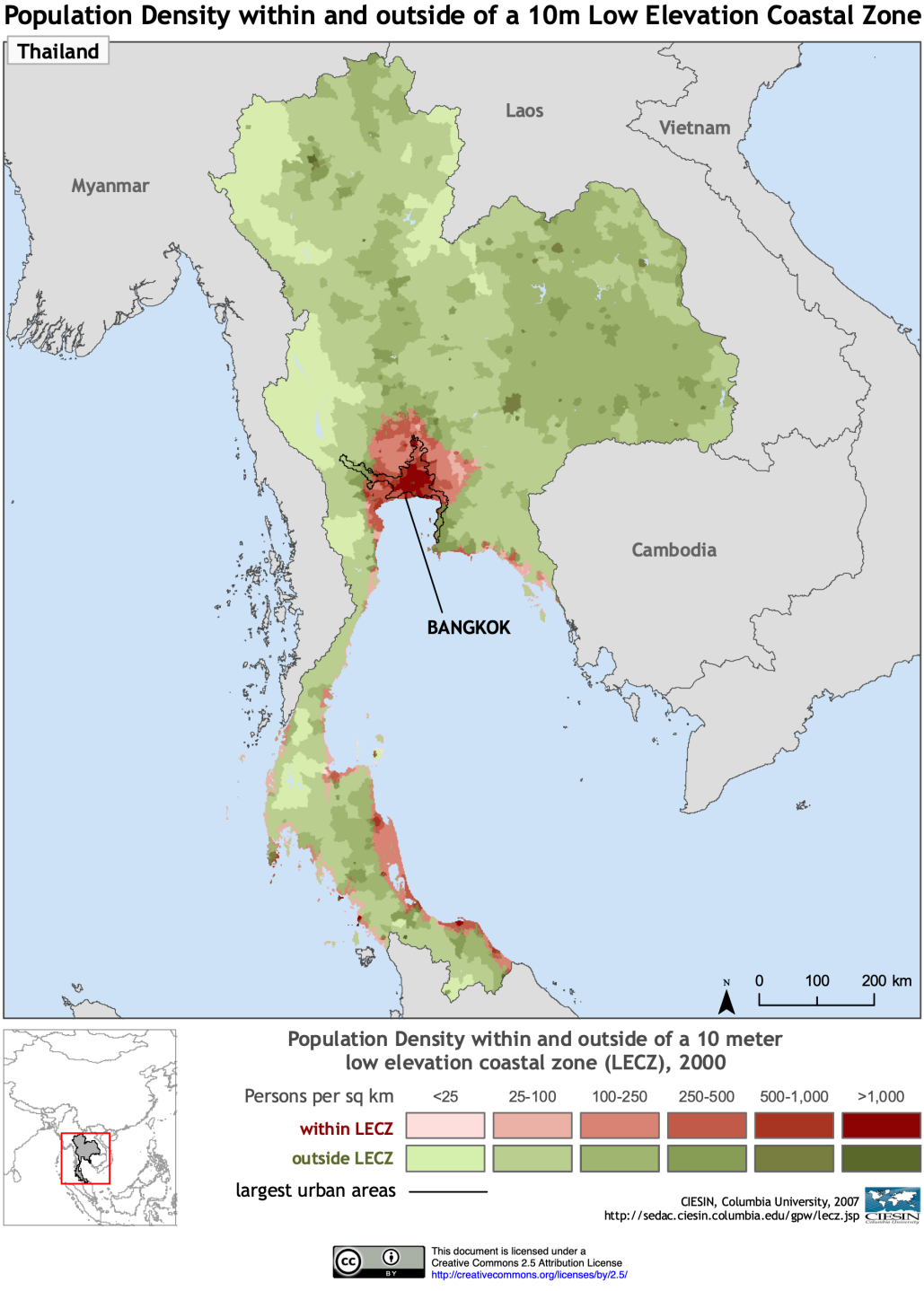
Drought risks are also largely correlated with human activities in Thailand. Areas under the coverage of water reservoirs and extensive irrigation facilities suffer less from the impacts of water scarcity occurring during drought periods. Statistics from Land Development Department (LDD) indicate that across the country, about 20 million rai[1] are hit by drought intensities 4 to 5 times higher than rest of the country due to limited irrigation and water reservoir systems (Land Development Department, 2018). Varying levels of water demand also contribute to the problem. In the Northern regions, higher water demand for cultivating rice during the off-seasons significantly stretch the farmers' capacities to manage their crops, especially when combined to the limited irrigation infrastructure that only covers approximately 11 percent out of the total cultivations (Bank of Thailand, 2019).

1 One rai is equivalent to 1,600 square meters, or 0,16 ha

Exposure also correlates with the regional and highly localized nature of some hazards. For example, dry seasons and droughts also correlate with forest fires which can spread quickly, cause significant problems in terms of air quality, and occur mostly in 9 of the northern provinces (Forest Fire Control Division, 2018). In terms of landslides, according to landslide assessment conducted by Department of Mineral Resources (DMR), 54 provinces, mainly in the northern and southern regions, are identified as highly landslide prone areas (Department of Mineral Resources, 2019). Similarly, storms have regional characteristics. Localized storms in the north usually occur between April and October, while the Southern region could expect storms in March to November (Thai Meteorological Department, 2015). Even though the impacts of storms vary across the country depending on the year, they are usually characterized by high precipitation and flooding as the main secondary hazard, followed by landslides.

Finally, communities along the coastlines are exposed to storm surges and saline intrusion, which heighten the risks of contamination of aquifers and the soil. Numerous provinces, including the metropolitan region of Bangkok, are indeed characterized by high population densities at the coast below 10 meters of elevation (figure 4). The problems are made worse by erosion and degradation of the coastal ecosystems following deforestation and land clearing to support economic activities, such as shrimp farming. The expansion of agriculture and industry has led to significant reduction in the coverage of mangrove forests in many of the coastal regions, leading to heightened exposure to inundation (UNDP Thailand, 2018). Mangroves act as a natural barrier against storm surges and high tides, not to mention their importance to flora and fauna – thus, their degradation has deleterious impacts on resilience and safety in areas worst affected by deforestation. However, the rate of mangrove loss has been significantly slower in Thailand than in other of the Southeast Asian countries, measured between 2002-2012 (Richards & Friess, 2016).

Figure 4. Population Density within and outside of a 10m Low Elevation Coastal Zones (Columbia University, 2007)



2.3 Socio-Economic Vulnerability

Exposure also has linkages to socio-economic vulnerabilities. For example, people are rarely choosing to live in exposed or highly-hazard prone areas – rather, they are forced to expand on unstable hillsides or flood-prone peri-urban regions either due to lack of affordable options, or because of the need to generate income. Similarly, deforestation and loss of vegetative cover are more likely to occur in regions where communities are more reliant on subsistence agriculture and the available land.

Between 2015 and 2018, poverty rate in Thailand increased from 7.2 percent to 9.8 percent, with the total number of people living in poverty resting at 6.7 million by 2018 (World Bank, 2020). Furthermore, while pockets of poverty tend to be concentrated in the northern regions and conflict-affected parts of the south, the increase in poverty occurring during 2018 affected 61 out of the 77 provinces (World Bank, 2020). Disparities in household wealth depending on the region is still prevalent, especially between peoples residing in the Bangkok Metropolitan area and those in the more rural provinces. Given the current prospects, gaps have been widening in terms of household income, consumption, education, skills and productivity levels (World Bank, 2017). While Thailand performs better than its ASEAN counter parts, the benefits of development are distributed unevenly, and bottom of the 40 percent of the income distribution still suffers from negative consumption and income-growth rates (measured between 205-2017) (World Bank, 2020).

In the nexus of poverty and disasters, those segments of the population living below poverty line (or are highly vulnerable to poverty) are among the most affected by hazards due to limited resources to prepare for, cope with and recover from their impacts. Recurrent hazards also affect the longer-term stability of household economies, as can be witnessed in the rising indebtedness among Thai peoples. While various reasons contribute to rising debts, hazards have been recognized to be one of the largest contributors to situations in which households require immediate financial liquidity, thus leading to debt burdens (Office of the National Economic and Social Development Council, 2019). Thus, poverty reduction in Thailand must be a multidisciplinary effort which addresses the current needs as well as the mounting debt burdens which may limit peoples' capacity to escape the cycles of poverty (Office of the National Economic and Social Development Council, 2019).

Alongside poverty, people may also be disproportionately vulnerable due to their age, disability, gender, ethnicity, religion or sexual orientation, among other characteristics. Socially determined roles and assumptions relating to these groups may then lead to marginalization and discrimination, a disposition which can contribute to higher vulnerabilities due to limited access to services and support, or because said groups are more likely to be living in poverty. For example, those discriminated against are less likely to seek out support, afraid to reach out to relief services due to implications it may have on their safety and wellbeing. Conversely, those elderly or disabled may be unable to access support due to limited transportation networks and public infrastructure, especially in the more rural regions. In Thailand, older people have been found to have lower levels of disaster preparedness due to lack of awareness and comprehensive plans (Sri-on, et al., 2019), and those elderly are also more likely to be living with a form of disability affecting their activities of daily living (Loichinger & Pothisiri, 2018).

2.4 Physical Vulnerability

Social vulnerability is also linked to physical vulnerabilities depending on the region. For example, those poor are more likely to inhabit sub-standard housing, built from materials which have poor seismic resistance, or limited capability to withstand strong winds and fire. Such settlements often characterize peripheries of megacities across Asia, wherein informal urban expansion, driven by high rates of domestic migration, is contributing to the problem. In such environments, physical vulnerabilities form, also due to the absence of land-use planning, enforcement of building codes, and because the expansion often takes place in hazard-prone areas. In densely populated areas, like Bangkok Metropolitan region, drainage infrastructure is also struggling to keep up with the rate of development, due to which flooding impacts may be worsened in urban regions resulted from low absorption rates and poor water management capacities. A study has indicated that the development of road networks in Bangkok has caused the permanent loss of some natural waterways, thus leading to reduced drainage capacity, and creating chronic flooding issues in the capital since 1960s (Roachanakanan, 2014). Similar situations are likely to be encountered in growing cities across the country if no adequate attention is paid on providing space for the water cycles. Flood risks are already prevalent in Hat Yai, Khon Kaen and Lad Krabang, which suffer from similar problems such as inadequate protection measures that focus only on some areas (Friend, et al., 2016).

While many urban areas have adopted the rhetoric of aspiring towards 'cities worth living in' (muang na-yu), the concept remains poorly defined in practice and policy (Friend, et al., 2016). Also, the rates of urbanization in Thailand are directly linked to climate vulnerabilities, as increasing numbers of housing and settlements are placed in hazardous areas, not to mention the interconnectedness of critical infrastructure from water and energy to waste management facilities and transport systems (Friend, et al., 2016). These dependencies magnify urban vulnerabilities due to the fact that a failure in one part of the system, due to a disturbance or another, may instigate cascading collapses in the network of interconnected facilities and services. Environmental pollution is also a feature of urban spaces in Thailand. Often, industrial waste or pollution from waste dumped into canals contribute to significant degradation of the urban water bodies, and air pollution is becoming more common in large cities (Friend, et al., 2016). All of these issues contribute to heightened urban vulnerabilities due to their impacts on public health and the environment, and how they are interlinked with seasonal hazards from flooding (when flood waters wash up waste, heightening the risk of coming into contact with humans) to dry conditions which are more likely to instigate the formation of smog in cities.

Wider public infrastructure is also at risk in the country. For example, schools and hospitals are affected by flooding and landslides across the hazard hotspots in Thailand, alongside non-engineered structures which may have severe deficits in terms of their seismic properties. Some of the latterly mentioned issues came into light following the earthquake of 2014 in Chiang Rai, which, while being relatively low impact, revealed some of the concerns related to improper building practices and lack of enforcement of building codes. For example, while the Building Control Act came into effect in 2007, it only applies to public buildings with heights of 15-meter high or above, and there are gaps in enforcing the earthquake-resistant designs in the construction industry, factors which contribute to physical vulnerabilities in Thailand (Rujivanarom, 2015).

2.5 Future of Disaster and Climate Risks

Hazards affecting Thailand are likely to be exacerbated due to the impacts of climate change. Already, farmers are subjected to impacts of flooding and droughts annually, leading to crop losses and low productivity, indebtedness and low household earnings. Variations in the regional weather patterns could have significant impacts on the stability of the agricultural sector due to low yields and compromised activities during critical stages from seeding to harvesting. Changes in temperature and humidity are also likely to increase the prevalence of pests, including mealy bugs destroying cassava, or brown planthoppers (Nilaparvata lugens) often found feasting rice crops during the rainy seasons (Krutmuang, 2011; Promrak & Rattanakul, 2017). Given that Thailand is a major exporter of rice and cassava, and because agriculture still employs large parts of the population, climate change impacts on the sector are projected to have significant economic consequences at all levels. The economic costs due to loss of farmland value and output alone have been projected to exceed US$ 94 billion under a high-emissions scenario by 2050 due to changes in precipitation and temperature (Witsanu, 2013). While the impacts have major spatial variability, with some provincial differences ranging from US$ 0.27 billion to 19.43 billion in losses depending on the scenario, the overall impacts are nevertheless severe, and call for practical adaptation interventions to relieve the pressures the changes are likely to impose on farmers (Witsanu, 2013).

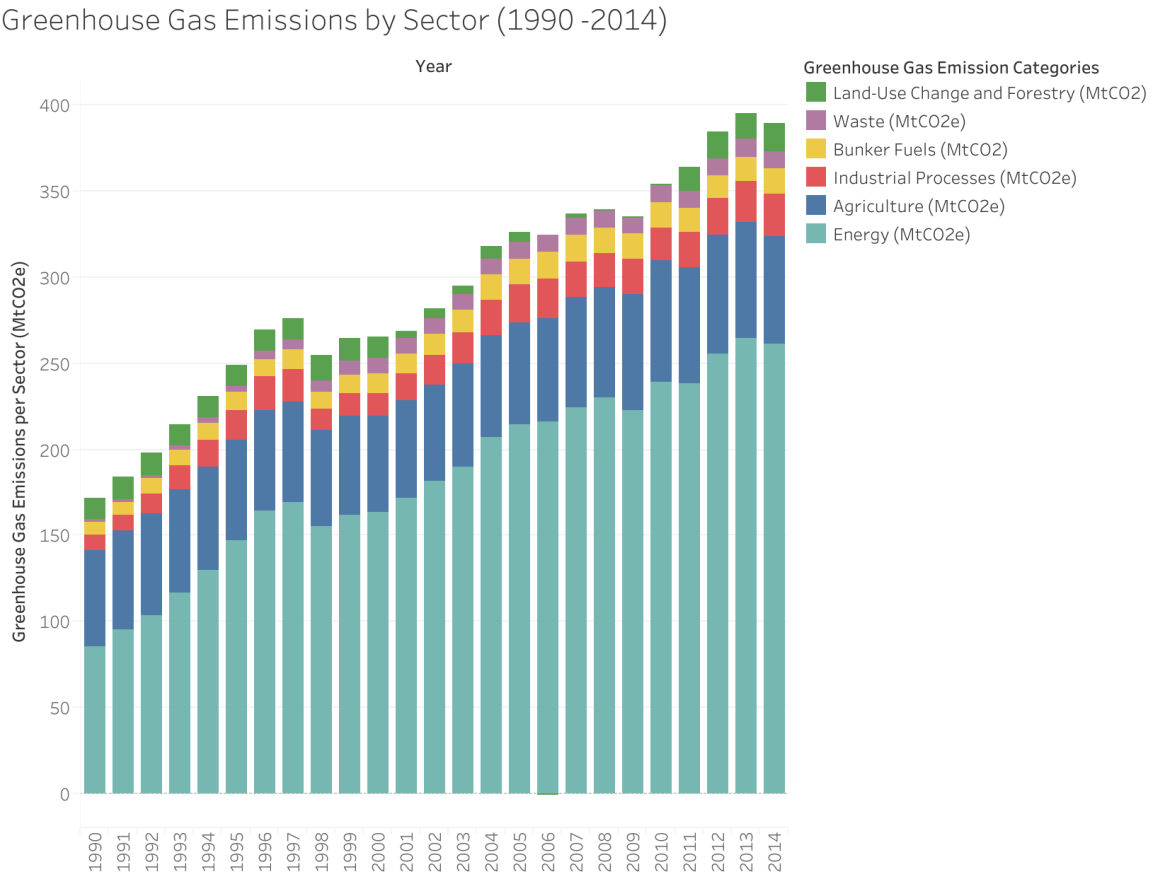
In this context, it is important to address water demand which is likely to increase under the changing climate and temperatures, while the availability of safe water could decrease. Still, excessive rainfall remains to be adequately managed for the purposes of agriculture to support the demand in dry seasons. Furthermore, records from major dams of the Chao Praya basin indicate water deficits during most of the years between 2008-2016, despite attempts to improve water utilization and allocation in various sectors vis-à-vis the actual capacities (Hydro-Informatics Institute, 2019). These issues are likely to be magnified during drought conditions and dry seasons if precipitation falls further from the current levels.

Sea level rise is also likely to worsen the impacts of flooding and storms, and lead to permanent inundation in some areas. For example, Bangkok which is located only 1.5 meters above sea level, is expected to become one of the world's worst affected urban areas alongside Jakarta and Manila (Deviller, 2018). Sometimes described as the 'Venice of the East', the city is likely to experience significant damages and loss of coastline, made worse by the inadequate protective measures and poor drainage infrastructure (Deviller, 2018). As early as 2009, the city was already experiencing the impacts of climate change from more severe flooding to significant heat stress caused by hotter days, often exceeding 35 degrees Celsius (Bangkok Metropolitan Administration, 2009). Thus, significant investments and adaptation actions are required to protect low-lying areas from inundation, sinking, and the impacts of hydrometeorological hazards.

Finally, chronic environmental stress from pollution contributes to the deteriorating quality of life for Thai peoples. Cities in the north suffer from degrading air quality seasonally due to particulate matter arising from burning of farm residues and forest fires, while in Bangkok, factory emissions, vehicles, construction sites and stagnant airflows of the dry seasons are major contributors to toxic haze (UN Environment, 2019). It must also be noted that due to the high reliance on fossil fuels in energy production, the GHG emissions of Thailand have also steadily increased between 1990-2014, which presents a significant challenge to managing sustainable and green growth as mandated by the SDGs and the Paris Agreement in the future (figure 6).

Unless investments are made in reducing pollution and GHG emissions through innovation and policy-interventions (such as limiting the numbers of private cars in major cities, and transforming the energy sector), such issues may be magnified manifold. Long-term exposure to fine particulate pollution has been estimated to shorten the life of an average Thai person by more than two years, and in the most polluted regions, by four years (AQLI, 2019). Also, excessive utilization of single-use plastics, compounding solid waste and poor waste management facilities are adding to the health risks especially in the urban regions, endanger the wellbeing of the population, and are immensely harmful to aquatic species. Thus, these wider considerations must be brought into the sphere of disaster and climate risk reduction alongside sustainable development, to guarantee that issues will not be magnified and replicated in the shadows of economic development aspirations.

Figure 5. Greenhouse gas emissions of Thailand by sector, measured between 1990-2014 (Open Development Initiative, 2018)



3. Disaster Risk and Climate Action Interventions

Despite the apparent challenges, Thailand improved its disaster risk management (DRM) to protect the people and their wellbeing, alongside strengthening resilience against hazards to maintain economic competitiveness. Learning from catastrophic events occurring in the country during the past decades, major advances have been made in preparedness, mitigation, response and recovery towards holistic risk management. Furthermore, the country has invested in human development in line with the Sustainable Development Goals, as well as to reduce its greenhouse gas (GHG) emissions as mandated by the Paris Agreement. This section provides an overview of the country's process vis-à-vis the mandates of the post-2015 development agenda (mainly the Sendai Framework for Disaster Risk Reduction, SDGs and the Paris Agreement), highlights some of the key issues and provides suggestions for supporting the further implementation of disaster risk reduction (DRR) and climate change adaptation (CCA) in the country.

Priority 1. Understanding Disaster Risk Analysing, collecting and managing disaster and climate risk-related data is essential for achieving a comprehensive understanding of disasters. Data is required for the purposes of risk assessments, prioritizing investments, as well as for the planning of resilient and sustainable development. It should also be categorized and 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.

In Thailand, a number of initiatives have been carried out to improve the understanding of disaster and climate risks in the country, led by various government agencies, technical institutions and academia. For example, the Department of Disaster Prevention and Mitigation (DDPM), in collaboration with government and technical agencies, has developed risk information databases for specific hazards at all levels (from provinces down to villages), including flooding and landslides (DDPM, 2014). Hazard maps for recurrent flood were developed by DDPM between 2005-2013 with technical support by the Geo-Informatics and Space Technology Development Agency GISTDA. Landslide hazard maps in different scales (1:1,000,000, 1: 250,000 and 1: 50,000) are also available, developed by Department of Mineral Resources (DMR) using GIS and landslide prediction modelling. DMR also serves as the focal agency for developing seismic hazard maps for the entire country, classified into five levels of risk according to the Mercalli scale.

Other risk information products include drought maps which cover sub-district levels (developed in 2017), recurrent drought maps for the entire country (2017) and drought maps by region, developed by Land Development Department, under Ministry of Agriculture and Cooperatives (Land Development Department, 2017). Also, Community Landslides Risk Assessment (2012-2014) have been devised, and they comprise community profiles alongside detailed information about contextual landslide risks. Similarly, Earthquake Risk Assessment (2014), developed by the Department of Mineral Resources outlines provinces and villages located in the vicinity of active fault lines. General risk assessments are conducted by different levels of administration under the lead of the DDPM which provides guidelines for provincial and local authorities for developing risk profiles to devise DRM strategies and plans.

Enhancing risk assessment capacity has improved nationwide, through research and development projects of DDPM, primarily utilizing simplified, yet effective tools for risk assessment of hydrological hazards by local government and community. Local level planning has also been supported by stakeholders including United Nations Development Program (UNDP) and the Asian Disaster Preparedness Center (ADPC) which have been involved in project-based risk assessments. For example, flood risk assessments in Song Kla province, and earthquake risk mapping in Chiang Rai under the Mainstreaming Climate Change Adaptation and Disaster Risk Reduction in Development Planning (MADRiD) have been useful in identifying contextual hazards, exposure and vulnerability aspects, compiled into handbook for relevant government authorities and other stakeholders (UNDP, ADPC, DDPM & NESDB, 2017).

Thailand has also maintained systematic collection of data assessing hydrometeorological hazards, which is utilized in hazard monitoring, climate trend projections, seasonal forecasts and the annual forecasting of flood risks across the country. Such products also serve as tools for sectoral planning, especially in the flood and drought prone provinces. Systems used in collecting data include weather observation networks comprising automatic rain gauges, weather radars and satellite data, automatic weather system (AWS) of Thai Meteorological Department (TMD), as well as real-time monitoring of water volumes in reservoirs.

Priority 2. Strengthening Disaster Risk Governance to Manage Disaster Risk Effective disaster management and climate change adaptation also require robust legislative 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 Thailand, disaster risk management (DRM) has a solid legal foundation, supported by a comprehensive policy framework which outlines the roles and responsibilities of the DRM landscape among administrative levels. The Disaster Prevention and Mitigation Act of 2005 provides the main framework for DRM, supported by subsequent regulations. The National Disaster Prevention and Mitigation Plan of 2015 describes a set of strategic objectives to guide the operationalization of DRM, aligned with the 4 Priority Actions of SFDRR. The plan put an emphasis on four inter-related objectives: inclusive disaster risk reduction; integrated emergency management; effective recovery and resilience building; and strengthened international cooperation, adopting multi-agency and multi-sectoral approaches (DDPM, 2015). The plan is adopted for a 5-year period, and recently it has undergone a review through a participatory process. At sub-national levels, all provinces and local administrative bodies are mandated to develop respective disaster management plans for their jurisdiction. Guidelines for formulating annual action plans are provided by DDPM to ease the process, and to ensure uniformity. As of 2017, all of the provinces in Thailand had a DRM plan in place, while plan formulation at district and sub-district levels was in progress (Government of Thailand , 2017).

The National Committee for Disaster Prevention and Mitigation is the main body guiding DRM policy-development and decision-making, while the inter-ministerial committee provides technical and managerial support for the implementation activities. The DDPM serves its role in coordinating all activities and facilitates capacity-building for emergency response. DDPM comprises one central office with 16 Bureaus and units, 18 Disaster Prevention and Mitigation Regional Centers, and Provincial Office in 75 provinces (apart from Bangkok, because the metropolitan has a self-administered DRM unit under the BMA). Disaster Prevention and Mitigation Academy of the DDPM also provides trainings and capacity building for DDPM officials and other relevant government agencies.

In terms of mainstreaming risk reduction, a coordination mechanism among concerned government agencies has been established, aiming to support unified action across the country. Key attempts include the development of DRR focal points in line ministries and provincial agencies, responsible for coordinating the implementation of DRM plans, and supporting the mainstreaming of DRR into sectoral interventions (Cazeau, 2019). This is a significant step towards achieving the whole-of-society integration of DRR as envisaged under the Sendai framework, and these initiatives provide not only cross-agency support, but also the opportunity to identify synergies among sectoral interventions through collaboration of the relevant authorities.

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

IMPLEMENTATION	PLAN/POLICY	SCOPE	PURPOSE
DEPARTMENT OF DISASTER PREVENTION AND MITIGATION	Disaster Prevention and Mitigation Act (2007)	National, Provincial, District, Sub-District, Local Community	Aims to streamline disaster management systems of Thailand by clarifying roles and coordination among stakeholders. Includes provisions for DRR.
DEPARTMENT OF DISASTER PREVENTION AND MITIGATION AND OTHER AGENCIES	National Disaster Prevention and Mitigation Plan (2015)	National, Provincial, Local	Outlines strategic focus areas for DRM interventions, aligned with SFDRR. Intended to cater for all levels of the government, alongside relevant stakeholders.
SUB-DISTRICT ADMINISTRATION UNIT	DRM Action Plan (updated annually)	Local	Guides the implementation of risk management activities at the local level. Intended for the respective sub-district authorities.
PROVINCIAL AUTHORITIES	Provincial and District Disaster Prevention and Mitigation Plans	Provincial	Guides the implementation of DRM activities at the provincial level, implemented by province governance and supporting stakeholders.

Priority 3. Investing in Disaster Risk Reduction for Resilience Disasters have wide implications to social and economic development of a country due to their potentially widespread impacts – but also because they require funding to manage. Disaster financing often requires innovation from the government (and private sector) to avoid losses and impacts to lives and livelihoods in the forms of investments into infrastructure, trainings, insurance schemes, preparedness and response, and so on.

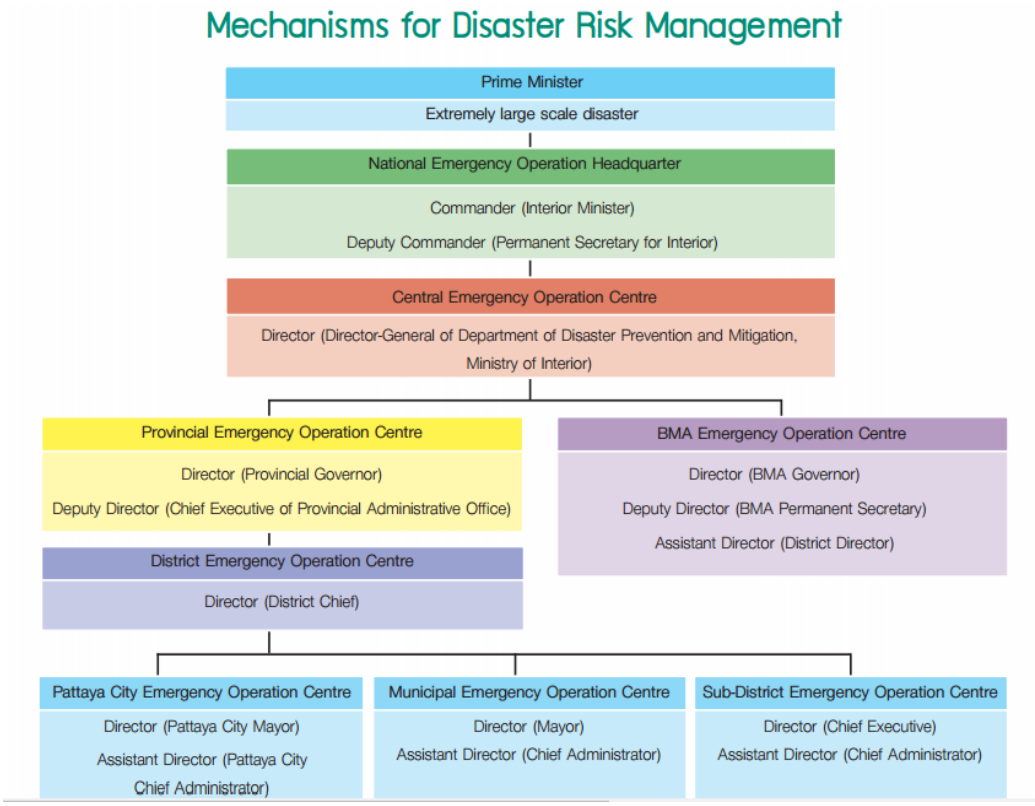
In Thailand, investing in resilience against disasters and climate change has been integrated into many sectoral plans and strategies. At the national level, these concerns are expressed in the 12th National Economic and Social Development Plan, reaffirming the importance of risk-informed and resilient development (Office of the National Economic and Social Development Board, 2017). Similarly, long-term development policy instruments, in particular, the 20-Year National Strategy for Security, Prosperity and Sustainability, and Water

Resource Management Master Plan B.E. 2018-2037, outlined a framework for guiding public investment. Financing priorities include flood management, increasing the efficiency of water usage, and the sustainable management of water supplies with a focus on reducing pollution (Office of the National Water Resources, 2018). While this indicates the strong commitment of the government to invest in resilience building, the extent to which these plans are translated into tangible action is subject to further review.

In terms of financial resources available for financing DRM, the annual budgets are the main source of funding for local government, BMA, and all government functionaries at the provincial level, as well as for ministries and departments. However, budget regulations have been modified in the past to target DRR and CCA in sectoral development programs. Money is also sourced from the national central fund managed by Bureau of Budget, and resources have been allocated towards forming contingency funds for government units for the purposes of emergency management, reconstruction (road, bridges, schools, hospitals, etc.), disbursement of relief assistance and implementing recovery schemes. At local level, according to Section 20 of the Disaster Prevention and Mitigation Act, local administrative units have full responsibility over disaster risk management in their jurisdiction and are obliged to set aside their own budget (generated by local revenues from local taxes, fees and charges) for DRM activities according to respective DRM plan. When facing financial constraints, they may seek additional support from central or provincial government agencies, or reallocate existing budgets for contingency as well.

Priority 4. Enhancing Disaster Preparedness for Effective Response to "Build Back Better" in Recovery, Rehabilitation and Reconstruction In terms of preparedness for disaster response, Thailand has made considerable progress in supporting the development of mechanisms that guarantee efficiency of response and recovery, supported by a system of coordination that identifies the roles and responsibilities of stakeholders involved in disaster response activities (figure 6). When disasters are declared in Thailand, the Emergency Operation Center (EOC) will be activated to assume the role of Incident Commander to supervise supporting units to carry out emergency operations. All local governments assume the roles of first responders when emergencies take place in the respective jurisdictions. If a situation exceeds their response capacities, the authority over operations is then transferred to provincial levels, or further upwards. In the case of large-scale disasters, Emergency Support Functions (ESFs), will be formed to support emergency management and operations. They comprise 18 tasks, including logistics, international coordination, medical services and public health, deployment of military equipment, firefighting, critical facilities & infrastructures, information technology, as well as social welfare & human security.

Figure 6: Organogram of Emergency Management (DDPM, 2015)



In terms of early warning systems, numerous initiatives and technological solutions are in place to improve the coverage and delivery of warnings for a range of hazards from hydrometeorological events to seismic activity. For example, EWS equipped with automated telemetry is operated by the Department of Water Resources, which monitors rainfall volumes and water levels in real-time to be utilized in flashflood and landslide alerts. Between 2005 – 2015, 1,546 detection and warning stations were installed, covering 4,915 villages located on mountainous terrain in the northern and southern regions (DWR, 2019). Furthermore, the Meteorological Department (TMD) has an important role in providing its support for monitoring hydrometeorological hazards from day-to-day weather forecasts to longer-term seasonal forecasts and storm tracking.

At the local levels, EWS have been developed for the purposes of delivering alerts to the 'last mile' with a focus on flash flooding and landslides. For example, rain gauges have been installed on hilly terrain and riverbank check points, providing information for communities as soon as signs of potential landslides are detected (Schmidt-Thomé, 2018). Volunteer networks and designated individuals with the responsibility over disseminating alerts in communities have been established since 2012 across the country with the support of Department of Water Resources (DWR), DDPM, Thailand Meteorological Department (TMD) and local administrative units. Some regions have also received support from international stakeholders to improve local EWS. In southern Thailand, UNDP and ADPC have worked with the DDPM to implement a community-based multi-hazard warning system, and the organizations also assisted the government in establishing both national and regional tsunami EWS. Sea-level gauge stations located at Ko Taphao, Ko Miang and Similian Islands (alongside numerous other multi-purpose gauges) are improving the capacity to monitor sea-levels and storm surges as well, which improve the accuracy for tsunami detection and climate change monitoring.

Building Back Better is also highlighted under Priority 4 to support recovery and rehabilitation that strives towards improving building resilience against hazards and climate change, as opposed to repeating development that has contributed to vulnerabilities on the ground. In Thailand, numerous issues still hinder the process of achieving BBB, especially due to the financial needs arising in the immediate phases of response and short-term recovery that often focus on returning a sense of normalcy. Funding for improving damaged infrastructure is often limited, especially in the aftermath of events such as the Indian Ocean tsunami of 2004 which cause widespread damage. While comprehensive studies about the capacity to conduct BBB in the country are sparse, some positive developments can be identified in the recent past.

For example, after the Great Flood in 2011, Post-Disaster Needs Assessment (PDNA) was conducted with the assistance of the World Bank, leading to the development of recovery and reconstruction plan for affected sectors, including loans and financial schemes, and enabling policies to support disaster-resilient recovery. High focus was given on improving the resiliency of overall infrastructure, including the construction of more weather-resilient roads and enhancing the drainage capacities to support flood management (World Bank, 2011). Yet, there is room for improvement. For example, a study conducted in a sub-district in Ayutthaya province indicated that recovery budgets provided by the national government were inadequate for the needs, and it did not cover all of the affected residents – in fact, most people could not afford a renovation that would offer better protection against future flooding (Sararit & Kondo, 2014). Thus, the government should also focus on developing the capacity for supporting BBB at the grass-root levels as well, for example by providing guidance, construction materials and skilled professionals to help the residents of heavily affected communities (Sararit & Kondo, 2014).

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

Harmonizing the synergies among policies and legislative frameworks to achieve holistic DRR, CCA and sustainable development is increasingly necessary due to the fact that all these efforts share overlapping characteristics, objectives and targets. By identifying synergies among major international agreements, it is possible to reduce overlapping responsibilities and doubled efforts at the country level. However, due to the nature of rapidly evolving "best practice" and country needs, policies are often formed on ad-hoc basis which leaves gaps among these three dimensions. Thus, work is often required to identify redundancies, to maximize the utilization of available resource, and to achieve the mainstreaming of DRR, CCA and sustainability as whole-of-society issues.

In Thailand, contemporary development policies and planning instruments are largely in alignment with the global agendas: the SDGs, SFDRR and Climate Paris Agreement 2015. The 20-Year National Strategy sets a long-term strategic vision for attaining prosperity and sustainability through inclusive, resilient and green growth. It is aligned with the SDGs, highlighting risk reduction and climate change adaptation as means to support wider development (NESDB, 2018). Similarly, the 12th National Economic and Social Development Plan (2017-2021), under the auspice of Thailand's 20-year National Strategy (2018-2037), sets a goal to strengthen the energy and agriculture sectors, alongside water management to improve water security. The implementation is led by the Office of the National Economic and Social Development Council: NESDC (a former Office of the National Economic and Social Development Board: NESDB), which identifies development priorities over 5-year periods. All planning instruments (e.g. ministerial plans, sectoral plans, provincial plans and other sub-plans) are aligned to these.

As a member of UNFCCC since 1995, Thailand is also active in integrating climate change action into its policy frameworks. Main responsibility over this work is assigned to the Office of Natural Resources and Environmental Policy and Planning (ONEP), under Ministry of Natural Resources and Environment (MoNRE). They receive their guidance from the the National Committee on Climate Change Policy (NCCC), chaired by the Prime Minister (ONEP, GEF and UNDP, 2018). Building upon preceding climate strategy, the Climate Change Master Plan (CCMP) 2015 – 2050, aligned with the Paris Agreement 2015, is a roadmap for Thailand to achieve sustainable low carbon growth and climate change resilience by 2050, with a set of targets on adaptation, mitigation and capacity building to be achieved for short term (by 2016), medium term (by 2020) and long term (2020-2050) (Office of Natural Resources and Environmental Policy and Planning, 2015).

At the sub-national levels, it is envisaged that by 2021, all provincial development plans will factor climate change considerations into local risk management planning, in accordance with the policy guide of the CCMP (GIZ, 2019). Aligned with the CCMP, the Nationally Determined Contribution Roadmap on Mitigation (2021-2030) aspires to fulfil the NDC commitments on reduction of GHG emissions, focusing on energy efficiency, alternative and renewable energy. Furthermore, the National Adaptation Plan is formulated to guide area-based and sectoral adaptation (focusing on 6 sectors: water management, agriculture and food security, tourism, health, natural resource management, human settlements and security), based on needs analyses identifying adaptation options (ONEP, 2019).

To track the progress of the plans identified above, multi-agency meetings have taken place in the past, led by different agencies. For SDGs tracking, the current status of implementation, successes and gaps were reviewed under the guidance of the Committee for Sustainable Development – a focal committee to operationalize SDGs (MoFA, 2018). Similarly, monitoring indicators have been developed to track progress under the 10 strategies of the 12th National Economic and Social Development Plan (2017-2012). They also cover elements of DRR, integrated into Strategy 3: Strengthening Thailand's economy on a sustainable basis, and Strategy 4: Promoting Green Growth or sustainable development (NESDB, 2019).

Table 2. Some of the synergies between international agreements and different policies and commitments of Thailand 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 Disaster Risk Management Plan (2015) (being reviewed and updated as of 2020)	20-year National Strategy (2018-2037) 12th National Economic and Social Development Plan (NESPD 2017– 2021)	Climate Change Master Plan (CCMP) 2015-2050)
Agriculture	Strategic Plan for Water Resource Management and Action Plan (2015- 2026)	Agricultural Sector Development Plan (aligned with 12th NESDP (2017– 2021)	Climate Change Strategy for Agriculture Sector (2017-2021) Integrating Agriculture in National Adaptation Plans (NAP-Ag) Thailand (2016-2018)
Disaster and Climate Risk Reduction	National Disaster Risk Management Plan 2015 (being reviewed and updated as of 2020)	12th National Economic and Social Development Plan (NESPD 2017– 2021)	Strategic Plan for Water Resource Management and Action Plan (2015- 2026) National Environmental Quality Promotion and Conservation Policy (2017 – 2036)
Vulnerability Reduction	Thailand Healthy Lifestyle Strategic Plan (2011–2020) National Adaptation Plan (2018)	National Health Strategy on Climate Change (Draft) (2017-2030) Strategic Framework on Food Security (2013–2016) National Plan for Older Persons (2002-2021) Women Development Strategy (2017-2021)	Nationally Determined Contribution Roadmap on Mitigation 2021 – 2030 (Draft) National Adaptation Plan (2018) 20-year Energy Efficiency Development Plan (2011-2030)

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
Urban Development	Bangkok resilience strategy 2017 Bangkok Comprehensive Plan (2013)	20-Year Strategic Plan for Housing Development (2017 – 2037) Bangkok Comprehensive Master Plan (2014-2018)	National Environmental Health Strategic Plan 2017–2021 Master Plan on Sewage and Wastewater Management 2017–2026

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

Despite comprehensive policy frameworks that have been established to support further mainstreaming of DRR and CCA, Thailand still faces numerous challenges in their implementation. Firstly, due to the interdisciplinary nature of DRM and climate action activities, they have to be integrated into the mandates and functions of authorities at all levels and sectors. Currently, disparities among the stakeholders and agencies in understanding their responsibilities in terms of mainstreaming these aspirations vis-à-vis the mandates as envisaged at the national level hinders the implementation of disaster and climate risk reduction efforts in a harmonized manner. Most problems are related to limited institutional capacities and resources. Especially the local government units (LGUs) face challenges due to their limited budgets tied to the taxation system. For example, financial constraints are common for the Tambon Administrative Organizations (TAOs), due to which their technical competency tends to be lower (Nikomborirak, 2016).

These provincial differences in levels of capacity and resources may impede the tangible implementation of wide range of policies in Thailand. Furthermore, fractured decision-making bodies lacking coordination may create conflicts of interests in different jurisdictions, especially in terms of management of water bodies. Unless holistic approaches and effective coordination mechanisms are well established, these issues may contribute to severe hindrances in achieving the aspirations for improving DRR and CCA.

During times of emergency, lack of clarity in terms of roles and responsibilities, lines of command and coordination mechanisms contribute to challenges in the phases of response. As much as response has been improved over the past decades, more remains to be done to strengthen the procedural standards, response guidelines and trainings to guarantee that the current frameworks are capable of responding to complex emergencies and rapidly evolving disasters that are often unpredictable in nature. In this context, administrative obstacles from limited financial procedures intended to support recovery should be reviewed against different hazard scenarios to ensure that the current financing approaches are capable to meet the urgent monetary needs in post-disaster phases as events unfold.

6. Stakeholder Analysis

Stakeholders – from communities to bilateral and multilateral partners – have an important role in improving the management of disaster and climate risks across Asia and the Pacific. As a member state of ASEAN, Thailand has actively taken part in regional DRM activities as a participant of the ASEAN Ministerial Meeting on Disaster Management (AMMDM), and the ASEAN Committee for Disaster Management (ACDM) which focuses on implementation of risk reduction activities. Initiatives arising from these conferences, including the ASEAN Agreement on Transboundary Haze Pollution (2002), and Roadmap on ASEAN Cooperation Towards Transboundary Haze Pollution Control with Means of Implementation (2016), have been jointly adopted by Thailand and other member states. In 2010, Thailand ratified ASEAN Agreement on Disaster Management and Emergency Response (AADMER) – a legally-binding document focusing on strengthening disaster management and emergency response in the ASEAN. Furthermore, Thailand is a member of the Mekong River Commission (MRC), represented by Department of Water Resources, Ministry of Natural Resources and Environment. The MRC seeks to improve water management and resilience of the Mekong river system and strengthens collaboration on transboundary water issues among the members.

At the national level, the armed forces are also important contributors to disaster response activities. Guided by the DDPM, Royal Thai Armed Forces and relevant agencies conduct regular exercises to strengthen emergency preparedness and response and mechanisms. They also participate in regional trainings of the ASEAN region, intended to improve cross-country coordination. Thailand-based associations, volunteers and communities themselves also provide their support to disaster management activities, especially to the phases of response, including search and rescue. For example, Emergency medical teams have been established nationwide under the auspice of the Emergency Medical Act B.E.2551 (2008) and National Institute of Emergency Management System (NIEMS), to strengthen the healthcare system and infrastructure in times of emergencies (National Institute for Emergency Medicine, 2019). One Tambon, One Search and Rescue Teams (OTOS) were formed as voluntary search and rescue units operating under local governments, with the intention to enhance locally mobilized emergency response. Approximately 7,386 OTOS teams with 77,466 members were active across the country as of 2016 (Department of Disaster Prevention and Mitigation, 2016).

Alongside the armed forces, a wide array of diverse non-governmental organizations and civil societies stakeholders have contributed to enhancing the national capacity for disaster preparedness, response and risk reduction. A number of NGOs and CSOs working in DRR-related domains include World Vision, Save the Children, CARE Thailand, all of which have extended throughout the country through their regional branches. They also engage with local governments and the education sector to enhance disaster risk awareness and promote DRR in schools and communities. The government also receives significant support from collaboration with agencies of the United Nations, and other development partners that have been contributing to capacity development at the national and sub-national levels to improve risk management across the country. These agencies include UNDRR, UNDP, UNESCAP, UNOCHA, WMO, IFRC, GIZ, and JICA.

Finally, acknowledging the importance of the private sector as stakeholders in DRR and CCA activities is increasingly important, given that development (especially in the urban regions) is often led by investors and companies. Partnerships and cooperation with private sector entities should be strengthened to engage said operators in resilient and risk-sensitive planning. Private sector engagement in DRM in Thailand has indeed improved, especially in the aftermath of the 2011 Great Flood, which spurred an interest to improve business continuity planning, especially in the heavily affected industrial sector. However, risk reduction and resilience building should also be incentivized through shared responsibilities in DRR between the government and private organizations. For example, joint initiatives could be explored in the context of water conservation, especially in the sphere of manufacturing activities which have high water consumption (Aksornkij, 2018).

7. Future Priorities

Numerous gaps and needs have been identified throughout this report. This section intends to summarize some of the findings and collate the most pressing challenges and issues to help prioritization of national strategic goals vis-à-vis the post-2015 development agenda.

7.1 Challenges

Firstly, initiatives seeking to address disaster risks have largely been conducted on ad-hoc basis, and often focus on addressing the immediate needs following recurrent hydrometeorological hazards as opposed to investing in longer-term DRR and CCA. High sectoral potential for mainstreaming risk reduction and adaptation remains underutilized, and the application of current activities may be limited due to lack of comprehensive overview across the on-going standalone initiatives across the country. Furthermore, investing in hard infrastructure (from flood embankments to drainage systems) is still common, while ecosystem-based options – from greening infrastructure to protection of mangrove forests - for the purposes DRR and CCA are overlooked in many regions. Furthermore, development and risk reduction are still treated as separate domains, especially at the sub-national levels, partly due to competing development interests and needs.

Moreover, lack of comprehensive risk information contributes to challenges in mainstreaming DRR and CCA in sectoral development planning. Issues arise from poorly managed data that may be incompatible across platforms used by various stakeholders, and because contextual information (sourced from local level authorities) remain limited. Furthermore, the process of developing risk profiles in Thailand often adopts simplistic approaches for assessing risks, based only on existing hazard profiles, past records, and use of discretion to determine likelihoods and potential impacts. There is potential for complementing current methodologies with disaggregated vulnerability data as well as cost benefit analyses – however, knowhow and technical competency to adopt such approaches remains limited (Department of Disaster Prevention and Mitigation, 2015). Another challenge is to enhance usability of the available risk assessment products, as the information may not always be user-friendly for the intended target audiences.

Finally, lack of capacity and human resources remain as the most apparent barriers hindering the process of implementing DRR and CCA in Thailand below the national levels. The range of trained and capable DRM professionals should be supported by providing contextualized professional skills development and other trainings, and investments should be made to increase the availability of financial resources for local governments that are currently largely dependent on their income sourced from their jurisdiction. DRR and CCA financing also suffers from inadequate targeting, due to which sectoral initiatives largely receive funding based on ad-hoc needs as opposed to being allocated money for resilience-building based on assessments identifying long-term strategic objectives. Budgeting processes are yet to be modified to incorporate DRR appraisal criteria against the broader DRM/DRR strategies.

7.2 Priority Issues

Among the first priorities for Thailand to address is the issue of water sustainability. Even without mentioning the impacts of climate change to the availability of safe water in the country, the current demands alone are enough to stress the current capacity to its limits. While the Water Resource Act came into effect in 2018, with the intention to respond to the challenges related to the sustainable use of water (Ministry of Foreign Affairs of Thailand, 2019), supported by the 20-year Master Plan on Water Resource Management (2018-2037), rolling out the aspirations as articulated in these documents into implementation will require a range of other legal instruments as well. Furthermore, enhancing multilevel water governance, establishing formal platforms to bring together user groups for joint planning, and developing precise (and contextual) information about the current risks regarding irrigation areas are required (Nikomborirak, 2016) to reduce the risks of droughts. In this context, it must also be noted that the agricultural sector requires significant investments towards mitigation and adaptation measures to reduce climate risks. However, this also requires market research, increased market access, and identifying of methods for increasing product value of alternative crops, which would then enhance the attractiveness of adaptation. If only faced with loss of productivity and income, farmers are less likely to partake in preparedness interventions due to higher value of currently farmed products.

There are also numerous vulnerable groups living in the country, who require support tailored to contextual needs, especially in areas characterized by high levels of poverty. Key Initiatives would ideally focus on diversifying household incomes, relieving indebtedness, and ensuring financial support for long-term recovery to avoid maladaptive practices such as land clearing, or expanding economic activities to hazardous areas. This calls for detailed assessments constructed from data covering different attributes and characteristics of population groups (from age to gender, disability or employment) to identify reasons behind their vulnerable disposition, and most importantly, to identify pathways to reduce vulnerabilities to specific hazards. Such efforts could provide a more informative and profound understanding of disproportionate risks arising among different segments of the population. This would also increase the capacity to conduct targeted DRR measures, as opposed to relying on the so-called 'one-size-fits-all' approach.

Communities and public should also be increasingly involved in risk reduction interventions. Shift from relying on structural measures alone is required, for example by focusing on farmer cooperatives to limit off-season rice growing (which contributing to water stress) or to improve the coordination of adaptation activities, including diversifying income crops. Facilitating meaningful participation at all levels and improving incentives to partake in risk reduction activities among communities is of paramount importance to increase the scope and efficacy of efforts that are often driven from the top-down to community levels in the country.

In this context, local governments are in important role in connecting the national development priorities to locally-led action and resilience building. Thus, continued efforts to build the capacities of the LGUs is necessary. Ensuring the strategic coherence and harmonized planning among those responsible over local level risk governance would strengthen flood and water management, for example, which has remained fragmented and centralized in Thailand (Nikomborirak, 2016). Also, local authorities still lack mechanisms for enforcing emergency response operations in a systematic manner. Thus, local incidence response plan and standard operating procedures (SOP) should be further strengthened and expanded with a focus on multi-hazard management (Kamolvej, 2014).

Finally, the DDPM must continue with its efforts to build the awareness of the public, educate governments and non-government counterparts, and maintain the momentum for mainstreaming DRR as an important cross-cutting development domain. Enhancing data availability and the capacity of information systems, as well as strengthening DRM in Thailand as a holistic discipline (in consideration of disasters as well as climate), should be first priorities in the near-term future (Kamolvej, 2014).

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