# Economic Outlook for Southeast Asia, China and India 2024

## DEVELOPING AMID DISASTER RISKS



2024

OECD DEVELOPMENT CENTRE

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**Please cite this publication as:**
OECD (2024), *Economic Outlook for Southeast Asia, China and India 2024: Developing amid Disaster Risks*, OECD Publishing, Paris, https://doi.org/10.1787/3bbe7dfe-en.

ISBN 978-92-64-82380-8 (print)
ISBN 978-92-64-42852-2 (PDF)
ISBN 978-92-64-61004-0 (HTML)
ISBN 978-92-64-71730-5 (epub)

Economic Outlook for Southeast Asia, China and India
ISSN 2310-1105 (print)
ISSN 2310-1113 (online)

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# Foreword

The *Economic Outlook for Southeast Asia, China and India* is a regular flagship publication on Asia's regional economic growth and development processes. It focuses on the economic conditions of the Association of Southeast Asian Nations (ASEAN) member countries (Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Viet Nam) and two other large economies in the region, the People's Republic of China (hereafter "China") and India. The *Outlook* was proposed at a 2008 informal reflection group on Southeast Asia following the 2007 Council Meeting at Ministerial Level (MCM) and approved by ministers and senior officials from ASEAN countries at the occasion of the 2nd OECD-Southeast Asia Regional Forum in Bangkok in 2009. The *Outlook* was launched as a series in 2010 and the first edition was released in November of that year.

The Outlook Consultation Group (OCG) was established in 2014, consisting of representatives from OECD Delegations and Emerging Asian countries. Since that time, two OCG meetings have been held for each edition of the *Outlook*. The most recent OCG meeting in March 2024 was the 22nd of such gatherings. The *Outlook* was integrated into the OECD's Southeast Asia Regional Programme (SEARP) at the Steering Group Meeting in Jakarta, Indonesia in March 2015 to offer a horizontal view of activities and provide a backbone for the different streams of the Programme as confirmed at the 2015 MCM. While previous *Outlooks* have typically been presented at the ASEAN or East Asia Summit, this edition was released at the OECD Ministerial Council Meeting in May 2024 during a session commemorating SEARP's tenth anniversary.

This edition of the *Outlook* comprises three chapters. Chapter 1 presents the macroeconomic challenges and risks the region faces. Chapter 2 explores how countries in the region should take holistic and interdisciplinary approaches to developing amid disaster risks. Finally, a series of country notes provides the state of the disaster risks and disaster risk management in each Emerging Asian country, with recommendations for overcoming the challenges.

The OECD Development Centre is committed to working alongside governments and other actors in the region to identify key issues and provide policy recommendations for addressing them. The Centre enjoys the full membership of five Emerging Asian countries: China, India, Indonesia, Thailand and Viet Nam and this project has also benefited from the generous support of other Emerging Asian countries. The OECD is committed to supporting Asian countries in their efforts to promote economic and social well-being through rigorous analysis, peer learning and the sharing of best practices.

# Acknowledgements

The *Economic Outlook for Southeast Asia, China and India 2024: Developing Amid Disaster Risks* was prepared by the Asia Desk of the OECD Development Centre. It benefited from constructive feedback received during the Outlook Consultation Group (OCG) meetings that took place in March 2023 and March 2024 in Paris, with OECD Delegations and representatives from Emerging Asian countries. This flagship report was also enriched by discussions with regional partners, including the Economic Research Institute for ASEAN and East Asia (ERIA), ASEAN Secretariat, the Asian Development Bank (ADB), the Asian Development Bank Institute (ADBI) and the ASEAN+3 Macroeconomic Research Office (AMRO), as well as the feedback from participants of the OECD Southeast Asia Regional Programme (SEARP) meetings. Preparatory missions to the region were conducted from April 2023 to January 2024.

The team was led by Kensuke Molnar-Tanaka, Head of the Asia Desk, and this edition of the report was prepared by a core team composed of Kensuke Molnar-Tanaka, Prasiwi Ibrahim, Grendell Magoncia, Alexander Hume, Robin Peer, Jihyung Nam, Serkan Imisiker, Ilan Noy, Eskander Shaikh and Sonja Marki. Rahmalia Devita provided useful inputs. Overall guidance was provided by Ragnheiður Elín Árnadóttir, Director of the OECD Development Centre. Federico Bonaglia and Setsuko Saya, Deputy Directors, provided useful advice and feedback. Many thanks go to the Communications Division of the OECD Development Centre, in particular Delphine Grandrieux, Elizabeth Nash, Aida Buendia and Henri-Bernard Solignac-Lecomte for turning the manuscript into a publication.

Useful feedback and support were received from OECD delegations, embassies of Asian countries in Paris and representatives from Emerging Asian countries, as well as participants in the Outlook Consultation Group (OCG) meetings, co-chaired by Mohamad Oemar, Ambassador of Indonesia to France and Junever M. Mahilum-West, Ambassador of the Philippines to France. Valuable comments and support received from Abdullah Maamor Ibrahim, Akira Kadomoto, Benedikt Madl, Cassey Lee, Catharine Tjing Yiing Kho, Chaikal Nuryakin, Chittrapon Lerttaweewit, Dianne Sarmago, Dimas Mohammad Halif, Debashis Chakraborty, Dk Nur Qamarina Pg Luba, Duangnapa Uttamangkapong, Heddy Agus Pritasa, Hyunjoo Kim, Jerome Jean Haegeli, Jiseok Byeon, John Zhu, Khin Nilar Soe, Kristine Margret Malang, Makiko Naemura, Megumi Muto, Misaki Kimura, Morakot Vongxay, Oktavi Andaresta, Pan Tso-Chien, Phuong Thuy Quan, Porametee Vimolsiri, Priscilla Ann Yap, Raditya Jati, Sakkapop Panyanukul, Sandri Ghifari, Shan Jee Chua, Shannen Nicole Chua, Shuvojit Banerjee, Sidharto R. Suryodipuro, Soveasna Sun, Steen Byskov, Thai Minh Huong, Thet Htar Nwe, Thi Thanh Mai Lai, Veronica Rompis, Xin Hui Woon and Yongdae Lee are gratefully acknowledged. Catherine Gamper and Simon Touboul, from the OECD Environment Directorate, provided useful comments, and Alexander Böhmer from the OECD Global Relations and Co-operation Directorate provided valuable support to this project.

The *Outlook* also benefited from discussion with experts in the region at the 11th Asian Regional Roundtable on Macroeconomic and Structural Policies, jointly organised with AMRO, ADB, ADBI, ERIA on 27-28 July 2023.

Last but not least, the OECD Development Centre would like to express deep appreciation for the financial support received from the governments of Japan and Korea.

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# Executive summary

## Growth in Emerging Asia remains resilient but faces challenges

Emerging Asian economies – comprising the ten ASEAN countries along with China and India – are showing resilience. Economic growth in the region will be driven by robust domestic and regional demand and continued recovery of the services sector, particularly tourism. The improvement of financial conditions is expected to continue this year. However, the region will face several challenges, such as external headwinds; the impact of extreme weather; and elevated levels of debt, particularly mounting private debt.

## Emerging Asia needs a holistic approach to disaster resilience

Emerging Asia is one of the most disaster-prone regions of the world. Beyond their potentially devastating immediate effects, disasters hinder the achievement of sustainable development. Achieving disaster-resilient development requires the strategic introduction of a holistic policy approach. Better co-ordination is essential for this approach to be effective. This includes governance and institutional capacity, budgeting, risk financing, infrastructure and land use planning, training and education, health, adoption of cutting-edge technology, and partnerships with the private sector.

Weak disaster risk reduction strategies persist in many Emerging Asian countries. Strengthening *institutional capacity* is critical. Developing robust risk assessment, providing capacity building in all phases of disaster management, as well as reviewing and updating laws and regulations are required to enhance disaster management.

Lack of *funding* is another roadblock to disaster resilience in the region. Steps that governments can take to strengthen their budgets for disaster risk management include ensuring quick access to sufficient disaster budgets and increasing the availability of funds for ex-ante measures.

Broadening *disaster risk financing options* is also important. Effective disaster risk financing requires formulating a grand design that covers the entirety of the economy. Facilitating access to disaster insurance and risk transfer instruments and ensuring their widespread delivery to populations at risk is crucial.

The *resilience of infrastructure* is key to mitigating the impacts of disasters. Policy measures for developing disaster-resilient infrastructure include applying disaster risk assessments; ensuring appropriate and adequate financing; developing operation and maintenance approaches for all phases of the disaster cycle; conducting regular monitoring and evaluation; and fostering effective collaboration among stakeholders. Integrating nature-based solutions into disaster-resilient infrastructure development represents another crucial step in protecting society from natural hazards and ensuring a sustainable future.

Comprehensive *land-use planning* is essential for identifying the needs of communities in disaster-prone areas. Such plans can help to direct development away from vulnerable land, lay the foundations for space acquisition and nature conservation campaigns, and encourage the utilisation of natural topography for disaster mitigation.

Policy makers should encourage the adoption of state-of-the-art *technologies and innovations* in disaster risk reduction and management. At present, technologies such as the Internet of Things, drones, search-and-rescue robots, big data, artificial intelligence and blockchain technology are not yet fully in use in the region. To successfully adopt such technologies, governments can support investment in research and development, improve access to foreign markets and enact policies that strengthen their country's capacity to deploy and provide access to them.

Governments should also set overarching, clear and mandatory policies of *disaster risk reduction education* at the national level while allowing implementation to be adapted to local contexts. Learning materials should be updated regularly and active learning methods should complement classroom teaching. Disaster risk reduction education should be accompanied by monitoring and evaluation, regular training sessions for teachers, and public awareness programmes.

The health impacts of disasters are often enormous. Policy measures for ensuring efficient *health responses* include developing robust plans for health system co-ordination in response to disasters, taking steps to preserve the health of the general population when disasters strike, ensuring the flexibility necessary to redistribute medical equipment and supplies during a disaster and scaling up mental health services.

Exposure to disasters presents the *private sector* with a range of challenges. Governments can enact policy measures aimed at enhancing the capacity of the private sector to manage and recover from disasters. Such measures include evaluating the susceptibility of all sectors to disasters, boosting disaster risk governance, facilitating access to designated disaster mitigation and response budgets, ensuring sustainable financing by mobilising public-private partnerships when investing in disaster resilience and encouraging the growth of private catastrophe risk insurance markets.

# Overview

## Growth in Emerging Asia remains resilient but faces challenges and risks

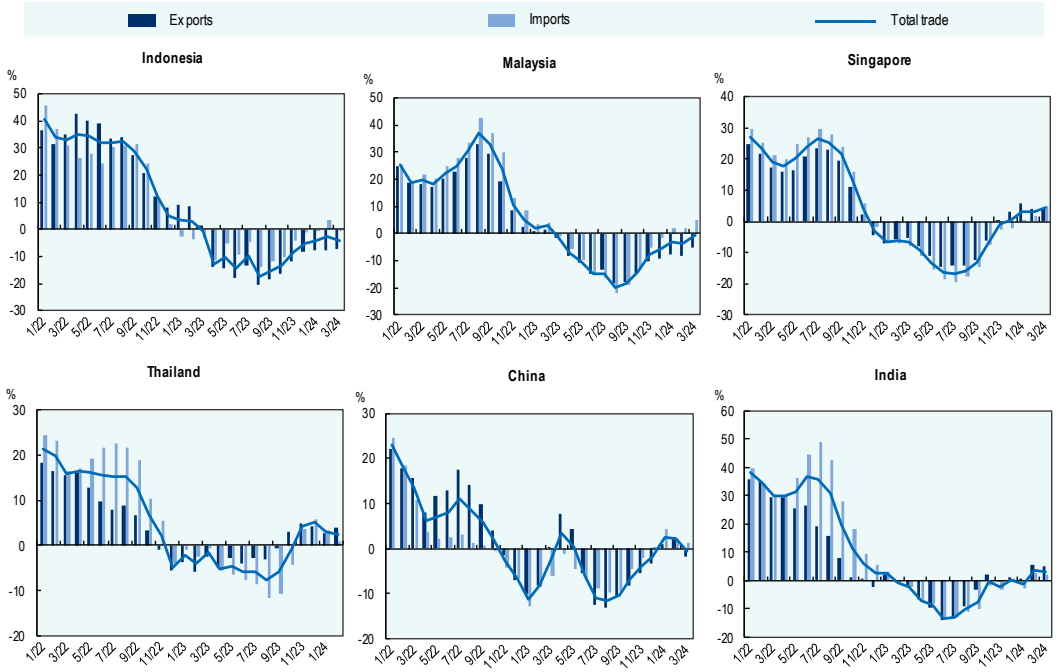
Emerging Asian economies are showing resilience.[1] Economic growth in the region will be driven by robust domestic and regional demand and continued recovery of the services sector, particularly tourism. The improvement of financial conditions is expected to continue this year. However, the region will face several challenges, such as external headwinds; the impact of extreme weather; and elevated levels of debt, particularly mounting private debt.

### *Merchandise trade in Emerging Asia show signs of recovery*

Recent merchandise trade data in the initial months of 2024, however, are showing signs of recovery in most economies of the region (Figure 1).

### Figure 1. Total merchandise trade in selected Emerging Asian economies

January 2022 to March 2024, year-on-year percentage change




Note: Data as of 22 April 2024.
Source: Author's calculations using data from CEIC.

StatLink https://stat.link/g8d41y

The ASEAN and China's manufacturing sectors showed signs of improvement in the first quarter of 2024 with their Purchasing Managers' Indexes (PMIs). India's manufacturing sector remained resilient with PMI surging to a record high in March, continuing to expand with higher intake of new business.

### *Services trade will remain resilient to global challenges*

Weak performance in goods trade in the region will be somewhat offset by growth in services trade. The growing digitalisation of services and the complete relaxation of border restrictions post-pandemic have spurred recovery in the travel and tourism sectors. Their strong rebound is supported by the return of international air passenger traffic to pre-pandemic levels.

The tourism industry is expected to be another important growth driver for ASEAN exports over the medium term. International tourism flows are expected to show robust growth as per capita household incomes in large Asian consumer markets continue to increase rapidly, driving international travel to ASEAN tourism destinations. This will help ASEAN economies where tourism contributes a significant share of total GDP, including Thailand, Cambodia and the Philippines.

### *Foreign direct investment should pick up in the near term*

Investment patterns worldwide, and particularly foreign direct investment (FDI), weakened in 2023 on the back of tight global financial conditions, higher uncertainty amid intensified geopolitical tensions and the unwinding of pandemic-related fiscal support measures. Emerging Asia, an engine of FDI growth, experienced declines in 2023. For instance, FDI dropped by 16% for ASEAN and by 6% for China.

However, the attractiveness of the region for manufacturing investments remains robust, supported by growth in greenfield project announcements. Emerging Asia's trade links will be strengthened through a gradual increase of FDI, particularly in the semiconductor and automotive industries. High-tech products and the rapid advancement of artificial intelligence (AI) and digital services are expected to be major drivers of growth in regional trade in the long term and to attract a sizeable share of FDI.

### *Financial market conditions will continue to improve while remaining vulnerable to tight policy rates*

Financial market sentiment in the region fluctuated in 2023 amid global uncertainty and changing views about possible rate cuts by monetary policy makers in OECD economies. Currencies in the region continue to weaken amid uncertainty about the timing of interest rate reductions. In the second half of 2023, expectations that the US Federal Reserve would keep key interest rates elevated for an extended period led to further weakening of financial conditions in the region. Monetary authorities in the region resumed hiking key interest rates to keep inflation in check and safeguard financial stability. Policy rates remain tight to date, as policymakers continue to manage lingering inflationary pressures.

The financial market outlook will remain stable in 2024 in general. Local-currency bonds in major economies in the region are expected to improve in the later months of the year, as such rate cuts are likely to strengthen Asian currencies against the dollar, boosting Asian local-bond returns. However, persistently elevated inflation in the US coupled with possible spike in oil prices amidst increased tension in the Middle East could increase uncertainty in monetary policies and will have a longer period of high interest rates.

### *Extreme weather, including events brought about by El Niño, adds to concerns about growth*

Emerging Asia has faced several episodes of extreme weather recently. Of the 20 cyclones that have produced the fastest sustained wind speeds in the region since 2000, 19 have occurred since 2019 and the other occurred in 2018.

The onset of El Niño in Emerging Asia can lead to higher air temperatures and limited precipitation along with more frequent extreme weather events such as droughts, floods and storms. Climate change will exacerbate these events, increasing the likelihood of record-breaking surface air temperatures. These can have significant impacts on crop yields and livestock, water supply and labour productivity. Warmer weather conditions also decrease water resources for energy generation and create higher demand for energy. In addition, extreme weather events such as cyclones can have significant negative effects on tourism-related income.

The impact of extreme weather on growth is more pronounced for countries with a larger share of agricultural activity in GDP such as Myanmar, Lao PDR, Cambodia and India. The adverse impact of El Niño events can also exacerbate inflationary pressures on food products and other primary commodities, particularly those with prices that remain above 2021 levels. Rice and palm oil are among the commodities that will be most affected. Declines in production volumes in conjunction with soaring prices may threaten food security in the region.

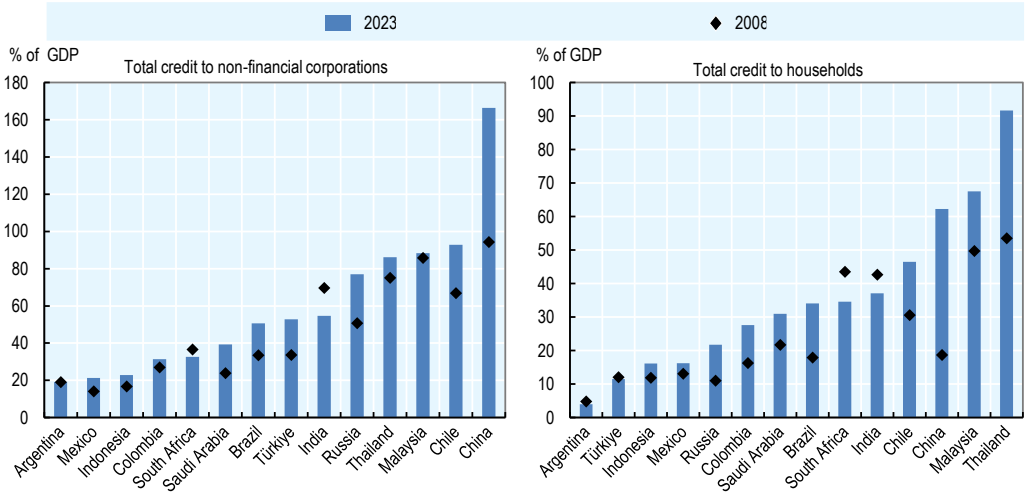
### *Mounting private debt poses a risk*

Concerns regarding debt management are increasing. Although, public debt has remained stable overall, many economies still face public debt levels larger in size than historical trends. More importantly, private debt (especially household debt) remains a risk to growth prospects in Emerging Asia.

Private debt in some Emerging Asian economies rose considerably during a prolonged period of accommodative monetary policy. The global financial landscape changed dramatically after supply-driven inflationary pressures persisted long enough to initiate a significant modification in the monetary stance of major central banks. The result was a synchronous rise in interest rates globally and tightening domestic financial conditions in the region. This increased debt payments and now threatens to cause financial distress among indebted households and corporates, especially in economies with larger private debt stocks. Total credit to non-financial corporations as a proportion of GDP averaged 22.9% in Indonesia, 54.6% in India, 86.2% in Thailand, 88.3% in Malaysia, and 166.4% in China over the first three quarters of 2023. Household debt as a proportion of GDP averaged 16.1% in Indonesia, 37.1% in India, 62.3% in China, 67.5% in Malaysia, and 91.7% in Thailand over the same span (Figure 2).

Excessive debt stock and increasing debt service costs can force households to prioritise debt repayment, with fewer resources available for consumption. Likewise, financially distressed corporations can choose to deleverage and spare limited funds for investment. These responses could weaken economic growth. In addition, the recent deflationary environment in China and Thailand complicates matters concerning private debt. Debt deflation could emerge from decelerating money supply growth, decreasing asset prices and damaged credit intermediation against the distressed selling of assets and debt repayment efforts.

## Figure 2. Private debt in selected emerging market economies



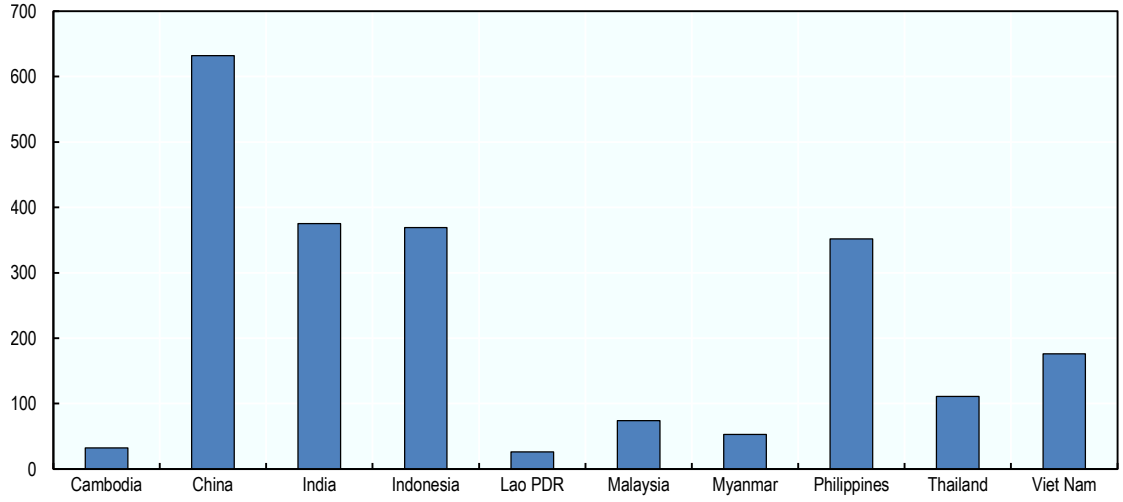

Note: The chart shows total credit to non-financial corporations and total credit to households during 2023 Q1-Q3 and 2008 Q1-Q3.
Source: BIS.

StatLink https://stat.link/4jqfa0

## Emerging Asia needs holistic approaches to disaster resilience

The countries of Emerging Asia are in the world's most disaster-prone region (Figure 3). They are affected by earthquakes, tsunamis, volcanic eruptions, floods, storms, landslides, droughts and forest fires.

## Figure 3. Total disaster occurrences in Emerging Asian countries, 2000-23




Note: The figure only includes disasters with available data. Disasters include drought, earthquake, extreme temperature, flood, glacial lake outburst flood, mass movement (dry, wet), storm, volcanic activity, and wildfire.
Source: Data from the EM-DAT database (CRED, 2024[1]).

StatLink https://stat.link/2c9m3p

Beyond their short-term effects, disasters hinder the achievement of long-term development and sustainability. Vulnerable groups and communities are particularly endangered by disasters, as economic and social structures are often compromised. Reducing disaster risk and increasing resilience are therefore crucial for development in the countries of Emerging Asia.

Achieving disaster-resilient development requires strategic development of a holistic policy approach that includes a combination of ex-ante and ex-post policies. Robust co-ordination underpins the success of such an approach.

The policy areas on which this publication builds its holistic approach are:

- improving governance and institutional capacity
- ensuring an adequate budget for disasters
- broadening disaster risk financing options
- investing in disaster-resilient infrastructure
- establishing comprehensive land-use planning
- developing disaster-related technology
- strengthening disaster risk reduction education
- improving health responses to disasters
- facilitating the role of the private sector.

### *Transforming governance and improving institutional capacity amid rising disaster risks*

Despite their commitments to build disaster resilience, many countries in Emerging Asia still have weak strategies for reducing disaster risk. They need to adapt their institutions and governance systems to cope with increasing disaster risks.

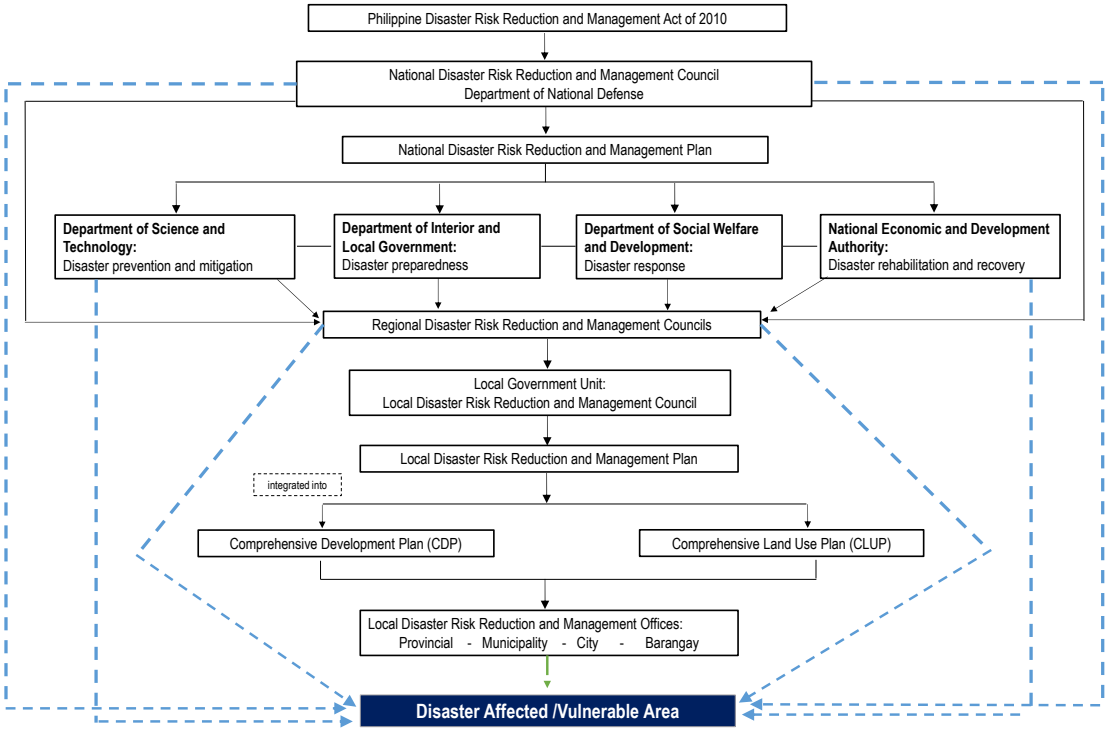
#### *Effective disaster risk management requires a proactive approach*

Disaster management and response require a holistic institutional perspective that accounts for cross-sectoral and multilinear levels of governance, and for the cascading impacts of disasters on the economy and society. Most national and local governments in Emerging Asia currently take a reactive approach to disasters. However, effective disaster risk management requires a proactive approach.

#### *Well co-ordinated systems can help local authorities and communities cope with disasters*

Systems where central and local authorities are well aligned could empower local authorities and communities to take an active role in disaster preparedness and response. Strengthening co-ordination, bringing cohesion to fragmented disaster response plans, increasing capacity and skills, and reducing disparities in resources among regions are critical objectives. Figure 4 lays out the system of disaster risk management co-ordination in the Philippines as an example of how a well co-ordinated system is backed by legislation, incorporates all levels of government, and delegates responsibilities among them and various agencies.

## Figure 4. The Philippines' Implementation Framework for Disaster Risk Reduction and Management




Source: Authors, based on national sources.

*Disaster resilience requires clarity on laws, regulations and responsibilities*

Most countries in Emerging Asia face legal challenges that impede the effectiveness of disaster preparedness, response and recovery. Governing institutions at all levels can face fragmented rules, with multiple laws, regulations and policies. A lack of clarity on roles, responsibilities, lines of command and co-ordination mechanisms contributes to challenges in the disaster response phase. Procedural standards and response guidelines remain weak, and administrative hurdles hinder the development of effective disaster risk management systems.

*Comprehensive monitoring and evaluation are key to managing disaster risk*

Well-developed monitoring and evaluation (M&E) systems are crucial to ensuring that disaster risk management efforts are effective, efficient and accountable. Efforts to develop M&E systems for disaster risk management in Emerging Asia have not been comprehensive and face several common issues, such as data deficiency, resource constraints, capacity gaps and weak political will. A robust M&E system across countries in Emerging Asia is essential in order put in place: i) the prioritisation of disaster risk management projects and activities; ii) a clear delineation of roles and responsibilities, with accountability for disaster risk management outcomes; and iii) appropriate, clear and identified funding sources for disaster risk management efforts.

### *Ensuring adequate budgets for coping with disasters in Emerging Asia*

Lack of funding is a significant roadblock to disaster preparedness and recovery in Emerging Asia. Budgets for both preparedness and response are, in general, below what is needed to put the region on track for

long-term readiness for disasters. In particular, increasing the availability of funds for ex-ante disaster risk reduction measures is critical. Governments can take various steps to bolster their budgets for disaster risk management. Local governments' disaster budgets may be tied to local fiscal income; in which case the adequacy of the resulting budget must be ensured.

### *Broadening disaster risk financing requires a grand design*

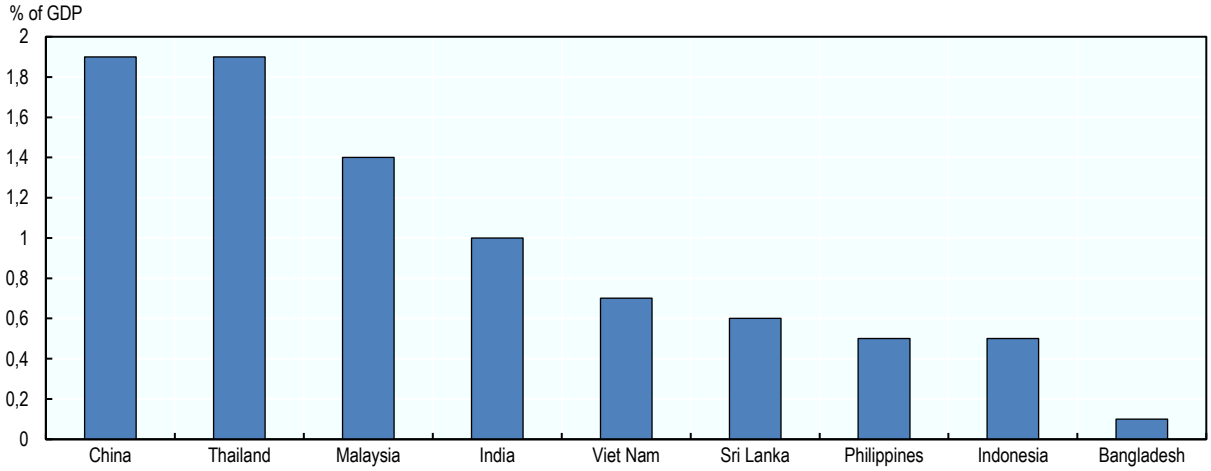
Effective disaster risk financing requires formulating a grand design that covers the entirety of the economy. Such a grand design has two main pillars: a risk-pooling function and a risk-transfer function. Pooling risk, typically in the form of insurance, improves resilience. Risk transfer typically takes place through market-based solutions such as insurance-linked securities or catastrophe (CAT) bonds. Coherent strategies for building financial resilience to disasters involve an approach that provides financing to all levels of government.

#### *Improving access to disaster insurance is crucial*

Disaster insurance is crucial for bridging the disaster financing gap in Emerging Asia. Developing the private insurance market in the region is proving challenging. Barriers hindering insurers from offering pure private disaster insurance solutions exist on both sides of the market. On the supply side, major obstacles can include insufficient capital and limited reinsurance capacity; the degree of freedom to manage the underwriting process; and data availability. Demand side barriers can include risk perception among consumers; price, availability and scale of public disaster relief; and claim-payment efficiency. These barriers work in concert to reduce insurance penetration rates in Asia (Figure 5).

**Figure 5. Insurance penetration in selected Asian countries, 2021**

Premiums as % of GDP




Source: Swiss Re (2022[21]), "World insurance: Inflation risks front and centre", https://www.swissre.com/institute/conferences/world-insurance-inflation-risks.html.

StatLink https://stat.link/dpv89a

To address insufficient market-based insurance and make risk transfer mechanisms more accessible and affordable, governments can take various measures. For instance, governments can encourage insurance uptake by subsidising premiums where necessary or offering support to private insurers to help them take on clients facing particularly high disaster risk. Governments can transfer some of their own risks to

markets using tools such as catastrophe bonds, though doing so requires developed financial markets and regulatory frameworks. At the same time, helping households and firms develop appropriate understandings of the financial risks associated with disasters and the benefits of disaster insurance is an essential component of disaster risk reduction education. Practical training on how to use this knowledge is also essential.

#### *Community-based approaches can be used in disaster risk financing*

Microfinance programmes offer an example of financial solutions based on community enforcement. Such programmes can provide insurance to those unable to access traditional markets. However, the flexibility offered by microfinance programmes may come at the cost of high interest rates. Thus, they must be properly structured to remain accessible amid post-disaster financial challenges. In addition to microfinance, agriculture insurance can help to protect farmers from the financial impacts of disasters.

#### *Catastrophe bonds offer an alternative means of disaster risk finance*

The adoption of market-based tools for transferring disaster risk is also important. Catastrophe (CAT) bonds provide an alternative to traditional sources as part of a country's disaster risk financing menu. CAT bonds securitise disaster risk and transfer it to capital markets. The CAT bond market has grown steadily since the 1990s, though growth has been heavily concentrated in the United States and Europe. In order to benefit maximally from CAT bonds, countries need to take some or all of the following actions: construct a grand design for disaster risk finance; invest in measurement infrastructure and enhance the quality of disaster data; use disaster data to develop tailor-made catastrophe risk models; enhance capacity building for finance and insurance officials; broaden investor bases; construct CAT bonds in a manner that minimises basis risk; prepare distribution schemes for the funds; and develop local-currency bond markets (OECD, 2024[3]).

### *Investing in disaster-resilient infrastructure*

A range of challenges must be addressed to scale up disaster-resistant infrastructure.

- The effective planning and implementation of resilient infrastructure projects is impeded by limited application of disaster risk assessments.
- Major capital investment and effective financing methods are needed for the construction of disaster-proof infrastructure, and maximising private-sector participation will be crucial as government revenues will not be enough to bridge the financing gap in the long term.
- Operation and maintenance approaches that can support disaster resilience before, during and after catastrophic events should be prioritised, with the collaboration of government, private investors and other stakeholders at both project and policy levels.
- Institutionalising the monitoring and evaluation of infrastructure projects is important to ensure regular risk assessment as climate and socioeconomic vulnerabilities arise.
- Effective collaboration among multiple stakeholders with a diverse range of skills and perspectives fortifies disaster-resilient infrastructure by enriching the decision-making process in project design and planning, and by ensuring comprehensive risk assessment and mitigation strategies.
- Preserving and developing infrastructure during and after disasters is necessary to ensure the resilience and recovery of the impacted region, including allocating public space to serve as protective barriers during a disaster and rebuilding transport infrastructure.
- Integration of nature-based solutions (NbS) into disaster-resilient infrastructure development is crucial. The balanced integration of nature-based solutions and grey infrastructure could offer a more effective and sustainable solution for comprehensive disaster risk management (Table 1).

## Table 1. Comparison between grey infrastructure and NbS in flood risk management

| Characteristics | NbS | Grey infrastructure |
|---|---|---|
| Time scale | Takes longer for the benefits to materialise | Benefits are immediate after construction |
| Spatial scale | Typically executed on a larger scale to be effective, encompassing multiple jurisdictions | Typically implemented within individual jurisdictions |
| Performance reliability | Uncertain performance due to complexity of natural systems | Performance is more predictable |
| Flexibility | Adaptable to changing environmental conditions as they are part of the natural landscape | More rigid and with limited adaptability as it typically provides a fixed solution for flood management |
| Sustainability | More sustainable as it involves the restoration of natural ecosystems | Can have negative impacts on the environment, e.g. increased erosion, altered hydrology and destruction of natural habitat, and requires significant maintenance and upgrades over time |
| Multifunctionality | Provides multiple benefits beyond flood risk reduction | Often has a more singular focus on reducing flood risk and rarely provides additional benefits |
| Quantification of benefits | Co-benefits are difficult to quantify, e.g. human health and livelihoods, food and energy security, biodiversity | Benefits are easy to quantify, e.g. prevention of damage to assets |
| Community engagement | Design, implementation, and maintenance involve local communities, hence promote community ownership and resilience | Designed and implemented by external engineers and experts, hence limited community engagement and lack of local ownership |

Source: (Molnar-Tanaka and Surminski, 2024[4]), "Nature-based solutions for flood management in Asia and the Pacific", *OECD Development Centre Working Papers* No. 351.

### *Addressing disaster-related migration and improving land-use planning*

Emerging Asian countries have experienced considerable migration and displacement because of disasters, with consequences that affect not just migrants and their families but also their nations of origin and destination. Making developmental investments for forcibly displaced individuals and host communities can alleviate the adverse consequences of displacement. Policies to facilitate disaster-induced migration where necessary and to otherwise reduce displacement include:

- establishing a framework that categorises displacement by mapping and monitoring potential environmental risk areas and adapting to changing regional conditions
- allocating more resources to disaster readiness to mitigate disaster impacts and the ensuing displacement
- refining and expanding the policy focus on social and community resilience and adaptation, especially concerning the social dynamics of resettlement
- ensuring community-focused interventions, particularly for displaced and economically vulnerable communities
- promoting the integration of environmental policies and responses in relief, recovery and development programmes
- incorporating climate-change adaptation strategies into disaster management policies
- encouraging community involvement in disaster management, as local communities have a superior understanding of their vulnerabilities and capacities.

Natural hazards also have a substantial impact on land-use planning in Emerging Asian countries. Comprehensive land-use planning is crucial for identifying the goals of communities in disaster-prone areas. Such plans can help to direct development away from vulnerable land, lay the foundations for space acquisition and nature conservation campaigns, and encourage the utilisation of natural topography for disaster mitigation. Recommendations on improving the efficiency of land use for disaster resilience encompass a range of topics.

- Alterations in land-use due to urbanisation have transformed agricultural land, forests and extensive coastal areas into built environments. In the face of evolving disaster risks, it is important to provide a proactive and sustainable approach to reduce vulnerability and enhance resilience through strategic planning, community engagement and the integration of ecosystem-based approaches.
- New land-use regulations can be imposed following a disaster to steer reconstruction efforts towards resilient, safe and sustainable development.
- Land-use management is a comprehensive approach that seeks to balance competing demands on land resources while promoting sustainability, resilience and the well-being of communities and ecosystems.
- Risk-sensitive land-use planning is a widely acknowledged non-structural risk mitigation measure with the potential to avoid exposure in the most hazardous zones and to reduce exposure and vulnerability over time in urbanised areas. Regulatory approaches could include the use of zoning to prevent or curb development or to minimise vulnerability.
- Restrictions on development can be implemented to prevent further settling of vulnerable areas.
- Property buy-outs and acquisition of open land may be considered as means of supporting owners of damaged properties, establishing and safeguarding buffer zones, and removing vulnerable land from the market.
- Relocation of infrastructure away from disaster-vulnerable areas can be the best way of preventing repeat damage. However, the restoration of infrastructure is often critical to post-disaster recovery, and the use of public assistance funding must be balanced between restoration and relocation projects.

### *Developing disaster-related technology*

Policy makers in Emerging Asia can explore a range of technologies for use in disaster risk reduction and management. They include resident-engaged disaster risk mapping, early warning systems (EWS), information and communications technology (ICT), disaster management platforms, physical infrastructure for alleviating the impact of disasters, unmanned aerial vehicles (UAVs) such as drones, and social media.

Recent advanced technologies with the potential to bolster disaster risk management capacity are not yet fully utilised in Emerging Asia. They include Internet of Things (IoT) technologies such as cloud computing, broadband wireless networks and devices with sensors; drones, which can reach otherwise inaccessible places and detect things beyond human capabilities; search-and-rescue robots; big data; artificial intelligence (AI); and blockchain technology.

For the successful adoption of new technologies related to disaster management, governments can provide support for research and development (R&D) investment in such technologies; embrace open- and fair-trade policies that improve access to foreign markets and increase competition, which encourages firms to invest more in R&D; and enact policies that strengthen the country's capacity to deploy and provide access to new technologies.

Key requirements for the successful adoption of new technologies include: i) resilient and state-of-the-art telecommunications infrastructure, including mobile internet coverage and smartphone penetration; ii) technical skills for the use of AI and spatial analysis tools; iii) access to data and software; iv) human capital formation and user education; and v) regulatory adaptation, with new regulatory frameworks to facilitate early acceptance of new tools.

### *Strengthening disaster risk reduction training and education*

Given the increasing frequency and intensity of natural hazards, disaster-prone countries are paying far more attention to the role of disaster risk reduction education (Table 2). Most of the region's countries have

integrated disaster risk reduction education into existing curricula or extracurricular activities, while other disaster preparedness and response programmes have been launched to improve public awareness at the societal level.

### Table 2. Disaster Risk Reduction Education Initiatives in selected Emerging Asian countries

| Country/Region | Initiation Year | Name of Initiative | Goals |
|---|---|---|---|
| India | 2004 | Disaster Management Curriculum in Class V, VIII, IX, X, XI | Integrating disaster management curriculum which includes basic concepts of the most commonly occurring disasters |
| Thailand | 2015 | Comprehensive School Safety (CSS) | Provision of teacher training to support teachers to design disaster risk reduction activities in schools |
| | 2023 | The Implementation of Disaster Education under National Disaster Prevention and Mitigation Plan 2021-2027 under MOU between Department of Disaster Prevention and Mitigation and Ministry of Education | Developing disaster curriculum and disaster preparedness activities in schools and other educational institutions; promoting disaster risk reduction activities in schools to create public awareness and enhance participation among students, teachers, administrators, and support staff |
| | 2023 | Implementation of disaster risk reduction education through the Thai Network for Disaster Resilience (TNDR) | Sharing best practices in terms of disaster risk reduction among experts and with others through 17 universities in Thailand |
| Indonesia | 2019 | Satuan Pendidikan Aman Bencana (SPAB) | Deliver instruction on prevention and management of the impact of disasters via educational institutions such as integration of disaster risk reduction education into K-13 curriculum |
| China | 2024 | Student Safety Education campaign | An educational campaign to strengthen risk preparedness and self-protection awareness among primary school and secondary school students, including fire safety, traffic safety and first-aid training |
| Philippines | 2013 | K-to-12 curriculum | Inclusion of Disaster Risk Reduction and Climate Change Education into school curriculum |
| ASEAN | 2015 | ASEAN Common Framework on School Safety | Ensuring safe learning facilities and reinforcing school disaster management capacities |

Source: Authors, based on national sources.

Countries in Emerging Asia face challenges in providing efficient disaster education for students, the public and other stakeholders. To meet these challenges, governments should set overarching, clear and mandatory policies for disaster risk reduction education at the national level that outline specific requirements for disaster preparedness in schools, including curriculum content, teacher training and emergency response protocols. Implementation should be adapted to local contexts to tailor disaster risk reduction education programmes to regional risks and needs; it is vital that remote villages and islands receive necessary support and resources given their increased vulnerability to disasters.

The central government and local authorities should ensure that learning materials are updated regularly, and the curriculum should be complemented by active learning methods including simulations, drills, role-playing, games and contests that enable students to apply the knowledge acquired from lecture-based education practically.

Another challenge is the lack of monitoring and evaluation of educational programmes. To measure progress in the implementation of disaster risk reduction education policies, the role of government involves: setting the goals of disaster risk reduction education initiatives; developing indicators for quantification; arranging tools for data analysis; involving a range of stakeholders in multidimensional evaluation; and providing measures for self-assessment.

Teachers should receive regular training with updated information to ensure accurate knowledge transfer, effective teaching strategies and enhanced emergency response skills. Policies are needed that encourage programmes such as community workshops, public awareness campaigns and seminars with experts.

Disaster prevention learning facilities offer interactive and realistic experiences where individuals learn practical skills, such as evacuation simulation or how to use fire extinguishers properly. Training in digital literacy is also an essential component of disaster risk reduction education, as vital information such as early warning messages and the locations of shelters and evacuation routes is now mainly disseminated via online platforms.

### *Improving health responses to disasters in Emerging Asia*

The health impacts of disasters are often enormous. The injuries suffered can be acute and may lead to lasting disability. Disasters can also spawn mental health issues originating from trauma and stress. All Emerging Asian countries have plans for directing health responses when a disaster strikes (Table 3).

**Table 3. Health responses to disasters in Emerging Asia**

| Country | Health responses | Mental health responses |
|---|---|---|
| **ASEAN-5** | | |
| Indonesia | Rencana Nasional Penanggulangan Bencana 2020-2024 addresses health service provision | Funds from national and subnational budgets contribute to Mental Health and Psychosocial Support (MHPSS) in disaster recovery |
| Malaysia | Crisis Preparedness and Response Centre (CPRC) and subnational CPRC within health departments responsible | National Guidelines for Mental Health and Psychosocial Response to Disaster |
| Philippines | Health Emergency Management Bureau clusters provide health services in disasters. National Emergency Medical Teams assist local government units as needed | The Health Emergency Management Bureau has a MHPSS cluster |
| Thailand | Local governments must budget for health services in disasters. Local governments respond but more severe disasters receive higher level responses | Health-related and social well-being rehabilitation includes MHPSS, Ministry of Public Health |
| Viet Nam | Ministry of Health (MOH) has a Commanding Committee for Natural Disaster Prevention and Control, Search and Rescue (CCNDPC/SAR); MOH and provincial departments participate in the disaster risk management system; Health Sector Action Plan | National Steering Committee for National Disaster Prevention and Control collaborates with a disaster risk reduction partnership composed of national and international organisations |
| **Brunei Darussalam and Singapore** | | |
| Brunei Darussalam | The Public Health Emergency Operation Plan co-ordinates efforts of the National Disaster Management Centre and Ministry of Health (MOH) and gives the MOH authority over health responses to disasters. | Brunei Darussalam Mental Health Action Plan 2021-2025 designates developing national disaster mental health management guidelines or incorporating mental health in National Emergency Preparedness Plan as a priority action |
| Singapore | Singapore Emergency Medical Team on call in hospitals always | Disaster Mental Health Programme for Communities in Asia organises forums and training sessions open to all of Asia |
| **CLM countries** | | |
| Cambodia | National Strategic Plan on Disaster Risk Management for Health 2020-2024 | MHPSS response is a priority strategy under the National Strategic Plan on Disaster Risk Management for Health 2020-24 but is absent from the Mental Health Strategic Plan 2023-32. |
| **China and India** | | |
| China | National Emergency Management System Plan developed during the 14th Five-Year Plan Period | MHPSS support in schools, training for rural health professionals, online lectures for public |
| India | Ministry of Health and Family Welfare collaborates with the Armed Forces | Mental Health and Psychosocial Support Services in Disasters (December 2023) |

Source: Authors, based on national sources, intergovernmental organisations and (Li et al., 2022[5]).

#### *Health responses to disasters require intricate co-ordination*

Health responses to disasters require efficient and robust plans for co-ordination among agencies and levels of government. While disaster management authorities are often central bodies, aspects of healthcare systems may be managed at local levels. Clear lines of communication must be established

between central and local government officials so that all parties can assess needs and capacity to assist. Roles of involved bodies should be clearly defined, with minimal overlap.

*The health of the general population must be preserved during disasters*

Disaster management organisations must not only contend with injuries or illnesses acquired during disasters but also work to preserve the health of the population. It is vital to ensure that those affected by disasters have access to clean water, along with hygiene equipment and supplies. Food and water security and health services must be preserved as well. Care must also continue for pregnant women, people with chronic medical conditions and those hospitalised prior to a disaster.

*Resource flexibility facilitates disaster response*

Flexibility is necessary to meet the need to redistribute medical equipment and supplies during a disaster. Maintaining accurate data on medical personnel, hospital and resource capacity at all levels of administration can help policy makers decide how best to allocate resources. Depending on the location and type of a disaster, local health-related physical and human capital might be insufficient. Health authorities should maintain a stockpile of critical equipment and supplies in a usable state.

*Mental health care in the aftermath of a disaster is crucial*

Disaster preparedness requires the training of medical personnel to deal with mental health issues such as trauma and stress. However, mental health services are scarce in Emerging Asia, with the proportion of psychologists and psychiatrists in the population in most countries far below the OECD average. Scarcity issues become even more concerning when the needs of different populations are considered. Mental health services should therefore be scaled up, including via digital services, with specialised services for vulnerable groups such as women, children and migrant workers.

### *Facilitating the role of the private sector*

The private sector in Emerging Asia faces significant challenges due to insufficient risk assessment, limited insurance coverage, weaknesses in supply-chain management, deficient co-ordination, and economic downturns and joblessness.

These challenges are spurring efforts from the private sector to improve disaster preparedness and management on its own. Adaptation measures by private firms across Emerging Asia include expanding and diversifying supply chains to decrease reliance on singular sources and locations susceptible to disasters; evaluating potential hazards and vulnerabilities; formulating contingency plans to handle risks effectively; formulating business continuity plans to guarantee the uninterrupted operation of critical business functions during and following a disaster; collaborating with other stakeholders, especially the government; and procuring insurance policies as a safeguard against losses arising from disasters.

Governments can enact policy measures aimed at enhancing the capacity of the private sector to manage and recover from disasters. Such measures include evaluating the susceptibility of all sectors to disasters, including the private sector; boosting disaster risk governance; mobilising public-private partnerships when investing in disaster resilience; and encouraging the growth of private catastrophe risk insurance markets.

## Country notes on disaster risks

### *ASEAN-5*

- **Indonesia** is exposed to hydrometeorological disasters such as floods, droughts, cyclones and heatwaves, and geophysical disasters such as earthquakes, tsunamis, volcanic eruptions and landslides. Improved co-ordination among levels of government, and between governments, will be a priority along with capacity building for local officials. Improvements to building codes would mitigate earthquake risk, and a simple increase in signage indicating vulnerable areas would mitigate landslide risk. Disaster risk financing should be streamlined beyond contingency funds.
- **Malaysia** is exposed to floods, droughts, landslides, fire-associated haze episodes and tsunamis. The country could improve a legislative framework to integrate disaster risk management with broader policy objectives. Policies should be developed to establish the duties of stakeholders to mitigate and respond to floods; to optimise coastal land use; and to discourage development in areas prone to landslides. Disaster risk management would benefit from the integration of disaster risk financing into budgets at all levels, as well as an expansion of human and financial capital at the local level. Public-private partnerships could assist in overcoming some of these barriers.
- The **Philippines** ranks as the country facing the highest disaster risk according to the WorldRiskIndex 2023. It is exposed to typhoons, floods, earthquakes, volcanic eruptions and droughts, with typhoons and floods being the most frequent and damaging disasters. The population is concentrated in vulnerable areas, with more than 90% exposed to floods, cyclones or earthquakes. Rapid urbanisation and climate change have exacerbated this problem in recent years. The government has increased its efforts to develop disaster risk management institutions and bolster resources. Mismatches between available funding for a given province and the disaster risk it faces can create financial constraints, and local-level institutions need increases in capacity. Land planning regulations should be enforced more stringently, and disaster risk education must be expanded, especially to those outside of formal schooling.
- **Thailand** faces floods, droughts, cyclones, landslides, earthquakes, tsunamis, wildfires and heat waves. Floods are particularly damaging. Heavy rainfall can also trigger landslides in mountainous areas. Agricultural areas are vulnerable to disasters due to lower levels of development, while urban areas are vulnerable due to population density. The National Disaster Prevention and Mitigation Response Plan provides a robust guide to disaster risk management, though measures remain largely ad hoc and focused on responses. Flood prevention and mitigation efforts were significantly expanded in the aftermath of floods in 2011, though there is still room for improvement in water management. Implementing methods of storing floodwater could reduce water shortages, while adjustments to forest conservation policy could discourage farming and other development in flood-prone areas. Moving to an approach underpinned by stronger risk assessments and risk transfer would help alleviate financial stress.
- **Viet Nam** is highly exposed to floods, cyclones and landslides, and faces lesser threats from droughts, earthquakes, tsunamis and heatwaves. Flooding threatens jobs in agriculture, aquaculture, tourism and manufacturing, while some areas of the country are at considerable risk of inundation due to sea level rise. Disaster risk management would benefit from stronger co-operation among agencies, levels of government and the private sector; and enhanced local-level disaster data. Disaster risk could be reduced by upgrading existing infrastructure, and by enhancing the capacity of urban planners to develop stronger building codes, safety standards and enforcement. The government faces disaster risk financing shortfalls. As urban and peri-urban areas are currently experiencing the most rapid increase in flood risk, more robust urban planning policies that account for flood risk should be enforced.

### *Brunei Darussalam and Singapore*

- **Brunei Darussalam** is perceived to be at minimal risk of disasters, yet the country faces floods, landslides, droughts, storms and wildfires, and there are large numbers of vulnerable people. Floods and landslides with significant effects occur annually. Small-scale individual flood mitigation measures and an enhanced capacity to forecast heavy rainfall could help reduce risks linked to floods. Early warning systems for disasters require significant modernisation, as they currently require significant manual operation and often fail to reach coastal fishing communities and ships offshore. Monitoring and forecasting systems for landslides and forest fires should also be improved.
- **Singapore** is exposed to floods, droughts, storms, heatwaves, earthquakes and tsunamis, but such occurrences are rare. Droughts have increased in recent years, but prudent water management has mitigated the effects. Flood risk could be mitigated via household- and firm-level measures such as the elevation of buildings or flood-proofing of properties. Policy makers could consider incentives for households and firms to take these actions. While disaster risk management is robust, there is room for improvement in data management, by building a comprehensive disaster risk database for example. The country would also benefit from enhancing food and water security management and fostering stronger public-private partnerships.

### *CLM countries*

- **Cambodia** is exposed to floods, landslides, droughts and tropical storms. As the plains along the Mekong River and surrounding the Tonlé Sap Lake cover almost three-quarters of the country, Cambodia is highly exposed to floods, which cause about 100 deaths and at least USD 100 million in agricultural losses annually. Irrigation management is currently the main method of flood control, but it is insufficient, and should be complemented by water-diversion schemes and reservoir construction. The country also faces droughts caused by El Niño, and large-scale droughts can threaten national food security.
- **Lao PDR** is exposed to floods, droughts, tropical cyclones, landslides and earthquakes, but as a landlocked country it is less exposed to disaster risk than other countries in Emerging Asia. Impacts of drought have been increasing, and severe El Niño conditions are expected to cause extreme drought in northern Lao PDR in the future. Given the large share of the population dependent on subsistence agriculture, food security can be severely threatened by floods and droughts. More robust drought risk assessments and more efficient early warning systems would enhance drought risk management, while flood risk management could be improved simply by encouraging farmers to adopt practices to mitigate flood effects, such as using flood-resistant crop storage and moving livestock to higher ground in the event of flooding. Improved data collection, analysis and management would greatly assist the formulation of policy at all levels of government. Major financing concerns include severe funding shortages that inhibit disaster risk reduction and relief. Lao PDR introduced a National Financial Protection Strategy Against Disaster Risk in August 2023 meant to address the dearth of disaster insurance coverage.
- **Myanmar**, one of the most disaster-prone countries in the world, is exposed frequently to floods, droughts and tropical cyclones, and occasionally to landslides, earthquakes, tsunamis and wildfires. Disasters have a large cumulative impact on development and cause major negative spillovers, including poverty traps, reduced labour-force participation and the financial exclusion of women. Climate change is expected to increase the frequency of floods, storms and droughts, which will exacerbate these problems. Disaster resilience could be enhanced through activities such as education in first aid, improving mobile phone infrastructure and using disaster-resilient public buildings as shelters. Severe funding gaps remain for both ex-ante and ex-post aspects of disaster risk management. Risk awareness remains low in the country; programmes to develop it

should be tailored for a variety of audiences, including risk management institutions, the private sector, and the general public.

### *China and India*

- **China** is exposed to all types of disasters and has been one of the most affected countries in recent years. Droughts occur somewhere in China most years, but affected regions vary. Many of China's largest cities are highly exposed to earthquake risk, with western China experiencing the most severe impact. The eastern seaboard faces most of the country's exposure to typhoons, while landslides are most common in mountainous and hilly areas. Rapid urbanisation of high-risk areas is increasing human and economic exposure. China's disaster risk management approach began shifting from reactive to proactive in 1998, but challenges remain in regulation, financing, international co-operation, data collection, risk assessment and emergency response, and low coverage of disaster insurance. The development of comprehensive legislation on disaster risk management could help streamline efforts to overcome challenges.
- **India** is exposed to floods, droughts, heatwaves, cyclones, landslides, tsunamis and wildfires. Floods are most frequent in the basins of the Ganges and Brahmaputra rivers, droughts are becoming more common in southern areas significant to agriculture, and coastal populations are most affected by cyclones. Current disaster risk management strategies remain focused mostly on response. Moreover, despite rapid urbanisation, urban disaster risk management receives little attention. Co-operation needs improvement, as gaps exist between national policy measures and local implementation. Flood management is particularly hampered by these issues. Financing challenges could be addressed via disaster risk layering, risk transfer and the fostering of public-private partnerships. CAT bonds for severe disasters, would reduce dependence on budget reallocation.

## Notes

[1] Emerging Asia includes the ten member countries of the Association of Southeast Asian Nations (ASEAN) – Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand and Viet Nam – plus China and India.

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# 1 Macroeconomic challenges and risks in Emerging Asia

Emerging Asian economies – the ASEAN member countries, China and India – are showing resilience. Economic growth in the region will be driven by robust domestic and regional demand and a continued recovery of the services sectors, particularly tourism. The acceleration of the digital and green economy could benefit services sectors and exports in the region. Overall, inflation continued to moderate thanks to prudent monetary policies. Extreme weather could threaten food and energy security and other economic activities in the region, and mounting private debt could increase the risks of excessive leverage.

## Introduction

Emerging Asian economies – the ten ASEAN countries, the People's Republic of China (hereafter "China") and India – are showing resilience. Emerging Asia has contributed strongly to global economic growth, and is expected to continue to account for more than half of total economic growth in 2024 (OECD, 2024[1]). Economic growth in the region will be driven by robust domestic and regional demand, and a continued recovery of the services sector, particularly tourism. The improvement of financial conditions is expected to continue this year. However, the region faces several challenges.

This chapter discusses the key macroeconomic challenges and risks: external headwinds; the impact of extreme weather; and elevated levels of debt, particularly mounting private debt.

### *Overview and main findings*

The main findings of the 2024 Outlook include the following:

- Overall, growth in Emerging Asian economies is showing resilience, supported by robust domestic and regional demand.
- Trade in Emerging Asia shows signs of recovery. Trade in intermediate goods will strengthen.
- The services sector continued to expand, becoming the largest contributor to growth. For major economies in the region, the development of high-technology-based services is becoming a driver of economic expansion.
- Foreign direct investment (FDI) should pick up. The region's attractiveness for manufacturing investments remains robust, supported by growth in greenfield project announcements.
- Financial markets in the region are stable in general, though monetary authorities need to monitor the market carefully. Inflation continued to moderate in the region in 2023 thanks to prudent monetary policies. However, sticky service price inflation could increase inflation pressures and trigger financial market volatility.
- Extreme weather could cause disasters that cost lives, reduce agricultural output, destabilise energy markets and increase inflationary pressures.
- Some Emerging Asian countries are experiencing elevated levels of debt, particularly private debt, stemming from rising interest rates and increased costs of energy and staple foods.

## Macroeconomic development in Emerging Asian countries

### *ASEAN-5*

#### *Indonesia*

Economic growth in Indonesia is driven by domestic demand, particularly private consumption which remained steady in the second half of 2023 while public consumption fell and investment grew modestly. The economy is expected to benefit from lower inflation and increases in economic activity that took place before the February elections and that are likely to occur during religious holidays and year-end holidays. Household consumption recorded 4.5% growth in the fourth quarter of 2023 and is expected to remain strong in the near term. This is supported by steady growth in the labour market across the service and industry sectors, a recent 3.6% increase in minimum wages and government food subsidies. Investments are expected to remain robust in the near term on the back of supportive domestic and foreign investment policies, infrastructure development and downstream development of hard commodities. In particular, foreign investment inflows are expected to remain strong in 2024, owing to several major investment

policies aimed at industrial expansion, notably in the processing of nickel and other minerals for electric batteries. In addition, the government is expanding its new investment list of priority sectors that are open to foreign direct investment, including high-technology services and manufacturing industries. Overall investment growth slightly moderated in the fourth quarter of 2023, posting year-on-year growth of 5.0%, from 5.8% in the previous quarter. Rapid expansion continued in services exports, which peaked at USD 9.2 billion in the third quarter of 2023. This served as a strong counterbalance to a contraction of goods exports. Growth in goods exports remains weak, at 0.4% in constant prices in the final quarter of 2023. However, the Purchasing Managers' Index (PMI) for manufacturing shows signs of steady improvement. This should support further progress in economic activity, including higher overseas work intakes, better demand conditions and positive business sentiment. Bank Indonesia is expected to bring down key interest rates in the second half of 2024 as inflation continues to decline and the rupiah steadily appreciates.

### *Malaysia*

The country's economic growth is driven by the steady expansion of investments, underpinned by a resilient labour market. However, private consumption experienced a strong decline, on a quarter-on-quarter basis. Weak external demand from major trading partners impacted the country's export industry for goods and services in 2023, with exports contracting by 7.9% in 2023, though the data for the first quarter of 2024 show robust GDP growth signalling the country may be regaining their growth momentum. On the supply side, major sectors registered an expansion in the first quarter of 2024, with construction recording the strongest growth at 9.8% from 3.5% in the last quarter of 2023, and manufacturing growth rebounding to 1.9% from -0.3% in the previous quarter. Services remain the largest contributor to economic growth, recording 4.4% expansion. Overall, growth in industrial production improved in early 2024 compared to 2023. However, manufacturing export growth in March shows a mild recovery though still weak but may signal that the worst of the slowdown seen in 2023 has passed and sets the manufacturing sector on course for gradual recovery in 2024. Headline inflation showed an uptick in February driven by non-food items such as housing, water, electricity, gas; recreation, sport, and culture; and transport.

Economic growth this year will be driven by the steady expansion of domestic demand underpinned by benign inflation and interest rates, and by the robust growth of the services sector. A potential turnaround in global trade, amid strong expectations of the United States should drive improved external demand, particularly in the electrical and electronics subsector. However, risks remain, particularly increased geopolitical tensions which could continue to disrupt supply chains and trade patterns.

Overall, headline inflation is expected to average between 2% and 3.5% in 2024. Upside risks will come from price increases on food and energy items with the extent of these risks hinging on potential second-round effects to which authorities should remain vigilant. Monetary policy will remain neutral as inflation starts to stabilise to long-term average. However, policy stance should remain vigilant to potential inflation pressures stemming from the planned withdrawal of energy subsidies and the continued depreciation of the ringgit. Malaysia's fiscal deficit will be improved in 2024, reflecting the government's modest pace of fiscal consolidation through a combination of spending cuts, new tax measures and reduced debt payments. Selective subsidy spending is planned, such as the continuation of electricity rebates for the poor in tandem with the phasing out of diesel subsidies. These policies, along with other fuel and food subsidy cuts, may cause some inflationary pressure. Government debt will remain elevated at 64% of GDP in 2024, up from 62% in 2023 (Ministry of Finance of Malaysia, 2023[2]). A significant drop in the value of the Malaysian ringgit in 2023 was driven by external pressure from the country's wide interest-rate gap with the United States, Chinese economic growth and a decline in local demand for the ringgit. Expected lower interest rates in OECD economies in 2024, as well as Malaysia's robust current account surplus, should contribute to the ringgit's recovery. The current account will continue to be supported by the anticipated recovery of exports in the electrical and electronic sector and by commodity prices remaining

elevated, driving the appreciation of the ringgit. However, the elevated commodity prices have exacerbated financial stress on poor households.

### *Philippines*

The economy of the Philippines bounced back in the second half of 2023, recording robust real GDP growth of 5.5% in the fourth quarter of 2023. On the demand side, better economic performance than expected was driven by resilience in domestic demand, particularly private consumption, and a strong rebound of investments. Household consumption grew by 5.3% year-on-year in the fourth quarter of 2023, while investments grew by 10.2% year-on-year. Government spending dropped to -1.0% year-on-year from a high of 6.7% in the third quarter of 2023, mainly due to the fiscal consolidation programme. Economic expansion from the supply side has been driven by the services sector, which remains the largest contributor to GDP growth, continuing its strong trajectory with 7.4% growth year-on-year in the fourth quarter of 2023. Real GDP growth was expected to bottom out in 2023, largely due to weak external demand affecting exports during the first half of the year. Nonetheless, it was expected to nearly reach the low end of the government's target of 6.0-7.0% amid easing inflation, a tight labour market and high consumer spending, particularly during the holiday season in December. In 2024, the country will continue its rapid economic recovery, driven by a robust household consumption, a healthy rebound of government consumption and an improved global growth outlook. Other key drivers supporting economic growth momentum in the near term include sustained remittance inflows, fast-growing exports in the information technology-business process outsourcing (IT-BPO) sector and steady expansion of the tourism sector.

The share of the services sector in GDP has exceeded that of the industry sector in the Philippines since the mid-1980s, growing to 55% in 2010 and 65% in 2023. The sector's share in total employment has also expanded steadily from 53% in 2012 to 60% in 2023. As of January 2024, the services sector employed 27.6 million people, far more than the 18 million employed in the agriculture and industry sectors combined. Export-oriented services were particularly significant, with a total services export share steadily expanding to reach 43% in the first quarter of 2024. However, services sectors generally offer lower productivity jobs, which come with low real wages for the majority of the workforce.

### *Thailand*

Economic growth in Thailand is mainly driven by robust growth in private consumption supported by an expanding services sector, a tight labour market and improving wage growth prospects. Total investment has stagnated, with year-on-year growth estimated at 1.2% 2023, down from 2.3% in 2022. Growth in exports of goods and services also continues to slow, registering 2.1% growth in 2023, down from 6.1% in the previous year amid the global economic slowdown and structural changes. On the supply side, the industry sector, particularly the manufacturing sector, is registering lower levels of production and declining business confidence. Inflationary pressure from higher raw material costs is pushing input costs up, signalling another worrying trend for manufacturers.

Thailand's services sector remains a bright spot in the economy, expanding by 4.3% in 2023. With manufacturing sector's share of the Thai economy shrinking, the services sector now holds the dominant share at 65%. The services sector is driven by a rapidly expanding tourism sector, which is helping keep unemployment at its lowest level since 2019 (0.8%). Total international tourism arrivals reached 28 million in 2023, a 154% increase from 2022. A recent mutual visa waiver agreement between Thailand and China, along with visa exemptions for tourists from India and Chinese Taipei, are expected to contribute to the sector's steady recovery in the near term. Authorities are targeting up to 35 million foreign tourists in 2024, edging closer to the pre-pandemic record of 40 million. This, along with the anticipated rebound of the goods exports and rising consumer confidence, will drive economic growth in 2024.

As of March 2024, headline inflation continued to register negative year-on-year growth for the sixth consecutive month, underpinned by government subsidies on diesel and electricity. Nevertheless,

inflationary pressures will continue and likely be driven by demand pull factors as private consumption continues to grow steadily and higher oil prices persist amid growing tensions in the Middle East. The Bank of Thailand's decision to keep the benchmark interest rate at 2.5% following eight rate hikes since August 2022 and a cumulative rate increase of 200 basis points, has resulted in relatively high real rates. However, the case for possible monetary easing should be carefully weighed against inflationary risks from expansionary fiscal policy, higher freight costs related to geopolitical tensions, and currency developments. The proposed handout scheme could stimulate the economy, while high household debt represents a downside risk to growth.

#### *Viet Nam*

The economy is showing steady signs of recovery with goods exports growing steadily in the first quarter of 2024 underpinned by robust increases in the shipment of electronics, smartphones, and garments. Growth in household consumption slowed to 3.2% in 2023 from 7.7% in 2022, while growth in investments moderated to 4.6% in 2023 from 5.6% in 2022, amid a slowdown in economic recovery and weak demand for credit. On the supply side, the services sector is the main driver of growth, at 6.1% year-on-year, supported by robust retail sales of goods and consumer services as well as transport. Tourism activities are maintaining high growth momentum, contributing to the robust growth of the services sector. Viet Nam saw a total of 4.6 million international visitor arrivals in the first quarter of 2024, an increase of 72% from the same period in the previous year. However, the industry sector faced challenges, particularly the manufacturing industry, which relies heavily on international trade for its expansion. The subsector's growth weakened in 2023, with growth of 3.6% compared to 8.2% in 2022, contributing to the overall slowdown of the economy with its 23% share of GDP. Viet Nam's economy is expected to recover in 2024 with the anticipated improvement of external trade coupled with a proactive monetary policy that should keep inflation within the range of 4.0-4.5%. However, a longer period of high interest rates in OECD economies could rekindle inflationary pressures. To close the gap from the fall in exports, the government has taken proactive policies such as extending a cut in the valued-added tax to boost domestic consumption, enhancing tax management on digital and e-commerce transactions, removing barriers for enterprises and expediting public investment, mostly on infrastructure. While the March 2024 PMI continued to show subdued demand, firms remain optimistic regarding 2024. For instance, data from the semiconductor industry is pointing to improvements in sales, which will benefit Viet Nam's exporters in the tech sector. An expansionary fiscal stance and accommodative monetary stance will be maintained to boost economic growth. The government is also providing support to households and firms through tax cuts.

Viet Nam's economy grew 5.7% in the first quarter of 2024 amid a steady expansion in exports. While marginally slower than the growth rate from the fourth quarter of 2023, which was recorded at 6.7%, the government is targeting 6.0-6.5% GDP growth for 2024.

### ***Brunei Darussalam and Singapore***

#### *Brunei Darussalam*

Growth was primarily supported by an expansion in private consumption and public investments amid declines in government spending, private investment and exports. On the production side, growth was attributed to the expansion in the non-oil and gas sector which increased by 4.5%, mainly driven by the continued expansion in air transport, finance, and the non-oil and gas manufacturing sector which covers the expansion of downstream activities, including production of petroleum and chemical products and other non-oil and gas activities. The oil and gas sector, which represents 52% of GDP, picked up in the fourth quarter of 2023, recording a growth of 11.1% year-on-year due to the increase in the activities of oil and gas mining and manufacturing of LNG. The services sector grew by 5.9% in the same period, largely supported by increases in air transport, finance, communication, and other transport services. Growth in the finance

subsector corresponded with developments in banking and insurance. The economy will continue to recover in the near term, mostly driven by higher exports from the recovery of oil and gas production and the continued expansion in downstream petrochemical and fertiliser production, which will help to render the economy less reliant on oil and gas output. Construction investment spending will also drive economic growth as work continues on the redevelopment of the port at Muara and the Phase II expansion of the Pulau Muara Besar petrochemical complex. The banking sector remains healthy with declining non-performing loans, though strengthening financial surveillance and risk monitoring remains key. Recent inflation estimates show a decline of -0.52% in February 2024, reflecting a fall in clothing and footwear; housing, water, electricity; transport and communications. The government's extensive subsidy policies and price controls will continue to tame inflation, which should help support private spending and the services sector. Risks to growth will largely come from a less favourable external environment. A weak growth momentum of major trading partners and a sharp decline in global energy prices could limit growth recovery.

#### *Singapore*

Economic activities show a faster pace of growth in the first quarter of 2024 than in the previous quarter. The services sector, which comprised the largest share of the economy at 65%, recorded continued a broad-based expansion of 3.2% primarily led by ICT, finance and insurance, and professional services and followed by wholesale and retail trade and transportation and storage sectors. However, the manufacturing sector expanded by 0.8% in the first quarter of 2024, a slowdown in growth from the previous quarter. The construction sector expanded by 4.3% underpinned by an increase in public sector construction. Core inflation remains sticky in the first three months of 2024, driven by a step-up in the GST rate, a carbon tax hike, and increases in essential services fees.

The 2024 economic outlook for Singapore is upbeat amid signs of recovery in exports and manufacturing, particularly an expected turnaround of demand for global electronics and the stabilisation of policy rates in advanced economies. Expansion in domestic demand underpinned by steady increase in investment, private consumption and government spending will also support near-term economic growth. Consumer-facing sectors such as travel and tourism, retail trade and food & beverage services will likely rebound with the expected return of tourists from China, which was Singapore's largest pre-pandemic source of visitors, at nearly 20% of visitors in 2019. Policy rates were maintained in the first monetary policy decision of 2024 as the Monetary Authority of Singapore (MAS) continued to monitor risks to inflation and growth. The MAS estimates that headline and core inflation will average 2.5-3.5% in 2024, due in part to the one-off impact of a hike in the goods and services tax (GST) by one percentage point from January 2024 onwards. Inflationary pressures remain such as hikes in global food and energy prices and a boost in household consumption amid a strong labour market. The construction sector will remain robust, driven by public housing and infrastructure projects, while private sector construction will also expand via residential and commercial developments. Direct investment liabilities, which are closely related to inward FDI, improved in the fourth quarter of 2023, recording 10.9% growth year-on-year compared to 7.6% in the third quarter of 2023. The government is contemplating recalibrations to align with the OECD global tax framework, a move that could reshape the incentives offered to multinational enterprises operating within Singapore. Potential challenges to the growth outlook include uncertainty over the monetary policy stance. This uncertainty continues to limit businesses as it impacts borrowing costs and investment decisions. Global uncertainty could potentially disrupt raw material supplies, and this could lead to cascading effects across various industries, impacting production, pricing and supply chains.

### *CLM countries*

#### *Cambodia*

Cambodia is on track towards gradual recovery, fuelled by a rebound in tourism, robust performance in non-garment exports and a recovery of the garments and footwear sector. The electronics industry

cushioned a large decline in garment and footwear manufacturing amid weak external demand in 2023. Annual exports of electrical parts grew by 71% year-on-year, while corresponding imports registered a substantial uptick amounting to USD 1.5 billion. The surge in import demand for technology, machinery and electrical equipment demonstrates the economy's pivotal shift towards higher production capacity. However, while total trade improved, the main export earner – the garments, footwear, and travel goods (GFT) sector – struggled in 2023 amid weak demand from US and European markets. Recent trade data in first two months of 2024, however, are showing a rebound in the garment and footwear industry while electrical parts registered a substantial decline.

Growth in the services sector is expected to increase in 2024, mainly due to tourism picking up since travel restrictions have been completely lifted and visitor arrivals from China and other Asian countries have increased, though tourist arrivals will remain below pre-pandemic levels. Cambodia will also see positive effects from its free trade agreements with neighbouring countries, as well as the Regional Comprehensive Economic Partnership (RCEP), which will promote inward investment by reducing regulatory uncertainty and harmonising standards. The industrial sector may post robust growth in 2024 thanks to strong demand for non-GFT goods as well as a recovery in certain pockets of the manufacturing sector, particularly electronics. On the demand side, drivers of growth will include continued infrastructure investment and a rebound in domestic consumption and investment, supported by strengthening tourism, transport and related retail segments. However, the continued tight monetary policy of the US Federal Reserve will constrain investments. Growth in 2024 will be hampered by external risks such as the moderate pace of economic growth in OECD economies. Cambodia also exhibits high levels of debt, and a rise in non-performing loans (NPL) poses major risks for the banking sector and the broader economy. Cambodia's proportion of non-performing loans in the banking and micro-finance sectors stood at 5.4% and 6.7% 2023, respectively, while private credit reached 160% of GDP as of August 2023. The latest El Niño episode will have a moderately negative effect on the agricultural sector. Household consumption will be dampened by elevated prices for energy, food, and other commodities. The country's inflation rate is forecast to continue to moderate in 2024 if the price of oil on the international market returns to normal. Meanwhile, fiscal policy will remain focused on combatting the effects of inflation.

### *Lao PDR*

Lao PDR's economy remains in recovery mode, supported by improved performance in tourism, transport and logistics services, as well as foreign investment. Growth is lower than expected amid a sharp depreciation of the Lao kip, high inflation, labour shortages and unfavourable weather. The depreciation of the kip and rising food and fuel prices saw headline inflation surge to more than 40% in the early months of 2023 and it has remained high at 25% as of the first quarter of 2024. The elevated level of inflation will weigh on private consumption. Furthermore, the kip continues to depreciate against the US dollar, hitting a new low in March 2024. Rising production costs and the effects of drought on hydroelectricity generation also impacted economic activity. Exports growth contracted year-on-year in the second and third quarters of 2023 but rebounded in the fourth quarter of 2023, posting growth of 8.0%. Exports in agricultural products earned more than USD 1.4 billion, exceeding the target for the year.

Real GDP growth is expected to improve moderately in the near term, led by steady expansion of the services sector and exports. The opening of the Laos-China Railway is expected to boost trade with China, particularly agricultural, metal and mineral exports. The industry sector will also benefit from investment in the power sector through multiyear electricity contracts with Thailand and other neighbouring countries. Downside risks include elevated external debt, estimated at 68% of GDP in 2022, and a continued decline of the value of the kip, which is likely to remain under pressure amid high imports and large debt repayments coming due. Demand for Lao exports may also decline due to moderate global and regional growth. The services sector will improve amid expected increase in external demand from tourism and logistics. Public expenditure remains well below pre-pandemic levels, especially in areas such as health and education, with fiscal austerity measures being used to rein in Lao PDR's sovereign debt stock.

Changes in weather conditions, such as the those caused by the lingering effects of El Niño, may still lead to a decline in agricultural output and reduce water levels in the Mekong River while of La Niña is expected to arrive later in the year and exacerbate the risk of flooding.

#### *Myanmar*

Myanmar's economic growth was primarily led by the agriculture, industry and services sectors. However, economic growth is expected to remain weak in the near term amid heightened conflict, which risks damaging the country's macroeconomic fundamentals. Domestic demand is expected to deteriorate, while supply chain disruptions, labour shortages and increased logistics costs will worsen trade activity and agricultural production. The Myanmar kyat depreciated by approximately 18% against the US dollar in the third quarter of 2023 and will continue to face downward pressure amid a persistent trade deficit and a bleak foreign investment outlook. Inflation will remain high given the depreciating currency and disruptions in supply chains and farming. Power outages, which persisted throughout 2023, will worsen amid disruptions to power transmission and generation infrastructure. Outages have lasted for extended periods, particularly in industrial zones, impacting businesses and further dampening growth prospects. Spending cuts will target social services such as education and healthcare, as well as economic planning and reforms.

### *China and India*

#### *China*

Economic activity on the demand side was largely driven by steady private consumption, though its growth was limited by low consumer confidence and the decline in asset prices. High precautionary savings after the pandemic are weighing on private consumption. Overall fixed-asset investment grew at 3% in 2023 reflecting the continuing adjustment in the real estate sector, but with infrastructure and manufacturing growing at a moderate but steady pace. Export and import growth picked up in the first quarter of 2024, both growing at about 5% following a weak 2023 amid subdued global demand. The manufacturing sector is showing signs of recovery, with PMI data of 51.1 in March 2024, signalling sustained increases in both output and new orders.

Growth momentum in China will ease somewhat this year but will likely reach close to the target of around 5%. Adjustment in the property sector will continue but pick up of infrastructure and manufacturing investment will more than make up for falling investment in real estate. Commitment to reach net zero emissions will keep investment in renewable energy infrastructure robust and so will suburban railway demand. Consumption will remain steady, but unlikely to pick up in the absence of social security reforms that would reduce precautionary savings. Exports will also pick up as global demand gradually recovers. Moreover, steady or falling prices will make Chinese products more competitive. Monetary and fiscal policy will hold up economic growth in 2024. Monetary policy will remain expansionary, with falling effective interest rates and fiscal policy will become looser. The People's Bank of China has taken steps to support the economy while managing economic risks and deflationary pressures. In February 2024, it cut the reserve ratio requirements for banks by 50 basis points, which will provide USD 139 billion in liquidity support. The interest rate on one-year policy loans was held steady at 2.5%, which helps reducing the debt burden. On the fiscal front, additional spending of 0.8% of GDP financed by ultra-long-term government bonds will be directed to priority projects. Furthermore, special local government bonds worth 0.4% of GDP have been carried over from last year. Excessive indebtedness of some local government investment vehicles that are key deliverers of urban infrastructure remain a key risk, even though plans to resolve their debt have been adopted.

Consumer prices are expected to remain depressed, with headline inflation staying at a very low, but positive level. Adjustment in house prices is expected to continue, in particular in smaller cities where there

is a greater need to work off excess capacity. In contrast, there are still restrictions on home purchases in place in big cities.

GDP grew by 5.3% year-on-year in the first quarter of 2024, following a moderate recovery earlier in 2023. Growth was led by a steady expansion of the industry sector, including high-tech industries. The country's ongoing energy transition underpinned a surge in the production of sustainable energy products such as solar panels, electric vehicles and power generation equipment.

*India*

The economy is reaping the benefits of strong macroeconomic fundamentals and financial stability. Large capital outlays focused on infrastructure should boost business investments across key sectors such as manufacturing and services. Increasing investments in residential property to respond to the rapidly expanding urban population is expected to further boost private investments. Rapid growth in the digital economy will accelerate growth in e-commerce, which will support a pivotal transformation in the retail market. The manufacturing industry registered robust growth in 2023 and will remain strong amid substantial expansion in production, moderation in input prices and positive business sentiment. Meanwhile, exports show signs of recovery though still slow, growing by 4.9% year-on-year in the first quarter of 2024 following a 3.4% increase year-on-year in the fourth quarter of 2023. Engineering goods, electronics, and pharmaceutical products were among commodities recording the highest estimated monthly export earnings during the financial year in 2023.

Retail inflation in India continued to decrease in the first three months of 2024, though food price inflation remains elevated in March 2024. Monetary policy easing will start around late 2024 once the inflationary pressure eases.

The ratio of total government revenue to GDP peaked at 12.5% in 2003, ranging between 8% and 10% of GDP from 2011 to 2022. Improving domestic resource mobilisation will support the government's aggressive measures towards infrastructure investments, particularly in transport, renewable energy and telecommunications. Fiscal consolidation and structural reforms will help improve resource allocation that will benefit several sectors, particularly agriculture.

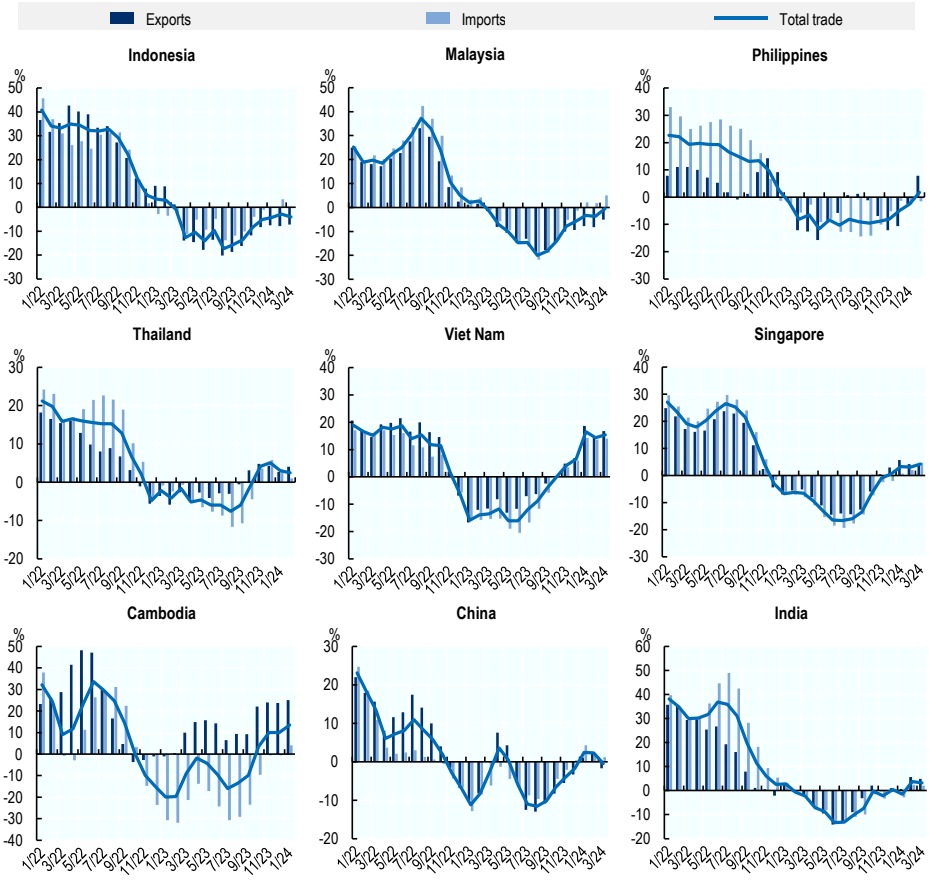
India's tax-to-GDP ratio, which is expected to reach a record high of 11.7% in 2024/25, is still substantially lower than the OECD average of approximately 34% (Ranjan and Ramesh, 2022[3]). Despite the marginal improvement in the tax effort from 7.6% of GDP in 2022, challenges remain. The lack of progress in revenue generation is attributable to several factors, such as the large informal economy, tax evasion, the complexity of the tax system and inefficient tax governance.

## Merchandise trade in Emerging Asia shows signs of recovery

Latest merchandise trade data in the initial months of 2024 are showing signs of recovery in ASEAN, though recoveries for Indonesia, Malaysia, Philippines and Thailand are still weak. Singapore, however, registered trade growth of 4.3% in the same period, signalling a positive start to the year. Viet Nam and Cambodia show strong rebounds, each recording double-digit export growth in the first quarter of 2024. The recoveries stem from a positive outlook in external demand particularly for electronics and semiconductors, textiles, oil, and non-oil goods.

## Figure 1.1. Total merchandise trade in selected Emerging Asian economies

January 2022 to March 2024, year-on-year percentage change




Note: Data as of 22 April 2024.
Source: Authors' calculations using data from CEIC.

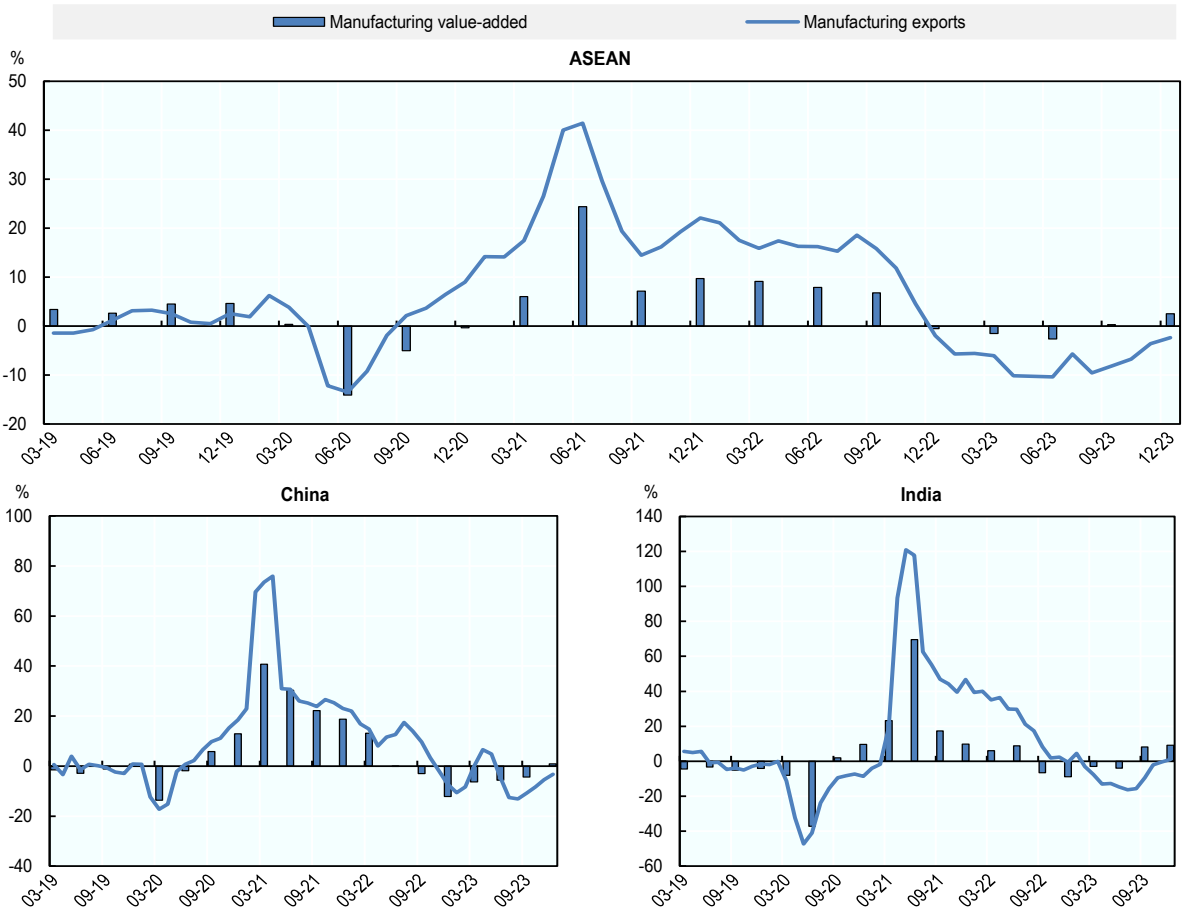
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## Manufacturing activity in Emerging Asia improves amid better external conditions

Figure 1.2 shows that the quarterly growth of the manufacturing industry sector value-added in Emerging Asia followed a trend similar to the monthly growth in manufacturing exports. The region, however, is beginning to show signs of a recovery from its sluggish 2023 performance. The anticipated end of monetary tightening by OECD economies in the second half of the year should help boost investments, adding fuel to a global trade rebound. Emerging Asia's manufacturing sector showed signs of improvement in the first months of 2024. ASEAN's manufacturing PMI recorded steady improvement in the first three months of 2024, signalling a continued recovery of the sector underpinned by better prospects in the electronics and semiconductor sector as global demand for AI microchips increases. High-technology exporters in the ASEAN will benefit from this trend though risks remain, in particular the continued high-interest-rate environments in major trade partners. India's manufacturing sector continues to perform well, with strong customer demand and more favourable input costs boosting production. Export orders continue to expand, signalling higher intake of new business from Africa, the Middle East, Asia, Europe and the United States.

As of April 2024, the GEP Global Supply Chain Volatility Index reports a continued rebound in the overall demand for raw materials, commodities and components. The index shows Asian producers are operating close to full capacity with the region's input demand growing at the fastest pace in over two years.

### Figure 1.2. Total manufacturing exports and manufacturing value-added in selected Emerging Asian economies March 2019 to December 2023 (year-on-year percentage change)




Note: Data as of 22 April 2024.
Source: CEIC.

StatLink https://stat.link/1pa8rg

## Trade in intermediate goods will strengthen as external challenges ease

Recent transformations in global logistics chains – not just for finished products, but also for intermediate goods – indicate that supply chain diversification has begun. One outcome in Emerging Asia is an increase in the flow of Chinese industrial goods to countries where production activity is being redirected, including Southeast Asia and India. This is expected to boost Emerging Asia's critical role as an intermediate goods provider for major export markets. Asia's role as an assembler (Factory Asia) and intermediate goods provider will remain significant, given how US and European industrial production indices are correlated with Asia's exports while Asia's imports are largely aligned with its own regional industrial production (ADB, 2023[4]).

The evolving trade between ASEAN and China also mirrors recent supply-chain transformations. More of China's high-value-added intermediate products are being exported to ASEAN and India for final assembly before re-export to the US market. Meanwhile, the ASEAN countries ramped up their sourcing of intermediate goods from the European Union, with import growth in the second half of 2023 improving to 7.4%. This turn of events is largely driven by the rise of EU imports from Indonesia, Malaysia and Thailand. The increase is linked with the automotive industry in Thailand, the region's automotive manufacturing hub, and Indonesia, which is increasingly becoming the region's electric vehicle (EV) hub with its rich nickel reserves. Exports from the European Union to Malaysia expanded by 10% and 8.4% in January and February 2024, respectively.

There is a growing emphasis on ensuring sustainability in global value chains which should boost regional trade in environmentally sustainable goods such as electric vehicles and renewable energy products (UN.ESCAP, 2024[5]). In one recent development with potentially significant consequences, attacks on commercial vessels transiting the Red Sea have started disrupting key shipping routes. Shipping costs have risen sharply since mid-December 2023 and delivery times have lengthened, especially for trade from Asia to Europe (OECD, 2024[6]). This has disrupted production schedules in Europe, particularly for automotive manufacturing, which accounts for a significant share of trade in certain countries of Emerging Asia. Additional supply capacity this year, as reflected by stronger new orders for container ships after the pandemic, should help to meet increased shipping demand and moderate upward cost pressures. Nevertheless, OECD estimates suggest that the recent 100% increase in shipping costs could raise annual OECD import price inflation by close to 5 percentage points if it persists for about one year (OECD, 2024[6]).

Certain indicators hint at potential improvements in the near term, including the resolution of other supply chain disruptions that lingered into 2022 as well as the impacts of the Russian invasion of Ukraine and the ensuing economic sanctions stabilising. These developments have helped to ease pressures on goods prices, which will contribute to the moderation of inflation in OECD economies.

## Foreign direct investment is expected to pick up

Emerging Asia's trade links will be strengthened through a gradual increase of FDI, particularly in semiconductor and automotive manufacturing. ASEAN's role as a manufacturing hub is expected to strengthen over the medium and long term as it continues to attract global investment despite reshoring trends elsewhere. A number of ASEAN countries are developing into critical links in the supply chain for certain products and components and are thus expected to attract a sizeable share of FDI in the near term, including Malaysia for semiconductors, Viet Nam and Cambodia for electronics, Thailand for automotive products, and Indonesia for electric vehicles. In 2022, ASEAN recorded FDI of USD 224 billion, with electric vehicles being the top haven for investors. ASEAN's share of global FDI rose to 17.3% in 2022 from 14.4% in the previous year. Meanwhile, the trend of international companies establishing facilities in the region is expected to continue despite trade policy setbacks, such as reshoring, nearshoring and legislation such as the US Inflation Reduction Act, which provides incentives for domestic production of lithium-ion batteries and other EV components.

High-tech products, the rapid advancement of artificial intelligence (AI), and digital services will be key drivers of regional trade in the long term, while a continued upturn in semiconductor and electronics production in 2024 will help to underpin merchandise trade in the near term. The global semiconductor industry is expected to rebound, with projected annual growth of 40% in chip sales by the first half of 2025 (Tan, 2023[7]). This is largely driven by the rise in demand for AI-integrated electronics. The rapid acceleration of AI and the digital economy has increased the role of chips in a wide range of products the world depends upon. The long-term outlook for the semiconductor industry is thus strong, and most economies in Emerging Asia are set to benefit. For instance, Singapore and Malaysia, active players in the downstream semiconductor supply chain, are poised to experience rapid growth stemming from

semiconductor-led exports. Demand for AI-integrated industrial electronics and 5G mobile phones is also expected to surge on the back of Industry 4.0 transformation initiatives and 5G rollouts over the next five years. In China, investment in high-tech manufacturing grew by 9.9% in 2023, beating the 6.5% increase seen in overall manufacturing, but this was still the slowest pace of high-tech manufacturing investment growth since records began in 2015.

The development of electric vehicles will deliver substantial gains to the ASEAN auto manufacturing industry. The subregion recorded USD 18.1 billion of international investment in EV-related sectors in 2022, representing a growth of 570% from just USD 2.7 billion in 2021. The investment covers the mining of critical minerals (nickel and cobalt), battery production and EV manufacturing. Further expansion is expected, with Indonesia, Singapore and Thailand actively bolstering their EV industries. Indonesia will benefit from sustained FDI for greenfield projects on nickel smelters and EV battery plants. In Thailand, the Board of Investment has introduced the EV 3.5 scheme, which aims to maintain the momentum of the country's EV industry. Thailand recently approved investments by 16 EV battery manufacturers that collectively amount to THB 39.5 billion (Thai baht).

The growth of ASEAN exports is expected to be strengthened by the Asia-Pacific (APAC) regional trade liberalisation architecture. This includes the large Regional Comprehensive Economic Partnership (RCEP), to which all ten ASEAN nations belong, as well as the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) multilateral trade agreement, which includes a number of ASEAN members. The region also benefits from the ASEAN Free Trade Area and a growing network of major free trade agreements involving APAC economies.

## Services trade moderated but will remain stronger than goods export growth

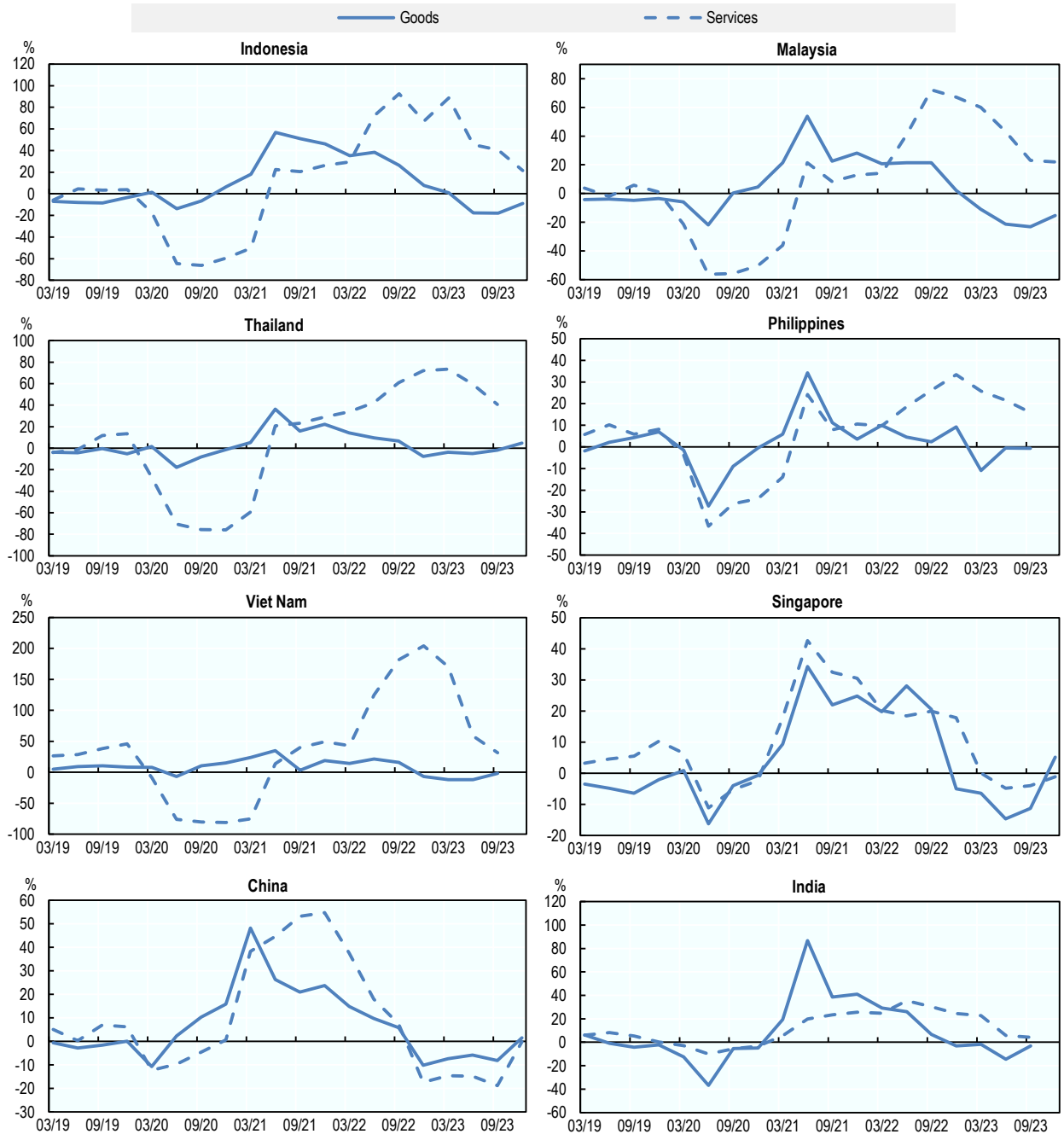
Strength in services trade in Emerging Asia in 2023 somewhat offset weak performance in goods trade (Figure 1.3). In the Asia-Pacific region, growth in services trade is expected to outperform the rest of the world in 2023, with exports growing at 8.8% and imports at 9.7% compared to 7.7% and 8.2% for global commercial services exports and imports, respectively (UN.ESCAP, 2023[8]). Strength in services trade is attributed to its growing digitalisation as well as recovery in the travel and tourism sectors since the complete relaxation of border restrictions post-pandemic. Trade in services remains concentrated in a few Emerging Asian economies.

Trade in services has mainly been supported by the full recovery of the tourism sector. The strong rebound is also supported by the return of international air passenger traffic to pre-pandemic levels. The tourism industry is expected to be an important driver of growth for ASEAN exports over the medium term. International tourism flows are expected to show robust growth as per capita household incomes in large Asian consumer markets continue to increase rapidly, driving travel to ASEAN tourism destinations. This will help ASEAN economies where tourism contributes a significant share of GDP, including Thailand, Malaysia, the Philippines and Singapore.

However, barriers have gradually increased in services trade since 2014, both in Asia and worldwide. Restrictiveness is significantly higher in Asia than in the rest of the world, according to the OECD Services Trade Restrictiveness Index, with equal or higher restrictiveness across all sectors in 2022 (UN.ESCAP, 2023[9]). Restrictions on foreign entry dominate the limitations. Cross-border movements of labour are still restricted by policies including limitations on stays, nationality, residency requirements and lack of recognition of professional qualifications across borders.

## Figure 1.3. Export growth in goods vs. services in selected Emerging Asian countries

Q1 2019 to Q4 2023 (year-on-year percentage change)




Note: Data as of 22 April 2024.
Source: CEIC.

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## Financial markets show nascent signs of improvement though they are still constrained by tight policy rates

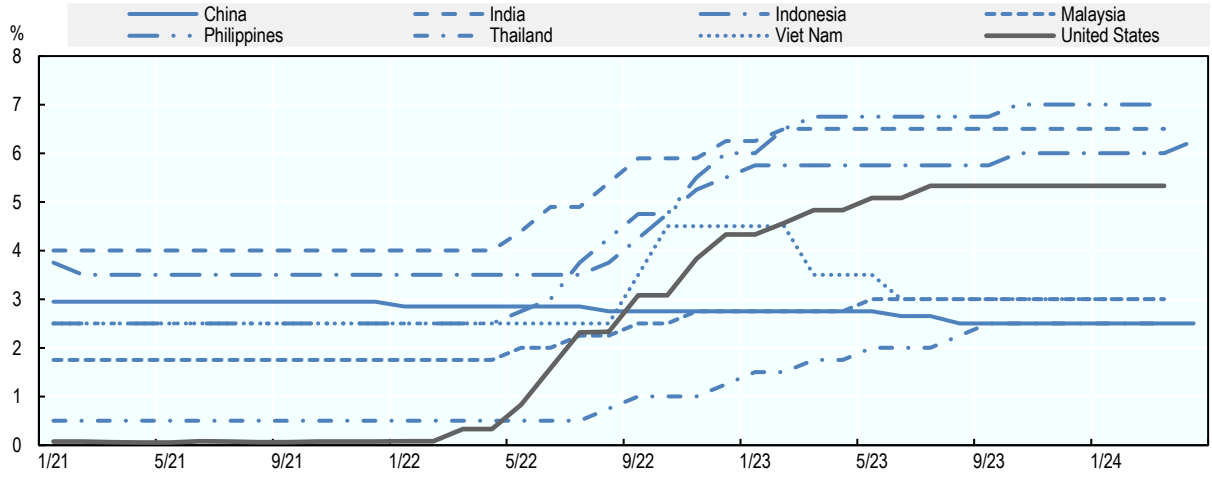
Inflation in Emerging Asian countries continued to moderate in 2023 thanks to prudent monetary policies across the region. As is the case globally, declines in energy and food price inflation and the gradual easing of supply-chain bottlenecks contributed to the easing. However, price inflation of services has been stickier. Persisting service price pressures could kindle inflation.

Financial market sentiments in the region fluctuated in 2023 amid uncertainty and changing views about possible rate cuts by monetary policy makers in OECD economies. While the likelihood of lower interest rates spurred rallies in equity markets, uncertainty about the timing of interest rate cuts was reflected in bidirectional movements in the US dollar that resulted in mild currency fluctuations in the region, amid volatile capital flows. Overall, currencies in Asia experienced rapid selling pressure, trading near their lowest levels between the third and fourth quarters of 2023 as Emerging Asia continued to experience the adverse impact of higher interest rates in the region and in advanced economies. In the second half of 2023, expectations that the US Federal Reserve would keep key interest rates elevated for an extended period led to a weakening of financial conditions in Emerging Asia. This drove capital outflows from emerging markets in Asia back to the stronger US dollar in 2023. A similar trend is observed until April 2024 with the strength of the US dollar resurging, fuelled by continued high interest rates, strong fundamentals sustaining GDP growth, and sticky inflation in the United States. The Indian rupee plunged to a fresh low in April since November of last year amid the strong dollar and continuous foreign fund outflows in the equity market. Similarly, the yuan is weighed down by the strong dollar and sharp depreciation in the yen and some Asian currencies. The Malaysian ringgit continued to depreciate, dragged down by reduced exports to China. Indonesia's rupiah dropped to a four-year low against the US dollar in April and Bank Indonesia increased its policy rate by 25 basis points.

External headwinds, including inflationary pressures amid elevated food and oil prices in some Emerging Asian markets, continued to leave monetary policy makers in the region little room to loosen key interest rates in 2023. Monetary authorities such as the Bank Indonesia, the Bangko Sentral ng Pilipinas and the Bank of Thailand have resumed increasing key interest rates to keep inflation in check and safeguard financial stability. This has led to higher risk premiums and a weakening of equity markets. Nevertheless, Emerging Asian equity markets showed resilience towards the end of 2023. Furthermore, equity markets in ASEAN fared reasonably well amid the challenging financial environment, displaying improved performance in the last months of 2023.

Although inflation is broadly expected to continue easing in 2024, policy rates remain elevated to date for most countries in the region as monetary authorities continue to manage lingering inflationary pressures (Figure 1.4). Monetary policy rate paths in the region will likely diverge in the second half of the year as policy makers prioritise domestic needs such as taming inflationary pressures in some countries or supporting economic growth in others. US monetary policy will remain critical given its impact on bond yields, particularly, long-term yields and currencies in the region.

## Figure 1.4. Evolution of policy rates in selected Emerging Asian economies




Note: Data as of 22 April 2024.
Source: CEIC.

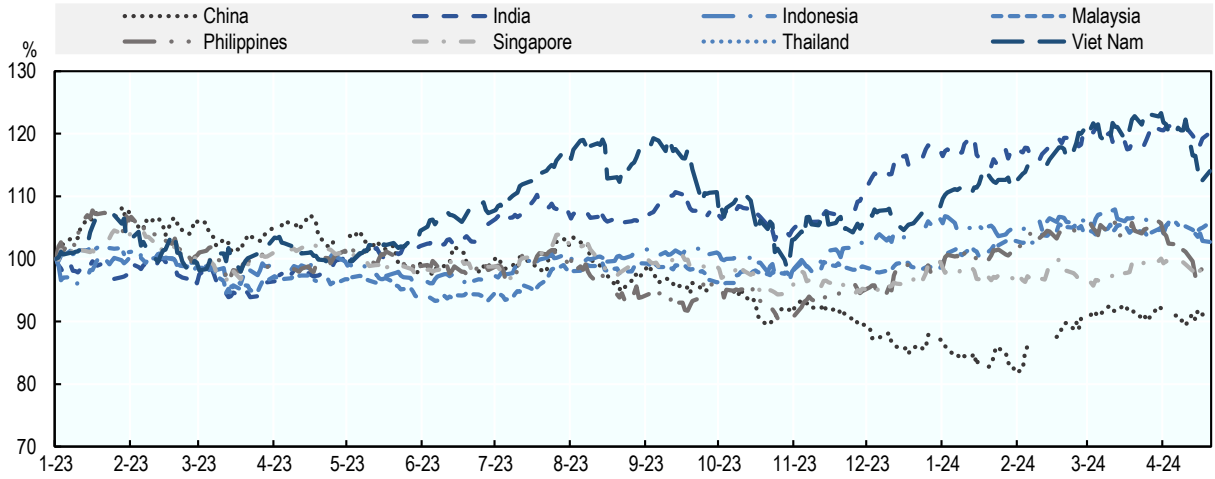
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The impact of the US Federal Reserve's policy rate will remain a key driver for the region's equity markets. Expectations that the Fed will stay on track for further cuts may support stock market optimism in the region this year. However, persistently elevated inflation in the United States coupled with a possible spike in oil prices amidst increased tension in the Middle East may pose a risk in the timing of the US Federal Reserve's rate cuts. At the same time, the European Central Bank may cut interest rates this year.

Asian stocks rose to their highest level in late March 2024, powered by technology companies, while global technology and commodity stocks led the charge in Europe amid greater confidence on lower interest rates. US stock index futures rose as chipmakers tracked sharp gains. Equity markets in ASEAN experienced a nascent rebound starting in December 2023, underpinned by an improving economic outlook for the subregion (Figure 1.5). This is expected to extend into 2024 amid a rapid shift in supply chains to ASEAN, a recovery in tourism that offers better prospects for the labour market, stronger currency relative to the US dollar and robust domestic consumption. Potential rate cuts by the US Federal Reserve in 2024 may be expected to boost the subregion's technology and high-tech automotive sectors as well as the digital services industry, particularly for major countries such as Indonesia, Malaysia, Singapore, Thailand and the Philippines. The MSCI AC ASEAN Index, which captures large- and mid-cap representation across these five economies, increased by 0.83% in 2023 and remained stable up to March 2024, both substantial improvements from the decline of 4.09% in 2022.

## Figure 1.5. Major stock market indices of selected Emerging Asian economies

January 2023-April 2024 (3 January 2023 = 100)



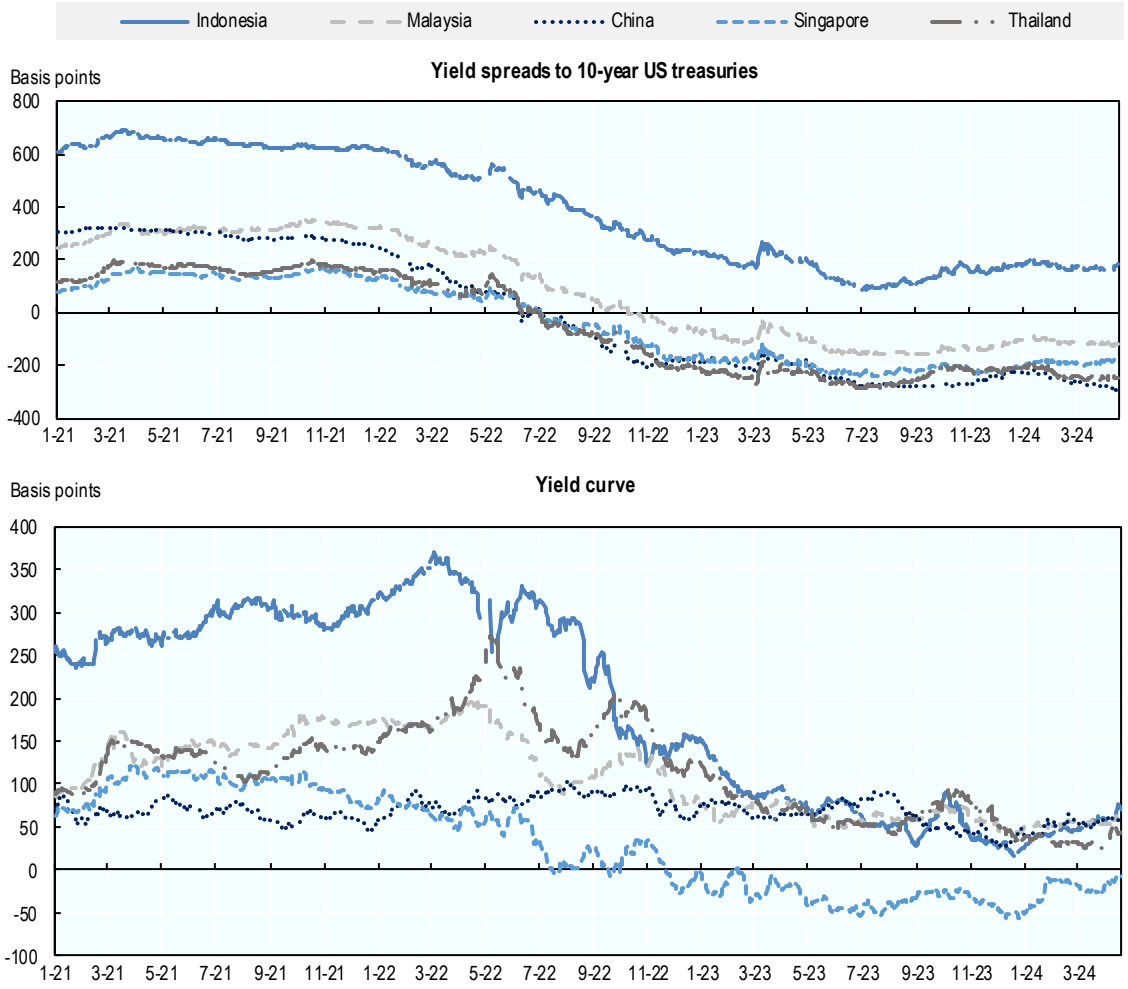

Note: Data as of 23 April 2024.
Source: CEIC.

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Viet Nam's banking sector played a leading role in the recent market surge, with its net profit increasing by 22.5% in the fourth quarter of 2023 compared to the same period of 2022. The increase was driven by accelerated credit growth, strong non-interest income, industry-wide income growth and a 5% reduction in provisioning expenses. The VN-Index, however, experienced a decline in April owing to mounting uncertainties regarding the resignation of the country's president. The National Stock Exchange of India has now become the world's fourth-largest stock market, overtaking the Stock Exchange of Hong Kong, propelled by strong earnings and expected interest rate cuts (Joshi, 2024[10]). The Reserve Bank of India (RBI) is guarding against upside risks to inflation, particularly food and energy prices, amid the impact of the latest episode of El Niño. Another risk is the escalating tensions in the Middle East which are showing signs of impact in the stock markets, especially, with India and the Philippines experiencing a losing streak in the first weeks of April. In contrast, the prolonged slump in China's real estate sector and exports industry has hurt the Chinese stock market, with the Shanghai Composite plummeting to a five-year low in February 2024. However, the Shanghai Shenzhen (CSI) 300 Index continued climbing back in March 2024 after plummeting in the first week of February, signalling that the stock market may be headed towards a more sustainable recovery. Hong Kong's Hang Seng Tech Index has seen an improvement, supported by cost cutting and improvements in efficiency by tech and renewable companies.

Meanwhile, with persistent high interest rates in OECD economies and in Emerging Asia, yields for both short- and long-term bonds rose in almost all markets in the region during the second half of 2023 (Figure 1.6). As of April 2024, US 1-year and 10-year sovereign bond yields edged up on rising uncertainty regarding the timing of the US Federal Reserve's rate cuts. Despite the fluctuation in bond yields in the United States, Emerging Asia's bond yields remained stable in the same period. Asian local-currency bonds are expected to improve if there are rate cuts in major economies in 2024.

## Figure 1.6. Bond market trends in selected Emerging Asian economies




Note: Data as of 23 April 2024.
Source: CEIC.

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Bond market conditions in the region improved starting in December 2023 and remain positive into the first quarter of 2024 despite the continued high interest rate in OECD economies and the recent resurgence of the US dollar. In the near term, positive indicators may help central banks consider easing monetary conditions to support economic growth and help drive better bond market conditions. In addition, banks in most major countries in the region have strong capital buffers and rising profitability, which contribute to financial stability.

Risks remain, however, including an escalation of geopolitical risks and continued tight global financial conditions. It can be noted that the Bank of Japan recently ended its longstanding policy of negative interest rates, raising its key policy rate to a range of 0% to 0.1% from -0.1%.

## Ongoing property market adjustment in China could present challenges for the region

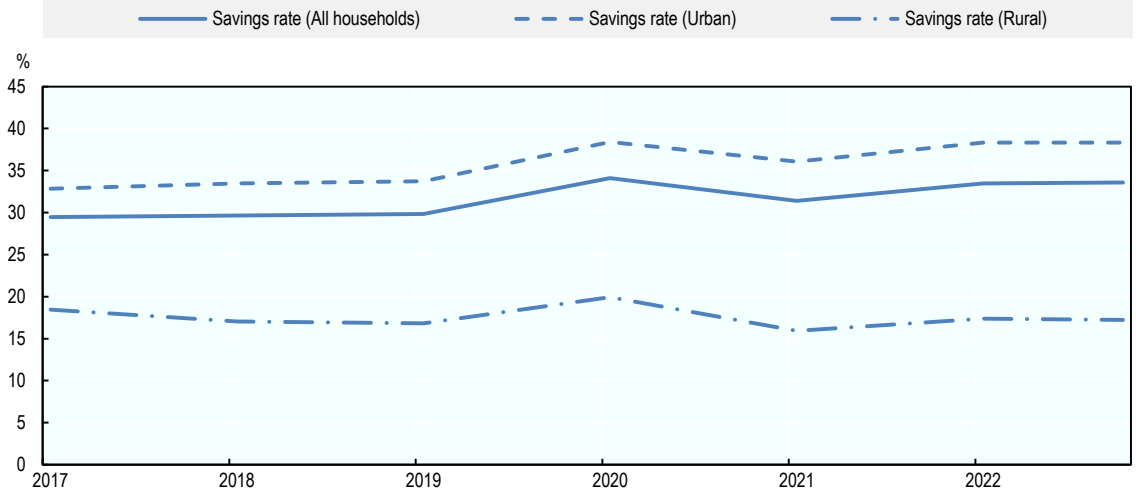
The development of property market adjustment in China could generate external headwinds for the other economies in the region. China has implemented various policy measures to cushion the adjustment in the real estate sector. Lending standards have been eased, depending on the location of the property and the type of borrower. To prop up demand, the central bank cut its benchmark interest rate twice in 2023, from 3.65% to 3.45%, and it lowered the reserve requirement ratio to support liquidity in the banking system. However, falling property prices are further deteriorating the debt repayment capacity of developers. The price of newly constructed residential properties declined year-over-year in 58 of 70 major Chinese cities, while prices of second-hand buildings had declined in all medium and large-sized cities as of January 2024.

Long-lasting adjustment of the sector is continuing, with annual property sales and real investment in real estate recording a year-over-year drop of 17.7% and 16.5%, respectively, in March 2024. The share in GDP of value added created by real estate dropped from 7% in 2019 to 6.1% in the first three quarters of 2023 (National Bureau of Statistics, n.d.[11]). Although emerging industries such as solar cell, lithium-ion battery and electric vehicle production are offsetting some of the detrimental effects, the real estate sector's considerable influence on the overall economy is weighing on the income and wealth of households.

Real estate assets represent a substantial share of household wealth in China. Against this backdrop, downward price movements and gloomy prospects in the property market weigh on consumption through the wealth effect. Chen, Hardin and Hu (2018[12]) find that the wealth effect for housing in China, which is about ten times greater than for financial assets, is much larger than previous estimates for advanced economies. They calculate that a 1% rise in housing value translates into a 0.19% change in household consumption, and that the current cycle of dwindling housing values thus undermines household spending.

The household savings rate rose in China after the onset of the disruptions in the real estate market, reaching 33.6% in the third quarter of 2023 before easing to 31.7% at the end of the year (Figure 1.7). The soaring savings rate of urban households has been the main driver of this trend. Despite moderation in the fourth quarter of 2023, the savings rate for urban households remains above pre-pandemic levels.

### Figure 1.7. Household savings rate in China




Source: Authors' calculations based on data of the National Bureau of Statistics of China.

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Decelerating housing prices and concerns over housing market prospects create a substantial drag on growth. Restoring consumer confidence via an orderly adjustment in the property market to curb further uncertainty will be key to addressing the challenges presented by the slowdown.

## Emerging Asia must cope with extreme weather

Climate change increases average temperatures along with the intensity and frequency of the weather-related disasters globally. Emerging Asia needs to manage the economic impact of extreme weather, together with making efforts to curb greenhouse gas emissions.

Surface temperatures near the Equator exhibit a persistent upsurge (Figure 1.8) and extreme weather events such as heatwaves and heavy precipitation have been observed more frequently and with increasing intensity for decades (IPCC, 2023[13]). Climate change has direct impacts on agricultural production, energy generation and tourism receipts. ASEAN economies are among the most vulnerable against climate risks, facing a severe threat to lose a significant share of their GDP, which could reach 37.4% in the case of the most severe projected scenario of continuing global warming through 2050 (Swiss RE, 2021[14]).

The average number of reported annual occurrences of droughts and storms in the region increased from 1.9 and 25.6 respectively between 2004-13 to 2.4 and 29 respectively between 2014-23. Average annual economic damages from these disasters more than doubled between those two periods (Table 1.1).

El Niño events typically bring higher surface temperatures with more frequent extreme weather events for the Southeast Asian countries and accordingly exacerbate the ongoing negative impacts of the climate change. The latest El Niño episode is one of the imminent challenges that countries in the region need to deal with.

### Table 1.1. Average annual number of occurrences of and damage from weather related disaster in Southeast Asia, China and India

| Disaster Type | Between 2004-13 | | Between 2014-23 | |
|---|---|---|---|---|
| | Average annual occurrence | Average annual damage (USD billion) | Average annual occurrence | Average annual damage (USD billion) |
| Drought | 1.89 | 1.06 | 2.44 | 4.10 |
| Flood | 43.6 | 15.14 | 42 | 17.57 |
| Extreme temperature | 2.20 | 2.14 | 1.88 | 0.20 |
| Storm | 25.6 | 6.53 | 29.0 | 13.39 |

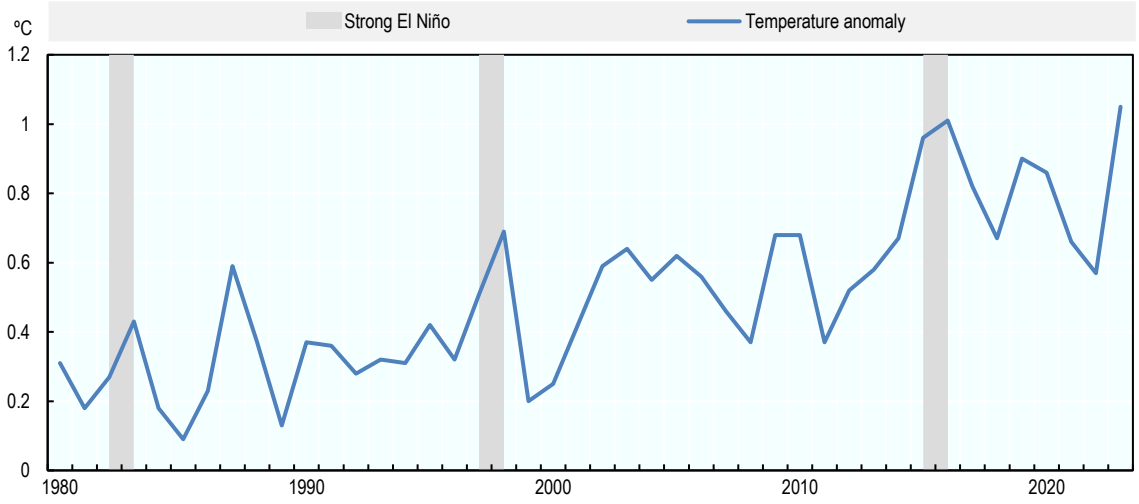
Note: Data cover all economies in the region except Brunei Darussalam.
Source: EM-DAT Database.

## The latest El Niño episode adds to growth concerns

In July 2023, the World Meteorological Organization (WMO) declared that the tropical Pacific region was on the cusp of a new El Niño event after a seven-year pause. This climate phenomenon, one of the two non-neutral phases of the El Niño-Southern Oscillation (ENSO), typically generates an upsurge in air temperatures and adverse weather conditions (WMO, 2023[15]). El Niño led 2023 to become the hottest year on record, warmer by a substantial margin than the previous hottest year, 2016, when another El Niño event occurred (Abnett, 2024[16]). Average temperature anomaly in the equatorial zone in 2023 surpassed the levels of the last 50 years, including three strong El Niño episodes, while the level of deviation from average temperatures between 1951 and 1980 reached 1.05°C in 2023 (Figure 1.8).

## Figure 1.8. Average land and ocean surface temperature anomalies in the equatorial region

Deviations from 1951-1980 average




Note: The equatorial region covers the latitudinal zone between 24° North and 24° South. The strong El Niño years of 1982 83, 1997-98 and 2015-16 were selected based on Oceanic Niño Index (ONI) values published by NOAA, https://origin.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ONI_v5.php.
Source: NOAA and GISTEMP Team, 2024, GISS Surface Temperature Analysis (GISTEMP), version 4, NASA Goddard Institute for Space Studies, https://data.giss.nasa.gov/gistemp/.

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The latest El Niño episode is expected to last around first half of 2024. The second year of the phenomenon was expected to be warmer than the first due to the time lag between the heating of the Pacific Ocean and surface temperatures, warranting continued efforts to monitor weather conditions to mitigate potential damage (Hirji, Rugard and Kahn, 2024[17]).

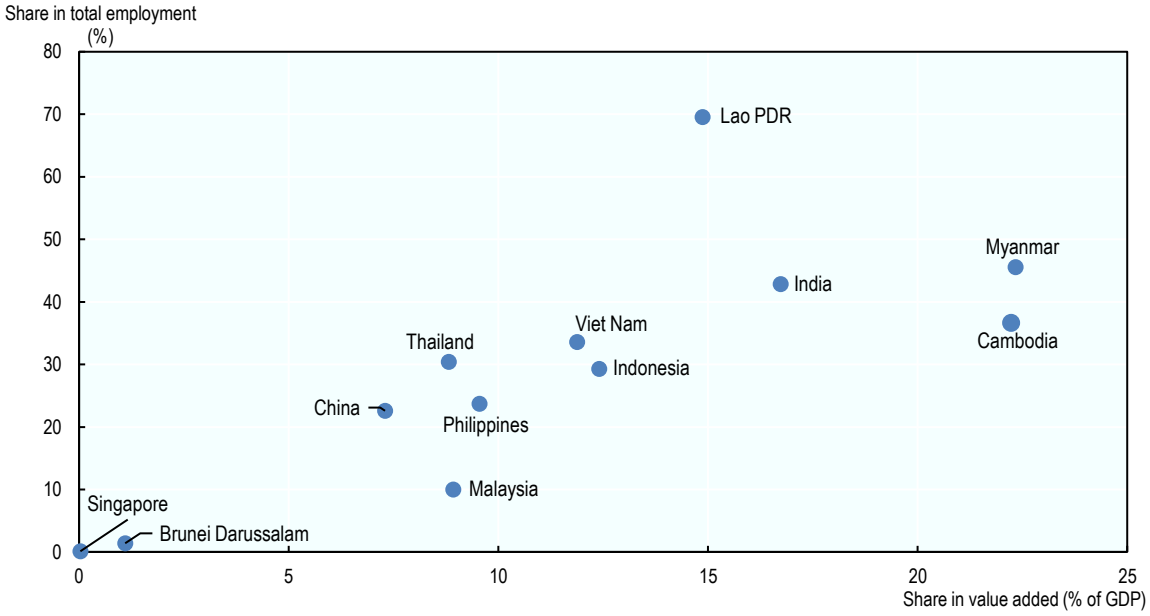
El Niño impacts Emerging Asian economies with diverse outcomes. A typical El Niño period leads to higher air temperatures and limited precipitation, along with more frequent extreme weather events such as droughts, floods and storms across the region. Climate change increases the likelihood of observing record-high surface air temperatures throughout El Niño episodes in Southeast Asia, especially during the month of April (Thirumalai et al., 2017[18]). Overall warming coupled with extreme weather events can alter economic activity in many ways. It can have a devastating impact on crop yields and livestock; curb water supply; reduce hydro energy generation; and lead to decreased labour productivity and a drop in tourism traffic and receipts.[1]

## El Niño as a supply-side drag can harm growth in numerous ways

Several empirical analyses have documented that previous El Niño events adversely affected growth in some Emerging Asian countries. For instance, Cashin, Mohaddes and Raissi (2017[19]) investigate the impacts in a multi-country framework between 1979 and 2013 and found that sustained negative Southern Oscillation Index (SOI) values (SOI anomalies) hurt the real GDP growth of India and Indonesia, while the effect was opposite for Singapore due to a rise in shipping activity after the El Niño shocks. According to their analysis, GDP growth in Indonesia dropped by about 0.64% in the year following an El Niño shock. The impact was relatively high due to a slowdown in agricultural activity (coffee, cocoa and palm oil) along with adverse effects on the mining sector arising from its high dependency on hydro energy generation.

(Smith and Ubilava, 2017[20]) demonstrated that the growth impact of ENSO events is more pronounced for countries with a larger share of agricultural activity in GDP. In this regard, Myanmar, Lao PDR, Cambodia and India are more vulnerable to the adverse consequences of El Niño in the coming months due to their relatively high dependence on agricultural production and labour in farming activities (Figure 1.9). In 2022, value added in the agriculture, forestry and fishing sector is estimated to be more than a fifth of GDP in Cambodia and Myanmar, while the share of employment across these sectors in the total workforce reaches 69.6% in Lao PDR. In contrast, the importance of agricultural production in domestic output is limited in Singapore and Brunei Darussalam, a critical factor softening the El Niño slowdown effect in these countries.

### Figure 1.9. Share of agriculture, forestry and fishing in value added and total employment in 2022




Source: World Bank and authors' calculation based on ILOSTAT, ILO Modelled Estimates (ILOEST database), https://ilostat.ilo.org/resources/concepts-and-definitions/ilo-modelled-estimates/.

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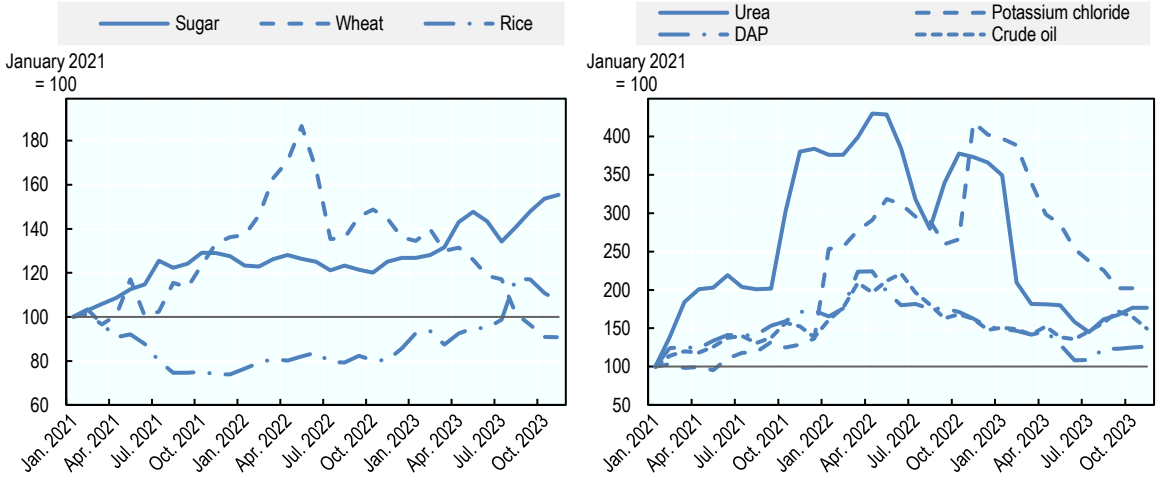
The importance of tourism activities to the economies of Thailand and Cambodia introduces an additional downside risk to growth in those economies during an El Niño episode. Extreme weather events such as cyclones can have significantly negative effects on tourism-related income (Hsiang, 2010[21]). Furthermore, the fact that the current episode of El Niño comes in conjunction with expectations of mild global growth and a slowdown in China adds to concerns about economic activity across the region in 2024.

## El Niño can exacerbate inflationary pressures and threaten food security in the region

The adverse impact of El Niño events on agricultural and mining output as well as hydro energy generation can exacerbate inflationary pressures on food products and other primary commodities. A major upward movement in food and energy prices began before the expansion of the war in Ukraine. Although the prices of most commodities have moderated since their peak in 2022, the cost of major fertiliser raw materials (urea, diammonium phosphate and potassium chloride), as well as crude oil, rice and sugar, remain above

the levels seen in early 2021, while wheat and sunflower oil prices have eased substantially below their pre-invasion heights (Figure 1.10).

### Figure 1.10. Cost of selected food, energy and fertiliser commodities (2021 January = 100)




Source: Authors' calculation based on IMF data.

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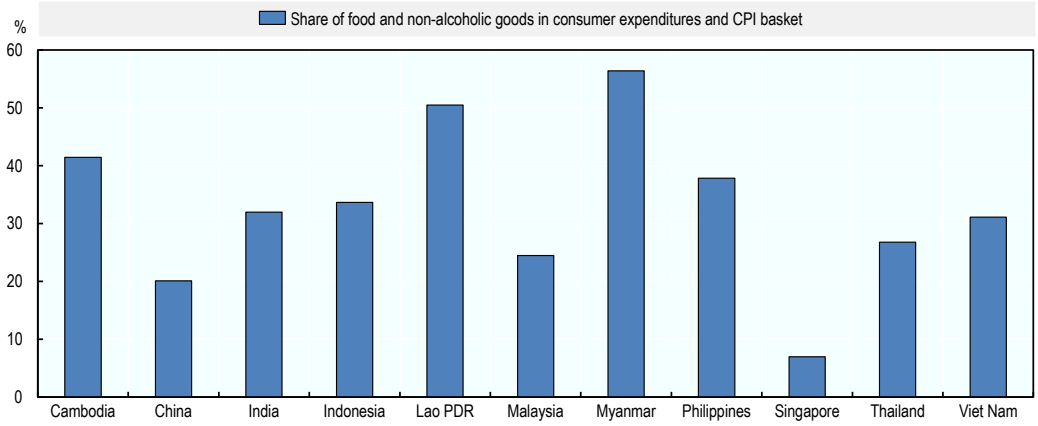
Brunner (2002[22]) noted that a 1-standard-deviation rise in El Niño Southern Oscillation generates a hike in real commodity prices of around 4% and accounts for about 20% of the fluctuations in these commodities. The study showed that agricultural commodities are particularly susceptible to the inflationary pressures of ENSO cycles, with rice and palm oil among the commodities most affected by SOI anomalies. Naylor et al. (2001[23]) found that El Niño episodes severely disrupt rice plantings and production in Indonesia and delay the harvest, and that these losses are hardly recovered after high amplitude events. Khor et al. (2021[24]) estimated the cost for the palm oil industry in Malaysia of lower rainfall and dry conditions caused by a strong El Niño event at around USD 3 billion. Cashin, Mohaddes and Raissi (2017[19]) note that El Niño events also have a detrimental impact on energy prices caused by lower generation from hydroelectric dams and an increase in energy demand for agricultural irrigation. Among their sample countries, Indonesia saw the highest estimated increase in average inflation, with a jump of 73 basis points in the year after the shock, followed by India (48 basis points) and Thailand (44 basis points). Malaysia, the Philippines and China saw adverse inflation effects on a lesser scale. The study noted the importance of the share of food products in the consumer basket as a determinant of this unfavourable impact.

Myanmar, Lao PDR and Cambodia are especially prone to the adverse price shocks generated by El Niño events due to the relatively high share of food products in their consumer baskets (Figure 1.11), with more than half of consumer spending attributed to food and non-alcoholic beverages in Myanmar and Lao PDR. Sharp rises in the cost of food staples can thus severely damage the purchasing power of households and disrupt demand for other consumer products.

Supplies of food staples are already under strain in the region. The drier weather conditions are expected to affect the rice harvest and palm oil output in Indonesia and Malaysia, and wheat yields in India (Thukral, 2023[25]). Droughts in Indonesia caused significant delays in rice planting, with the area planted between September and November 2023 dropping by more than half compared to a year earlier (Christina, 2023[26]). Moreover, with this episode's lessening effect on monsoon rainfall, India's annual sugar yield may fall by

more than 10% in the coming months, sparking expectations that the country, the second largest global supplier of sugar over the last five years, may impose an export ban (Jadhav, 2023[27]).

## Figure 1.11. Share of food and non-alcoholic beverages in consumer expenditures (2022)




Source: US Department of Agriculture Economic Research Service, https://www.ers.usda.gov/topics/international-markets-u-s-trade/international-consumer-and-food-industry-trends/ (accessed on 18 January 2024).

StatLink https://stat.link/95lhe0

The accumulated impact of warming and prolonged droughts due to climate change and the latest El Niño cycle, in tandem with elevated energy and input costs, weigh on the farmers, creating a risk of further inflationary pressures in the coming months. Declines in production volumes in conjunction with soaring prices may threaten food security in the region. Harmful interventions in the international flow of agricultural products, implemented after the sharp rise in food prices following the start of the war in Ukraine, add to these worries. India banned exports of broken rice and imposed a 20% export duty on other types of rice in August 2022. The export ban was extended in July 2023 to include non-basmati rice. Although India has since relaxed the ban, approving rice export quotas for several countries including Malaysia and Philippines, the measures are still curbing the international flow of one of the main nutrition sources in Southeast Asia.

Mitigating the impact of El Niño and safeguarding food security in the region requires a multifaceted strategy and co-operation among the region's economies. Closely monitoring weather developments, improving early warning systems and keeping farmers abreast of adverse weather changes in a timely manner are crucial to ensuring successful planting and harvesting seasons. Encouraging the use of drought-tolerant crop varieties and supporting the efficient use of limited water resources would be a major step towards increasing crop yields under conditions of a diminishing water supply.

The effects of El Niño are quite heterogenous. Severe weather events can disproportionately strike one subregion, while favourable weather elsewhere in the region can offset some of the output losses. Exporting and importing countries may change their usual roles under extreme weather conditions. Thus, maintaining the flow of food staples across borders and avoiding a vicious cycle of reciprocal trade interventions are vital to enhancing food security.

Southeast Asian economies implemented various policies, such as subsidies, tax cuts and price controls, to rein in the inflationary pressures on food and energy prices following the onset of the war in Ukraine. These measures explain the relatively low inflation rates in the region compared to OECD economies (OECD, 2023[28]). To soften the adverse impacts of El Niño shocks on food security, it is important to

maintain fiscal measures that preserve the affordability of food staples and to use targeted programmes to help the low- and middle-income households most vulnerable to food price shocks, while keeping an eye on the sustainability of fiscal policy.

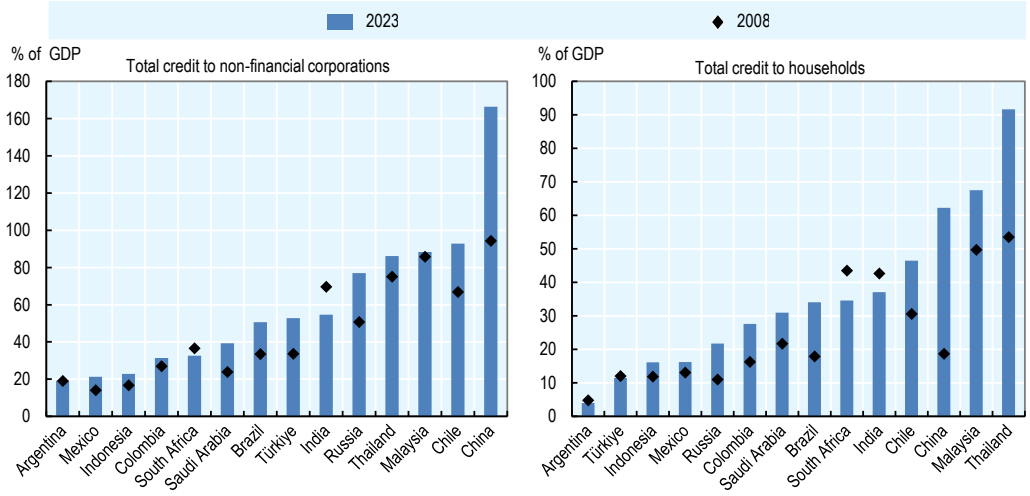
Warmer weather conditions also decrease water resources for energy generation and create higher demand for energy due to the increasing need for air-conditioning and the use by farmers of water pumps to harness ground water resources for irrigation. The destabilising impact of warmer conditions on the supply-demand balance of the energy market requires the diversification of energy sources in order to lessen dependence on water resources and avoid disruptions in power supply and spiralling energy prices. Such action throughout the period of rising temperatures caused by the climate change will also be beneficial during El Niño episodes.

## Elevated levels of debt, particularly private debt could threaten the growth prospects and financial stability

Concerns on debt management is increasing. Overall, public debt-to GDP ratios have remained stable, but many economies still face public debt stocks larger in size than historical norms. More importantly, private debt (especially household debt) remains a significant risk to growth prospects in Emerging Asia.

In the aftermath of the global financial crisis, low interest rates and ample liquidity in major advanced economies led to a search for higher yields elsewhere and a rise in the capital inflows and private debt stock of emerging economies. Despite short-lived breaks in loose global financial conditions during the "taper tantrum" and the policy normalisation efforts of the US Federal Reserve, the funding cost for reserve currencies stayed close to zero for more than a decade. During this episode of accommodative monetary policy, private debt in Southeast Asian economies rose considerably.

### Figure 1.12. Private debt in selected emerging market economies




Note: The chart shows total credit to non-financial corporations and total credit to households during 2023 Q1-Q3 and 2008 Q1-Q3.
Source: BIS.

StatLink https://stat.link/4jqfa0

Total credit to non-financial corporations as a proportion of GDP averaged 22.9% in Indonesia, 54.6% in India, 86.2% in Thailand, 88.3% in Malaysia, and 166.4% in China over the first three quarters of 2023. Household debt as a proportion of GDP averaged 16.1% in Indonesia, 37.1% in India, 62.3% in China, 67.5% in Malaysia, and 91.7% in Thailand over the same span (Figure 1.12).

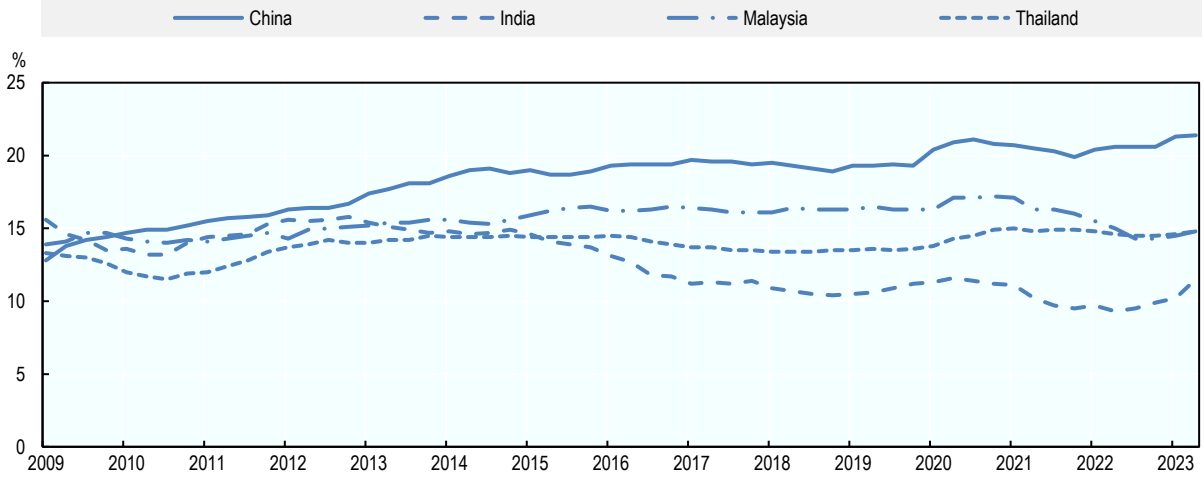
The global financial landscape changed dramatically after supply-driven inflationary pressures persisted long enough to initiate a significant modification in the monetary stance of major central banks. A synchronous rise in interest rates globally and tightening domestic financial conditions in the region have increased debt payments and threaten to cause financial distress among indebted households and corporates, especially in economies with higher private debt stock.

Policy rate hikes can usher in financial stress, particularly during an episode of supply-driven inflation where external inflationary shocks have already deteriorated borrowers' cash flows (Boissay et al., 2023[29]). Many central banks in the region raised policy rates considerably starting from mid-2022.

Elevated prices for energy and food staples since the onset of the war in Ukraine have not only impaired household purchasing power for other goods and services but have also worsened the prospects of debt repayment given increasing interest payments. The expectation of rate cuts from major central banks increased considerably beginning in mid-2023 on the back of subsiding inflationary pressures. However, the size of monetary loosening in 2024 may be limited by resilient economic activity in some OECD economies and the risk of further supply-side shocks to goods prices from factors such as geopolitical tensions in the Middle East.

The share of income used to service the debt obligations of households and non-financial corporates, the so-called debt service ratio, is an important indicator of the debt burden of the private sector. Debt service ratios steadily increased in China and Thailand in the aftermath of the global financial crisis (Figure 1.13). In China, the share of debt payments rose sharply between March 2009 and June 2023, from 12.8% to 21.4%. According to Thailand's Household Socio-Economic Survey, the average debt to annual income ratio per household rose from 53.7% to 62.7% between 2009 and 2021 (NSO, n.d.[30]).

## Figure 1.13. Debt service ratios for private non-financial sector in selected Asian economies




Source: BIS.

StatLink https://stat.link/8otn25

## Elevated debt burden puts growth at risk in countries with highly indebted private sectors

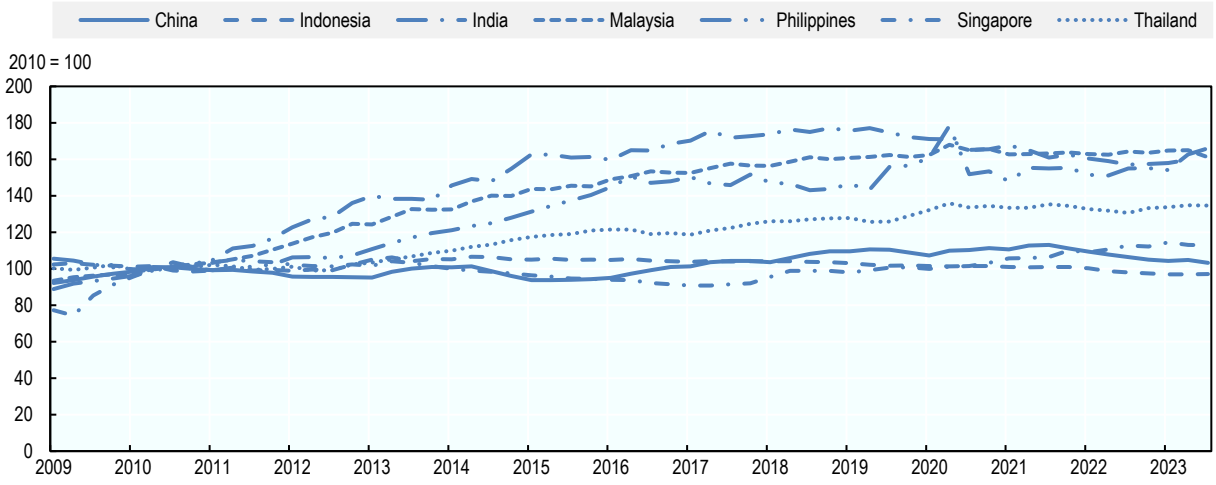
The relationship between credit and economic growth depends on the level of financial development in an economy. Financial deepening generally contributes to income at low levels of debt stock by reducing transaction costs and allocating capital efficiently across the economy. However, credit growth can hinder aggregate real growth of an economy when total private debt exceeds a certain threshold, such as annual GDP (Cecchetti and Kharroubi, 2012[31]).

In Cambodia, China, Malaysia and Thailand, where the existing level of debt is higher than annual income, elevated levels of accumulated private debt could damage economic growth. Although Singapore is an important financial centre in Asia and typically holds a large credit stock, it could be affected to a lesser extent due to the large-scale indebtedness of the private sector. Nevertheless, the impact of high debt varies among economies depending on structural factors and macroeconomic fundamentals.

Excessive debt stock and increasing debt service costs can force households to prioritise debt repayment, with fewer resources available for consumption. Likewise, financially distressed corporations can choose to deleverage and spare limited funds for investment. These responses could weaken economic growth.

Rising property prices usually occur simultaneously with rapid private credit growth, the most noticeable indicators of financial booms (Drehmann, Borio and Tsatsaronis, 2012[32]). A rise in the real cost of residential properties since 2010 in Thailand (61.2%) and Malaysia (34.6%) has accompanied rapid credit growth for households, while real appreciation of houses has been relatively subdued in Singapore (Figure 1.14). Nevertheless, the speed of increase in property prices has eased in these economies and has turned negative in China, where the long-lasting slump of the property sector continues.

### Figure 1.14. Real residential property prices in selected Asian countries (2010 = 100)




Source: BIS.

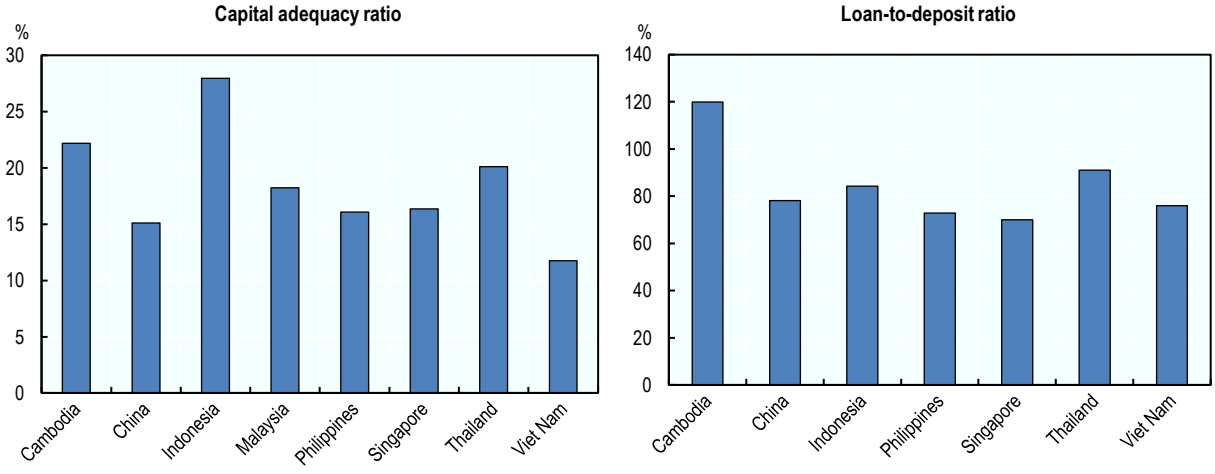
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Real estate constitutes an important part of collateral for private debt obligations. Policy makers should attempt to avoid a persistent decline in nominal property prices, as this can have serious economic and financial ramifications. Expectations of a further depreciation in collateral values can impel borrowers to liquidate properties, inducing an additional drop in prices. A fall in real estate prices impairs consumer spending and economic growth via the wealth effect, and also deteriorates the credit quality of the financial

institutions that provided the credit in the first place. Balance sheets of property developers also deteriorate in response to declines in property and land prices, jeopardising the credit rating of leveraged companies.

Vigilant monitoring of financial institutions is key to ensuring the continuation of prudent lending practices and maintaining an adequate level of capital buffers. The capital adequacy ratios of banks in the region are generally compliant with regulatory limits, ranging from 11.8% in Viet Nam to 28% in Indonesia. Loan to deposit (LTD) ratios in Cambodia and Thailand are relatively high, standing at 119.9% and 91%, respectively (Figure 1.15). A banking sector with a higher LTD ratio relies more heavily on non-deposit funds, such as wholesale funding, which makes financial institutions more vulnerable to rapid changes in external financial conditions. The liquidity conditions of the financial sector should be scrutinised carefully, especially when cross-border banking flows, which are susceptible to sudden changes in direction, constitute the main financing source of rapid credit growth.

## Figure 1.15. Capital adequacy and loan-to-deposit ratios in selected Asian countries




Note: Capital adequacy ratio data as of Q4 2023 for China, Indonesia, Malaysia, Thailand and Viet Nam, September 2023 for Singapore and 2022 for Cambodia. Loan-to-deposit ratio data as of Q4 2023 for China, Philippines, Singapore, Thailand and Viet Nam, and 2022 for Cambodia. Figures for the Philippines and Singapore are preliminary.
Source: CEIC and national sources.

StatLink https://stat.link/tmwlfz

The deflationary environments that have developed in China and Thailand recently complicate matters concerning the elevated levels of private debt in these economies. Debt deflation, a destabilising interaction between deflating prices and high debt stock, emerges from the feedback from decelerating money supply, a slump in asset prices and damaged credit intermediation against the distressed selling of assets and debt repayment efforts in an economy (von Peter, 2005[33]). It is thus pivotal to avoid deflationary pressures in order to prevent further disruptions in the debt repayment capacity of borrowers and a slump in economic activity. Higher real interest rates stemming from depressed inflation would also dampen domestic consumption and investment.

## Concerted monetary, fiscal and regulatory policies may be needed

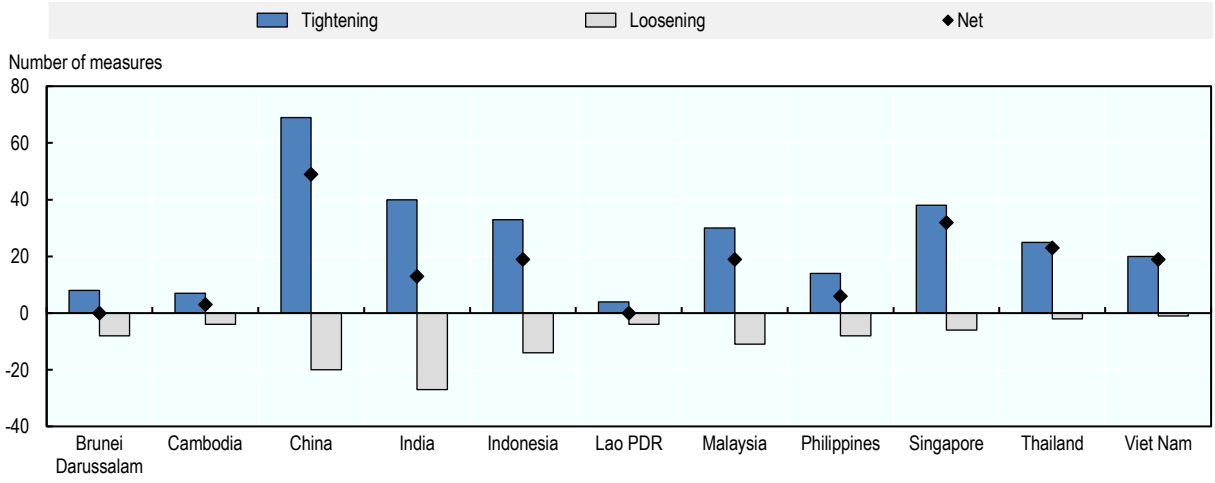
Policy prescription against rapid credit growth depends on an economy's financial structure and level of private debt. For low-stock, high-flow economies such as Indonesia, the Philippines and Lao PDR, where new credit creation is high, but the overall financial depth is relative shallow, the first line of defence against

rapid credit growth is implementing preventive measures to limit the build-up of financial imbalances. In this regard, emerging Asian economies strengthened their macroprudential policy toolkits in the aftermath of the global financial crisis, using instruments such as countercyclical capital buffers, limits on the loan-to-value ratio, and liquidity ratio and reserve requirements (OECD, 2021[34]). In economies with growing non-bank financial activity, it is vital to monitor credit activity through non-bank financial intermediation and to implement similar prudential measures for the institutions involved in these transactions in order to prevent excessive credit generation and ensure the establishment of adequate buffers to cope with possible shocks during financial stress.

The region's most active users of prudential measures to tackle financial stability risks are China and Singapore, which implemented 49 and 32 net tightening measures respectively between 2009 and 2021 (Figure 1.16). Despite the rapid growth in indebtedness in Cambodia and Lao PDR, the range and use of macroprudential policy measures has been relatively limited during this period. Among the more recent steps, the Reserve Bank of India recently tightened credit standards for consumer loans, increasing the risk weights for personal loans (excluding housing, education, vehicle and gold-backed loans) by 25 percentage points to curb excessive credit growth in specific components of consumer credit. Indonesia and Lao PDR have more than doubled reserve requirement ratios for local currency deposits since 2022 in order to help boost the liquidity buffers of financial institutions and moderate credit growth. Nevertheless, implementation of macroprudential policy has not been sufficient to prevent credit volume from growing in tandem with income growth in some economies in the region. Employing capital flow measures for prudential purposes during times of strong capital inflows can be effective in curbing excessive credit growth during loose global monetary conditions, such as after the global financial crisis.

## Figure 1.16. Number of tightening and loosening macroprudential policy measures, 2009-21

Selected Asian economies




Source: Authors' calculations based on (Alam, 2019[35]) and the IMF's Integrated Macroprudential Policy Database, https://www.elibrary-areaer.imf.org/Macroprudential/Pages/iMaPPDatabase.aspx.

StatLink https://stat.link/kisvzy

Managing a large private debt stock requires a concerted effort from monetary, fiscal and regulatory policy makers. Avoiding an abrupt decline in credit and a persistent fall of asset prices, especially property prices, is crucial to limit the probability of realising major financial risks. A balance sheet recession, where borrowers prioritise minimising their debt burden by repaying existing obligations, can generate long-lasting slow economic growth.

In a high private debt environment, an accommodative monetary policy can at best postpone the necessary adjustment, but it is insufficient to spur domestic demand as long as the excessively indebted borrowers are reluctant to expand their financial obligations (Borio, 2014[36]). Moreover, such an approach may also conflict with the price stability objective of central banks, seeing that headline and core inflation figures have yet to be completely reined in following several supply-side shocks since the onset of the pandemic. However, the inflation outlook in China and Thailand diverges from other economies in the region, and headline inflation remains in negative territory, providing some policy space to loosen monetary policy with relatively fewer trade-offs between policy goals. Nonetheless, releasing capital and liquidity buffers that accumulated during the implementation of macroprudential policy is a crucial step to help banks maintain regular financial intermediation functions while staying complaint with regulatory requirements. In China, the central bank has cut the reserve requirement ratios for both local and foreign currency deposits several times, releasing liquidity for banks. Moreover, to facilitate the flow of funds from abroad, it raised the key parameter for the upper limit of outstanding cross-border financing of enterprises and financial institutions.

To cope with the economic and financial risks of high private debt, it is important to repair the balance sheets of highly indebted households and corporations gradually, without an abrupt phase of deleveraging. In this regard, support for export and tourism driven growth can be effective towards curbing financial imbalances. Policy efforts to redirect funds to the relevant sectors can achieve such an outcome. Funding for lending programmes, which various central banks, including the Reserve Bank of India, started using after the pandemic, can be a viable option.

While fiscal policy can provide debt relief for overindebted households, fiscal space should also be accounted for to avoid exacerbating debt sustainability. Fiscal measures such as subsidies and various forms of support for households were used to cushion inflationary pressures during the pandemic. On the other hand, fiscal stimuluses can be used to encourage debt repayment rather than spending on consumption and investment and may thus serve to spur further deleveraging (Borio, 2014[36]).

In Thailand, the government has recently been working on a fiscal stimulus plan to provide about 50 million people with digital handouts of THB 10 000 (Thai baht) that can only be used for local spending within a six-month period (Wongcha-um and Ghoshal, 2023[37]). The use of these digital handouts as a substitute for regular household income should be carefully monitored to assess the possible net effect on aggregate demand for consumption and investment. In addition, the Bank of Thailand has introduced a wide range of debt assistance measures, including debt restructuring support for small and medium-sized enterprises, credit cards and personal loans. The programme also includes targeted measures for households with income lower than a threshold to convert their revolving personal loans into instalment loans with an interest rate cap.

## Notes

[1] See (Dell, Jones and Olken, 2014[38]) for an extensive review of the literature on the effects of weather on economic outcomes.

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# 2 A holistic approach to disaster-resilient development

Disasters endanger people from all walks of life and all sectors of a country's economy. Beyond their devastating immediate effects, disasters hamper the achievement of sustainable development. Achieving disaster-resilient development requires a holistic policy approach. This chapter discusses key policy areas to consider in designing a holistic approach: transforming governance and improving institutional capacity, ensuring adequate budgets, broadening financing options, strengthening disaster-risk reduction training and education, investing in disaster resilient infrastructure, addressing disaster-induced migration and adopting risk-sensitive land-use planning, developing and adopting technology to bolster disaster response and resilience, fortifying health responses to disasters, and facilitating the contributions of the private sector.

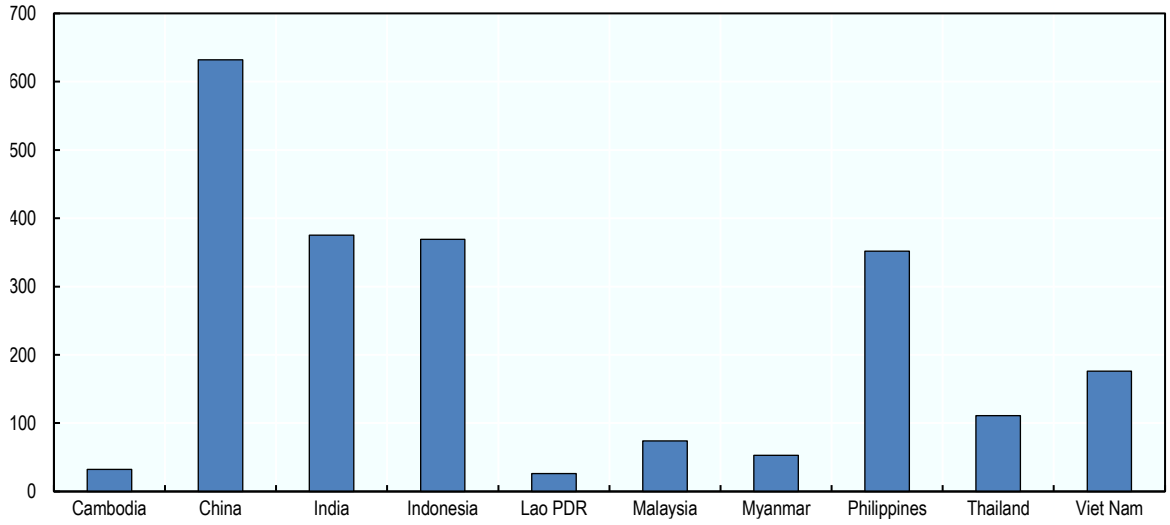
## Introduction

The countries of Emerging Asia are located in the world's most disaster-prone region[1] (Figure 2.1). The region is affected by earthquakes, tsunamis and volcanic eruptions. In addition, rising temperatures are contributing to increasingly frequent and severe climatological and hydrometeorological disasters, such as floods, storms, landslides, droughts and forest fires.

Different countries face different types of disasters. Floods are the major threat in most of the region's countries, but some countries, such as Myanmar, the Philippines and Viet Nam, are more affected by tropical storms, while Indonesia is more exposed to earthquakes.

The WorldRiskIndex ranks the Philippines, Indonesia and India as among the countries most vulnerable to natural hazards in the world, while the People's Republic of China (hereafter "China") and many other countries in the region are also among the world's most exposed to natural disaster risk. High vulnerability levels are attributed to a high susceptibility to natural hazards, a lack of coping capacity and a lack of adaptive capacity (Figure 2.2).

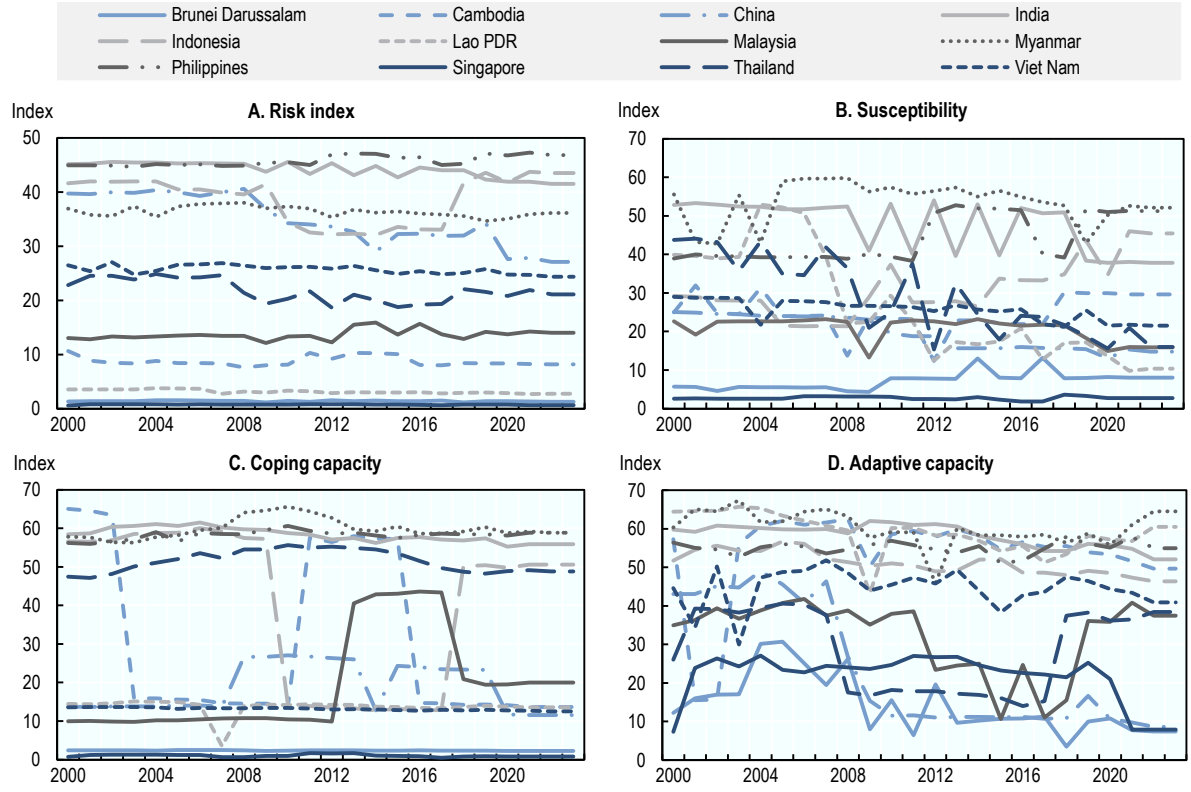
### Figure 2.1. Total disaster occurrences in Emerging Asia, 2000-23




Note: The figure only includes disasters with available data. Disasters include drought, earthquake, extreme temperature, flood, glacial lake outburst flood, mass movement (dry, wet), storm, volcanic activity, and wildfire.
Source: Data from the EM-DAT database (CRED, n.d.[1]), *EM-DAT, The International Disaster Database*, https://www.emdat.be/.

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## Figure 2.2. World Risk Index and its components for Emerging Asia, 2000-23




Note: The WorldRiskIndex is calculated on a scale of 100. Susceptibility describes the characteristics of a society that increase the risk that its population will suffer damage from extreme natural events; coping capacity involves the capacity of societies to counter the negative impacts of natural hazards and climate change; adaptive capacity refers to long-term strategies to counter or mitigate future long-term impacts.
Source: The WorldRiskIndex database, https://weltrisikobericht.de/en/.

StatLink https://stat.link/g7ywau

Beyond their immediate effects, which can be potentially devastating, disasters impede the achievement of long-term development and sustainability by interrupting the production and distribution of goods and services. Vulnerable groups and communities are particularly endangered by disasters. The effects of disasters can be seen through the human, physical, economic, social and cultural challenges. For instance, consumption changes and reduced human capital development are the effects disasters can have on economic behaviour. Molnar-Tanaka, Ibrahim and Hean (2023[2]) find that disasters reduce consumption and change consumption patterns in the short term, based on evidence from Thailand and the Philippines. Aladangady et al. (2017[3]) show that in the immediate aftermath of Hurricane Matthew in the United States in October 2016, consumer discretionary spending decreased, falling by 4.1% at restaurants, and 6.8% at clothing stores. Moreover, disasters also affect human capital development through health, education, and migration. Husted, Opper and Park (2022[4]) find that disasters reduce a region's stock of human capital along multiple dimensions, including out-migration of productive labour, reduction of student achievement and learning, and postponement or permanent reduction of higher levels of educational attainment. Similarly, Baez, de la Fuente and Santos (2010[5]) find that disasters bring substantial damages to human capital through death and harmful consequences for nutrition, health and education.

### *A holistic approach is needed for disaster-resilient development*

Achieving disaster-resilient development is critical, and doing so requires the strategic introduction of a holistic policy approach. A holistic approach is one that accounts for factors that strengthen synergies in disaster risk reduction by identifying potentially beneficial opportunities across policies and programmes (UNDRR, 2023[6]). Such an approach considers the whole of the economy and integrates needs and solutions for each sector. Therefore, robust co-ordination underpins a successful holistic approach. Weak co-ordination also hampers quick and effective responses in times of emergency. Clarification of the roles of each agency involved in disaster management is important for effective co-ordination (UNISDR, 2015[7]). In addition, approaches to disaster risk management should ideally be interdisciplinary. Disasters often have a widespread impact on myriad systems and environments, so individual disciplines are unable to address all risks and problems caused by natural disasters (Ingham et al., 2012[8]; National Research Council, U.S. Committee on Disaster Research in the Social Sciences: Future Challenges and Opportunities, and U.S. Division on Earth and Life Studies National Research Council, 2006[9]; Peek and Guikema, 2021[10])

Disasters and development process are closely interlinked and a more thorough incorporation of disaster risk considerations into development policies and strategies would lead to improved disaster-resilient development (Molnar-Tanaka, forthcoming[11]). The Hyogo Framework – which represents a paradigm shift from prevention to resilience – is reinforced in the Sendai Framework. At the 43rd ASEAN summit, held in Jakarta in September 2023, the ASEAN member countries reaffirmed the need for commitment to support and accelerate implementation of the Sendai Framework for Disaster Risk Reduction (SFDRR), and also emphasised commitment towards enhancing disaster resilience in the region through effective implementation of the ASEAN Agreement on Disaster Management and Emergency Response (AADMER). The ASEAN Leader's Declaration on Sustainable Resilience focuses on enhancing regional collaboration and partnership for climate and disaster resilience. The declaration, which sets 12 goals, emphasises strengthening partnerships, sharing knowledge and information, and building capacity to address sustainable resilience challenges. The declaration also calls for improving disaster risk governance, refining early warning and dissemination systems, and financial resilience through risk financing and insurance. It advocates leveraging science, technology and innovation; ensuring inclusive resilience practices; and supporting local communities by integrating global commitments into a harmonised approach.

This paradigm shift recognises the interplay between disaster risk and development, highlighting how poor development practices can exacerbate vulnerability and lead to significant development setbacks. Comprehensive risk assessment and management, and strategic development of a holistic policy approach towards disaster-resilient development is required.

The policy areas on which this chapter builds its holistic approach are:

- improving governance and institutional capacity
- ensuring an adequate budget for coping with disasters
- broadening disaster risk financing options
- investing in disaster-resilient infrastructure
- establishing comprehensive land-use planning
- developing disaster-related technology
- strengthening disaster risk reduction education
- improving health responses to disasters
- facilitating the role of the private sector.

## Transforming governance and improving institutional capacity amid rising disaster risks

Understanding disaster risk management in Emerging Asia requires analysis of the region's institutions and co-ordination networks. Current implementation frameworks and governance choices signal misalignment of intent and actions on the ground. Weak disaster risk reduction strategies persist in many parts of Emerging Asia, translating directly into more severe loss of lives and livelihoods, massive economic losses, and a worsening of health and social systems when disasters strike.

This section focuses on the question of how countries in Emerging Asia can adopt or transform institutions and governance systems to cope with the increasing risk posed by disasters. The governance structure for addressing disasters requires integrating complex causal structures and dynamic institutional transformation. New processes and rapidly evolving actions are also required in disaster risk management to enhance community engagement and transformative change.

### *Institutional challenges inhibit progress towards proactive disaster risk reduction implementation*

Institutional and governance challenges present barriers to disaster risk reduction implementation. Multilayered bureaucracies and fragmented national policies impede a unified, co-ordinated approach to disaster risk management in both pre-disaster (ex-ante) and post-disaster (ex-post) response. They defy efforts to delineate boundaries, identify causes or map the consequences of decisions, leading to a situation that is difficult to manage through normal means.

At the same time, disaster risk management should aim to be proactive, although most national and local governments in Emerging Asia tend to take a reactive approach. This can be attributed to factors including complex governance structures and co-ordination issues across sectors and national and local entities; lack of an updated legal framework for disaster risk management implementation; administrative constraints in ensuring that disaster risk management funding cascades down to local governments; lack of public awareness and technical capacity; and lack of well-integrated feedback mechanisms.

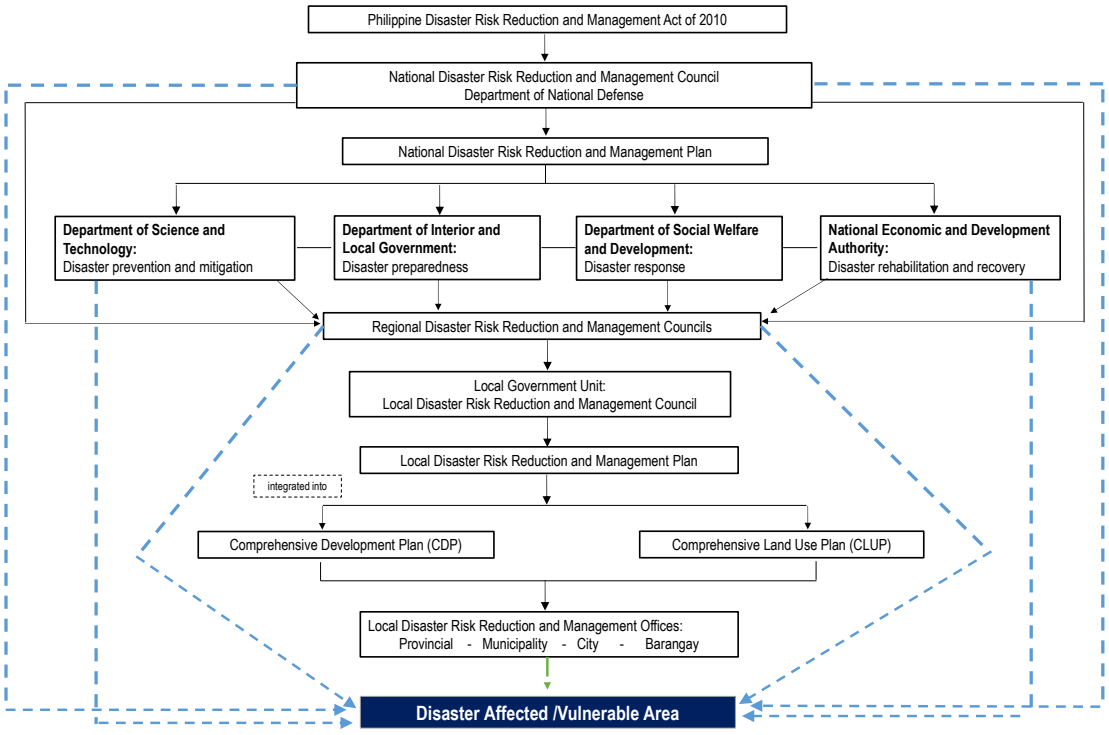
Many governments in Emerging Asia have not implemented disaster risk reduction policies fully. Factors that contribute to such protracted progress include institutional traps and capability traps. Institutional traps are self-reinforcing processes that keep the key institutions implementing disaster management in a configuration likely to undermine the potential of a society to cope with the impact of natural disasters (Lebel and Lebel, 2017[12]). Capability traps involve persistent stagnation of administrative capability, which constitutes a major constraint to disaster management progress (Pritchett, Woolcock and Andrews, 2010[13]).

### *Local systems well-aligned with well-functioning national systems are critical for disaster risk management*

In Emerging Asia, disaster risk management systems usually feature a high-level governing body authorised to design and implement policy and lead co-ordination. This body is responsible for formulating frameworks, strategies and action plans at the national level. However, well-aligned national government and sectoral ministries could facilitate local authorities and communities taking a critical role in disaster preparedness and response, while ensuring that their needs are met. Such a delegation of authority is intended to address challenges such as geographic diversity, differences in local knowledge and expertise, and layers of bureaucracy. This approach applies to many countries in Emerging Asia, where disaster risk management governance systems often possess a combination of centralised and decentralised elements. For instance, the Philippines' National Disaster Risk Reduction and Management Framework (NDRRMF) follows a two-pronged approach where authority is vested in sectoral agencies of the national government

as well as multiple sub-national governments. Both aspects of the Framework are expected to converge at the regional level, wherein regional development plans are well-aligned with the national sectoral plans, and integrated into the activities at the provincial, municipal, city, and barangay level (Figure 2.3).

## Figure 2.3. The Philippines' Implementation Framework for Disaster Risk Reduction and Management




Source: Authors, based on national sources.

A decentralised disaster risk management system, however, presents implementation challenges due to the institutional weaknesses of many countries in the region. The challenges include co-ordination issues, fragmented disaster response, weak capacity and skills, ambiguous legal frameworks and disparities in resources between regions. Decentralised systems can also raise accountability issues and suffer from authoritative ambiguity due to the multilayered dispersion of power. For instance, in the Thai disaster risk management institutional framework, the proper assessment of the severity of a flood is critical to avoid ambiguity in authority and ensure appropriate response measures. During the severe floods in 2011, national and local roles and responsibilities became unclear and ambiguous under the emergency and disaster mechanism. At the provincial and local level, there was lack of co-ordination on flood prevention and management planning across administrative areas (GFDRR/World Bank/UN, 2011[14]).

Inefficiencies in resource allocation often occur, stemming from unclear legal and administrative processes and diverging priorities between national and local governments. Many countries in Emerging Asia face inadequate resources and capacity to support programmes, projects and activities on disaster risk reduction. This has contributed to the predominance of reactive disaster risk management in the region. The potential magnitude of economic losses due to disasters has not translated into budgetary policies that support the strengthening of disaster management initiatives.

### *Ambiguous laws and regulations and misalignment of goals at different government levels weaken disaster risk reduction implementation*

Many countries in Emerging Asia face legal challenges that impede the effectiveness of disaster preparedness, response and recovery. In most countries of the region, governing institutions at all levels face fragmented rules, with multiple laws, regulations and policies vesting authority in various departments that govern different aspects of disaster management.

Such laws often give overlapping authority to local government units, which can lead to conflicting interpretations on which authority is the highest. A lack of clarity on roles, responsibilities, lines of command and co-ordination mechanisms contributes to challenges in the response phase. In addition, procedural standards and response guidelines remain weak, and administrative hurdles weaken the development of an effective disaster risk management system.

In addition, the implementation framework (national, sectoral and local) is not able to adapt its policies and measures to the evolving nature of disasters. There is also misalignment in the executive-legislative agenda, which does not reflect the short- and long-term objectives under regional and local planning documents. The Government of India, for example, continues to demonstrate substantial efforts in its transition from a response-based paradigm to an anticipative, prevention-based approach. This requires a deeper assessment of the dynamics of disasters, institutions, policies, and localities. The institutional structure proposed in law should be understood based on the political and bureaucratic contexts of the central and state governments.

In some countries, political cycles and short-term priorities drive decision making in the approval of projects, programmes and budget allocation at the local level. A higher priority tends to be given to projects with immediate, visible benefits, such as cash donations and other in-kind handouts to communities during disaster relief efforts. This results from the absence of political will to invest in long-term, less-visible disaster risk reduction measures. It leads to a cycle that prioritises reactive measures. Moreover, priorities in disaster risk management often diverge between national governments with broader, longer-term objectives, on the one hand, and local institutions with more localised concerns on the other. This leads to conflict and a lack of alignment in disaster preparedness and response efforts.

The factors that affect the operationalisation of disaster risk management at the local level can be classified into three groups: i) institutional factors, such as the autonomy of local bodies, institutional cohesion, organisational co-operation and collaborative arrangements; ii) information factors, or knowledge, awareness and the availability of reliable information; and iii) resource factors, or the availability of financing and human resources (Cuevas, 2017[15]). At the institutional level, local authorities are often confronted with ambiguous and disjointed laws and regulations that do not account for the limited capacity and needs of localities on the ground. This can lead to disconnected, overlapping and ambiguous communication among institutions involved in disaster management and ignorance of established disaster action plans.

### *More thorough monitoring and evaluation of the impact of disaster risk management is necessary*

Well-developed monitoring and evaluation (M&E) systems are crucial to ensuring that disaster risk management efforts are effective, efficient and accountable. Through M&E, governments are able to gather accurate data to make informed decisions, allocate resources wisely and prioritise timely programmes. M&E systems can help governments to streamline accountability for disaster risk management outcomes. They provide transparency in tracking progress and ensure that resources are used effectively and efficiently. To ensure effective and efficient resource allocation, comprehensive cost-benefit analysis – which includes full economic appraisals rather than only financial appraisals – is necessary. M&E systems are also able to identify and address issues and gaps in disaster preparedness

and in response and recovery plans. This contributes to strengthening the overall disaster risk management strategy.

Efforts to develop M&E systems for disaster risk management in Emerging Asia have not been comprehensive and face common issues, such as data deficiency, resource constraints, capacity gaps and weak political will. A main challenge in setting up M&E is the limited availability of disaster risk data, especially from the subnational level. Fragmentation and limitations of data across all components of disaster risk reduction and management hamper not just measurement and evaluation of the impact and outcomes of disasters, but also disaster-related research. Another challenge is that scarce financial and technical resources, which limit disaster risk management implementation, can make M&E development a low-priority issue. A robust M&E system across countries in Emerging Asia is essential in order put in place: i) the prioritisation of outcomes, projects and activities; ii) clear delineation of roles and responsibilities among mandated agencies and local governments for accountability; and iii) appropriate, clear and identified funding sources for each of the priority outcomes.

## *Policies for improving governance and institutional capacity*

As discussed above, disaster risk management in most countries in Emerging Asia poses a complex and multifaceted challenge that requires that the institutional framework at the national level be able to match the needs and capability of sectoral, regional and local units. This section discusses a set of policies for improving governance and institutional capacity in Emerging Asia.

### *Develop robust risk assessment*

Governments need a well-developed risk assessment mechanism. Comprehensive risk assessment should be made an obligatory step in the formulation of disaster risk management policies and measures. Decisions on ex-ante investments should be carried out only after a rigorous risk assessment. In particular, the assessment should be able to account for the evolving nature of disasters, which are expected to become increasingly systemic and complex, and should be matched with a highly dynamic institutional and governance mechanism. Risk assessment should include the cumulation of technical knowledge covering all disciplines that are vulnerable to disasters, including economic, environmental, social and cultural dynamics. Robust risk assessment is dependent on establishing accurate and up-to-date data on disasters, risks and vulnerability assessments.

### *Prioritise sustained ex-ante investments in disaster risk reduction*

An effective disaster management strategy relies heavily on pre-disaster planning and preparedness in order to mitigate the impact of disasters. Ex-ante planning ensures that response efforts can be initiated promptly when a disaster occurs. Both national and local governments across major countries in the region struggle to implement activities due to a lack of financial resources, which stems from legal and administrative constraints and competing demands for financing in other areas. It is important to increase flexibility in budget allocation and support disbursement of funds from the national or central government to local authorities. Meanwhile, local government units should promote the transparency and accountability of their disaster risk management budgets to ensure that the funds are allocated and used effectively. Community involvement is also crucial in pre-disaster planning and preparedness. Local input and participation in budget decisions is important to help ensure the integration of needs and priorities down to the community level.

At the regional level, the ASEAN intensified its commitment to support the implementation of the ASEAN Framework on Anticipatory Action in Disaster Management. The ASEAN Ministerial Meeting on Disaster Management adopted the Halong Statement, which aims to further strengthen key areas of disaster risk management across all ASEN member states by i) improving risk information, forecasting and early

warning systems at the regional and national levels; ii) enhancing planning, operations, and delivery of anticipatory actions; and iii) promoting pre-arranged finance to support successful anticipatory actions. It is also important to advocate for increased support and flexibility in the budget allocation and disbursement of funds from the national or central government to local authorities for disaster risk management activities.

#### *Develop a capacity-building programme for all levels of government*

Capacity building is vital in both the ex-ante and ex-post phases of disaster management. Capacity development will make local communities aware of their vulnerabilities and contribute to increasing their involvement in local planning, preparedness and emergency response. Capacity-building programmes should cover all aspects of disaster management. They should include training on the relevant disaster risk management regulations, guidelines and procedures so that all government units have the institutional knowledge to effectively carry out their functions and roles. The development of technical skills is critical for governments and agencies to develop comprehensive risk assessments and build emergency response strategies that are tailored to the specific context. Training modules for all stakeholders should be dynamic, incorporating lessons learned from past disasters and analysing the successes and failures of disaster management vis-à-vis recent disasters.

#### *Review and update disaster management laws and regulations*

With more frequent disasters and extreme climatic events, Emerging Asia is facing profound changes in the disaster risk landscape. Factors such as increasing urbanisation and population growth are expected to exacerbate the systemic risks posed by disasters. In order to mitigate and respond effectively to the evolving risks, countries need to adapt their disaster management laws and regulations. In this context, clarity in disaster risk management governance structure and co-ordination mechanisms is crucial. Laws and regulations should be reviewed and continuously refined to ensure that national agencies, implementing units and local governments can discern their roles and responsibilities, and avoid ambiguity and overlapping functions. Reviewing disaster management laws, regulations and guidelines for update offers the opportunity to incorporate lessons learned from post-disaster evaluations. By periodically reassessing institutional frameworks, countries can identify gaps and impediments, and strengthen disaster resilience and response. Finally, advances in technology need to be incorporated in disaster management operationalisation. New ways of carrying out data collection, analysis and risk assessment will be vital to forming appropriate policies and measures. The role of social media should be maximised to ensure quick dissemination of information, community awareness and participation, co-ordination of emergency response efforts and timely updates for affected communities.

## Ensuring adequate budgets for coping with disasters

A significant roadblock to disaster preparedness and recovery in Emerging Asian countries is lack of funding. Budgets for both disaster preparedness and disaster response and recovery are below what is needed to put the region on track for sustainable, long-term readiness for natural disasters (UN.ESCAP, 2023[16]). Governments can take various steps to strengthen their budgets for disaster risk management. This section discusses a set of policies for preparing disaster management budgets in Emerging Asia.

### *Increase the availability of funds for ex-ante disaster risk reduction measures*

Ex-ante measures can contribute to overall sustainable development, and can tackle issues of disaster preparedness and climate change at the same time (UN, 2015[17]). Given the high effectiveness of ex-ante measures, increasing budgetary provisions for them is an important policy objective.

However, in the immediate aftermath of a disaster, there is often strong political support within the international community for offering aid to affected countries, mobilising resources that would otherwise not have been available (Wisner and Gaillard, 2009[18]). Large international transfers are thus tied up in urgent but less efficient response and recovery measures and not available for preparedness measures. As a result, only approximately 7.4% of the financial needs for disaster adaptation are currently covered Southeast Asia (UN.ESCAP, 2023[16]).

Governments could create separate budgets for ex-ante and ex-post measures within funding structures in order to ensure that funds for ex-ante measures do not have to compete with post-disaster needs (Villacin, 2017[19]). This can help to ensure a dependable budget for long-term preparedness that can reduce the burden borne by ex-post funds. A model for such separation of funds can be found in Mexico's former FONDEN Fund, which contained two separate pillars for expenditures: one for prevention and mitigation, and one for reconstruction. The Philippines government has taken the first step in this direction by reserving 30% of its main disaster funds for post-disaster activities, with the remaining 70% earmarked to finance ex-ante measures, although this is often not respected by local governments (Domingo and Manejar, 2021[20]). A clearer separation of funds will be needed to ensure that ex-ante objectives are met.

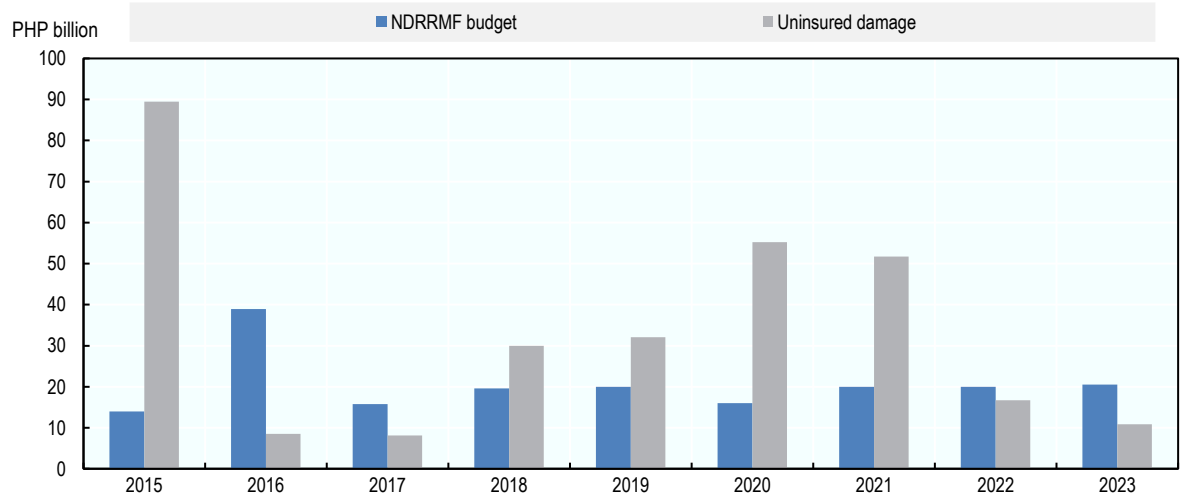
Governments can incentivise the uptake of disaster resilience measures by tying higher reimbursement rates for property damage to risk reduction measures (Brucal et al., 2020[21]). Better conditions can be given to properties with ex-ante risk reduction measures in place or to those where such measures are part of the reconstruction plan (OECD/The World Bank, 2019[22]). Such incentives need to be accompanied by an effective communication strategy in order to raise awareness among businesses and households of the risks they face and their responsibilities in ensuring disaster resilience.

### *Fortify local government disaster budgets*

Centralised co-ordination is beneficial for dealing with large-scale disasters but leaves little room for local decision making and for the integration of local capacities and expertise (Gaillard and Mercer, 2012[23]). Local governments have limited fiscal autonomy, relying on central government transfers for a large share of their disaster risk management budgets. This limits the ability of local governments to plan and implement timely and appropriate activities. Policy makers should aim to find the right decision-making balance between central and local governments so that a unified and efficient framework for disaster response can be centrally provided while still adapted to local needs. When tasks and responsibilities are devolved to local governments, adequate fiscal resources must be devolved as well to avoid overburdening the local budget (Domingo and Manejar, 2021[20]).

A lack of local capacity forces local governments in many countries into an unsustainable reliance on outside aid, both financially, and in terms of human capital. The volatile flow of knowledge into and out of disaster-prone areas undermines efforts to integrate local knowledge into disaster management. The effectiveness of nationally dispatched rescue teams can be severely hindered by their lack of familiarity with local areas, especially when there is a lack of local personnel with whom to co-ordinate (UNDRR, 2014[24]).

## Figure 2.4. Philippines national disaster budget and uninsured natural disaster damage, 2015-23




Source: Philippine Department of Budget and Management: National Disaster Risk Reduction and Management Fund (https://www.dbm.gov.ph/), and EM-DAT database (https://public.emdat.be/data).

StatLink https://stat.link/cel7k5

In Thailand, for example, local government units have primary responsibility for responses to disaster events. However, local budgets are financed exclusively by local taxes and thus often limited in volume, preventing local government agents from developing the expertise in water management required to conduct effective flood-prevention programmes (UNDRR, 2020[25]). In Indonesia, where regional disaster management agencies are the first responders to natural disasters, human resources in those agencies could be subject to erosion by frequent staff rotation in government posts (Srikandini, Hilhorst and Voorst, 2018[26]).

In the Philippines, local governments are mandated to be the first to respond to disasters and to reserve 5% of their projected regular revenue for their local disaster funds. Between 2009 and 2016, the average disaster affected person in the Philippines has suffered approximately USD 161.40 in direct economic damage per capita compared to USD 19.36 per capita available in public funding (Brucal et al., 2020[21]). The National Disaster Risk Reduction and Management Fund has been too small to cover uninsured damage caused by disasters in some years, particularly those of heavy typhoon seasons (e.g. 2015, 2020 and 2021) (Figure 2.4). Furthermore, even when the amount of the fund would otherwise be sufficient, restrictions on the purposes for which the fund may be used can lead to the funds being inaccessible to authorities in charge of disaster recovery. For example, the Vietnamese Disaster Prevention and Control (DPC) Law narrowly describes the use-cases for the national disaster fund, including mostly disaster response measures and complicating its use for most ex-ante measures (World Bank Group, 2018[27]).

Several measures to increase the availability of disaster budgets to local governments should be considered. For instance, countries may consider tying them directly to fiscal income at the respective level (Villacin, 2017[19]). Interregional fund sharing can be implemented by allowing local governments to share their disaster budgets with disaster-affected neighbouring governments. Such sharing is allowed in the Philippines if the receiving locality is in a state of calamity, but it has taken place infrequently and regional disparities in disaster budgets have persisted (Domingo and Manejar, 2021[20]).

Unexpended funds at the end of a fiscal year can be accumulated in trust funds and invested in insurance or disaster-related capital market instruments to improve the capacity to respond to large-scale disasters in the ensuing fiscal periods.

## Broadening disaster risk financing options

### *Formulating a grand design is essential for effective disaster risk financing*

Effective disaster risk financing requires formulating a grand design that covers the entirety of the economy. Coherent strategies for building financial resilience to disasters involve an integrated approach to managing disaster risk across all levels of government.

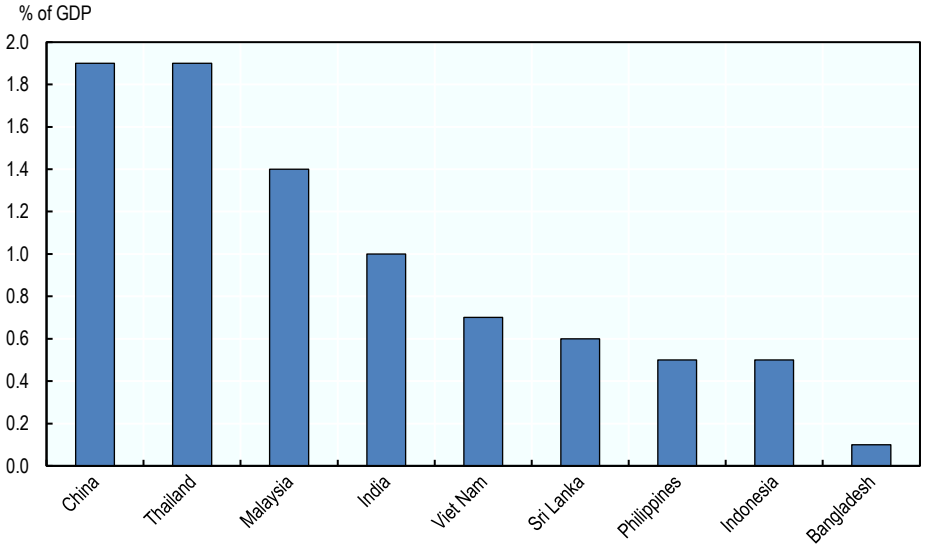
The financial aspect of such a grand design has two main pillars: a risk-pooling function and a risk-transfer function. Pooling risk, typically in the form of insurance, improves resilience. These pools can act as insurance carriers that provide insurance unavailable through the private sector or as reinsurers that fortify the risk-bearing capacity of primary insurers. National schemes have been used effectively both in OECD countries and in emerging markets. Examples include the National Flood Insurance Program in the United States and Türkiye's Catastrophe Insurance Pool. However, governments should also foster private insurance markets so that private insurers cover most disaster losses incurred by households and firms. Risk transfer is another strategy for increasing disaster resilience. This process typically takes place through market-based solutions such as insurance-linked securities (ILS) or catastrophe (CAT) bonds. Risk transfer should be an integral pillar of any grand design. CAT bonds in particular should be included in an optimal sovereign risk management strategy for any country facing high exposure to disasters.

### *Improving access to disaster insurance is crucial*

Many Emerging Asian countries exhibit low insurance penetration rates, with a relatively small percentage of GDP allocated to insurance premiums (Figure 2.5).

### Figure 2.5. Insurance penetration in selected Asian countries, 2021

Premiums as % of GDP




Source: (Swiss Re, 2022[28]), *World insurance: Inflation risks front and centre*.

StatLink https://stat.link/dpv89a

Facilitating access to disaster insurance and ensuring their widespread delivery to at-risk populations is a crucial issue. Two approaches have been commonly employed to encourage adoption: premium subsidies and compulsory bundled insurance. However, both approaches include substantial administrative costs incurred by insurers and in particular, compulsory bundled insurance adds to the administrative responsibilities of insurance providers, as they must manage both the insurance aspect and the financial product, increasing operational costs (Shynkarenko et al., 2022[29]).

Simplifying disaster insurance and making it more accessible could increase penetration among households or firms with lower financial literacy. Insurance companies should be incentivised to create user-friendly and transparent insurance products that can lead to improved access for potential customers. Digitalisation has the potential to bridge insurance protection gaps by enhancing the precision of underwriting, risk mitigation and risk assessment, increasing the accessibility and affordability of insurance. Integrating digital strategies into disaster insurance can better align the offerings with consumer demand, while removing burdens from traditional approaches that will be useful in areas of weaker internet connectivity or digital literacy.

### *Designing a disaster risk insurance programme involves setting appropriate premiums*

Disaster risk insurance programmes can be distinguished based on the type of coverage offered, the range of perils and policyholders covered, and the premium pricing structure applied within the programme. These elements can yield distinct effects in terms of overcoming the challenges of insurability, increasing the accessibility of affordable disaster risk insurance, promoting risk reduction and protecting public finances.

Premium pricing structures vary. One common type can involve a fixed cost based on sum insured, disregarding property location or construction features. Another approach employs simplified premium structures that account for broader risk characteristics, such as property location and construction type. This is typical of the earthquake and volcanic eruption reinsurance programme in Japan, the disaster insurance programmes provided in several cantons in Switzerland, the earthquake insurance programme in Türkiye and the National Flood Insurance Program (NFIP) in the United States. Some programmes implement fully risk-based premiums, factoring in property location, characteristics of construction and other underwriting aspects, such as the earthquake insurance programme in California and the hurricane reinsurance programme in Florida.

In the case where all policyholders share the same level of risk, the premium rate would be identical for each one. This uniform premium rate approach is observed in several countries, including New Zealand and Indonesia (JICA, 2021[30]). In practice, however, variations in the anticipated loss usually arise due to differences in the insured facility's location and its susceptibility to risks. When such variations exist, employing a uniform premium rate leads to mismatches between expected losses and the actual premiums paid by individual policyholders, with the policyholders at lower risk cross-subsidising those at higher risk.

In contrast, risk-based premiums adhere to a fundamental principle of ensuring fairness among policyholders, a core necessity for an insurance system. As technologies for assessing and anticipating localised risks become more accessible, insurers are increasingly adopting personalised risk-assessment and pricing strategies (Lucas and Booth, 2020[31]). In a perfect market, risk-based insurance products would inform both the market and households about the cost of risk management. As a result, consumers would react to price signals by making their properties more resilient to disasters, consequently driving down the cost of coverage (Aakre et al., 2010[32]). However, issues may arise if the implementation of risk-based premiums by private insurers results in scenarios where they opt not to provide insurance to specific households (McAneney et al., 2016[33]), or if premiums rise to unaffordable levels for low-income households residing in high-risk zones (Penning-Rowsell and Pardoe, 2015[34]). The most vulnerable populations may then have limited access to insurance coverage, leading to clusters of uninsured properties in high-risk areas (Gearing, 2018[35]).

### *Government support for disaster insurance presents a varied landscape in ASEAN*

In economies with underdeveloped insurance markets, insurance products might be unavailable or unaffordable because disaster risk is challenging or even impossible to insure due to the anticipated frequency and severity of such events. A study conducted on insurance schemes across the European Union (EU) Member States highlights that high insurance penetration rates are linked to the government's direct participation in insurance programmes, whereas countries with low insurance penetration rates often lack direct governmental involvement in their insurance programmes (Paleari, 2019[36]).

To address insufficient market-based insurance and make risk transfer mechanisms more accessible and affordable, governments often take on the role of primary insurer. When the government assumes this role, it directly bears liability for losses without the private insurance sector sharing the losses. As governments possess the ability to access funds at the lowest cost, they can offer the most cost-effective disaster risk insurance. However, government insurance programmes might face significant challenges related to moral hazard, a condition whereby people are reluctant guard against risk when protected from its consequences, raising the cost of providing protection.

Subsidies are another measure taken by governments to render insurance products more affordable. Subsidies can mitigate the financial barriers that hinder individuals or businesses from obtaining necessary coverage. A direct premium subsidy is the most basic type of subsidy, as it immediately lowers the policyholder's financial obligation. While recognising the pressing need to ensure that low-income households are financially protected against disasters, governments in developing economies often struggle with the financial burden associated with providing subsidies (Reyes et al., 2017[37]). Striking the right balance between alleviating short-term welfare concerns for the low-income population and promoting long-term economic growth opportunities demands a targeted approach to subsidies. Comprehensive consideration of subsidy programmes is required to ensure that they are both cost effective and targeted towards those who need them the most. However, subsidies alone may not stimulate insurance penetration as much as desired, even if policies become affordable. In Viet Nam, for instance, uptake of insurance among farmers is low, as income and willingness to pay are uncorrelated. Factors such as behavioural traits, social networks and other traditional risk management practices may also suppress demand for insurance.

Governments may enter public-private partnerships (PPPs) that incorporate advantages of both private and public insurance systems. Indeed, PPPs are a common method for governments to work with private companies to deliver public services with the goal of improving quality and offering greater value for cost (Auzzir, Haigh and Amaratunga, 2014[38]). In a PPP, the government assumes multiple obligations, such as acting as a guarantor, subsidising premiums and providing reinsurance.

Altun and Güldiken (2019[39]) highlight that PPPs offer remedies for market failures and behavioural biases relating to disaster insurance. For instance, government guarantees that facilitate extreme risk coverage can expand penetration of mandatory insurance programmes. Furthermore, insurance companies may be able to set reasonable premiums in a competitive system driven by PPPs (Ma and Jiang, 2017[40]). In recent years, several OECD countries, for instance, Hungary in 2003, Belgium in 2007, have implemented PPPs due to concerns about maintaining the affordability and financial viability of insurance amid increasing expected losses (Paleari, 2019[36]). The role of government is important in initiating and fostering such collaboration in a PPP model. Beyond improved weather monitoring infrastructure and reporting mechanisms, insurers in the region seek government support in providing accurate data that is easily available and useful (MicroSave Consulting et al., 2022[41]). In parallel, insurance companies can develop products that accurately reflect the potential risks associated with a specific region as they are equipped with actuarial expertise and risk assessment capabilities.

### *The region faces challenges in developing the private insurance market*

In 2021, for instance, out of USD 250 billion in total natural disaster losses globally, 58% were uninsured (Swiss Re, 2023[42]). Barriers hindering insurers from offering pure private disaster insurance solutions exist on both sides of the market. On the supply side, major obstacles can include insufficient capital and limited reinsurance capacity; the degree of freedom to manage the underwriting process; and data availability (Dlugolecki and Hoekstra, 2006[43]). Demand side barriers can include perception of risk among consumers; consumers' trust in insurance providers; price, availability and scale of public disaster relief; and claim payment efficiency. Regarding risk perception, individuals often exhibit limited awareness concerning their risk exposure, especially in the case of events characterised by low frequency but severe impact. This lack of awareness or understanding undermines the demand for adequate insurance coverage tailored to these risks, leading to market inefficiencies and gaps in coverage. If premiums are too high, consumers may be reluctant to purchase insurance due to the perceived unaffordability or lack of value in the insurance offered, leaving individuals and assets inadequately protected. Fast and efficient claim settlement is essential to encourage consumers and improve their confidence in purchasing insurance products. Failure to meet expectations when claim settlements lack efficiency or timeliness can deter consumers from investing in disaster insurance, contributing to potential market failure in the disaster insurance sector.

Countries with a long history of insurance and high insurance penetration rates are typically those that have left the development of disaster risk insurance markets to market-driven mechanisms and have seen some success in doing so (Blazhevski, 2019[44]). This success often reflects a long-standing culture of insurance adoption and a robust regulatory environment that enables market mechanisms to operate efficiently. According to a study conducted by Feyen et al. (2011[45]), the development of the non-life insurance sector can be associated with private ownership of the industry, a strong legal framework and developed credit markets. This is in line with Kwon (2011[46]), suggesting that privatisation, deregulation and liberalisation alone would not suffice for the insurance market to grow. Such growth requires a comprehensive legal framework within the country that outlines market accessibility and the extent of insurers' operation. This regulatory framework should encompass aspects related to risk management and the diversification of investment portfolios, while also promoting fair competition within the market (Kwon, 2011[46]).

In a market characterised by deregulation, consolidation and reduced government ownership, the relaxation of underwriting constraints and premium regulations has created a growing opportunity for insurance companies to adopt a more commercially oriented and strategically focused approach. In countries such as China, India, Malaysia and Thailand, market deregulation and liberalisation have lowered the barriers for international insurers and fostered a more market-based system (Hussels et al., 2007[47]).

Despite these successes, limited openness to international markets can hamper private insurance market development in ASEAN. Under 2016 legislation in Indonesia, for instance, insurers seeking reinsurance coverage must first approach domestic Indonesian reinsurers before transferring premiums to offshore reinsurers. For Indonesian consumers, this mandatory local cession may be harmful since it limits their access to the global expertise and cutting-edge reinsurance solutions that foreign reinsurers may provide. Moreover, restrictions on offshore reinsurance can enhance localised risk concentration and have a detrimental impact on the economy, especially after the occurrence of a disaster since the local reinsurance industry may not be able to supply the capital needed to support economic recovery. The insurance industry's heightened vulnerability over time may lead to macroeconomic weakness and financial instability.

Limited foreign ownership could also hinder local market development, while full ownership may ensure a more open and competitive market environment. This results in quality and long-term investments in local insurance markets, boosting employment, expanding coverage and strengthening domestic capital markets. Foreign investors can bring expertise, which will eventually develop local talent through

knowledge transfers and sharing of best practices. Absorbing foreign expertise, using talent pools established by multinational corporations, and fusing them with local networks and customer bases, can help to develop domestic insurers, contributing to the overall improvement of the local industry. As the market becomes more competitive, there is greater incentive for local insurers to innovate and improve their services. As a result, more open markets typically experience faster growth (EU-ABC, 2016[48]).

Legal and regulatory frameworks that govern claims management represent additional key elements in the development of a private disaster insurance market. Regulators are generally responsible for two primary functions: protecting consumers against potential misconduct throughout the development and distribution of insurance products; and protecting insurance companies from the potential financial risk associated with offering coverage for events that may incur highly correlated losses (Hellmuth et al., 2009[49]). For instance, the European Union has been implementing a common framework that governs insurance companies' capacity to meet their liabilities since the 1970s. This framework has undergone significant changes over time, including the introduction of newer directives such as the Solvency II Directive, which standardises insurance regulations across the European Union and provides guidelines related to margin requirements to mitigate insolvency risks (Mysiak and Pérez-Blanco, 2016[50]). In addition to solvency and risk management regulations, the fundamental elements of an insurance regulatory framework typically include corporate governance regulations, reinsurance regulations, intermediary regulations and authorising laws, such as licensing (Le Quesne et al., 2017[51]).

### *Training and education can help to close the insurance gap*

Insurance penetration can be positively associated with financial literacy and risk exposure awareness. However, explaining insurance products to individuals with limited literacy and little engagement in formal financial markets can be challenging. The uptake of insurance can be stimulated by raising awareness of available financial protection options and the necessity of financial strategies to mitigate disaster risks. While many countries have introduced initiatives to promote disaster preparedness, few focus on addressing the financial impacts of disasters and the need for being financially prepared, despite the benefits of doing so (OECD, 2015[52]). Adding a financial component to public disaster preparedness messaging, and offering appropriate training for households and firms, should be an urgent policy priority.

An example is China, where the government, insurance regulatory agencies and private insurance companies actively participate in disaster advocacy initiatives through public service announcements, discussions and product promotions. These efforts promote disaster risk financing tools for individuals while encouraging other disaster loss prevention activities. Improving insurance awareness and insurance literacy in the region will be accomplished through PPPs.

### *Community-based approaches can be used in disaster risk financing*

People in Emerging Asia rely on both formal and informal mechanisms to meet their insurance needs. In many cases, people prefer to rely on their social networks (family, friends and community), turning to government programmes as a last resort. However, those who lack strong social networks prior to a disaster risk being left out of such informal systems. Informal insurance systems also tend to fail when a disaster affects an entire region, as there are too few unaffected persons to participate.

Microfinance programmes offer an example of financial solutions based on community enforcement and may act as a form of insurance for those unable to access traditional markets. However, the flexibility offered by microfinance programmes may come at the cost of high interest rates. They must thus be properly structured to remain accessible amid post-disaster financial challenges.

In addition to microfinance, agriculture insurance can help to protect farmers from the financial impacts of disasters. Such programmes have been scaled up in Indonesia, the Philippines and Thailand via government support in the form of subsidies. In Cambodia, Myanmar and Viet Nam, agricultural insurance

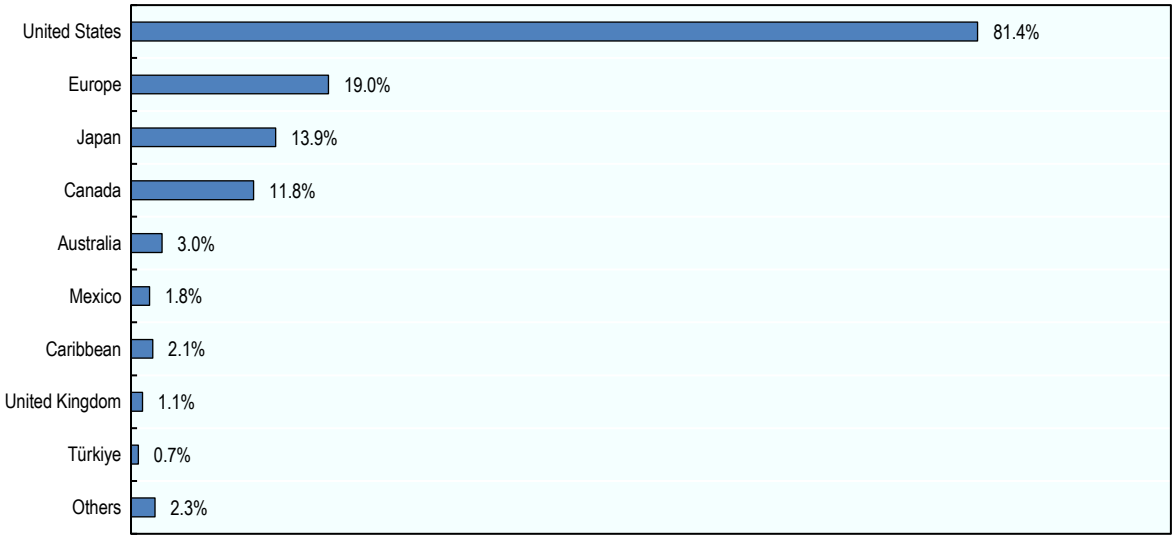
is in the pilot phase, and Lao PDR and Malaysia are developing adequate institutional, legislative and regulatory frameworks, and operating models. For large-scale farmers, insurers can offer financial protection as the premium is adequate to cover the costs of pre-acceptance risk inspections, mid-season monitoring inspections and end-of-season crop yield assessment (GIZ, 2022[53]). For subsistence farmers, implementing and assessing losses can be costly and difficult.

### *Catastrophe bonds offer an alternative means of disaster risk finance*

Catastrophe bonds provide an alternative to traditional sources as part of a country's disaster risk financing menu. CAT bonds securitise disaster risk and transfer it through capital markets. They are attractive to institutional investors due to their low correlation with other financial market movements. The CAT bond market has grown steadily since the 1990s, though growth has been heavily concentrated in the United States and Europe (Figure 2.6). Most countries in ASEAN require better regulatory frameworks for CAT bonds to reach their full potential.

## Figure 2.6. Geographical coverage of CAT bonds issued in 1996-2022

% of total issuance




Note: Only 144A CAT bonds or similar issued from 1996-2022 were included in the figure. Others include to Chile, China, Cyprus, Colombia, El Salvador, Guatemala, Israel, New Zealand, Peru, Philippines and Chinese Taipei. Some numbers in the figure involve multiple counting. It applies to a CAT bond transaction that covers multiple countries or regions.
Source: Artemis (n.d.[54]), *Catastrophe Bond & Insurance-linked Securities Deal Directory* (database), www.artemis.bm/deal-directory/.

StatLink https://stat.link/0wc7xk

### Box 2.1. CAT bond markets are growing in OECD countries

CAT bond markets have experienced significant growth in advanced economies, led by the active participation of the private sector, especially the insurance and reinsurance industries. The cases of successful CAT bond influence in United States, Japan, Australia, and New Zealand and they are indicative of the potential a mature CAT bond market is able to reach.

CAT bond markets arose out of the aftermath of Hurricane Andrew in 1992 (USD 15 billion in insurance losses). CAT bond sponsors in the **United States** are typically either insurance companies, reinsurers, or state catastrophe funds. The California Earthquake Authority (CEA) formed out the need to bolster resilience against a particular type of disaster to which California is highly prone. Just as in Florida after Hurricane Andrew, private insurers grew concerned about participating in the market after the 1994 Northridge Earthquake in California (USD 12.5 billion in insurance losses); state laws mandating disaster insurance coverage as part of standard property insurance led to insurers exiting the market and the state funds were formed to entice them back. The CEA entered the market in 2001 and has made annual issuances since 2014. The Federal Emergency Management Agency (FEMA) entered the market in 2018 to reinsure the National Flood Insurance Program (NFIP) and has made annual issuances of its own ever since.

**Japan**'s first CAT bond transaction occurred in the mid-to-late 1990s when a major insurer sought reinsurance for USD 100 million of earthquake risk over ten years. A special purpose reinsurer was created in the Cayman Islands and payout were determined by earthquake severity and location (i.e. using a parametric trigger). The issuance consisted of two tranches and resulted in oversubscription. Thirty-two institutional investors participated, 16 were either mutuals or banks, while different types of insurers, reinsurers and hedge funds comprised the rest. Since then the Japanese national mutual aid system for agriculture co-operatives has entered the market – a CAT bond issued in 2008 paid out in full after the 2011 Tohoku Earthquake – and it has been joined by other insurers, leading to the Tomoni Re CAT bond issued by two insurers jointly in 2022. The joint issuance attracted investors due to the combination of expertise resources and reputations of each party.

The first CAT bond covering risks in **Australia** was issued in 2006. The issuance by SPV Australis allowed Swiss Re to secure USD 100 million in earthquake and tropical cyclone protection. The bond used a parametric trigger to hasten and simplify potential payouts. The success of this issuance led to another in 2007, but despite these early successes, the CAT bond market in Australia did not begin growth in earnest until 2019. At that time, a large insurer issued a CAT bond that provided AUD 75 million (Australian dollars) in protection against perils common to Australia and New Zealand. The three-year bond represented the first issued by a special purpose reinsurance vehicle (SPRV) domiciled in Singapore. The sponsor chose Singapore as the domicile of the SPRV to reduce transaction costs grant scheme offered by the Monetary Authority of Singapore.

The Earthquake Commission (EQC), a **New Zealand** state-owned residential property disaster insurance entity, issued its first CAT bond in 2023 as a third-tier source of funds, allowing EQC to diversify its funding sources. Issued via a Singapore-domiciled SPRV, the CAT bond offers NZD 225 million (New Zealand dollars) of protection against a variety of perils. The bond has a term of four years and uses a per-occurrence indemnity trigger.

The examples are indicative of the growing demand for reinsurance and the willingness of investors to participate. Their diversity also showcases the high degree of flexibility offered by such instruments.

Source: Authors, based on OECD (2024[55]), *Fostering Catastrophe Bond Markets in Asia and the Pacific*, The Development Dimension.

In order to benefit maximally from CAT bonds, countries need to take the following actions: i) construct a grand design for disaster risk finance; ii) invest in measurement infrastructure and enhance the quality of

their disaster data; iii) develop tailor-made catastrophe risk models; iv) enhance capacity building for finance and insurance officials; v) broaden investor bases; vi) construct CAT bonds; vii) prepare distribution schemes for the funds; and vii) develop local-currency bond markets (OECD, 2024[55]).

Investment in measurement infrastructure should be headed by national meteorological or geological agencies. If such agencies are not in place, it would be beneficial for governments to create them. Use of state-of-the-art measurement tools allows for more precise risk assessment, making CAT bonds better tailored to a country's needs and giving investors increased confidence in participation. These investments could be conceived as part of a larger package of technology investments. Data from the new tools must be stored in accessible databases administered at the national or regional level. Improved data quality will allow for the development of CAT bonds covering more perils or covering perils in a more precise fashion. Major catastrophe risk modellers are currently developing models for perils in the Emerging Asia region. Minimising basis risk is best accomplished through the use of indemnity triggers, but this requires building a national insurance portfolio. Parametric index triggers will help to reduce basis risk.

To use the tools effectively, expertise must be built up. Regular upskilling of policy makers is essential to guide them based on the latest trends and best practices. Training in catastrophe bonds and other insurance-linked securities is offered by private companies, and the fees are often reduced or waived for officials from developing countries. Policy makers should seek to broaden investor bases by encouraging women and people from minority language groups to participate. Doing so would likely require developing targeted training, respecting the different preferences and the need to provide training in local languages (particularly important for countries with large migrant worker populations). Local-currency bond markets must also be developed further. Local-currency bond market growth is facilitated by lower fiscal balances, a deeper banking sector and clear regulations on investment and the tax treatment of financial instruments (including CAT bonds).

## Investing in disaster-resilient infrastructure

Natural hazards wreak havoc on crucial infrastructure systems. Half of the world's disasters occur in Asia and the continent is particularly prone to flooding. Floods in Asia, which account for 70% of all such events globally, cause significant damage to infrastructure, with estimates suggesting that 65% of all flood-related losses are infrastructure related. Asia-Pacific is also among the world's most seismically active regions due to the presence of several tectonic plate boundaries as well as the Pacific Ring of Fire. The region is frequently exposed to earthquakes, which often cause a secondary wave of disasters, such as tsunamis and landslides, that compound damage to infrastructure. Evaluated more than 30 000 transport and energy infrastructure assets in the region found that nearly three-quarters of these assets are highly exposed to earthquakes (ADB, 2022[56]).

### *Earthquake-resistant infrastructure and earthquake-proof buildings*

Seismic events disrupt the critical services provided by vital public and private infrastructure, resulting in severe economic and socio-economic consequences. Governments and private entities therefore need to consider earthquakes in a multi-hazard context and provide a holistic and systematic risk assessment of built infrastructure and future infrastructure investments to reduce the potential impact of disasters (ADB, 2022[56]). Collaboration between the public and private sectors is essential. Public-private partnerships offer benefits such as enhanced expertise and resources, and increased innovation.

The impact of earthquakes on people and property can be managed and mitigated using appropriate earthquake engineering and earthquake-resistant infrastructure design. The collapse of buildings poses the greatest threat to human life in the event of an earthquake. Private and public entities need to collaborate to implement measures that can prevent earthquake damage to buildings, including earthquake

engineering, i.e. the planning, design and construction of new earthquake-resistant buildings; and the repair, strengthening and retrofitting of existing buildings and those damaged by previous earthquakes.

A seismic-resistant design standard for buildings is common practice in most of the world's regions with frequent seismic activity. Some Emerging Asian countries have adopted laws and building codes to improve seismic resistance in buildings, increasing resilience of infrastructure to earthquakes. Indonesia's national standard on seismic design was established in 1983 and is regularly improved and updated. The National Building Code of the Philippines, enacted in 1977, provides a framework of minimum standards and requirements to regulate and control the design, construction and maintenance of all buildings and structures.

### *Landslide-resilient infrastructure: Retaining walls*

Landslides occur frequently in countries with mountainous terrain, such as Indonesia and the Philippines, and in countries with glaciers and glacial lakes, such as China and India. As climate change brings more frequent and intense rainfall, the occurrence of landslides also increases, and could result in more frequent cascading disasters, such as landslide dams across rivers, affecting areas far downstream. The resilience of infrastructure is key in efforts to mitigate the impact of landslides and improve the safety of communities in high-risk area.

Four main factors impact the resilience of infrastructure to landslides: the depth of the sliding mass; the velocity of the slide; differential movements in lateral zones of a slide; and the potential for progressive or sudden accelerations. These factors are influenced by fluctuations in climatic conditions, which can be short term (i.e. high intensity rainfall) or long term (i.e. a wet season lasting weeks or months). Taking these factors into account for purposes of increasing infrastructure's landslide resilience involves the selection of an appropriate depth of drainage boreholes or trenches and appropriate construction design.

Retaining walls, an old and simple form of infrastructure, can hold back earth, stabilise slopes and minimise landslides. Innovation has given rise to the development of different forms, such as gravity retaining walls, which depend on their own mass and weight to resist falling over and which hold back land, reducing the risk of landslides. Gravity retaining walls require less excavation, minimising disturbance to other nearby infrastructure and communities. Cantilever retaining walls, the most common type, are reinforced concrete structures in which lateral earth pressure is countered by the cumulative action of total structural members.

Retaining walls are found in most countries in the region. For example, Indonesia built a retaining wall to prevent landslides on the eastern side of the Doho Kediri International Airport platform. In Myanmar, numerous retaining walls have been constructed to protect towns from potential landslides. Some of these include the Daungmyu Creek landslide protection project in Kawlin Township, Sagaing Region which spans the townships of Kawlin and Wuntho and the upgrading of the Chindwin riverbank landslide protection project which includes the townships of Phaungbyin, Kalewa, and Kani.

### *Concrete seawalls*

Concrete seawalls remain a centrepiece in coastal protection due to their structural stability, endurance and capacity to mitigate the impact of rising sea levels, hurricanes, tsunamis and storm surges on coastal cities and towns. Much research has been carried out to improve concrete seawall performance. Recently upgraded seawalls are designed to absorb wave action, prevent coastline erosion and alleviate flooding (Hosseinzadeh et al., 2022[57]). Current innovations in material science, civil engineering and construction technology have produced concrete for the construction of seawalls that is sustainable, durable and resilient. The main concerns in building concrete seawalls include that they remain an artificially built infrastructure and their integration in the overall coastal ecology is typically poor; that the steel that supports the overall structure corrodes over time, which deteriorates the overall structure; and that timely inspection and maintenance of seawalls is often neglected.

In the face of more severe and more frequent disasters, traditionally designed seawalls often fail to offer the desired level of protection, especially during extreme events such as tidal waves, tsunamis and storm surges. Coastal seawalls can also have a negative impact on marine ecosystems. Their installation over existing coastal wetlands and intertidal zones can cause irreversible damage to the overall coastal ecosystem.

However, recently developed seawall structures not only protect shorelines but are also environmentally sustainable. These structures include the integration of nature-based solutions, such as planting mangroves, and design that follows ecological considerations, helping the seawall to act as an artificial habitat for marine life to thrive. An innovative seawall design is the use of non-corrosive steel reinforcements, such as stainless steel and fibre-reinforced polymer (FRP) as an alternative to conventional steel rebar. Another cutting-edge seawall design is the use of concrete seawall structures consisting of two vertical walls with a chamber in between, one perforated concrete wall positioned towards the sea, and one solid concrete wall positioned behind. Such design works to mitigate the wave load on the structure and to reduce wave reflection in front of the structure, while also improving the water quality and minimising the negative effects on coastal ecology (Hosseinzadeh et al., 2022[57]).

### *Dam construction or rehabilitation*

Ageing dams have become an emerging global development issue, with tens of thousands of dams having reached or exceeded an “alert” age threshold of 50 years (UNU-INWEH, 2021[58]). At the same time, water infrastructure has become more vulnerable, with increasingly intense and frequent flooding increasing the risk of damage to dams, dikes and levees, posing risks to communities.

In many countries in Emerging Asia, dams built for irrigation and hydropower generation are also critical in mitigating vulnerability to water-related disasters by buffering against floods. Flood control has become a critical function for existing dams in the region and, for some countries, will be a major function for dams that are being planned or are under construction. In addition, dams assist vulnerable countries with water supply management, temporarily storing water during heavy rainfall and releasing water later or in times of drought. This is particularly important given the dramatic changes between the region’s wet and dry seasons.

As in other parts of the globe, the performance of dams in Emerging Asia has declined, posing risks to the expanding downstream communities. This is due to a combination of factors such as the ageing of the infrastructure, backlogs in maintenance, lack of proper instrumentation and monitoring, deficient reservoir operation practices, and inadequate regulatory and operational safety measures (UNESCO, 2020[59]). The consequences of these factors include sedimentation, increased operation and maintenance costs, and increased signs of breakage (UNESCO, 2020[59]). Enhancing the resilience of water infrastructure is a particularly key issue in most developing countries in Emerging Asia.

### *Challenges in scaling up disaster-resilient infrastructure*

The construction of more resilient infrastructure is a critical step towards adapting to climate change. It involves the implementation of zoning, land-use strategies and construction regulations to minimise or mitigate the harm caused by disasters (also discussed below in the section on land planning). In particular, structures like buildings and hospitals should be constructed in areas with a lower disaster risk and built to endure disasters. This section considers the challenges involved in scaling up disaster-resistant infrastructure.

#### *Limited application of disaster risk assessments*

The United Nations Office for Disaster Risk Reduction (UNDRR) defines disaster risk assessment as a qualitative or quantitative approach to determine the nature and extent of disaster risk by analysing

potential hazards and evaluating existing conditions of exposure and vulnerability. Disaster risk assessments provide information on the likelihood and severity of hazard impact, allowing stakeholders to carry out efficient long-term decision making. They also present opportunities for investment in infrastructure resilience. Whether in the context of small-scale or large-scale projects, city-wide or country-wide planning, improving awareness and understanding of disaster risk is the foundation of an effective assessment of the benefits that come with resilience interventions in infrastructure projects. But in order to reap these benefits and opportunities, disaster risk assessments need to be integrated into development plans, policy plans, investments and planning for programmes, projects and activities. Lack of knowledge and understanding in the execution of disaster risk assessments will result in failure to reach the maximum potential of disaster-resilient infrastructure systems and in missed opportunities to manage risks cost-effectively through appropriate disaster-proofing of the overall built environment (ADB, 2022[56]).

The development of disaster-resilient infrastructure in Emerging Asia currently faces substantial challenges in the realm of risk assessment that impede effective planning and implementation of infrastructure projects. Key determinants, cited in an array of research and reports, include lack of knowledge and expertise, incomplete or outdated data, lack of standardised methodologies and lack of budget to fund the overall operations that support the disaster risk assessment system. While each catastrophe has a unique impact pathway, the interconnectedness and cascading effects of such disasters add a further layer of complexity collectively referred to as “systemic risks”. An emerging challenge that should be highlighted is the limited integration in disaster risk assessments of these systemic risks. The diverse and unpredictable nature of catastrophes increases the challenge of establishing a standardised disaster risk assessment methodology, which leads to difficulties in conducting accurate risk assessments.

While a systemic multi-hazard approach to disaster risk assessment is still at its nascent stage in the region, the application of general standardised risk assessment is also limited. This is due to a combination of factors including lack of assessment capacity, limited expertise and lack of financial resources, defined processes and technologies. Another key challenge is a lack of comprehensive, up-to-date data on historical disaster events; the vulnerability of the existing natural and built environment; and changing climate patterns.

The accuracy of quantitative risk assessments depends on the quality of input data and the validity of applied algorithms and modelling tools. Accurate disaster risk assessments require the development of technical capacities, a long-term process requiring stable funding. A lack of steady financing makes it impossible to overcome key technical issues and modelling methods in disaster assessment (OECD, 2015[52]). In addition, many countries in the region lack the institutions and resources for accurate data collection and processing. The majority of national governments do not systematically collect data related to disasters and leave it to local governments and local satellite ministries, which lack the necessary resources.

Disaster risk assessments in Emerging Asia currently utilise qualitative analysis of a broad range of specifications, such as potential areas of impact and infrastructure damage; however, less than half involve quantitative assessment (ADB, 2022[56]). At the same time, qualitative assessments still require numerical data or semiquantitative methods, such as the attachment of numerical values to descriptive indicators in order to determine the relative likelihood and extent of possible damage and loss.

Finally, the lack of standardised risk assessment methodologies across the region limits the comparison of risk levels and the harmonisation of risk mitigation strategies. A harmonised regional approach to risk assessment is crucial to enable regional co-operation and information sharing, which would foster a more effective response to common regional risks and disasters.

### *Limited financing for disaster-resilient infrastructure*

Major capital investment and effective financing methods are needed for the construction of disaster-proof electricity grids, public transport systems, irrigation systems, dams, buildings and schools. This requires the holistic collaboration of the government, the private sector, civil society and international organisations.

While investments in disaster-resilient infrastructure are currently being pursued in Emerging Asia, these initiatives remain limited, with the public sector contributing the major share of funding. Opportunities for private-sector participation are not maximised, and competing priorities within the national budget limit the scope of government investments.

Disaster-proofing is essential across all types of infrastructure, and this translates into trillions of dollars of investment. Government revenues alone will be insufficient in the long-term. Hence, maximising private sector participation will be crucial to bridge the financing gap. However, attracting private capital to fund disaster- and climate change-resilient infrastructure is difficult, as the benefits will be enjoyed by multiple stakeholders and are hence difficult to quantify in tangible returns for private investors (Ding et al., 2021[60]).

Private-sector participation in infrastructure is mainly through privatisation and public-private partnerships, with financing via banks (OECD/ADBI/Mekong Institute, 2020[61]). Alternative sources of funding may be accessed through technology-enabled financing platforms. An example is crowdfunding, which makes it easier for small projects or businesses to enter the marketplace by providing lower cost of entry to participate (Box 2.2). Tokenisation using blockchain technology can support the development of crowdfunding, as it provides a platform that is less reliant on traditional intermediaries in the flow of funding. When fiat money is converted into tokens, payment, clearing and settlement no longer pass through banks, custodians and clearinghouses, which brings down transaction costs and minimises financial barriers to investor participation (OECD/ADBI/Mekong Institute, 2020[61]).

Another challenge to increasing private-sector participation is the inherent risks of infrastructure as well as high-up front costs, which pose significant impediments. It is therefore crucial for the public and private sectors to collaborate and help develop innovative financial instruments to leverage private capital. The public sector can provide an enabling environment for increased private-sector finance via disclosure requirements, metrics and incentives (Ding et al., 2021[60]). However, bureaucratic hurdles often discourage private-sector participation. Cumbersome administrative processes, complex regulatory frameworks, unclear legal frameworks and slow decision-making impede the timely execution of disaster-resilient infrastructure projects and create a degree of uncertainty for investors. It is therefore crucial to establish streamlined government procedures to expedite the implementation of disaster-resilient infrastructure projects.

### Box 2.2. Crowdfunding for infrastructure

Crowdfunding has emerged as a useful tool to mobilise resources and foster multiple stakeholder engagement in disaster-resilient infrastructure. However, the use of crowdfunding remains marginal as a means to finance public infrastructure but, progress in using alternative financing schemes to develop transport, power, and water projects may catalyse the broader use of this platform in financing disaster-resilient public infrastructure in the future.

Crowd support for local government to finance pedestrian bridge. The construction of the 400-metre long Luchtsingel pedestrian bridge in Rotterdam in 2011 was the first crowdfunded public infrastructure project in the world, raising approximately 100 000 euros. The project featured the names of the donors etched on the planks used to construct the bridge and more than 8 000 planks were sold during the fundraising campaign. The outcome of the initiative also became a measure of public support for the project and helped convince the local government to shoulder the remaining project cost which amounted to EUR 4 million.

Crowdfunding and debt to establish solar farms. A town in the Southwest of England also used crowdfunding to bankroll its solar farm projects through the Swindon Borough Council's campaign. This offered tax-free, interest-earning debt and raised about GBP 1.8 million in five months through the Abundance Investment platform. The crowdfunding helped in the town council's own capital outlay of

GBP 3 million (British pounds) for the solar projects. earmarked to meet the town's objective of shifting towards renewable energy. Meanwhile, the local government in London also launched "Crowdfund London" in 2014 which has now raised GBP 4.85 million, making it one of the longest-running and largest crowdfunding initiative in the world. Of this amount, GBP 1.8 million came from the mayor's office and GBP 2.2 million came from the crowd. The funding catered to around 130 projects such as construction and refurbishment of markets, community kitchens, public spaces, gardens and parks, community centres, village halls and small bridges, among others.

Crowdfunding a water purification system. Crowdfunding can catalyse political will to help achieve local projects and may serve as a model for other communities that feel neglected politically yet are also facing more imminent needs for development. As an example, crowdfunding was used to install a water purification system in Branson, Colorado – a remote community close to several springs – which will allow the town to continue to benefit from a pump-free water system for household use and irrigation despite new state standards for water safety. The campaign was able to raise nearly one-third of its USD 100 000 goal through donations from locals and community organisations. It also sought partnership with a local company specialising in filtration, which provided the system for USD 76 000. The crowdfunding initiative not only qualified the project for several government grants to cover the shortfall but also earned the interest of decision makers as the crowdfunding exceeded the matching contribution required.

Crowdfunding to help a marginalised community finance a water infrastructure project. In Buttah Windee, Australia, crowdfunding of a water infrastructure project helped save lives and preserve the liberty of a marginalised community. Unsafe levels of uranium were detected in the water supply in 2009 and led to the displacement of the Aboriginal community. The state government considered the problem too costly to fix and offered to help with the resettlement of the remaining families instead. In response, a local couple reached out to a company that offers a technology based on solar hydropanels to draw water vapour from air. The couple initiated a crowdfunding campaign, but the company later donated the solar panels free of charge upon learning about the community's dire situation, allowing the Aboriginal community to stay on their ancestral lands, preserving its way of life and traditions. The AUD 26 000 raised in the crowdfunding campaign was diverted to fund the construction of a reverse-osmosis water treatment plant which allowed for further expansion of the safe water supply.

Source: Authors, based on OECD/ADBI/Mekong Institute (2020[61]), *Innovation for Water Infrastructure Development in the Mekong Region*, The Development Dimension.

### *Operation and maintenance of disaster-resilient infrastructure*

Sustaining the efficiency and effectiveness of disaster-resilient infrastructure throughout its life cycle is also essential. To achieve this, it is critical to consider several key aspects: risk assessment, investment, and operation and maintenance. Risk assessment starts at the early stages of project design and planning and includes identifying and quantifying disaster risks for infrastructure assets using open-source data, risk models, and software (ADB, 2022[56]). Ensuring adequate funding for risk and resilience analysis is critical. This includes evaluating the potential climate-related hazards, vulnerabilities, and impacts that infrastructure assets may face. However, in most cases, preparation budgets tend to be constrained, making it challenging to conduct accurate analyses in project design which would be more cost-efficient in the long term. Investing in project risk assessment, appropriate project design, and examining various engineering options, including nature-based solutions, is another key to ensuring the effectiveness and efficiency of the infrastructure. Hence, a more proactive approach is needed wherein the appropriate budget is invested upfront to avoid potentially massive downstream costs in operation and maintenance, retrofitting, reconstruction or replacement (UNDRR, 2022[62]).

In addition, operation and maintenance (O&M) approaches that can support disaster resilience before, during and after catastrophic events should be prioritised. Developing economies in the region often lack a well-defined, consistent, standardised O&M framework, which leads to infrastructure O&M being deprioritised.

Various institutional impediments that contribute to this problem. Constrained short-term budgets may drive infrastructure operators to cut maintenance budgets. Limited budget allocations can compromise the O&M system of regular inspection, repair, and upgrades of disaster-resilient infrastructure. In addition, financing mechanisms such debt, equity, or grants can restrict funds for ongoing expenses. This compels infrastructure operators to prioritise capital-intensive repairs, overhauls and reconstruction or new investments over periodic O&M spending (ADB, 2022[56]).

Capacity-building and skills shortages further hinder effective implementation of O&M. Advanced technology and innovation in disaster-resilient infrastructure require continued investment, research and adaptation by infrastructure operators and owners. Governments, private investors and other stakeholders need to collaborate to prioritise the development of an O&M framework to protect disaster-resilient infrastructure at both the project level and the policy level. This includes investing in capacity building for skilled technical staff, who are crucial in ensuring the longevity and adaptability of infrastructure.

### *Monitoring and measuring the impact of infrastructure projects*

Institutionalising a monitoring and evaluation plan for infrastructure projects allows for regular updates as additional climate and socioeconomic vulnerabilities and risks arise. In addition, regular monitoring is important to ensure regular risk assessments and state-of-the-art asset life cycle management of infrastructure projects. This contributes to the effectiveness and longevity of the infrastructure. By continuously assessing structural integrity, environmental conditions, and operational efficiency, stakeholders of disaster-resilient infrastructure projects can detect early signs of malfunction and damage that may compromise resilience. This enables timely interventions such as repairs, reinforcements, or upgrades which minimises the risk of infrastructure failures during disasters. In addition, regular standardised monitoring facilitates data collection on hazard patterns or trends and valuable information into the real-time performance of resilient infrastructure. This helps enable decision-makers to refine risk assessments and enhance disaster preparedness strategies. Through the analysis of monitoring data, engineers and planners can identify areas needing improvement, streamline operational processes, and incorporate lessons learned from past events. Some of the key considerations in the preparation of the monitoring and evaluation plan include the sensitivity of assumptions; a clear and feasible time frame for periodic review; and regular updating to integrate new research technology (ADB, 2022[56]).

### *Effective collaboration among stakeholders is essential for successful disaster-resilient infrastructure development*

Effective collaboration with multiple stakeholders, from local to international, serves as a cornerstone in fortifying disaster-resilient infrastructure. It brings together a diverse range of skills and perspectives which contributes to enriching the decision-making process, project design and planning, and ensuring comprehensive risk assessment and mitigation strategies. In particular, it contributes towards leveraging diverse expertise by harnessing the insights of engineers, architects, urban planners, policy makers, community leaders, and disaster management exports. In turn, stakeholders are able to identify vulnerabilities, prioritise interventions, and design infrastructure solutions that are technically sound, socially inclusive and environmentally sustainable. Engaging multiple stakeholders also facilitates resource mobilisation and cost-sharing, enabling countries to leverage the collective resources and capabilities of diverse partners. This also promotes policy alignment and co-ordination at both national and international levels, ensuring coherence and consistency with international standards in efforts to strengthen disaster-resilient infrastructure. Through platforms such as multilateral agreements, intergovernmental fora, and

regional co-operation mechanisms, partners can harmonise regulatory frameworks and share best practices.

### *Integration of nature-based solutions*

With the world facing increasingly complex natural hazards and climate-related challenges, relying solely on grey infrastructure is inadequate to address the risks. The most favourable solutions for adaptation will likely consist of a diverse portfolio of options such as green measures (e.g. wetland or dune restoration), grey measures (e.g. seawalls or dams) and policy measures (e.g. land use zoning). The integration of nature-based solutions (NbS) into disaster-resilient infrastructure development will be a crucial step in protecting society from natural hazards and ensuring a sustainable future. Nature-based solutions harness the inherent resilience of ecosystems to bolster infrastructure against the impact of disasters. Complementing conventional engineering measures such as sea walls and storm channels, NbS can support traditional infrastructure and offer a cost-effective and sustainable approach to building disaster-resilient infrastructure. Nature-based solutions offer an alternative or complementary approaches to grey engineering infrastructure (Table 2.1).

**Table 2.1. Comparison between grey infrastructure and NbS in flood risk management**

| Characteristics | NbS | Grey infrastructure |
|---|---|---|
| Time scale | Takes longer for the benefits to materialise | Benefits are immediate after construction |
| Spatial scale | Typically executed on a larger scale to be effective, encompassing multiple jurisdictions | Typically implemented within individual jurisdictions |
| Performance reliability | Uncertain performance due to complexity of natural systems | Performance is more predictable |
| Flexibility | Adaptable to changing environmental conditions as they are part of the natural landscape | More rigid and with limited adaptability as it typically provides a fixed solution for flood management |
| Sustainability | More sustainable as it involves the restoration of natural ecosystems | Can have negative impacts on the environment, e.g. increased erosion, altered hydrology and destruction of natural habitat, and requires significant maintenance and upgrades over time |
| Multifunctionality | Provides multiple benefits beyond flood risk reduction | Often has a more singular focus on reducing flood risk and rarely provides additional benefits |
| Quantification of benefits | Co-benefits are difficult to quantify, e.g. human health and livelihoods, food and energy security, biodiversity | Benefits are easy to quantify, e.g. prevention of damage to assets |
| Community engagement | Design, implementation, and maintenance involve local communities, hence promote community ownership and resilience | Designed and implemented by external engineers and experts, hence limited community engagement and lack of local ownership |

Source: (Molnar-Tanaka and Surminski, 2024[63]), "Nature-based solutions for flood management in Asia and the Pacific", *OECD Development Centre Working Papers* No. 351.

Several case studies provide evidence that the net benefits of NbS for climate resilience are significant. For instance, a risk assessment comparing the cost effectiveness of nature-based adaptation across the Gulf of Mexico coast of the United States found that a set of cost-effective adaptation measures (with benefit-to-cost ratios above 1) could prevent up to USD 57-101 billion in losses (Reguero et al., 2018[64]).

Despite the crucial role of NbS in mitigating the risk of disasters and boosting traditional infrastructure to ensure better resilience, opportunities to pursue NbS remain underexplored in Emerging Asia. Although the NbS approach has been gaining recognition in the region recently (Box 2.3).

### Box 2.3. Nature-based solutions to flood management in ASEAN

Indonesia's strategies for flood prevention have relied mainly upon grey infrastructure so far, but acknowledgement of NbS as a complementary option is increasing. For instance, the Indonesian government has designed a programme for Restoring Four Critical Watersheds that will reduce flood impacts by greening 150 000 hectares of land in the provinces of Banten, DKI Jakarta, West Java and North Sumatra. In addition, NbS using a Building with Nature (BwN) approach have been implemented successfully on the Demak coast. Semi-permeable structures made of local brushwood and bamboo were installed in an area where mangroves had been lost due to other development projects. The structures slow currents and trap sediment, preventing the erosion caused by the loss of the mangroves and producing local ecosystems ideal for mangrove re-growth. Unproductive aquaculture ponds were also repurposed into areas for mangrove growth.

The Philippines is developing a Flood Risk Management Master Plan for six priority river basins in Luzon, Visayas, and Mindanao. The NbS for the Buayan-Malungon river basin makes "room for the river" by reviving old river channels, removing man-made obstacles, and enhancing the riverbanks with vegetation. Projects in other basins involve wetland restoration and re-routing rivers often obstructed by debris from earthquakes.

Flooding is a major concern in the Mekong region. Plans have been made for a town in Lao PDR that sits on the banks of the Mekong River to restore drainage canals using bioengineering and the natural system of floodgates in the northern part of the town.

Thailand has adopted several NbS in Bangkok such as urban forests, eco-friendly parks, green roofs, and wetlands. The Chulalongkorn Centenary Park slows runoff and allows the collection, treatment, and storage of water to reduce the burden on sewerage during heavy rains. In addition, Bangkok offers a higher floor-area ratio limit to developers if certain NbS are incorporated into building designs.

Finally, the city of Dong Ha, Viet Nam faces frequent flooding despite a system of canals and a drainage basin. NbS proposed would redesign the basin into an attractive green zone that would act as a drainage corridor, water retention facility, landscape recreation area and water and air purifier.

Source: (Molnar-Tanaka and Surminski, 2024[63]), "Nature-based solutions for flood management in Asia and the Pacific", *OECD Development Centre Working Papers* No. 351.

Given the complex nature of risks and expected changes, an appropriate combination of tools is required. Relying solely on either NbS or grey infrastructure is unlikely to be sufficient to meet the heightened disaster risk. A combined approach may offer better results in terms of protection, biodiversity and socio-economic benefits. The balanced integration of NbS and grey infrastructure could overcome the limitations of each approach and offer a more effective and sustainable solution for comprehensive disaster risk management.

#### *Preserving and developing infrastructure during and after disasters*

The role of infrastructure in disaster risk reduction and management is to lessen the adverse effects of disasters on individuals, property and the environment. Infrastructure can aid in disaster prevention through the provision of early warning systems, evacuation pathways and secure shelters (UN, 2016[65]). It can also assist in reducing the impact of disasters by offering emergency services, medical treatment and supplies of food and water. Furthermore, infrastructure can support recovery efforts by providing temporary accommodation, transport and other vital services. Following a catastrophe, various forms of infrastructure development are required to ensure the resilience and recovery of the impacted region:

- *Transportation*. Rebuilding transport infrastructure emerges as a top priority among the multiple recovery tasks triggered by disasters (Padgett and Tapia, 2013[66]). The reconstruction of transport infrastructure is often addressed in the short-term recovery phase, yet long-term considerations and plans are required for large-scale disasters (Minato and Morimoto, 2012[67]). The inability to rebuild transportation networks can hinder the pace of recovery and reconstruction in other sectors (Mechler, 2016[68]; Yamashita, Watanabe and Shimatani, 2016[69]). Disruptions in the affected regions caused by issues of inaccessibility can hinder the recovery process. Hence, an immediate and rigorous effort is crucial to restore the transportation systems to their normal operations as swiftly as possible (Lou and Zhang, 2011[70]).
- *Allocating public space for streets, infrastructure and parks*. These areas can act as protective barriers during a disaster (Mead, 2022[71]). Furthermore, the United Nations underscores the significance of soft infrastructure in disaster risk reduction and management. This encompasses communication, knowledge and the interaction between authorities and community members. Despite a narrative that advocates for the involvement of people in preparedness planning and risk reduction, community members are rarely genuinely empowered to shoulder this responsibility (UN, 2016[65]).
- *Advanced warning systems*. Infrastructure can encompass systems engineered to give early alerts of impending disasters, enabling individuals to evacuate or implement other safety measures.

## Addressing disaster-related migration and improving land-use planning

Migration and displacement are frequently instigated by disasters, climate change and environmental decline[2] (IOM, 2023[72]). This has the potential to worsen disparities and increase the likelihood of conflict, particularly in regions with restricted access to services and limited economic prospects. The presence of displaced populations can impact behaviour (such as job searching, interpersonal interactions and conflict) and socio-economic factors (including economic inequality and wealth) in a way that influences social cohesion (World Bank, 2022[73]). Migration and displacement can also bring environmental deterioration. Swift urbanisation or inadequately administered refugee camps and settlements for internally displaced persons (IDPs) may strain limited water, energy and food resources, and give rise to unregulated waste disposal (UNEP, 2016[74]).

### *Emerging Asia is seeing a rise in disaster-induced migration*

Emerging Asian countries have experienced considerable migration and displacement because of natural hazards. From 2010 to 2021, more than 225 million people were displaced across Asia and the Pacific due to disasters linked to natural hazards (ADB, 2022[75]). In just the year 2020, the ASEAN region experienced 405 disaster events, impacting 19.3 million individuals, displacing 2.4 million people and resulting in damage totalling USD 227.4 million (ASEAN, 2022[76]). Such compelled migration, deemed significant, has been on the rise owing to the accelerated impacts of climate change and heightened disaster risk in recent decades (Munawar et al., 2022[77]).

Migration and displacement entail extensive consequences that impact not just the migrants and their families but also their nations of origin and destination. For example, the displacement and relocation of people can cause increased insecurity and fear of displacement among people inhabiting the lands receiving the displaced group (Johnson et al., 2021[78]). Implementing inclusive policies and making developmental investments for forcibly displaced individuals and host communities can alleviate the adverse consequences of displacement and promote social unity. It is crucial to formulate policies addressing these concerns, ensuring that the advantages of migration surpass the associated costs (World Economic Forum, 2022[79]). Governments in Emerging Asia have implemented various policies to deal with disaster-induced migration and displacement. Examples include enhancement of operational and

administrative capabilities by Cambodia, incorporating human mobility into disaster preparedness and climate change adaptation in Indonesia and legislating the safeguarding of internally displaced individuals in the Philippines and India.

### *Policies for addressing disaster-related migration and displacement*

Policies regarding disaster-induced migration and displacement include the following:

- The establishment of a framework that categorises displacement – mapping and monitoring potential environmental risk areas and adapting to changing regional conditions – would provide a more effective foundation for policy development in Emerging Asia. Improving hazard mapping in disaster-vulnerable areas through frameworks that include both disaster probability and damage severity can help to identify which areas should be prioritised. To map localised disaster risk, insurance rate maps may be consulted where available.
- Governments should adopt proactive development policies to tackle potential displacement impacts resulting from climate change, with a focus on strengthening coping capacities, adaptation and sustainability. This entails incorporating resilience strategies into programmes and projects. It is essential to promote the integration of environmental policies and incorporate them into relief, recovery and development programmes during conflicts and forced displacement.
- The policy focus on social and community resilience and adaptation, especially concerning the social dynamics of resettlement, needs further refinement and expansion. Many countries in the region, such as Cambodia, Viet Nam, the Philippines, Indonesia and Lao PDR, lack sufficient financial and technological resources, infrastructure and capacity for effective mitigation of and response to climate-induced disasters leading to displacement.
- Community-focused interventions are particularly relevant for displaced and economically vulnerable communities, especially in Cambodia, Viet Nam, the Philippines, Indonesia and Lao PDR. From a programme perspective, such an approach involves enhancing adaptation and resilience measures and fostering the development of appropriate funding mechanisms to support protection and assistance.
- It is crucial to promote the integration of environmental policies and responses in relief, recovery and development programmes during conflicts and forced displacement. Resilient ecosystems play a significant role in reducing vulnerability to natural hazards and contributing to human well-being and sustainable development. Strengthening environmental protection and post-disaster rehabilitation is thus essential. Exploring international partnerships for financial and technological support may be one avenue to achieve these goals (Islam and Khan, 2018[80]).
- Governments should incorporate climate-change adaptation strategies into their disaster management policies. Few laws and policies currently address disaster-induced displacements and related issues, and there is scope for improvement of existing frameworks. For example, the Chinese government has formulated more than 60 laws and regulations on topics such as natural disaster events, accidental disaster events, public health events and social security (Zhe et al., 2016[81]). These laws could be reassessed and fortified to ensure they sufficiently tackle the issue of disaster displacement.
- Governments should encourage community involvement in disaster management. Local communities should be included in decision-making processes as they have a superior understanding of their vulnerabilities and capacities. Policies should guarantee consideration of the requirements of the most susceptible sections of the population, such as the elderly, women, children and people with disabilities, in all phases of disaster management.

### *Disasters have a significant impact on land-use patterns*

Natural hazards, which can lead to shifts in land-use patterns, have a substantial impact on land-use planning in Emerging Asian countries, and can also change farming patterns. In the Philippines, for example, Infanta, Quezon experienced four consecutive typhoons in December 2004 (Unding, Violeta, Winnie and Yoyong). Consequently, while farming decreased in general, production of cattle, chicken, carabao (water buffalo) and pork increased, and farmers changed from vulnerable crops like rice and bananas to more hardy crops like coconut and fast-growing root crops (Eugenio et al., 2014[82]). In Indonesia, on the Banda Aceh coast, the 2004 tsunami wore away the shoreline, drastically changing wetlands from fertile fish-farming zones to deserted lake areas. The total area of aquaculture shrank from 1 346 hectares (ha) in 2004 to 816 ha in 2011 and 787 hectares in 2017. In contrast, the lagoon area grew from 241 ha in 2004 to 499 ha in 2011 before decreasing slightly to 423 hectares in 2017.

Comprehensive land-use planning is crucial for identifying the goals of communities in disaster-prone areas. Such plans can help to direct development away from vulnerable land, lay the foundations for space acquisition and nature conservation campaigns, and encourage the utilisation of natural topography for disaster mitigation. Localised hazard mitigation plans can help to identify areas where measures are needed and provide an opportunity to work with communities to find perceived vulnerabilities and take them into account. While risk assessment lies at the core of planning efforts, it often focuses too much on the likelihood of disasters alone, not considering the vulnerabilities of specific regions and the severity of a potential disaster's impact (Saunders and Kilvington, 2016[83]).

### *Planning for more efficient land-use as disaster risk increases*

Numerous global frameworks, such as the 2030 Agenda for Sustainable Development, the Paris Agreement on climate change and the Sendai Framework for Disaster Risk Reduction, have underscored the significance of integrating land-use planning into development issues, climate change issues and disaster risk management strategies, respectively (Shaw and Banba, 2017[84]). Such integration becomes increasingly important as climate change increases the risk of natural disasters. Recommendations on improving the efficiency of land use for disaster resilience encompass the following topics:

- *Alterations in land-use*. The process of urbanisation has transformed agricultural land, forests and extensive coastal areas into built environments. Due to the pressure of economic growth, these changes have been quite swift, sudden and, in most cases, unplanned. This has created new disaster exposures by subjecting the built assets and infrastructures to various types of natural hazards, whether in coastal, mountain or river basin areas. Urbanisation could also increase disaster vulnerability. For example, soil artificialisation reduces water infiltration and increases runoff, leading to higher flood risk in developed areas. In view of such alterations in land use, and in the face of evolving disaster risks, it is important to provide a proactive and sustainable approach to reducing vulnerability and enhancing resilience through strategic planning, community engagement and the integration of ecosystem-based approaches.
- *Regulations after disasters*. Following a disaster, new land-use regulations may be imposed to steer reconstruction efforts towards resilient, safe and sustainable development. By establishing guidelines that prioritise risk reduction, environmental conservation and community engagement, these regulations contribute to the creation of disaster-resilient communities that can withstand future challenges and changes. Specific measures vary by region. For example, in coastal regions, a strict coastal land-use regulation with strict boundary conditions is typically imposed or reimposed after a disaster. Coastal land-use regulations are essential tools for managing development, protecting ecosystems and ensuring the sustainable use of coastal resources. By balancing economic development with environmental conservation, such regulations contribute to the long-term health and resilience of coastal areas. In urban areas, new urban development zones can be formed post-disaster. Urban development zones may incorporate environmentally sustainable

practices to minimise the environmental and ecological impact of future disasters. This can include green building standards, energy-efficient infrastructure and the preservation or restoration of natural green spaces within the urban environment. In mountain areas, strict slope regulations can be introduced after disasters. Such regulations can play a crucial role in balancing development with environmental protection, ensuring the safety of communities and preserving the unique ecological and cultural characteristics of mountain regions.

- *Land-use management*. Land-use management is a comprehensive approach that seeks to balance competing demands on land resources while promoting sustainability, resilience and the well-being of communities and ecosystems. It involves strategic planning, policy development and regulatory frameworks to guide land-use decisions in a manner that aligns with broader societal goals and values. Sustainable land-use requires supervision of the use and development of land resources, in both urban and rural environments, in order to ensure their best possible competing use in different economic sectors including agriculture, forestry, water resource management, industrial development, housing development and more.
- *Risk-sensitive land-use planning*. This is a widely acknowledged non-structural risk mitigation measure with the potential to avoid exposure in the most hazardous zones and to reduce exposure and vulnerability over time in already urbanised areas. Land-use planning can contribute to disaster mitigation through the strategic use of land resources and the evaluation of development applications based on the adopted plan. Regulatory approaches could also include the use of zoning to prevent development altogether; to curb overdevelopment; or to implement requirements to minimise vulnerabilities. Changing the zoning of disaster-vulnerable areas and implementing restrictions on development can help to redirect new development to safer areas and provide the space necessary for resilience measures like nature-based solutions. It should be ensured that any development that does take place in a vulnerable area does not cause adverse effects on pre-existing development. Building elevation can also be regulated for new properties as part of the recovery process after flood events.
- *Restrictions on development*. Restrictions can be implemented to prevent further settling of vulnerable areas. In areas of unrestricted development, bulk regulations may be implemented to set maximum land-plot coverage, minimum building setbacks and requirements for area ratios to ensure that an adequate portion of each land plot remains open space.
- *Property buy-outs and acquisition of open land*. Such actions may be considered to support owners of damaged properties, establish and safeguard buffer zones, and remove vulnerable land from the development market. While the cost of acquisition campaigns can be prohibitively high, some disaster prevention programmes may generate revenues that can be used to repay their own cost. An example is revenues from stormwater utilities built on acquired land.
- *Relocation of infrastructure*. Relocating damaged or destroyed infrastructure away from disaster-vulnerable areas can be the best way of preventing repeat damage. However, the restoration of infrastructure is often critical to the post-disaster recovery process, and the use of public assistance funding has to be balanced between restoration and relocation projects.

## Developing disaster-related technology

Deaths and property losses due to disasters can be reduced by providing timely and accurate information for exposed populations and assets, and environmental factors in disaster risk. Such information is increasingly becoming available via recent technologies such as meteorological and Earth Observation satellites, geographical information systems (GIS), communication satellites and satellite-based navigation systems, coupled with modelling and analysis. These technologies help stakeholders to analyse the risk of disasters and develop contingency plans and risk management policies for disaster relief.

### *Various technologies are available to mitigate disaster risk*

Policy makers in Emerging Asia can explore a range of technologies for use in disaster risk reduction and management. They include the following:

#### *Resident-engaged disaster risk mapping*

Resident-engaged disaster risk mapping is a tool that allows a community to assess its vulnerabilities and prepare for disasters. The risk maps include all significant buildings that could be affected during a disaster, such as schools and hospitals, as well as farmland, roads and other infrastructure. They also include hazardous features such as volcanoes, flood-prone areas and dry areas that are susceptible to fire. Resources such as shelters and fire stations are also mapped to facilitate quick response to a disaster (UNDRR, 2004[85]). Disaster risk mapping helps to improve villagers' recognition of hazards and risks in their communities. It helps them to prepare for potential dangers and encourages them, in the event of disaster, to act based on the information on the map. In many countries, community risk mapping is mainly provided by professional institutions. Because such mapping is costly and complex, it is difficult to put in place countrywide. Resident-engaged mapping is used for disaster risk reduction in only a few countries in Emerging Asia: China, India and Indonesia.

#### *Early warning systems (EWS)*

Early warning systems can alert people to the imminent prospect of weather-related extreme events such as heavy rain, typhoons, earthquakes, tsunamis, heatwaves, coastal storms, fires and landslides. Such systems are currently used in most countries of Emerging Asia (UNDRR, 2006[86]). However, they are not fully operational in some countries for reasons such as insufficient training of practitioners, malfunctioning equipment or lack of community awareness. An early warning system is an integrated system of hazard forecasting and monitoring; disaster risk assessment; communication and preparedness activities; and processes that enable individuals, communities, governments, businesses and others to take timely action to reduce disaster risk in advance of hazardous events. Early warning systems for climate and weather-related disasters are evolving thanks to the development of technologies such as Earth Observation systems. Creation of an early warning system for all is a goal to achieve in the next phase. An intergovernmental early warning system should go beyond local systems to encompass observations from the entire world, with international exchanges of observations and global numerical weather prediction.

#### *Information and communications technology*

Cutting-edge information and communications technology (ICT) is being used in a few Emerging Asian countries. For example, in the Philippines, in August 2023, the Office of Civil Defence allocated 22 satellite communication kits sourced from a private-sector firm to strengthen the nation's disaster response and reporting capabilities. As the kits deliver high-speed internet via satellite, they can allow precise communications and reporting for critical government functions even when the normal telecommunications network is down, regardless of region. Sentinel Asia is an initiative to use a satellite for disaster management support in the Asia-Pacific region that was first proposed in 2005 at the Asia-Pacific Regional Space Agency Forum (APRSAF) and later accepted. Under Sentinel Asia, the data acquired from the satellite are combined with near-real-time internet dissemination methods and Web-GIS mapping tools to provide visualisation of disaster impacts on the Sentinel Asia website, helping improve the speed and accuracy of disaster preparedness and early warning, and establish rescue or rehabilitation plans.

#### *Disaster management platforms*

Platforms for crisis management play a key role during disasters, facilitating networking between government and regional disaster management officers, and between people in need and rescue teams.

For example, China's National Natural Disaster Management System (NNDIMS) is a reporting platform that can manage information regarding natural disaster loss, disaster relief and on-site multimedia data. Beyond national-level platforms, intergovernmental and international platforms have been developed to enhance co-operation among countries through exchange of knowledge and past experiences.

#### *Unmanned aerial vehicles*

As climate impacts increase, unmanned aerial vehicles (UAVs), such as drones, have become a popular technology for mapping out future geohazard risks. Drones can be used for orthophotos (photographs that allow for distortion-free measurement) and topographical maps that are more accurate than those delivered by satellite-based monitoring systems. These images can be used for creating a rescue plan. Drones can also restore public networks, deliver emergency supplies through airdrops and accomplish many other activities in hard-to-reach places. In China, UAV sensing technology is currently used for disaster rescue operations, as well as for environmental research and predicting landslides.

#### *Social media*

Social media can be a useful tool to support crisis management thanks to five key traits: collectivity, connectedness, completeness, clarity and collaboration. In terms of disaster management, social media are mainly used in the gathering and dissemination of information, disaster planning and training, and collaborative problem solving and decision making (Chan, 2013[87]). Via social media, shared documents such as Google Sheets or Tencent can be used for information-gathering purposes.

### ***Use of the latest technologies for disaster resilience is limited in the region***

#### *New technologies that can strengthen disaster risk management capacity*

While early warning systems are used in many countries, the level of technological maturity or performance differs by country. Reasons for these disparities can include lack of demonstration by practitioners beforehand, malfunctioning of monitoring or detection devices, negligence in the management of equipment, communities' lack of awareness of the system, or lack of recognition of its significance. For instance, a flash flood generated by glacial lakes caused serious damage in North Sikkim, India in October 2023. The monitoring system failed as one of the sensors installed in 11 glacial lakes malfunctioned and did not generate any data. Recently developed advanced technologies with the potential to bolster disaster risk management capacity are not yet fully utilised in Emerging Asia. The use of UAVs during or after disasters are limited by the small number of drones or as it is still on the pilot phase in Southeast Asian countries (FAO, 2017[88]; Widiatmojo et al., 2023[89]). They include the following:

- *Internet of Things (IoT) technologies*, such as cloud computing, broadband wireless networks and devices with sensors, can be used to alleviate damage from a disaster. The Internet of Things refers to the collective network of devices or systems that connect and exchange data with each other. IoT technologies are real-time systems and enable automation of early warning systems. For instance, tree sensors can detect outbreaks of fire by testing temperature, moisture and carbon dioxide levels (ITU, 2019[90]).
- *Drones*, which were initially developed for military purposes, include unmanned aerial or underwater vehicles. Drones can aid disaster management by reaching inaccessible places and detecting things imperceptible to humans. Small aerial drones were deployed to search for survivors after Hurricane Katrina struck the United States in 2005. More recently, drones conducted aerial surveys of disaster-affected areas of Vanuatu after Cyclone Pam struck in 2015 (Meier and Soesilo, 2015[91]).

- *Search-and-rescue robots* were first used to assess the wreckage of the World Trade Center in September 2001. Since then, more than 50 deployments of robots for disaster use have been reported (ITU, 2019[90]). Japan is a pioneer in the use of robots in disasters. Japan's "Little Sunfish" swimming robot, unveiled in 2017, was used for underwater probes of the core of the Fukushima reactor, which was damaged by an earthquake and tsunami in 2011. Furthermore, a Japanese company developed a disaster response robot equipped with 3D sensors and hand grippers for search-and rescue.
- *Big data* created by sensors, mobile phones and internet activities is still mostly used for commercial purposes, but it has the potential for disaster risk management. A telecommunications company research team used mobile phone data to monitor population movements and communication patterns during flooding in Mexico in 2014 (Frías-Martínez, 2016[92]). However, challenges remain when using big data given the possibility of false information, non-representativeness or data capacity management issues.
- *Artificial intelligence (AI)* is potentially available for predicting earthquakes or accelerating recovery and response times (Box 2.4). AI, which imitates human intelligence, has become highly proficient at predictions, identification and classification (ITU, 2019[90]). During a major earthquake in Nepal in 2015, relief groups used pre- and post-disaster imagery, crowdsourced data analysis and machine learning to identify disaster locations. AI has also been deployed to analyse real-time information from social media. Artificial Intelligence for Digital Response is an open-source platform capable of processing a large number of tweets and other social media posts related to disasters and other emergencies.
- *Blockchain technology* was first used for disaster management in the aftermath of the 2010 Haitian earthquake to facilitate managing overfull information coming from many data sources. The blockchain-distributed ledger system and chain of verified records could play a significant role in ameliorating information control or facilitating fundraising activities that accept cryptocurrencies (Harmes, 2018[93]). Crowdfunding and tokenisation are already used in several countries in Emerging Asia (OECD/ADBI/Mekong Institute, 2020[61]).

### Box 2.4. The use of AI in disaster risk reduction

Artificial intelligence (AI) can play a significant role in optimising disaster response and reducing resource waste, assessing damage, and contributing to the design of recovery plans.

Big data and AI are already used in disaster risk reduction. For example, a Japan-led programme used satellite data to develop floodplain maps of Bangladesh during the monsoon season with areas, depths, and flood durations. The programme focused on border regions with India, highlighting the benefit of satellite-based analysis for addressing cross-border disasters (Kwak, 2017[94]). The US state of California launched a pilot programme to detect forest fires using AI in 2023 (Office of Governor Gavin Newsom, 2023[95]; Office of Governor Gavin Newsom, 2023[96]; UC San Diego, 2023[97]). AI can detect differences in satellite images of a specific location over time, such as signs of smokiness, and thermal cameras can identify hotspots, while remotely piloted aircraft are able to offer rapid mapping of existing wildfires and a combination of Big Data and AI can help predict expected behaviour, so firefighters and safety officials can make optimal choices.

AI-equipped devices with response capabilities (such as firefighting robots) can also help contain a disaster promptly after it begins and evacuate people from dangerous areas (Pizzuto, 2023[98]; Agurbash, 2023[99]). These devices have the potential to be adapted to respond to other disaster types. The 2023 Maui wildfires provide a further example: The Pacific Northwest National Laboratory (PNNL) developed a software tool called "Rapid Analytics for Disaster Response" (RADR) and used it to provide

an assessment of the damage caused by the Maui fire and to predict areas at risk for spread. RADR used AI to evaluate Big Data, large volumes of data originating from multiple sources (vegetation, fuel, and weather), integrating the information into a cohesive picture for policy makers, providing a fire spread risk map (Ashby, 2023[100]).

In response to the rapid proliferation of AI for a variety of applications, the OECD has founded the OECD AI Policy Observatory to help countries "manage risks and reap benefits" of AI, while acting as a global policy hub that unites stakeholders (OECD, 2023[101]). In 2019, the OECD also adopted the OECD AI Principles based on sustainable development, human-centred values, transparency, security, and accountability, among other things (OECD, 2019[102]).

Source: Authors.

### *Policies in supporting technology for disaster risk reduction*

To drive disaster risk reduction and resilience, governments must build capacities utilise ICT and key technologies (UN and UNDRR, 2013[103]). To achieve the successful adoption of disaster-related new technologies, governments can adopt the following policies:

- *Research and development (R&D) policies*. Governments can provide various types of support for R&D investment in technologies that can be used for disaster risk reduction and management. Although the price of equipment such as drones or robots has dropped, it is still costly for many developing countries. Policies to spur R&D in advanced technologies include fiscal and financial incentives, such as intergovernmental or government-to-company grants, tax incentives, loans, tariff exemptions for infrastructure equipment, bonds or subsidised services. The most popular policy instrument is direct or indirect grants or funding. Funding for innovation can be implemented through grants or by establishing and/or funding public incubators to offer seed funding to private-sector companies for pilot projects. An example of a public incubator is South Korea's Disaster-Safety Industry Technology Commercialisation Project, which assists private R&D projects supporting the development of disaster-related technologies (Ministry of the Interior and Safety of the Republic of Korea, 2022[104]). Tax incentives to promote R&D investments will encourage investment in new technologies. They include tax credits, which reduce the tax liability of a company for certain R&D expenses, and tax deductions for R&D costs, called full expensing (Wu et al., 2022[105]).
- *Open- and fair-trade policies*. International open- and fair-trade policies contribute to innovation by improving access to foreign markets and increasing competition, which encourages firms to invest more in R&D. For example, the Technical Barriers to Trade (TBT) Agreement is an international treaty that ensures that regulatory measures are transparent, non-discriminatory and not overly trade restrictive; it has promoted trade liberalisation and innovation of digital technologies (WTO, 2020[106]). Other policies that prevent the abuse of dominant positions, anti-competitive behaviour and technology lock-in should also be considered (WTO, 2020[106]).
- *Policies to increase use of new technologies.* Governments should enact policies that strengthen their capacity to deploy and provide access to new technologies. They could begin by constructing a basic structure that facilitates access to wireless and telecommunications technologies across the country. It is estimated that 2 to 4 billion people in Emerging Asia have no internet access. Policies that promote competition will help to reduce access charges and enable more people to take advantage of such technologies (Bleiberg and West, 2015[107]). Governments can also provide or incentivise the provision of digital public goods such as open-source software, open data, AI models, standards and content that make digital public infrastructure an operational reality (UN, 2020[108]). Financial support can incentivise the conversion of digital private goods into digital public

goods, while governments can also directly provide public digital goods such as open government data. Formation of human capital and support for education is another key area for government policy action. In particular, education in the STEM subjects – science, technology, engineering and mathematics – has been shown to boost innovation. Governments should also encourage industry-academia collaboration, while policies to relax legal and regulatory requirements for new technologies like drones would stimulate technological research. Finally, promoting international co-operation is an important role of government in speeding technical advancement. Governments should actively participate in global research projects. An example of international co-operation, the 2nd ASEAN-Japan Public Private Seminar on Innovative Policies and Technologies for disaster risk reduction, took place in October 2023.

In summary, there are several key requirements for the successful deployment of disaster-related new technologies: i) resilient and continuously improving telecommunications infrastructure, including mobile internet coverage and smartphone penetration; ii) technical skills for the use of AI and spatial analysis tools; iii) access to data and software; iv) human capital formation and user education; and v) regulatory adaptation, with new regulatory frameworks to facilitate early acceptance of new tools.

## Strengthening disaster risk reduction training and education

### *Disaster risk reduction education is on the rise in Emerging Asia*

Given the rapidly increasing frequency and intensity of disasters, disaster-prone countries are paying far more attention to the role of disaster risk reduction education. Disaster risk reduction education should be integrated into the curriculum of mandatory schooling, and training sessions for teachers and administrators in developing practical learning materials and delivering such courses should be offered. Beyond formal schooling, disaster risk reduction education also includes teaching and learning activities targeted to the public and specific communities. Community-based education mainly focuses on transferring information via media such as radio, television, mobile phones, flyers, and banners. Further efforts to encourage communities' participation may include conferences and workshops where locals can communicate with experts. Many countries in Emerging Asia, have already implemented national education frameworks to strengthen public knowledge bout disasters and enhance coping capabilities. The majority of the region's countries have integrated disaster risk reduction education into existing curricula or extracurricular activities, while various other disaster preparedness and response programmes have been launched to improve public awareness at the societal level (Table 2.2). Such programmes can include courses, rehearsal of response plans, knowledge contests, exhibitions, workshops and seminars, and can be broadcast via television, radio and social media to disseminate basic knowledge on disaster reduction.

**Table 2.2. Disaster risk reduction education initiatives in selected Emerging Asian countries**

| Country/region | Initiation year | Name of initiative | Goals |
|---|---|---|---|
| **India** | 2004 | Disaster Management Curriculum in Class V, VIII, IX, X, XI | Integrating disaster management curriculum which includes basic concepts of the most commonly occurring disasters |
| **Thailand** | 2015 | Comprehensive School Safety (CSS) | Provision of teacher training to support teachers to design disaster risk reduction activities in schools |
| | 2023 | Implementation of Disaster Education under National Disaster Prevention and Mitigation Plan 2021-2027 via MOU between Department of Disaster Prevention and Mitigation and Ministry of Education | Developing disaster risk reduction curriculum and promoting disaster risk reduction activities in schools to create public awareness among students, teachers, administrators, and support staff. |
| | 2023 | Thai Network for Disaster Resilience (TNDR) | Sharing best practices for disaster risk reduction among experts from 17 universities in Thailand |

| | | | |
|---|---|---|---|
| **Indonesia** | 2019 | Satuan Pendidikan Aman Bencana (SPAB) | Education in prevention and management of disasters to be delivered via educational institutions; such as through integration of disaster risk reduction education into K-13 curriculum |
| **China** | 2024 | Student Safety Education Campaign | An educational campaign to strengthen risk preparedness and self-protection awareness among primary school and secondary school students, including fire safety, traffic safety and first-aid training |
| **Philippines** | 2013 | K-to-12 curriculum | Inclusion of Disaster Risk Reduction and Climate Change Education into school curriculum |
| **ASEAN** | 2015 | ASEAN Common Framework on School Safety | Ensuring safe learning facilities and reinforcing school disaster management capacities |

Source: Authors' compilation based on national sources

### *Challenges in disaster education require policies to address them*

Countries in Emerging Asia face challenges in providing efficient education for students, the public, and other stakeholders due to the diverse nature of each locality's geographical conditions and socio-economic and cultural background that cannot be accommodated in a uniform national curriculum. Regional context should be fully considered when implementing education and training programmes to maximise the efficiency for students in the application of knowledge acquired from courses and activities. In countries susceptible to earthquakes, tsunamis and volcanic eruptions, such as Indonesia, Thailand and the Philippines, which lie near the Pacific Ring of Fire, education should be accessible to communities in remote and hard-to-reach areas. Cultural diversity and language barriers, as well as lack of co-ordination among governmental and non-governmental organisations (NGOs), can also hinder effective disaster risk reduction education.

#### *Schools need clear policies for successful implementation of disaster risk reduction education*

Several countries in Emerging Asia, such as Cambodia, India, Indonesia, Lao PDR, Malaysia and the Philippines, have already integrated disaster risk reduction education into their school curricula or are in the process of doing so, but such integration is not universal in these countries due to a lack policies declaring disaster risk reduction education to be mandatory. Countries elsewhere offer examples of better integration of disaster risk reduction education in schools. For instance, Japan makes it compulsory for educational institutions at all levels to develop disaster risk reduction education (Wongphyat and Tanaka, 2020[109]). The curriculum not only covers knowledge about natural disasters and how to respond to them, but also focuses on building skills that are required for survival in those emergencies. In the United States, disaster preparedness exercises such as tornado drills are often implemented in schools, while Australia's disaster preparedness education in schools puts an emphasis on bushfire awareness.

Beyond clear policies, the successful implementation of disaster risk reduction education in schools requires systematic management. The government should set overarching, clear and mandatory policies for disaster risk reduction education at the national level that outline specific requirements for disaster preparedness in schools, including curriculum content, teacher training and emergency response protocols. In developing a comprehensive framework for disaster risk reduction education, national governments are responsible for setting learning objectives and defining key components of learning materials. On the other hand, implementation of the framework should be adapted to local contexts. This approach allows local government to tailor disaster risk reduction education programmes to specific regional risks and needs. Mandatory legal and regulatory enforcement of disaster risk reduction education, which could include penalties for non-compliance or rewards for compliance, should be accompanied by the allocation by the central government of an adequate budget in order to incentivise local governments or schools to prioritise implementation of disaster risk reduction education.

Finally, disaster risk reduction education policies must ensure that remote villages and islands receive the necessary support and resources. In countries where the predominant language differs by region; policy makers may consider strategies such as supplying online courses or establishing mobile training organisations which offer multilingual support in order to offer equal opportunities nationwide. In conclusion, the success of disaster risk reduction education relies on a well-balanced approach with clear and centralised policies, enforced regulations and inclusivity.

### *Disaster risk reduction education content should be rich, balanced, locally relevant and updated regularly*

When disaster risk reduction education is implemented in schools, an imbalance between knowledge and action in education can lead to a gap between theory and practice during disaster events. Furthermore, the quality of the education declines when textbooks have poor or outdated content, or when unified learning materials do not consider regional aspects. In Emerging Asia, geographical and cultural diversity have slowed implementation of disaster risk reduction education or hampered its performance. In India, for example, it has been challenging to develop a uniform educational curriculum given the country's large population and diverse terrain and weather conditions, coupled with an overall lack of direction at the national level. Greater efforts and attention are needed in India to overcome the reluctance of state and local governments to implement disaster risk reduction education.

Indonesia allows schools to develop the syllabus and learning materials for disaster risk reduction education based on guidelines provided by the Curriculum Centre, a unit under the Ministry of Education. Schools can consider the local context, including locally specific risks, local culture and the needs and conditions of learners (Pandey, 2007[110]).

In Japan, local approaches are encouraged, and the autonomy of each region is assured in textbook updates. Disaster risk reduction education in Japan is also content-rich, as it includes not only theoretical knowledge but also action in the form of evacuation drills and training. In New Zealand, where evacuation drills have been held in schools for at least a century, casualties were avoided during the onset of the 1987 Bay of Plenty earthquake because students had been taught to crouch under their tables.

Although customised textbooks based on the vulnerabilities of each region are uncommon, they are recently attracting much attention, as they may address region-specific vulnerabilities intensively, which may improve outcomes of disaster risk reduction education. Such textbooks are especially recommended for countries facing disaster risks that differ by region. Once a central government has built the foundation and issued guidelines for the curriculum, local governments or schools should tailor textbooks accounting for regional factors. Both the central government and local authorities should ensure that learning materials are updated regularly, for example with recent cases or research on the impacts of climate change. Such revisions should be frequent to ensure that disaster risk reduction education delivers precise and practical knowledge related to disaster preparedness and responses that reflects the current disaster risk profile at both the local and national level.

Beyond being based on up-to-date textbooks, curricula should be complemented by active learning methods including simulations, drills, role-playing, games and contests. These practical experiences will enable students to apply the knowledge acquired from lecture-based education.

### *Assessment of disaster risk reduction education performance is essential*

The quality of disaster risk reduction education suffers when there is a lack of evaluation and monitoring of programmes. In India, for instance, the absence of an assessment tool has caused inefficiencies and a lack of improvement in content (Annan, 2022[111]). Indonesia faces the same issue for lack of a proper assessment tool.

An example of good disaster risk reduction education assessment is offered by the Philippines, where teaching effectiveness was evaluated and observation forms to evaluate teachers were developed by the Department of Education during its *Mainstreaming Disaster Risk Reduction in the Education Sector* project (Selby and Kagawa, 2012[112]).

To measure progress on implementation of disaster risk reduction education policies, an efficient and multifaceted evaluation and monitoring system is needed. Assessments by expert groups should consider the capability of teachers and the effectiveness of training or education. Countries need to consider several factors in developing an efficient performance assessment framework. The authorities should first decide what specific outcomes are expected from disaster risk reduction education initiatives and what an assessment should aim to measure. They should then determine indicators to quantify the effectiveness of disaster risk reduction education, (e.g. number of schools participating, the frequency of training for teachers, student performance in courses or activities, and the incorporation of local disaster risk knowledge into educational materials). Qualitative indicators should also be considered, such as interviews to assess the opinions of students or teachers.

Authorities should also ensure that there are adequate tools for data collection and analysis. This might encompass surveys, interviews and document analysis instructions for the qualitative assessment of textbooks. The evaluation framework should involve experts and stakeholders such as teachers, school administrators, students and community members. Self-assessment tools can be used to evaluate disaster risk reduction education efforts and capture weak points in curricula or practical activities. Such tools can help stakeholders to make informed decisions to enhance their disaster preparedness. Self-assessment might also be carried out by peer review, unified checklists provided by the authorities and an online feedback system. In summary, the role of government is as follows: setting the goals of disaster risk reduction education initiatives, developing indicators for quantification, arranging tools for data analysis, involving a range of stakeholders in multidimensional evaluation and providing measures for self-assessment.

### *Regular training sessions should be provided for school staff and the general public*

School staff not only convey critical information about natural hazards, but when a disaster strikes, they are often first responders in schools. Disaster risk reduction education thus requires the provision of regular training sessions for teachers regarding appropriate disaster responses. Furthermore, teachers must be able to convey updated information and ensure accurate knowledge transfer.

Countries in Emerging Asia that already provide teacher training programmes include Indonesia, the Philippines and Thailand. The content of the training is not sufficient, however, given the multifaceted characteristics of disasters and of the areas where schools are located. For instance, even though training on evacuation procedures is provided to school staff members, few have experienced disasters or been trained on disaster-related themes and topics (Amri et al., 2017[113]; Kawasaki et al., 2022[114]).

The ASEAN Co-ordinating Centre for Humanitarian Assistance on Disaster Management (AHA Centre) has been conducting disaster risk reduction and response training programmes and initiatives. It currently offers the ACE Programme, which aims to prepare future leaders for disaster management. The goal of the curriculum is to enhance the knowledge, skills and behaviour of participants as humanitarian experts, multistakeholder collaborators, result-oriented managers and effective leaders. Participants interact with experts in the field and experienced leaders to explore the application of concepts and practice in their national context.

Elsewhere, Japan offers teacher professional development opportunities in disaster risk reduction education, with disaster prevention education seminars, courses to foster advisors, seminars for teachers in charge of mental care and seminars for science teachers in co-operation with meteorological observatories and crisis and environment management policy institutes. Türkiye's Ministry of Education sponsored a Basic Disaster Awareness Instructor Training Programme, with support from USAID, which

offered teachers a distance learning course as a prerequisite to applying for Master Instructor Training. Teachers who received the week-long training delivered a one-day training to more than 15 000 schoolteachers and school administrators, which led to extracurricular seminars for more than 5 million students, teachers and parents by 2005 (Petal, 2008[115]).

Disaster risk reduction education training should be mandated by policies that can be integrated into professional development requirements and teacher certificate curricula. Financial support from central or local government is required for developing training programmes and materials, and for hiring highly trained experts who can convey in-depth knowledge to teachers. Public-private partnerships are crucial to enhancing resource pooling and expertise-sharing for disaster risk reduction education training. This partnership would bring the strengths of both sectors into disaster risk reduction education training.

Government-financed private organisations with expertise in emergency response can play a key role in disaster risk reduction education. An example is South Korea's Community Emergency Response Team (CERT), which is comprised of local public and private organisations such as fire departments, emergency rescue and relief teams, the Red Cross, civic groups, private volunteer groups, religious organisations, private medical teams, etc. The CERT educates volunteers who participate in disaster response.

Regular disaster risk reduction education for communities is also essential in improving preparedness for natural disasters. Policies that encourage programmes such as community workshops, public awareness campaigns and seminars with experts are needed. Central and local financial support should extend to these community training programmes to ensure that they are accessible to all residents in the region and target citizens who are especially vulnerable to disasters such as children, the elderly and people with disabilities.

### *Disaster prevention learning facilities and digital literacy improvement programmes are useful*

Several countries, especially those that are prone to natural hazards, have established disaster prevention learning facilities run by the public sector. These facilities offer interactive and realistic experiences where individuals learn practical skills, such as evacuation procedures or how to use fire extinguishers properly. They also help individuals to understand the importance of preparedness, in terms of both knowledge and practical skills, to protect themselves during disasters.

A significant project in Emerging Asia is the ASEAN Safe Schools Initiative (ASSI), which aims to make children more resilient to disasters by making schools safe and secure. This initiative is implemented by the ASEAN Secretariat in co-operation with various civil society organisations and is supported by the European Commission's Humanitarian Aid and Civil Protection Department (ECHO) and Australian Aid. However, disaster prevention learning facilities are not yet widely considered as a tool for strengthening the capabilities of citizens in the area.

Among OECD countries, Japan is known for its disaster-prevention-experience learning facilities. For example, the Tokyo Rinkai Disaster Prevention Park provides simulations of earthquakes, fires and other emergency scenarios to educate visitors on disaster response. In the United States, the California Academy of Sciences in San Francisco has an earthquake simulator where visitors can experience a realistic earthquake simulation, the aim being to educate the public on the need for readiness.

Training in digital literacy is also essential for disaster risk reduction as crucial information such as early warnings and the location of shelters and evacuation routes is now mainly disseminated via online platforms. Several countries in Emerging Asia, including Singapore and Malaysia, have implemented initiatives for improving the digital literacy of the public and students, although such programmes do not necessarily focus on disaster risk. Thailand, however, has initiated a programme to train individuals in rural and remote areas to use digital tools for receiving early warnings and disaster updates. Across the region, there is room for improvement in training in the use of online platforms designed for disaster events.

## Improving health responses to disasters in Emerging Asia

The health impacts of disasters are often enormous. The injuries suffered can be acute and may lead to lasting disability. Disasters can also spawn mental health issues related to trauma and stress. They can significantly stress healthcare resources, which may also face distributional issues. All Emerging Asian countries have plans for directing health responses to disasters. Central government agencies responsible for disaster management typically co-ordinate with health ministries to address the negative health impacts (Table 2.3). Responses to large-scale disasters often involve support from a country's armed forces and external professionals, while responses to smaller-scale disasters may be managed at lower levels of government.

### Table 2.3. Health responses to disasters in Emerging Asia

| Country | Health responses | Mental health responses |
|---|---|---|
| **ASEAN-5** | | |
| **Indonesia** | Health service provision is addressed in *Rencana Nasional Penanggulangan Bencana 2020-2024* | Funds from national and sub-national budgets (ABPN and APBD) contribute to MHPSS in disaster recovery |
| **Malaysia** | Crisis Preparedness and Response Centre (CPRC) and sub-national CPRC within health departments responsible | *National Guidelines for Mental Health and Psychosocial Response to Disaster* |
| **Philippines** | Health Emergency Management Bureau (HEMB) clusters provide health services in disasters. National Emergency Medical Teams (EMT) assist LGUs as needed | HEMB has a MHPSS cluster |
| **Thailand** | Local governments must budget for health services in disasters, local governments respond, but more severe disasters receive higher level responses | Health-related and social well-being rehabilitation includes MHPSS, MOPH responsible |
| **Viet Nam** | Ministry of Health has a Commanding Committee for Natural Disaster Prevention and Control, Search and Rescue (CCNDPC/SAR); MOH and provincial departments participate in disaster risk management system; Health Sector Action Plan | National Steering Committee for National Disaster Prevention and Control (NSCNDPC) collaborates with Disaster Risk Reduction Partnership members (NGOs, etc.) |
| **Brunei Darussalam and Singapore** | | |
| **Brunei Darussalam** | The *Public Health Emergency Operation Plan* co-ordinates efforts of the National Disaster Management Centre (NDMC) and Ministry of Health (MOH) and gives the MOH authority over health responses disasters. | *Brunei Darussalam Mental Health Action Plan 2022-2025* calls developing national disaster mental health management guidelines or incorporating mental health in National Emergency Preparedness Plan a priority action |
| **Singapore** | Singapore EMT on-call in hospitals always | *Disaster Mental Health Programme for Communities in Asia* organises fora and training sessions open to all of Asia |
| **CLM countries** | | |
| **Cambodia** | *National Strategic Plan on Disaster Risk Management for Health 2020-2024* | MHPSS response is a priority strategy under the *National Strategic Plan on Disaster Risk Management for Health 2020-2024 but is absent from the Mental Health Strategic Plan 2023-2032* |
| **China and India** | | |
| **China** | *National Emergency Management System Plan during the 14th Five-Year Plan Period* | MHPSS support in schools, training for rural health professionals, online lectures for public |
| **India** | Ministry of Health and Family Welfare collaborates with Armed Forces | *Mental Health and Psychosocial Support Services in Disasters (December 2023)* |

Source: Authors' compilation from national sources and intergovernmental organisations, and (Li et al., 2022[116]), "Mental health and psychosocial interventions to limit the adverse psychological effects of disasters and emergencies in China: A scoping review", *The Lancet Regional Health - Western Pacific*.

The localised nature of health systems and regional disparities within countries can result in uneven provision of healthcare services in the wake of a disaster. Countries with relatively stronger disaster response and healthcare systems are more likely to have plans to offer interregional assistance at the

subnational level (e.g. to an affected state or province from one that is unaffected). This section addresses policy considerations for mobilising healthcare to disaster-stricken areas, preserving healthcare capacity in the aftermath of a disaster and scaling up healthcare capacity in the short and long term.

### *Health responses to disasters require intricate co-ordination*

Severe disasters often present significant health response challenges that local or even national authorities may have difficulty handling on their own. As part of the broader effort to develop interconnectedness within ASEAN, the association has founded the ASEAN Co-ordinating Centre for Humanitarian Assistance on disaster management (AHA Centre) under the auspices of the ASEAN Agreement on Disaster Management and Emergency Response (AADMER). The AHA Centre provides support for national disaster management organisations of the respective member states, and facilitates co-ordination between member states and international organisations, NGOs and private sector actors in disaster response management.

Health system co-ordination in response to disasters involves various levels of government. While disaster management authorities are often national in scope, aspects of healthcare systems may be managed at subnational levels. Clear lines of communication must be established between national and subnational officials so that all parties can understand needs and capacity to assist. In countries where military personnel play a significant role in disaster response, a clear delineation of authority between civilian and military co-ordinators and responders may be useful. In either of these cases, avoiding unnecessary duplication of efforts is a key objective to minimise wasted time and funds. Most countries in Emerging Asia have established disaster response hierarchies. In some cases, the scale of an event determines which officials are authorised to declare a disaster or which level of government is primarily responsible for managing it. For instance, Thailand classifies disasters from levels 1 to 4, based on areas affected, geographic size, level of severity and complexity, population affected, existing capacity for emergency management and availability of resources. As severity increases from 1 to 4, command and co-ordination responsibility is delegated to higher authorities (Table 2.4). Several other Emerging Asian countries use similar systems (e.g. Brunei Darussalam, Malaysia, Viet Nam).

**Table 2.4. Disaster declaration authority and command by disaster level in Thailand**

| Disaster level | Declaration authority | Disaster management authority |
|---|---|---|
| 1 (small-scale disaster) | Provincial/Bangkok Metropolitan incident commander | District/local government incident commander or Bangkok Metropolitan assistant incident commander |
| 2 (medium-scale disaster) | Provincial/Bangkok Metropolitan incident commander | Provincial/Bangkok Metropolitan incident commander |
| 3 (large-scale disaster) | National incident commander | National incident commander |
| 4 (catastrophic disaster) | Prime minister or assigned deputy | Prime minister or assigned deputy |

Source: Authors' adaptation from (NDPMC, 2015[117]), *National Disaster Risk Management Plan*.

Hierarchies must be defined clearly enough to ensure functional chains of communication and command, while allowing those closest to the disaster – usually local officials at the bottom of the hierarchy – enough autonomy to make assessments of needs and communicate those needs to officials at higher levels of government. In Emerging Asian countries, several government agencies are typically involved in disaster responses. Disaster responses therefore require efficient and robust plans of co-ordination between agencies and levels of government. Roles of involved bodies should be clearly defined with minimal overlap.

For example, Thailand incorporates 27 government agencies into its disaster response plans. The Ministry of Public Health is the agency primarily responsible for health aspects of disaster responses. It is

responsible for issuing directives to several agencies under its supervision and co-ordinating among other agencies, universities and medical facilities. The 2015 National Disaster Risk Management Plan was designed and implemented in response to findings that disaster responses in Thailand were fragmented by local jurisdictions and that co-ordination among government agencies was insufficient. In the aftermath of the Indian Ocean tsunami of 2004, Thai hospitals performed well given the stressful demands placed upon their facilities and staff, but procedures for assisting victims differed by province. A national agency charged with the oversight of health responses to disasters may help to reduce regional disparities in care available. Intraregional (hospital-to-hospital) co-ordination and interregional co-ordination are both essential.

### *The health of the general population must also be preserved during disasters*

Disaster management authorities must not only contend with injuries or illnesses acquired during disasters, but they must also work to preserve the health of the population. A breakdown in sanitary conditions may arise from infrastructure damage that makes hygienic practices difficult or from unplanned exposure to substances dangerous to human health. It is thus a top priority to ensure that those affected by disasters have access to clean water for drinking and maintaining hygiene, along with hygiene equipment and supplies. Food security may also be threatened during and immediately after a disaster, while individuals whose homes are damaged or destroyed in disasters require temporary shelter. Food and water security, hygiene and health services must be preserved during and following disasters. Advisory messaging to stockpile potable water, non-perishable food and prescription medications should be disseminated in all phases of the disaster cycle.

In addition to these immediate environmental concerns, care must continue for pregnant women, people with chronic medical conditions and those already hospitalised prior to a disaster. Hospitals should be equipped with generators and have stocks of critical supplies to be used only in a disaster scenario. It should be a priority to ensure that patients requiring frequent regular treatment (e.g. those on dialysis or undergoing cancer treatments) have their treatment schedules preserved as much as possible or are triaged for limited care at the very least (Lempert and Kopp, 2019[118]), as alterations to these schedules may lead to negative health consequences. Individuals with medical conditions requiring chronic use of medication should be permitted and encouraged to stockpile some of their medications for use during and after a disaster. Health authorities should also instruct doctors to inform outpatients requiring regular treatments about how to seek those treatments during a disaster.

### *Resource flexibility facilitates disaster response*

Resource flexibility is vital in disaster response. Depending on the location and type of a disaster, local health-related physical and human capital might be insufficient. While severe disasters or catastrophes often draw international aid, smaller or more localised disasters may not. ASEAN has some support programmes in place, but these programmes operate on a relatively small scale, so the quickest and most robust response most often needs to come from the affected country itself. Maintaining accurate data on medical personnel, hospital and resource capacity at all levels of administration may help policy makers decide how to best allocate resources.

For instance, in areas where medical demand is lower, medical personnel could be encouraged to make themselves available to go elsewhere in the country in response to a disaster. Because it is undesirable for such temporary personnel movements to cause shortages in the regions of origin, accurate data would help policy makers choose which regions can best afford to participate in such a programme. Licensure requirements vary by country: while many countries operate medical (or nursing) licensure on a national basis, some, such as Canada and the United States, require additional licensure at subnational levels. Requirements of this type inevitably constrain the flexibility of the workforce. Any requirements of this type

should be suspended for out-of-region domestic professionals during a disaster. Formal agreements of mutual credential recognition may prove helpful.

There is also a need to redistribute medical equipment and supplies during a disaster. Health authorities might consider maintaining a stockpile of critical equipment and supplies in a usable state. The database should be reviewed regularly to remove expired medicines or equipment that has reached the end of its useful life. During a disaster, local incident authorities should be responsible for updating the database frequently so that it reflects the current status of the stockpile. Logistics plans including how the supplies are stored, distributed or transferred may be helpful as they would allow disaster responses to be accelerated.

Because disaster medicine often requires medical personnel to work in atypical conditions with additional constraints, specialised training is useful (Box 2.5). Courses in disaster medicine should be offered, and countries with a high incidence of disasters should consider making such teaching a mandatory component of medical and nursing training. In the longer term, as emergency response capacity improves, national teams capable of helping Emerging Asian peers could be envisaged.

### Box 2.5. Effective disaster response requires special training for medical professionals

Disaster medicine can be significantly different than medicine practised under standard conditions. During a disaster or its immediate aftermath, medical personnel may be faced with adverse working conditions in a new environment, an inability to access the full range of equipment or medicines available in clinics or hospitals and limited or no electricity. Disaster medicine also requires special triage skills to allocate scarce medical resources in a way that leads to the best outcome in terms of lives saved. Due to these factors, disaster medicine requires special training beyond basic medical education.

Within Emerging Asia, Singapore already has a disaster medicine training programme. Although Singapore faces natural disasters infrequently, an emergency medical team (EMT) consisting of two doctors and four nurses is available for every shift at all public tertiary hospitals. The EMTs are provided with the necessary equipment and supplies and operate on a “scoop-and-run” principle, where minimal care is provided at the disaster site and patients are transferred to hospitals as quickly as possible. While training in disaster medical response was conducted mainly on an ad hoc basis in Singapore for some time, a formal course began in 2013 in response to demand from multiple stakeholder groups. Developing familiarity with available equipment and supplies, and conducting appropriate assessments and treatments under those constraints, are key components of the course. Similar training courses are available for disaster management teams in Japan, Korea, Australia and New Zealand.

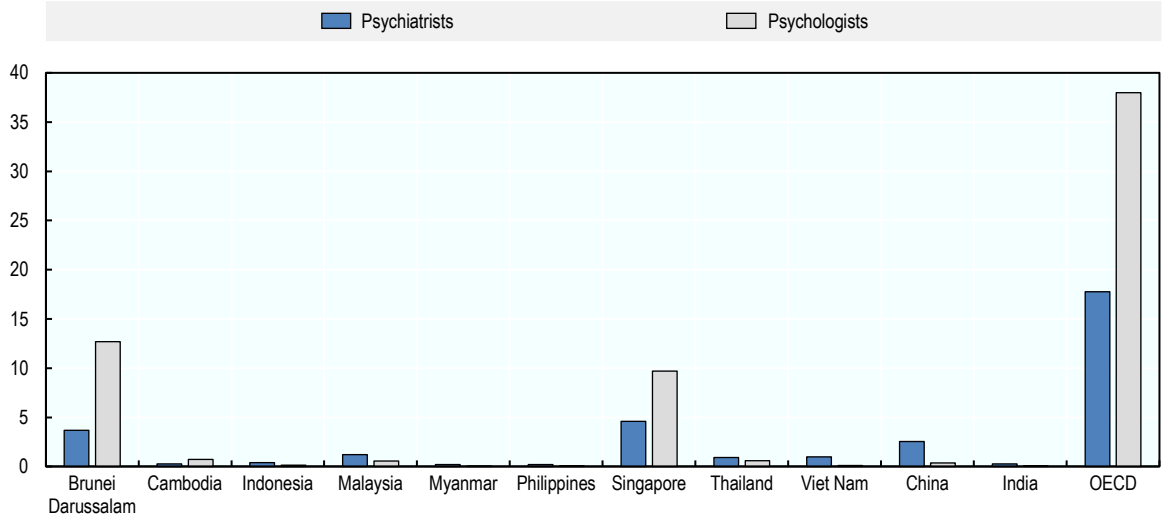
All Emerging Asian countries would benefit from making such training a standard component of the basic medical and nursing curriculum. Given the relative scarcity of medical professionals in many Emerging Asian countries, policy makers should consider making disaster medicine training a mandatory part of the medical curriculum for those entering emergency medicine or emergency nursing, if not for all potential medical or nursing graduates. The development of other national EMTs would increase disaster resilience in the region.

Source: Authors based on Ciottone (2016[119]), “Introduction to Disaster Medicine” in *Ciottone's Disaster Medicine*; Pek et al. (2015[120]), “Emergency medicine as a specialty in Asia”, *Acute Medicine & Surgery*, and Pek et al. (2023[121]), “Developing the Disaster Medical Responder's Course in Singapore”, *Western Pacific Surveillance and Response Journal: WPSAR*.

### *Mental health care in the aftermath of a disaster is crucial*

The mental health consequences of a disaster can include post-traumatic stress syndrome (PTSS), depression and anxiety, which differ in duration and prevalence across age groups and disaster types (Newnham et al., 2022[122]). Disaster preparedness thus requires the training of medical personnel to deal with mental health issues. However, mental health services are relatively scarce in Emerging Asia. In most Emerging Asian countries, the proportion of psychologists and psychiatrists in the population is far below the OECD average (Figure 2.7). As a result, it can be difficult to access care by these professionals even in typical times, with the effects of disasters only exacerbating the problem while also increasing demand.

## Figure 2.7. Mental health professionals per 100 000 population, latest data available




Note: OECD data represent a simple average among reporting economies (37 of 38 for psychiatrists, 34 of 38 for psychologists). All 12 Emerging Asian countries report values for both psychiatrists and psychologists.
Source: (WHO, 2019[123]), *Global Health Observatory Data Repository (database) - Mental health workers by country*; (WHO, n.d.[124]), *WHO Mental Health Atlas*; (Ministry of Health Singapore, 2021[125]), *Sufficiency of Number of Practising Psychiatrists and Psychologists in Singapore (website)*; and (OECD, 2023[101]), *Healthcare resources: Physicians by categories (database)*.

StatLink https://stat.link/wbzgtv

Scarcity issues become even more concerning when the needs of different populations are considered. Children and adolescents may have different psychological or psychiatric needs than adults, and countries with large migrant worker populations would benefit from professionals who can speak their languages. Mental health services should therefore be scaled up, including via digital services, with specialised services for vulnerable groups such as women, children and migrant workers.

Despite these challenges, many countries in Emerging Asia offer disaster-specific mental health and psychosocial support services, and some have formal plans. Some plans also include caring for disaster workers who may face psychological challenges due to extreme stress and exposure to tragedy (Box 2.6).

### Box 2.6. Disaster-response workers may need mental health care

While many Emerging Asian countries acknowledge the need to provide mental health and psychosocial support (MHPSS) to victims of disasters, relatively few have explicit plans to provide mental health support to disaster-response workers. Examples of such workers include rescue workers (fire, police, ambulance, military), medical personnel (doctors, nurses, hospital or clinic staff), or the professionals providing MHPSS to disaster victims themselves. In the course or aftermath of a disaster, these workers are faced with situations of extremely high stress, where complex decisions must be made quickly, and where error may prove fatal to those they are working to help.

Among Emerging Asian countries, Malaysia and India make mention of mental health care for disaster response workers in their disaster response plans. India mentions first responders as a vulnerable group, while Malaysia focuses on mental health considerations for disaster responders.

Stress management is essential both for those who volunteer and those who are obliged to assist (e.g. medical professionals near a disaster site). Team leaders can help manage stress by limiting shifts to 12 hours and ensuring a minimum of 12 hours off between shifts, and by providing workers access to MHPSS professionals. Reducing potential sources of frustration by maintaining clear command and role structures, and ensuring that essential supplies and equipment are available, is also helpful. A "buddy system" where pairs of colleagues observe each other can help identify colleagues who are overstressed but unaware of their state or afraid or ashamed to mention it. To manage stress, leaders can also rotate workers between high, medium- and low-stress tasks as skillsets permit (e.g. a nurse qualified to provide intensive care may benefit from periods of time in a standard nursing role). Workers will also need extended time away from their assignments. In addition, exit plans comprising a relatively fixed end date of a service period and the details of re-entry into service (e.g. length of leave, number of service periods expected) should be available to workers as a means of goal setting. MHPSS should also be made available to disaster workers once they have finished a period or the entirety of their service. Following a disaster, some workers might find readjusting to normal life challenging, especially if they have been separated from their families or regular activities for a long time.

Emerging Asian countries would be well-served to pursue similar approaches to assist the mental health of disaster response workers. A scarcity of human capital in some areas (e.g. specialist doctors) may lead to health professionals being overworked and becoming overstressed out of necessity. Likewise, MHPSS should be offered to all disaster response workers at the end of their period of service, and a mandatory debriefing (individual or group) could be considered. However, this may further strain limited MHPSS resources dealing with disaster victims, so alternative modes (e.g. online MHPSS or debriefing) should be considered as options.

Source: Authors based on (NDMA, 2023[126]), *National Disaster Management Guidelines: Mental Health and Psychosocial Support Services in Disasters* and (Ministry of Health Malaysia, 2013[127]), *Manual on Mental Health and Psychosocial Response to Disaster in Community*.

The Asia-Pacific Disaster Mental Health Network provides guidance for mental health considerations specific to disaster situations. The network recommends implementing initiatives at the individual, family and community levels to strengthen mental health (Newnham et al., 2020[128]). Psychological first aid, child-specific mental health services and mental health education are key components of a successful response in the immediate aftermath of a disaster. Policies to reduce the economic harm caused by disasters will also help alleviate stress. Newnham et al. (2020[128]) mention that low-intensity programmes are necessary for those who suffer longer-term mental health effects. Clinical treatment should be provided for those with diagnosable conditions. Since disasters are likely to have larger effects on rural areas, digital mental health services should be scaled-up, supported by the digitalisation efforts that commenced in earnest during the

COVID-19 pandemic (Ben-Zeev, 2020[129]; Newnham et al., 2020[128]). However, this should not come at the expense of development of traditional in-person services, as they are not necessarily interchangeable. As with other types of socio-economic interventions, high-risk groups require special attention. Women, children, the elderly and ethnic or religious minorities are potential examples of these.

Several researches on the relationship between disasters and suicide rates reveals the importance of post-disaster mental health follow-up and hints at a possible secondary benefit of disaster risk reduction measures. For instance, according to Matsubayashi et al. (2013[130]), Japanese data indicate that changes in suicide rates following a disaster depend on the severity of the disaster as measured by the number of people affected (killed, injured, or having a damaged or destroyed home) in a given prefecture, and may differ among demographic groups (age-sex pairs). The study found that suicide rates tend to increase, decrease and increase again following disasters (increasing on a net basis over five years). However, these findings are heavily influenced by the effects of the Great Hanshin Earthquake of 1995. Without this severe disaster, the positive relationships disappear and the trend in the suicide rate becomes negative for all years, at the period of the disaster and five years later.

MHPSS programmes should be in place for up to five-six years following a severe disaster, and suicide trends should be monitored, and anti-suicide measures taken (e.g. messaging, helplines). The programmes may need to be tailored for demographic needs.

## Facilitating the role of the private sector

### *Disasters present Emerging Asia's private sector with a range of challenges*

Exposure to disasters has confronted the private sector of Emerging Asian countries with a range of significant challenges. They include:

- *Regulatory and compliance issues*. After a disaster, governments frequently implement new or modified regulations and compliance standards in order to improve preparation for any such future events. This is an important measure for any disaster-vulnerable country, especially when targeting critical infrastructure such as schools and hospitals that can also serve as shelters during a disaster. However, this obliges the private sector to adjust to the changing regulatory framework, which might include stricter building codes and amplified environmental criteria (UN, 2015[131]), resulting in additional upfront investment.
- *Insufficient risk assessment*. Emerging Asia's private sector is dominated by micro, small and medium-sized entrepreneurs, many of whom operate in an informal setup. Such businesses may not have access to state-of-the-art risk assessment tools that can analyse a wide range of factors, from disasters to supply-chain vulnerabilities. Without such tools and necessary expertise to use them, businesses may struggle to quantify and understand the multifaceted nature of risks they face, making it challenging to make informed decisions, especially in the face of repeated disaster events.
- *Limited insurance coverage*. Emerging Asian countries have a long heritage of small cottage-based industries that often run on tight budgets, where the cost of an insurance premium might be perceived as additional financial burden. Many businesses in the region are either underinsured or lack insurance altogether, exposing them to significant financial losses in the event of a disaster, which can lead to job losses and economic downturns in the affected regions.
- *Weaknesses in supply-chain management*. Damage by disasters to crops, transportation networks, manufacturing facilities, warehouses and other critical infrastructure disrupts supply chains, causing delays, shortages and increased expenses. To mitigate these risks, the private sector needs to establish more resilient supply-chain systems. This involves diversifying suppliers,

implementing robust risk management practices, investing in technology for real-time visibility into the supply chain and developing contingency plans.

- *Deficient co-ordination*. Public-private co-ordination enables the joint development of policies and advocacy efforts aimed at creating a conducive environment for disaster preparedness and response. This collaboration can lead to the formulation of regulations that incentivise businesses to adopt resilient practices and contribute to overall community resilience. However, the private sector often faces challenges in co-ordinating with government agencies and other stakeholders, leading to duplicated efforts and inefficient resource utilisation. Moreover, the private sector frequently lacks the necessary communication infrastructure and protocols to respond efficiently (ASEAN, 2016[132]). Consequently, post-disaster recovery can be delayed and become less efficient.
- *Economic downturn and joblessness*. In a survey conducted in ten ASEAN countries from 2022 to 2023, a significant portion of respondents in all countries identified unemployment and economic recession as the primary challenges confronting the region. This situation can become even worse in the aftermath of a disaster. Smaller businesses without proper insurance coverage can face an existential crisis, while supply-chain disruptions encountered by larger businesses can influence business expansion and stability.

In India, for example, the private sector has encountered numerous disaster-related challenges over the last decade that have impacted its operations, performance and reputation. Disasters such as cyclones, floods, earthquakes, landslides, droughts and pandemics have impacted private-sector supply chains, infrastructure, assets, workforce, customers and markets, posing threats to the sector's recovery.[3] India's private sector has acknowledged the need to bolster business continuity and resilience through strategies like risk assessment, contingency planning, insurance, backup systems and crisis management.

In China, the risk of disasters has been escalating due to swift economic development and urbanisation as well as climate change. Over the last ten years, China's private sector has been significantly impacted by disasters including earthquakes, typhoons, floods, droughts, sandstorms, storm surges, landslides and debris flows, hailstorms, cold waves, heat waves, pests and rodent disease, forest and grassland fires, and red tides.

### *The region's private sector can take various measures to adapt to disaster risk*

The disaster-risk challenges facing the private sector are spurring efforts to adapt via enhanced disaster resilience and preparedness, and improved disaster management. In Cambodia, for example, the private sector is actively working to implement strategies to adapt to natural disasters, guided by principles encompassing preparedness, response and recovery. Across Emerging Asia, adaptation measures undertaken by private firms include:

- *Supply-chain diversification*. Supply-chain diversification refers to expanding and varying supply chains to decrease reliance on singular sources and locations susceptible to disasters (UNCTAD, 2021[133]). It is a proactive disaster risk reduction strategy that enhances the resilience and adaptability of businesses before and after a disaster. Emerging Asian countries are encouraging such diversification. For example, the Singapore Economic Development Board has been promoting the benefits of making commodities in different countries (SEDB, 2023[134]). Both local and international manufacturers can benefit from Singapore's SG+ twinning model, which establishes dual production facilities in Singapore and in the neighbouring region of Johor in Malaysia and the islands of Batam, Bintan and Karimun in Indonesia. By spreading risk across multiple suppliers, regions and facilities, companies can better navigate disruptions, maintain business continuity and safeguard their long-term sustainability. While diversification may involve additional upfront costs, it can lead to long-term cost efficiency by preventing substantial financial losses associated with supply-chain disruptions. The investment in diversification often proves to

be a prudent strategy given the potential costs of extended downtime, loss of customers and reputational damage resulting from single-source dependency.

- *Risk assessment and management*. Companies are engaging in the evaluation of potential hazards and vulnerabilities, formulating contingency plans to manage risks effectively. Supply-chain diversification encourages companies to conduct comprehensive risk assessments and develop effective risk management strategies. This proactive approach enables businesses to identify vulnerabilities in their supply chains, implement risk mitigation measures and continuously monitor and adapt to changing risk landscapes.
- *Business continuity planning*. Enterprises are formulating business continuity plans to guarantee the uninterrupted operation of critical business functions in the face of and following a disaster. In the event of disaster-induced disruptions, companies equipped with diversified supply chains are better positioned to maintain operations, meet customer demand and uphold contractual obligations. This, in turn, helps protect the company's reputation and market share.
- *Collaboration*. Collaboration between stakeholders, especially with the government, is a cornerstone of effective disaster management for businesses. By working together, businesses can access additional resources, share critical information and contribute to a more co-ordinated and resilient response. The collaborative approach enhances overall preparedness, response and recovery efforts, ensuring that businesses can navigate the challenges posed by disasters more effectively and contribute to the well-being of the broader community. Firms are actively co-operating with various stakeholders, including governments, NGOs and local communities, to devise and implement strategies aimed at reducing the risks associated with disasters (Renaud et al., 2021[135]).
- *Insurance uptake*. Businesses are procuring insurance policies as a safeguard against losses arising from natural disasters. Insurance serves as a critical risk management tool for businesses during disasters, providing financial protection, supporting recovery efforts and contributing to overall resilience. Businesses that prioritise comprehensive insurance coverage are better equipped to navigate the challenges posed by disasters and emerge stronger in the aftermath.

Apart from these actions, certain companies have embraced adaptation measures based on ecosystems. For example, the United Nations Environment Programme (UNEP) and its collaborators are supporting the private sector in Cambodia to adjust to climate change through the enhancement of agricultural resilience, the extensive reforestation of natural areas and the creation of "home gardens" (UNEP, 2022[136]).

In Indonesia, especially in the aftermath of the 2004 Indian Ocean tsunami, emphasis on partnerships in disaster management was reinforced by the Disaster Management Law of 2007. The initiation of the Disaster Resource Partnership by the World Economic Forum aimed to establish collaboration across three sectors: government, private sector (with a focus on construction and engineering companies) and humanitarian workers. The primary focus of this collaboration, which was officially launched in 2012, was on reducing the risk of disasters, recognising Indonesia's susceptibility to various hazards. The initiative features robust support from the government and private sector along with collaboration with the United Nations (Rembeth, 2015[137]). This support and collaboration helps to streamline co-ordination, deliver expertise, share knowledge and advocate for the involvement of the engineering and construction sector in humanitarian endeavours.

In 2008, Malaysia organised the 3rd Asian Ministerial Conference on Disaster Risk Reduction, which endorsed corporate social responsibility, business continuity plans and the establishment of disaster risk insurance markets that offer financial incentives for reducing disaster risks.[4] Both the private sector and NGOs have achieved success through their collaborative activities in areas such as raising awareness and interest, sharing knowledge and expertise, establishing sustainable long-term collaborations and developing disaster preparedness programmes. By supporting and collaborating with NGOs, private

companies can contribute to activities they deem crucial even if those activities are not their primary focus or expertise (Mathan and Izumi, 2015[138]).

In the Philippines, numerous private-sector entities perceive the escalating effects of climate change as a substantial threat to their operations. Both businesses and households contend with frequent typhoons and are exposed to repercussions of climate change such as rising sea levels. Micro, small and medium-sized enterprises (MSMEs), which constitute 99% of all registered businesses in the Philippines, encounter notable difficulties in comprehending how climate change impacts may affect their profitability and long-term sustainability. To address these concerns and enhance climate change resilience, the national government, local government units and development organisers collaborate with private sector entities and other non-state actors. This collaborative effort aims to alleviate constraints faced by businesses, particularly MSMEs, making them more resilient to external shocks. Such endeavours carry significant implications for economic growth in the Philippines (Casado-Ascensio, 2021[139]).

In India, the private sector typically plays a supportive role following a disaster, actively engaging in humanitarian efforts during the response and relief phases.[5] While these engagements have a significant impact on the community, they are dependent on aid and primarily focus on post-disaster relief and rehabilitation (Bhatt, 2002[140]; Twigg, 2001[141]). Most corporations that participated in disaster response or recovery in the aftermath of 2001 Gujarat Earthquake had a significant community tie or business interest in the disaster area (Patel and Alagh, 2013[142]). International, national or state-level corporations that participate in the long-term recovery process are those with significant corporate social responsibility (CSR) funds. International corporations typically collaborate with NGOs or foundations, while national and state-level companies contribute to a shared fund. Local organisations have fewer funds to contribute and serve mostly as beneficiaries, primarily acting as first responders. Disasters are gradually becoming catalysts for increasing private-sector involvement and contributing to societal well-being (Chatterjee and Shaw, 2015[143]).

### *Policies on measures to improve private-sector capacity for disaster resilience*

Governments can enact policy measures aimed at enhancing the capacity of the private sector to manage and recover from disasters. Policy measures include:

- *Evaluating the susceptibility to disasters of all sectors, including the private sector*. The Sendai Framework highlights the need to understand disaster risk as a crucial action point. In particular, it is important to establish risk information and modelling systems to evaluate the economic and fiscal repercussions of natural disasters, integrated into overall fiscal risk management.
- *Boosting disaster risk governance*. This entails improving the legal, institutional and policy frameworks for disaster risk reduction, including those relevant to the private sector. Such improvements will boost disaster preparedness for effective response at all levels, including the private sector (Wen et al., 2023[144]).
- *Mobilising public-private partnerships when investing in disaster resilience*. The challenges associated with financing climate-change adaptation measures, particularly in the private sector, largely stem from the perceived lack of a "business case" for adaptation. It is therefore important to understand the need for public-private partnerships, together with a comprehensive benefit-cost analysis, when investing in disaster risk reduction for resilience.
- *Encouraging the growth of private catastrophe risk insurance markets*. This can be accomplished through collaborative efforts between the public and private sectors, along with the development of supportive regulatory frameworks and risk market infrastructure. Governments can endorse initiatives such as the UN-supported Private Sector Alliance for Disaster Resilient Societies (ARISE) to leverage private-sector strength in reducing the nation's vulnerability to disasters (Lu, 2022[145]).

## Conclusion

A holistic approach to disaster-resilient development can help countries to cope with the rising risk of natural disaster. As we have seen, this is particularly important in Emerging Asia, the world's most disaster-prone region. The accepted governance norms of the past can no longer meet the requirements posed by the increasing complexity of systemic risks. Addressing the impact of disasters requires strategic development of new holistic policy measures towards resilience.

Beyond their potentially devastating short-term effects, disasters impede long-term development and sustainability by interrupting the production and distribution of goods and services and by overwhelming government budgets. Vulnerable groups and communities are particularly endangered, as the economic and social structures they rely on are often compromised.

This chapter has examined how countries in Emerging Asia can evolve and adopt institutions and governance systems to cope with the increasing risk posed by natural hazards. It has shown that a proactive approach, i.e. preparing for disasters before they strike, is far more efficient and effective than the region's currently predominant reactive approach of managing disasters in their aftermath.

Measures that can be taken to transform governance and improve institutional capacity to manage rising disaster risks include steps such as bolstering risk assessment, developing a capacity-building programme for all levels of government and updating disaster management laws and regulations. A key challenge is that the limited availability of disaster risk data hinders effective monitoring and evaluation of policy implementation.

Lack of funding for disaster preparedness and recovery is another major constraint faced by countries in the region. At present, funding for disaster resilience is often deprioritised due to competition from other urgent budget items. Policy makers should seek to redress this situation by increasing the availability of funds for disaster risk reduction measures, with particular attention to local government budgets and aligning policies at different government levels to prevent overlaps.

Coherent strategies for building financial resilience to disasters involve an integrated approach to managing disaster risk across all levels of government. A key step for the region is to boost the use of disaster insurance by households and firms. To better manage the financial impact of disasters, it is also important for governments to consider new options, such as catastrophe bonds, insurance pools and disaster risk financing mechanisms.

Building disaster-resistant infrastructure and retrofitting existing infrastructure for disaster resilience is a critical step towards adapting to climate change. However, major capital investment and effective financing methods are needed for the construction of disaster-proofed electricity grids, public transport systems, irrigation systems, dams, retaining walls, seawalls, buildings, etc. Nature-based infrastructure solutions are important in ensuring a sustainable future.

Likewise, at a time when millions of people in Emerging Asia are being displaced by disasters, policies are needed to address disaster-linked migration and its economic, social and environmental repercussions. Land planning also needs to be improved, for example by changing the zoning of disaster-vulnerable areas.

Technological innovations such as drones, search-and-rescue robots, artificial intelligence, blockchain technology and spatial analysis tools offer major potential for disaster risk management. Governments can build capacity for the use of new technologies by supporting investment in research and development, facilitating internet and mobile phone access, and encouraging co-operation between industry and academia.

Education in disaster risk reduction can be challenging in the region due to geographic and cultural diversity. However, as disaster risk rises, building public preparedness is essential. Steps include incorporating disaster risk reduction education (both theory and practice) into school curricula; organising

training for school staff and community members; and monitoring and assessing education programmes to ensure their efficacy.

Meeting the health response challenges of severe disasters requires efficient and robust plans of co-ordination between agencies and levels of government. Roles of involved bodies should be clearly defined with minimal overlap. Maintaining accurate data on medical personnel and hospital and resource capacity at all levels of administration may help policy makers decide how best to allocate resources. Effective response requires special training of medical professionals in health and mental health care for disaster victims.

Finally, exposure to disasters has confronted the private sector in Emerging Asia with significant challenges. In view of increasing risks, private-sector businesses can improve their disaster preparedness through steps such as supply-chain diversification, risk assessment and investment in resilient infrastructure, while governments can enact policy measures to enhance private-sector disaster resilience.

## Notes

[1] Emerging Asia groups the ASEAN member countries – Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand and Viet Nam – plus China and India.

[2] The likelihood of displacement varies across the region. In Singapore, a high-income nation, the chance of experiencing displacement in a disaster is one in a million. In contrast in Lao PDR and the Philippines, this risk is more than 7 000 and 6 000 times higher, respectively (Lavell and Ginnetti, 2014[146]). The probability of displacement is more than 10 times higher for Laotians and Filipinos than for Indonesians, even though Indonesians also face various geophysical and weather-related hazards (Islam and Khan, 2018[80]).

[3] India's private sector suffered significant economic losses from a succession of natural disasters: losses of more than INR 70 billion (Indian rupees) from the Gujarat Earthquake in 2001; about INR 50 billion from the Mumbai Floods in 2005; about INR 120 billion from the Uttarakhand Floods; and more than INR 40 billion from Cyclone Phailin (Chatterjee and Shaw, 2015[143]).

[4] Disaster risk reduction initiatives in Malaysia have been developed not only by the government but also by other stakeholders, including the private sector, often in close collaboration with NGOs. A leading animation service provider in Malaysia, Animasia, was approached by an NGO to support and participate in their disaster education programme for primary school students. Animasia enhanced disaster preparedness among students and built disaster resilience, ultimately creating a positive corporate image and generating more business development opportunities through collaboration with a popular NGO.

[5] The private sector has engaged in disaster management through five types of CSR activities: philanthropic or charitable actions, contractual obligations, collaborative efforts, adversarial relationships, and unilateral initiatives.

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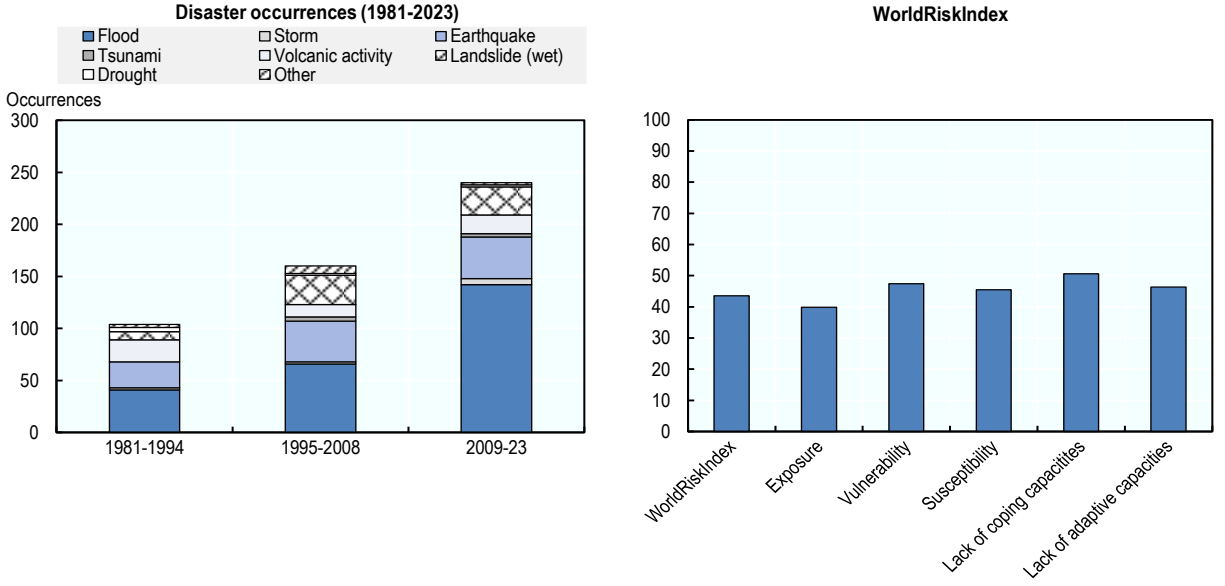
# Country notes on disaster risks in the ASEAN-5 countries

# Indonesia

## Introduction

Indonesia is one of the most disaster-prone countries in the world, characterised by high levels of natural hazards along with high vulnerability and exposure. It is classified as facing a very high disaster risk, ranking second in the WorldRiskIndex 2023. Between 2000 and 2022, disasters triggered by natural hazards caused almost 190 000 deaths and affected nearly 24 million other people (CRED, 2024[1]).

### Indonesia: Disaster occurrences (from 1981 to 2023) and WorldRiskIndex




Source: EM-DAT and WorldRiskIndex.

StatLink https://stat.link/wtxdg9

## The hazardscape

Indonesia is exposed to a wider range of natural hazards than the countries in peninsular Southeast Asia. These hazards include both hydrometeorological events (floods, droughts, cyclones and heatwaves) and geophysical hazards (earthquakes, tsunamis, volcanic eruptions and landslides). While most of the disaster events are hydrometeorological , and they affect the greatest number of people on average, the geophysical hazards can be more deadly and cause greater damage to property and infrastructure (Djalante et al., 2017[2]).

Indonesia experiences both riverine and coastal flooding, and both their impact and frequency is increasing. The number of people affected by riverine flooding annually is projected to grow from 6 million to almost 9 million between 2010 and 2030 (WRI, n.d.[3]). La Niña conditions (part of the El Niño Southern Oscillation [ENSO] cycle) can significantly increase the rainfall amounts in some years, exacerbating the risk of inland flooding. Indonesia is also impacted by the risks posed by cyclones from both the southeastern Indian Ocean (between January and April) and the western Pacific (between May and December). Climate change is expected to increase the frequency and intensity of these hydrometeorological hazards (World Bank and ADB, 2021[4]). The mega-city of Jakarta is particularly exposed given its low-lying location and rising sea levels.

Parts of the country regularly experience drought conditions as well, with the islands of Java, Bali and Nusa Tenggara estimated to be the most exposed and vulnerable to extreme drought impacts, especially in El Niño years. For example, the drought of 2015 affected over 82 000 hectares of paddy fields in Central Java (Pratiwi et al., 2020[5]).

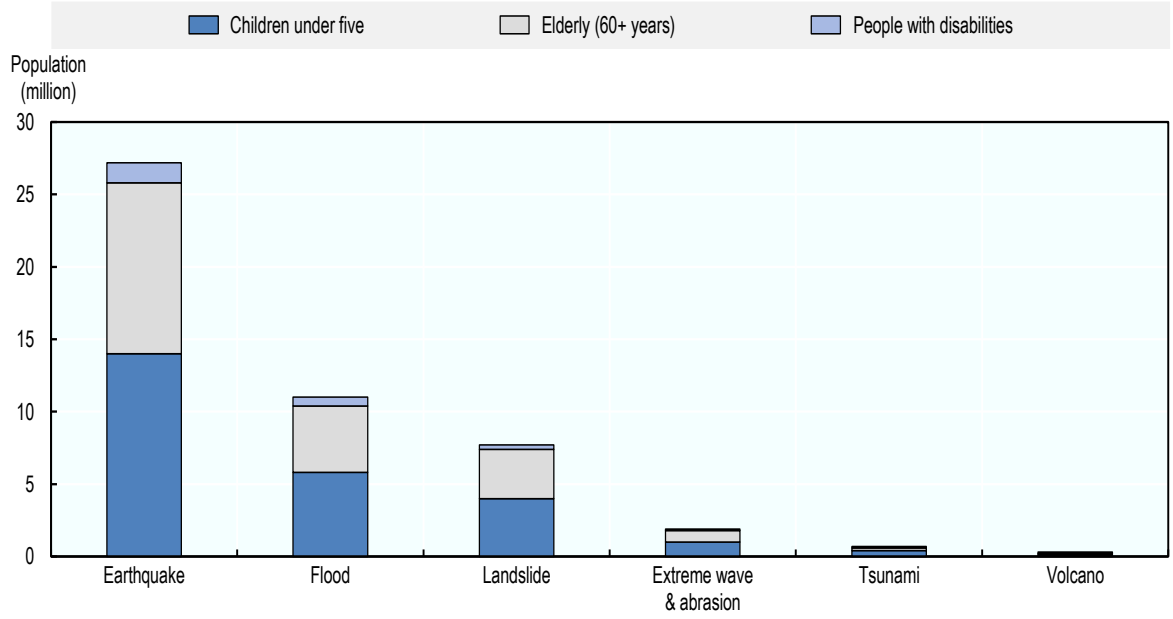
Landslides in Indonesia are often caused by high rainfall or earthquakes and constitute a significant risk, accounting for a substantial fraction of disaster-related deaths in the country (Cepeda et al., 2010[6]; Rahardjo and Marhaento, 2018[7]). Between 1995 and 2005, landslides in Java caused more than 1 100 deaths (Zamroni, Kurniati and Prasetya, 2020[8]). The 2018 Lombok earthquake sequence alone triggered more than 10 000 landslides (Zhao, Liao and Su, 2021[9]).

Indonesia's location along the Pacific Ring of Fire, at the intersection of three tectonic plates, makes it highly exposed to earthquakes, volcanic eruptions and tsunamis (Jufriansah et al., 2021[10]). Earthquakes of magnitude 6.0 and higher occur once a year on average and are associated with significant damages. Between 2000 and 2022, the country reported 74 damaging earthquakes, which caused estimated damage and losses of more than USD 13.5 billion (CRED, 2024[1]).

Tsunamis represent another major hazard, especially given their possible high-mortality consequences. Between 1900 and 2020, Indonesia experienced more tsunamis than any other country (Reid and Mooney, 2022[11]). In any given year, the regions of Sumatra, Java, Bali, Lombok and Papua, face a 1-10% chance of experiencing a tsunami of over 3 metres high, which could cause severe inundation and fatalities (Horspool et al., 2014[12]). The 2004 Indian Ocean tsunami was the deadliest on record, causing approximately 230 000 deaths globally. Seventy-three percent of these deaths occurred in Indonesia (in Sumatra), which also faced damage estimated at USD 4.45 billion (Ministry of National Development, 2005[13]). Tsunami risk is increasing due to growing population density in coastal regions (Løvholt et al., 2014[14]; Reid and Mooney, 2022[11]). Mortality may have been reduced in more recent tsunami events through the implementation of early warning systems, enabling timely evacuations (Horspool et al., 2014[12]), but the system of early warnings is yet to be tested fully.

Volcanic eruptions constitute another hazard. Indonesia is home to more than 100 active volcanoes and records at least one significant eruption annually. While active volcanoes are often located in remote areas and most eruptions do not result in significant damage, some have led and may lead to severe impacts, including the generation of tsunamis. Between 2006 and 2020 on the island of Java, which has the highest population density and where the volcanic hazard is high, earthquakes and other geohazards caused 7 000 fatalities and resulted in injuries and displacement affecting 1.8 million people (Pasari et al., 2021[15]).

### Vulnerable population of Indonesia exposed to natural hazards




Note: Vulnerable population includes children under five, people over 60 years of age, and people with disabilities.
Source: (UNFPA, 2015[16]), *Population Exposed to Natural Hazards*, United Nations Population Fund and Government of Indonesia, https://indonesia.unfpa.org/sites/default/files/pub-pdf/Population_Exposed_0.pdf.

StatLink https://stat.link/lb0nsy

## Climate change perspective

Indonesia is characterised by extremely high disaster exposure, with 97% of the population living in disaster-prone regions (UNFPA, 2015[16]). As of 2000, almost 40 million people (18% of the population) inhabited low elevation coastal zones, with the number projected to increase to almost 60 million by 2030 (Neumann et al., 2015[17]). More than 148 million people (62.4% of the population) are exposed to earthquakes, over 63 million to floods, and more than 40 million are exposed to landslides (UNFPA, 2015[16]). Continuous development in areas prone to landslides and floods is increasing disaster exposure (Rahardjo and Marhaento, 2018[7]).

Disaster vulnerability is exacerbated by factors such as significant poverty, poorly maintained protective infrastructure, unequal economic development and rapid urbanisation (Hodgkin, 2016[18]; Djalante et al., 2017[2]). As of 2021, 14% of the population lived below the national poverty line (UNDRR, 2022[19]). The poor condition of housing and infrastructure greatly increases disaster vulnerability (Jena, Pradhan and Beydoun, 2020[20]).

## Challenges for disaster risk management policy

Disaster-related activities are governed at a national level by the Indonesian National Board for Disaster Management (Badan Nasional Penanggulangan Bencana; BNPB). Activities at a subnational level are managed by local governments with the support of BNPB (Srikandini, Hilhorst and Voorst, 2018[21]). The 2004 Indian Ocean tsunami led to a reform of Indonesia's disaster-related laws, policies and institutions. This significantly increased its disaster risk management capabilities and shifted disaster risk management processes towards a more proactive approach (Djalante et al., 2017[2]). The recovery from the 2004

tsunami is generally considered a success, with significant progress since then at the national level. However, local governments are still viewed as lacking the financial and human resources to manage disaster risk effectively (Djalante et al., 2017[2]; Srikandini, Hilhorst and Voorst, 2018[21]). There is room for improvement in co-ordination between the central, provincial and local governments related to response planning, and similar challenges in the co-ordination of activities with international organisations (UNDRR, 2020[22]; De Priester, 2016[23]).

The priorities for enhancing Indonesia's disaster risk management include strengthening risk governance at the local level and improving co-ordination between provincial and local disaster risk management actors (Djalante et al., 2017[2]; De Priester, 2016[23]; Mardiah, Lovett and Evanty, 2017[24]). Activities related to disaster management would also benefit from further technology adaptation, enhancements of transportation infrastructure and greater community participation in disaster prevention and mitigation efforts (Ayuningtyas et al., 2021[25]; Pramono et al., 2020[26]). In addition, more extensive disaggregation of disaster data would allow for optimal targeting of policy (UNDRR, 2020[22]).

As regards earthquake risk mitigation, there is room for improvement in building code enforcement and understanding of local hazards (Pribadi et al., 2021[27]). Landslide risk awareness is an area that can be improved simply with more prevalent signage. At a policy design level, fostering communication between technical experts and policy makers would allow for easier maintenance of best practices (Zamroni, Kurniati and Prasetya, 2020[8]).

Streamlining the allocation of funds could benefit disaster risk financing in Indonesia (World Bank, 2020[28]). Local governments predominantly rely on contingency funds, which are often inadequate to meet recovery (Soetanto et al., 2020[29]; Fahlevi, Indriani and Oktari, 2019[30]). There is room to expand the use of ex-ante financing (Soetanto et al., 2020[29]) and CAT bonds or other sovereign insurance mechanisms can provide the government with the liquidity needed to support stronger response and recovery in the aftermath of severe disasters (Sakai et al., 2022[31]; OECD, 2024[32]).

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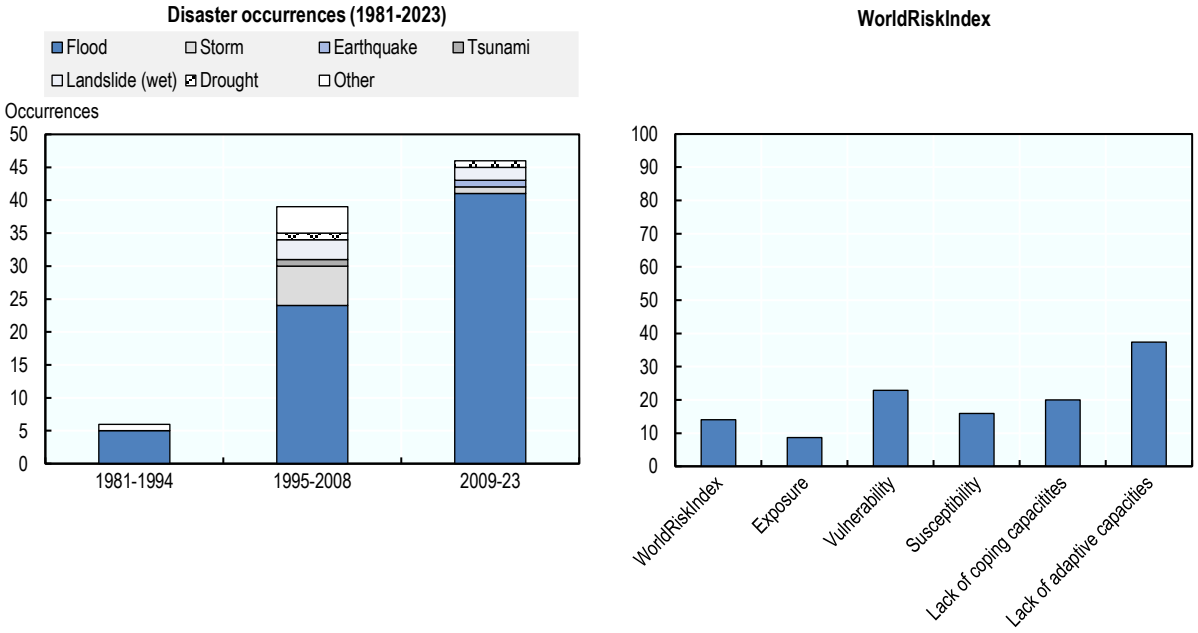
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# Malaysia

## Introduction

Malaysia is primarily exposed to floods, droughts, landslides, severe haze episodes associated with fires, and tsunamis (Chan, 2015[1]). It is classified as facing the 36th-highest disaster risk by the WorldRiskIndex 2023. The country lies close to the equator and beyond from the Pacific Ring of Fire, leaving it relatively less exposed to both tropical storms and hazards associated with geotectonic risks (earthquakes and volcanic eruptions) than other countries within that region (Chan, 2015[1]; Mohamed Shaluf and Ahmadun, 2006[2]). However, smaller earthquakes and storms do occur and have the potential to cause damage. Between 2000 and 2022, 74 disasters triggered by natural hazards led to almost 500 deaths, affected more than 3.3 million people and caused USD 4.3 billion in economic damage (CRED, 2024[3]).

### Malaysia: Disaster occurrences (from 1981 to 2023) and WorldRiskIndex




Source: EM-DAT and WorldRiskIndex.

StatLink https://stat.link/dvhyar

## The hazardscape

Floods are the most frequent and impactful disasters in Malaysia. Seasonal floods can occur during most of the year due to the northeast or southwest monsoon seasons, and flood risk is especially high in low-

lying riverine areas and coastal flatlands (Chan, 2015[1]; Izumi, 2019[4]). Floods also account for the majority of disaster losses. Between 2000 and 2022, floods caused estimated damage of approximately USD 2.9 billion and more than half of total disaster mortality (CRED, 2024[3]). The severe floods of 2014, one of the worst hydrometeorological disasters on record in Malaysia, affected 230 000 people and caused economic losses of more than USD 350 million (CRED, 2024[3]). This flood event also impacted more than 13 000 small and medium enterprises (SMEs), caused a significant reduction in palm oil production (a major export crop), and reduced the following year's GDP by an estimated 0.5% (Auzzir, Haigh and Amaratunga, 2018[5]). The major floods of 2021 led to 56 deaths and caused economic losses of more than USD 1.5 billion (CRED, 2024[3]).

Floods mainly affect agriculture, but they also impact other economic sectors, including manufacturing (through their impact on infrastructure) and mining (Shaari, Karim and Hasan-Basri, 2016[6]; 2017[7]). Malaysia's SMEs are also highly impacted by floods, with 34% of surveyed SMEs reporting that they had experienced flood impacts in a five-year timespan (Auzzir, Haigh and Amaratunga, 2018[5]).

Malaysia experiences frequent landslides due to its mountainous terrain and frequent rainfall (Nor Diana et al., 2021[8]; Chan, 2015[1]; Izumi, 2019[4]). Majid, Taha and Selamat (2020[9]) identified 21 000 landslide-prone areas, of which 76% are located in peninsular Malaysia. However, the factors affecting landslide occurrence also relate to human activity and especially development in hilly areas, at times characterised by poor slope and building site management (Majid, Taha and Selamat, 2020[9]; Rahman and Mapjabil, 2017[10]). Landslides in Malaysia lead to fatalities, property damages and disruption of transportation networks (Izumi, 2019[4]). Between 1973 and 2011, landslides caused more than 600 deaths and inflicted economic losses of more than USD 1 billion (Abdullah, 2013[11]). Between 2015 and 2019, 86 landslides with considerable social and economic impact were reported in the state of Selangor alone (Izumi, 2019[4]). With many low-lying areas developed during rapid economic growth since the 1980s, meeting the high demand for new development has increasingly been achieved by building on sloping or hilly terrain, affecting landslide risk directly by removing forest cover and increasing exposure (Izumi, 2019[4]; Majid, Taha and Selamat, 2020[9]).

Malaysia is also vulnerable to droughts, with frequent short-term droughts in most regions as well as severe drought episodes with the potential to affect the entire country (Hasan et al., 2021[12]; WMO, 2014[13]). High drought frequency and severity is observed especially in the northeast and southeast regions of peninsular Malaysia (Hasan et al., 2021[12]). Prolonged drought conditions in peninsular Malaysia have in recent years been increasing in frequency, with further increases in frequency projected for the western region, putting water resources and the agricultural sector under severe pressure (Hui-Mean et al., 2019[14]; Zin, Jemain and Ibrahim, 2012[15]). Drought impacts in Malaysia include reduced productivity in agriculture and aquaculture, reduced freshwater supply for consumption and adverse effects on the industrial sector (World Bank and ADB, 2021[16]). For example, the drought in 2014 adversely affected more than 8 000 paddy farmers and caused crop losses of around USD 22 million (Tan et al., 2017[17]). Drought conditions also contribute to the risk of wildfires, with more than 7 000 bush and forest fires reported during the 2014 drought (WMO, 2014[13]).

## Climate change perspective

Climate change is expected to increase the frequency of floods, droughts and heatwaves through changes in temperature and precipitation patterns (World Bank and ADB, 2021[16]). Flood risk has been increasing over the last 40 years due to intensifying rainfall associated with climate change. The frequency and intensity of flood events are expected to increase with future warming, with rainfall projected to increase especially in the east of the country (World Bank and ADB, 2021[16]). Future sea level rise is expected to exacerbate coastal hazards, with some sections of the Malaysian coastline also expected to face increased and previously unseen storm surges due to a southward shift in cyclone paths (Wood et al., 2023[18]).

Malaysia has a large coastal population potentially exposed to future sea level rise and to coastal hazards such as storm surges and tsunamis. As much as 60% of the country's population occupies the coastal regions, and this is also where most SMEs are located (Azimi, Syed Zakaria and Majid, 2019[19]). Malaysia is also characterised by very high flood exposure, with 90% of nighttime lights (a proxy for the concentration of economic activity) estimated to be in areas exposed to floods (Chantarat and Raschky, 2020[20]).

Disaster vulnerability in Malaysia is shaped by factors such as rapid urbanisation and ecosystem degradation driven by high growth. Rapid urbanisation has contributed to flood risk through increased population density, land use change, obstructions to water flow and drainage, and reduction of natural buffer zones due to deforestation (Chan, 2015[1]; Izumi, 2019[4]). While poverty has been decreasing rapidly in recent decades, pockets of poverty remain. Poverty is more prevalent in rural regions such as Northern Kelantan or Hulu Terengganu. Rural to urban migration is also increasing the number of urban poor, increasing urban vulnerability in some locations.

## Challenges for disaster risk management policy

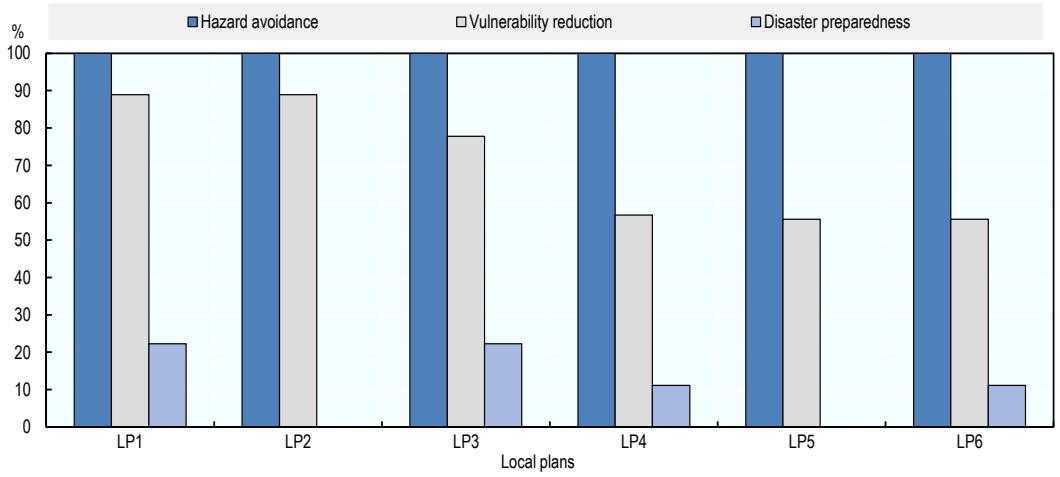
The 4th National Physical Plan (NPP-4), issued in 2021 and covering the years 2021-25, explicitly mention implementing disaster risk mitigation as a strategy (Economic Planning Unit Malaysia, 2022[21]). The government should develop a flood-related policy to establish the duties of various stakeholders including the government, non-governmental organisations and the public (Ridzuan et al., 2022[22]) consistent with a target objective of NPP-4. Other priorities include designing and implementing policies for coastal land use, regulating development in landslide-prone areas and improving disaster preparedness and resilience (Economic Planning Unit Malaysia, 2022[21]). However, Malaysia lacks a legislative framework to integrate flood management policies and mechanisms with broader policy objectives (Ridzuan et al., 2022[22]; UNDRR, 2020[23]). Many of Malaysia's disaster risk management processes currently involve reactive rather than proactive approaches and lack a long-term planning perspective (Chong and Kamarudin, 2018[24]; Ridzuan et al., 2022[22]). Therefore, more emphasis should be placed on disaster preparedness and prevention. The integration of disaster risk management considerations into sectoral development policies is also limited (UNDRR, 2020[23]). Climate change adaptation should also be more strongly integrated with disaster risk reduction efforts (Madnor, Harun and Ros, 2024[25]).

As for disaster financing, disaster-related budget measures need to be strengthened, and disaster risk management would benefit from disaster financing being expanded into budgeting at all levels (Rosmadi et al., 2023[26]; UNDRR, 2020[23]). At the local level, the country faces shortages of both human and financial capital to enable effective implementation of disaster risk management policies. Therefore, investments to increase local-level disaster risk management capacity are required (Rosmadi et al., 2023[26]).

The use of ex-ante financing mechanisms such as disaster insurance should be expanded. Implementation of agricultural insurance is constrained by factors such as lack of insurer experience, lack of required data, limited financial capacity and high administrative costs. To enable disaster insurance implementation, the possibility of a public-private partnership should be explored to assist the market and design appropriate insurance products (Alam et al., 2020[27]).

Disaster risk reduction measures need to be better incorporated into local-level planning and zoning, especially as regards disaster preparedness (Norizan, Hassan and Yusoff, 2021[28]; Majid, Taha and Selamat, 2020[9]; Ridzuan et al., 2022[22]). Other obstacles limiting disaster risk management efforts, as well as progress in resilient development more broadly, include non-compliance with suitable urban development plans and guidelines, a lack of data for detailed risk assessments at the local level and a lack of support and commitment from the local authorities (Mohamad Amin and Hashim, 2014[29]).

## Percentage of flood risk reduction dimensions integrated in local plans




Source: (Norizan, Hassan and Yusoff, 2021[28]), "Strengthening flood resilient development in Malaysia through integration of flood risk reduction measures in local plans", *Land Use Policy*, 102, 105178.

StatLink https://stat.link/kjnfcm

For flood risk management, greater emphasis could be placed on preparation strategies and adaptation measures reducing vulnerability (Norizan, Hassan and Yusoff, 2021[28]). These efforts could include stricter enforcement of standard operating procedures and disaster-related laws, increasing asset inspection and maintenance, conducting awareness campaigns and community activities to enhance community awareness and foster community involvement with local agencies, and enhancing the influence and jurisdiction of some relevant flood management agencies (Rosmadi et al., 2023[26]). For the Sarawak region, for instance, the flood risk management challenges were described to include upgrading the drainage systems, strengthening of flood forecasting and early warning systems, and enhancing public awareness and collaboration among government agencies (Muzamil et al., 2022[30]).

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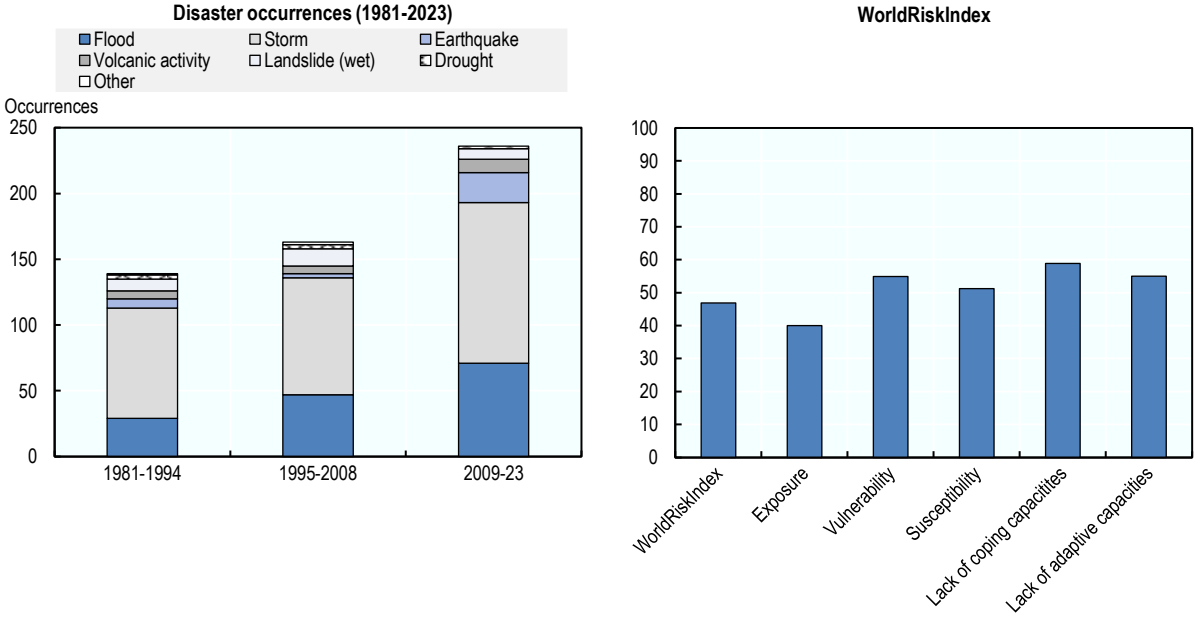
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# Philippines

## Introduction

The Philippines is one of the most disaster-prone countries in the world. It ranked as the country facing the highest disaster risk according to the WorldRiskIndex 2023. The country's high exposure to both geophysical and hydrometeorological hazards is to a large extent a consequence of its location in one of the most tectonically active regions along the Pacific Ring of Fire and on the Pacific typhoon belt. The Philippines is exposed to typhoons, floods, earthquakes, volcanic eruptions, landslides, fires and drought, which lead to significant social, economic and environmental costs. Between 2000 and 2022, 361 disasters triggered by natural hazards led to almost 27 000 deaths, affected over 181 million people and caused nearly USD 24 billion in economic losses. Storms (51%), floods (29%), earthquakes (7%), landslides (4%), and volcanic eruptions (4%) comprise the majority of disaster events (CRED, 2024[1]).

### Philippines: Disaster occurrences (from 1981 to 2023) and WorldRiskIndex



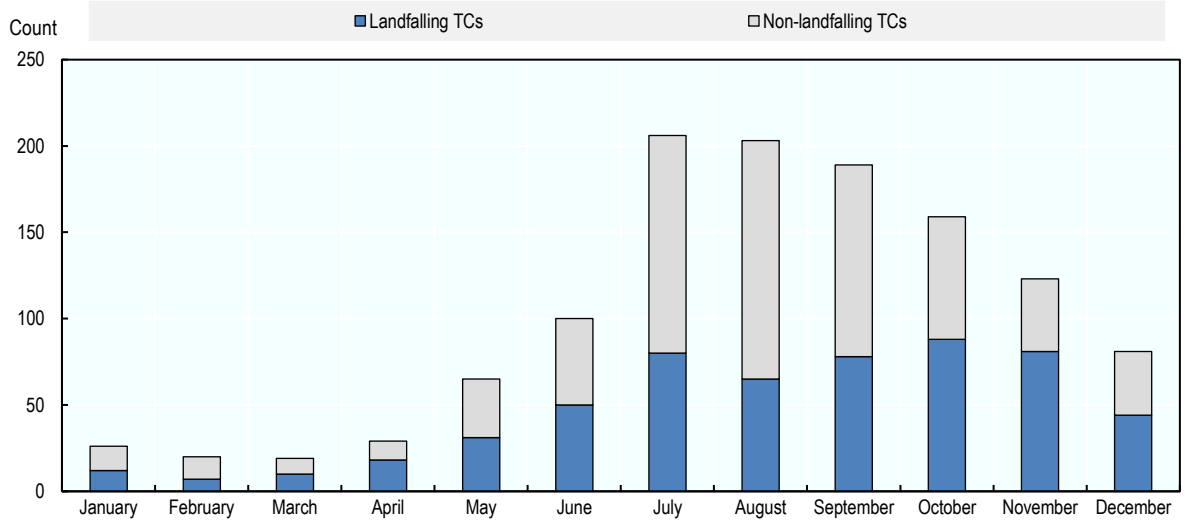

Source: EMDAT and WorldRiskIndex.

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## The hazardscape

Typhoons and floods are the hazards to which the Philippines is most exposed, and they are becoming more frequent. They account for 83% of disaster fatalities, 96% of affected people and 98% of economic damage (CRED, 2024[1]). The country's exposure to typhoons is the highest in the world, with approximately 19 typhoons (roughly a quarter of all tropical cyclones) occurring within the Philippine Area of Responsibility (PAR) annually, and with 6-7 of them causing significant damage (Cinco et al., 2016[2]; Holden and Marshall, 2018[3]; OCHA, 2014[4]). Most of the typhoon-related impacts are caused by few catastrophic events: between 1970 and 2014, 80% of typhoon-induced deaths and damage were associated with just six events, including Typhoon Haiyan in 2013 (Espada, 2018[5]). Typhoon Haiyan, considered the strongest cyclone ever to make landfall in the Philippines, killed more than 6 300 people, destroyed more than 1.1 million houses, affected 16 million people and led to USD 12.9 billion in damage (World Bank, 2017[6]).

### Monthly frequency of tropical cyclones entering the Philippine Area of Responsibility and tropical cyclones making landfall from 1951 to 2013




Source: (Cinco et al., 2016[2]), "Observed trends and impacts of tropical cyclones in the Philippines", *International Journal of Climatology*, Vol. 36/14, pp. 4638-4650, https://rmets.onlinelibrary.wiley.com/doi/abs/10.1002/joc.4659.

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Typhoons in the Philippines have significant socio-economic implications as they increase household poverty (Jha et al., 2018[7]). In the aftermath of Typhoon Haiyan, 2.3 million people were estimated to have fallen below the poverty line (World Bank, 2017[6]). The island most frequently affected by typhoons is Luzon, and it also records the highest typhoon-induced rainfall, especially when compared to the southern parts of the country (Cinco et al., 2016[2]). While the frequency and intensity of typhoons appear to be increasing, there is uncertainty regarding the effects of future climate change on typhoon activity in the region. However, there is significant evidence indicating a likely increase in the rainfall intensity of severe events (World Bank and ADB, 2021[8]).

Extreme rainfall events, including those that are not typhoon-related, are associated with major damage as they can lead to both floods and landslides. Low-lying and partially developed areas are exposed and vulnerable to recurrent flooding brought about by the monsoon rains. The increasing intensity of the monsoon seasons, along with rapid urban development, are exacerbating this flood risk. Flood damages

are projected to increase by over 200% by 2030 in some areas of Manila as a consequence of increased extreme weather events and urbanisation (Kefi et al., 2020[9]). Assuming the government maintains a protection level for a 1-in-12-year event (i.e. there will not be full protection against rare events), it is estimated that riverine flooding will affect 1.7 million people annually by 2030 (WRI, n.d.[10]).

The Philippines is also exposed to frequent landslide events, often resulting from other hazards such as heavy rainfall, storms, earthquakes or volcanic eruptions, but can also be caused by human activity including mining or construction (Froude and Petley, 2018[11]). The Baguio mountainous area in northern Luzon, which has the highest recorded rainfall in the country, is also the most landslide-prone, with a significant number of rainfall-induced landslides occurring as a consequence of the southwest monsoon, tropical cyclones and their interactions (Nolasco-Javier, Kumar and Tengonciang, 2015[12]).

The risk associated with destructive earthquakes in the Philippines is also quite high. In the Davao region, the probability of a severe magnitude 8 earthquake occurring in the next 50 years is estimated at over 70% (Pailoplee and Boonchaluay, 2016[13]). Soil conditions are an important factor determining the damage from earthquakes, and liquefaction is a serious concern, especially in low-lying areas of central Luzon and Metro Manila.

Droughts constitute another hazard with significant impact, causing severe losses in the agricultural sector. Between 1990 and 2022, six recorded drought events affected more than 3 million people and caused approximately USD 277 million in damage (CRED, 2024[1]). The ENSO cycle is one of the main drivers of drought in the country. According to the Philippine Atmospheric Geophysical and Astronomical Services Administration (PAG-ASA) El Nino Advisory No. 9 issued on 7 March 2024, drought is defined as three consecutive months of reduction from average rainfall by more than 60%. Droughts can last up to 11 months and affect the whole country in a given year, though higher drought intensities occur in the western and southeastern coastal regions (Salvacion, 2021[14]). Grain-producing regions at the northern tip of Luzon, on Mindanao and in several provinces in the western and central parts of the country are the aeras most vulnerable to the effects of droughts (Cruz, Aliño and David, 2017[15]).

The Philippines also faces significant volcanic risk due to the presence of 24 active volcanoes. Volcanic activity in the Philippines is the highest in the world, with a fraction of eruptions causing major damage, especially in the case of the Taal and Mayon volcanoes. The Taal Volcano in southern Luzon is the second most frequently erupting volcano, and its potential for a high magnitude eruption is a threat to around 2 million people in its vicinity in the Batangas Province, but also to coastal populations located within a wider radius due to its potential to generate a tsunami (Paris et al., 2013[16]; Delos Reyes et al., 2018[17]).

Overall, therefore, the Philippines is highly exposed and vulnerable to disaster risks. More than 90% of the population is located in areas exposed to floods, cyclones, earthquakes, or a combination thereof (Chantarat and Raschky, 2020[18]). Population and asset exposure is higher along the coast than in the inland areas, with the majority of the population residing within 60 km of the coast and with the four major cities (Manila, Davao, Cebu and Puerto Princesa) located in coastal areas (Cruz, Aliño and David, 2017[15]). Lower-income populations are disproportionately vulnerable to disaster impacts; as of the first half of 2023, 16.4% of the population still lived below the national poverty threshold of PHP 13 797 per month (PSA, 2023[19]). Both exposure and vulnerability are being exacerbated by an increasing number of urban poor communities in hazard-prone areas, linked to rapid and unplanned urbanisation.

## Climate change perspective

Climate change is exacerbating disaster risks, with extreme weather events such as heavy precipitation and typhoons becoming more frequent in recent decades, a trend which is projected to continue (World Bank and ADB, 2021[8]).

The proportion of the population in informal settlements is very high. For example, one-third of Metro Manila's population and as much as 60% of the population in some rural areas reside in informal housing (Usamah et al., 2014[20]). Furthermore, according to the Philippine Development Plan 2023-2028, 3.7 million informal settler families do not have security of tenure as of 2021, 500 000 of which are living in slums and high-risk areas in Metro Manila or the National Capital Region (UN-Habitat, 2023[21]). People living in informal settlements are extremely vulnerable to disaster impacts, as the houses are poorly constructed, typically with substandard materials, and living conditions are characterised by higher vulnerability associated with inadequate access to clean water and health care (Morin, Ahmad and Warnitchai, 2016[22]). Urban vulnerability is also exacerbated by poor enforcement of land-use plans and zoning regulations (Yonson, Noy and Gaillard, 2017[23]). The vulnerability of the Philippines to the economic impact of disasters is exacerbated by the country's reliance on climate-dependent sectors such as agriculture, aquaculture and coastal and marine resources (Brucal et al., 2020[24]). Almost half a million people annually face short-term consumption poverty due to disasters (Walsh and Hallegatte, 2020[25]). All of these vulnerabilities are especially relevant in the face of climatic changes that increase the hazard frequencies in the location in which these vulnerable populations are most exposed.

## Challenges for disaster risk management policy

After the devastation brought about by Typhoon Haiyan in 2013, the Philippines government increased its efforts to develop the country's disaster risk management institutions and resources. The country is shifting its disaster risk management from a reactive to a proactive approach, with an increasing focus on disaster preparedness and resilience building (World Bank, 2023[26]). While these developments are very positive, various disaster risk management-related issues remain. There is an urgent need to strengthen the capacity of local disaster risk management institutions, especially regarding policy implementation (UNDRR, 2019[27]). Current disaster risk management processes are also characterised by an insufficient focus on and funding of disaster preparedness (Brucal et al., 2020[24]; Dariagan, Atando and Asis, 2020[28]). Furthermore, disaster risk reduction initiatives need to target lower administrative levels, as there is broad spatial heterogeneity in social vulnerability at a sub-provincial level (Lloyd et al., 2022[29]; Yonson and Noy, 2019[30]).

Financial aid is also not always disbursed across provinces proportionately to the disaster risk or impacts the provinces face, and disaster risk management funds are often underutilised due to bureaucratic obstacles (e.g. complex approval processes) (Brucal et al., 2020[24]; Domingo and Manejar, 2018[31]; World Bank, 2020[32]). Emergency and other post-disaster funding processes should be streamlined and strengthened, and bureaucratic obstacles should be removed. This should include efforts such a developing an annual risk financing strategy which is integrated within national fiscal planning, simplifying and streamlining the procedures for accessing the NDRRM fund, revising Quick Response Fund allocations and enhancing the control and tracking of post-disaster funding and expenditure (World Bank, 2020[32]). Disaster risk finance outcomes could also be improved by addressing the complexities in sourcing the revenue of local governments (Resuello, 2020[33]).

There is a need to improve the enforcement of land-use planning. At the community level, disaster preparedness is inadequate, with only one-third of Filipinos undertaking measures to prepare for disasters (Bollettino et al., 2020[34]), therefore strengthening disaster risk management education is important (Pulhin and Tapia, 2021[35]).

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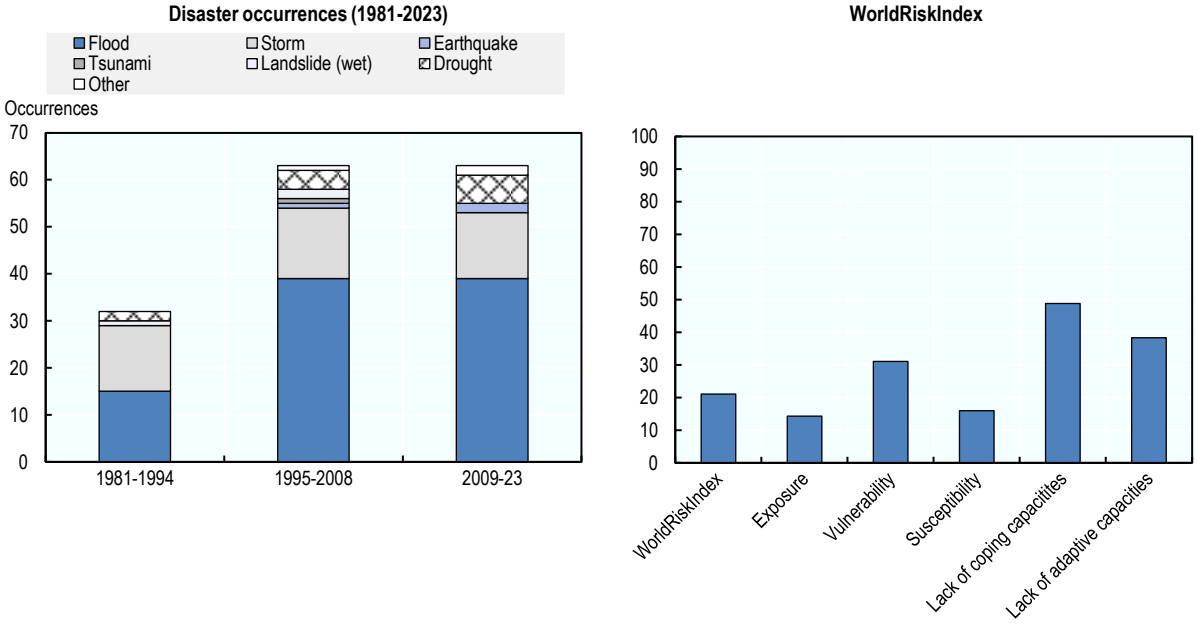
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# Thailand

## Introduction

Thailand is exposed to natural hazards including floods, droughts, cyclones, landslides, earthquakes, tsunamis, wildfires and heat waves. It is ranked 23rd in the WorldRiskIndex 2023. Floods represent by far the single most frequent and impactful hazard, while floods, droughts and storms combined inflict the highest combined damage and losses. Between 2000 and 2023, 116 disasters triggered by natural hazards caused over 11 000 deaths and affected more than 81 million people (CRED, 2024[1]).

### Thailand: Disaster occurrences (from 1981 to 2023) and WorldRiskIndex




Source: EM-DAT and WorldRiskIndex.

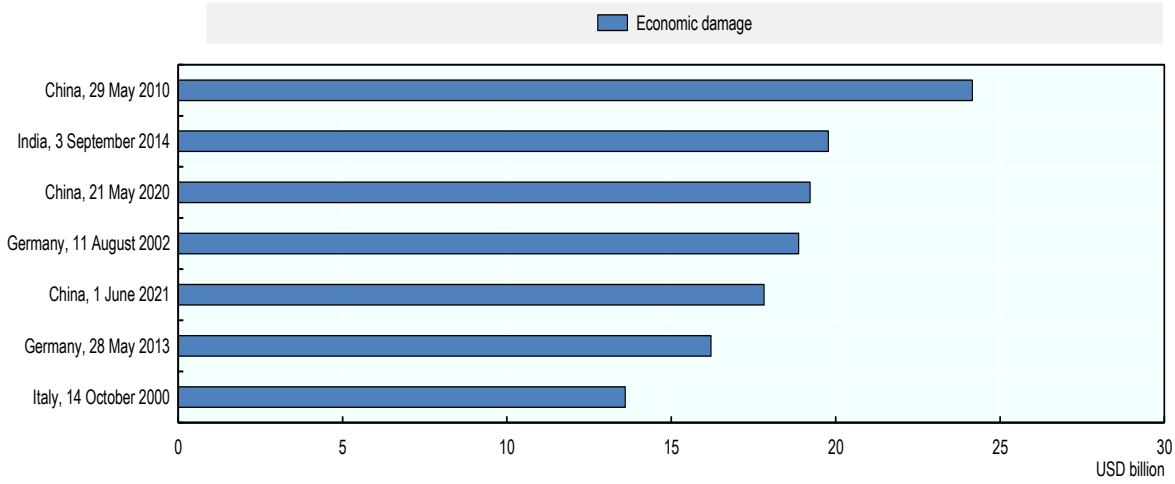
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## The hazardscape

Thailand is heavily affected by storms and floods. In particular, Thailand is one of the most flood-affected countries in the world and is exposed to riverine, coastal and flash flooding (World Bank and ADB, 2021[2]; Inter-Agency Standing Committee and the European Commission, 2023[3]). The large-scale flood of 2011 ranks among the most damaging flood disasters globally in recent decades. The flood covered about

100 000 square kilometres, resulted in more than 800 deaths, affected more than 13 million people across 66 provinces and caused approximately USD 46 billion in damage and losses (Loc et al., 2020[4]; World Bank, 2012[5]). At the same time, the impact of floods is increasing. Between 2010 and 2030, the number of people affected annually by riverine flooding is projected to rise from 630 000 to 1.3 million, and annual urban damage is projected to increase from USD 2.1 billion to USD 11 billion (WRI, n.d.[6]). The high risk of flooding is associated with Thailand's numerous river basins, canal networks and floodplains. Flood risk is exacerbated by human factors including rapid urbanisation; deforestation; and excessive extraction of groundwater leading to land subsidence (Fernando et al., 2022[7]; Olson and Kreznor, 2021[8]; Seemuangngam and Lin, 2024[9]).

## Comparison of the 2011 Thai Floods to floods in other countries




Source: (Ikeda and Palakhamarn, 2020[10]), "Economic damage from natural hazards and local disaster management plans in Japan and Thailand", *ERIA Discussion Paper Series*, No. 346, Economic Research Institute for ASEAN and East Asia, https://www.eria.org/publications/economic-damage-from-natural-hazards-and-local-disaster-management-plans-in-japan-and-thailand/.

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Thailand is also highly exposed to droughts and drought trends have been increasing in recent decades (Zhao et al., 2022[11]). Between 2000 and 2022, droughts in Thailand affected more than 33 million people and caused economic damage exceeding USD 4.7 billion (CRED, 2024[1]). A severe 2015-17 drought episode led to estimated damage and losses of USD 3.3 billion (Khadka et al., 2021[12]). Droughts severely impact the agricultural sector, causing heavy damage specifically to the rice and sugarcane crops. Agriculture employs approximately one-third of the labour force, and rice is a major export, so these impacts have significant economic implications (World Bank, n.d.[13]; Ikeda and Palakhamarn, 2020[10]). Furthermore, droughts can lead to severe water shortages and increase fire risks (Pak-Uthai and Faysse, 2018[14]). Vulnerability to droughts varies across the country, with areas without reservoirs and irrigation infrastructure being more vulnerable (Tingsanchali and Piriyawong, 2018[15]). The proportion of irrigated areas is especially low in the southern and the northeastern regions of the country.

Thailand is also exposed to earthquakes and tsunamis. While only five large seismic events were recorded between 1989 and 2018, these events caused a disproportionate number of fatalities. The catastrophic 2004 Indian Ocean tsunami was the deadliest disaster in the country's history, causing more than 8 000 deaths and more than USD 1 billion in damage (CRED, 2024[1]; Ikeda and Palakhamarn, 2020[10]).

Landslides generally occur due to heavy rainfall, with the landslide risk and the number of people affected increasing in recent decades (Schmidt-Thomé et al., 2018[16]). Landslides are most frequent and impactful

in the rural hilly regions, with most of the damage caused by debris flow due to heavy rainfall and landslides upstream (Schmidt-Thomé et al., 2018[16]). Settlements in landslide-prone areas are expanding, leading to increasing landslide exposure (Schmidt-Thomé et al., 2018[16]). Human factors such as uncontrolled deforestation, land clearing and use of land for cultivation are contributing to the landslide risk. Thailand also faces the risk of wildfires, with the majority of fire events occurring between January and March, in the northern regions of the country. Forest fire events caused more than USD 5.8 billion in damage between 1999 and 2014. However, the damage from wildfires has been decreasing in recent years (Ikeda and Palakhamarn, 2020[10]).

## Climate change perspective

Climate change is expected to increase the frequency and intensity of climate-related disasters in Thailand, including floods, droughts, cyclones and heatwaves, and this will likely lead to an increase in the cascading hazards of landslides, wildfires, and damage to the built environment (World Bank and ADB, 2021[2]; Supratid and Aribarg, 2022[17]; Thilakarathne and Sridhar, 2017[18]). Extreme precipitation caused by climate change is projected to further increase the landslide risk.

Given its long coastlines and the concentration of urban and tourism assets on the coasts, Thailand is also highly vulnerable to sea-level rise, ranking as the sixth most impacted country in the world (Supratid and Aribarg, 2022[17]). Sea-level rise is expected to inundate some areas permanently and to exacerbate the impacts of coastal flooding and storm surges, with Bangkok projected to be among the worst affected cities globally (Hallegatte et al., 2013[19]; Dutta, 2011[20]). Sections of the Thai coastline are also projected to experience an increase in storm surges due to a southward shift in cyclone tracks (Wood et al., 2023[21]).

Disaster vulnerability is high in agricultural areas, as these tend to be characterised by relatively higher rates of poverty and inadequate social safety nets, while highly developed urban areas are characterised by high disaster exposure associated with high population density (Christenson et al., 2014[22]). Changes in land use and the expansion of economic activity increase disaster risk by altering ecosystems and reducing their protective functions. For example, the replacement of mangroves by shrimp farms is exacerbating vulnerability to coastal inundation (Pumijumnong, 2013[23]; UNDP Thailand, 2018[24]). Another example is the development of roads and railroads over floodplains that limit natural drainage and exacerbate flood risks in the cities of Hat Yai and Khon Kaen, and the district of Lat Krabang (Friend et al., 2016[25]). The process of urban expansion has generally not been well informed by disaster risk assessments. This generated increase in risk became especially evident during the 2011 floods, as a significant fraction of the damage was associated with high-value infrastructure located in flood-prone areas (Friend et al., 2016[25]).

## Challenges for disaster risk management policy

The National Disaster Prevention and Mitigation Plan of 2021-2027 describes a set of strategic objectives to guide disaster risk management including inclusive disaster risk reduction; integrated emergency management; effective recovery and resilience building; and strengthened international co-operation, adopting multi-agency and multi-sectoral approaches.

Thailand's disaster risk management processes are largely ad hoc and response-based (though the National Disaster Response Plan 2015 provides a robust guide to making them thorough) (DDPM, 2015[26]), but there remains insufficient focus on long-term planning (Kitagawa, 2020[27]; UNDRR, 2020[28]). There is room to integrate disaster risk management into development planning more thoroughly, especially at subnational levels, and investment in comprehensive disaster risk data – including disaggregated information about vulnerabilities – would help maximise the mutual benefits of disaster risk

management and other aspect of development. The role and capacity of local governments to mobilise human and financial resources to implement risk reduction measures needs to be strengthened (UNDRR, 2020[28]). Improved co-ordination is needed between disaster risk management activities related to prevention, mitigation and preparedness – within the government, relief organisations, the private sector and the community (CFE, 2022[29]). Making this a priority in the next national and provincial Disaster Prevention and Mitigation Plans would benefit all stakeholders (Ikeda and Palakhamarn, 2020[10]).

Other disaster risk management-related priorities include reducing poverty among vulnerable and exposed populations; improving large-scale water management, including water sustainability, to meet rising demand; and increasing the participation of local communities in disaster risk management activities (CFE, 2022[29]). Following the severe impacts of the 2011 floods, the government increased its flood prevention and mitigation efforts, and many structural and emergency response measures were implemented, mainly in the Chao Phraya River Basin (where most of the damage occurred). Current flood-risk prevention strategies could be improved upon but greater consideration of non-structural measures, such as regulation, land-use planning and flood education (Laeni, van den Brink and Arts, 2019[30]; Singkran, 2017[31]; Singkran and Kandasamy, 2016[32]). Moreover, some of the implemented water development projects could have their capacities enhanced. In the Mun River basin, introduction of additional measures such as small farm ponds, a subsurface floodwater harvesting systems, and oxbow lake reconnections may prove beneficial (Prabnakorn et al., 2021[33]). Some forest protection policies may be causing upland communities to farm in disaster-prone areas, exacerbating disaster exposure. Integrated forms of land-use such as agroforestry may be beneficial in these cases (Beckman, 2015[34]). Potential areas of focus within tsunami risk management include enhancing evacuation procedures through improved planning and novel systems (e.g. coloured streetlamps and modern geographical information technology), crowdsourcing disaster-related information through social media, encouraging the provision of evacuation manuals by hotels and resorts, and proper maintenance of evacuation shelters (Leelawat et al., 2020[35]).

Disaster risk management is financed primarily through the central government budget and borrowing (UNDP, 2023[36]). However, Thailand's disaster risk management financing could be better targeted by a shift to a more proactive approach underpinned by state-of-the-art risk assessments (UNDRR, 2020[28]). Risk-transfer mechanisms currently in use include some insurance for public assets and a national crop insurance scheme (UNDP, 2023[36]), but there is room to increase risk transfer in breadth and scope particularly as regards insurance options for firms and households, and of the use of alternative ex-ante national-level funding mechanisms such as catastrophe (CAT) bonds or a disaster fund. Limited uptake of contingency fund advances for disaster relief and emergency assistance in the past (UNDP, 2023[36]) may contribute to why these instruments have not been prioritised, suggesting there is room for improvement in financial literacy as it pertains to risk management.

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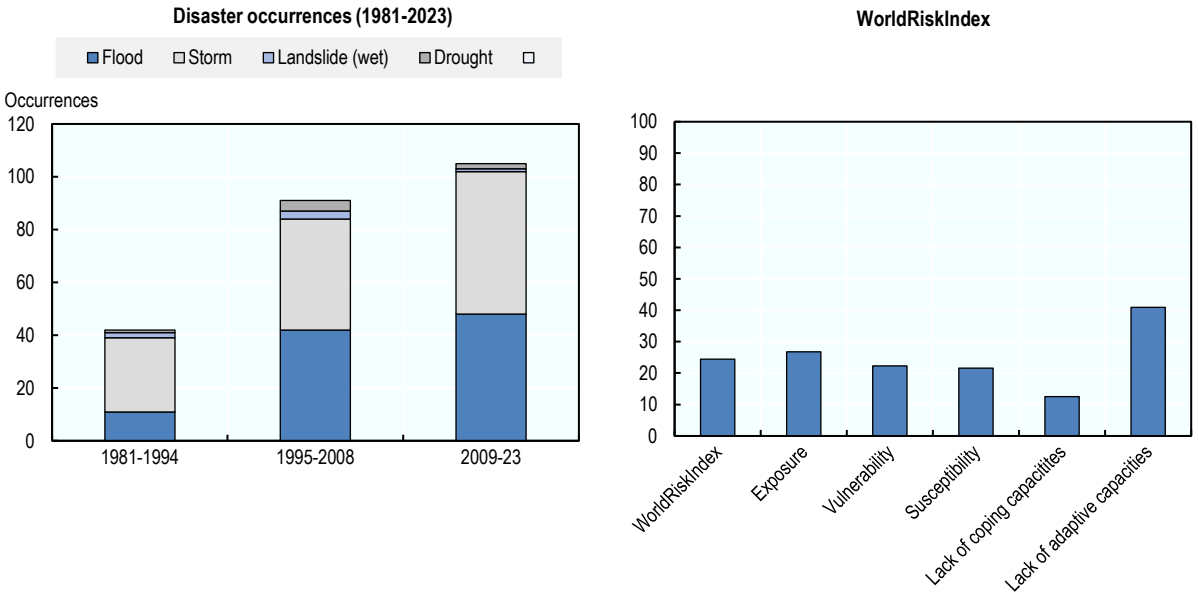
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# Viet Nam

## Introduction

Viet Nam ranks among the most hazard-prone countries in the Asia-Pacific region. It is highly exposed to floods, cyclones and landslides, and it also faces the risk of droughts, earthquakes, tsunamis and heatwaves (Lan Huong et al., 2022[1]). The WorldRiskIndex 2023 classifies the country's exposure as very high, as shown in the figure below. Disaster risk in Viet Nam is characterised by a high level of hazard and exposure, but relatively lower vulnerability and higher coping capacity.

### Viet Nam: Disaster occurrences (from 1981 to 2023) and WorldRiskIndex




Source: EM-DAT and WorldRiskIndex.

StatLink https://stat.link/ux2lsm

## The hazardscape

Viet Nam is at risk of both riverine and coastal flooding. The central and northern hilly regions are most exposed to flash floods, and the low-lying deltas are exposed to slower-moving riverine floods and storm surges (Ba, Nam and Hung, 2022[2]; Nguyen et al., 2021[3]). Floods, which are often caused by cyclone-induced rainfall, represent the most frequent and impactful hazard in the country, accounting for most disaster damage and losses (World Bank and ADB, 2020[4]). Between 2000 and 2023, floods and storms accounted for 96% of disaster-related deaths and 66% of economic damage. Flood risk threatens more

than 300 000 jobs in the agriculture, aquaculture, tourism and industry sectors (Rentschler et al., 2020[5]), and flood impacts are increasing. Between 2010 and 2030, the number of people affected by riverine flooding is projected to increase from 2.4 million to 3.8 million annually, and annual urban damage is projected to rise from USD 2.3 billion to USD 14 billion (WRI, n.d.[6]). Flood risks are exacerbated by rapid urbanisation, poor urban development planning and improper land use. Examples include loss of water retention capacity due to excessive construction of non-permeable surfaces and reductions in drainage due to ground levelling and construction in flood-prone areas (Ba, Nam and Hung, 2022[2]; Nguyen et al., 2021[3]).

Viet Nam is exposed to tropical cyclones, which occur more frequently in the central and northern regions (Takagi, 2014[7]). Between 1977 and 2017, approximately 2-3 cyclones with wind speeds above 20 knots made landfall along the country's coastline annually during the southwest monsoon between June and November (Takagi, 2019[8]; Nguyen-Thi et al., 2012[9]). Storm-related damage has been increasing, and much of this increase appears attributable to the country's economic development rather than significant trends in storm occurrence in the last four decades (Takagi, 2019[8]). The Red River delta, southern coastal area and southeast are at high risk due to their geophysical features and typhoon intensity. These risks could worsen due to future sea-level rise (Nguyen, Liou and Terry, 2019[10]).

Viet Nam also faces droughts, and their frequency has been increasing. Drought risk is highest during the dry season from November to March (Vu-Thanh, Ngo-Duc and Phan-Van, 2013[11]). Drought events in recent years, including severe drought and saline intrusion events in 2016 and 2019-20, affected millions of people, caused water stress to hundreds of thousands of households and severely impacted the agricultural sector by damaging crops and reducing yields (Park et al., 2021[12]; Thao et al., 2019[13]; UN Viet Nam, 2016[14]). The drought vulnerability of Vietnamese communities appears to be largely determined by water availability and livelihood strategies (Thao et al., 2019[13]). Drought-affected communities suffer adverse health impacts, with households with low agricultural incomes and a lack of coping capacity being especially vulnerable (Lohmann and Lechtenfeld, 2015[15]).

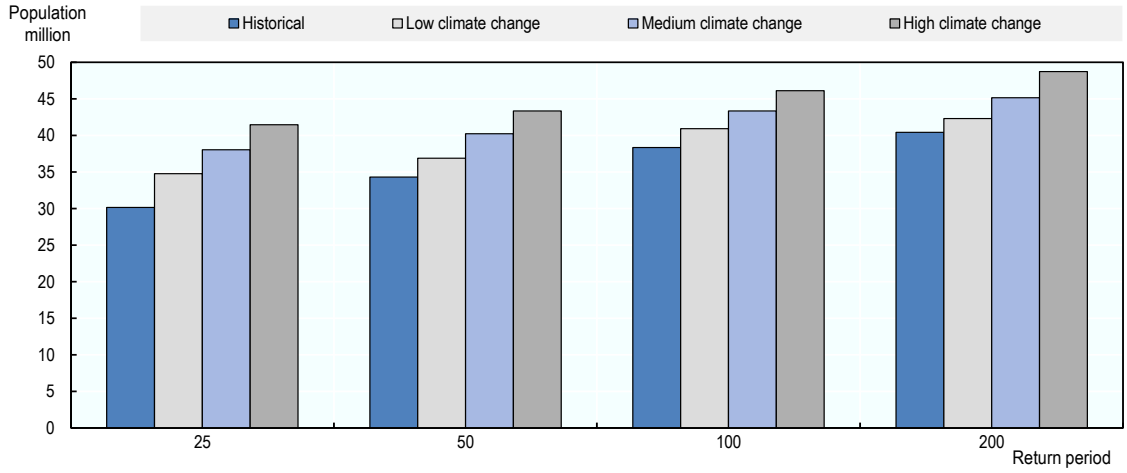
Moreover, Viet Nam faces the risk of landslides, which are typically triggered during heavy rainfall. Landslides are among the most serious hazards in the mountainous parts of central and northern Viet Nam due to the geological and topographic conditions and the occurrence of tropical storms in these regions (Le et al., 2021[16]). Human activities such as deforestation, construction and other changes to the environment exacerbate the landslide risk (Le et al., 2021[16]; Nguyen, Tien and Do, 2019[17]).

Viet Nam faces tsunami risk from earthquakes in the South China Sea, with central and north-central regions estimated to be at most exposed (Hong Nguyen et al., 2014[18]). A tsunami generated by an earthquake in the Manila Trench (the most probable tsunami source) could reach the Vietnamese coastline in approximately two hours (Hong Nguyen, Cong Bui and Dinh Nguyen, 2012[19]).

## Climate change perspective

Disaster exposure in Viet Nam is significant. Approximately two-thirds of the population reside in storm- and flood-exposed locations along the coast and in low-lying deltas, and 97% of nighttime lights (a proxy for the concentration of economic activity) are located in areas exposed to floods (Chantarat and Raschky, 2020[20]). Assuming no protection, one-third of the population is exposed to a 1-in-25-year flood event (Bangalore, Smith and Veldkamp, 2018[21]). More than one-third of settlements are located on eroding coastlines, and 26% of public hospitals and health care centres, as well as 11% of schools, are at risk of severe coastal flooding (Rentschler et al., 2020[5]).

## Estimated population exposed to flood risk, by scenario and return period




Source: (Bangalore, Smith and Veldkamp, 2018[21]), "Exposure to floods, climate change, and poverty in Vietnam", *Economics of Disasters and Climate Change*, Vol. 3, pp. 79-99, https://link.springer.com/article/10.1007/s41885-018-0035-4.

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Development activities continue to be concentrated in high-risk coastal areas, increasing the exposure of population and assets. Both exposure and vulnerability are exacerbated by development in areas that act as a natural buffer to inundation, such as floodplains, coastal swamps and drainage channels (Nguyen et al., 2021[3]). Approximately 12% of the population lives below the national poverty line, and 38% of poor households are exposed to disasters. This population is characterised by higher vulnerability and a lack of capacity to cope with disaster impacts (UNDRR, 2022[22]). Land scarcity in urban areas is forcing poor populations to occupy high-risk areas, and they reside in low-quality, non-engineered houses due to a lack of resources, contributing to their vulnerability (Bangalore, Smith and Veldkamp, 2018[21]; UNDRR, 2022[22]).

All these factors make them more exposed to climate change. Viet Nam's disaster risk is thus being shaped by climate change and sea-level rise. These factors are expected to exacerbate the risks of flooding, drought, erosion and saline intrusion (Rentschler et al., 2020[5]). Climate change could increase population exposure to severe floods (Bangalore, Smith and Veldkamp, 2018[21]). Unless effective adaptation measures are adopted, fluvial flooding may impact an additional 3-9 million people by 2035-44, and 6-12 million more people may be affected by coastal flooding by 2070-2100 (World Bank and ADB, 2020[4]). Storm surges may increase by up to 1 metre, and the range of the coastline currently exposed to storm surge heights of 2.5 metres will likely more than double by 2050 (Wood et al., 2023[23]). The Mekong River delta region is projected to face a 20% increase in delta inundation, prolonged submergence of 1-2 months and a two- or three-fold increase in annual rice crop damage (Triet et al., 2020[24]). The annual probability of drought will likely increase by approximately 10% (World Bank and ADB, 2020[4]). By 2050, 39% of the country's GPD is projected to be exposed to the physical risks of climate change, such as floods, storms, wildfires and sea-level rise (S&P, 2022[25]).

## Challenges for disaster risk management policy

Viet Nam's disaster risk management efforts would benefit from increased human and financial resources; stronger co-operation among regions, ministries and sectors; and more granular disaster data to optimise policy for local needs (Lan Huong et al., 2022[1]).

Enhancing the funding and capacity of urban planning institutions would allow for the implementation of updated risk-informed building codes, safety standards, and enforcement of each as well as state-of-the-art spatial planning that considers disaster risk exposure in an optimal fashion. For instance, two-thirds of the country's dike system does not meet current safety standards, and the standards leave significant protection gaps in some high-growth provinces (Rentschler et al., 2020[5]). Increasing capacity and funding within the Viet Nam Disaster and Dyke Management Authority would help upgrade substandard dikes, benefitting those dependent on their protection.

Gaps in the existing flood risk assessments include insufficient attention to social drivers of flood risk and vulnerability (Nguyen et al., 2021[3]). Urban and peri-urban areas are seeing an increase in flood risks while also experiencing high population growth yet are characterised by relatively lower flood resilience than in rural areas (FRA, 2023[26]). Therefore, these areas should be designated priority locations for disaster risk management improvement initiatives. Poverty eradication should be integrated into flood risk management as one of the main priorities, as poverty-related factors were identified to be among the root causes limiting disaster resilience of households in rural and suburban areas (Nguyen et al., 2021[27]).

Disaster risk is financed primarily from national and local contingency reserve funds, but also from sources outside the state budget such as the Fund for Natural Disaster Prevention and Control, as well as international assistance. The present financial capacity is insufficient, leaving the country at a risk of a severe financing gap, especially in the case of major events. The use of ex-ante funding mechanisms such as disaster insurance is currently limited. Disaster insurance is sold as an add-on to existing policies and has very low penetration rates. Public assets are insured for fire hazards, but insurance for flood and typhoon hazards, arguably the most pertinent risks, is almost non-existent (ISF, 2022[28]), suggesting community-level awareness of disaster risk must improve (Lan Huong et al., 2022[1]).

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# Country notes on disaster risks in Brunei Darussalam and Singapore

# Brunei Darussalam

## Introduction

Brunei Darussalam is generally perceived as facing little disaster risk despite its location in Southeast Asia, a highly disaster-prone region. Nevertheless, it faces risks from several types of disasters and has a relatively large population of vulnerable people. Floods, and landslides are the most common disasters, particularly as a result of short periods of heavy rainfall. While landslides are not especially damaging, they can disrupt transportation networks, resulting in negative economic consequences.

## The hazardscape

Brunei Darussalam faces a risk of floods, landslides, droughts, storms, earthquakes and wildfires. It is additionally exposed to the potential impacts of tsunamis generated in the region (Ndah and Odihi, 2017[1]). Floods and landslides, especially associated with the rainy season, constitute the most frequent and impactful disasters, and inflict considerable social and economic damage (Jamalullail et al., 2021[2]; Ndah, Dagar and Becek, 2016[3]). Severe disaster events, such as floods or wet landslide events, affected thousands of people and damaged hundreds of buildings in the country in 2009, 2011 and 2014 (Ndah, Dagar and Becek, 2016[3]).

Heavy rainfall events, which occur mainly during the rainy season between October and May, have the potential to trigger coastal, riverine (fluvial) floods, flash (pluvial) floods and landslides (Yassin et al., 2021[4]). Heavy rainfall lasting only one or two hours can lead to flooding of up to one metre deep in some inland areas (JICA, 2012[5]). Severe events occur typically during the wettest months of December and January and can affect the whole country given its small size (Ndah, Dagar and Becek, 2016[3]). Flooding occurs mainly in low-lying regions, especially in the Tutong and Belait districts, with the Tutong district estimated to have the highest integrated flood vulnerability (Ndah, Dagar and Becek, 2016[3]; Jha et al., 2020[6]). Most residential areas are located on coastal plains and near rivers (Yassin et al., 2021[4]). Kampong Ayer, a traditional settlement built on stilts above the Brunei River just outside the capital city, has a population of more than 10 000 people and is at a high risk of flooding. The risk is highest when heavy precipitation combines with a high tide that sea-level rise can exacerbate (JICA, 2012[5]).

The risk of severe landslide damage is relatively low. However, landslides in the hilly regions affect transportation networks. On top of weather and geological factors, the dynamics of rapid urbanisation and loss of vegetation cover contribute to an increase in landslide risk (Jamalullail et al., 2021[2]). As of 2017, no landslide mitigation strategies had been implemented despite the potential for landslide damage. The reactive measures employed were not perceived to be effective or sustainable by experts, despite government spending of approximately USD 3.6 million annually on slope rectification projects (Ndah and Odihi, 2017[1]).

Brunei Darussalam has recently experienced an increase in forest fires, most likely as a consequence of elevated temperatures, more variable rainy seasons and longer dry spells associated with the intensification of the El Niño Southern Oscillation (ENSO) cycle. These forest fires adversely affect human

health due to reduced air quality, and negatively impact the forestry sector. The Brunei-Muara district is estimated to be most affected by fires (Shahriar et al., 2019[7]). In the last few decades, the country has also been experiencing increasing haze and air pollution as a result of forest fires across in neighbouring Indonesia (Shahriar et al., 2019[7]).

The earthquake risk in Brunei Darussalam is considered to be low and the country has not suffered any catastrophic earthquake losses, but damaging earthquakes do occur causing estimated annual losses of nearly USD 6 million (Ndah and Odihi, 2017[1]). While there are no recent records of tsunamis, the coastline is exposed to tsunami risk.

Winds strong enough to cause damage also occur regularly at the tail end of tropical storms during the southwest monsoon or during heavy thunderstorms. The country experienced prolonged droughts in the 1960s and 1990s, but drought risk is currently perceived to be low. The construction of several dams in the last two decades has increased the country's water storage capacity and drought resilience (CFE, 2022[8]).

## Climate-change perspective

Climate change is increasing the threat of floods, landslides, heatwaves and forest fires in Brunei Darussalam as it shifts rainfall patterns, increases temperatures and causes sea-level rise (CFE, 2022[8]; Hasan, Ratnayake and Shams, 2016[9]). Future sea-level rise is expected to increase the risk of coastal floods, and reduce river drainage, with the most populated inland floodplains becoming vulnerable to tidal floods by the end of the century (Ratnayake et al., 2022[10]).

## Challenges for disaster risk management policy

Flood risk could be reduced by investment in small-scale individual flood mitigation measures, such as elevation of residential properties or flood-proofing, and by implementation of ecosystem-based measures such as restoration of mangroves or riverside vegetation (Islam, Reinstädtler and Ibrahim, 2023[11]). Flood management may benefit from an enhanced capacity for heavy rainfall forecasting, which would require a better and more comprehensive understanding of intra-seasonal rainfall variability and anomalous rainfall events (Ndah, Dagar and Becek, 2016[3]). Flood monitoring, forecasting and warning systems should be improved, especially as regards communicating risk information to the general public (Islam, Reinstädtler and Ibrahim, 2023[11]). More detailed landslide mapping and regular monitoring should be conducted and incorporated into urban planning to mitigate landslide risk (Jamalullail et al., 2021[2]). As regards forest fires, potential improvements in forest fire mitigation include more effective personnel planning, increasing fire departments' capacity and training, and planning to avoid the use of treated water in fighting fires (Shahriar et al., 2019[7]).

Early hazard warnings are broadcast via television, radio or SMS, but there are gaps in delivering the hazard information, especially to coastal fishing communities and ships offshore (CFE, 2022[8]). Brunei Darussalam's warning system is operated manually and requires personnel for constant monitoring, making the system less efficient and unnecessarily slow. The country's disaster warning system could be improved by establishing processes designed around a modern digital alert system (Yassin et al., 2021[4]).

Disaster data appear relatively less extensive in Brunei Darussalam than in other countries in the region. This could indicate a need to improve data collection, particularly with regard to smaller-scale recurrent events (Ndah, Dagar and Becek, 2016[3]).

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# Singapore

## Introduction

Singapore is exposed to occasional floods, droughts, storms, and heatwaves, and also has some risk of exposure to earthquakes or tsunamis. Although Singapore is located in Southeast Asia, a region generally known to be highly hazard-prone, its overall disaster level is low and the country has been relatively sheltered from the impact of major disaster events (Lin et al., 2021[1]). The WorldRiskReport estimates that Singapore faces little disaster risk.

## The hazardscape

Singapore has not suffered any major disaster impacts in recent decades, yet impactful disaster events can occur. A few severe flood events were recorded in the second half of the 20th century. Since 1950, at least three flood events, two drought events, and three haze events occurred (Lin et al., 2021[1]). Floods in 1969 left up to 75% of Singapore inundated, killed five people, rendered 3 100 people homeless and led to more than SGD 4 million (Singapore dollars) in damage. A flood event in 1978 killed seven people, generated numerous landslides and led to SGD 10 million in damage (Kennedy, 2015[2]). Post-1970s improvements in urban planning, including the construction of drainage systems and implementation of other flood prevention measures in flood-prone and low-lying areas, led to a 95% reduction in areas identified as flood prone (Tortajada and Joshi, 2013[3]). Despite these improvements, both coastal and inland flooding remain a risk, especially given changing precipitation patterns and an observed increase in the frequency of flash floods in the last 30 years (Chow, 2017[4]). Between 2000 and 2015, floods damaged about 550 homes and led to about USD 24 million in damage but caused no fatalities (Kennedy, 2015[2]). Notably, localised floods in the Orchard Road shopping district in June 2010 led to USD 17 million in insurance claims (Chow, 2017[4]).

Singapore can also experience drought, and episodes have become more frequent (Chow, 2017[4]; Chuah, Ho and Chow, 2018[5]). While Singapore significantly increased its drought resilience through implementation of water management practices, including water retention and desalination facilities as well as water recycling, it ranks among the most water-stressed countries in the world (Chuah, Ho and Chow, 2018[5]; Luo, Young and Reig, 2015[6]). Droughts are thus among the key disaster-related concerns due to their potential to reduce water supply for private consumption, and thus affect all residents, as well as water-dependent industrial and commercial activities (Biswas, 2012[7]).

## Climate change perspective

Climate change is expected to affect the disaster risks faced by Singapore via increasing temperatures, increased precipitation during the wet months, decreased precipitation during the dry months, possible increases in wind speed during the northeast monsoon and rising sea levels. These climatic changes will exacerbate the flood, drought, storm and heatwave hazards (NCCS, n.d.[8]; Chow, 2017[4]). Regarding sea

level rise, almost one-third of the country is situated less than five metres above sea level, resulting in large areas exposed to coastal flooding as well as the risk of future permanent inundation (Cannaby et al., 2016[9]; NCCS, n.d.[8]). Singapore is also highly vulnerable to potential effects of climate change abroad in the form disruptions in water and food availability, given that the country imports approximately 60% of its water and more than 90% of its food (SFA, 2020[10]; Chuah, Ho and Chow, 2018[5]).

## Challenges for disaster risk management policy

While Singapore's disaster risk management policy is relatively well established, various disaster risk management-related challenges remain. They include the lack of a comprehensive disaster risk information database, the limited dedicated disaster fund, the need to establish robust mechanisms to ensure long-term food and water security, and the need to increase disaster awareness among the public. Importantly, as disaster risk management and development planning still appear to be treated as separate issues, better integration of disaster risk management concerns within planning could improve the country's disaster risk management efforts. Emphasis should also be placed on increasing community-level risk awareness and collaboration with the private sector as regards developing disaster risk reduction solutions (UNDRR, 2020[11]). Stronger private-public partnerships should be promoted to mobilise the resources of non-state actors and incentivise businesses and civil society organisations to support awareness-raising programmes and disaster risk reduction efforts in general (Ha and Jamil, 2014[12]). As regards flood risk management, challenges include resolving jurisdictional ambiguities, for example in the management of coastal versus inland floods, where the remit of the Building and Construction Authority includes Singapore's coastal protection, but flood control responsibility, including coastal flooding, typically falls under the purview of the Public Utilities Board (Chan et al., 2018[13]).

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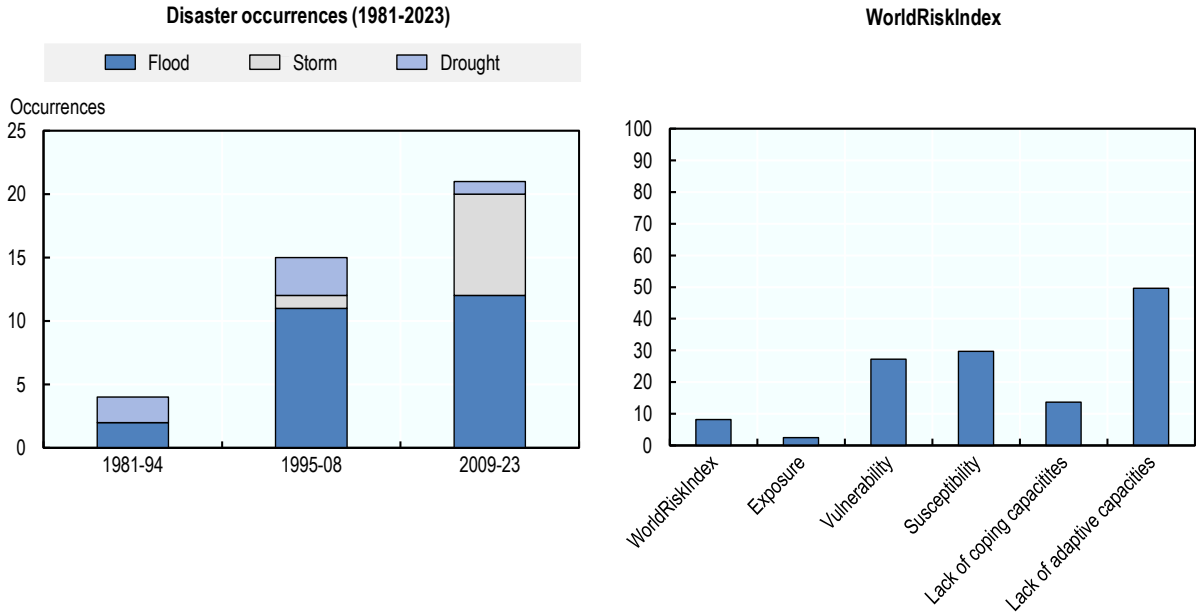
# Country notes on disaster risks in the CLM countries

# Cambodia

## Introduction

Cambodia is exposed to floods, droughts, tropical storms and landslides (GFDRR, 2017[1]). Floods are the most prevalent type of disaster affecting the country, as shown in the figure below. It is classified as facing high disaster risk by the WorldRiskIndex (8.19, 65th-highest risk out of 193 countries). Between 2000 and 2022, disasters triggered by natural hazards caused more than 1 200 deaths and affected more than 16 million other people (CRED, 2024[2]).

### Cambodia: Disaster occurrences (from 1981 to 2023) and WorldRiskIndex




Source: EM-DAT and WorldRiskIndex.

StatLink https://stat.link/2fwcbr

## The hazardscape

Cambodia is particularly exposed to flooding, as the low-lying plains along the Mekong River and the Tonlé Sap Lake cover almost three-quarters of the country (Phy et al., 2022[3]). Seasonal riverine floods, which are associated with a steady rise of river levels, occur regularly during the monsoon season as a result of heavy rainfall in the upper catchment hills, and can be aggravated by rainfall around the Tonlé Sap or by cyclone-induced rainfall, especially along the coasts. Flash floods, which typically result from rainfall in mountainous areas flowing into the Mekong tributaries, occur more suddenly and last several days at most

(Oudry, Pak and Chea, 2016[4]). Flooding may also occur as a consequence of upstream dam failures, as was the case in 2018 when a dam breach in southern Lao PDR caused catastrophic flooding downstream (Latrubesse et al., 2020[5]). Floods cause the highest disaster-related losses in the country and are estimated to lead to about 100 fatalities annually, as well as to yearly agricultural losses of USD 100-170 million (Royal Government of Cambodia, 2010[6]). Between 1996 and 2013, floods damaged almost 1.7 million hectares of rice paddy fields, which represented 67% of the total damaged rice paddy fields by area (UNDP, 2014[7]). A 2011 flood affected more than 1.5 million people and destroyed approximately 10% of the country's agricultural crops (ADB, 2012[8]). The population exposed to riverine floods is projected to increase to 4 million by the 2040s if no further mitigation measures are implemented (World Bank and ADB, 2021[9]).

Cambodia is also exposed to drought, threatening rural populations whose livelihoods are based on subsistence agriculture, as these areas do not use large-scale irrigation (UNDP, 2019[10]). Kampong Speu, Takeo Banteay Meanchey, and Svay Rieng are among the most drought-prone provinces. Droughts are also related to the El Niño Southern Oscillation (ENSO) cycle. In 2015, an El Niño led to the worst drought in 50 years, affecting more than 2.5 million people and threatening national food security (UNDP, 2019[10]). Upstream damming on the Mekong River is affecting drought risk as well and was linked to a severe drought in 2019 (Lu and Chua, 2021[11]). From 1987 to 2007, drought losses were estimated at USD 138 million (Oudry, Pak and Chea, 2016[4]).

Cambodia is also exposed to infrequent tropical cyclone impacts (as most cyclones in the region affect Viet Nam's coast), though the recorded frequency of such impacts has increased recently. In 2009, Cambodia was struck by Tropical Cyclone Ketsana, one of the most intense storms in the country's history, affecting 180 000 people and leading to USD 132 million in damage (Royal Government of Cambodia, 2010[6]).

## Climate change perspective

Climate change is expected to increase the frequency and intensity of droughts and floods, endangering 10% of Cambodia's GDP by 2050 (World Bank and ADB, 2021[9]; Thilakarathne and Sridhar, 2017[12]; Nop, 2021[13]). In addition, parts of the Cambodian coastline are projected to face new risks from storm surges due to a southward shift in tropical cyclone tracks (Wood et al., 2023[14]).

Eighty percent of Cambodia's population lives in rural regions and relies on subsistence agriculture (GFDRR, 2017[1]). While manufacturing and services increasingly contribute to the economy, agriculture and fisheries, which are highly vulnerable to the impacts of extreme weather, still constitute roughly one-quarter of GDP and employ half of the country's labour force (World Bank and ADB, 2021[9]). Disaster vulnerability is exacerbated by the high prevalence of poverty, with 17.8% of the country's approximately 17 million inhabitants living below the poverty line of KHR 10 951 per day (Karamba, Tong and Salcher, 2022[15]). Other factors contributing to high vulnerability include a lack of adequate protective infrastructure, inadequate drainage systems and the presence of many informal settlements (UNDRR, 2019[16]).

The capital city of Phnom Penh has approximately 250 000 informal urban dwellers (15% the of the city's urban population), a significant fraction of whom occupy low-lying, flood-prone areas (Flower et al., 2017[17]). Physical vulnerability is exacerbated by the poor quality of housing. In 2017, almost 10 million people were estimated to lack access to decent housing; this is more than 60% of the national population (Habitat For Humanity Cambodia, 2017[18]). Both exposure and vulnerability are being altered by urbanisation. Rapid development in Phnom Penh's peri-urban districts increases flood exposure and vulnerability, as construction in these areas involves the filling of marshlands that serve important floodwater and wastewater regulation functions (Flower et al., 2017[17]).

## Challenges for disaster risk management policy

The disaster risk management funding allocated in the government's budget is not always sufficient to cover losses, especially as the country is exposed to the impacts of relatively frequent major events and is heavily reliant on international assistance for disaster response, relief and recovery. Emergency response costs (especially for floods) lead to short-term funding gaps and necessitate reallocation of public funds, which has negative implications for development funding (GFDRR, 2017[1]).

The Cambodian disaster insurance market is still at an early stage, with minimal coverage of private property, public assets or agricultural production. In 2017, it was estimated that non-life insurance penetration is only 0.16% of GDP, the second lowest level in ASEAN, while disaster perils are typically excluded in standard insurance policies (GFDRR, 2017[1]). In the case of small agricultural communities and villages, innovative disaster insurance models, such as community-based catastrophe insurance, could be implemented. The potential advantages of community-based insurance include a more flexible insurance-policy structure, possibly including parametric triggers for payments, lower fixed underwriting and assessment costs and thus better affordability, and the inclusion of risk mitigation incentives (Bernhardt et al., 2021[19]). Ways to increase public asset insurance should also be explored (GFDRR, 2017[1]).

Co-ordination of response and recovery activities needs to be strengthened further. Disaster risk management efforts are also constrained by limited disaster data, with better data required for disaster risk assessments and disaster risk reduction planning (Mochizuki et al., 2015[20]). These requirements include mapping of flood hazards. Given the importance of flooding, additional funding for flood hazard mapping, risk and damage assessment, and projected future flood analysis due to climate change are needed (Phy et al., 2022[3]). Improved disaster data collection more generally, as well as more detailed risk assessments, would greatly benefit Cambodia's disaster risk management efforts. Flood and drought risk mitigation would also benefit from improvements in water management. The current approach, in the form of irrigation management, is not sufficient and should be complemented by water diversion schemes, large-scale reservoir construction, and increased community-based water management efforts (Sithirith, 2021[21]). These measures may ameliorate both wet-season floods and dry-season water scarcity.

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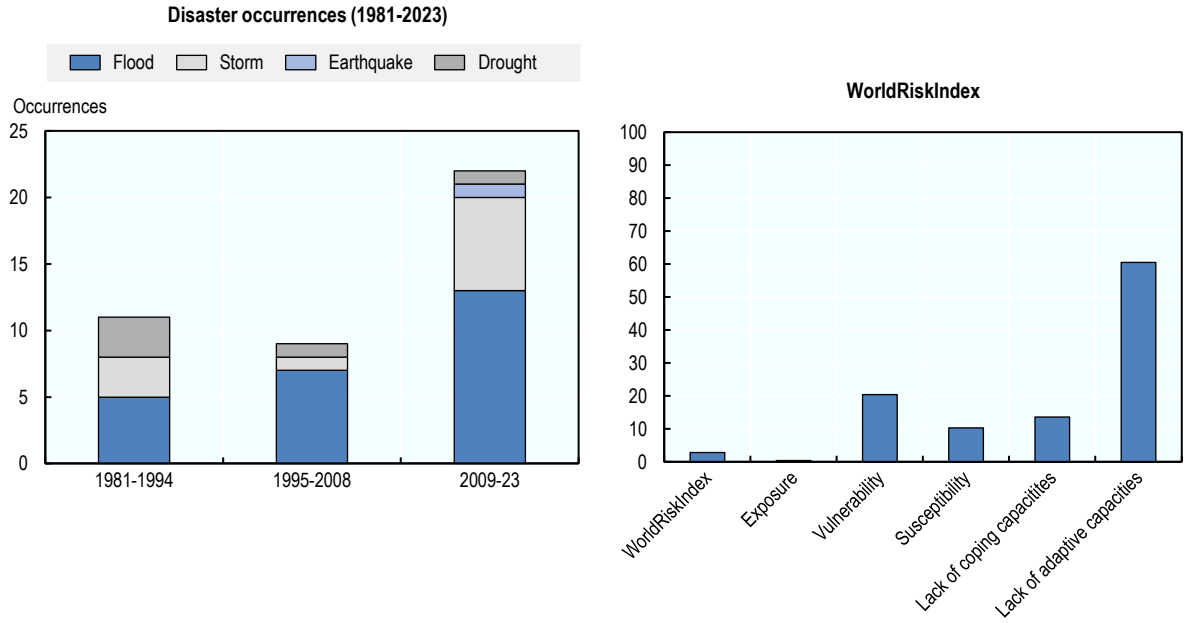
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# Lao PDR

## Introduction

Lao PDR is exposed to multiple natural hazards including floods, droughts, tropical storms, landslides and earthquakes, as are the other countries in peninsular Southeast Asia (GFDRR, 2017[1]). It is classified as facing a low disaster risk by the WorldRiskIndex (ranked 127th). Historically, Lao PDR has been relatively less exposed to major disasters due to its landlocked location and lower seismicity than other countries in Emerging Asia (UNDRR, 2019[2]). However, the country has experienced some significant disasters in the last two decades. Typhoons Ketsana in 2009 and Haima in 2016 caused estimated losses of USD 58 million and USD 63 million, respectively (GFDRR, n.d.[3]).

### Lao PDR: Disaster occurrences (from 1981 to 2023) and WorldRiskIndex




Source: EM-DAT and WorldRiskIndex.

StatLink https://stat.link/9xdzgm

## The hazardscape

Riverine and flash flooding associated with episodes of heavy monsoon rains are recurring phenomena in Lao PDR, with damaging floods occurring mostly in the central and southern regions in low-lying areas along the Mekong and Nam Ngum rivers. More than 12% of the country is considered to be at medium or

high risk for floods (Phakonkham, Kazama and Komori, 2021[4]), and a large number of settlements are located in flood-prone areas such as the Mekong River valley (NDMC and UNDP, 2010[5]). Countrywide, 89% of nighttime lights (a proxy for the concentration of population and economic activity) are located in flood-prone areas (Chantarat and Raschky, 2020[6]). Flooding in densely populated and more economically developed areas along the Nam Ngum River results in significant economic losses (Hansana et al., 2023[7]). Flooding can also occur as a consequence of dam failure, as was the case in 2018 when a dam breach in southern Lao PDR caused severe flooding in both Lao PDR and Cambodia (Latrubesse et al., 2020[8]). Flood impacts are increasing, with the number of people affected annually by riverine flooding projected to increase from 170 000 to 250 000 between 2010 and 2030 (WRI, n.d.[9]). Recent government efforts to mitigate flood risk by implementation of water management systems and flood prevention strategies seem to have reduced flood footprints (Hansana et al., 2023[7]). In the future, the expected annual flood damage is estimated to increase significantly due to urban development (Tierolf, de Moel and van Vliet, 2021[10]).

Lao PDR has experienced at least nine major droughts since the 1960s, and drought losses have been increasing in the last decade (Maniphousay, 2021[11]). Droughts occur as a consequence of low local rainfall, below-average river flows (associated with less rain upstream) or a combination of these two factors. The entire area of Lao PDR is considered to be at risk of drought throughout the year, but the risk of severe drought is estimated mainly for the highland areas of Northeast Lao PDR. In the last decade, hydropower development in both Lao PDR and the People's Republic of China (hereafter "China") has been affecting the hydrology of the region and potentially increasing drought risk, as rainfall occurring in the upper parts of the Mekong River may reach downstream communities less reliably (Lu and Chua, 2021[12]). In the future, the northern part of Lao PDR is expected to face extreme drought during severe El Niño conditions (UN.ESCAP, 2021[13]).

Given its mountainous topography, Lao PDR is also exposed to landslides, usually triggered by heavy rainfall and affecting transport infrastructure during the rainy season (Arambepola and Devkota, 2013[14]). Forty-four percent of the country's area is estimated to be at a medium landslide risk and approximately 5% is at a high risk, mainly in southeastern and central Lao PDR (NDMC and UNDP, 2010[5]). Lao PDR also experiences occasional earthquakes, but the earthquake hazard is higher in the northern parts of the country where population density is much lower. Most recurring earthquakes thus typically do not cause significant damage.

## Climate change perspective

Disaster risk in Lao PDR is characterised by high rural vulnerability, as approximately 60% of the population live in rural regions and are largely dependent on subsistence agriculture (GFDRR, 2017[1]). While the country has one of the fastest growing economies in Southeast Asia, it is still among the least developed, with high poverty rates and approximately 80% of the population living on less than USD 2.5 per day (GFDRR, n.d.[3]).

The economy of Lao PDR is highly reliant on agriculture, with 64% of the population working in the agricultural sector. Agriculture represents about 24% of the country's GDP, exacerbating its exposure to disaster risk (GLPDR, 2018[15]). Extreme weather impacts on agriculture lead to major disruptions to rural household livelihoods and reduce food security (Soulibouth, Hwang and Shin, 2021[16]). Disaster vulnerability is highest among the most remote rural communities, which largely consist of minority ethnic groups which are characterised by the highest poverty rates, higher rates of disability and low access to health services and education, limiting their potential for social development (UNDRR, 2022[17]). Community resilience is further reduced due to the extensive use of monoculture farming, limited infrastructure, and inadequate public social protection systems (GLPDR, 2018[15]; GFDRR, 2017[1]).

Climate change is projected to intensify both flood and drought hazards in Lao PDR through rising temperatures and changes in rainfall patterns (Paltan et al., 2018[18]; Thilakarathne and Sridhar, 2017[19]).

## Challenges for disaster risk management policy

Following the devastation brought about by Typhoon Ketsana in 2009, disaster risk management in Lao PDR is in the process of gradually shifting from mostly ad-hoc and reactive approaches towards more proactive and holistic ones (Vivona and Suyavong, 2021[20]). In this vein, improved collection, analysis and management of disaster data on hazards, exposure and vulnerability should be among the main priorities as it would greatly assist the formulation of policy (UNDRR, 2019[2]). In terms of implementation, there is room to improve the capacity of disaster risk management institutions at the provincial and district levels (Soulibouth, Hwang and Shin, 2021[16]). Increasing capacity of civil society organisations would allow them to take on a great share of the burden, which would be beneficial to both the government and the population as a whole (Vivona and Suyavong, 2021[20]).

As regards drought risk management, the priorities include strengthening drought risk assessment and early warning systems, supporting drought risk financing mechanisms, and enhancing adaptive capacity to drought to reduce drought-related conflict (UN.ESCAP, 2021[13]). Disaster resilience among farmers could be increased through encouragement of the use of flood-resistant storage facilities, moving livestock to higher grounds during floods, growing alternative crops which can be harvested early, strengthening social protection systems, and supporting projects that can help farmers restore their farms following a disaster event (Soulibouth, Hwang and Shin, 2021[16]).

Disaster insurance coverage in the country is extremely limited for residential assets and minimal for commercial assets (GFDRR, 2017[1]). Agricultural insurance could potentially enable farmers to transfer some extreme weather financial risk to insurance companies and financial markets. One study found that rice farmers were willing to pay for a premium with an indemnity of 17% (Wongpit and Sisapangthong, 2021[21]). In April 2023, Lao PDR launched a National Financial Protection Strategy Against Disaster Risk, which may address some of these disaster financing concerns.

Lao PDR is facing a funding gap that leaves it unable to sustain disaster risk reduction efforts and provide emergency relief, especially in the case of severe and large-scale events (GFDRR, 2017[1]).

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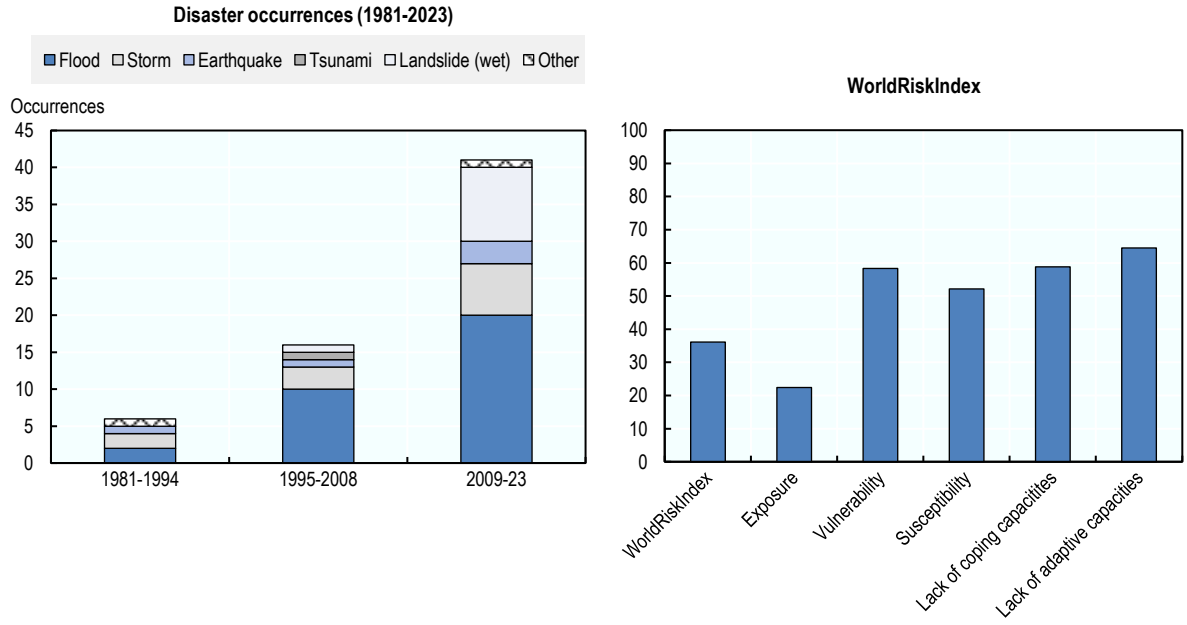
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# Myanmar

## Introduction

Myanmar is among the world's most disaster-prone countries. It faces frequent floods, droughts, tropical cyclones and landslides, and is also exposed to other natural hazards including earthquakes, tsunamis and wildfires (NDMC, 2017[1]). Myanmar faces 6th-highest disaster risk, according to the WorldRiskIndex 2023. Another organisation, the Global Climate Risk Index, ranked Myanmar second among countries most affected by extreme weather events in the last two decades (Germanwatch, 2019[2]). The disaster risk in Myanmar is characterised by a high level of natural hazards and exposure, high vulnerability and a lack of coping capacities. Between 2000 and 2023, 55 disasters triggered by natural hazards led to over 140 000 deaths, affected more than 7.5 million other people and caused nearly USD 7 billion in economic damages (CRED, 2024[3]).

### Myanmar: Disaster occurrences (from 1981 to 2023) and WorldRiskIndex




Source: EM-DAT and WorldRiskIndex.

StatLink https://stat.link/2tgioz

## The hazardscape

The most frequent natural hazards in Myanmar are floods (49%), landslides (22%), storms (18%), and earthquakes (7%), with floods and storms being the most impactful with respect to the number of people

affected. Disasters caused by natural hazards inflict significant social and economic impacts in the country. Average annual expected disaster losses amount to 0.9% of the country's GDP (World Bank, 2012[4]). In 2008, Cyclone Nargis, one of the deadliest cyclones in recorded history and the most impactful disaster event on record in Myanmar, led to 140 000 deaths, affected 2.4 million people and caused more than USD 4 billion in economic damage and losses (GFDRR, 2022[5]; UNDRR, 2012[6]). In 2015, severe floods displaced approximately 1.6 million people, while economic damage and losses exceeded USD 1.5 billion (World Bank, 2015[7]). In addition to such large-scale disaster events, the cumulative impact of small-scale and recurrent events is also significant. The prevalence of natural hazards severely threatens the country's economic development via disruptions in economic activity following the loss of livelihoods and infrastructure, and because of the costs associated with reconstruction and recovery. Disasters are a significant contributing factor to people's inability to escape poverty and to low labour-force participation and financial exclusion of women (NDMC, 2017[1]).

## Climate change perspective

Myanmar's disaster vulnerability is exacerbated by inadequate development and high poverty rates, with a quarter of the population living below the poverty line. Rural vulnerability is especially high, as rural populations have significantly higher poverty rates (38%) than the urban populations (14.5%) and are largely reliant on climate-sensitive activities such as subsistence agriculture (World Bank, 2017[8]). Myanmar is still heavily dependent on the agricultural sector, which contributed approximately 22% to the country's GDP in 2022 and is disproportionately vulnerable to extreme weather events (World Bank, n.d.[9]). Other factors linked to high vulnerability include poor infrastructure, gender inequality, unplanned urbanisation and a lack of access to financial services (NDMC, 2016[10]).

Climate change is expected to increase the risk of floods, storms and droughts, which may consequently affect the risks associated with landslides and wildfires. Furthermore, sea level rise is threatening the livelihoods and economic activity along the coast through higher tides and storm surges, damage to infrastructure, and salinisation of soil and water resources (Oo, Huylenbroeck and Speelman, 2018[11]).

## Challenges for disaster risk management policy

The National Disaster Management Committee (NDMC) released Myanmar Action Plan on Disaster Risk Reduction, 2017" designed a comprehensive disaster risk management plan with the help of the UNDP and the Ministry of Foreign Affairs of Finland. The plan was specifically called "integrated" and takes a very similar approach to what this publication calls "holistic". Notably, the plan identifies several challenges to each objective and proposes solutions to them (NDMC, 2017[1]). Nonetheless, disaster risk management remains highly centralised in Myanmar. A shift towards local-level implementation would allow for authorities to optimise policy for local contexts, while central policy formulation and clear response hierarchy would provide a foundation for policy co-ordination and response support.

At the community and household level, disaster resilience and preparedness could be improved by various measures including education on first aid, improving mobile phone infrastructure for communication during a disaster, and involvement of public buildings as shelters in disaster response (Heinkel et al., 2022[12]). Risk awareness could be improved by emergency day events, media campaigns and other awareness programmes (Soe et al., 2021[13]). These programmes should be aimed at risk management institutions, the private sector, the civil society, and the general public. Maps of public buildings should be developed, shelter management training conducted, and escape routes and evacuation sites established (Than, Kyi and Kraas, 2020[14]). Myanmar's earthquake disaster plan (the National Earthquake Preparedness and Response Plan) should be updated to include considerations for infrastructure management including water supply and electricity (Inoue, Numada and Meguro, 2020[15]).

The central government has increased its efforts to improve financial resilience, having established a National Disaster Management Fund and allocated a contingency budget for relief and recovery. However, the budgetary provisions to meet post-disaster financing needs are inadequate. Severe funding gaps remain, with the country relying on international assistance especially in the case of major disaster events. Potential steps to improve Myanmar's disaster risk financing include improved assessments of available financing instruments, the establishment of additional sources of rapid emergency response funding, the development of contingent financing mechanisms, the utilisation of existing social protection schemes for distribution of financial aid and the introduction of public asset insurance (World Bank, 2017[16]).

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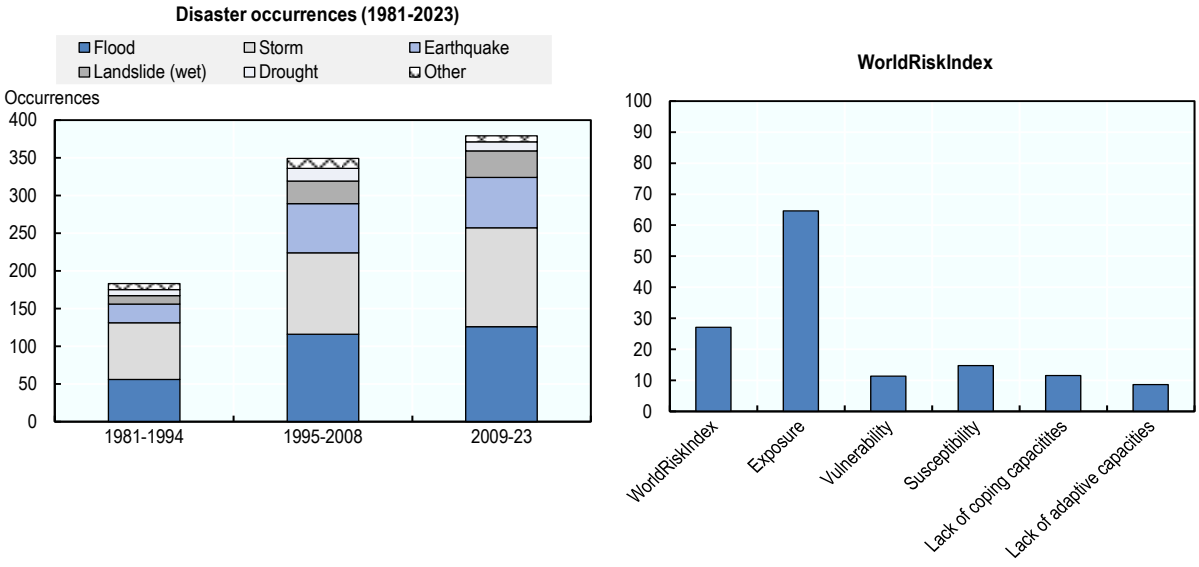
# Country notes on disaster risks in China and India

# China

## Introduction

The People's Republic of China (hereafter "China") is exposed to all types of natural hazards, including floods, tropical cyclones, droughts, earthquakes, heatwaves, landslides and wildfires, and is one of the most affected countries globally, with 371 disasters having been recorded from 2009 to 2023. However, direct economic losses expressed as a percentage of GDP have been decreasing, as have disaster mortality rates (GFDRR, 2020[1]).

### China: Disaster occurrences (from 1981 to 2023) and WorldRiskIndex




Source: EM-DAT and WorldRiskIndex.

StatLink https://stat.link/t9xo8m

## The hazardscape

Two-thirds of China's population is exposed to risk of flooding (GFDRR, 2020[1]). Much of the flooding occurs in densely populated areas in the low-lying eastern plains, with the most impactful flood disasters occurring in the middle and lower parts of the Yangtze River and in the Yellow River Basin (Du et al., 2016[2]; Wang et al., 2019[3]). In recent decades, reductions in socio-economic vulnerability, along with improvements in flood risk management and implementation of both structural and non-structural flood prevention measures, have led to a large reduction in flood fatalities (Ding et al., 2022[4]). However, floods continue to inflict significant socio-economic losses, and in many years flood fatalities have exceeded

1 000, and floods have caused more than USD 10 billion in economic losses (Kundzewicz et al., 2019[5]). Both flood risk and flood-induced economic losses have been increasing in much of China, largely as a consequence of sharp rises in exposure due to population growth, socio-economic development and rapid urbanisation, but also due to changes in weather patterns (Du et al., 2016[2]; Kundzewicz et al., 2019[5]). Flood frequency and intensity have been increasing in central, northwest and southwest China, and further increases are projected in many Chinese regions (Kundzewicz et al., 2019[5]; Zhang et al., 2015[6]).

Regional droughts occur almost every year somewhere in China. The droughts often strike the northeast, north, and northwest, with severe droughts also occurring in the southwest and south (GFDRR, 2020[1]; Wang et al., 2019[3]). The decomposition of drought risk suggests that high drought hazard is concentrated in arid areas: high vulnerability is estimated for the Junggar Basin and Inner Mongolia Plateau, and high drought exposure is observed in the Loess Plateau and in southern coastal areas (Chou et al., 2019[7]). In the past 30 years, a regional warming and drying trend has been observed in northern China, and future increases in drought frequency, duration and intensity are expected in parts of southwestern China (Leng, Tang and Rayburg, 2015[8]; Ye et al., 2016[9]). The expansion of agriculture is linked to increasing drought vulnerability, especially since agricultural production is concentrated primarily in drought-prone regions with limited water resources. Rapid urbanisation and industrialisation also increase the drought vulnerability of some regions through increased water demand from urban areas for personal consumption and manufacturing (Ye et al., 2016[9]).

China is located in a tectonically active area and faces frequent earthquake activity. Most of the earthquakes are continental, amounting to one-third of all damaging continental earthquakes globally (GFDRR, 2020[1]). Urban earthquake risk is especially high, with 22 provincial capital cities and two-thirds of large cities located in regions with a high seismic hazard (Xu et al., 2016[10]). Between 1993 and 2016, earthquake-related direct economic losses and human deaths were on a rising trend, even without taking the catastrophically destructive 2008 Sichuan earthquake into account (Li et al., 2018[11]). Cumulative earthquake impact is highest in western China, but central China appears to be the most vulnerable, if confronted with an earthquake of the same magnitude (Li et al., 2018[11]).

### 2008 Sichuan Earthquake in numbers

| | |
|---|---|
| **Magnitude (Richter scale)** | 7.9 |
| **People killed or missing** | 87 150 |
| **People injured** | 374 643 |
| **People left homeless** | 4 800 000 (approx.) |
| **Estimated direct cost, purchasing power parity** | USD 191.9 billion |
| **Cost of rebuilding the affected areas** | USD 137.5 billion |
| **Depth of the epicentre** | 19 km |
| **Distance at which tremors could be felt** | 1 700 km |

Source: ADRC (https://www.adrc.asia/view_disaster_en.php?NationCode=&Lang=en&Key=1153), and CATDAT Damaging Earthquake Database (https://nhess.copernicus.org/articles/11/2235/2011/nhess-11-2235-2011.pdf).

Typhoons (tropical cyclones) constitute another impactful hazard. Typhoons frequently affect the eastern seaboard regions, with an average of seven typhoons hitting these areas annually (GFDRR, 2020[1]). The typhoon hazard is highest in southeastern coastal regions and gradually decreases to the northwest. Population and asset exposure to typhoons is high, as the coastal regions are characterised by high population density and economic development. Between 2000 and 2014, typhoons affected more than 37 million people per year, causing average annual economic losses of USD 8 billion as well as 244 deaths (Zhang et al., 2017[12]). Between 2011 and 2020, increased cyclone frequency and precipitation, along with greater disaster losses, were seen in the north, especially in northeast China, areas that have historically been less affected (Li et al., 2023[13]).

China is also exposed to landslides and debris flow, mainly in the mountainous and hilly regions, with the frequency of these events increasing as well. The landslide hazard is highest in southwest China, where the risk is exacerbated by the fact that the development expands into mountainous areas, in vulnerable locations (Han et al., 2016[14]; Wu et al., 2016[15]).

## Climate change perspective

Extreme weather events – floods, droughts and typhoons – are all increasing in frequency (Guan et al., 2014[16]; Han et al., 2016[14]). These events lead to significant impacts on the agricultural sector in most regions of China, with the impacts of droughts being most severe (Guan et al., 2021[17]). Agricultural losses from disasters constitute more than 80% of average annual losses, despite agriculture only accounting for approximately 9% of China's GDP (UN.ESCAP, 2020[18]). Crop failure induced by extreme weather events occurs on approximately a third of the country's 120 million hectares of agricultural land annually (ADB, 2015[19]). Flood-related agricultural impacts are mainly concentrated in the southwest, central-south and east. Drought-related agricultural losses are observed mainly in the north, northeast and northwest, while both floods and droughts severely affect agriculture in the northeast (Guan et al., 2021[17]).

Approximately half of China's population and more than 70% of its cities are located in hazard-prone zones (GFDRR, 2020[1]). More than 150 million people reside in low-elevation coastal areas associated with flood and cyclone exposure (ADB, 2015[19]). China's exposure to future sea-level rise is also among the highest in the world; nearly a quarter of the global population projected to be affected by sea-level rise by 2100 resides in China (Hanson et al., 2010[20]; UNDRR, 2022[21]).

However, overall disaster vulnerability in China has decreased in recent decades due to the country's economic development, increases in living standards and improvements in disaster management practices (World Bank and ADB, 2021[22]). Vulnerability is relatively lower in the eastern coastal regions, largely because these regions are more prosperous. Vulnerability is highest in more remote rural areas, which are also significantly poorer than elsewhere in the country (Sim and Yu, 2018[23]; Wu, Ma and Li, 2023[24]; Wang et al., 2019[3]).

Rapid urbanisation is increasing the exposure of the population and assets sharply. Approximately half of the new urban residents reside in cities that are drought- or flood-prone. More than 25 million urban residents already reside in areas of high or extremely high flood occurrence (Cai et al., 2017[25]). Between 2000 and 2030, the urban areas in high-frequency flood zones and in drylands are projected to expand by 3.9 and 3.1 times, respectively (Güneralp, Güneralp and Liu, 2015[26]). For example, in Zhengzhou City, the proportion of very high and high flood risk areas increased from 1.4% in 2000 to 24.2% in 2020 (Guoyi, Liu and Shao, 2023[27]). Given these dynamics, the country's urban flood risk has become a key concern.

## Challenges for disaster risk management policy

Since 1998, China's disaster risk management activities have largely shifted from a response-based approach to a more proactive ex-ante risk management, with a focus on reducing mortality and economic losses (Ding et al., 2022[4]). The disaster risk management reforms following the catastrophic 2008 Sichuan earthquake have strengthened the country's capacity and allowed it to develop efficient practices. Still, challenges remain, such as the need to increase budgetary provisions for disaster risk reduction, the need for closer international co-operation, substandard construction that still exists, insufficient collection and quality of the data about risks, risk assessment processes, and emergency response mechanisms (Renwick, 2017[28]).

As regards flood prevention and mitigation, the current use of resistance-based strategies should be complemented by adaptive approaches (Cai et al., 2017[25]; Ding et al., 2022[4]). Improvements are also

needed in areas such as flood risk, flood uncertainty analysis, and spatial planning. The opportunities to improve drought risk management and reduce drought-induced losses include enhancing water conservation capacity, increasing protection of cultivated land by reclaiming forests and pastures from cropland, adjusting planting structure, and using water-efficient crops (Zhao et al., 2020[29]).

China's disaster management legislation is fragmented as disaster-related laws are the responsibility of many different administrative departments and levels of government. Emergency response plans vary across cities and provinces, and the implementation of these plans below the provincial level is ineffective (Ding et al., 2022[4]). China has complemented traditional ex-post disaster funding mechanisms with ex-ante financing, including disaster insurance mechanisms (ADB, 2022[30]). For example, the China Earthquake Insurance Pool covers losses from earthquakes of a magnitude above 5.0. The China Earthquake Catastrophe Reinsurance Scheme then covers insurers from major earthquake losses (Singh and Jha, 2023[31]). Since 2014, regional disaster insurance pilots have been launched in several locations, including in Shenzhen, Ningbo, Yunnan, Sichuan, Guangdong and Heilongjiang (Kong and Wang, 2022[32]). Still, the coverage of disaster insurance is nevertheless limited and much lower than in high-income countries. The share of insured losses in total disaster damage is sometimes less than 1% (Kong and Sun, 2021[33]). For the severe floods in southern China in 2022, for example, only 6% of losses were insured (Xue, 2023[34]). Improvements in supporting technologies such as catastrophe risk models and implementation of localised insurance schemes based on each region's needs and disaster profiles would increase insurance uptake (GFDRR, 2020[1]).

New disaster insurance funds could be set up in specific regions and for specific disaster types, for example a provincial typhoon disaster insurance fund for the southeastern coastal provinces, or a provincial earthquake disaster insurance fund for the earthquake-prone southwestern provinces. The potential for public-private partnerships for the establishment of disaster insurance schemes could also be explored (Kong and Wang, 2022[32]). Since the mid-2000s, China has increased its efforts to develop agricultural insurance systems, and agricultural insurance has been growing rapidly and playing an increasing role in protecting agricultural producers from disaster losses (GFDRR, 2020[1]). The potential for an increased use of parametric insurance should also be explored, especially in the context of public disaster financing (e.g. the public financing of Yellow River and Yangtze River Basin flood relief and the disaster responses of municipal and local governments) (ADB, 2022[30]). Similar arrangements have been developed in Mexico and the Philippines. The use of parametric insurance could provide the government with more certainty regarding its contingent liabilities and help in long-term fiscal planning.

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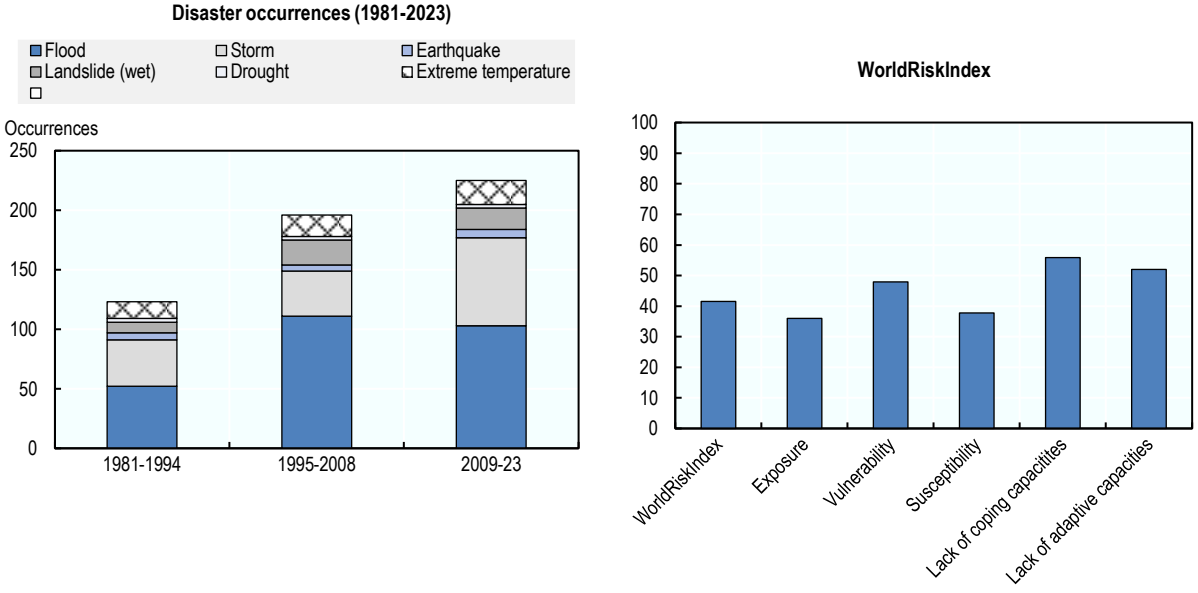
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# India

## Introduction

India, which ranks among the most disaster-prone countries in the world (third in the WorldRiskIndex 2023), is exposed to a range of natural hazards including floods, droughts, cyclones, heatwaves, earthquakes, landslides, tsunamis and wildfires (Bhatt, 2017[1]).

### India: Disaster occurrences (from 1981 to 2023) and WorldRiskIndex




Source: EM-DAT and WorldRiskIndex.

StatLink https://stat.link/iyh0sz

## The hazardscape

India is highly exposed to floods, with 103 events having been recorded from 2009 to 2023. More than 80% of flood events are caused by monsoons or heavy rain, with the rest caused by storm-induced torrential rain or by dam release or failure (Mohanty, Mudgil and Karmakar, 2020[2]). Twelve percent of India's land is prone to flooding and river erosion, and floods affect more than 2% of India's land annually (ADRC, 2022[3]; NIDM, 2014[4]). Flood events are a significant contributor to the country's disaster losses, with an impact of USD 7 billion per year on average (World Bank and ADB, 2021[5]). While floods occur in almost all of the country's river basins, they are most frequent in the Ganges and Brahmaputra basins (ADRC, 2022[3]; Mohanty, Mudgil and Karmakar, 2020[2]). Flood-related deaths and economic impacts are

rising, partly because of increasing flood frequency and intensity, but also as a consequence of large increases in population exposed in flood-prone regions in the states of Uttar Pradesh, Bihar and West Bengal (Patri, Sharma and Patra, 2022[6]; Singh and Kumar, 2017[7]). Furthermore, climate change is expected to increase the frequency and intensity of flood events across the country (Ali, Modi and Mishra, 2019[8]; Patri, Sharma and Patra, 2022[6]; Singh and Kumar, 2017[7]; 2013[9]). Between 2010 and 2030, the affected population is projected to increase from 12 million to 32 million annually, with the greatest increase in people affected by extreme floods projected to be in Bihar, one of India's poorest states (WRI, n.d.[10]; Willner et al., 2018[11]).

India's coastline experiences many tropical cyclones, and the intensity of major cyclones has been increasing in recent decades (Balaguru et al., 2014[12]; NCRMP, n.d.[13]). The likelihood of cyclone-induced floods is especially high during the monsoon season due to antecedent saturated soil conditions (Rajeev and Mishra, 2022[14]). Cyclone exposure is high, as 40% of India's population reside within 100 km of the coastline and thus approximately 370 million people are exposed to cyclone risk annually (NCRMP, n.d.[13]). India's east coast is more exposed, with the coastal regions of West Bengal, Odisha and Andhra Pradesh being the most prone to cyclones (Mohapatra et al., 2011[15]).

India experiences frequent and impactful droughts. Its dry regions cover approximately one-third of the country's total land area and are home to roughly one-third of the population (Gupta, Tyagi and Sehgal, 2011[16]). Severe droughts are most frequent in the Deccan Plateau, a large region covering more than 40% of southern India, with significant drought conditions occurring approximately once every three years (UNDRR, 2021[17]). Droughts are shifting, however, to the important agricultural regions of coastal South India, central Maharashtra and the Indo-Gangetic plain (Mallya et al., 2016[18]). Droughts can severely affect agricultural production, especially in non-irrigated areas, with approximately two-thirds of the cultivable area being vulnerable to drought (Kala, 2017[19]; NIDM, 2014[4]). Drought events can also cause cascading effects on other economic sectors, such as food processing, leading to severe economic repercussions. Despite large reductions in the contribution of agriculture to the country's GDP in recent decades, the annual impact of severe droughts appears to be on the order of 2-5% of GDP (Gadgil and Gadgil, 2006[20]). For example, during the severe drought in Tamil Nadu in 2012-13, a 20% decrease in production in the primary sector led to a 5% reduction in industry and a 3% decrease in services (UNDRR, 2021[17]).

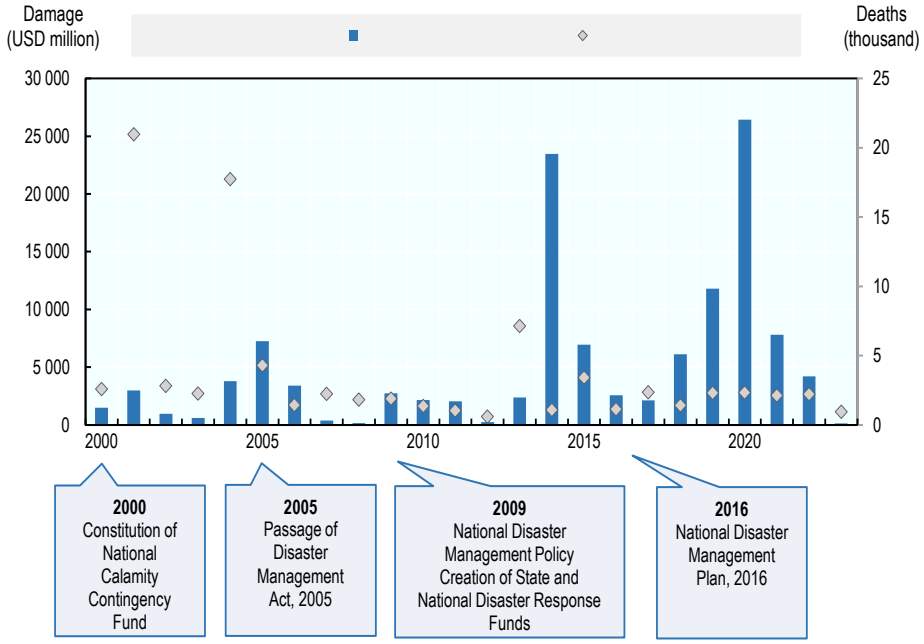
Subsistence farmers are among the most vulnerable to drought and even milder droughts can have significant impacts on them (UNDRR, 2021[17]). Drought vulnerability is exacerbated by insufficient irrigation coverage (more than half of the total cropped area is rain fed), a lack of water-retaining infrastructure, and heavy reliance on groundwater resources (Reserve Bank of India, 2013[21]; Pathak and Dodamani, 2018[22]; UNDRR, 2021[17]). Climatic variability has been increasing in frequency and intensity in the form of prolonged dry spells, increased total dry days and decreased light precipitation days, and this has led to more agricultural droughts. These trends are projected to continue and intensify, despite a projected increase in total monsoon precipitation (Aadhar and Mishra, 2018[23]; Bisht et al., 2018[24]; Mishra and Liu, 2014[25]). The area at risk of severe drought is projected to increase by 150% by the end of the century (Aadhar and Mishra, 2018[23]). With warming of 1.5-2°C, a 1-in-100-year event is estimated to become a 1-in-40-to-50-year event (World Bank and ADB, 2021[5]).

Heatwaves represent another significant health risk for the Indian population. India experiences some of the highest temperatures in the world, with an average monthly maximum of 36°C (World Bank and ADB, 2021[5]). Heatwaves are relatively more frequent in the Indo-Gangetic plain, with five or six heatwave events occurring annually on average (ADRC, 2022[3]). Heatwave exposure is increasing due to the country's high rates of population growth and urbanisation. Urbanisation increases heatwave vulnerability, as urban areas (especially slums) are associated with the heat-island effect of increased temperatures due to paved surfaces radiating heat and a lack of greenness to absorb it (UNDRR, 2023[26]). Heatwave likelihood is also projected to increase the most along India's west coast (World Bank and ADB, 2021[5]).

India is also exposed to earthquakes, with almost 60% of the country prone to quakes of at least moderate intensity. Most of the high-risk areas are located in the northern regions affected by the Himalayan uplift (NIDM, 2014[4]). Earthquakes have caused severe impacts. In the last 15 years, 10 major earthquakes led to more than 20 000 deaths (NDMA, n.d.[27]), while the Gujarat earthquake of 2001 caused about the same level of mortality and was the deadliest natural hazard disaster event of recent decades. Earthquake exposure is exacerbated by population growth as well as significant increases in built-up areas featuring multistorey buildings, factories, malls and warehouses (NDMA, n.d.[27]). Widespread substandard construction is linked to high seismic vulnerability (Jain, 2016[28]; Mittal et al., 2023[29]).

India is also affected by landslides, with more than 12% of the country's landmass deemed to be prone to landslides (NDMA, 2019[30]). Major landslides can lead to fatalities and large-scale destruction of property and infrastructure. Landslides occur mainly in the hilly regions of the Himalayas, northeast India, the Nilgiris, and the Eastern and Western Ghats (ADRC, 2022[3]). They are most often triggered by heavy rainfall but can also be generated by seismic activity (NDMA, 2019[30]).

### Damage and deaths from natural disasters in India and the introduction of important disaster management policies




Source: EM-DAT database (https://www.emdat.be).

StatLink https://stat.link/ouzx34

## Climate change perspective

Given its large population and high exposure to natural hazards, India's disaster exposure, along with that of the People's Republic of China (hereafter "China"), is the highest in the world in absolute terms. Disaster vulnerability is exacerbated by high rates of poverty and inequality (INFORM, 2023[31]). More than 30% of the population live below the national poverty line (UNDRR, 2022[32]). Human-related factors such as high population density and growth, unemployment, environmental deterioration, poorly planned development and urbanisation, low building standards, and rudimentary agricultural and water management practices

further affect and exacerbate disaster vulnerability (ADRC, 2022[3]; Yadav and Barve, 2017[33]). Climate change is increasing the frequency and intensity of most extreme weather events, and sea -level rise is threatening coastal populations. By 2050, more than half of India's GDP is projected to be exposed to extreme weather, wildfires and sea level rise; more than 60% of agricultural land may become exposed to water stress; and 40% of the population may be exposed to heatwaves (S&P Global, 2022[34]).

## Challenges for disaster risk management policy

While India has made incremental improvements towards a proactive disaster risk management approach, many of the current disaster risk management practices remain response-based, and there is still an insufficient focus on prevention (Jain and Bashir Bazaz, 2016[35]; Ogra et al., 2021[36]). Co-operation among government agencies needs to be fortified, as do partnerships with local communities. A conceptual shift towards disaster risk reduction characterized by understanding the social determinants of disasters (Ogra et al., 2021[36])would help bridge gaps between national-level policy formulation, and local-level policy implementation. The focus on urban risk management is limited, as regards, for example, drought risk management, where increased attention needs to be paid to water access and water quality in urban areas (Jain and Bashir Bazaz, 2016[35]). Urban risk management should incorporate a multi-hazard approach rather than being divided among departments and at different levels of governance.

The implementation of flood-related policies suffers from a lack of successful enforcement and is associated with the aforementioned policy discord (Gupta, 2020[37]; Mohanty, Mudgil and Karmakar, 2020[2]). For example, city drainage systems need upgrades to be able to cope with increasing rainfall intensity (Gupta, 2020[37]). Insufficient maintenance of flood-control structures represents another major issue (Mohanty, Mudgil and Karmakar, 2020[2]; Singh and Kumar, 2017[7]). The nature and drivers of floods differ between the Brahmaputra River basin, the northwest region, the Ganges River basin and Central India and Deccan, suggesting a potential need for varied and location-specific flood risk reduction strategies (Mohanty, Mudgil and Karmakar, 2020[2]). This should be a priority, as by one estimate, approximately 26 of India's 36 states will require significant increases in flood protection in the next 25 years just to keep high-end fluvial flood risk at present levels (Willner et al., 2018[11]).

Drought management systems and strategies would benefit from re-examination. Improvements in rainwater harvesting, development of technically advanced water storage structures, revival of traditional water conservation systems, increased use of micro-level irrigation systems, and promotion and market development of drought-tolerant crops should all be explored (Kala, 2017[19]; Nair, Gupta and Nathawat, 2024[38]). Furthermore, a localised approach would enhance the accuracy of drought forecasting and early warning systems (Nair, Gupta and Nathawat, 2024[38]).

Heat wave management should focus on embedding preventive measures into social care structures in the short-term, issuing early warnings for impending risks, and an employment of both passive and active cooling strategies in healthcare and other critical facilities, and the use of cool roofing technologies in the medium- and long-term (Guleria and Gupta, 2024[39]).

As regards both earthquake and cyclone risk management, it is necessary to increase the safety of the built environment. Potential areas of focus include competence-based licensing of civil and structural engineers, training and education of all construction chain participants, building a research and development culture of seismic safety, and enhancing building code enforcement and building inspection (Jain, 2016[28]; Goyal, 2024[40]).

Disaster risk layering, further emphasis on risk transfer mechanisms, and the fostering of public-private partnerships could help relieve existing financing challenges (Bahadur, Lovell and Pichon, 2016[41]; Jain and Bashir Bazaz, 2016[35]; Sen, 2017[42]). For example, tools such as reserve funds and contingent credit could be used for immediate funding needs, while insurance and catastrophe (CAT) bonds could be utilised

to fund further recovery and reconstruction (Panwar, Sen and Shaw, 2022[43]). Developments of this type would represent a beneficial shift from a response-based financing strategy that relies heavily upon post-disaster budgetary reallocation from the central government and donor assistance.

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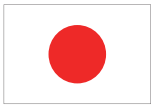
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# Economic Outlook for Southeast Asia, China and India 2024

## DEVELOPING AMID DISASTER RISKS

The *Economic Outlook for Southeast Asia, China and India* is a regular publication on regional economic growth and development in Emerging Asia – Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Viet Nam, as well as China and India. It comprises three parts: a regional economic monitor, a thematic chapter addressing a major issue facing the region, and a series of country notes.

The 2024 edition discusses the region's macroeconomic challenges such as external headwinds, impacts of El Niño and elevated levels of private debt. The thematic chapter focuses on strategies to cope with more frequent disasters. Emerging Asia is among the world's most disaster-prone regions, and the threat of disasters, such as floods, storms, earthquakes and droughts, is increasing. The report explores how countries can reduce disaster risks and improve resilience by developing a comprehensive approach involving policy measures such as improving governance and institutional capacity, ensuring adequate budgets and broadening financing options, strengthening disaster-related education, improving land planning, investing in disaster-resilient infrastructure and disaster-related technology, improving health responses, and facilitating the role of the private sector.



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PDF ISBN 978-92-64-42852-2
ISBN 978-92-64-82380-8

