IT'S THE END OF THE WORLD AS WE KNOW IT: SURVEYING THE ADAPTATION LANDSCAPE

III

A. Introduction

July 2021 was the hottest month ever recorded on the planet, following on from the hottest year in 2020 which, itself, came after the hottest decade on record. Intense heatwaves, increasingly powerful tropical cyclones, prolonged droughts, rising sea levels, spreading diseases are just some of the threats accompanying the unrelenting rise in global temperatures, bringing with them ever greater economic damage and human suffering. And worse is to come. Even if we get our mitigation efforts together within this decade and manage to keep the global average temperature rise to 1.5°C above pre-industrial levels by the year 2100, the extreme climate events in 2021 serve as a foretaste of what an additional 0.4°C to the average global temperature has in store for communities and countries across the planet.

On current trends, global heating will trigger tipping points in the Earth's natural systems, leading to irreversible changes that will reshape life in this century (IPCC, 2021). Even assuming economic collapse can be avoided, the loss of output over coming decades will be significant everywhere, but particularly in the developing world (SwissRe, 2021); hundreds of millions of people will be forced to move within and across borders (Rigaud et al., 2018) with large parts of the tropical world outside the limits of human adaptation (Zhang et al., 2021); food production will change dramatically (Kuma et al., 2021); access to ever scarcer sources of fresh water will trigger increasing geo-political tensions (WEF, 2019). In short, barring intense action to curb greenhouse gas (GHG) emissions, parts of the planet will simply become uninhabitable for future generations (Wallace-Wells, 2018).

To date, the global policy response to the climate crisis has been divided between mitigation and adaptation measures. *Climate mitigation* focuses on slowing down and reducing emissions of greenhouse gases (GHG), through a mixture of more efficient energy use and the replacement of fossil fuels with renewable sources of energy. *Climate adaptation* centers on harnessing resilience and protection mechanisms to minimize the negative impact of climate change on lives and livelihoods (Ge et al., 2009). While, in practice, the two sets of measures are often difficult to separate, in much of the agenda-setting discussion on climate, adaption has remained a poor cousin of mitigation efforts. This is proving short-sighted and increasingly costly, particularly for developing countries.

The consequences of continued neglect have become more apparent in the aftermath of the health pandemic as talk has turned to building resilience in the face of a global shock. Up until now, climate adaptation policies have been driven by a mixture of the procedural politics surrounding climate conferences, a technocratic approach to policy design and an undue faith in the efficiency of markets to price the way to a sustainable future. The aim has been to meet internationally agreed targets through a better assessment of climate-related risks and their improved management using insurance and other market-based mechanisms. While this approach has yielded some positive results, it has offered too little, too late and no longer stands up to the scale of environmental shocks and the economic damage they are causing.

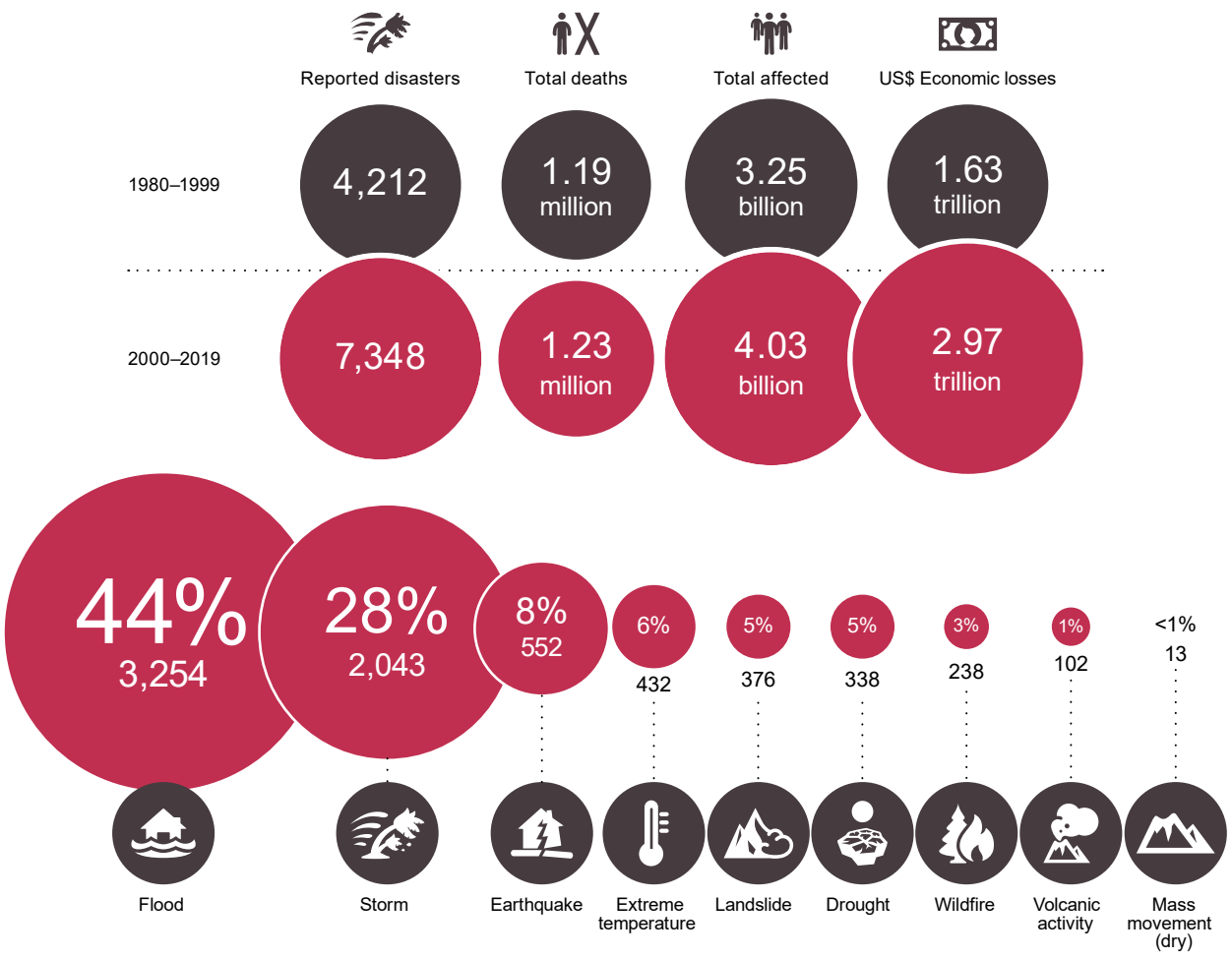
The chapter is structured as follows. Section B takes account of the measure of the challenge, focusing on the damage to regions and countries around the world and the scale of investment required to meet it. Section C discusses some of the limits of the existing institutional architecture to manage the adaptation challenge. Section D considers how framing the adaptation challenge as one of risk management distracts from the need to position adaptation measures in the context of economic transformation.

B. Measuring up to the adaptation challenge[1]

The economic impact of climate change comes both through a steady deterioration in the environmental conditions required for everyday life, such as access to water, air quality, and tolerable working temperatures, as well as through shocks that are more temporary in nature, such as wildfires, storms and floods, albeit often with more immediate and devastating consequences. The latter are, arguably, easier to gauge and have certainly garnered more attention. According to the United Nations Office for Disaster Risk Reduction Human Costs of Disaster Report, between 2000 and 2019, 7,348 major recorded disaster events claimed 1.23 million lives, affected 4.2 billion people (many on more than one occasion) with global economic losses totaling US$2.97 trillion (CRED and UNDRR, 2020). The numbers are clearly on a rising trend (Figure 3.1).

These disasters cannot be solely attributed to a changing climate. Still, there is no doubting a strong

FIGURE 3.1 Disaster impacts 2000–2019 relative to 1980–1999



Source: CRED and UNDRR 2020.

connection to their increasingly devastating impact (IPCC, 2021).

Emergency Events Database (EM-DAT) data show that storms cost more than any other disaster type in terms of recorded economic damage ($1.39 trillion), followed by floods ($651 billion). In 2020 alone, more than 50 million people were impacted by flooding, droughts and storms (UNEP, 2020). About three-quarter of climate-induced disasters were attributable to floods and storms while heatwaves are becoming more intense and widespread, inducing costs to large swathes of populations in developed and developing countries. Major monsoon floods and tropical cyclones affected more than 2.2 million people in China and 9.6 million in South Asia, including Nepal, India and Bangladesh that cost more than $20 billion in damage across these areas. At the regional level, economic losses in the Americas accounted for 45 per cent of the total losses, followed by Asia (43 per cent) between 2000 and 2019. In the Americas, the U.S. accounts for 78 per cent of total losses with $1.03 trillion in economic losses over the same period, reflecting higher income and replacement costs than in other countries. In Asia, China and Japan account for 38 per cent and 35 per cent of the region's total losses respectively in this timeframe (CRED and UNDRR, 2020).

The damage also follows a clear economic divide. High-income countries tend to have lower numbers of people adversely affected and killed by disaster events, but incur much larger financial losses in absolute terms. Low-income countries report low, but increasing, financial losses per capita and relatively high death tolls per disaster event. Lower-middle and upper-middle income countries make up most disaster events, deaths, and total numbers of people affected; however, they also account for most of the world's population, with Asia standing out as having incurred the largest number of disasters. However, despite making up most of the world's financial losses, high-income countries have the smallest losses as a percentage of GDP. In comparison, least developed countries and Small Island Developing States (SIDS) had the highest losses compared to GDP; the proportion of economic losses is three times higher in low-income compared to high-income countries (CRED and UNDRR, 2020).

Estimates by economists of the rolling damage from climate change have been made with the addition of damage functions to standard growth models. These have produced surprisingly benign results in terms of the loss to global output, even with significant temperature rises, albeit with a steadily worsening assessment as these models have become more complex, integrated and refined (Nordhaus, 2018). Indeed, in his Nobel lecture, William Nordhaus, who has done much to advance "integrated assessment models", concludes, that "economic growth is producing unintended but dangerous changes in the climate and earth systems… (with) unforeseeable consequences".

While using such models to estimate the potential damage is, consequently, a difficult business, their aura of quantitative rigour, precision and reliance on a variety of strong assumptions to allow the modeling to proceed, raises questions about their relevance to the climate challenge (Ackerman, 2018). Even in their more sophisticated versions, these models have been criticized for ignoring tipping points (Keen et al., 2021) and feedback loops (Kikstra, et al., 2021) which leads them to underestimate the scale and persistence of the potential damage from climate change. Moreover, they have little to say about structural inequality or historical patterns of development, particularly the evolving asymmetries in the global economy that shape growth prospects in many developing countries.

There is a further tendency to underestimate the potential threat by distinguishing between manageable and unmanageable system responses and focusing almost exclusively on low-income countries, particularly in tropical regions and coastal states, because of the greater dependence of economic activities on natural ecosystems, which are seen as more difficult to manage than activities and sectors in higher income countries. This dichotomy runs the danger of downplaying, or ignoring altogether, how policy decisions, at all levels of development, can have a profound effect in exacerbating climate threats, including in rural economies with a heavier reliance on the natural ecosystem. As discussed in the previous chapter, the widespread adoption of structural adjustment programmes has resulted in the erosion of public services and investment and tied many developing economies to an even greater dependence on commodity exports, making them even more vulnerable to external shocks. Moreover, this dichotomy, while recognizing the climate-related stresses that some developing countries are already facing, runs the further danger of underestimating the wider damage facing many middle and higher-income developing countries, and indeed, advanced economies, as temperatures rise towards (and above) 1.5°C.

A full picture of the costs and damages of climate change is further complicated by significant under-reporting of data about the economic losses in many developing countries. For instance, one source of discrepancy in the data available concerns heatwaves. According to the Emergency Events Database (EM-DAT), only two heatwaves were recorded in Sub-Saharan Africa between 1900 and 2019 that lead to 71 fatalities (Harrington and Otto, 2020). By contrast, the same database has registered 83 heatwaves in Europe between 1980 and 2019 that resulted in over 140 000 deaths and in more than $12 billion in economic damages. This shows major gaps in data collection, appropriate infrastructure and resources available to national agencies and an overreliance on external parties to collect data in developing regions. What is not in doubt, however, is that the greater the temperature increase the greater the threat of catastrophic events (Figure 3.2).

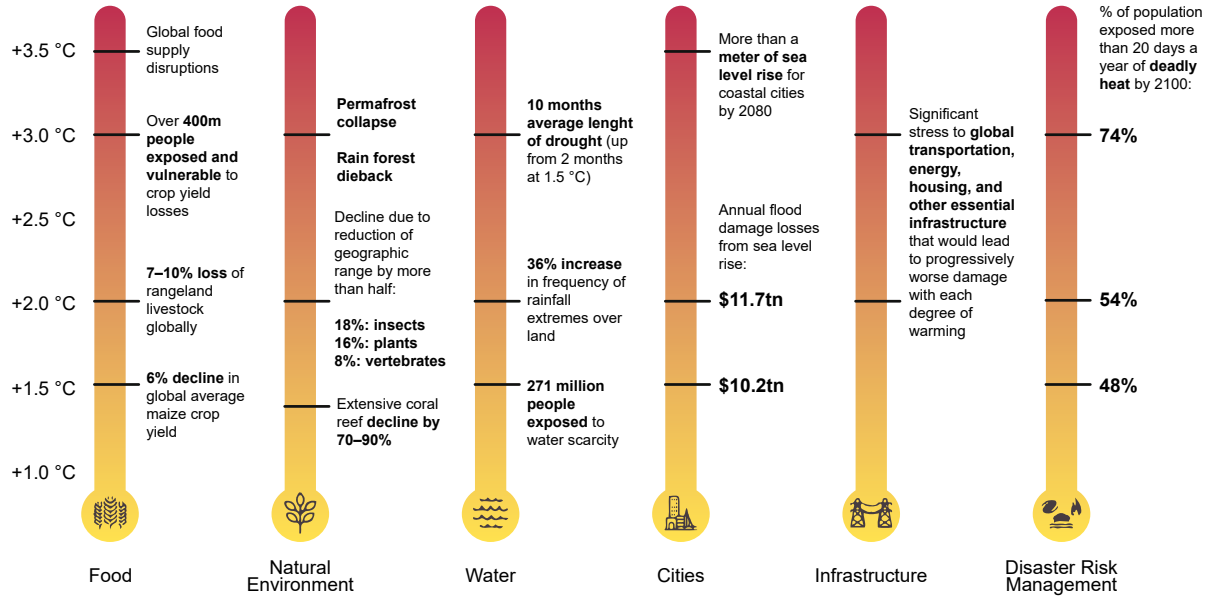
1. Slowing growth, widening gaps

The consequences of rising global temperatures reflect existing structural inequalities within and across countries. The historical responsibility for global greenhouse gas emissions (the principal cause of global warming) lies squarely with the developed nations, which account for around two-thirds of the cumulative total of emissions in the atmosphere compared with just 3 per cent for Africa.[2] And while some developing economies like China, India, Brazil and South Africa have rapidly rising emissions, on a per capita basis they are still behind advanced countries and even the consumption-related emissions of their richest citizens are below their counterparts in advanced economies (Oxfam, 2015).

For many developing countries, rising global temperatures are already compounding a vicious development cycle that has been constraining resource mobilization, weakening adaptive capacities and widening income gaps for decades. Developing countries with underfunded health care systems, underdeveloped infrastructure, undiversified economies and missing state institutions are more exposed not only to potentially large-scale environmental shocks but also a more permanent state of economic stress as a result of climate impacts.

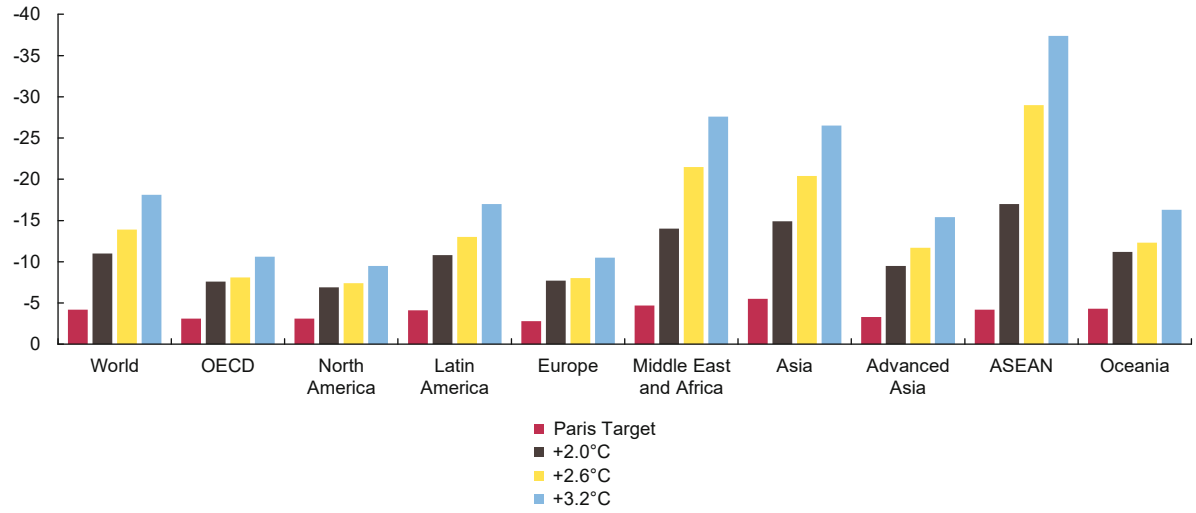
On one estimate, warming temperatures have already, over the period 1961 to 2010, slowed economic growth of (relatively poorer) countries in the middle and lower latitudes, with median losses exceeding 25 per cent over large swaths of the tropics and subtropics where most countries exhibit very high likelihood of negative impacts (Diffenbaugh and Burke, 2019). As Figure 3.3. clearly shows, this situation will only get worse, with rising temperatures hitting growth prospects in developing regions the hardest; and all the more, the higher the increase above the 1.5°C target.

FIGURE 3.2 The Risk of Catastrophic Events Increases with Temperature



Source: World Resources Institute, adapted from the IPCC and others.

FIGURE 3.3 **Mid-century GDP losses by region generated by global warming**
(per cent)



Source: SwissRe, 2021.

On some accounts, poverty is a better gauge of the impact of climate change, given the compounded vulnerabilities of the poorest sections of society to shocks, their lack of assets to fall back on when they are hit and the constraints they face in building up adaptive capacity (Hallegatte, 2018). While levels of extreme poverty have been declining since the start of the new millennium, climate change is projected to aggravate poverty, notably in the particularly vulnerable developing countries, and create further islands of deprivation in countries with rising inequality, at all levels of development (IPCC, 2019). The World Bank estimates that between 68 million and 132 million people will become impoverished by 2030 due to the accelerating impacts of the climate crisis, and that 143 million people could be forced to internally migrate by 2050 (World Bank, 2020; Rigaud et al., 2018).

Because the vulnerability of the poorest sections of society is multidimensional, so are the channels through which climate change will impact them. Climate change is expected to induce shortages in food supplies and increase agricultural prices exposing millions more people to hunger and water deprivation by 2050 (Global Commission on Adaptation 2019). The onset of the pandemic which is estimated to have increased the number of people facing hunger and malnutrition by 129 million is a foretaste of what is to come (WFP, 2021). Sub-Saharan Africa will suffer the most, with lower agricultural yields, driving up food insecurity. Likewise in South Asia, especially areas like Bangladesh and India which are among the most vulnerable countries to natural hazards, as many as 30.6 million will suffer increased poverty levels, compared to East Asia and Pacific (11.8 million people on average), and Latin America and Caribbean (1.9 million people on average) (World Bank, 2020).

The rural poor are particularly sensitive to sea level rises and other extreme weather patterns, especially since the incidence of rural poverty is higher across the board. However, the growing numbers of urban poor in the developing world are also vulnerable given precarious housing conditions and limited access to public services (World Bank, Chapter 1, 2012).

2. *Sectoral and regional impacts*

The impact of climate change, and the nature of the adaptation challenge, will vary across regions and sectors of the economy, making a one-size-fits-all response inappropriate. Extremely hot days are expected to primarily increase in the tropics, where temperature variability across years is lowest. Dangerous heatwaves are thus forecast to occur earliest in these regions, and they are expected to become widespread at 1.5°C global warming rise (IPCC, 2018). As the most food insecure region, Sub-Saharan Africa is likely to face deepening challenges. In South Asia, more intense and frequent tropical cyclones, accelerated heatwaves and a rising sea level will continue to generate adverse impacts on the region. Climate-induced disasters

in Latin America and the Caribbean will reduce developmental progress. Middle East and North African countries face acute water shortages, where as many as 60 per cent of the region's inhabitants already experience a serious lack of water. East Asia and the Pacific, which have a quarter of the world's population, already suffers from the most severe storms, cyclones and inundation globally, and will likely face the highest levels of climate-induced displacements.

Large portions of populations in low-lying coastal zones – 84 per cent in Africa, 80 per cent in Asia, 71 per cent in Latin America and the Caribbean and 93 per cent in the least developed countries (Neuman et al., 2015) can be especially affected. Critical infrastructure assets and networks like ports, airports, railways and coastal roads will also face devastation by rising sea levels which will cause permanent or even repeated damage and will impede access to food, materials, and other income-generating supplies to people and businesses.

SIDS are being particularly affected. For instance, in 2016 Category 4 hurricane Matthew in the Caribbean caused over $1.1 billion in infrastructure damage in Haiti (ECLAC, 2018, p. 27). Similarly, in 2017, almost 90 per cent of building structures on Barbuda were damaged or destroyed by Category 5 Hurricane Irma, which led to a complete evacuation of the island (UNDP, 2018). In the Fiji islands, as many as 30 369 houses, 495 schools, and 88 health clinics and medical facilities were damaged or destroyed and approximately 540 400 people, or approximately 62 per cent of the population, were significantly impacted by the cyclone (Government of Fiji, 2016). Heavy precipitation and consistent rainfall can cause considerable damage to the structural integrity and affect operations of coastal transport infrastructure such as roads, energy, communications, water and sanitation.

For SIDS especially, their middle-income status does not take into account the high risk and economic damage from extreme weather episodes. Caribbean SIDS are among the most indebted in the world, and the level of public debt to GDP is particularly severe in Antigua and Barbuda, Barbados, Grenada, Jamaica and Saint Kitts and Nevis (ECLAC, 2020). This acute level of debt means that they increasingly rely on external financing to meet domestic adaptation needs. SIDS are marginalised through their lop-sided incorporation in the international economic system, failed structural adjustment programs and intensifying financialization. They are, on average, considered 35 per cent more susceptible to economic and financial shocks (UNCTAD, 2021).[3] There has been little movement in this respect from donor countries, lending agencies and the private finance sectors to address the peculiar climate risks that SIDS face, and illustrated, once again, by their lack of coordination on specific debt relief measures in response to Covid-19 shock.

TABLE 3.1 Top ten countries and territories by economic losses as % of GDP
(2000–2019)

Countries and territories	*Economic losses*
Dominica	15.0
Cayman Islands	9.1
Haiti	8.0
Grenada	7.8
Turks and Caicos	5.8
Bahamas	4.3
Guyana	3.6
Puerto Rico	3.5
Belize	3.4
Samoa	2.1

Source: (CRED and UNDRR, 2020).

The International Labour Organisation (ILO) estimates that thermal stress will result in an economic loss of $2.4 trillion and 80 million jobs worldwide by 2030 (Kjellstrom and Maître, 2019). There will, however, be uneven distribution of these adverse outcomes, with South Asia and Africa particularly hard hit (Kjellstrom and Maître, 2019). By 2050, costs of climate change impact to urban areas will have risen to more than US$ 1 trillion. Therefore, the need to increase adaptation actions in cities and to invest in solutions that have benefits is higher than ever before.

There is a further risk of severe ill-health and disrupted livelihoods for large urban populations due to inland flooding in some regions (IPCC, 2014). The IPCC notes that mortality and morbidity are very likely during periods of extreme heat, particularly for marginalised urban populations and those working outdoors in urban or rural areas. Food insecurity and the collapse of food supply chains are linked to warming, drought, flooding, and precipitation variability, particularly for lower-income

and impoverished populations in urban and rural environments. Threats increase for those without adequate essential infrastructure and services or who live in shoddy housing and exposed areas. In urban and rural regions, wage-labor-dependent poor households that are net consumers of food are expected to be particularly affected due to increases in food prices, including in areas with relatively food insecure populations such as Sub-Saharan Africa.

3. The Economic Costs of Adaptation

Adaptation costs are typically higher for high-income countries in absolute dollar value terms, but costs are higher relative to gross domestic product for low-income countries. Traditionally, adaptation needs have been measured by the gap between what might happen as the climate changes and the desirable response to meet related shocks (IPCC, 2014). In their initial NDCs, 46 countries included assessments of their adaptation costs totaling $783 billion by 2030 (Bhattacharya et al., 2020). These costs include project financing, income support, technological support, and capacity-building but despite the formal global goal on adaptation enshrined in the Paris Agreement and elaboration in the Cancun Declaration, no single, straightforward metric (or even set of metrics) exists that could be employed to translate the global goal on adaptation into a measurable target (and baseline) at the global level (UNEP, 2020). This is usually because adaptation actions are often defined at the local level and with relevant stakeholders within a country.

Despite these uncertainties surrounding detailed accounting of the adaptation challenge, there is no doubting the consequences of its neglect. In the run up to the Copenhagen COP in 2009, the UNFCCC estimated that annual worldwide costs of adapting to 2 degrees of warming would be between $49 to $171 billion by 2030, with developing countries facing a $34 to $57 billion bill. A decade later, the delay in responding has been costly. Annual adaptation costs in developing countries are now estimated at $70 billion, reaching $140–$300 billion in 2030 and $280–$500 billion in 2050 (UNEP, 2020). Current funding reaches less than a half of current needs and will not reach the 2030 target without a fundamental change of track. Admittedly, adaptation finance and adaptation costs are difficult to compare and estimate for a number of reasons (Pauw et al., 2020; UNEP, 2020 figure 4.1). Most developing countries make their mitigation and adaptation contributions conditional upon receiving international support (finance, technology transfer and/or capacity building.[4]

In general, Pauw et al. (2020) point out that cost estimates for adaptation among the 60 countries they survey varied in terms of quality, sources, estimation techniques with only some fully provided and several others with partial sector-based costs in their NDCs. However, given the available estimates, the adaptation finance gap is widening in relation to costs. As extreme events become more frequently, the gap will be considerable and overall costs will likely to increase if we consider the possibility of indirect and unpredictable costs. The major quantitative shortfalls, along with gaps in technical know-how and human resources, remains a binding constraint on implementation of climate action plans (UNEP, 2020), particularly for the least developed countries (see Box 3.1), where the ongoing impacts of climate change and poorly devised responses impede longer-term efforts that address key sectoral goals (see table 3.2).

The Global Commission on Adaptation has noted that even countries which have made use of multilateral and domestic public finance in response to COVID-19 pandemic – amounting to upwards of US$10 trillion – have not sufficiently incorporated climate resilience in their recovery programs (Saghir et al., 2020; UNEP, 2020). A recent analysis by the World Resources Institute demonstrated that only 18 of the 66 countries surveyed had explicitly incorporated physical climate risk, adaptation and resilience in their stimulus packages, whether selectively, in specific interventions, or holistically, as a central aspect to their strategy.[5] The 12 countries that specifically cited climate risk management interventions as a primary objective of stimulus spending were Bangladesh, Barbados, Colombia, Fiji, Kenya, Kiribati, Nepal, Niger, the Philippines, South Korea, St. Lucia, and Vanuatu. It is notable that apart from South Korea, all of these belong to the V20 and all face binding financial constraints on mobilizing resources.[6] The benefits of investing in adaptation are however clearly advantageous to both developed and developing economies, but definitely more urgent for developing countries whose climate risks are rising and becoming more complex over time.

Box 3.1 National Adaptation Programmes of Action (NAPAs)

Least Developed Countries (LDCs) face disproportionate exposure to climate change and environmental degradation, while these nations also have the least resources and institutional apparatus to recover from climate change impacts. Multiple stressors, such as unequal socioeconomic conditions, high vulnerability, and precarious institutional systems combine to produce low adaptive capacity to impacts of climate change.

Acknowledging this situation, National Adaptation Plans (NAPAs) were launched at the COP7 held in Marakesh in 2001, to address the immediate and urgent adaptation needs of LDCs regarding climate change and sustainable development. Each country's NAPA provides a special funding window and adaptation planning guidance to support LDCs to jumpstart their adaptation plans, tailored to the unique contexts of these nations. Through the NAPA process, LDCs identify priority activities with regard to adaptation to climate change, and propose adaptation projects based on greatest areas of need and urgency, especially those needs for which further delay could increase vulnerability or lead to increased costs at a later stage (Least Developed Countries Expert Group, 2002).

One key objective of NAPAs is to better understand climate variability at a local and regional level and to identify urgent action needed to build adaptive capacity. Strategies do exist at the community level for dealing with climate variability and extreme events. NAPAs therefore involve both expanding current coping range and enhancing resilience to current climate variability and extremes. National Adaptation Plans are then established to develop and implement strategies and programmes to address medium- and long-term adaptation aligned with broader sustainable development objectives. The associated Least Developed Countries Fund (LDCF) operated by the Global Environmental Facility (GEF) supports NAPA implementation, in correspondence with and guidance from the Conference of the Parties (COP). However, the LDC Fund was under-resourced, preventing timely development and implementation of NAPAs. As a consequence, many countries were unable to translate the NAPA plans into clearly defined implementation programmes.

The synthesis of adaptation objectives into national development planning means aligning poverty reduction strategies and overall sustainable development objectives with an understanding of geographical, social and physical criteria of climate change impacts. Eight focus areas were found to be important: 1) conducting a participatory needs assessment; 2) having a clear mandate; 3) having a clear road map for the NAPA process; 4) identifying how adaptation can be integrated into development strategies; 5) establishing effective institutional supports and arrangements; 6) ensuring open, ongoing dialogue with relevant stakeholders especially marginalised communities; 7) continued assessments for climate risk and vulnerability; and 8) assessing capacity needs for all aspects of the NAPA process, including comprehensive monitoring and evaluation (M&E).

By December 2017, all LDCs had submitted NAPAs and began undertaking their implementation. A review of these programmes suggests their key strengths and successes as well as some challenges, when considering the overall impact of NAPA on building more inclusive, resilient communities, and contributing to sustainable development.

Against this backdrop, there are three key aspects to successful adaptation highlighted by these programmes.

1. Integrating adaptive capacities

Developing the capacity for working at a level of complexity that is commensurate with climate change, and then integrating this with sustainable development processes—itself another complex undertaking—is a very difficult task; yet it appears to be a key factor in successes. Bearing these layers of complexity in mind, LDCs have focused on the challenge of integrating climate change adaptation into national poverty reduction policies and programmes and sustainable development programming. This challenge has been met in various ways, such as, via setting up a climate change adaptation focal point or designing multidisciplinary teams which house the quality and degree of capacity needed for working in an integrative manner, and also promoting and enabling regional synergies for adaptation. For example, in Zambia, a climate change facilitation unit was created to be responsible for harmonizing climate change action within the country, as a way to operationalize the degree of integration needed for effective adaptation. NAPAs that are well-integrated with sustainable development processes at a national level seem to do so by building on the existence of government endorsement and commitment to implementation of these sustainability outcomes. Likewise, Samoa used an integrated approach to combine its priorities identified under the NAPA and strategically plan the implementation of these priorities in line with its national development strategy and policies, in an integrated project with adaptation activities across "four sectors identified in the NAPA, namely: (i) climate health; (ii) agriculture and food security; (iii) ecosystem conservation; and (iv) early warning systems" (Least Developed Countries Expert Group, 2012, p. 55). Developing such integrative adaptive capacity to bring responses to climate change into national and

subnational planning processes, engaging with a complexity that is more commensurate with the climate change issue itself, appears as a key factor for success amongst NAPAs to date.

2. Scaling adaptation

Urgency and expediency lie at the core of the NAPA concept, and as such, scaling the impact of these programmes is important for their success. The Least Developed Countries Expert Group (2009, p. 30) points out that "Scaling up adaptation is an emerging concept, and can only be fully realized if properly planned… Scaling up also recognizes the linkages between systems both in space and over time, and if implemented properly, would lead to lasting impacts and sustainable benefits." Current research agrees that this cannot just include *scaling out* into greater numbers of initiatives or in replicating projects in greater quantity. Additionally, *scaling up* adaptation efforts into changed institutions and structures is important (Moore et al., 2015), particularly relevant in instilling adaptation objectives in all aspects of development planning. For example, during the implementation of the first NAPA project in Benin, this translated into mainstreaming adaptation practices across sectors, strong national and local coordination, and active involvement of local authorities at the very beginning, which in turn facilitated the mobilization of co-financing and cross-sectoral management (Least Developed Countries Expert Group, 2012, p. 26). 'Scaling up' inserts adaptive thinking and design into the very institutional structures that guide and shape development for the country and in particular specific focus areas with a clear mandate. In addition to scaling out and up, *scaling deep*—into changed values and worldviews—also matters (Moore et al., 2015); such as in fostering ownership and uptake of adaptive practices by local communities and actors. Cambodia for example, undertook a year-long awareness raising campaign with farmers and authorities in target districts in the largely agrarian economy of the country (Least Developed Countries Expert Group, 2012, p. 30). This focus on 'scaling deep' to promote greater awareness and attention to values was carried out alongside other projects for strengthening policy and science in vulnerable regions and building the adaptive capacity with various climate resilient agricultural practices. Such a three-pronged approach to scaling out, scaling up, and scaling deep may be a key component for NAPA success.

3. Adaptation towards Transformation

An important link has been made between climate change adaptation and transformation in the fifth assessment report of the Intergovernmental Panel on Climate Change (IPCC, 2014). This stemmed from the acknowledgement that there is a range of adaptive responses, including those that are more reactive and incremental through to actions that are more deliberate and transformative. Some researchers argue that adaptation approaches which merely make adjustments to current development practices risk extending and even reproducing unsustainability and maladaptation. Researchers also note that the vast majority of proposed adaptation strategies aim to inform the short-term tactical decisions for incremental change (Eriksen et al., 2021) but may not account for how climate impacts interconnect with wider processes of change (Ensor et al., 2019). IPCC 2018 underlined this saying "Limiting warming to 1.5 C would require transformative systemic change, integrated with sustainable development [and] would need to be linked to complementary adaptation actions, including transformational adaptation" (Masson-Delmotte et al., 2018, p. 16). The NAPAs that work across this range of adaptive responses, extending into that of transformational adaptation, are therefore better set up for success (IPCC, 2014(O'Brien, 2018). These are inherently long-term processes of change and have multiplier effects in building adaptive capacities and involve new sectoral alignments to meet adaptation goals.

The effective design and implementation of NAPAs depends on their integration into existing national development planning so that climate adaptation can be integrated as a coherent aspect of overall sustainable, equitable development, across regions. Yet often development institutions are not necessarily well set up for such *cross-thematic, cross-programmatic integration*; this constitutes a second major challenge that NAPAs face. The work by the Least Developed Country Expert Group (LEG) to support regional synergies assists in this regard, as well as the UNFCCC's Adaptation Committee which aims to strengthen synergistic engagement with national, regional and international organizations, centres and networks (Least Developed Countries Expert Group, 2015, pp. 16–17).

C. The disarticulated architecture of climate governance

Developing economies have borne the brunt of the adverse effects of rising global temperatures, with worse to come. However, given their marginalized position in the current architecture of global

environmental governance, or more accurately, the unwillingness of negotiating partners to address their concerns, they have not received the required multilateral support to face the adaptation challenge (including for loss and damage). The lack of bold and generous leadership has given rise to a lack of trust which further weakens the international cooperation needed to address the climate challenge in all its dimensions.

Moreover, and unlike the mitigation challenge where the big investment push to transform energy systems, is common to all countries, the wide-ranging measures across activities and sectors in response to the adaptation challenge (Table 3.2), vary from country to country depending on local circumstances, ruling out a one size fits all policy approach and underscoring the importance of allowing governments the space to tailor policies to those circumstances.[7]

The ongoing health pandemic, which has focused attention on strengthening resilience to shocks, may yet catalyse a transformation in the climate adaptation challenge, while a series of extreme weather events in 2021, which hit communities in advanced as well as developing countries with unprecedented losses, has made news headlines. The latest IPCC Report leaves no doubt that more threats to lives, livelihoods and (social and physical) infrastructure will materialize in the near future. Consequently, it has become apparent that properly financed adaptation strategies are vital not only for survival of island nations, but for the protection of human habitats across the planet and at all levels of development.

The Paris Agreement, adopted in 2015 and entered into force in 2016, is intended to enhance the implementation of the UN Framework Convention on Climate Change (UNFCCC) and included, inter alia, an objective "of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to contributing to sustainable development and ensuring an adequate adaptation response in the context of the temperature goal",[8] where adaptive capacity refers to the stock of assets which can be drawn upon to support adaptation at a future point (IPCC, 2014). The goal will be achieved by all Parties committing to periodically communicate their nationally-determined contributions (NDCs), including their mitigation

TABLE 3.2 Potential areas of intervention for climate adaptation

Sector	*Adaptation measures*
Urban areas	Creating flood-adapted and resilient infrastructural networks and built environments where people live closer to work or work in safe environments to eliminate excessive transport costs and time, and ensure equitable patterns of work, and to provide emergency safe havens or evacuation sites in the event of floods or extreme weather events.
Water	Using and improving rainwater harvesting techniques Improving water storage and distribution facilities and arrangements Investing in irrigation amenities, adjusting drainage management systems, altering tillage practices to preserve water Desalinization Enhanced irrigation plotting, links to farmlands, and efficiency
Agriculture	Adjusting planting/ harvesting periods and increasing crop varieties Crop redeployment, forage, and tree species Improved land management systems and techniques, for example, erosion management and soil protection through tree planting Improving land tenure arrangements for small farmers and rural indigenous communities
Infrastructure	Improved levees and change in building patterns Creation of wetlands as a buffer against sea-level rise and flooding Climate-proofing of essential public physical infrastructure Creation of accessible and resilient public emergency shelters and evacuation sites
Health	Improved capacity to surveil and manage disease outbreaks Improved water and sanitation amenities and management Climate-proofing frontline community public health infrastructure Ensure accessible public health services in times of climate-induced emergencies
Transport	Development and relocation of transportation networks and systems Improved coding and planning methods for transport infrastructure to cope with warming and damage
Energy systems	Reinforcing generating facilities and grids against flooding, windstorms and heavy rainfall cycles Developing and deploying decentralized, off-grid, micro- or community-based renewable energy power generation facilities

Source: Adapted from UNDESA, 2008.

and adaptation actions, consistent with equity and common but differentiated responsibility and respective capabilities in light of different national circumstances. Parties also committed to reporting on the progress of implementing their NDCs through the Paris Agreement's enhanced transparency framework. Parties' subsequent NDCs under the Paris Agreement would be informed by regular global stocktaking of the state of progress.

In 2010, the 16th Conference of the Parties (COP 16) established the Adaptation Committee as the principal body under the UNFCCC – and the United Nations system more broadly – to provide comprehensive expert advice on adaptation action and support for targeted measures.

It is the sole body under the Convention whose work regularly addresses all facets of the adaptation challenge in a comprehensive manner (United Nations, 2019). The Intergovernmental Panel on Climate Change (IPCC) has subsequently distinguished between incremental and transformational adaptation; the former "maintains the essence and integrity of a system or process at a given scale," whereas the latter "changes the fundamental attributes of a socio-ecological system in anticipation of climate change and its impacts."

The foundational principle of climate negotiations regarding equity under the UNFCCC remains "common but differentiated responsibility", which recognises different levels of responsibility for the climate crisis and for solving it, including transfers of finance and technology from developed to developing countries. Still, tensions in climate negotiations continue around the appropriate scale of transfers among states, as well as the possible adverse impact of policy decisions in advanced countries, with respect to trade measures, intellectual property rights, etc., on the climate response in developing countries (see further Chapter V). Moreover, in the multi-layered framework of decision-making and management around the climate challenge other actors, at different levels of government, from the private sector, civil society and the scientific community, are involved in advancing a common agenda.

The political forces that have delayed action on mitigation have been extensively discussed, whether framed as an incentive problem linked to the pressure of bridging short-term and long-term decisions (Carney, 2015), a public good problem subject to free riding (Stern, 2006) or a "global commons" problem subject to the undue influence of vested interests, particularly the "winners" from the carbon-based economy (Standing, 2019). Arguably, disagreements around climate mitigation are the main reason why the nexus between national and global decision making has been the focus of attention in climate discussions. Disagreements over the extent to which all Parties should take on mitigation commitments were among the causes of the delays in negotiating a successor to the Kyoto Protocol. The Copenhagen Climate Conference broke down on the failure to deliver such commitments and a further six years were required before the Paris Agreement was signed, on the basis of Nationally Determined Contributions (NDCs) reflecting a just and fair way of operationalising "common but differentiated responsibility and capacities."

The issues of power, conflicting policy preferences, resource allocation, and administrative tensions are no less involved in the adaptation challenge, albeit played out more visibly along the national and sub-national decision-making nexus than is the case with the mitigation challenge (Dolsak and Prakash, 2018). Global monitoring and analysis can certainly help identify those marginalized regions and communities with particularly high levels of vulnerability, including in developed countries. In Nepal, for example, framing of the Himalayan region as particularly vulnerable has prompted external support for its National Adaptation Programme of Action (NAPA).[9] But the national level is still the focal point for mobilizing resources for adaptation action, including for the international community, and remains key for translating global ambition on adaptation to effective action. In this context, the climate challenge is difficult to disentangle from the longstanding development constraints on resource mobilization and which must now include an understanding of the way climate variables constrain development policy at the national level. However, policymakers can still draw some important lessons for the adaptation challenge from the experiences of developing countries over the last four decades of adjusting to exogenous economic shocks:

- If left to make the adjustment themselves, countries will likely be forced to squeeze down incomes, which would result in a prolonged and destabilizing adjustment process, increasing poverty levels, damaging long-term growth prospects and adding to further vulnerabilities.

- Economies that are more diversified (both sectorwise and geographically) tend to show greater

resilience with respect to external shocks and recover more quickly, as do economies that are more strategically integrated in the global economy.

- Societies with greater equality are better able to manage shocks by distributing the burden of adjustment and avoiding the possibly dangerous conflicts that adjustment can trigger.

In this context, the challenge for states is, in part, recognizing adaptation as a cross-cutting issue which needs to be mainstreamed across a variety of line ministries, for example, finance, environment and agriculture. For example, in Malawi, Tanzania and Zambia, institutional structures and availability of resources influence the levels of staff motivation and capacity to design and implement adaptation policies and programmes (Pardoe et al., 2018). The effects of neoliberal policies, burdensome debt instruments and in many cases costly institutional realignments reduce the availability of domestic resources to implement appropriate adaptation policies that further give rise to a reliance on donors for operational budgets (Ciplet and Roberts, 2017; UNCTAD, 2017, 2019). This overreliance limits the capacity of the state to take determined adaptation actions and points to the need for local specification of decisions, increased resource mobilization, and mobilization to change structures over time. In such circumstances, the capacity to act is constrained and leads to selective implementation of adaptation policies (Pardoe et al., 2018).

Global and national level adaptation agendas are likely to require implementation at sub-national levels where local public institutions and civil servants link the state with citizens and thus must negotiate the different interests and trade-offs involved (Funder and Mweemba, 2019). In the context of irregular availability of resources, and particularly where the central state has a weak record of delivering on policy promises, these "interface bureaucrats" have to navigate the different interests involved and be willing to accommodate local priorities in implementation. Representatives of responsible ministries may also have to negotiate space to act within the context of local governments and to engage traditional governance relations through local political leaders (Funder et al., 2018).

A more technocratic framing of adaptation has often tried to sidestep the need for politics of representation that uncovers differential local vulnerability (Ojha et al., 2018). In this case, many developing countries have raised concern that the top down-mandated participatory processes involved in national climate adaptation policy development contribute to reinforcing existing levels of vulnerability (Nagoda and Nightingale, 2017) and led to calls for greater commitment to locally-led adaptation (Soanes et al., 2021; Mikulewicz, 2018).

Community-based adaptation has a long history as a way of enabling local collective action to address climate risk (Forsyth, 2013). However, community-based adaptation, while potentially offering an alternative option to technocratic fixes, is also inherently political. It can therefore drive or delay changes that take into account systemic risk of climate change. Community spaces are subject to local level power structures and uneven power dynamics among different actors that need to be considered when delivering public and other sources of finance to projects. This has generated particular effects on participatory development approaches adopted by the donor community (Dodman and Mitlin, 2013). These outcomes are part and parcel of a broader approach to economic governance embedded in much climate policy thinking that has fragmented the state and created asymmetries of power and resources and limited the necessary structural changes and equity to communities most in need (Ciplet and Roberts, 2017; Perry, 2020).

The importance of recognising local political economy dynamics in interpreting and fine-tuning an adaptation agenda to suit those circumstances also highlights the diversity of the interested parties involved. At the sub-national level, it is not only local governments, communities and grassroots leaders, but also non-state actors that play a role in implementing adaptation measures. Given resource constraints in many developing countries, the role of multilateral and bilateral donors working in partnership with international NGOs and local civil society organisations often play a key role. Although it tends to receive less attention, in some cases the private sector is also included within coalitions for adaptation. In Kenya, for example, the Climate Change Act encourages collaborations to support climate response, and there are some examples of multi-stakeholder partnerships involving SMEs (Gannon et al., 2021). However, regardless of the composition, the establishment of partnerships and coalitions is itself a way of (re) producing uneven power relationships at local level that may lead to maladaptation (Naess et al., 2015).

Donors can also play a crucial role in adaptation policy development, especially the financing of

projects and disbursements of funds and have to be engaged more than in an arms-length manner. Donor support drives the implementation of global agendas and plays a key role in shaping the emergence and evolution of the national adaptation agendas in several SIDS in the Caribbean and Pacific regions (Perry, 2020; Robinson and Dornan, 2017). Still, as discussed further in subsequent chapters, the use of ODA for climate adaptation carries its own specific challenges linked to policy conditionalities attached to accessing such support, all the more so in the absence of effective multilateral monitoring and assessment of that support, especially including local communities and grassroots organizations.

The recent Leaders' Summit on Climate change hosted by US President Joe Biden held in April 2021, placed a particular emphasis on climate resilience and environmental justice as a major pillar of international support. The US Government has committed to make investments "in underserved and marginalised communities, including indigenous communities, in Canada, Mexico, and the United States to prepare them for climate-related impacts". The plan would focus on small island communities and locally-informed adaptation strategies that draw on culturally-sensitive knowledge and data. In addition, the President proposed providing funding for community-based organizations in the US and abroad to drive local solutions to climate impacts.[10]

Three specific initiatives have been proposed or enhanced, including: (1) the Local2030 Island Network, which connects U.S. island territories with others around the world; (2) the Energy Transitions Initiative – Global**,** which will seek to support the transformation and resilience of island communities in the Caribbean and Asia-Pacific regions; and (3) the Pacific Climate Ready project and Caribbean Energy and Resilience programs to support SIDS to promote climate-resilient development. At the recent Climate Adaptation Summit, the United Kingdom launched the Adaptation Action Coalition, a group of leading nations that will collaborate with the Race to Resilience initiative and the UN Climate Action team at the COP26 in 2021. Comprising Egypt, Bangladesh, Malawi, the Netherlands, St. Lucia and the UNDP, the Coalition will aim to accelerate efforts to turn political commitment to action on the ground that support the most marginalised and impacted countries.[11]

To what extent these initiatives will prove effective, and how quickly, is a question not only of political will at all levels of decision-making, but of material resources. The challenge of mobilizing resources is discussed in the next chapters. But decision-making, itself, rests on the kind of conceptual framework used to design climate adaptation strategies. The next section addresses this issue in more depth.

D. Climate adaptation: Risky business?

Adapting to the vagaries of the natural world has been part of the human condition for millennia. As early hunter and gatherer societies transitioned to more sedentary patterns of life, rural societies learnt how to deal with unanticipated environmental events through crop diversification, water storage systems, etc. Equally, the benefits of living in low lying coastal regions have forced human settlements to adapt to the threats that those local climatic conditions can bring, through the development of storm warning systems, flood response mechanisms, etc. Not all attempts at adaptation have succeeded. However, most of those failures have been confined to specific geographical locations and to singular climatic events. By contrast, the contemporary adaptation challenge is both widespread and connected to a wider set of deep-seated social and economic vulnerabilities that have emerged in recent decades (*TDR* 2017; Gallagher and Kozul-Wright, 2019).

The increasing damage from economic shocks, both before and after the GFC, from more frequent extreme climate events, and now from a health pandemic have highlighted the lack of preparedness of policy makers to the inherent fragilities and crises of the contemporary global economy. In response, governments, at all levels of development, have been told to strengthen their resilience to shocks by improving their data gathering and risk assessment techniques to better protect existing assets and by providing temporary financial support when shocks materialise. This approach is appealing because no new methodologies and frameworks appear to be needed. Rather, adopting and adapting already operational approaches is seen as providing a rapid response to the threat to lives and livelihoods.[12]

One review (Sherman et al., 2016) of the different approaches to the adaptation challenge has

distinguished between: (1) technocratic risk management (TRM), (2) pro-poor vulnerability reduction (PPVR), and (3) sustainable adaptation (SA). The first two tend to be closely aligned as they tend not to question the underlying development model and the resulting structure of the economy, and instead aim at conserving and protecting the existing assets and the current structure of the economy.[13] That can be termed a conventional, incremental, or a technocratic approach to climate adaptation.

In the technocratic approach, adaptation is seen as the result of mostly technical interventions which are implemented without properly regarding power relations, conflict dynamics or political contexts. Consequently, adaptation measures mostly comprise disaster risk reduction, ecosystem management, agricultural practices, water management, meteorological and early warning system improvements, social safety nets, insurance, and microfinance. That way, adaptation is retrofitted into development assistance. These may provide partial resilience now but by using scarce resources for adaptation to current climate hazards, these interventions preclude other future-oriented interventions and lock in path-dependent dynamics which reproduces current vulnerabilities. Dilling at al. (2015) show that there is no guarantee that adapting to current climate variability would automatically reduce the vulnerability to future climate change.

The use of risk assessment is a well-established tool of economic policymaking where different choices carry different outcomes in terms of benefits and costs. Assuming the alternative outcomes can be calculated with some degree of precision, then policy makers can prepare in advance for the costs of the chosen path through the adoption of various hedging and coping strategies. In measuring the potential costs, economists have distinguished between idiosyncratic risks that are one-off or local in nature, and tend to carry smaller potential costs, and covariant risks, which are more widespread or systemic, tend to be less predictable and carry larger costs. As noted earlier, drawing on conventional economic models tends to focus attention on idiosyncratic risk and ignore systemic risk, paying little attention to longer-term structural trends and tending to underestimate the scale and complexity of the climate challenge, particularly in developing countries.

The extension of this approach to the adaptation challenge can be more explicitly traced to the Sendai Framework for Disaster Risk Reduction that the United Nations General Assembly adopted in 2015 as a blueprint for disaster-related resilience and reacting to human-made hazards (UNGA, 2015). The 2015 adoption of the Paris Agreement also emphasized this approach with its focus on the reduction of risks related to climate change (Opitz-Stapleton et al., 2019).

The weakness of extending a risk-based approach to the adaptation challenge is its reliance on pricing and other market-assessment techniques which bias the approach towards what is predictable and incremental in nature rather than what is uncertain and systemic and that tend to bend the discussion of the appropriate response to coping rather than transforming (UNDESA, 2008; Global Adaptation report, 2019). The IPCC, 2014 Synthesis Report (p.107) is an example: "Existing and emerging economic instruments can foster adaptation by providing incentives for anticipating and reducing impacts (medium confidence). Instruments include public-private finance partnerships, loans, payments for environmental services, improved resource pricing, charges and subsidies, norms and regulations, and risk sharing and transfer mechanisms. This weakness becomes particularly apparent when the understanding of the nature of shocks, and the appropriate response to them, is derived from financial market analysts, where episodic crises are seen as an idiosyncratic threat to existing asset positions, best dealt with by the more effective pricing of risk by adding another layer of market-based instruments (derivatives) which purport to reduce investor uncertainty. Such an approach, under the umbrella term of "de-risking" (*TDR* 2019) calls for the establishment of a 'low-risk' national investment climate through the deepening of capital markets, the creation of large-scale asset classes that can be securitized into safer financial products and the pursuit of transparent economic governance. Policy institutions and think tanks pushing a de-risking agenda have argued that it gives international financial institutions greater scope to attract private investment into otherwise unattractive investment opportunities, including in the area of climate adaptation.

Despite the differences in the nature of climatic and financial shocks, several common assumptions inform the risk-based approach to the adaptation challenges. First, in finance, risk is generally understood as involving a quantifiable divergence of actual from expected outcomes which, given sufficient information, can be effectively measured and properly priced. How much is spent on insuring against risk is then very much a matter of choice reflecting individuals' or communities' attitudes to spending money today in order to insure against damage materialising sometime in the future. Second, while risk drivers may be endogenous (i.e., driven by the behaviour and policies of

stakeholders), climate risk tends to be understood as exogenous (i.e. whose origin is outside of the system and therefore beyond the control of a national government or organisation), but predictable.

In the context of the global climate challenge, these core premises carry several critical limitations. The assumption of divisibility of risk overlooks the problem of systemic risk.[14] Despite revisions to financial regulation in the wake of the GFC, post-crisis reforms have underplayed the notion of systemic risk, while epistemic approaches to systemic risk are often contradictory and under-developed. For example, while it is often seen as an external threat caused by improbable and unpredictable exogenous events, systemic risk also arises from endogenous structural weaknesses in complex and highly interconnected systems (Goldin and Vogel, 2010), as well as political decisions. Climate change and accelerating extreme events present a range of complex, systemic risks which cannot be diversified and priced using traditional risk-management tools as they concern social, geo-ecological and political dimensions.

Reflecting this, a revised, "risk and resilience" approach has offered a more comprehensive framework around the complex, interconnected and systemic nature of risk (e.g., Opitz-Stapleton et al., 2019). In this way, based on recent events that are more severe than scientists' modelling predictions, climate risk is even more uncertain and less amenable to quantification and consequent management through traditional risk management instruments. Instead, to cope with complex risk that extreme weather events pose, we may need to shift our understanding from risk events to the *resilience of an impacted system*.

The resulting policy agenda proceeds in five steps: (i) understanding risks, especially complex systemic risks, by identifying the risk drivers and their potential impact; (ii) preventing and mitigating risk, i.e. by addressing the risk drivers by reducing the probability of shocks and avoiding the creation of new risk, especially through ensuring good governance and creating an enabling environment; (iii) reducing the impact of risk by enhancing resilience and lessening vulnerabilities; (iv) managing residual risk through risk sharing, including through insurance and safety nets; and (v) recovering and building back better by adapting to new realities and transiting towards more resilient and sustainable growth and development paths (United Nations, 2021).

The step towards a more integrated approach and systems-based view of policymaking marks an advance from narrow agendas focusing on single risk drivers and narrowly defined vulnerability indicators. Policy implications of this approach most prominently concern "buffering capacity" (Hallegatte, 2014; Caldera-Sanchez et al., 2016), "risk-informed development" (Opitz-Stapleton et al., 2019), or a "risk and resilience framework" (United Nations, 2021). The first two of these approaches are relatively limited and technocratic. "Risk-informed-development" actions emphasize increased understanding of complex risk and acting upon that knowledge. It also recognizes that all decisions involve trade-offs across different development objectives and stakeholders. Building "buffering capacity" emphasizes increased understanding and knowledge creation. But it targets *anticipatory* actions: those aimed at harnessing the ability to anticipate risk and evaluate potential impacts, and at stemming the build-up of vulnerabilities, especially in the domestic economy, to avoid adverse shocks from turning into crises.

Yet even this revised, evolutionary approach to managing climate risk suffers from limitations. If risk results from the *interaction* between threats and underlying conditions, building resilience means creating buffers, rather than changing the wider ecology of risks.

From an economic development perspective, the application of risk-resilience approaches suffers from at least three shortcomings. First, given its roots in financial risk management, the approach privileges a return to (pre-crisis) normality and stability over a dynamic vision of change and new trajectories. In the case of many communities, this 'normality' means a return to persistent inequality. Preservation, in other words, still takes priority over transformation which in the case of climate crisis, is not simply insufficient, but also counterproductive and leads to maladaptation. It occludes the role of a collective set of mobilising actors and policies that may pursue a different set of defined objectives and actions.

Risk-resilience approaches are especially problematic in the current political context, where new social contracts are needed to regain citizens' trust in public policies and multilateral efforts. Tackling current global challenges like climate adaptation requires a new vision of common goals rather than emphasizing the avoidance of risks and worst-case scenarios that emerge from current circumstances. This is, for example, recognised in discussions around a green new deal.

Second, the sequence of crises and the sharpening of inequality and exclusion around the planet suggest that it is not simply a matter of omissions

(insufficient information and instruments), but of commission. In the context of climate change, the rules and policies that make contemporary economic globalization and the associated vulnerabilities exclusionary and unstable have been institutionalised over a long period of time. Calculative private financial mechanisms of risk management are unable to address the spectrum of climate dangers, most of which include extreme events, indivisible in their impact and associated uncertainties. Instead, a strategic policy response needs to be built on "active precautionary measures to minimise worst-case risks," which is far beyond milder regulatory measures stemming from conventional probability approaches to risk management and institutional architecture (Ackerman 2017: 163).

Third and relatedly, risk-resilience approaches view the state mainly as a facilitator that sets the incentives and frameworks for self-regulating markets and private-sector initiatives. Within this framework, governments may play three key roles regarding risk (United Nations, 2021): (i) as a risk-bearer of last resort, such as by bailing out insolvent banks and corporates to limit contagion; (ii) as shaping the risk landscape for private investors and other stakeholders, such as by aligning incentives with SDG-relevant risks; and (iii) as seeking risks associated with long-term transformative investments, with a view to de-risking private-sector engagement in such highly uncertain ventures. Governments may also undertake risk-reducing investment to improve coping capacity by creating buffers in terms of increased human capital, social protection, digital infrastructure that improves connectivity and helps to bridge digital divides and, especially, by expanding fiscal space.

These three shortcomings are reflected in the current balance of power (and issues) that frame international efforts to address climate adaptation. Despite our growing knowledge about the threats from rising global temperatures and the resulting adaptation needs, technocratic fixes have so far failed to produce successful adaptation strategies in vulnerable countries (Boyd, 2017). This is, in part, because even if the requisite data is collected and the appropriate technology available, this never just comes "off the shelf" but is (re)produced through social rules (Jasanoff, 2013), including those constructed around intellectual property, which can make accessing and adapting the required technologies a difficult and expensive process for many developing countries. Coping with climate shocks is, moreover, strongly positively correlated with income levels and reflects changes in economic and social structures as countries diversify into more sophisticated and higher productivity activities. The establishment of institutional networks can also build synergies across those activities, and popular deliberation mechanisms can push for increasing the capacity and reach of developmental states to embrace the climate challenge (see next chapter and Gabor, 2020).

A more transformative approach to adaptation, however, will, as discussed in Chapter V, only be possible if the funding required to implement the institutional and structural measures is made available through appropriate mechanisms at both the national and multilateral levels.

E. Conclusion

This chapter has surveyed the scale and scope of the adaptation challenge and the institutional and policy environment that frames the responses to that challenge. It has set down some broad markers for policy action and reform, suggesting that not only should the political, epistemic and financing components of the climate challenge be addressed through a more integrated framework, but that a more developmental approach to climate is needed, given the persistent underestimation of the adaptation challenge in conventional climate action programmes.

Investing in adaptation will improve the resilience of both advanced and developing economies against rising global temperatures. But while responsibility for the threat resides principally with the former, the damage is felt disproportionately in the latter. Moreover, in many cases, their vulnerability to external shocks has been heightened by the imposition of market-friendly adjustment programmes that have reduced the capacity of the state to respond in a timely and effective manner. Improved knowledge, measurement and monitoring of the adaptation gap is certainly needed, as well as a better understanding of local political and power structures that can obstruct adaptation. The chapter has also shown why current risk-resilience measures drawn from financial markets are inappropriate for framing a transformative

adaptation agenda. Rather, retrofitting the developmental state and providing it with greener industrial policies will, as discussed in the next chapter, be critical to advancing such an agenda.

Notes

1 Adaptation is used here in a broad sense to refer both to managing the adverse effects of climate change, and the related issue of "loss and damage" incurred beyond what adaptation measures can address.

2 See https://ourworldindata.org/co2-emissions

3 See https://dgff2021.unctad.org/foreword/.

4 UNEP notes that estimating adaptation costs is a complex challenge; the stage and process of development changes adaptation costs which can be increased or decreased accordingly; incomplete knowledge about costs of adaptation for some sectors, notably for biodiversity and ecosystem services; indirect and unpredictable climate change impacts can change dynamics and increase certain costs; estimates based on autonomous actions, for instance, if farmers take certain measures that result in improved adaptation, can be severely underestimated, among other reasons. See list in Annex 1 in the Adaptation Gap Report (2020) at https://www.unep.org/resources/adaptation-gap-report-2020.

5 A draft copy of the report is available here: https://www.dropbox.com/s/ayqrjt2xphc7st2/WRI-Are%20COVID%20packages%20building%20resilience%20-%20Jan%2020%202021-%20DRAFT%20FOR%20COMMENT.pdf?dl=0 and cited in (Richmond et al., 2021).

6 The Vulnerable Twenty (V20) Group of Ministers of Finance of the Climate Vulnerable Forum is a dedicated cooperation initiative of economies systemically vulnerable to climate change. The V20 works through dialogue and action to tackle global climate change. Full membership available here: https://www.v-20.org/members.

7 The IPCC has considered adaptation transformation along three axes: (1) transformation inducing fundamental change through the scaling up of adaptation, conceived as a limited, technical intervention with transformative potential; (2) transformation as actions or interventions opened when the limits of incremental adaptation have been reached; (3) transformation seeking to address underlying failures of development, including increasing greenhouse gas emissions by linking adaptation, mitigation, and sustainable development (IPCC, 2014).

8 See: https://unfccc.int/topics/adaptation-and-resilience/the-big-picture/new-elements-and-dimensions-of-adaptation-under-the-paris-agreement-article-7.

9 Support was provided by the Green Climate Fund (GCF), as well as a number of private and foreign government agencies. See here: https://napglobalnetwork.org/wp-content/uploads/2018/07/napgn-en-2018-nepal-nap-process.pdf.

10 See: https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/23/fact-sheet-president-bidens-leaders-summit-on-climate/.

11 See: https://adaptationexchange.org/adaptationActionAgenda.

12 For discussion of risk-resilience approaches in different scientific fields see, for example, Bhamra, Dani and Burnard 2011; Briguglio et al. 2011; Brinkmann et al., 2017; Renn et al., 2020.

13 The two approaches differ in how they conceptualize adaptation and development. The TRM approach sees them as separate (adaptation plus development), while the PPVR sees them jointly (adaptation as development).

14 The latter can be understood as a breakdown of the entire system as opposed to breakdown of its individual components, or a risk that cannot be diversified away (def).

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