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Acting on climate and poverty: if we fail on one, we fail on the other

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Contents

1. Overview and introduction: tackling climate change and poverty together, and the false dichotomy

Managing climate change and overcoming poverty are the defining challenges of this century. They are deeply interwoven: if we fail on one, we fail on the other. Poorer people are more vulnerable to extreme events, disruptions and shocks such as health hazards, epidemics, natural disasters, conflicts and economic downturns, and they have fewer resources to cope and recover. Climate change amplifies the scale, frequency and intensity of these events and shocks, driving people into poverty and limiting their ability to escape. Poorer people are also more vulnerable to the 'slow-onset' effects of climate change, including sea-level rise, salinisation, land and forest degradation, glacial retreat and desertification.

The impacts of climate change are already widespread, and they will intensify. According to the Intergovernmental Panel on Climate Change (2022), the growing frequency of extreme weather and climate events has exposed millions of people to acute food insecurity and to severe water scarcity. Heat-related deaths, climate-related illnesses, malnutrition and threats to mental health are rising. In all regions, climate change, both extreme and slow-onset events, is increasingly driving the displacement of people, and it is a contributing factor to violent conflict.

The consequences of climate change for poor people are not gender-neutral, and they are skewed to particularly affect the young and the old. Climate change threatens economic sectors and activities, including agriculture, and the natural resources, on which women and girls rely for their livelihoods. Compared with men, they face higher food security risks, disproportionate health impacts and risks of violence, disruption to their education and reduced work opportunities as a result of climate change. As COP26 President Alok Sharma observed in his opening statement for Gender, Science and Innovation Day: "We know that women and girls are disproportionately impacted by climate change. And we cannot allow equality to be a casualty of climate." Similarly, older people are far more exposed to climate-related health shocks as well as economic distress, lacking the necessary reserves and resilience to recover. When it comes to children, climate impact has been linked to stunting, which can affect cognitive and physical development and income potential for the rest of their lives. Climate change contributes to the intergenerational transmission of poverty.

It is clear that *inaction on climate change* undermines and sets back the fight against poverty and inclusive development. Some of the damage and losses linked to climate change are now inevitable and irreversible: thus it is of fundamental importance to press ahead with both adaptation and mitigation at the same time. As the IPCC Working Group II has shown so clearly, "any further delay in concerted anticipatory global action on adaptation and mitigation will miss a brief and rapidly closing window of opportunity to secure a liveable and sustainable future for all" (IPCC, 2022).

It is also increasingly clear that *action on climate change*, structured well, provides considerable benefits and opportunities in the fight against poverty. Indeed, we will argue in this paper that the drive towards sustainability and net-zero emissions is the development opportunity of this century. This is true not only for mitigation action but also for investment in adaptation: see, for example, the 2019 report of the Global Commission on Adaptation, which found that every $1 invested in adaptation could generate between $2 and $10 in net economic benefits. Many investments for development, mitigation and adaptation are mutually supportive. At the same time, poorly designed climate policy can hurt development and worsen the livelihoods of poor people, which can, understandably, provoke serious opposition and undermine action. And further, in some environments, poverty itself can lead to activities that accelerate climate

change, such as unsustainably cutting down trees for fuel or to release land for agriculture.[1] Hence, action on climate must help overcome poverty if is to succeed. And it can, as will be shown here.

Misconceptions that climate action inevitably requires a trade-off with economic development have held back countries from pursuing policies to bring down emissions. Substantial parts of the economic literature embody the assumption that climate mitigation must involve net costs, in the sense that a cleaner economy is unambiguously more expensive (see Stern [2015] for a critical review). Some development economists and practitioners portray climate action as being in competition with the pursuit of economic development goals and have argued that developing countries should instead focus on poverty reduction efforts (Dercon, 2014). This is a false dichotomy[2] as we shall show, but these perspectives and assumptions have significantly influenced domestic and international climate politics.

The false perception of mitigation as a costly burden for development is reflected in, indeed 'baked into', the original agreement of the UN Framework Convention on Climate Change, which states that countries will address climate change according to "their common but differentiated responsibilities and respective capabilities" and recognises that "economic and social development and poverty eradication are the first and overriding priorities of the developing country Parties" (UNFCCC, 1992). It goes on to ask what "appropriate burden sharing among the developed country Parties" should look like. That false dichotomy still has some traction, even though it is fading.

The narrative that climate action damages economic opportunity and development has also been promulgated by fossil fuel and other vested interests to delay or curtail climate action. These interests have worked to promote confusion about climate science itself and have acted, indeed described themselves, as "merchants of doubt" (chronicled carefully in Oreskes and Conway, 2012). They further promote claims that climate action would be economically damaging (Franta, 2021). And they argue that pursuing renewable energy over 'cheaper' fossil fuel diverts scarce resources away from the fight against extreme poverty (as Mann, 2021, shows). Such arguments and claims are largely wrong in terms of basic science and economics, and they are highly misleading on the dynamics and opportunities in climate action. Technologies and methods are changing rapidly and, across many geographies and sectors, renewable energy is already cheaper than fossil fuel alternatives, without subsidy or a carbon tax (SYSTEMIQ, 2021). These processes of change are moving quickly across the world.

Thus, in all too many discussions the costs of climate action have been overstated while the related benefits and the potential future risks of climate change have been systematically downplayed. Ambitious action on climate change with a focus on reducing poverty and inequalities can deliver the fundamental economic investment, innovation and impacts required to unlock strong, inclusive, resilient and sustainable development. The new development paths can and must be resilient and embody adaptation. Investing in sustainable technologies will, if adopted across the world, reduce the adaptation necessary. But past and future emissions have made decisive action for adaptation unavoidable. The development choices made this decade will either realise attractive new paths of development for the world economy and society, with many opportunities for poorer people, or if maintaining old, dirty technologies, will lead to a very dangerous world.

Developing countries, which have contributed the least to historical greenhouse gas emissions, are also the most vulnerable. As such, climate change embodies deep injustice and inequality. Because climate change depends on the actions of all, poorer nations and communities must be

[1] As discussed in Section 4, we should be clear that the world's wealthiest individuals are responsible for the majority of all global emissions, and thus they are disproportionately responsible for climate change.

[2] Of course, where poor countries invest in global public goods, such as forests and carbon sequestration, it is incumbent upon the international community to help fund these investments.

part of the global effort on both mitigation and adaptation. But this action involves resources and investment, and developing countries cannot, and should not, be left to raise these resources and respond to these challenges alone. Therefore, international collaboration will be essential to delivering an integrated and concerted response to these twin challenges.

Success in accelerating the shift towards a low-carbon economy will be, in large measure, dependent on developed countries stepping up their own domestic action, fostering international climate action and enabling developing countries through finance and technology. Such international action and support from developed countries will be critical in realising the full potential for the investment and innovation in emerging markets and developing economies. This will both yield a new development story and strong poverty reduction on the one hand, and be vital to tackling climate change on the other. Like all significant technological transformations, climate action will involve the dislocation of people, since the structure of economies will have to change quickly and fundamentally. This dislocation should be carefully and fairly managed: we must seek a just transition. Developed countries have responsibility to tackle climate change in their own countries and to support equivalent action in the developing world.

Structure of the paper

We begin Section 2 by explaining why delayed action on climate change will be profoundly damaging for poverty reduction efforts. We then show, in Section 3, how rising to the climate and poverty challenges in tandem can generate great gains for people and the environment across the world and create new paths for sustainable development and poverty reduction. In Section 4, we sketch out briefly how the international community can work together to create this new sustainable, resilient, inclusive approach to development and poverty reduction, before offering some brief conclusions in Section 5.

2. The impacts of climate change on poverty

Understanding what a warming world could look like is critical to understanding how future impacts could affect efforts to reduce poverty,[3] and how to approach the task of adapting to those impacts of climate change that are already 'locked in'. This section first presents past and current impacts as pointers to the future (section 2.1). However, this is done while recognising that these carry only limited information and guidance on the challenges ahead because we are already at the limits of human experience of global warming.

The evidence shows that a high-carbon road to development would create an unstable and hostile world that would make poverty reduction very difficult or impossible. Three decades of delayed action since the UNFCCC was formed in Rio de Janeiro in 1992 have increased the human and economic costs of climate impacts and have slowed socioeconomic development. Developing countries already spend $70 billion a year to adapt to the consequences of climate change, with that figure expected to rise to between $140 and $300 billion by 2030 (UNEP, 2021). The losses and damages from climate change in developing countries are forecast to rise to far higher levels, $290–580 billion in 2030 and $1.1–1.8 trillion in 2050 (Markandya and González-Eguino, 2019). A further delay in climate action would accelerate these impacts and likely lead to the crossing of climate thresholds, which could create climate instability, destabilising feedback loops and vicious circles. In section 2.2 we examine the potentially immense consequences of future impacts. One of the important rationales for early action on climate is the ***uncertainty*** around future impacts, which could be massive as well as irreversible.

2.1. Current impacts

Climate change amplifies the extreme events and major shocks that force people into poverty and keep them there. Because poor people are often more exposed, more vulnerable and lack the resources to cope and recover from these shocks, poor communities are hit the hardest by climate change (Birkmann et al., 2022). The evidence suggests that the impacts are greatest on women and girls, as well as the young and the old. We highlight below some of the main channels through which climate change impacts poverty already today. These include impacts from both extreme events and 'slow-onset' phenomena.

The costs of physical damage

Climate change is increasing the frequency and intensity of natural hazards in many parts of the world. The World Meteorological Organization estimates that the number of weather, climate and hydrological disasters has increased fivefold over the last 50 years, and the economic loss attributed to such events has grown by a factor of seven (WMO, 2021). Hallegatte et al. (2017) conclude that climate change is pushing upwards of 26 million people temporarily or permanently under the international extreme poverty line every year. This does not, of course, include the impact on those who are already poor, or on those living just above the poverty line. The human costs are disproportionately severe for low- and lower-middle income countries, which suffered 82 per cent of all fatalities from 1970 to 2020 (WMO, 2021; World Bank country classification).

[3] It is important to note that there is no uniformly shared or standard definition of poverty. In this paper, we use different concepts based on the availability of data and studies, and the questions at hand. As highlighted by Atkinson et al. (2019), "The measurement of poverty is not a purely technical subject [...] the right answers depend on views that are politically influenced and, at heart, matters of moral judgement." Various approaches are used to measure poverty, including measures of income (the international poverty line of $1.90/day for extreme poverty; income thresholds relative to the national average are often set at 60%); measures of income combined with direct measures of consumption (e.g. the EU's 'at risk of poverty and social exclusion measure'); and multidimensional measures that take into account other dimensions of welfare beyond income, such as education, health, housing and personal security (e.g. the Alkire-Foster measure).

Socioeconomic disparities shape both the severity of the shocks on the affected population and the duration of the recovery (World Bank, 2021b). Poorer households that do not have the same kind of access to coping mechanisms that richer households do, such as financial savings or insurance, take longer to recover from a disaster, and thereby face greater long-term impacts on their economic and physical wellbeing. In a study looking across 92 developing countries and combining assessments of the physical impacts of climate change in various sectors with household surveys, Hallegatte and Rozenberg (2017) find that the poorest 40 per cent of the population experience income losses relative to their wealth that are 70 per cent larger than the losses of the average population as a result of climate change. Even within developed countries, poor people stand to lose more than wealthier people from natural disasters. Ten years after Hurricane Katrina, which hit flood-prone low-income communities of colour the hardest in New Orleans, residents whose homes had flooded maintained lower credit scores and homeownership rates than their neighbours, for example (Bleemer and van der Klaauw, 2017).

More frequent and successive climate events increase the risk of extreme poverty further for low-income households, which often face another disaster before they have time to recover from an earlier crisis.

Impacts via disruption to agriculture

By disrupting agricultural production, climate volatility and extreme weather events are a significant threat to both rural communities, who depend on the agricultural sector to survive and as a means through which to escape poverty, and for poor people in urban areas, due to cascading impacts on food prices (FAO et al., 2018). Climate change makes it more expensive and difficult for farmers to sustain livestock and crops as it exacerbates water scarcity, land degradation, and weather and precipitation patterns, resulting in crop and livestock losses. Human-induced land and water degradation combined with worsening climate impacts have already pushed many agricultural systems to breaking point (FAO, 2021). In Africa, climate change has reduced agricultural productivity growth by 34 per cent since 1961, more than anywhere else in the world (Trisos et al., 2022).

The disruption to agriculture systems from both extreme events and slow-onset phenomena also encourages migration (Falco et al., 2019) and exacerbates the risk of conflict occurring (Wischnath and Buhaug, 2014; Koren et al., 2021), both of which are driving forces of poverty. Abel et al. (2019) show that the effects of climate change on the severity of drought increased armed conflict in West Asia and North Africa in the period 2011–2015, which in turn drove an outflow of asylum-seekers. In Syria, climate change heightened the severity of the 2007–2010 drought in a context of growing water scarcity and poor water management, leading to widespread crop failures and mass migration from rural to urban areas and contributing to the causes of the civil war (Kelley et al., 2015).

Impacts on health – and health's impacts on poverty

Climate change has adverse health impacts in all countries, but disadvantaged and vulnerable populations are most severely affected. It amplifies major health outcomes, including death from natural disasters, mental health issues, heat-related illnesses (e.g. cardiovascular, cerebrovascular, and respiratory conditions) and vector-borne diseases such as malaria, and puts pressure on healthcare systems and facilities (Romanello et al., 2021; Watts et al., 2018). Again, these effects arise both from extreme events and slow-onset phenomena. The net impact is largely negative, with very few beneficial outcomes to human health and wellbeing.

It has been estimated that extreme heat and cold events are associated with 17 different causes of death (e.g. cardiorespiratory and metabolic diseases; suicide) and caused around 1.7 million deaths globally in 2019 (Burkart et al., 2021). This includes 356,000 heat-related deaths, mostly in South Asia, Africa and the Middle East. Changing environmental conditions are increasing the transmission risk of climate-sensitive infectious diseases: the number of months suitable for malaria transmission has increased by 39 per cent in densely populated highland areas of countries rated low on the UN's Human Development Index (Romanello et al., 2021). The number

of dengue virus infections has doubled every decade since 1990, driven by climate change combined with global mobility and urbanisation (ibid.). Impaired crop yield and water scarcity as a result of climate shifts could also worsen malnutrition, with severe health impacts in developing countries.

Health shocks are a well-documented driver of poverty (e.g. Moser, 2008), as a result of the income loss from an inability to work and the costs of medical care for which poorer households are often uninsured. The World Health Organisation estimates that health shocks push around 100 million people into poverty every year, with a growing number of these cases being related to climate change (WHO, 2021). Agricultural workers in developing countries are among the most vulnerable. In 2020 they suffered almost half of the 295 billion potential work hours lost due to extreme heat (Romanello et al., 2021). Climate change is amplifying these impacts.

In addition, the human activities that destabilise the climate, namely the combustion of fossil fuels, have devastating health effects through their impact on air quality – again, disproportionately affecting poor people. While estimates vary, recent studies of outdoor air pollution from fossil fuels suggest it contributed to around 9 million premature deaths in 2018, in the context of global deaths of around 57 million a year (Vohra et al., 2021).[4] People in developing countries tend to be more exposed to toxic air than other populations. In Africa and Asia, particularly in rural areas, people are exposed to high concentrations of indoor air pollution, in part due to poor ventilation practices and in part due to the use of polluting fuels for cooking and heating (e.g. wood, crop wastes, charcoal and coal). Research has indicated that household air pollution contributed to 2.3 million deaths in 2019 (about 4 per cent of all global deaths), almost all in Sub-Saharan Africa, South and East Asia, and Oceania (Health Effects Institute, 2020). Women are 40 per cent more exposed than men to this type of pollution (Romanello et al., 2021).

Climate change also threatens the lives and livelihoods of the poorest communities that depend heavily on natural resources through their impact on soil and water quality. Soil pollution reduces crop yields and quality, degrades soil structure, thereby reducing the resilience of terrestrial landscapes to flooding and drought, and is linked to many diseases (FAO and UNEP, 2021). Water pollution harms fish populations, an important source of protein and income for poor populations, and increases the risks of disease for low-income households that do not have access to clean drinking water and that use surface water for household activities (e.g. bathing, washing clothes) (UNEP, 2016). Through its impact on temperatures and water scarcity, climate change increases the prevalence of water-borne diseases including diarrhoea, a key cause of death among children under the age of 5 (Hallegatte et al., 2016). Women and girls are also particularly vulnerable as they carry out household chores and thus come into contact with polluted waters more frequently than do men. It is clear that in any given area, whether urban or rural, it is poor people who suffer the most from all forms of pollution.

Disproportionate impacts on women and girls

Another issue that has been given insufficient attention is that climate change worsens the cycle of poverty for women and girls, who are on the frontline of this crisis. A growing body of research shows that women and girls are more vulnerable than men to climate change impacts and are less able to cope and recover. Indeed, existing gender inequalities and unequal power dynamics amplify their vulnerability and limit their adaptation to climate-related impacts (Schipper et al., 2022). In turn, climate change exacerbates gender inequalities, thereby creating additional barriers that keep women and girls in poverty. The bottom line is that natural disasters disproportionally affect women's life expectancy, unemployment, labour force re-entry and relative losses of assets (Erman et al., 2021).

[4] It is striking to see how limits on sources of industrial pollution, especially in urban areas, including steel and coal plants, reduced the number of premature deaths in China over the period 2012 to 2018, from 3.6 to 2.4 million due to a 43.7 per cent reduction in $PM_{2.5}$ particulate matter deriving from fossil fuel combustion.

An important reason for this effect is that climate change threatens economic sectors and natural resources – including agriculture, fisheries, land, forests and water – on which women and girls disproportionately rely for their livelihoods, generally without having control of the assets or their output. This hampers their ability to efficiently cope with and adapt to climate impacts (see, for example, Eastin, 2018). Women represent 43 per cent of the global agricultural workforce, with significantly higher rates in agriculture-dependent countries in Asia and Africa, but just 15 per cent of agricultural landholders (OECD, 2019). As such, they have limited access to credit for climate change adaptation practices, for example, to invest in climate-smart technologies to increase harvests, increase resilience, or invest in off-farm activities (Atela et al., 2018). Research on a pastoralist community in Tanzania showed that female-headed and poor households were unable to access the financial assets, land or water necessary to adopt available adaptation practices, including practising irrigated farming, to diversify their livelihoods, using new forms of mobility during droughts, and treating livestock with modern medicines (Wangui and Smucker, 2018). This leaves them more vulnerable to food insecurity and malnutrition (Schipper, 2022).

Furthermore, climate change disproportionately affects women's health and wellbeing. Women face a higher risk of physical, sexual and psychological harm, as well as being deprived of basic opportunities for advancement. In rural areas, where women are often the primary providers of food, water and fuel, resource scarcity can force women to travel long distances, reducing the time available for income generation and disrupting the education of girls; women and girls spend more than 200 million hours collecting water every day (UNICEF, 2016). Often, they must travel through unsafe areas. In West Darfur, 82 per cent of rape treated in clinics were found to have taken place when women conducted daily tasks such as water and firewood collection (MSF, 2005).

More generally, competition over scarce resources can exacerbate gender-based violence as a means of control and reinforcement of unequal power dynamics. The devastating impacts of climate-induced disasters on communities (resource stress, loss of property and livelihoods, and financial pressures, and even post-traumatic stress disorder) can increase the incidence of domestic violence, child marriage and sexual exploitation (Castañeda et al., 2020). For instance, prolonged droughts in Ethiopia have led to an increase in girls sold into early marriage in exchange for livestock (UNOCHA, 2017).

2.2. Future impacts

The Earth has already warmed by around 1.1°C compared with the 1850–1900 average (the usual baseline, equating approximately to the 'pre-industrial' temperature). If today's development patterns do not change, and without deep emissions reductions, global warming will far exceed the temperature goals of the 2015 Paris Agreement set at COP21 – containing temperature rise to "well below 2°C", while pursuing efforts for an upper limit of 1.5°C, the latter being a strong focus at COP26 in Glasgow in 2021.

Every extra increment of warming will have increasingly devastating impacts on lives and livelihoods across the world; but it is poor and marginalised communities who will suffer the most. Limiting global warming to 1.5°C rather than 2°C would significantly reduce the number of people exposed to dangerous climate impacts and vulnerable to poverty. It would also reduce the risks of poor people experiencing food and water insecurity, adverse health impacts and economic losses.

Byers et al. (2018) show that the impacts of climate change on poverty are extremely sensitive to different levels of warming. The number of people affected by multiple climate risks could double between 1.5°C and 2°C of warming, and almost double again at 3°C of warming, to half the global population, with 91–98 per cent of the exposed and vulnerable population living in Asia and Africa.

Thresholds and irreversible impacts

Even though there continue to be margins of uncertainty in projections, especially many decades out, there is no question that unmanaged climate change would render many regions uninhabitable and would radically change lives across the world for the worse – especially those of the poor. Some of the future impacts of climate change are already 'locked in' and therefore unavoidable. The IPCC (2022) stresses that "many ecosystems are near the hard limits of their natural adaptation capacity": that is, ecosystems are approaching the thresholds beyond which they cannot successfully adapt to avoid severe risks. Once these hard limits are reached, no additional adaptation actions can prevent irreversible loss and damage. Some warm water coral reefs, some coastal wetlands, some rainforests, and some polar and mountain ecosystems have already reached or surpassed their limits (ibid.). The climate-driven extinctions of species and the loss of glaciers and ice sheets are irreversible.

Every increment of warming increases the risk of passing major thresholds, which could generate dangerous feedback loops, e.g. the collapse of the Amazon and boreal rainforests, thawing of permafrost, destabilisation of polar ice sheets, and large-scale die-offs of coral reefs. Recent research from the International Thwaites Glacier Collaboration indicates that the glacier's ice shelf could collapse within the next five to 10 years, much earlier than previously expected, accelerating its flow to the sea. Thwaites, in Antarctica, holds the equivalent of 65 centimetres (two feet) in global sea level. If it collapses along with other key Antarctic glaciers, that would open the way for the West Antarctic Ice Sheet, which holds 3.3 metres (10.8 feet) worth of sea level, to press outward towards the Southern Ocean (Bamber et al., 2009).

Impact on livelihoods

Increases in global temperatures will both intensify and increase the frequency of many climate-related extreme events, as well as accelerate slow-onset impacts including sea level rise and desertification, thereby amplifying impacts on food and water systems. Poor populations are particularly vulnerable to slow-onset events due to their limited capacity to anticipate and adapt to these phenomena. Agricultural and ecological droughts in drying regions[5] that occurred once every 10 years on average in past centuries before industrialisation, as well as extreme temperature events that occurred once every 50 years, would occur more frequently with every increment of warming (IPCC, 2021). Climate events such as droughts and extreme heat could also coincide more often in the future and exacerbate the damaging impacts on global crop yields (Lesk et al., 2018). As a result, under 2°C warming compared with 1.5°C, the number of people exposed to lower crop yields would be 10 times worse, most of them living in South Asia and Sub-Saharan Africa; around 586 million people would be exposed to water stress (Roy et al., 2018). Marine fisheries would decline by more than 3 million metric tons per degree of warming (Cheung et al., 2016). These developments would have devastating impacts on poor communities that are likely to be hit harder, and – as we have argued – particularly women and girls.

Impact on lives

With additional warming, the proportion of the global population exposed to severe heat at least once every five years is likely to increase from 14 per cent at 1.5°C of warming to 37 per cent at 2°C of warming (Dosio et al., 2018). For instance, at 2°C, Pakistan and India would likely experience similar conditions to their deadly 2015 heatwaves on an annual basis. Greater warming

[5] The IPCC defines drying regions as "the AR6 [Sixth Assessment Report] regions in which there is at least *medium confidence* in a projected increase in agricultural/ecological drought at the 2°C warming level compared to the 1850 – 1900 base period in CMIP6 [Coupled Model Intercomparison Projects 6]. These regions include W. North-America, C. North America, N. Central-America, S. Central-America, Caribbean, N. South-America, N.E. South-America, South-American-Monsoon, S.W. South-America, S. South-America, West & Central-Europe, Mediterranean, W. Southern-Africa, E. Southern-Africa, Madagascar, E. Australia, S. Australia (Caribbean is not included in the calculation of the figure because of the too small number of full land grid cells)" (IPCC, 2021).

will expand the transmission seasons and geographical range of climate-sensitive food-borne, water-borne, and vector-borne diseases. For instance, dengue risk would increase in Asia, Europe, Central and South America and Sub-Saharan Africa, potentially putting additional billions of people at risk by the end of the century (IPCC, 2022). At 2°C or higher levels of warming, the IPCC warns that "food security risks due to climate change would be more severe, leading to malnutrition and micro-nutrient deficiencies, concentrated in Sub-Saharan Africa, South Asia, Central and South America, and Small Islands" (ibid.).

A WHO study projects that by the year 2030, all told climate change could be responsible for an additional 38,000 annual deaths due to heat exposure among elderly people, 48,000 due to diarrhoea, 60,000 due to malaria, and about 95,000 due to childhood undernutrition (Hales et al., 2014). Morbidity (incidence or prevalence of a disease) would also increase, with consequences for poverty.

Summary of projected impacts and their implications for society and humanity

A range of expected climate impacts under different temperature scenarios are summarised in Table 1. In all of them poor people are the most vulnerable.

Table 1. Impacts under different rates of warming

Impacts	1.5°C	2°C	4°C	Sources
Food systems	10-year agricultural and ecological droughts in drying regions will likely occur every 5 years (range 2-10)	10-year agricultural and ecological droughts in drying regions will likely occur every 4 years (range 1.7 – 7.7)	10-year agricultural and ecological droughts in drying regions will likely occur every 2.4 years (range 1.4 – 5.9)	IPCC (2021)
	32–36 million people exposed to lower yields	330–396 million people exposed to lower yields	*Information unavailable*	Roy et al. (2018)
Ecosystems	70–90% of coral reefs at risk from bleaching	99% of coral reefs at risk from bleaching	*Information unavailable*	Roy et al. (2018)
Water scarcity	496 (range 103–1,159) million people exposed and vulnerable to water stress	586 (range 115–1,347) million people exposed and vulnerable to water stress	*Information unavailable*	Roy et al. (2018)
Health	50-year extreme temperature event will likely occur every 5.8 years (range 4.7– 11.6)	50-year extreme temperature event will likely occur every 3.6 years (range 3–7.2)	50-year extreme temperature event will likely occur every 1.3 years (range 1.2–1.8)	IPCC (2021)
	14% of global population exposed to severe heat at least once every 5 years	37% of global population exposed to severe heat at least once every 5 years	*Information unavailable*	Dosio et al. (2018)

Even though hard to predict, we need to consider the possible social implications of developments such as those set out in Table 1. Past evidence highlighted earlier shows that climate change already contributes to destabilising social dynamics, such as the forced migration and displacement of communities dependent on agriculture following prolonged droughts, and significant increases in gender-based violence.

The concern, as shocks and numbers scale up, is that greater warming could trigger mutually reinforcing economic, social and political instability, leading to cascading disruptions including

impoverishment, food insecurity, migration and displacement, and civil and political conflict. For instance, as temperatures rise the existing trends of rural–rural and rural–urban migration might accelerate suddenly and significantly, involving tens to hundreds of millions of people that rely on climate-sensitive livelihoods in Africa, Asia and Latin America. This could lead to large-scale ethnic or civic strife, as is already being witnessed, for example, between pastoralist and agricultural communities in Nigeria and the Sahel, and would put extreme pressure on urban areas, triggering conflicts (Birkmann et al., 2022). The intensification of extreme precipitations associated with flooding, tropical cyclones, droughts, and sea level rise would also drive displacement as entire areas become uninhabitable (IPCC, 2022). Under a high emissions scenario leading to global temperatures increasing above 3°C by the end of the century, rising sea levels would threaten land that is home to between 2.5 and 9 per cent of the global population with annual coastal flooding by the year 2100 (Kulp and Strauss, 2019; Kirezci et al., 2020; Rohmer et al., 2021). This would trigger large-scale humanitarian crises and destabilise societies on an unprecedent scale. Poorer people are the most exposed to this kind of destabilisation.

The incompatibility of a high carbon path and development

The bottom line is that attempts at high-carbon development pathways are simply not compatible with long-run development. Already, the effects of climate change are coming through earlier than expected and at a greater scale and intensity than anticipated, affecting developing countries and poor communities the hardest. That is a crucially important reason not to frame climate action as a cost in terms of poverty and development objectives, but rather to recognise it for what it is: a path to more inclusive, resilient and sustainable development.

3. The development and poverty reduction story of the 21st century

Investing to manage climate change would help prevent poverty and suffering on a huge scale – that is the message of the previous section. If well designed and managed as part of a broad development strategy, it would also set the world on a sustainable, resilient and inclusive development path, which delivers many job opportunities and poverty reduction. Developing countries can leapfrog the dirty and destructive phase of fossil fuel-based growth of developed countries and build cleaner, safer, more energy-secure, more resilient, more biodiverse and more inclusive ways of living and working.

Here we first examine, in section 3.1, the dynamic drivers of growth and economic transformation in the period ahead. Section 3.2 reviews the potential economic and social benefits of this model at an aggregate level, taking into account action to manage the inevitable dislocation. Then, in section 3.3, we look at the particular role of innovation in tackling both poverty and climate, and in 3.4 we consider how climate and nature investments can improve quality of life and, if well-articulated with a broader development strategy, open up new opportunities for poverty reduction. In so doing we will emphasise throughout that development plus climate change mitigation and adaptation can and should be mutually reinforcing. Presenting strategy as a choice between climate action and poverty reduction is to portray a false dichotomy and an artificial horse race. So too in setting mitigation against adaptation.

3.1 A new, more sustainable development model

Before turning to the empirical evidence from the literature, it is worth recognising the broader framework in which economic development and poverty reduction are likely to play out in the coming decades. We are at the threshold of major structural change in economies everywhere, a change that the World Economic Forum and others have called the 'Fourth Industrial Revolution', enabled by extraordinary technological advances (Schwab, 2016). This moment in economic history is full of opportunity for development and for tackling poverty. But we need to change our thinking about development. We are used to dealing with development as an incremental process in which physical and human capital and institutions gradually build over time; but the economic transformation that we are beginning to witness will, at its core, be a Schumpeterian story of growth and structural change driven by the dynamics of discovery, innovation and investment. These investments and innovations will create new forms of supply, demand and job opportunities, as we have seen in earlier periods of dynamic change such as the Industrial Revolution of the 19th century and the Green Revolution in agriculture of the 1960s and 1970s.

Climate technologies and investments, for instance the way we generate, store and distribute energy, how we transform our mobility, or how we digitally enable climate-smart farming and the monitoring of forests, are key components of this revolution. They can provide strong development directly or by complementing other technologies and investments (such as combining digitally enabled education and payments with solar home systems for poor people in rural areas; the social sustainable energy enterprise SELCO in India is an excellent example). And in some cases, climate investments and innovation substitute for or compete with traditional development approaches, most evidently in rendering the extraction and use of fossil fuels obsolete, or in protecting forests from unsustainable exploitation.

Growth through innovation and investment can provide a sound basis for poverty reduction if part of broader, inclusive development programmes that widen access to human capital and social safety nets. And poverty reduction itself reduces climate vulnerability – there is an important two-

way relationship between these goals.[6] Climate change creates more poverty, and at the same time reducing poverty through socioeconomic progress reduces the poverty consequences of future climate change. Jafino et al. (2020) find that under an improved development scenario the impact of the same degree of climate change is reduced from an additional 132 million to 68 million people in poverty in 2030.

Like any economic and technological transformation, the low-carbon transition can impose adjustment costs on sectors and people. The transition is not painless, even if its benefits are net-positive and large, and it needs to be managed carefully and with fairness. We discuss the 'just transition' briefly below. Furthermore, even though climate technologies are increasingly delivering attractive development at low cost, the scale and urgency of investment to both cut emissions to meet the Paris targets and to achieve the Sustainable Development Goals means that we must raise the level of investment quickly and sustain that increased rate of investment over the medium term, especially in the energy sector. And investment must be innovative and clean if these goals are to be achieved and extreme dangers are to be avoided. That investment must be financed, a point to which we return in Section 4.

3.2. The economic and social benefits of the transition and of a *just* transition

The necessary increase in investment rates for this new approach to growth and development, as a proportion of output, relative to the last decade, would likely be around 2 percentage points in developed countries, and somewhat more in emerging markets and developing economies (EMDEs). China is an exception with its very high investment rate and the necessary change there could be achieved within the current rate of investment. The scale of these investments is examined in Stern (2021) and in Brookings Institution et al. (2022).

Much of the increase in the rate of investment would reverse the decline experienced since the global financial crisis of 2007–08, and is associated with investments, including infrastructure, that are necessary anyway as countries move to higher income levels. These are investments for development and growth, and the increment associated with low-carbon trajectories is relatively modest. However, the objective to reduce carbon on the required scale cannot be achieved without such investment – it is a necessary condition. The challenge is to increase investment and to make sure all allocations are clean and sustainable. The evidence shows that the returns on these investments across a broad range of criteria will be high. They should therefore be perceived as attractive investments in their own right and should not be misperceived as a cost.

The work of the Global Commission on the Economy and Climate identified the extra infrastructure investment needed for a clean and sustainable transition as only 5 per cent or so higher than the investment associated with a standard, i.e. previous, approach to growth (New Climate Economy, 2014). An increase in overall investment, particularly for infrastructure, is necessary to sustain growth and development in the context of urbanisation and the structural transformation towards industry and services in developing countries. The challenge now is to deliver that investment and make it clean and sustainable. If it is not, the likely lock-in of high-carbon activities would not only be very dangerous for the future of our climate, but would also carry risks of stranding assets on a substantial scale, which would be damaging to development prospects.

Estimating the impact on jobs

The benefits for poorer people from these new development paths would come from the processes that would apply across the whole economy and population, particularly through new and better job opportunities, increased output/income, and better health. The poor do not benefit automatically from these opportunities, though, and active policies to strengthen access to

[6] We are grateful to Stéphane Hallegatte for highlighting this two-way relationship. See Jafino et al. (2020).

human capital, among others, are essential. Still, many of the new job opportunities would likely be of special importance for poorer people and younger age groups as they come into the workforce. Some of these job opportunities would require tech skills that younger groups could acquire more easily than older. Many would be in the informal sector, such as local installation of solar, or improving energy efficiency. Investments in skills would be a necessary part of the process.

There have been various estimates of the increase in jobs and output that could come from the new approach to growth and development. We describe a few briefly in what follows.

The Global Commission on the Economy and Climate estimates that the low-carbon path it sets out could "deliver a direct economic gain of US$26 trillion through to 2030 compared to business-as-usual" and could generate over 65 million new low-carbon jobs by 2030" (NCE, 2018). Modelling work from the Organisation for Economic Co-operation and Development highlights that "a climate-compatible policy package can increase long-run GDP by up to 2.8 per cent on average across the G20 in 2050 relative to a continuation of current policies", with a net effect of 5 per cent if avoided climate damages are taken into account (OECD, 2017). Recent analysis from the International Monetary Fund suggests that a comprehensive policy package to mitigate climate change, including initial fiscal stimulus through public investment to accelerate post-pandemic recovery, could boost global output by about 0.7 per cent per year in the next 15 years and create 12 million new jobs each year up to 2027 (IMF, 2020).

The aggregate models used in such analyses are usually cautious about technical change and thus likely underestimate output and employment gains. In fact, the advancement of low-carbon activities and markets over the last decade far exceeded expectations, and their costs are falling faster than anticipated (SYSTEMIQ, 2020, 2021). Average solar prices have fallen to $0.05/kWh 30 years faster than forecast by the International Energy Agency in 2014. In 2021, more than 80 per cent of all new electricity capacity added was renewable, with 91 per cent of this coming from solar and wind power generation (SYSTEMIQ, 2021). This has meant, in turn, that the rates of technical progress embodied in most economic modelling are modest compared with those experienced in recent years. Taking a disaggregated view of sectoral technology trends, a recent report from the International Finance Corporation estimates that trends in 10 low-carbon investment areas in 21 emerging markets could generate investment opportunities of $10.2 trillion and 213 million jobs by 2030 (IFC, 2021). Investment areas cover the decarbonisation of existing and future infrastructure, support to climate-smart cities and the transition of key industries to greener production. In Section 3.2, we provide further examples of very rapid reductions in technology costs.

Climate-friendly investments create more jobs per $1 million of investment than unsustainable investments and can create 'quality' jobs if the right kind of policy is put in place, the World Resources Institute finds (Jaeger et al., 2021). WRI's report indicates that investing $1 million in ecosystem restoration, in buildings efficiency and in solar PV creates respectively 3.7, 2.8 and 1.5 times as many jobs as investing $1 million in fossil fuels. Bicycle-only infrastructure and mass transit each create 1.4 times as many jobs as road construction per $1 million.

A just transition

As we have emphasised, such a fundamental shift will involve some dislocation of work – some jobs will disappear, others will change radically. Changing relative prices could reduce incomes in the short term for some parts of the population whose consumption patterns are intensive in fossil fuels. The *Gilets Jaunes* protests in France in 2018 and social unrest in Ecuador in 2019, following the sudden end to fuel subsidies, have shown that the way the zero-carbon transition is managed will be pivotal to building the political and societal will for continuing strong and sustainable action. Climate action should aim to leave no one behind and deliver benefits to vulnerable communities and workers. Climate policy should deliver investments in basic infrastructure, in education and lifelong learning, in training and skills, and in social protection measures for the most vulnerable members of society including transfers, welfare support and

housing subsidies. For the transition to be 'just', decarbonisation strategies will need to go beyond a narrow focus on workforce and skills and look across, for example, regional development needs and opportunities for all groups including the most vulnerable and, where necessary, income support. It will involve investing in places and people.

Writing in April 2022 and in the context of the war in Ukraine, we should also emphasise the close relationship between moving away from fossil fuels and energy security. There have been a number of major crises around supply shocks for fossil fuels since the Second World War, including the deep crises of the 1970s. Dependence on fossil fuels undermines energy security. The actions necessary for decarbonisation, such as energy efficiency, renewables, better functioning grids and better designed cities, are actions that promote energy security. At the same time, possible new dependencies on 'green minerals' will have to be managed, e.g. through technological diversity.

3.3. Innovative investments as drivers of change

The pace of technological advancement and cost reductions has moved faster than predicted over the last 15 years or so. In 2015, the Paris Agreement laid out a clear emissions reduction pathway for 196 countries in order to limit temperature rise to well below 2°C, and preferably 1.5°C. This shared direction of travel set the conditions for investment and innovation in low-carbon activities, and accelerated progress far beyond expectations; systems change company SYSTEMIQ (2020) has described this as "the Paris effect". Low-carbon activities now out-compete high-carbon alternatives in sectors representing around 25 per cent of emissions, whereas as recently as 2015 almost none did. With the right investment flows, low-carbon activities and businesses could scale-up rapidly, become competitive and reduce emissions in sectors representing 90 per cent of emissions by 2030 (SYSTEMIQ, 2021).

A whole range of technologies necessary for emissions reduction and sustainable development are now available and cost-competitive with fossil-fuel-based technologies. In 2020 the majority of new solar and wind power generation was cheaper than the cheapest new fossil fuel option: within 10 years, the cost of large-scale solar projects had fallen by 85 per cent and that of onshore wind by 56 per cent (IRENA, 2021). Falling lithium-ion battery prices and lower overall operating costs are expected to bring electric vehicles to price parity with internal combustion engines as soon as 2024 (ETC, 2021). Many of these technologies and new practices can be rapidly implemented and will be labour-intensive, with strong economic multipliers and positive externalities. Interestingly, what has driven these cost declines is primarily demand from investments at scale.

Improving access to energy

Energy access is at the heart of economic and social development, and it is one key area where affordable, climate-friendly technologies are addressing the needs of poor people. Energy access can drive productive activities and is essential to meeting basic human needs including food, healthcare, education and shelter. Today, 770 million people still live without access to electricity, mostly in Africa and South Asia, and more than 2.5 billion people lack access to clean cooking (IEA, 2021).

The rapid expansion of renewable energy, from large-scale grid-based renewables to smaller-scale off-grid solar, is playing an important role in improving energy access in the poorest communities. Local and decentralised forms of renewable energy generation are accelerating the electrification of rural areas and providing households with more autonomy at a competitive cost. For example, solar home systems helped about 8.5 million people gain access to electricity in Sub-Saharan Africa between 2016 and 2019 (IRENA and AfDB, 2022). Kenya has been leading the way since 2010, having connected 17 million people to off-grid energy (IEA et al., 2021). Renewable energy can provide clean cooking and reduce reliance on fuelwood, the latter often requiring long trips to gather and causing deforestation. The impact on the lives and livelihoods of women and girls would be large and positive, given the evidence presented in section 2.1 on the disproportionate cost they are bearing from climate change and the fossil fuel economy.

Technological solutions

Climate-smart technologies and approaches can promote a more productive, sustainable and resilient agriculture. They can increase agricultural yields, reduce the risk of climate-related losses, and improve the efficiency of water usage while reducing greenhouse gas emissions. This can improve food security, water security and health outcomes among farming communities. Evidence from Ethiopia suggests that climate-smart agricultural practices improve household nutrition, even more so when a combination of these practices is adopted (Teklewold et al., 2019). In Nepal, farmers increased their crop production by switching to climate-smart agriculture techniques including the sowing of stress-tolerant crop and fodder varieties, and by using a digital technology that alerts them about forthcoming climate variability and provides suggestions for adaptation (FAO, 2020). A study conducted in northern Benin demonstrated that solar-powered drip irrigation, a system that delivers small and controlled water flows directly to plants' roots, improved the income of women farmers, along with household nutrition intake and food security (Burney et al., 2010).

New technologies and innovations can enhance the ***resilience*** of poor people to climate change in vulnerable regions. For example, climate-related insurance tools could reduce the economic impacts of natural disasters and help poor households recover faster. The company WorldCover, for example, aims to apply technological innovations to help farmers in Ghana, Uganda and Kenya access crop insurance from droughts. It uses high-resolution satellite imaging to determine the level of compensation required and trigger automatic payments using decentralised blockchain technology. Many of these examples illustrate how development, mitigation and adaptation can be mutually supportive. Nevertheless, practical insurance applications for smallholders have generally struggled to become viable.

3.4. Key systems and an integrated approach

Beyond reducing the risks from climate change, the low-carbon path is a much more attractive form of development. Investments and innovation across a range of vital physical, natural and intangible assets can deliver strong results for the climate while carrying many co-benefits for health, education, unemployment, inequality and biodiversity. Developing countries also have the opportunity to build greener cities and industries by leapfrogging dirty and destructive technologies. They can harness their vast resource potential to develop new market opportunities and shift to higher-productivity sectors. For example, 80 per cent of India's expected infrastructure requirements in the 2050s will be built between now and then, and therefore can incorporate new green technologies (see e.g. Brookings Institution et al., 2022); it is similar for much of Africa.

Cities

Well-connected cities where people enjoy healthy and active lives can underpin sustained development and generate economic opportunities for poor people. The UN estimates that the number of people living in slums exceeded 1 billion in 2018, primarily in East and South East Asia, Sub-Saharan Africa and Central and Southern Asia (UN, 2021). This likely understates the scale and severity of housing pressures, which have been worsened by the COVID-19 pandemic. By providing sustainable and affordable housing for low-income urban residents, developing countries can avoid disaster-prone development in peri-urban areas, and thus improve economic security and health outcomes for poor people in urban areas (NCE, 2018). This could unlock significant benefits for low-income women living in slums where basic needs for water and sanitation are not met (UN WOMEN, 2018). There are opportunities to invest in better waste management infrastructure that prioritises recycling and composting, to support decentralised forms of renewable power generation that can increase energy efficiency, and to facilitate the use of locally sourced low-carbon materials that can enhance the durability and resilience of urban housing.

Transport

Scaling up zero-emissions road transport will also be central to the creation of environments where people can live and breathe healthily. Powering more than half of New Delhi's metro with solar energy has cut energy costs and improved air quality in one of the world's most polluted cities (World Bank, 2019). In Uganda, the development of Africa's first electric bus plant will both reduce air pollution and improve local infrastructure (Lombrana and Ojambo, 2020). The poorest people suffer particularly from inefficient cities where they are exposed to toxic air and where daily commutes often take hours. The development of affordable and better integrated public transport networks can reduce the geographical and social exclusion of poor communities and improve their access to jobs and services. Prioritising investments in active, non-motorised and shared transport systems rather than private vehicles will particularly benefit poor people. Minha Casa, a social housing programme in Brazil, benefitted 1.8 million people by improving rates of walking and cycling as well as access to public transport (Gulati et al., 2020). The local government of Medellin, Colombia built cable cars to connect informal hillside settlements to the city centre in order to boost access to essential services and jobs among the poorest communities (ibid).

By 2030, the accelerated electrification of fleet vehicles alone could help prevent around 120,000 deaths per year from air pollution associated with road transport, with the largest benefits for densely populated areas in developing countries, e.g. there could be 12,000 avoided deaths in India (Climate Group, 2021). There would be additional health benefits from enhancing possibilities for cycling and walking. In Africa, switching to clean energy sources could save nearly 50,000 lives each year by 2030 (Marais et al., 2019).

Investing in nature and adaptation

'Nature-based solutions' will play an important role in adaptation to climate impacts and could provide around one-third of the emissions reductions needed to limit global warming to 2°C (Griscom et al., 2017). Investments in nature protection and restoration, including forests, peatlands, mangroves, seagrasses and saltmarshes, will be essential to build fruitful ecosystems in which people can thrive. For example, mangrove reforestation efforts in coastal villages near Tobor in Senegal have restored all of the rice fields from salinisation and boosted fish stocks, thereby improving food supplies and livelihoods (Mwangi and Evans, 2018). The growing demand for carbon offsets could also unlock new streams of revenues for poor communities in developing countries to support the protection and restoration of the natural capital they rely on for their livelihoods. From 2019 to 2021, the market for forestry and land use credits more than tripled in value to $544 million (Forest Trends' Ecosystem Marketplace, 2021).

Adaptation and resilience interventions will be critical to protect the most vulnerable from the worst impacts of the climate crisis and can deliver high returns. Priority areas for adaptation include food and water systems, the natural environment, cities, infrastructure and disaster risk management. Many of the required investments will reduce emissions and promote resilience while fostering development and boosting the economies of vulnerable countries. For example, climate-smart agriculture and sustainable land management brought a 56 per cent increase in crop yields in Niger, which helped improve food security and livelihoods while building farmers' resilience to climate change (World Bank, 2021a). The Global Commission on Adaptation estimates that a $1.8 trillion investment in strengthening early warning systems, making water resource management and new infrastructure resilient, improving dryland agriculture crop production and protecting mangroves would deliver $7.1 trillion in returns over the next decade (Global Commission on Adaptation, 2019).

Integrated approach

Examples of how development, mitigation and adaptation/resilience can come together to reduce poverty can be found across the globe. An integrated approach to mitigation, adaptation and development offers opportunities for a more effective response to climate change and poverty.

Restored wetlands, degraded lands and forests cannot only act as carbon sinks but also absorb storm surges, improve water systems, reduce risk from floods and droughts, and support local economies (e.g. through improved soil quality, pollination and habitat protection, and reduced disruption to economic activity). Investing in mangrove restoration supports fisheries, captures carbon, and protects against storm surges. Similarly, public transport, more efficient buildings, better city design act together, and so on. Decentralised wind and solar power generation would reduce emissions from energy use and can provide uninterrupted electricity supply when electricity grids are damaged by natural disasters. Such an approach would limit the unwanted negative consequences for biodiversity and communities that come with, for example, large-scale hydropower dams, of the kind witnessed in the Amazon, the Congo and the Mekong basins (Moran et al., 2018).

All these effects would be of particular value to poorer people. It is a great mistake to separate out development, mitigation and adaptation. Good development and effective poverty reduction combines all three.

4. The importance of internationalism

The opportunities for new forms of growth and development which both raise living standards and reduce emissions are evident across the world. They are particularly attractive for developing countries that yet have far to go in building their infrastructure and much to lose from unmanaged climate change. But, as we have argued, realising these gains and making the crucial change requires substantial economy-wide investment, and that in turn requires both the conditions to foster that investment and low-cost finance of the right kind, on the right scale, at the right time. The world in the last decade or more has been in a position where planned saving is in excess of planned investment, and this is reflected in both low growth and negative real interest rates in many countries. The world's macroeconomic position would both allow and benefit from increased investment. However, funding that investment will be difficult for many developing countries with their limited fiscal headroom and, for many, restricted access to the world's capital markets.

Mutual gains

The world as a whole has great potential gains to be reaped from moving together on development, on poverty and on climate. We all gain from the expansion of world demand and from the avoidance of catastrophic climate change, which itself depends on future emissions from all countries. The returns to collaboration also include potential gains from open and growing markets for trade and investment, improved investment confidence from a clear and shared strategy for investment and the new growth path, as well as substantial returns from economies of scale and the discovery of new technologies. Internationalism has been central to the reduction of poverty around the world in the past few decades, at a historically unprecedented pace. The case for internationalism and coordinated action is more powerful than ever.

However, time is short and the development decisions made this decade will determine whether the world will succeed in the fight against climate change. Global emissions reductions by 2030 in excess of 40 per cent are necessary to keep 1.5°C within reach. The EMDEs will be the main source of output and income growth in the coming few decades, and thus potentially of increased emissions, unless new approaches to production and consumption are pursued now.

Fairness

There is deep inequality and injustice in how climate impacts are distributed: those least responsible for emissions suffer most of and from the adverse effects of climate change. Despite having contributed very little to the climate crisis, developing countries will be central to an effective global climate response. Recent work from the World Inequality Lab highlights large emissions inequalities: North America, Europe and China are responsible for 60 per cent of global historical greenhouse gas emissions released since 1850, compared with just 4 per cent for Sub-Saharan Africa (Chancel et al., 2021). India, with around 18 per cent of the world population, contributes 7 per cent of global emissions (WRI, 2021). Furthermore, the top 10 per cent of the world's population by income are responsible for close to half of all emissions each year, while the bottom 50 per cent contribute only 12 per cent of the total. Given these significant inequalities in emissions, recent research estimates that lifting more than one billion out of poverty worldwide would only increase global carbon emissions by 1.6 to 2.1 per cent (Bruckner et al., 2022). And poor people, as we have argued, have so much to gain from newer technologies.

Nevertheless, in the words of then-prime minster of Ethiopia Meles Zenawi as he addressed COP17, "it is not justice to foul the planet because others have fouled it in the past".[7] Developing

[7] Speaking at 'Africa Day' at COP17 in Durban in 2011; Nicholas Stern was on the platform with him.

countries can fully capitalise on the opportunity to foster sustainable, resilient and inclusive development by actively pursuing the investment and innovation that can propel development forward, drive down emissions and build resilience. They cannot do this alone. They will need support with technologies and with financing investment.

Collaboration on technology

A collaborative approach to technology development will create increasing returns to scale in production and discovery. It will also enhance mitigation efforts by accelerating the diffusion of low-carbon technologies, and generate significant development gains for developing countries, as highlighted in Section 3. While the costs of low-carbon activities are falling rapidly, developing countries still play a small role as buyers, sellers or innovators in low-carbon markets and thus they can fail to access or realise the benefits arising from these investments, including economic diversification, productivity growth and the development of technical skills. Although their technological capabilities are improving, the poorest countries accounted for just 0.01 per cent of low-carbon technology exports in 2016, and almost no such technology was transferred to these countries between 2010 and 2015 (Pigato et al., 2020). Measures to enhance technology transfer and to foster skills and promote infrastructure development would enable developing countries to seize these economic opportunities and scale up climate action.

There is a need for international collaboration on technologies to be carefully tailored to each emitting sector.[8] Each sector has its own political economy, industrial structure, and unique opportunities and challenges in relation to its low-carbon transition. International collaboration can be more effective if an appropriate approach is designed for each of the major emitting sectors and its necessary 'system transition'.

Financial commitment

The even greater challenge is around the financing gap for investments in EMDEs. As noted in Section 3, for many EMDEs, given their stage of development, associated infrastructure needs and level of urbanisation, the necessary increase of investment rates for the sustainable development they seek will be likely higher than the 2–3 per cent of GDP (Brookings Institution et al., 2022) that is relevant for developed countries. It will be very difficult for developing countries to avoid fossil-fuel-driven growth and follow a cleaner path unless there is support for investment at scale in the alternative pathways. Thus, high-income countries and communities must not only rapidly cut their own emissions, but also enable developing countries to make their transition to a low-carbon economy and to adapt to climate impacts. If support is available, developing countries can reduce emissions, build a more resilient economy and pursue much more attractive paths of development than the old, dirty, and destructive pathways of the past. As we have argued, these paths would not just promote development of growth across society but would also be of particular benefit to poor people.

At COP15 in Copenhagen (in 2009), there was agreement by developed countries to support developing countries with flows of $100 billion per year of climate finance, public and private, by 2020. It was stipulated that the private flows to be counted towards the $100 billion should, in principle, be closely linked to programmes and projects that correspond to the public flows.[9] By the time COP26 took place in Glasgow in November 2021, the $100 billion target had not been achieved, although there were indications that it would likely be achieved by 2023, three years late. The tardiness in delivery on the $100 billion has understandably eroded trust, and the first priority is to meet this target quickly if internationalism is not to be further damaged.

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[8] We are grateful to Vanessa Perez (WRI) for highlighting this point.

[9] This agreement (informal at that stage) was formalised the following year at COP16 by the Cancun agreement, which was carried into the Paris Agreement of COP21 in 2015.

Beyond the $100 billion

However, even though important both practically and symbolically, the scale of action and necessary flows extend way beyond the $100 billion. There is a need for far larger financial flows in this decade from the developed world to finance the extra investment in the developing world, given the urgency and scale of the challenge. Bhattacharya and Stern (2021) have argued that overall investment in EMDEs (excluding China) should increase over the 2020s and reach an incremental financing of around $2 trillion per year by 2030 for climate and development goals. Significant fractions must be financed internally and by the private sector (domestic and international). In fact, it will be crucially important – to avoid the build-up of external imbalances – for developing countries also to tap into domestic sources of capital at greater scale than has been possible so far. Those would include fiscal sources (arising for example from a carbon tax but also from broadening bases and strengthening administration), strengthening of commercial and development banks, as well as local capital markets following, for instance, the examples of Colombia, Kenya and Nigeria, all of which have succeeded in channelling local pension-fund resources into long-term sustainable infrastructure. But there is no feasible path to tackling the EMDE financing gap without a large increase in official bilateral and multilateral finance.

Given investment requirements, Bhattacharya and Stern (2021) argued that finance from the multilateral development banks (MDBs) to EMDEs should triple over 2018–2025 and country-to-country official ('bilateral') funding should double, on the way to much larger numbers in 2030. We should be very clear that without this scaling up, the overall targets for investment will be missed, particularly since the public flows are critical to building the confidence necessary for greater private flows. Private flows are potentially very large, as evidenced by the commitments associated with the GFANZ, which saw a commitment of around $130 trillion assets under management to net-zero (GFANZ, 2021). But private capital will not flow at scale without a positive investment climate and without the involvement of public flows to help share and reduce risk, if necessary through blended public-private finance (Lankes, 2021).

The MDBs will have a crucial role to play in the flow of funds and in structuring them in a way that helps reduce and share risks with EMDE governments and with the private sector. They also have a crucial role to play to support the building of the policies, institutions and capacity that can foster the necessary enabling environment for investments, and the country platforms to help coordinate and converge around common visions and objectives. While the creation of those platforms will be for the countries themselves, there is much that the MDBs can do to support them.

Further, given the fiscal and debt pressures in so many EMDEs following a difficult decade after the global financial crisis, and then the COVID crisis, action on debt management and reduction will be critical. Looking forward, instruments that help avoid future debt service difficulties will be of great importance. Bhattacharya and Stern (2021) show how the combination of bilateral support, MDBs, philanthropies and voluntary carbon markets, along with major increases in private sector flows, could yield the necessary finance. However, the significant expansion of bilateral and MDB flows will be at the core of this package, if it is to be realised on the scale necessary. These increases in flows will not happen without the strengthening of policies and institutions in EMDEs and much greater international commitment from developed countries. Such commitment would be in the interests of all, including, we should emphasise, developed countries.

5. Conclusions

We have argued and endeavoured to show that managing climate change and reducing poverty are not competing goals. Indeed, a failure to tackle climate change would dramatically increase poverty, and measures to reduce emissions that damage the prospects of poor people would face strong opposition and likely fail. Climate change and poverty are the two defining challenges of our century: if we fail on one, we fail on the other. Measures to overcome these twin challenges will succeed only if we act on both at the same time. Large and sustained investments and innovations are essential to tackle climate change and can drive a new form of sustainable, resilient and inclusive growth. This new story of growth will offer avenues out of poverty for many, with gains in all dimensions of wellbeing. Developing countries cannot do this alone, and thus success will depend on the developed world acting strongly to support the necessary policies and deployment of technology, and on it providing the necessary scale of finance to accelerate mitigation and adaptation efforts.

It has long been argued that supporting development in poor countries and communities benefits us all (see e.g. Report of the Commission for Africa 2005, *Our Common Interest*).[10] This argument is particularly powerful when we think of climate change. The nature of growth and development choices in the developing world will, in large measure, determine our future climate and welfare. The duty and self-interest of the developed world to both act to reorient their own growth model and drive to net-zero and to act in support of the poorest has never been stronger. This drive to net-zero will itself propel the growth story of the 21st century. To delay is dangerous. The time to act is now.

[10] The report was prepared ahead of the G8 Summit of 2005 under the UK Presidency, which took place in Gleneagles, Scotland. The writing of the report was led by Nicholas Stern.

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