

IMPACT OF CLIMATE CHANGE ON DEVELOPING COUNTRIES: CASE OF LEAST DEVELOPED COUNTRIES

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ABSTRACT

Climate change has emerged as one of the biggest threats facing the world in this millennium. Climate change is a global phenomenon, but developing countries are likely to be the real victims. Due to geographical disadvantages and low income, it will make the poor more difficult to adapt to climate change. Present paper is an enquiry to the impact of climate change on development momentum in developing countries. Secondary data collected from the publications of UN and its subsidiaries, World Bank, and other international organisations are used in the paper for analysis. The gravity of global warming with its impact, frequency and associated risk are increasing at an alarming rate in recent times. Paper used global multi-dimensional poverty index of UNDP to define Least Developed Countries (LDCs) and assess the extent of deprivations in different dimensions and country groups, with special emphasis on South Asian countries. Impacts of climate change such as migration, economic loss, conflicts, and adaptation planning are discussed in detail in the paper. Importance of climate financing is also reviewed with updates from COP 28 in Dubai. Paper concludes with a note that climate change challenges not only affect the development momentum in the least developed countries (LDCs) but also dilute the achievements of the Millennium Development Goals (MDGs) and other sustainable development indicators.

Keywords: Climate Change, Global Warming, Least Developed Countries, Multi-Dimensional Poverty, Environmental refugees and conflicts, Climate Financing, COP 28.

1.0 INTRODUCTION

Climate change has emerged as one of the biggest threats facing the world in this millennium. Climate change is experiencing in big ways, which are not easily predictable and the impacts are irreversible. The year 2020 is reported to be the hottest year ever recorded, with record-breaking extreme weather patterns and climate-driven disasters ranging from forest and bush fires to floods, and to cyclones and hurricanes. The greenhouse gas (GHG) emission from human activity is reported to be the biggest threat to global warming. The Intergovernmental Panel on Climate Change (IPCC) has warned that temperatures could rise by another 2°C to 5°C, or perhaps even more, by 2100 (IPCC, 2022). It will have widespread impact on human welfare and natural ecosystems, including wide-ranging economic, ecological and social effects.

Climate change endangers the planet itself and delayed action trigger natural calamities so that the earth itself will become unrecognizable. The next few years are going to be so important and the adaptation course requires immediate and concerted efforts. It should include a package

of programmes such as slashing of emissions, building resilience, conserving ecosystems, and above all increasing the finance for adaptation and addressing loss and damage.

LDCs are disproportionately vulnerable to threats of climate change, while they haven't historically contributed to emissions (Castells-Qintana, et al. 2015). Climate change is a global phenomenon, but the impact are more on the so called poor countries, it will even lead to shifting of climatic zones. Technological innovations, sustainable investments in infrastructure, and productivity assurance are the highlights of modern development, which also ensures efficient and livable cities, low-carbon and resilient infrastructure, restoration of degraded lands, and protection of valuable forests (Kahn, et al. 2019). In the coming year's new development models including technological advances, preservation of essential natural capital, and the full health benefits of cleaner air and safer climate are required.

Present paper enquires the important impacts of climate change on development momentum in developing countries. Specific objectives of the paper include the following.

- To review the gravity of global warming and major risks.
- To examine the extent of deprivation of Least Developed Countries (LDCs) in basic requisites amidst climate change.
- To account the economic impact of climate change on LDCs.
- To review the extent of climate financing.

Secondary data collected from the publications of UN and its subsidiaries, World Bank, and other organisations in this field are used for detailed review and analysis. The paper composed of seven sections including introduction and conclusion. The gravity of global warming is reviewed in section two. Based on global multi-dimensional poverty index of UNDP, major deprivations of LDCs in different country group are discussed in detail in the midst of severity of climate impacts in section three. Special emphasis is given to South Asian countries. Major impacts of climate change in LDCs are discussed in detail in section four. Major risks of climate change, issue of migration, economic loss, threats of conflicts, and adaptation planning are discussed in detail. Importance of climate financing is briefed in section five. Section six is a brief review of climate action at COP 28 in Dubai. The final section concludes the discussion with important recommendations.

2.0 GLOBAL WARMING

There are doubts raised by some sections on the anthropogenic linkages of global warming. However, evidence suggests that many of the causes of climate change are anthropogenic, including lifestyles, consumption patterns, pollution, and exploitation of resources. China, US, European Union, Russia, India, and Japan are some of the top emitters of GHGs. Since the industrial revolution, emissions of GHGs increased from a negligible level to more than 40 billion tons a year, resulting in an annual average temperature rise of 1oC compared to the pre-industrial era (Guivarch, et al, 2021).

Concentrations of GHGs are now at the highest level and among the last 19 years, 18 are the warmest years on record globally. Accelerated sea-level rise, melting of ice in the polar region, disruption of ocean currents, and occurrence of extreme weather events such as floods and heat waves are some of the visible impacts of the warming. Limiting the global warming to 1.5°C

by the end of the century requires achieving net zero CO₂ emissions by 2050 and reducing global emissions by 50 per cent in 2030 (Briceño, 2022).

GHG emission and accumulation are directly linked to the level of development, the wealthiest countries represent only 16 per cent of the global population but contribute 40 per cent of CO₂ emissions. On the other hand, the poor segment of global population is 60 per cent, but emits less than 15 per cent of global emissions (Hulme, et al, 2005). Alternative method of analysis is per capita basis of emissions, which is 20 metric tons of CO₂-equivalent in USA, 10 times of the amount in India. The contribution of developed countries to global warming is greater than their poor counterparts, because they have added to the accumulation of GHGs for a longer period. The contribution of USA to cumulative emissions is 25 per cent, which is 22 per cent for European Union, 13 per cent for China, and for India, it is only 3 per cent (Guivarch, et al, 2021).

Studies suggest that every tenth of a degree of additional warming will have severe repercussions on human survival and ecosystems, leaving safety concerns even to the Paris target of limiting to 1.5oC. Scientific models corroborate that at 1.5oC of warming glaciers around the world will either disappear or lose most of their mass, 350 million more people will face water shortage by 2030, and 14 per cent of terrestrial species will extinct (Hulme, et al. 2005). Detailed analyses of risks at three different scenarios are provided in Table-1. The model covers all range of risks from biodiversity loss, drought impacts, food security, floods, sea level rise, and so on.

Table: 1 Risks of Global Warming

Risks	Temperature rise		
	1.5°C	2°C	3°C
1. Biodiversity loss (% of species at extinction)	14	18	29
2. Drought – Population exposed (Billion people)	0.95	1.15	1.29
3. Food security (Costs to major crops) – Billion USD	63	80	128
4. Fires (% increase in area)	40-54	62-87	96-187
5. Extreme heat (Increase in number of days/year above 35°C)	45-58	52-68	66-87
6. Sea level rise (meter increase by 2100)	0.28-0.55	0.33-0.61	0.44-0.76
7. Floods (% increase in population exposed to floods)	24	30	NA
8. Coral reefs (% decline)	70-90	99	NA

Source: World Resources Institute

In this context, if we imagine a further rise above 1.5oC means that more severe, often irreversible effects of climate change may happen including severe cyclones, frequent heat waves and cyclic droughts, extreme rainfall patterns, faster sea-level rise, melting of ice sheets in Polar regions, and more. Repercussions of such events will be too severe including loss of forest areas, turning critical carbon sinks into carbon sources. The IPCC already warn that re-occurrence of hazards in the same region will have severe impact. It will affect agriculture yield and food security in many regions, mainly low income countries and will trigger heat-related mortality. These impacts will jeopardize the development that poor countries have already attained.

The latest IPCC report is realistic to the extent that limiting warming to 1.5oC is possible by dropping the GHG emissions to half. Recognizing the necessity, governments, local governments and business are making commitments to reach net-zero emissions within their jurisdictions or businesses (Guivarch, et al, 2021). Net-zero emission is characterized wherein GHG emissions as part of economic activities are counterbalanced by carbon removal. This is a two dimensional approach, wherein human-caused emissions should be reduced as much as possible and it will be removed through carbon sequestration, which is through restoring forests or through technologies, the latter scrubs carbon directly from the atmosphere.

Under the Paris Agreement, countries agreed to limit warming to well below 2oC, ideally to 1.5oC. Any delay in this target almost guarantees surpassing 1.5oC leading to a climate catastrophe and in such situation only solution is universal carbon removal (Baarsch, et al. 2020). It does not means that all countries need to reach net-zero emissions at the same time. The focus should be on higher emitters and wealthier countries. Equity considerations on fixing past emissions in consensus with per-capita emissions and counteraction measures are also really does matter.

Despite the enormous efforts of international agencies such as IPCC and UN, progress is happening slowly. The UN reports show that current pace of climate policies would lead the world to a 2.8oC rise by the end of the century. Rapid transformation on the climate front requires integrated strategies ranging from how we power our economies to how we transport people and goods, to how we feed growing population. For instance, in pathways to 1.5oC rise, zero-carbon sources need to supply 98-100 per cent of electricity by 2050 (Anisimov & Magnan, 2023). Energy efficient transportation, efficient food production, restoration of degraded lands, and reducing food loss and waste all have significant role in reducing emissions.

Important solutions identified to mitigate climate change include retiring of coal mines, investment in efficient and clean energy, retrofit and decarbonise buildings, decarbonisation of cement, steel and plastic, shift to electric vehicles, efficient utilization of public transport, decarbonisation of aviation and shipping, reduction of food waste and improved agricultural practices, halting deforestation and restoration of degraded lands, and promotion of vegetarian diets (IPCC, AR 6). Structural and economic transition measures toward net zero should be smooth and equitable as possible. The significance of technologies is so vital in this regard in cost-effective manner with high-carbon alternatives. Non-conventional energy sources such as solar and wind provide the cheapest power alternatives.

Global momentum for setting net-zero targets is growing faster. Bhutan was the first country to set net-zero targets in 2015. Currently over 100 countries, representing nearly 80 per cent of global emissions, are covered by a net-zero target. Commitments of these countries are in the form of nationally determined contributions (NDCs), long-term strategies, domestic laws, policies, and political pledges from heads of state. Under the Paris Agreement, countries are required to submit climate plans every five years through NDCs, currently target 2030. Countries having net-zero targets started incorporating them to their NDCs. The net-zero targets set by some countries rely on purchasing emission reductions, and thereby delaying their own reductions. However, the time horizon for net-zero targets for 2050 and beyond feels distant.

3.0 LEAST DEVELOPED COUNTRIES

The 'World Economic Situation and Prospects 2024' of the United Nations classified countries broadly into three groups including developed economies, economies in transition, and developing economies. For detailed analyses countries are further classified as high income, upper middle income and low income countries on the basis of per capita gross national income (GNI). Countries with a GNI per capita of USD 1135 or less are included under low-income countries, those between USD 1136 and USD 4465 as lower-middle income countries, those between USD 4466 and USD 13845 as upper middle income countries, and those above USD 13,845 as high income countries (United Nations, 2023).

The list of least developed countries (LDCs) are framed by the UN Economic Social Council, and ultimately by the UN General Assembly. The methodology used in this method is highly scientific one and has the criteria such as income, human assets, and economic and environmental vulnerability as shown in Table-2. The per capita GNI is an indicator of the income status. To measure human assets health indicators and education indicators are used; the former include child mortality rate, maternal mortality ratio, and prevalence of stunting. Lower secondary school completion rate, adult literacy rate, and gender parity index for lower secondary school completion are used to measure education assets. Economic vulnerability is measured by share of agriculture, forestry, and fisheries sector in GDP, remoteness and land-lockedness, merchandise export concentration, and instability of exports of goods and services (UNDP, 2023). Environmental vulnerability is reflected through share of population in low elevated coastal zones and also in dry lands and victims of disasters along with instability of agricultural production.

As per the latest report based on November 2023, 46 LDCs are identified, of which 4 are from South Asia, which includes Afghanistan, Bangladesh, Bhutan, and Nepal. Nearly 72 per cent of LDCs are from Africa (33 countries).

Correspondingly, the UNDP has used Multidimensional Poverty Index (MPI) to identify the poor. The MPI is based on deprivation in four major dimensions such as health, education, standard of living, and poverty of people. Based on MPI, 49 countries are identified as poor as shown in Figure-1.

Least Developed Countries (LDCs) are a group of 49 countries that are recognised as the world's poorest and weakest countries. LDCs have a per capita Gross Domestic Product (GDP) of less than USD 900 and very low levels of capital, human and technological development

(United Nations, 2023). These 49 countries have a combined population of about 785 million, which is equivalent to just over 10 percent of the world’s population (UNDP, 2023). Among the LDCs, 534 million people live in Sub Saharan Africa, followed by South Asia (389 million).

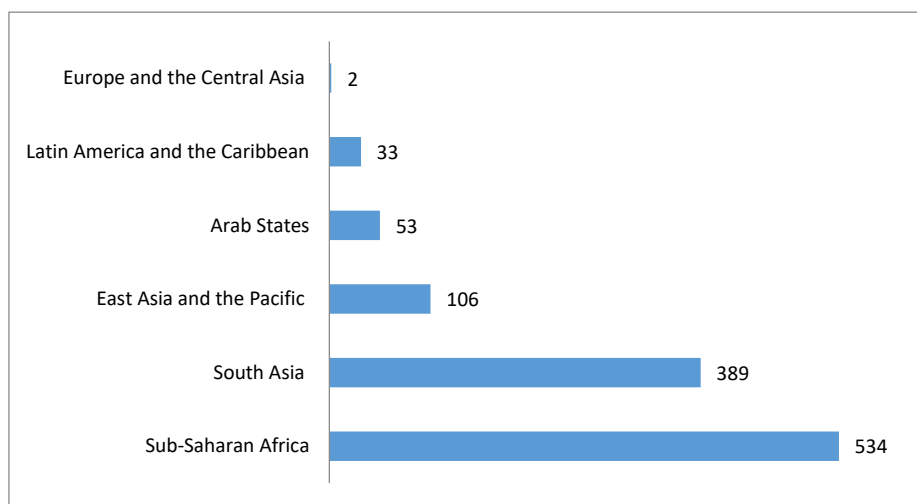
Detailed analysis of deprivation of poor people is given in Figure-2; 991 million people are deprived of cooking, followed by housing, sanitation, and nutrition. In the paper special attention is also given to South Asia (Figure-3). Chinese case is also reviewed for South Asian comparison.

Table: 2 Criteria of Least Developed Countries

Income	Human Assets Index		Economic and Environmental Vulnerability Index	
Per Capita GNI	Health Index	Education Index	Economic Vulnerability Index	Environmental Vulnerability Index
3 year average defined by the World Bank	Under-five mortality rate	Lower secondary school completion rate	Share of agriculture, forestry, and fisheries in GDP	Share of population in low elevated coastal zones
For 2024 review is USD 1088	Maternal mortality ratio	Adult literacy rate	Remoteness and land-lockedness	Share of population living in dry lands
Calculated by the UN Statistics Division	Prevalence of stunting	Gender parity index for lower secondary completion	Merchandise export concentration	Instability of agricultural production
			Instability of exports of goods and services	Victims of disasters

Source: Dept. of Social Affairs, UN

Figure: 1 Poor people and their geographical distribution (in million)

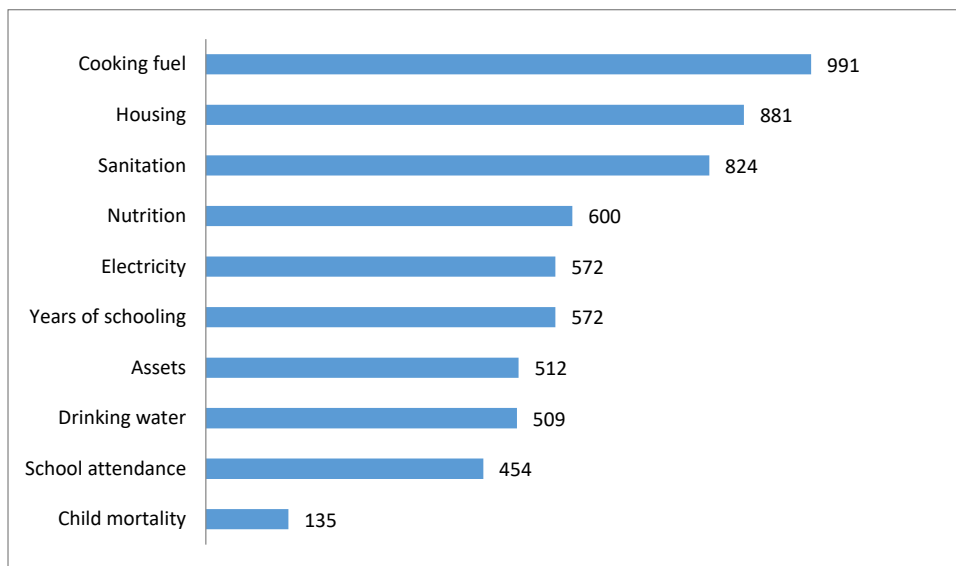


Source: UNDP, Global Multidimensional Poverty Index

4.0 LDCs AND CLIMATE CHANGE

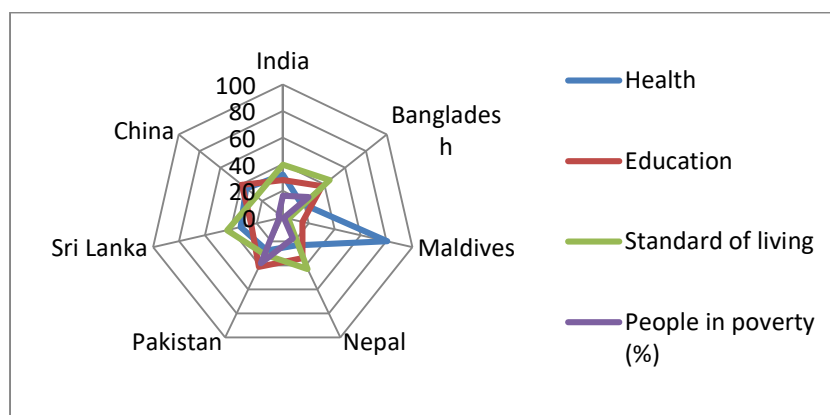
Even though climate change is a global issue, the real victims are developing countries. In particular the poor due to geographical disadvantages and low income, and make them more difficult to adapt to climate change. High dependence on natural resources and limited capacity to cope with climate extremes make the poor people real victims of climate change. It is an irony that developing countries contribute the least to the problem, but bear the larger brunt of climate change. In fact, 74 of the world’s poorest countries account less than one tenth of global GHG emissions, but are hardest hit by the climate change (Guivarch, et al, 2021). Climate change in most cases jeopardizes the developmental gains that these countries have already achieved. Some of the communities are going to be affected very badly within the next two to three decades.

Figure-2 Deprivation of poor people in the World (million)



Source: UNDP, 2023

Figure: 3 Deprivation of poor people in South Asia (Per cent)

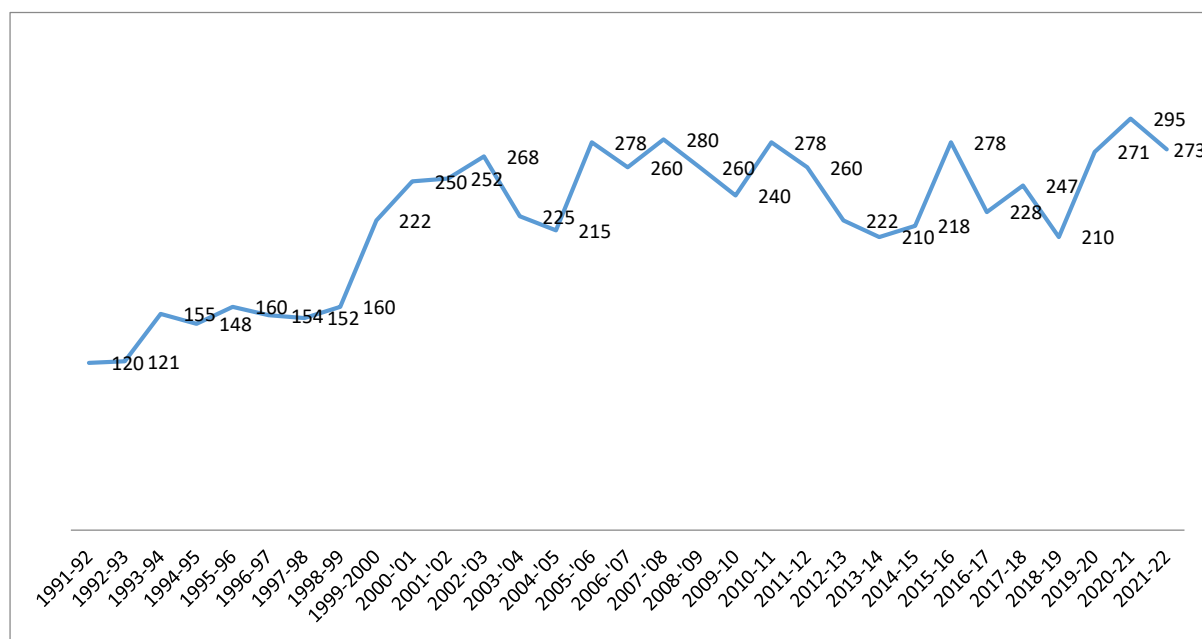


Source: UNDP, Global Multidimensional Poverty Index

Climate change used to have double shock on the livelihood and survival of poor people, initially exposed to extreme weather and secondarily they do not have access to basic health services and social security protection. Small Island Developing States (SIDS) and fragile and conflict-affected countries face high climate risk for unique but equally pressing reasons. Frequent occurrences of natural calamities due to climate change are witnessed in the underdeveloped countries in Asia, Africa and Latin America. Between 1970 and 1999 about 3.76 billion people were affected by natural disasters in Asia alone (Rodrik, et. al. 2002). Africa had the second most sufferings of people due to frequent occurrence of natural calamities and high dependence of agriculture resources. Latin America and Caribbean are frequently threatened by floods, windstorms, and earthquakes in recent times.

Details of weather related incidents affecting LDCs are given in Figure-4. Number of such incidents was 121 in 1991-92, which increased to 273 in 2021-22.

Figure: 4 Number of weather related incidents affecting LDCs, 1991 to 2022



Source: lossanddamagecollaboration.org

Article 4, paragraph 9 of United Nations Framework Convention on Climate Change (UNFCCC) specifies that Parties should account the funding and technological requirements of LDCs to combat climate change. The vulnerability of LDCs to climate change and their low adaptation capacity is recognized in the Marrakech Accords, where a special LDC Fund was established. In the light of the disproportionate impact of climate change on the poorest countries, international organizations such as UNDP had associated with developing countries on climate change adaptation and mitigation measures to expand opportunities for sustainable livelihoods. On the mitigation front, promotion of energy efficiency and use of renewable energy got emphasis as it ensures the most cost-effective means of reducing emission intensity.

Major difference between the so-called advanced countries and LDCs in this regard is that former got ample time and convenience in industrializing their communities without any botheration of climate actions, but the latter do not have that luxury, as the countries regardless of their development faces climate disaster. Accordingly, LDCs requires support to slow climate change and to ensure safer, prosperous, inclusive, and sustainable lives. Multidimensional approach and policy including low-carbon, resilient growth by addressing poverty and inequality is required. Climate change not only drain hard-won development gains of LDCs, but also force approximately 200 million people to migrate as environment refugees by 2050 (World Bank & WHO, 2017).

One of the major impacts of climate change on developing countries is that the progress they have already achieved through reducing poverty and inequality are going to be threated and eroded. In such a situation, the policies designed to combat climate change should be directed to address poverty reduction as well. The World Bank studies estimated that due to climate change an additional 68 to 135 million people could be pushed into poverty by 2030 (Guivarch, et al,2021). The IMF studies also validate that climate change would reverse the gains of the past few decades and cause inequality between communities. Care should be taken to balance climate resilient strategies and poverty reduction policies in developing countries. Persistence of long-standing extreme weather events will hit the poor and at the same time causes more people to fall into poverty. The efforts to reduce emission in LDCs should be viewed from a broader objective of poverty and inequality reduction, generation of jobs, improvement of air quality and public health.

The IPCC6 reported that Africa is the most vulnerable continents to climate change due to the interaction of multiple stress factors occurring at various levels. Agricultural production and food security stress, water stress, and sea-level rise will aggravate the impact including human health. In LDCs 70 per cent of the population are dependent on climate sensitive sectors such as agriculture (Anisimov & Magnan, 2023). They are exposed to land degradation, drought, desertification, deforestation, as well as water and air pollution, which are all associated with climate change.

Climate change adversely affect the world's poor, both geographically and economically, making adaptation more challenging (Dervis, 2007). Lower income countries are paying the highest price; 189 million people every year got affected by extreme weather events since 1991. Developing countries experienced 79 per cent of recorded deaths and 97 per cent of the people affected by extreme weather. Africa is responsible for less than 4 per cent of global emissions but was losing between 5-15 per cent of its GDP per capita growth. Every fraction of a degree of further warming means more losses in developing countries, which is estimated to be between \$290 billion and \$580 billion by 2030 (Gao & Christiansen, 2023). These estimates do not include non-economic losses and damages, such as socio-psychological impacts and biodiversity loss.

Small Island Developing States (SIDS) are one of the most vulnerable lands mass to climate change, which comprise small islands and low-lying coastal countries constrained by small population, limited resources, and remoteness, vulnerable to natural disasters and susceptible to external shocks. There are 51 SIDS; 14 of which are non-UN members or are associate members of UN regional commissions. SIDSs are located across the Indian, Pacific and

Atlantic Oceans, the Caribbean and the Southwest Pacific. There are 11 of these countries which are both LDCs and SIDS.

The latest IPCC report (Sixth Assessment Report) point to a grim picture for the globe and impact of Climate change are affecting every nook and corner of the world (IPCC, 2022). It is urgently required to halve GHG emissions and to scale up adaptation strategies in war footing. The IPCC report details effective and feasible climate adaptation strategies for the vulnerable sections in the society and highlights the following.

1. The gravity and impacts of climate change are widespread and severe than anticipated, affecting the global food systems and security (Schilling, et al. 2020).
2. The impact of GHG emissions that is happening since the industrial revolution will continue even if we could completely contain the GHG emissions (New, et al. 2022).
3. Risks associated to increasing temperatures will have irreversible impact on humans, habitats and even climate itself.
4. Studies show that nearly 3.3 - 3.6 billion people live in countries that are hotspots to climate change, especially SIDSs, the Arctic, South Asia, Central and South America, and Sub-Saharan Africa (Hulme, et al. 2005).
5. Climate adaptation is a major policy option adopted by a good number of countries to combat climate change. It has been reported that adaptation as a climate policy has been adopted by 170 countries, but are lagging in their implementation.
6. Some of the LDCs have already reached their limit to adapt to extremes of climate adaptation. Present rate of warming of 1.1oC has already made people vulnerable and ecosystems to their limits.

In developed countries too nature related disaster risks are rising especially in urban areas in informal settlements, where inadequate housing and basic services impede resilience efforts. In LDCs, these figures are even higher. For instance in sub-Saharan Africa, 60 per cent of the urban population live in informal settlements, and in Asia, 529 million people reside in such vulnerable areas. Conditions of indigenous people, whose livelihoods depend more on climate sensitive sectors are more vulnerable to climate risks, such as agriculture, fishing and forestry (Barnett, 2001). Studies show that rising temperatures will hit global economy by \$250 trillion by 2050. Forecast models show that US economy, world's largest economy, will be the least affected economy due to climate change (Block & Webb, 2001). These analyses show a high negative correlation between climate change and economic impact and will be a warning to the LDCs.

The adaptation approaches used across developing countries can be clubbed under the following three categories (Brooks, Adger & Kelly, 2005).

1. Social protection programmes: Adoption of social protection programmes such as cash transfers, public works and social safety nets coupled with access to infrastructure and basic services, including clean water, sanitation and healthcare will lower vulnerability to climate risks. Involvement of governments, civil society organizations and the private sector in these initiatives will trigger climate resilience.

2. Ecosystem-based programmes: It encompasses strategies such as ecosystem protection, restoration and sustainable management including agricultural practices. This approach has

multi-dimensional benefits including for biodiversity, livelihood, health, food security and carbon sequestration (Nair, Reji, 2008). Involvement of local people and application of their indigenous knowledge are more important in this endeavour.

3. Technology based approaches: Nature-based technology solutions with engineered options will help in reducing climate risks. Climate resilient crop varieties, improved livestock breeding, and eco-friendly power generation will help to strengthen resilience. But extra care needs to be taken in addressing short-term mitigation rather than long term goals.

Important effects of climate change include increasing intensity of extreme weather events, flooding, water scarcity and drought in arid regions, spread of vector-borne diseases, and damage of natural resources and ecosystems (Church, et. al, 2006). While climate change management requires multi-faceted policy solutions, there is consensus that extreme weather and disruption from drought, floods, and conflicts over natural resources disproportionately affect the developing world, particularly the poor, women and children (Easterly & Levine, 2003).

Impact of climate change is creating greater instability in fragile and emerging countries and markets across the developing world. The most important among them are the following.

1. Environmental refugees: Climate change has not only contributed to conflict and extremism in vulnerable countries of tropic but also led to the displacement of 80 million people as climate refugees. By 2050, more than 143 million people could be driven from their homes by conflict over food and water insecurity and climate-driven natural disasters (World Bank, 2022). By 2070, almost 20 per cent of the planet could be too hot to be habitable (Jafino, et. al. 2020). In 2025 impact of climate changes including water shortages, decreasing agricultural productivity, and rising sea levels will force more than 140 million people to migrate from Sub-Saharan Africa, South Asia, and Latin America (Kanta & Rigaud et al. 2018). Studies show that in 2019 itself, climate change forced 24.9 million people to displace from their native places (IDMC, 2020). In many countries climate changes had reversed past gains of development efforts and even lead to violent conflicts.
2. Food and water insecurity: Of the 124 million people worldwide, who face crisis levels of acute food insecurity, 76 per cent were affected by climate shocks and extremes, and more than half of the people in developing countries dependent on agriculture (Dervis, Kemal, 2007). Global warming increase the costs of agricultural production and threaten biodiversity, with one million species in danger of extinction that affect crop growth, fisheries, and livestock. Climate change could damage crop yields, especially in the food-insecure regions of the LDCs. Even the IPCC reports warn that agriculture, forestry, and land use changes are responsible for nearly 25 per cent of the GHG emissions (Sultan, et. al. 2019). It means that the agriculture sector is core to addressing the climate challenge as well as it is climate sensitive too. Around 70 per cent food is required to feed nine billion people by 2050 (Baarsch, et al. 2020). Climate-smart agriculture including optimized land uses and efficient water management, recycling, application of stress-tolerant seeds, and bioengineering are required as part of climate resilient agriculture. The World Bank supports community-supported agriculture (CSA) initiatives through productivity and resilience enhancement, and emissions

reduction. In 2020, 52 percent of the World Bank's finances were channeled to the agricultural sector targeting climate adaptation and mitigation. One of the major impact of climate change has been water scarcity, especially in developing countries. In such vulnerable areas, it is necessary to invest in the construction of dams and aquifers in addition to repairing existing water reservoirs (Thwaites, 2022). At the same time, floods are also contributing towards increased tension and competition over resources.

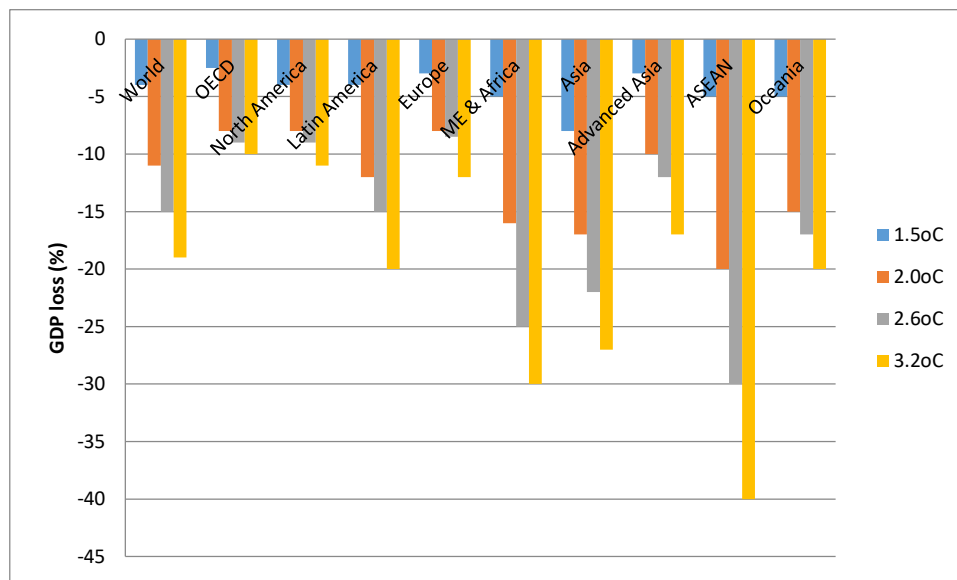
3. Health hazards: Global warming is reported to spread deadly infectious diseases such as zika, dengue, and chikungunya. A warmer climate could lead to an additional 250,000 people dying of diseases including malaria each year between 2030 and 2050 (World Bank & WHO, 2017). The Red Cross estimates that more than 50 million people around the world have been jointly affected by COVID-19 and climate change (Patel, et. al. 2021).
4. Developmental issues: The World Bank estimates show that the effects of climate change could push an additional 100 million people below the poverty line by 2030 (Pritchett, 2000). Studies show that extreme weather could push 26 million people into poverty each year (Burke, et. al. 2015). Major commercial ports in developing countries including Rio de Janeiro, Mumbai, Guangzhou, and Dar es Salaam, etc are anticipated to face the threat of being submerged by rising sea levels (Dell, et. al. 2012). A Stanford University study found that climate change has increased economic inequality between developed and developing nations by 25 per cent since 1960 (Easterly, et al. 1993).
5. Conflicts: Experiences in LDCs reveal that there is a close nexus between climate change, communal conflicts, fragility, and development. Climate change related threats to livelihoods used to exacerbate violent conflicts. Studies on conflicts in East Africa between 1990 and 2009 reported that temperature rise of 2 standard deviations from the normal average resulted in 29.6 per cent rise in conflicts (Mufson, 2022). Climate-induced water shortages were reported to be the contributing factor to the 2012 Syrian Conflict. Climatic related resource scarcity and competition was reported to be contributors to many conflicts in the Middle East countries in the past (Sultan, et. al. 2019). Climatic changes exert extra pressure on the fragile institutions and further weaken their ability to respond to threats. These transformations create conducive environment for violent groups to control key resources and thrive (Briceño, 2022). Lacunae in governance are reported to be the major factor that compounds the risk of violent conflict in areas that are prone to climate-related tensions.
6. Economic Loss: Empirical studies prove that there is a strong negative relation between warming and fall in GDP growth. Climate change is reported to reduce real world GDP by more than 7 per cent per year, if mitigation measures are not taken on time (Kahn et al, 2019). Even though global warming will impact both the developed and developing countries, its impact will be much stronger in LDCs such as in Sub Saharan Africa where the population dependence is more on nature based activities like farming. Without scientific approaches to mitigation annual loss of income will be 23 per cent by 2100 (Clara, et al. 2016).

The direct economic cost of climate change to the global economy is worked out to be \$7.9 trillion by 2050. Based on current trends the fallout of warming temperatures would cut shot 3 per cent of global GDP by 2050 (UNCTAD, 2021). Africa would be most at-risk, with 4.7 per cent of its GDP at risk. Along with Climate change, air pollution will lead to over 4.2 million premature deaths annually. Details of GDP loss due to climate change is provided in Figure-5.

At 1.5oC, global GDP will shrink by less than 5 per cent, but at 2oC, it would be more than 10 per cent. At 3.2oC of warming, ASEAN countries, and Middle East and Africa will be badly hit.

The annual report on Weather, Climate and Catastrophes reported that in 2019 climate change related disasters had resulted in economic losses of \$232 billion (Thwaites, 2022). Global economic losses due to disasters between 2010 and 2019 were \$2.98 trillion dollars, of which Asia Pacific region alone had 44 percent of losses (Council of EU, 2020). Along with environmental and health related impacts climate change will also affect industries, including tourism, energy, and water. There is strong link between climate and development and also climate and conflicts. Accordingly global sustainable development initiatives should be made more conflict-sensitive and security policies more climate-sensitive.

Figure: 5 GDP losses due to climate change by 2050



Source: UNCTAD, 2021

5.0 CLIMATE FINANCING

Globally there are multitudes of multilateral and bilateral environmental assistance programs to protect biodiversity, promotion of renewable energy, and adaptation. Important arrangements include Global Environment Facility and the Green Climate Fund within the United Nations as well as multilateral development banks such as the World Bank, the Inter-American Development Bank, and the African Development Bank.

Measures taken by countries in relation to climate change adaptation planning is provided in Table-3. Implementations of programmes are much weaker especially in LDCs and SIDs. Monetary and evaluation part is even much weaker.

The average annual adaptation finance requirements of developing countries during 2021–2030 period is estimated at USD387 billion. Adaptation projects in developing countries are financed

by both public and private sources through international finance flows and domestic expenditures. Along with emergency support, developed countries can invest in employment creating initiatives to facilitate long-term economic growth by providing financial resources through micro-finance to diversify their livelihoods (Mufson, 2022).

Climate adaptation finance requirements in different country groups are as given in Figure-6, which is estimated to be USD 387 million. In South Asia and Sub Saharan Africa, financial requirements are estimated to be 2.4 per cent of GDP. Climate change cannot be addressed through simple single-sector, single-country, or single-organization solutions; instead it requires collaboration and knowledge-sharing. Mitigation policies do impact inequalities through their secondary effect on energy and food prices, and their access. Mitigation efforts should address development, poverty and inequality, air quality, health, and so on, and rich countries should initiate financing policies in LDCs.

Table: 3 Effectiveness of Climate Change Adaptation Planning among the Countries

Criteria	Indicators	Percentage of all 197 Parties	Percentage of LDCs	Percentage of SIDS
1. Comprehensiveness	1.1 Adaptation options address assessed risks <i>(partially)</i>	81%	78%	84%
2. Inclusiveness	2.1 Stakeholder engagement <i>(in progress)</i>	83%	87%	89%
	2.2 Gender consideration <i>(in progress)</i>	71%	76%	74%
3. Implementability	3.1 Central administrative body in place	69%	65%	63%
	3.2 Regulations	58%	54%	58%
	3.3 Incentives	42%	30%	32%
	3.4 Direct investment/domestic funding	68%	59%	66%
4. Integration	4.1 Horizontal coordination mechanisms <i>(in progress)</i>	77%	83%	79%
	4.2 Sectoral adaptation plans <i>(in progress)</i>	68%	72%	68%
	4.3 Vertical coordination mechanisms <i>(in progress)</i>	36%	33%	18%
	4.4 Subnational adaptation plans <i>(in progress)</i>	32%	15%	5%
5. Monitoring and evaluation (M&E)	5.1 M&E framework in place <i>(in progress)</i>	24%	11%	8%
	5.2 Progress/Monitoring report published	22%	9%	8%
	5.3 Evaluation report published	8%	2%	0%

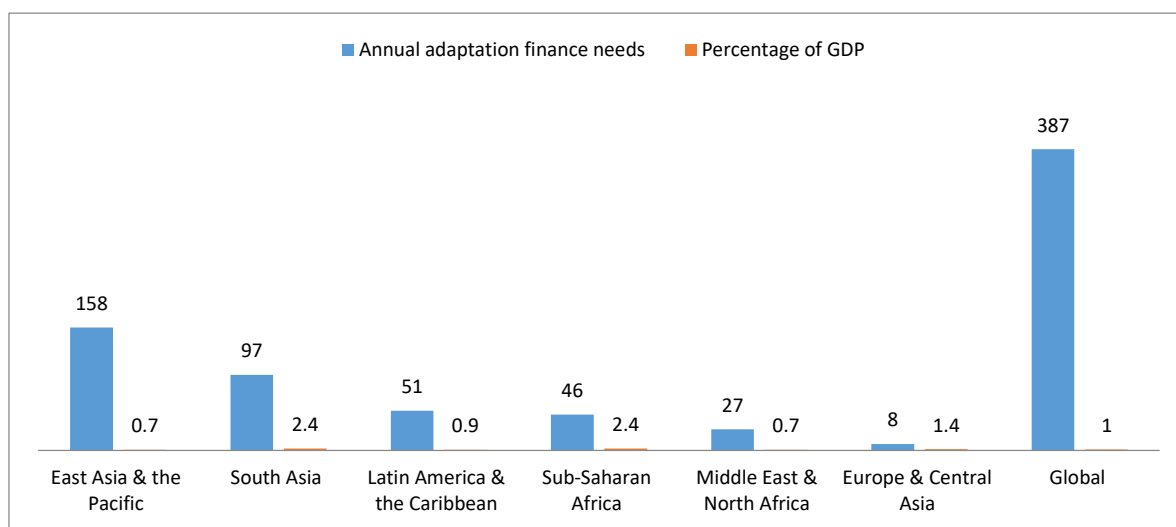
Source: UNEP (2023).

Alternative financing options such as revenue generation through carbon trading are going to be important financing option for the LDCs. Low-carbon and energy-efficient technologies are progressing so faster as part of climate action around the world, especially in the energy sector, transportation, buildings, and agriculture. To capture full economic benefits of low-carbon and resilient growth, along with UN and international organizations involvement of all countries, especially developed countries is required in the next 10 -15 years.

To ensure full benefits worth of USD26 trillion through to 2030 by transforming the world economy to stable pathways, the Global Commission calls up on the following strategies (Council of the EU, 2020).

1. Governments should price carbon by mandatory climate risk disclosure to business.
2. Countries should emphasis on investing in sustainable infrastructure as part of new growth model.
3. Potential of the private sector and innovation needs to be tapped.
4. Decentralised approach is required to ensure sustainable and smooth transition.

Figure: 6 Climate adaptation finance requirements (million USD)



Source: UNEP (2023).

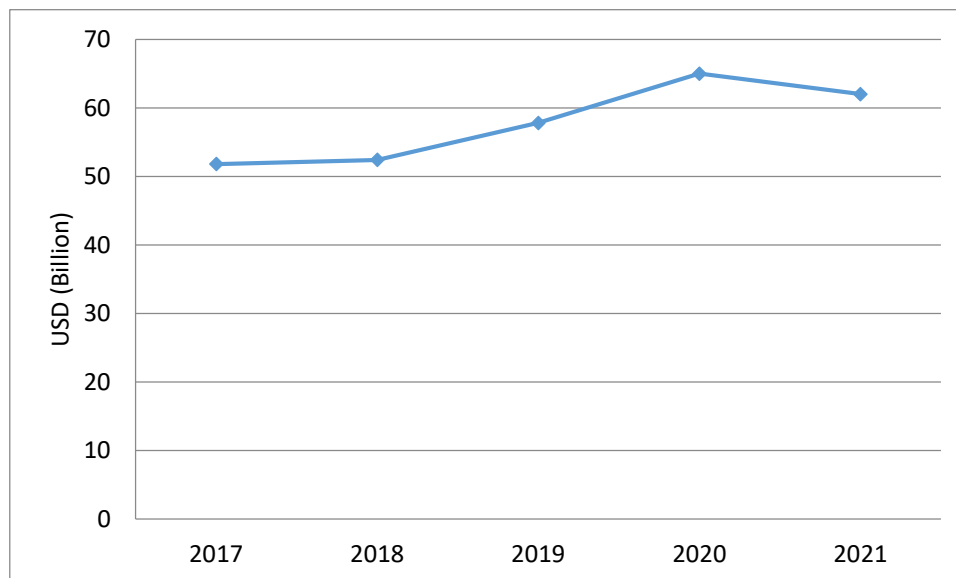
Lack of coordination and focus, political interests, etc weaken some of the arrangements. The solution is for wealthy countries to collaborate more effectively with organizations like the U.N, especially the UNFCCC and IPCC to lead and coordinate climate action globally. The World Bank is the world's major multilateral financier of climate action in developing countries, which also includes support from IDA, through investments in clean energy. In 2021, 61 per cent of total IDA climate finance was for adaptation and it helped 62 countries institutionalize disaster risk reduction as a national priority (Nishio, 2021).

Between 2017 and 2021, climate-specific international public finance commitments towards developing countries remained well below USD 70 billion per year as shown in Figure-7. At USD 65 billion, 2020 was the year with the highest amount. Notably, the increasing trend

between 2017 and 2020 is followed by a decrease in finance commitment in 2021 (IDMC, 2020).

UNDP estimates indicate that more than 100 million people could fall additionally into extreme poverty due to climate change by 2030; over 200 million people will be displaced from their home villages. UNDP, the UN's largest provider of climate finance with over US\$3 billion of projects in over 140 countries always used to try to build the resilience of the poor (Kishan & Walid, 2018). In effect, UNDP serves as a platform to combat both climate change and poverty (Kishan & Walid, 2018). Adaptive social protection systems play a key role in combating poverty and climate change through solutions such as cash transfers to counter climatic disasters, subsidies to enhance food and water, employment-generation in climate resilient infrastructure, insurance for farmers, and effective resettlement measures.

Figure: 7 Climate specific Finance Commitments to Developing countries (USD Billion)



Source: UNEP, 2023

Left with just five more years to achieve the 2030 targets under the SDGs and the Paris Agreement, the UN is accelerating its integrated policy solutions in vulnerable countries. The SDG Climate Facility is a measure to address country's capacities to act under their pledges to the Paris Agreement by generating co-benefits for poverty reduction and related SDGs on gender equality, and food and water security. It will help in tracking climate-poverty hotspots and ensure social protection and poverty reduction measures are in place.

6.0 PROGRESS OF CLIMATE ACTION AT COP 28 IN DUBAI

The COP 28 climate talks held in Dubai in December 2023 addressed the vulnerability of climate impacts. One of the major highlights of COP 28 was initiation of Global Stocktake, the Paris Agreement's process to climate action. Significant progresses including commitments of reducing methane emissions, creation of sustainable food systems, and protection of forests are major highlights in this regard.

Tripling the renewable energy capacity and doubling its efficiency by 2030, accelerated emission reductions through various measures including use of zero-emission vehicles, promotion of public transport, and safe cycling infrastructure are highlights in the energy front. One of the major achievements of Dubai summit is the operationalization of Loss and Damage Fund, which is designed to support climate-vulnerable countries deal the climate impacts. It was a tough journey where developing countries were forced to make significant concessions to reach the deal. Roughly with USD700 million funds was promised by interested parties, but anticipated damage due to climate change faced by vulnerable countries is estimated to be \$580 billion by 2030.

The COP28 struck most finance issues to COP29 including the new climate finance goal, called 'New Collective Qualitative Goal (NCQG). It will replace developed countries' 2009 commitment of providing USD100 billion annually in climate finance to developing nations. This is in tandem with the developing countries' needs and priorities, estimated at USD5.8 trillion – USD 5.9 trillion until 2030. It was agreed that the COP28, COP29 and COP30 presidencies will initiate a 'Road map to Mission 1.5.' For the first time, 159 nations, covering nearly 80 per cent of the world's land, signed the declaration on sustainable agriculture. This is a commitment to integrate food and food systems into their NDCs by 2025. COP28 demonstrated action towards the Glasgow Leaders' Declaration on Forests and Land Use in 2021 to halt and reverse forest loss and land degradation by the end of the decade. It could be seen that all nations formally agreed to move away from fossil fuels and rapidly ramp up renewable energy, while our cities and food systems were elevated in the climate fight like never before.

7.0 CONCLUSION

Climate change is a global challenge and accordingly it requires global action including the participation of UN and all stakeholders, especially the developed countries. Climate, development, and security are interrelated and accordingly it is essential to develop an integrated approach by coordinating global actors to harmonize climate action. To escape from the climate-induced poverty trap, climate adaptation programmes and strategies in the LDCs should be integrated with development activities. In LDCs it is to be ensured that green agricultural policies are connected both backward and forward to green industrialization, by preserving the environment, and improving food security through higher farm production and stable incomes. Governments around the world promote public awareness programs on climate change and its effects, to ensure that the public has access to information, so as to ensure their participation in solutions.

Development of early warning systems is key elements to reduce losses and damages from climate disaster risks as they effectively protect lives, assets, and livelihoods. The World Meteorological Organization recommended the importance of early warning systems through the involvement of regional and local stakeholders in the Global Climate Observing System (Hallegatte, et al. 2016).

The LDCs and SIDS are at the frontline of climate change effects, but remained neglected on the current debate on climate change. Adaptation as a strategy to climate change management is not only a sustainable development challenge in LDCs and SIDS but also an issue of their survival. To ensure better and informed decisions on climate change, it is important to improve

the multiple stresses at local, national and global scales. Advanced scientific researches are progressing across the world to understand the impact of climate change on LDCs and SIDS as there are location specific socio-cultural dynamics. National Adaptation Programmes of Action prepared by the LDCs are important step in enhancing adaptive capacity (Kanta, et al. 2018). However, scope of the current adaptation programmes is narrow and there is need for more comprehensive ones. Accordingly, adaptation needs should be mainstreamed in national development plans and strategies. LDCs and SIDS lack financial resources and technical expertise to meet the adaptation needs. Accordingly, international community should provide stronger financial and technical support to the LDCs and SIDS, such as the Brussels Programme of Action for the LDCs and the Barbados Programme of Action for SIDS.

Climate sensitive sectors such as agriculture and forestry should be transformed to third engine of economic growth as they have the potential to ensure food security, rural prosperity, equitable growth, resilience, and valuable ecosystem services. New growth approach ensures higher productivity, resilient economies and social inclusion. This new model is sustainable and will determine the development of the 21st century. Urgent policy reforms are required to address climate change with strategies for energy and transportation, food security, and housing. The question of financing these policies is one of the biggest challenges.

Climate change enforces drastic challenges to livelihood strategies in developing countries, where limited opportunities exist for economic diversification and the best way to address the dual dilemma is by integrating adaptation responses into development planning (Clara, et al. 2016). Investments in development could help countries adapt to climate change and build resilience from shocks, natural disasters, and conflict, while reducing chronic vulnerability. From the foregone discussions it could be seen that following areas requires special attention for smart climate change management.

1. Reducing impact of droughts and floods
2. Increasing access to clean water
3. Addressing migration
4. Financing resilience for coasts and cities
5. Reforestation
6. Predicting extreme weather
7. Public-private partnerships to address climate change

Building a better, people-centred, resilient growth by accelerating structural transformation is determined by key areas such as clean energy systems, smarter urban development, sustainable land uses, wise water management, and circular industrial economy (Nair, Reji, 2022). Climate change challenges not only the development momentum in the developing countries but also dilute the achievements of the Millennium Development Goals (MDGs) and other sustainable development indicators.

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