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Impact of Climate Change on Poverty

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Abstract

Poverty has been a long battle that's half won and Climate change is merely an unknown phenomenon today. Both form an integral part of the sustainable development literature of policymaking. However, their linkages have been long overlooked by nations when addressing growth and sustainability. In this literature, we explore the possible linkages of poverty and climate change by introducing the two concepts thoroughly, defining the global poverty scenario and shedding light on some real-life examples. The examples delve into underdeveloped or less developed countries that are most exposed to climate variability to understand vulnerabilities present to the world, especially the poor world, and examine the impact of rising earth temperature on poverty, poverty alleviation programs and economic growth. At the same time, we look at different policy actions that countries over the world have undertaken for the same. Finally, policy insights are provided with conclusions that may assist future studies and current policies.

Keywords: *climate change, poverty, global warming, developing countries, emissions*

1.0 Introduction

There has been a remarkable decline in poverty over the past three decades, especially with once underdeveloped countries making great strides in development. China and India alone have pulled out a significant number of 900 million poor people above the international poverty line since their whopping growth progress started in the late 90s (Bhattacharya, 2018). The International Poverty line is a monetary threshold under which a person is considered poor. The present International Poverty line (2015) is \$1.90 per day. This trend is expected to continue in developing countries that manage to maintain a stable and rapid growth rate with rising growth per capita.

At the same time, we have been experiencing a rise in the earth's temperature due to the increased emission of Greenhouses Gases (IPCC, 2007). Today, it is widely acknowledged by the scientific community that global warming is a reality. The Intergovernmental Panel on Climate Change (IPCC) has concluded that human activities are dominantly altering the patterns in our climate system. Climate Change is associated with an impact on the physical and biological systems of the world. It brings about gradual changes in the environment like

rising sea levels, change in precipitation patterns and changes in climatic zones due to an increase in average temperatures. It is also likely to increase the magnitude of extreme weather conditions like droughts, floods and storms. While there remains a question about the magnitude of impact, its consequences are highly likely to change the fate of many future generations and particularly affect the poorer sections of society. Climate change is expected to increase the number of poor by 2100 in developing and developed countries, while dominantly affecting the urban poor, and jeopardizing sustainable development. (Olsson, Opondo, et. al, 2014.)

Climate Change and policies related to it will affect poverty reduction efforts both through natural factors like natural disasters as well as economic factors like economic growth. The resulting climate change is likely to affect agricultural productivity and directly impact the local livelihood assets- access to clean water and natural resources, health, infrastructure, and the homes of the people living below the poverty line, especially in developing countries.

Climate change has the potential to push people that hover just above the poverty line into poverty. According to the United Nations Development Programme, developing countries, which hold a significant proportion of the world's poor, suffer 99% of the casualties attributed to climate change. If unchecked, it will push 132 million people into poverty over the next ten years, undoing hard-won development gains (World Bank, 2021). Climate change, according to the IPCC (Yohe et al., 2007), will impair countries' ability to reduce poverty and achieve sustainable development, as measured by progress toward the Millennium Development Goals.

There remains a concern about changing climate patterns on the highly vulnerable poor population of developing countries. Climate Change is expected to add to the misery of the already vulnerable people in these countries, acting as a threat multiplier. Moreover, it is suggested by prior research that climate change has the potential to increase the number of poor people in low-income, middle-income and high-income nations as well. While many countries acknowledge the impact of changing climate and take steps to promote sustainable development, many developing or middle-income countries slack in this regard. Ironically, these countries hold the poorest populations. Hence, the sole task remains to extend the adaptability of the affected, vulnerable and poor communities and countries, while continuing

to work on policies that promote- income per capita, especially in poor and middle-income countries, in a sustainable manner.

This paper focuses on understanding how livelihoods, lives of the poor people and poverty interact with changing weather patterns. While establishing a link between changes in climatic patterns and poverty to analyze the consequences of climate change on overall economic growth and poverty alleviation programs. This can be done through direct and indirect channels while ascertaining the global distribution pattern of poor people across countries using the Multidimensional Poverty Index (MPI). We will be looking at certain examples from underdeveloped and developing countries - Sub-Saharan Africa and Bangladesh - to understand poverty in the context of climate variability. The paper also sheds light on the attitude of various countries towards climate change and their policy actions to tackle it and poverty to get a comprehensive view of their welfare policies. And finally, we will be concluding with policy recommendations that we deem fit for the same.

2.0 Global Distribution of Poverty in Urban and Rural Areas

The definition and factors that determine poverty have significantly evolved over time. Following the years after World War II, monetary and economic factors took the center stage and helped determine the prevalence of poverty. However, into the late 20th century, other non-monetary indicators, like social participation, psychological well-being, and other well-being and happiness indicators, started playing an equally important role in conceptualizing poverty. Poverty is acknowledged to be multidimensional, and cannot be restricted to just monetary indicators. Poverty is also influenced by a group of other social, economic, political, institutional, and cultural factors. This multidimensionality is partly reflected in the Human Development Index (HDI) which is developed by the United Nations Development Programme (UNDP). The Human Development Index is a summary measure of achievements in major aspects of human development: longevity, literacy or education and a good standard of living (UNDP, n.d). Health is assessed by life expectancy and education is measured by average schooling for adults aged 25 years and more, and expected years of schooling for children of school entering age. Standard of living is judged by gross national

income per capita. The geometric mean is used to combine the scores from all three indices into a composite number. In climate change literature, the HDI is frequently employed as a poverty index (UNDP,n.d).

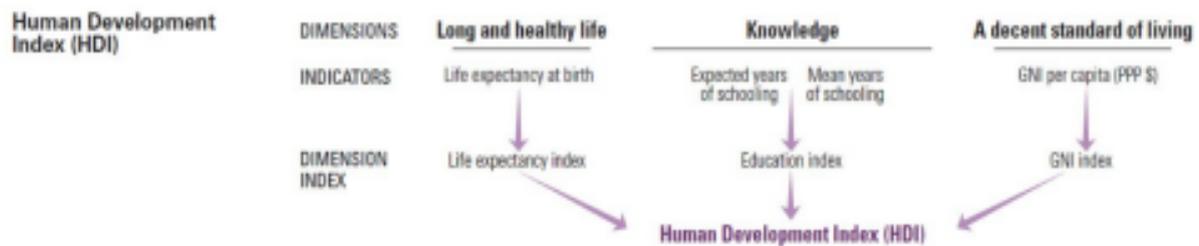


Image 1.0: Human Development Index (HDI)

Source: Human Development Reports, 2020

There are three main approaches to study poverty – the monetary approach, an approach that considers human capabilities and the approach that deals with deprivation related to social exclusion. Monetary Approach makes it easy to compare diverse countries and communities with vastly different cultural and social values. Literature on Poverty also makes a distinction between absolute and relative poverty. Absolute poverty represents those who lack sufficient resources to meet their basic needs to an extent that hinders their survival. A common method used for estimating the number of people living in absolute poverty involves the use of income thresholds. On the other hand, relative poverty examines whether or not a person is substantially deprived as compared with other individuals in his or her community, region, or country. Benchmarks of Relative poverty are based on what is considered to be the normal standard of living in a particular social context. In the context of Global Warming, absolute poverty measure is typically used in cross-country analyses and analyses focused on developing countries. Relative poverty is commonly used in developed countries.

The global Multidimensional Poverty Index (MPI) is one way of measuring progress against SDG. It was created by the Oxford Poverty and Human Development Initiative (OPHI) and the Human Development Report Office of the United Nations Development Programme (UNDP). The MPI uses the same indicators to estimate rural and urban poverty, so we can directly compare MPI poverty in rural and urban areas (Alkire, S., Chatterjee, M., Conconi, A.,

Seth, S., & Vaz, A., 2014). It is composed of three equally-weighted dimensions- health, education and standard of living, measured by ten indicators, which are equally weighted within each dimension. When a person is deprived of at least one-third of the weighted indicators, he or she is described as poor under the MPI. Of all the 105 countries that are MPI poor, 85% of the population live in rural areas. A common pattern shows that the incidence and intensity are higher in rural areas than urban areas across different regions in developing nations (Alkire, Chatterjee, et.al., 2014). It supports the international poverty line of \$1.90 per day by showing the extent of deprivations for each person. According to the MPI analysis, the majority of the MPI poor, urban and poor, live in South Asia. The rural-urban difference in the headcount ratio is significantly high in Sub-Saharan Africa and South Asia. The percentage of urban dwellers living on less than \$1.25 per day of poverty is also high for Sub-Saharan Africa and South Asia, but it tends to be much lower elsewhere. Notably, the majority of the world's poor live in what can be considered middle-income countries (Leichenko and Silva, 2014).

Poverty, in the context of climate change literature, is also distinguished on the basis of the time a person spends in poverty. Chronic Poverty is when a person has been poor for a long period of time, often since birth. Empirically, the probability that a person living in poverty for five or more years is likely to remain poor for the remainder of his life, is high. (Leichenko and Silva, 2014). Chronic poverty is likely to be intergenerational, passed on from parents to their children. Temporary poverty is when a person is poor for less than five years and it is usually due to external shocks like unemployment, change in weather conditions, etc. Whether climate change contributes to chronic poverty is still open to empirical research. Some of the anticipated impacts of climate change are positive (IPCC, 2001). For example, water-scarce regions of Southeast Asia may benefit from rising water levels. On the other hand, Developing nations are likely to be affected the most negatively, and only particularly due to Economic dependency on climate-sensitive sectors which are generally in the rural areas.

2.1 Climate Change and Poverty in Sub-Saharan Africa: A Case Study

Sub-Saharan Africa (SSA) is one of the most vulnerable regions to climate shocks, since a bulk of the world's extreme poor live here, and are also unexpected to escape this extreme

poverty (Beegle et al., 2016)), mostly due to the negative effects of climate change in African agriculture (Lotze-Campen, 2011). Low-Income households live in the driest villages of arid areas, and also in the extremely moist regions of wetter areas, resulting in an inverted U-shaped relationship between predicted income and precipitation (Angelsen & Dokken, 2018). According to research conducted by Azzarri and Signorelli (2020) across the Sub-Saharan African region, which is based on a large collection of nationally representative household survey data for 24 countries in the SSA, rain has been steadily decreasing in

Western Africa while the opposite happened for the overall temperature. In terms of evapotranspiration, proxied by the SPEI (SPEI is an extension of the Standardized Precipitation Index, which takes into account precipitation, temperature, and potential evapotranspiration in determining drought), there is a downward trend until the mid-1990s and then a slight increase, and especially a reduction in overall volatility can be observed. Flood exposure is linked to a 35% drop in consumption and a 17% point increase in extreme poverty. Per degree Celsius increase in temperature is associated with higher poverty rates of 2.8 percentage points and lower per capita consumption expenditures of 4.6%. Flood shocks yield a negative impact on total expenditure.

A drought shock, on the other hand, shows an ambiguous effect. The findings of the research are different for different regions in the SSA, while floods are associated with detrimental effects across all SSA, droughts are associated to bring better outcomes in Western Africa and, heat waves are associated with better outcomes in Central Africa. A flood shock is linked to a reduction of the total, and food consumption and an increase in poverty headcount ratios of about 50% to 60%. Smallholder farmers appear to be the most susceptible to weather variability, both for floods and droughts, compared to both large-holder farmers and non-farming households. For simulated future increases in weather shocks incidences, research shows an alarming effect on regional poverty rates, if the capacity to adapt remains unchanged in the SSA. The research evidence suggests that welfare and climatic conditions are likely to be correlated.

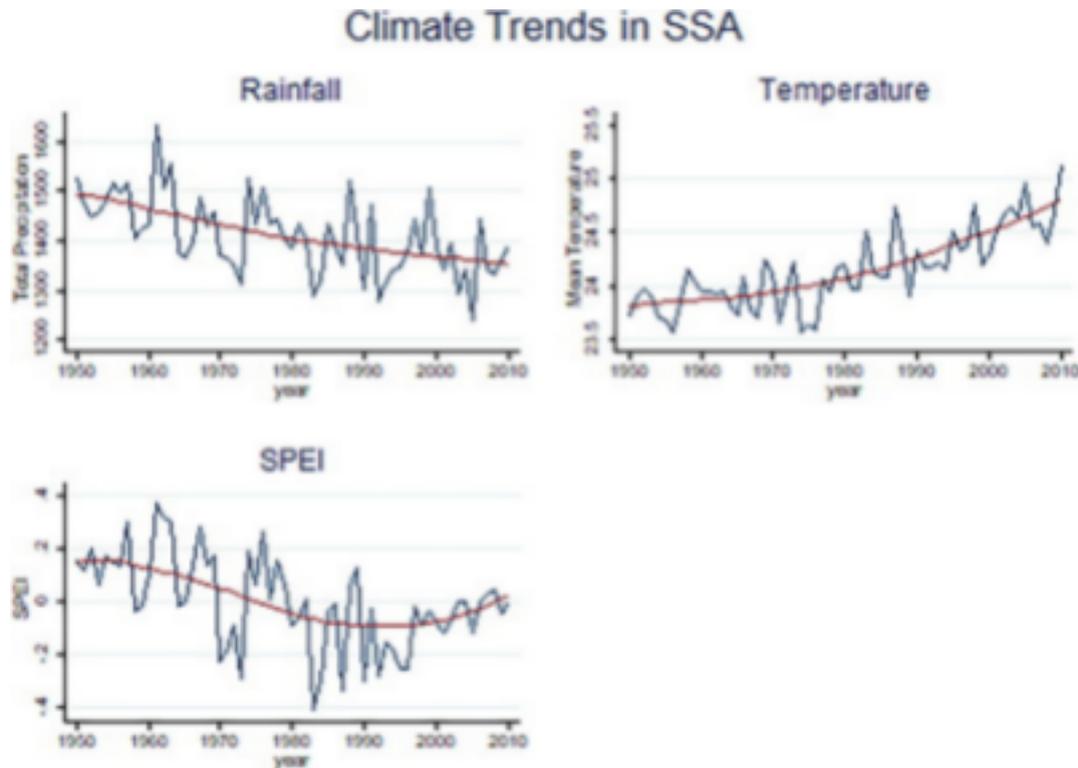


Image 2.0: Climate Trends in Sub-Saharan Africa

Source: Azzarri, C., & Signorelli, S. 2020

2.2 Other Examples

Bangladesh is another prime example that is vulnerable to climate change. The lives and livelihoods of people living here are frequently threatened by cyclones and associated effects, such as saltwater intrusion that makes agricultural land unproductive, due to its low-lying coastline, high population density and agriculturally-dependent economy. Between the years 1974 and 1998, the country experienced seven major floods (Matin, 1998). In 1998, about 68 per cent of the country's area was flooded. It affected 30 million people and resulted in 918 deaths (Choudhary, 1998), as well as a \$3.3 billion economic loss (equal to 8% of the country's GDP).

3.0 Poverty and Vulnerability to Climate Change

Poverty is a key factor that increases the vulnerability of people to climate change. The propensity of individuals having to suffer adverse consequences from climatic and other environmental shocks and stresses is vulnerable. By this means, this definition has an

“exposure” component, which reflects location in an area that is subject to climate hazards, and a “social” component, which depends on a range of community characteristics like economic, political and cultural factors that may increase susceptibility to harm by climate shocks. Extreme poor have a high propensity to be harmed by climate change for a variety of reasons, primarily because of their inability to recover from shocks due to lack of assets. Most poor people are dependent on agriculture for their livelihood which is a climate-sensitive sector, along with forestry, fishing, etc. Due to their informal nature, such jobs don’t provide security or protection to poverty-stricken people when climate-related shocks strike, and also due to lack of education and knowledge about coping and adapting mechanisms, they are left with fewer livelihood options hence almost trapping themselves to life-long poverty. Monetary methods or HDI are usually used as indicators of social vulnerability to climate change. There are a group of factors, like social exclusion, failed government development and welfare policies, lack of education and capabilities, lack of assets and other external shocks, that increases the vulnerability of already vulnerable people. Especially for developing countries, limited land ownership, lack of alternative livelihood options, lack of market access, degradation of natural resources for development or ‘welfare’ projects of the government that potentially hurts the poor people whose livelihood depends on it, etc. are another set of factors in addition, that increases the vulnerability of poor people. Urban working conditions for the urban poor in developing countries increase the vulnerability of urban poor as well due to hazardous environments, weak infrastructures and governance.

Low literacy rate and lower emphasis on education, especially in poorer regions, and regressive attitudes in most developing countries mostly pertaining to gender relations and roles, make low income or poor women more vulnerable to their male counterparts. Currently, around One Billion people live in extreme poverty on less than \$1 a day-two-third of which are women (OECD, 2001). Although climate change is majorly discussed in developing countries or middle-income countries’ contexts, poor people of advanced nations are also vulnerable to climate change, especially in the USA. This vulnerability of poor people of advanced countries is mostly related to infrastructure and the provision of urban services. Rural agriculturists are often considered most susceptible to climate shocks and stresses, due to their reliance on

agriculture and natural resources, particularly in drought-prone regions. Living in low-lying coastal zones or in informal urban settlements, as well as poor nutrition and health status, are other commonly accepted indications of climatic change. However, identifying poor populations living within these exposed regions still remains a key research challenge.

	Undernourished ²² (Total Population in Millions, 2007–2009)	Urban Slum Residents ²⁶ (Total Population in Millions, 2012)	Resident of Low-Lying Coastal Zone ²⁶ (Total population in Millions, 2000)
Global	867	N/A	634
Developing World	852	863	527
Selected regional breakdown of developing countries			
East Asia and Pacific	245	724	361
Latin America and Caribbean	50	36	29
South Asia	311	207	135
Africa	220	226	56

Image 3.0: Potentially climate exposed Population

Source: Leichenko, R. & Silva, J., 2014

The impact of climate change and the vulnerability of poor people of different countries to climate change vary greatly, but climate change is generally superimposed on already existing vulnerabilities and is likely a compound of existing poverty. Climate change will increase the level of the sea while reducing the availability of drinking water, with an increase in incidences of floods will increase food shortages, especially in developing countries. In areas with limited livelihood earning choices, reduced crop yields threaten famines, or where the loss of landmass in coastal regions is predicted, relocation might be the only solution. Its impact is likely to be more striking on the developing countries because of their climatic and geographical conditions, due to their high dependence on nature for livelihood and survival and also due to their limited capacity to adapt to changing environments. In these countries, the extreme poor who have even meagre access to resources and the least capacity to adjust to changing environmental patterns are the most vulnerable. Projected Changes in the frequency duration and rate of climate extremes as well as changes in average temperature will notably threaten their livelihoods, which will further broaden the inequities between the developing and advanced worlds. Hence, climate change poses a serious threat to poverty eradication and

makes vulnerable groups more vulnerable. Persistent poverty and Inequality are the most notable conditions that shape climate-related susceptibility (Ribot, 2010).

4.0 Impact of Climate Change

Prior Research on the impact of climate change on poor people has categorized them into direct and indirect channels. Direct channels' postulate direct causal relations between market responses, biophysical changes, and poverty outcomes. Indirect channels hypothesize that chains of causality between climate exposure and poverty are complex and influenced by individual and household characteristics and other factors such as decision-making processes, socio-economic conditions, and quality of institutions and governance. Indirect channels also highlight the effects of climate change on factors that are thought to contribute to poverty like political conflict or poor health status, stressing that climate change overlaps, interacts with, and often multiplies the effects of other social, economic, and environmental stressors.

This section highlights the impact of climate change on different areas of human life, particularly focusing this impact on poor households, such as studies of agricultural production and food prices, livelihoods and ecosystems services, health, migration and conflict. These may not be inclusive of all climate-poverty impacts, but these highlight key areas. The direct impact of climate change on poverty is most prominent among agricultural production channels and food prices. Water is another major yet overlooked aspect of climate change. Indirect channels of impact are prominent in works that explore livelihood vulnerabilities. We will examine how climatic shocks and stresses are affecting the resource-based livelihoods of rural and indigenous populations.

Climate change impacts themselves may arise in the form of either shorter-term shocks, disasters and/ or climate extremes (drought, heatwaves, flood and storms), or longer-term stresses, such as sea-level rise, water scarcity, increased seasonal variability and overall changes in rainfall and temperature patterns. Effect on food prices is first and foremost evident when climate adversity hits and is the most important one. Climate change affects the natural resources, on which many livelihoods depend. Poor and extremely poor of the world, whether in developing, underdeveloped or developed, operate at the earth level and are the ones that are

most connected to nature, especially through their way of earning a livelihood and the food they grow themselves or get from nature itself. With the persistence of rising global temperature and change in rainfall patterns and other changing weather conditions, land and agriculture are directly hit at their root which causes a series of other multifold effects that causes trouble for the poor that are majorly dependent on nature for their survival. Food prices may increase under climate change due to a decline in crop yields and climate policies that constrain land uses for land production. Even with adaptation to changing circumstances, food prices will still be affected by climate change impacts on agricultural productivity, including through extreme events, diseases and pests. (Knox, et. al., 2012).

According to the IPCC report (2014), global warming could lead to increases in food prices by 3 to 84% by 2050 if the effect of CO₂ fertilization is disregarded. With the fertilization effect taken into account, uncertainty is much larger and the increase then ranges from -30% to +45% by 2050. The model of the IPCC report ignores the effects of ozone, pests and disease, and hence underestimates the uncertainty, which is why the possible increase in food prices is likely to be even more. These are also global estimates, with the possibility of much large local change, especially in places not well connected to global markets. In addition to this, land use climate policies that aim to increase the use of bioenergy and reduce deforestation emission, forest degradation emission and other forest-related emissions would lead to an increased scarcity of land and thus increase domestic market prices of food crops and will likely decrease food consumption (Kuik, 2013). Poor spend a significantly larger percentage of their budget on food in all regions, hence they are more vulnerable to this price rise of food, even though everybody is exposed to the same price rise in food. The net impact will however vary, considering that most poor people have their livelihood dependent on agriculture and these food prices may actually benefit them. So the net impact will vary based on whether they are net food consumers or producers (Ahmed et al., 2009; Devarajan et. al., 2013). It will also depend on their connection to larger food markets, and also on their ability to adapt to these high prices, like by modifying their diets towards cheaper crops or relying more on imports than on local produce. Without changes in productivity and returns in agriculture, a rise in food prices could increase poverty rates considerably.

Ivanic and Martin (2014) find food price increases unrelated to changes in productivity and wages raise poverty in most developing countries in the short-run: a 10% price increase leads to a 0.8 percentage point increase in poverty headcount rates; a 50% price increase, 5.8 percentage points; a 100% price increase, 13 percentage points. In countries where most poor are wage earners or urban labourers, large productivity losses in agriculture can increase poverty via consumption channels. Productivity shocks resulting from an increase in the frequency of weather extremes could worsen poverty in developing countries. Of this, urban poor are the most vulnerable group as they spend more share of their income on food than rural poor. The poverty-related effects of climate change are more problematic for rural agricultural producers. For farmers living in a region affected by a climate-related shock, such as a large-scale drought, reduced production, and loss of income can directly contribute to food insecurity and poverty. For farmers who are not living in an affected region, increased food prices may potentially mean higher market prices for their produce, which may help to compensate for increased consumption and production costs otherwise. Although research is more focused on the developing world, the climate shocks of food prices aren't limited to the developing world but will also affect developed countries, though such effects are muted by social safety nets. Climate change has a highly uneven impact across countries, with the greatest poverty-inducing consequences happening among urban and non-agricultural households in low-income African and South Asian countries, but with potentially poverty alleviating effects among agricultural households in some countries in East Asia and Latin America. (Leichenko and Silva, 2014). If climate change increases weather volatility which it most likely will, then poverty will increase and affect the poor and especially the extremely poor, but if it decreases volatility then poverty is expected to decrease.

Climate Change can affect productivity in different sectors, which in turn affects the returns to land and labour which affects income. This presents the “other side of the coin” aspect of the above Food Price theory. Climate Change predominantly affects agricultural land productivity with gains in some places and losses in others. World Bank (n.d) states that nearly more than 75% of the workers in Sub-Saharan Africa are in the agricultural sector and 95% of them are poor farmers. Crop productivity is anticipated to be affected by increases in average global

temperatures, changes in rainfall patterns and frequency, carbon fertilization from higher CO₂ concentrations, diseases/pests, water run-off/regulation, and soil erosion. The estimated mean biophysical yield effect (without CO₂ fertilization) is a 17% reduction in crop productivity by the year 2050 relative to a scenario with unchanging climatic conditions (Nelson et al., 2014), with rising risks to soybean, maize and wheat in most producing countries by 2050 (Fernandes et al., 2012). In Bangladesh, climate change is estimated to reduce long-term rice production by an average of 7.4% each year through 2050, with the potential to lower GDP by an average of 1.15% each year (Yu et al., 2010). As for water and marine-culture productivity, economies and fishing societies in tropical or subtropical countries, especially in South Asia, East Asia and the Pacific, could experience a considerable loss in production potential (Allison et al., 2009). Another obvious consequence of rising overall temperature would be the inability of the labourers to work in such extreme conditions and heat, further decreasing their labour productivity. According to DARA, (2012) this reduction in labour productivity alone could account for up to 56% of the total economic costs due to climate change in 2030. The poverty impact in this regard would be most associated with the population earning their livelihood or are self-employed through channels that show such adverse effects of productivity and return.

Another direct impact of climate change is through its effect on energy prices, energy Prices may be affected through direct impacts like reduced availability of water for thermal and hydro based energy generation but also by climate mitigation policies (Hallegatte, S., Bangalore, M., Bonzanigo, L., & Fay, M.,2014). People are affected by changing energy prices and taxation as consumers but also as payers of public spending and for some as workers as well if it affects competitiveness and job creation. A rise in prices of energy resources this way will hence increase poverty if it is not offset by an increase in energy efficiency (Ürge-Vorsatz and Herrero, T., 2012). Impacts on poverty will also depend on household exposure and vulnerability to changing climate, the need for energy consumption (which depends on the climate and economic activity), and also the ability to shift from one energy source to another. In developing or middle-countries, prior studies have focused on the reform of fossil fuel and energy subsidies, which poses similar distributional challenges (Clements et al., 2013). Although energy subsidy reforms and carbon taxes have the potential to harm the poor, they

can also generate resources that can be utilised to compensate the poor (World Bank, 2014). As the poor generally benefit less than the non-poor from energy subsidies, compensatory policies can more than offset negative impacts from a reform (Hallegatte, S., Bangalore, M., Bonzanigo, L., & Fay, M., 2014). Third, land prices are also affected by climate shocks and policies that constrain land availability. In Paris, it was estimated that a strict flood zoning policy preventing all new development in the floodplain will raise rents, although by a small amount. In places that are growing faster and have a larger fraction of land exposed to flood, this effect is more significant. This increase in housing and land costs could have a direct impact on poverty reduction. It slows down the migration of rural people to urban areas, through which poor people access better salaries, livelihood, health care and education for their children. Land use-based mitigation policies could also raise land values through subsidies for certain activities (e.g. production of bioenergy) or payment for ecosystem services like techniques for carbon insulation or sequestration. Larson et al. (2013) suggest that this could also induce competition for land in which wealthier and richer and more powerful land users can oust the poor, who often lack secure formal land titles. Increases in land prices may also challenge the ability of the poor to access land, whether by buying or renting or using it illegally, for instance when they migrate to cities.

Food, land, and energy rates are affected by macroeconomic policies such as trade policies, and market regulations. Many markets in poor countries are inadequate and are frequently disturbed by market incompleteness and failures, potentially worsening consumption and price impacts of climate change. A more open economy will be less exposed and less vulnerable to local shocks but more exposed to imported shocks. The net impact will be dependent on the type of shock and local context. Agriculture holds utmost importance as a livelihood sector in the least developed countries, especially for the people living in the rural or village areas. Climate change has the ability to worsen the prevalence of hunger directly by affecting production adversely, and indirectly affecting purchasing powers of those living in poverty. Land degradation, price shocks, and population growth are already some of the major concerns for sustaining agricultural productivity. Changes in temperature, precipitation patterns and frequency, and intense weather conditions will add to the stress on agricultural resources in many developing countries and reduce the land quality for agricultural production. Access to

fertile and productive land is essential for reducing rural poverty and hence inequality, the impacts of climate change on the productivity of land will further prove counterproductive to efforts to combat rural poverty. The impact of climate change on food availability will be a major concern for Africa. Low-lying coastal communities will deal with rising sea levels and the impact of climate change on marine resources as well. An increase in sea level may lead to salinization of water and render agricultural areas unproductive. In areas where fish constitute a significant portion of meals for poor people, declining and migration of fish stocks due to climate variability and associated changes in the nearby water ecosystem will further need to be considered in their impact on the local food availability and security.

Water scarcity is already a major concern for the world's poor. The number is projected to increase from about 1.7 billion to around 5 billion by 2025, independent of climate change (IPCC, 2001). It is anticipated that changing weather patterns in many arid regions, particularly in the subtropics, will further reduce water availability due to the increasing frequency of droughts, increased evaporation, and changes in the rainfall patterns. Precipitation is expected to increase in areas that tend to suffer less from water scarcity. With rain expected to increase in water-dense areas, the incidence of floods may increase, jeopardizing human settlements, infrastructures and livelihoods. Increases in temperature and changes in precipitation are expected to accelerate the retreat and loss of glaciers. The melting of glaciers has become a serious concern over the past few years, this adds to the pressure of already rising sea levels.

Another consequence of climate change on the lives of poor people, albeit indirectly, is its impact on assets. By affecting the return on investments, climate change carries huge potential to negatively affect the ability of households to accumulate wealth or assets. Firstly, it can directly affect the natural and physical assets of the people through extreme weather conditions causing disasters like droughts and floods. From instances of so many countries, we know that floods can wreak havoc on the lives of the people, damaging their homes, property and assets that are physically present with them. Although weather departments of various countries (this mostly happens in countries with better climate technology) may or may not accurately issue a warning, most poor, especially poor or underdeveloped countries, have inadequate resources to actually take actions to safeguard their wealth or assets when adversity

hits. Hence households holding less-transferable and less-diversified assets, like in the case of poor people, will be disproportionately hit by rapid changes in climatic patterns. Climate changes can also disincentivize the need to accumulate assets in the first place. Increased perception of climate changes and loss of assets or uncertainty, may make people less willing to invest and save for the future. For example, after the Ethiopian famine of 1984-85, it took asset-poor households an average of 10 years, to bring livestock holdings back to their pre-famine levels (Dercon, 2004). It is observed that asset-rich households are expected to smooth out their consumption after any shock while asset-less households may smooth assets and destabilize and reduce consumption in an effort to safeguard the small productive resources they still possess (Carter & Barrett, 2006). Further literature in this context suggests that the asset impact of climate change has great potential to keep the poor population poor and further pull down the less poor but equally vulnerable population into poverty. This hits hardest to the population with inadequate social protection, limited credit access and smoothing instruments. As for the impact on physical asset holdings of the poor population, Dercon (2004) finds that in Ethiopia, where cattle accounts for more than 90% of the household wealth, poor rainfall years increases the livestock mortality to 25%-35%. While the poor may not always be the most exposed population to shocks of climate change and natural disasters that destroy assets, evidence suggests that when hit, they lose a greater percentage of their assets (Hallegatte et al., 2014).

Many countries are trying to come up with environmentally-conscious policies to tackle climate change, via predominantly the use of regulations, however, these pollution-reducing regulations are such that are sub-optimal at best and hit the poor people the most due to their ownership of most of the lesser-expensive pollution producing assets. This we see particularly in the field of agriculture. Some countries extend their policies to mandating the use of green technology in the pollution-causing industries, however, they fail to take into account the cost of these green technologies which are much more expensive, for the poor people, and only benefit them marginally if they do, putting them at a disadvantage yet again. Possible non-agricultural or less direct impacts of climate change on human health would increase vulnerability and reduce opportunities by impairing education and employability. Building

health and education are important pathways to escape poverty. This is especially important for children and future generations, as this paves the way to end intergenerational poverty. Although any attempt at predicting and gauging the impact of climate change and extreme weather conditions on human health is a complicated task, it is highly likely that climate change will have both direct and indirect adverse effects on human health and good health is key to getting a good education and being able to earn a standard of living for themselves. It is observed that after a climatic shock such as a natural disaster when food scarcity persists which we know is much more prevalent in poor households, children and women are most vulnerable as men are preferred first to have a meal as in most households men are the ones making the living for the entire household and need proper nutrition to sustain a living for everyone. Women and children are dependent in such cases and lack the necessary nutrition to sustain themselves, this, especially for children, creates a problem as their mortality rate rises drastically in such events and in other cases also creates a problem for them to be able to pursue a good education and end this perpetual state of intergenerational poverty. A straightforward impact is an increase in temperature-related illnesses and mortality. Intense and prolonged heat waves with humidity may increase mortality and morbidity rates, particularly among the elderly and the poor in urban areas. Another direct and devastating effect will be increased death and injury from extreme weather events such as flooding, landslides, droughts etc. Over 96% of disaster-related deaths in recent years have taken place in developing or middle-income nations (World Bank, 2001). Changes in temperature and rainfall patterns also give birth to a range of vector-borne diseases such as malaria and dengue. Malaria contributes to prenatal mortality, low birth weight and anaemia (WHO, 2002).

Climate changes degrade and reduce potable water supplies and increase water-borne diseases such as cholera and diarrhoea, particularly in areas with inadequate sanitary infrastructures. Poor sections of the society in developing countries already lack adequate access to safe drinking water and sanitation, have poor hygiene practices that are causes of ill health and life-threatening diseases in developing countries. Women are especially vulnerable to water-borne diseases due to their exposure to traditional household chores, especially in low-income countries. Worsening health conditions are not just limited to the aftermath of

natural disasters, but also occur as a result of a decrease in agricultural yield that results from climate variability. Food Security is already an issue in many countries, the prevalence of climate change is anticipated to add to the misery, increasing the incidences of stunting and malnutrition and as history has it the poor population of the poor countries suffer the most.

Lloyd et al. (2011) developed a model for estimating future patterns of malnutrition caused by climatic and non-climatic factors and they find that climate change will lead to an increase in stunting of 1-29 per cent in 2050 compared to a future with no climate change while severe stunting could increase by up to 23 per cent in Sub-Saharan Africa and 62% in South Asia region even when accounting for economic growth (Hallegatte, S. et al., 2014). Climate change is also expected to alter the social relationship and behaviour of people. Ranson (2014) finds a strong correlation in the United States between crime and violence and temperature rise and suggests that climate variability will increase murders, rape, assaults and other violence. An increase in crime in the developed world is largely associated with psychological factors whereas, in lesser developed worlds, it's usually the decrease in income affected by climate change. The meta-analysis of Burke et al. (2014) suggests that interpersonal disputes rise by 1.2 per cent and intergroup disputes increase by 4.5 per cent when temperature deviates by one standard deviation. Underdeveloped and middle-income countries lack the safety net to safeguard the poor population making them the most vulnerable to any climate stresses. Lack of security is also one of the ultimate threats to poverty reduction and well being of the poor. Not only via food and livelihood shocks but climate change also leaves its dark footprint in basically all areas of human life, especially for the most vulnerable population of the poor people which lack the capabilities and necessary safety nets to bounce back from the stresses and shocks. Even if minute, one effect opens a series of further effects which puts them in the most disadvantaged group of people to be affected by climate change.

5.0 Establishing Relationship between Climate Change, Economic Growth and Poverty

Over 1 billion people live in extreme poverty - two-thirds of them women - on less than US\$1 a day. Using a standard of \$2 a day, this figure translates roughly to 2.8 billion (OECD, 2002). Poverty will increase as a result of climate change. Developing nations will be hardest hit by its antagonistic impacts due to their geographical and climatic conditions, high

dependence on natural resources, and limited capacity to adapt to climate change (*The Oxford Companion to the Economics of Africa*, 2011). It is the poorest in these countries who are most vulnerable due to their lack of resources and ability to adapt. Climate extremes (such as heatwaves, heavy precipitation, and drought), as well as changes to the average climate, will endanger the livelihood of poor people - further edging the development gap. Therefore, climate change poses a serious threat to poverty eradication. However, current development strategies do not take climate change risks into account. It is imperative to adopt an approach that incorporates both mitigation and adaptation. The current method to mitigate the impact of climate change by limiting greenhouse gas emissions (GHG) won't stabilize atmospheric concentrations of these gases. To complement climate change mitigation efforts, developing adaptive capacity and strength to minimize the adverse effects of climate change on livelihoods is essential.

So, climate change adaptation, which involves reducing vulnerability to climatic conditions, plays an important role in poverty eradication policies. Instead of focusing on adaptation as a separate activity, separate from other environmental and socioeconomic concerns that impact the development of the poor, a comprehensive approach should be used. This approach should take into account both harmonious and hostile relationships among local and global environmental changes and socioeconomic factors.

Climate change has finally been accepted by the scientific community over the past few years. Since the beginning of the twentieth century, climates in different parts of the world have changed rapidly, in a way that has never before been seen. Nearly all geographical regions have experienced an increase in maximum temperatures, number of hot days, and heat index during the second half of the 20th century. There is sufficient evidence that the observed global warming over the past half-century is largely due to human activity. The average global surface temperature is expected to increase from 1.4 to 5.8°C by 2100 compared to 1990 (OECD, 2002). In many regions of the world, there is growing evidence that regional climatic shifts have contributed to various changes in physical and biological systems. Variations in climatic circumstances have caused glaciers to decrease, permafrost to thaw, changes in rainfall frequency and intensity, shifts in the growing season, early flowering of trees and emergence of

insects, and adjustments in the distribution ranges of plants and animals.

Climate change can be seen at the regional level in variations in:

1. Average climatic conditions. Some locations, for example, may become drier or wetter on average.
2. Variability in the climate. Some areas, for example, may get more unpredictable rainfall.
3. Extreme event frequency and magnitude.
4. In comparison to 1990, sea levels are expected to rise by 0.09 to 0.88 meters by 2100. (OECD, 2002)

5.1 Impacts of Climate Change, Vulnerability, and Adaptive Capacity (OECD, 2002)

Table 1:

Region	Likely Regional Impacts of Climate Change	Vulnerability and Adaptive Capacity
Africa	<ul style="list-style-type: none">● Extreme events, like floods and famines, occurring more frequently would place a strain on water supplies, human health, and infrastructure, limiting development.● Desertification would be exacerbated by changes in rainfall and increased land usage (particularly in the Western Sahel and Northern and Southern Africa).● Grain yields are expected to fall, putting food security at risk, especially in small food-importing countries.● Coastal settlements, flooding, and coastal erosion would all be affected by rising sea levels, particularly along the eastern Southern African coast.	<ul style="list-style-type: none">● Due to low GDP per capita, widespread poverty (the number of poor rose during the 1990s), unbalanced land distribution, and low education levels, the adaptive ability is low. Furthermore, in the aftermath of agricultural calamities, social safety nets have ceased to exist.● Individual desertification coping techniques are already stressed, resulting in increased poverty. Rain-fed agriculture is very reliant.● Within 100 kilometres of the coast, more than a quarter of the population resides. The majority of Africa's major cities are located around coastlines, making them vulnerable to sea-level rise, coastal erosion, and extreme weather.

	<ul style="list-style-type: none"> ● Major rivers are very vulnerable to climate change and may face reduced runoff and water availability, hurting agriculture and hydropower systems and perhaps increasing cross-border tensions. ● In some regions, the frequency of some extreme events is increasing. 	<ul style="list-style-type: none"> ● Food security, water resources, natural resource productivity and biodiversity, human health, desertification, and coastal zones all need to be recognized as key concerns as a result of climate change. ● The degree of civic order, political openness, and solid economic management will determine adaptive capacity.
Asia	<ul style="list-style-type: none"> ● Floods, droughts, forest fires, and tropical cyclones have all become more common in temperate Asia. ● Food security in the desert, tropical, and temperate Asia would be harmed by thermal and water stress, floods, droughts, sea-level rise, and tropical storms. ● Agriculture in the north would expand and become more productive. ● Land degradation and desertification may be exacerbated by reduced soil moisture in the summer. ● Tens of millions of people might be displaced when sea levels rise and tropical storms intensify across temperate and tropical Asia's low-lying coastal districts. 	<ul style="list-style-type: none"> ● Social structure, culture, economic capacity, and environmental deterioration all influence adaptive capability, which differs by country. ● Water and agriculture, water resources, food security, biodiversity conservation and natural resource management, coastal zone management, and infrastructure are all areas of importance. ● In some parts of Asia, capacity is growing, as evidenced by the success of early warning systems for extreme weather occurrences in Bangladesh. However, it is still hindered by a lack of resources, income disparities, inadequate institutions, and technological limitations.
Latin America	<ul style="list-style-type: none"> ● In locations where snowmelt is a major water source, the loss and retreat of glaciers would have a negative influence on runoff and water availability. 	<ul style="list-style-type: none"> ● Adult literacy, life expectancy, and access to safe water are among the social metrics that have improved since the 1990s. ● Other factors, such as high infant mortality, low secondary school enrolment, and significant

	<ul style="list-style-type: none"> ● Floods and droughts would become more often, resulting in lower water quality in some locations. ● Increases in tropical cyclone strength would alter the dangers of heavy rain, flooding, storm surges, and wind damage to people, property, and ecosystems. ● Sea-level rise would have a negative impact on coastal human settlements, productive activities, infrastructure, and mangrove ecosystems. 	<p>wealth disparity, however, also contribute to a lack of adaptive ability.</p> <ul style="list-style-type: none"> ● Agriculture, fisheries, water resource management, infrastructure, and health are all areas of importance.
<p>Small Island States</p>	<ul style="list-style-type: none"> ● For the next 100 years, sea levels are expected to rise by 5 millimetres every year. ● Greater soil erosion, land loss, poverty, human displacement, increased risk from storm surges, diminished coastal ecosystem resilience, saltwater intrusion into freshwater resources, and high resource costs to respond to and adapt to changes would occur over years. ● Bleaching and reduced calcification rates owing to increased CO₂ levels would be detrimental to coral reefs; rising temperatures and rapid sea-level rise would be detrimental to mangrove, seagrass beds, and other coastal habitats, as well as the species associated with them. 	<ul style="list-style-type: none"> ● Small island states have a poor adaptive capacity of human systems and a high sensitivity to climate change; they are anticipated to be among the countries most severely impacted by climate change. ● Concerns include food security, water resources, agriculture, biodiversity and coastal management, and tourism. ● Islands with limited water supplies are particularly vulnerable to climate change's effects on the water balance. Reef fisheries, individuals who rely on the fisheries for a living, and those who rely on the fisheries as a substantial food source would all be harmed if coastal ecosystems deteriorated. ● Small islands are especially vulnerable to climate change, both for domestic food production and for cash crop exports, due to a lack of arable

		area and soil salinization. <ul style="list-style-type: none">● Climate change and sea-level rise will severely affect tourism, which is a major source of revenue and foreign cash for many islands.
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Source: OECD, 2002

Climate change has diverse effects in different parts of the world (See Table 1). Climate change does not always have a negative influence on society. It also offers a few advantages. Increased water availability, for example, may assist water-scarce regions such as Southeast Asia. Developing countries, on the other hand, are among the first to bear the brunt of climate change's negative consequences. This is primarily due to these countries' weak human, institutional, and financial capacity to foresee and respond to climate change's direct and indirect effects, as well as the economic importance of climate-sensitive sectors (such as agriculture and fisheries).

6.0 Response of the United Nations towards Climate Change and its Impacts

Climate change affects every country on every continent. It is destabilizing national economies and endangering people's lives. Although the COVID-19 pandemic's travel restrictions and economic slowdowns are predicted to lower greenhouse gas emissions by about 6% in 2020, this improvement is only temporary. Climate change isn't going away anytime soon. After the world economy recovers from the pandemic, emissions are expected to rise again. (The Paris Agreement | UNFCCC, 2020) To save lives and livelihoods, both the epidemic and the climate calamity require quick action.

The Paris Agreement on Climate Change

The historic Paris Agreement, a legally binding international treaty on climate change, provides countries with the opportunity to strengthen the global response to climate change by keeping global temperature rise well below 2 degrees Celsius this century and pursuing efforts to keep it even lower at 1.5 degrees Celsius. On December 12, 2015, 196 Parties agreed to it at the United Nations Conference on Climate Change (COP 21) in Paris, and it took effect on

November 4, 2016. (The Paris Agreement | UNFCCC, 2020) In comparison to pre-industrial levels, the goal is to keep global warming below 2 degrees Celsius, preferably 1.5 degrees Celsius. Countries seek to accomplish global peaking of greenhouse gas emissions as soon as feasible to achieve this long-term temperature objectively, culminating in a climate-neutral world by mid-century. Because it is the first time that a legally binding pact binds all nations together to combat climate change, the Paris Pact is a watershed point in the worldwide climate change process.

How does the Paris Agreement Work?

- **Nationally Determined Contributions (NDCs)** Explanation: The Paris Agreement's implementation necessitates economic and societal adjustments based on the most recent available data. The Paris Agreement is set up on a five-year cycle, with each year requiring countries to adopt more ambitious climate action. National climate action plans, also known as Nationally Defined Contributions (NDCs), must be submitted by 2020.
- **NDCs:** In order to reach the Paris Agreement's targets, countries must declare steps they will take to reduce greenhouse gas emissions in their NDCs. In their NDCs, countries also outline the activities they plan to take to build resilience and adapt to the effects of rising temperatures. (The Paris Agreement | UNFCCC, 2020)
- **Long-Term Plans:** The Paris Agreement requires countries to prepare and implement long-term low-carbon development plans by 2020 in order to effectively demonstrate their commitment to the long-term goal (LT-LEDS). The NDCs benefit from the long-term perspective afforded by LT-LEDS. Unlike NDCs, they aren't necessary.

How are countries supporting one another?

The Paris Agreement establishes a framework for giving poor nations financial, technical, and capacity-building support.

- **Finance:** The Paris Agreement maintains that wealthier countries should take the lead in providing financial assistance to less-developed and vulnerable countries, while also, for the first time, inviting voluntary contributions from other Parties. Because large-scale expenditures are necessary to considerably cut emissions, climate financing is required for mitigation.

Climate finance is particularly crucial for adaptation, as large sums of money are required to adapt to and minimize the negative effects of climate change.

- **Technology:** The Paris Agreement sets a goal of fully adopting technological development and transfer to promote climate change resilience while cutting GHG emissions. It lays out a foundation for ensuring the Technology Mechanisms' smooth operation. The mechanism is increasing technology development and transfers through its policy and implementation arms. (Pooran Chandra Pandey, 2021)

- **Building Capacity:** Many of the concerns raised by climate change are beyond the reach of many underdeveloped countries. As a result, the Paris Agreement places a particular emphasis on poor countries' climate-related capacity-building activities and encourages the wealthier countries to enhance their support.

7.0 Policy Recommendations

Responses to climate change interact with socio-political processes to affect the welfare and climate-resilient pathways, and in turn, livelihoods and poverty. Climate policies include responses by governments, non-governmental organizations, bilateral and multilateral organizations and individuals and communities. These policies are formulated and meant to have a positive effect on sustainable development or play a neutralizing role in case of other damaging effects other development and welfare policies might have. Yet so far, as suggested by empirical evidence, the positive impact of adaptive and mitigation policies in terms of poverty and climate change have been limited. As the problems of climate change and poverty are generally in tandem with each other, we must collectively formulate ways at national and international levels to tackle them both, that means, formulating policies that tackle climate change byways of reducing the emission of GreenHouse Gases while also working with policies that contribute to enhancing the robustness of poverty alleviation programs already set in place, because reversal of the damage to climate is anticipated to take a long time and also as evidenced by prior research the recovery from damage from climate shocks already done is a long and slow process, and hence asks for safety against any future shocks that are due to occur.

IPCC (2018) estimates that current mitigation responses of countries undertaken at the national level under the Paris Agreement would not limit the average global temperature to 1.5, which is a threshold safe level of temperature. A complete reduction in net emission by 2030 is required to limit global warming to 1.5° Celsius. Adaptation and mitigation are anticipated to be more challenging for ecosystems, food and crops and health systems at 2° Celsius global temperature than at 1.5° Celsius. Policy measures that can be taken that limit this rise in temperature include limiting the cumulative carbon emission via ways of Carbon Dioxide Removal (CDM). Potential CDR Measures include afforestation, land restoration and soil carbon sequestration, DACCS (direct air carbon capture and storage), enhanced weathering and ocean alkalization. Most CDR measures have a significant impact on land, energy, water and nutrients. The sustainability and Feasibility of most CDR policies undertaken at the national level can be enhanced by a portfolio of options deployed rather than one single measure. One such measure to reduce carbon emission is to help the poor transition from traditional cooking energy fuels to renewable green energy fuels. Globally, residential biomass burning for cooking and heating is responsible for approximately 18% of carbon emissions (Bond et al., 2007). The majority of the poor population, particularly in SSA and South Asia, still relies on traditional biomass sources for cooking and heating (IEA, 2016) and traditional sources like fuelwood are said to contribute a significant amount to carbon emission. Policies actions can be undertaken at the local level to promote the use of cleaner-burning cooking technology like greener fuels while reducing the use of fuelwood in general in rural areas particularly, which can help reduce carbon emission. This can be used by ways of providing cleaner technologies to the rural population at lower rates, using promotional and educational methods to educate and sell the same to the rural population, increasing the availability of cleaner fuels and cooking technology in rural areas.

Recently there has been a rise in electrical kitchen appliances, which provide us with another pathway to reduce this dependence on traditional cooking fuels, however, their usage remains mostly limited to urban areas and are not much popular amongst the rural population. They may pose feasibility challenges in terms of cost and adaptation may take time for the rural population, but with appropriate educational workshops and selling them at subsidized rates,

we might see lower carbon emissions. This may seem to pose considerable stress to the government budget with subsidies, however in reality, electrical appliances have proven to be efficient and energy saving, while saving budget for the government and also proving sustainable in long term. Smith (2014) argues that “It is sometimes ignored that electricity is part of the solution to cleaner cooking. In the developed world, electric cooking devices include a wide range of appliances that are now starting to appear in comparatively poorer regions as well, such as rice cookers, water pots, microwaves, and specialized devices often tailored to local food needs. These do recurring household tasks easily and efficiently with no pollution at least at the household level and can be expected to become increasingly important as electrification progresses. Electrification of kitchen appliances combined with renewable sources of electricity will prove highly sustainable. Depending on socio-economic conditions in the future, limiting global temperatures to 1.5° Celsius compared to 2° Celsius is likely to prove less devastating and life-uprooting for people, and may even reduce the fraction of the world’s population exposed to an increase in water stress induced by climate change, by up to 50%.

Second, in the impact section, we focused on the impact on Energy prices as impacted by changes in the physical environment and also mitigation policies. Carbon Taxation is a widely used mitigation policy measure to reduce carbon emission, which ultimately aims to reduce the Greenhouse Gas levels in the environment. However, the poor population is adversely affected by having to pay taxes and also bear the price rise in energy resources. Although energy subsidies reform and carbon taxation could hurt poor people, they are expected to generate enough resources in terms of revenue that can be used to compensate the poor by ways of in-kind benefits or cash transfers (World Bank, 2014). As poor populations usually benefit less than the comparatively rich population from energy subsidies, compensatory policies can more than offset the negative impacts of the reform. Example- In 2005, Ghana introduced a subsidy reform that increased the transport fuel prices by 50% but included in-kind benefits like the expansion of healthcare, improved public transport, elimination of primary and secondary school fees etc. (Coady et al.,2006). Ghana provides us with an example of how well-targeted mitigation policies can contribute to the success of the poverty-climate reforms.

Third, Energy usage is critical to the development and welfare of the rural population and also forms an important part of poverty alleviation programs. Implementing policies that boost the use of renewable energy is one way to tackle climate change that will also aid in poverty reduction while increasing the access to energy for the billions of people who are impoverished. This will help reduce the emission of greenhouses which proves even more beneficial for the poor population in terms of better health, healthy crops, fertile land, clean water, air, fewer diseases and less adversity.

Another direction that policymakers can pursue is ensuring the poor people for their livestock. As apparent by prior research, the majority of the poor population work in farming and related activities to earn a livelihood. The use of livestock in farm-related professions, especially in pastoring is predominant. Livestock is anticipated to be adversely affected by rising global average temperatures. Due to the physiological and biological nature of said animals, farm animals are not at capacity to bear the extreme warmth that might persist in the environment, and due to this the mortality of livestock increases, which in turn affects the farm activities causing the income-earning resources of the poor population to decline. One way to tackle this problem for the poor is to insure them in case the livestock is affected due to climate change. This policy measure however comes with its own drawbacks. Farming and Agriculture in general are informal in nature and unorganized to be able to keep a track of livestock and cause of death of livestock. Due to the informal nature of the market, it becomes difficult to determine the real cause of death of the farm animals. Guaranteed compensation in case of death of livestock increases incentives for the poor population to fake the death or kill the animal in unnatural ways and pretend climate adversity to extort insurance money. This, in turn, is also likely to reduce the incentive to actually farm and work to earn an honest living if insurance money seems like easy money incoming. It can also be difficult to assess the cause of death especially in underdeveloped countries or countries where necessary technology to assess the cause of death of animals is not easily available. Even with drawbacks, with better research, we can certainly explore this policy measure to safeguard poor peoples' livestock, in turn, livelihood, in case adversity hits.

Fifth, adaptation to climate change is often discussed together with efforts to build climate resilience, that is, the capability of households, communities and nations to deal with shocks and stresses. Focus on resilience building can provide a unifying way to improve the linkages between, on the one hand, poverty reduction and food security, and on the other hand, climate mitigation and adaptation. (FAO, 2019). Appropriate Disaster Management policies go a long way in handling when extreme weather conditions, like droughts and floods, hit. Disaster Management policies of many middle-income countries may be at best at +par with the developing conditions, however, many underdeveloped countries lack in this regard. Understandably, the majority of the world's poor live in regions lacking appropriate Disaster Management policy measures and adequate protection from their government in the form of safety nets that could potentially safeguard them, hence the poor of the poorer nations suffer most. Since Climate shock and stress are a consequence of collective damage from rich and poor countries both, organizations at the international level can be set up to fine nations contributing most to global damage and compensate the poor nations for the same.

Middle-income countries, particularly the fastest-growing nations, contribute the most to global warming, while able to provide some or better safety net options to its poorer population and leaving the poor nations and poor people of these countries to suffer. Along with possible damage to livelihood, we cannot overlook the loss of assets the poor population suffers when extreme weather conditions hit. Not only do extreme weather conditions uproot the livelihood sources of most poor people, via its effect on agriculture and related activities where most of the poor population is employed, but it also takes away the future building asset holdings of the very same population, pulling them further down the poverty line. Apart from international action to hold accountability and adequate compensation, Governments at national and local levels can aim to develop social safety nets, and if already in place, should scale them up and ensure assets under a threshold level remain intact for the poor people when disasters hit. Educating the poor population of urban and rural areas, at the local level, about asset management may be another way to make them aware of alternative safer options of asset keeping. Adequate compensation to the poor families in case the earning member of the family dies while making sure to provide the next eligible member with a job opportunity for them to

be able to earn a standard living nonetheless is another form of protection that may go a long way in helping the poor affected by climate adversities.

Sixth, with the apparent effect of climate change on land productivity and fertility, governments must aim to provide adequate protection in terms of other income-earning opportunities for the poor, providing food subsidies in case of price rises and while also promoting and developing technologies that could help aid food production and agriculture in general, after climate adversity becomes too much to handle for land resources. They must also keep working towards ensuring food availability and should now aim to scale up their policies of food security. We already established that the agriculture sector is particularly vulnerable to changes in weather and climate, especially in places such as the tropics, semi-arid regions, and areas that essentially depend on monsoonal rainfall patterns for land productivity. For example, Schlenker and Lobell (2010) predict that without adaptation, maize yields in Africa could decrease by 22 per cent by 2050. Hence building resilience against climate change in the agricultural sector, particularly in rural areas for rural communities and small farmers must be at the forefront along with other major policy measures of ensuring growth and sustainable development and could even aid in enhancing the effectiveness of poverty alleviation programs and programs aimed at promoting equality and equity. One such way is reducing methane emissions, which contribute to the formation of tropospheric ozone. This leads to an estimated 1.3 to 3.2% increase in crop productivity globally, with an estimated economic value of \$4-33 billion (UNEP WMO, 2011). Along with this, flood-proofing, pest-proofing and drought-proofing the world's agricultural land, can take centre stage as resilience-building concepts in the agricultural sector. Agricultural Endurance in this changing climate can only be supported by three pillars:

- i. Sustainably increasing agricultural productivity and rural agricultural incomes
- ii. Reducing overall emission of Greenhouse gases from nearly all areas of life
- iii. Adapting and Building Resilience to climate change

Finally, developing Health systems of the rural areas is another policy measure that can be undertaken by the governments at the national and local level, to protect the rural population against the possible rise of diseases. The rise of Vector-borne diseases has been on the rise

since the global average temperature is rising. Governments at the local level can create awareness about them by means of educating the local populations about these diseases and also ways to safeguard against them, via means of educational workshops, seminars and hoardings. Women being in proximity with places that breed diseases like malaria and dengue are at much more risk of catching them. Hence, policy measures to provide Women with appropriate health care services in case of disease hits at substandard or lower cost can be undertaken.

8.0 Conclusion

The negative effects of climate change on the economy and human welfare are likely to outweigh the favourable ones in the long run, according to this evaluation of literature estimates. In poorer, hotter, and lower-lying countries, the negative effects will be far larger. Development is a supplementary strategy to GHG emission reduction because poverty creates climate change vulnerability; any trade-off between slower economic growth and lower emissions must be carefully considered. Climate change may also alter the economy's growth rate and trap more people in poverty, though estimates of the magnitude of these consequences range from negligible to substantial. As a result, climate change appears to be a significant issue primarily for individuals concerned with the far future, distant regions, and improbable prospects.

Furthermore, more research is required on a number of unresolved concerns. First, the impact of climate change on a wide range of important issues—water resources, transportation, migration, violent conflict, energy supply, space cooling, labour productivity, tourism and recreation—has received insufficient attention; there is either a scarcity of solid evidence, inconclusive evidence, or no quantification of welfare impacts. This means that climate change impact estimates are insufficient, and we won't know whether the bias is upwards or downwards until further study is done. However, as the impact of climate change becomes more unknown, the justification for reducing GHG emissions becomes stronger (Tol, 2018). Future research is unlikely to alter the fundamental fact that the poor will be the ones who suffer the most from climate change and that reducing poverty should be a top goal for programs aimed at mitigating the effects of climate change. There is an urgent need for nations,

whether rich or poor, to allot a significant government budget to dealing with the effects of climate change and poverty together, and if not done in the search for allotting the very same finance to more growth-inducing elements, there could be devastating consequences that could otherwise be counterproductive for the very same growth policies climate and poverty policies were traded-off for.

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