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Climate Change Risk and Climate Finance in India: A Critical Analysis and Policy Recommendations

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Abstract: Climate change and its impacts are more evident today than they ever were. Empirical findings and projections indicate that climate change threatens the stability of the entire financial system. And developing and least developed economies are most vulnerable to adverse impact of climate change. A direct government financial support is not adequate in these countries. Hence, several multinational climate funds have been set up to enable them to mitigate and/or adapt the adverse effects of climate change. The present study critically analyse the major inefficiencies and issues in the existing international financing and way forward. In India, strong GDP growth projection adds up to the risk of climate change due to increased energy consumption, such as increased frequency of droughts, variability in rainfall, and rise in temperature. Hence, achieving economic growth bounded by the commitment to reduce emissions is a major challenge as well as an opportunity for India. This requires several policy initiatives as suggested in the present study.

1. Introduction

The change in climate and its impact on various aspects of life does not need any introduction because these impacts are more evident today than they ever were. Financing these efforts to mitigate and/or adapt the climate changes involves several types of policies, such as target lending, issuance of green bonds, weather-indexed insurance, feed-in-tariffs, tax credits, and national climate funds. Each of these policy initiatives converges on a common goal of mobilizing the funds to tackle the challenges arising due to climate change. Mainly, countries with low and lower middle-income group require crucial financial and technical support from other developed and industrialised nations as they are more vulnerable to climate change.

Just like discussion and debate on climate change is going on for decades, research in the area of policy effectiveness and the impact of climate change is not new. Plenty of research is available that collectively investigates into a broad area of climate finance, climate change, approaches to incorporating climate risk in macro-finance models, pricing of climate risk, and the impact of climate change on different sectors of economies. According to a report by Commodity Futures Trading Commission (USA) Gillers, Litterman, Martinez-Diaz, Keenan, & Moch (2020) reported a systemic risk of climate change on the U.S. financial system that threatens its ability to sustain the American economy. This, however, is not limited to only one nation. Countries all over the globe are facing the adverse impact of climate change on agriculture, public health, finances, housing, production, and other sectors of the economy. Later in this paper, we discuss the impact of climate change on the Indian economy and its policy implications.

In a global effort to help mitigate and/or adapt the climate change, under the Kyoto Protocol and the Paris Agreement, countries having greater financial resources committed themselves to financially assisting the less endowed and vulnerable countries. The argument is that these developed nations have already utilised far more than their fair share of the global carbon budget to achieve industrialization, and the environmental cost have been shared by all countries. And now it's the ethical and moral duty of these developed nations to help the emerging economies and least developed countries (LDC) to tackle the challenges of climate change rather than just expecting them to reduce their greenhouse gas (GHG) emission and consumption of energy and fossil fuel. Therefore, climate finance is needed for mitigation, because large-scale investments are required to significantly reduce emissions. Climate financing has two main focus areas, i.e., mitigation and adaptation. The present study focuses on the sources and impact of climate change in the Indian context. Followed by this, we discuss the financial mechanisms available to address climate change and India's current and needed investment status. Finally, we present the policy recommendations for future direction.

2. Literature Review

The present study contributes to the existing literature on climate finance and the effect of climate change. The study focuses the discussion on a critical analysis of the present state of climate finance, existing issues related to climate finance mechanisms, the ever-evolving challenges of climate change, and the policy implications for India. Mitigation and/or adaptation of climate change and its effects has become a major concern for nations around the world. However, developing nations such as India, and LDC are most vulnerable to these effects. The principle of Differentiated Responsibilities and Respective Capabilities (CBDR-RC) requires developed nations to take responsibility for combating climate change and its adverse effect thereof.

2.1. Need for Climate Finance

Climate finance is "local, national, or transnational financing drawn from public, private, and alternative sources of financing that seek to support mitigation and adaptation actions that will address climate change" (United Nations Environment Programme, 2022). Reducing emissions is the key focus area

of addressing climate change, however, this requires a large-scale investment to develop technology that is environment friendly. Therefore, climate finance is needed for the mitigation and adaptation of adverse impacts of it if they have already taken place. And since less developed nations are not financially sound enough, the developed nations contribute to various international funds and grants that provide financial support to developing and LDC. As per the World Economic Forum's year 2020 latest projections, a humongous amount of USD 5.7 trillion is required every year for green infrastructure, compared to this the existing commitment of USD 100 billion is still inadequate (Barua, 2020). Direct government financial support is not adequate in poor and vulnerable nations. Therefore, several multinational climate funds have been formed which are discussed in the following section.

2.2. Rationale and Argument for Climate Finance

Let's take the example of the most recent case of a global pandemic which hit almost all nations around the globe. Although a pandemic-like crisis which is sudden and whose impacts remain over quite many years is very different from climate change which plays out over decades and potentially has permanent consequences. They still have a similarity and that is the 'cost of delayed actions and appropriate policy implementation. According to a study, delayed social distancing by one week caused the death rate to double in the United States (Pei *et al.*, 2020). Similarly, delayed policy actions by one year can cause higher average global temperature leading to irreversible and catastrophic damages. Hence, appropriate timely actions to mitigate and/or adapt to the adverse impact of climate change are of utmost importance.

However, this brings us to the question that how the cost of dealing with climate change should be shared among nations. Should the wealthy nations bear the entire burden or the burden be shared by all? The emerging economies have just begun to grow, and the growth obviously requires energy consumption leading to emissions. Whereas developed nations have already consumed far more than their fair share of the global carbon budget. The argument is, this would be unjust to ask developing nations to compromise their economic development while they shared the environmental cost of the developed nation's growth. Therefore, it's the moral duty of these developed nations to provide the financial and technical support needed to achieve sustainable economic development.

2.3. Financial Mechanism

Presently there are several financial mechanisms available to address climate change and the risk arising from it. Figure 1 and the following discussion present the scope of these financial mechanisms.

The *Global Environment Facility (GEF)* which is also the largest multilateral trust fund, was established 30 years ago at Rio Earth Summit to enable developing countries to invest in nature and support the implementation of major international environmental conventions. The corpus of GEF replenishes every four years. Under its ambit, GEF has a small grant programme which is focused on including biodiversity, climate change, chemicals, and desertification (Global Environment Facility, 2022).

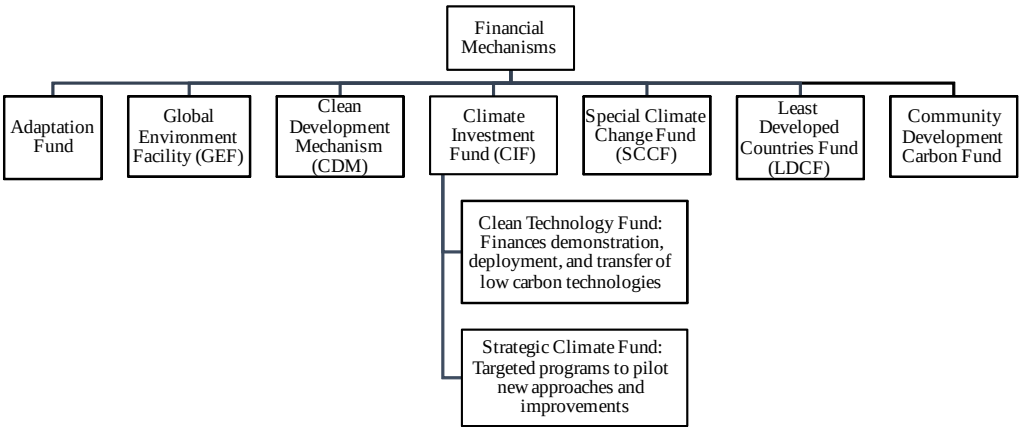

Figure 1: Financial Mechanism of Climate Financing

Source: Compiled by Authors

The focus of the *Special Climate Change Fund (SCCF)* is to help vulnerable nations to address the negative impacts of climate change and supports a wide spectrum of adaptation activities. It is one of the world's first multilateral climate adaptation finance instruments (The Special Climate Change Fund, 2022). The fund operates in parallel with the *Least Developed Countries Fund (LDCF)*. Both SCCF and LDCF are managed by the GEF only.

However, the LDCF is exclusively dedicated to help LDC to adapt to new climate realities. The objective of LDCF financing is to enable the implementation of National Adaptation Programs of Action (NAPAs) at the country level. These are the strategies specific to the requirements of a country which is necessary for addressing the most urgent adaptation needs of that country (LDC Fund, 2022).

Under the Kyoto protocol which is an international treaty for emissions reductions, Article 12 focuses on efforts in direction of reducing GHG emissions. *Clean Development Mechanism* (CDM) aims at establishing a market mechanism that enables the achievement of emission reduction goals. Hence, it allows developed and industrialised countries to establish emission-reduction projects in developing countries that cannot undertake such projects on their own. In exchange, these developed countries get tradable Certified Emission Reduction (CER) credits roughly equivalent to a tonne of CO_2. These are saleable CERs and serve as a tool to measure whether a country has successfully met the prescribed Kyoto targets (The Clean Development Mechanism, 2022).

Similarly, Green Climate Fund (GCF) also focuses to limit or reduce GHG emissions in developing countries. In addition to mitigation, it also aims at helping vulnerable societies adapt to the unavoidable impacts of climate change (GCF, 2022).

As the name itself suggests, the *Adaptation Fund* focuses on the adaptation of harmful effects of climate change. As developing nations are less equipped to do so, the fund helps by financing projects and programs aimed at developing and implementing adaptation strategies. Its funding mainly comes from government and private donors (Adaptation Fund, 2022).

Under its purview the Climate investment fund (CIF) has the Clean Technology Fund (CTF) and Strategic Climate Fund. CIF is over $10 billion fund, established in 2008 (Climate Investment Fund, 2022). CIF aims at lowering the risk and cost of climate financing by providing long term and low cost financing to developing and middle-income countries.

Community Development Carbon Fund (CDCF) is operational since 2003 and presently has a USD115.9 million fund capitalization (The World Bank, 2022). It focuses on equitably distributing carbon finance resources for desired social, environmental, and economic benefits.

Figure 2 presents the cumulative data on the pledges, deposits, and project approvals made by multilateral climate change funds. According to the latest data (the year 2022), the current status of funds pledged stands at USD 43,184 million; Deposited funds amount to USD 34,848 million, and USD 28,380 million of funds are approved.

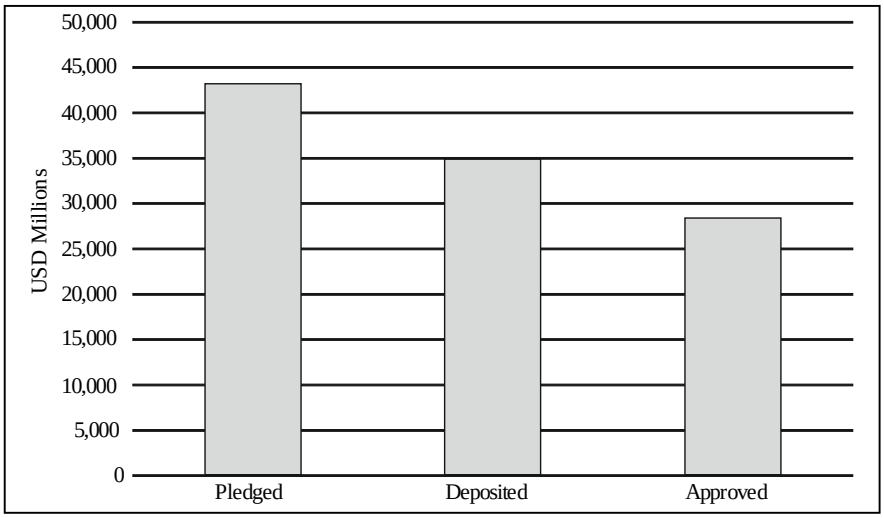

Figure 2: Status of Funds

Source: Climate Funds Update. Latest Data (2022).

2.4. Major Recipients of Climate Finance

Figure 3 presents the recipients of climate finance from the multilateral *climate change funds*. Among the lower income and lower middle-income groups of recipient countries, India is the biggest recipient country followed by Indonesia, Bangladesh, Magnolia, Vietnam, and Egypt. The detailed data pertaining to Figure 3 is presented in Appendix 1.

2.5. Major Contributor to Funds

Under the 'Cancun Agreements' in 2010 developed nations committed to collectively mobilize a corpus of USD 100 billion every year by 2020 to cater to the financial needs of poor nations and help them mitigate and/or adapt the climate change (Smith, *et al.,* 2011).

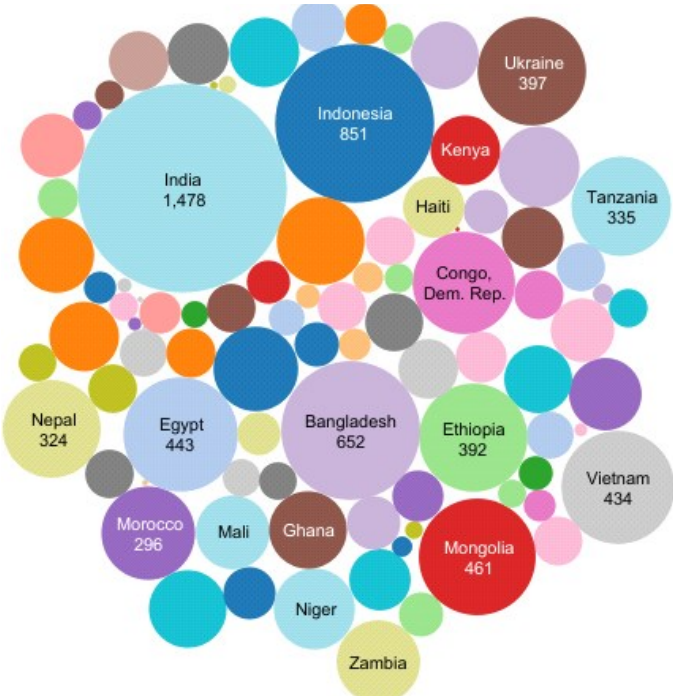

Figure 3 : Major Recipient Countries

Source: Climate Funds Update (All figures in USD millions)

Figure 4 presents data on major contributors of climate finance. As can be observed United Kingdom is the largest contributor to the climate fund and pledged USD 7,393 million. Followed by the United States, Germany, and Japan with a pledged corpus of USD 5,885 million and USD 5,874 million USD 4,852 million respectively. Among other countries, France, Norway, and Sweden are the major contributors. The detailed data pertaining to Figure 4 is presented in Appendix 2.

3. Objectives of the Study

With this backdrop, based on secondary research and data analysis, the present study discusses about the climate change and the need for climate finance, particularly in the context of India. The study focuses on the following objectives:

- To investigate the present state of climate issues in India
- To study the major sources of climate change in India.
- To study the impact of climate change on the Indian economy.
- To examine the major challenges ahead.
- To suggest policy recommendations.

Figure 4: Major Contributors

Source: Climate Fund Update

4. Data and Methodology

4.1. Data and Sample

The study is based on secondary data collected from various repositories and data provided by several multinational organisations and funds such as Intergovernmental Panel on Climate Change (IPCC), United Nations Framework Convention on Climate Change (UNFCCC), Climate Fund Update, World Bank, Ministry of Earth Sciences (MoES), Green Environment Facility and Climate Investment Fund. The available research in this area was systematically evaluated and conclusions were drawn accordingly. Apart from this information has also been gathered from several websites and press releases. The sample comprises of the data from 1990 to 2019 on GHG emissions by major countries.

4.2. Methodology

The present study is based on secondary data analysis comprising of research papers, reports, articles, and interviews. Comparative analysis of data collected for the period 1990 to 2019 is performed across major developed and developing nations. The present status of climate funding is analysed for the most recent year.

5. Institutional Arrangement for Climate Financing in India

In September 2011, '*Climate Change Finance Unit'* was set up as the first institutional response of GoI towards the need for a national-level climate finance unit. The mechanism of climate financing in India is made of domestic and international resources. Table 1 presents the international sources of climate financing in India. The domestic resources and financing mechanism can be segregated into public and private sources. Public climate finance draws funds via budgetary support both union and state, taxes, subsidies, and other market mechanisms. On the other hand, private sources are mainly comprised of debt and equity instruments, and partial risk guarantee facilities. As can be observed in Table 1, more than 50% of international funding comes from Clean Technology Fund (CTF). It promotes the demonstration, deployment, and transfer of low-carbon technologies which have significant potential for long-term GHG emission savings and implementation of technologies that uses renewable sources of energy and clean transport in emerging economies (Clean Technology Fund, 2020).

Table 1: International Sources of Climate Financing in India

Fund Name	*Fund Type*	*Funding Approved (USD millions)*	*Percentage of Overall*
Global Environment Facility (GEF7)	Multilateral	33.25	2%
Special Climate Change Fund (SCCF)	Multilateral	9.82	1%
Global Environment Facility (GEF4)	Multilateral	171.53	11%
Adaptation Fund (AF)	Multilateral	44.37	3%
Green Climate Fund IRM (GCF IRM)	Multilateral	134.36	9%
Pilot Program for Climate Resilience (PPCR)	Multilateral	0.2	0%
Partnership for Market Readiness	Multilateral	8.329	1%
Global Energy Efficiency and Renewable Energy Fund	Multilateral	14.97	1%
Clean Technology Fund (CTF)	Multilateral	846.99	56%
Global Environment Facility (GEF5)	Multilateral	32.93	2%
Global Environment Facility (GEF6)	Multilateral	22.94	2%
Global Environment Facility (GEF7)	Multilateral	11.7	1%
Scaling Up Renewable Energy Program (SREP)	Multilateral	0.55	0%
Green Climate Fund IRM (GCF IRM)	Multilateral	181.02	12%

Source: Climate Funds Update. Latest Data (2022). Compiled by Authors.

6. Issues and Challenges

Existing research has studied the historic drivers of emissions in India. Chandran and Tang (2013) investigated the causalities between coal consumption and emissions and GDP growth in India and compared it with China. Several other studies focused on household consumption of electricity as the

source of GHG emissions in India. Pachauri (2014) examined whether increased household access to and consumption of electricity affects the emissions in India and Das & Paul (2014) investigated what are major uses of electricity. Yang and Zhao (2014) looked into the effect of trade openness on energy consumption and emissions. Since India is among the fastest growing economy, and also among the top countries by total GHG emission, India's way forward will require developing more energy-efficient technology, reducing reliance and consumption of traditional non-renewable sources of energy, infrastructural investment to generate energy from renewable sources and target sustainable growth while complying with the commitments of Paris Agreement.

Talking about the Paris Agreement which was initiated in the year 2015 and officially implemented in the year 2016, the gravity of funding commitments made by developing nations remains questionable. Especially after the USA decided to exit from the "Paris Agreement" in the year 2017 under Donald Trump's leadership (McGrath, 2020). Although the USA decided to join back with yet another change of leadership in the year 2021 (U.S. Department of States, 2022), this has put a dent in the solemnity of the pact. This has also slowed down the pace towards the achievement of the ambitious goal of a USD 100 billion annual contribution to developing nations by the year 2020. But in 2019 only USD 79.6 billion was raised (McGrath and Rincon, 2021).

At the 26th UN Climate Change Conference in Glasgow (COP26) developed countries expressed their confidence that the USD 100 billion goal shall positively be met by 2023. Only time will tell the credibility of this decade-old commitment. However, the developing and poor nations are in immediate need of funds. The Figure 5 exhibits the amount provided and mobilised by developed countries since 2013. Clearly, the funds fell short of the committed amount every year while the adversities of climate change continue to become grave.

Apart from this following are some other noted issues with the multinational climate funds:

- Poor accounting framework leading to leads to double-counting, and exaggerated numbers.
- Allegations that the reported figures of the contribution by developed countries is inflated.
- The definition of climate finance lacks transparency and uniformity.
- Skewed funding with a limited focus on climate adaptation projects. The majority GCF funding is diverted toward mitigation projects in the renewable energy sector.
- Lack of scientific proof to support that the USD 100 billion funds shall be sufficient to address the problem.
- The majority of funds contributed by developed countries are being used domestically while the poor and vulnerable nations bear a much higher proportionate burden of emission and depletion of natural resources.

7. Impact of Climate Change: Observed and Projected Changes

India is deeply vulnerable to climate change due to its geographically 7,500-km long coastlines and dependence of the agriculture sector on the monsoon and rivers water. As per the latest record, the surface of the Indian Ocean has warmed faster than the global average (IPCC, 2021). Further to quote

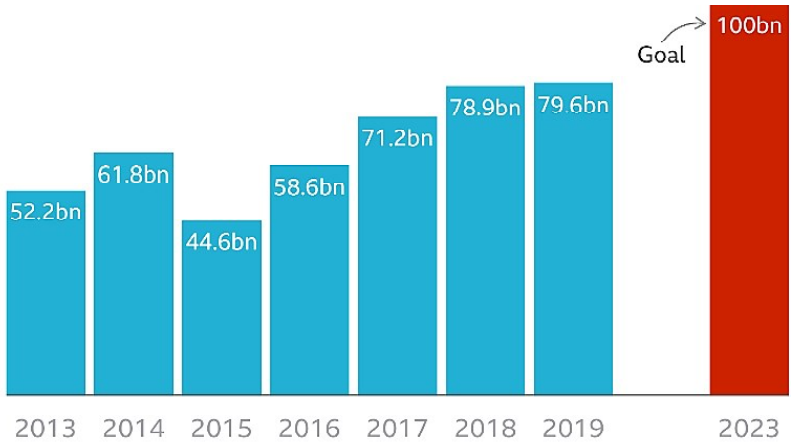

Figure 5: Amount Provided and Mobilised by Developed Countries (USD)

Source: OECD

the latest projection of IPCC on climate change effect on coastal cities, "there is a high probability that the rising sea level, caused by both sea level rise and storm surge, and extreme rainfall/river flow events will increase the occurrences of flooding". In another report by the Ministry of Earth Sciences (MoES), the Government of India further strengthen the weight of these projections. Krishnan, et al. (2020) predicted that India will face a major challenge to tackle the adverse effects of climate change over the next century due rise in the frequency and severity of droughts, greater variability in monsoon rainfall, and rising temperature.

Both frequency and spatial extent of droughts have increased significantly over the last 6 to 7 decades (from 1951 to 2016). There has been an overall decline in the summer monsoon rainfall, particularly in areas over central India. More alarmingly, over the same period, the areas affected by droughts have increased by 1.3% per decade. As per the latest projection in a report by the Ministry of Earth Sciences (MoES), GoI, this problem is expected to more severe by the end of the 21st century.

7.1. Housing Market

The buying decision in the housing market is affected by the potential vulnerability of the housing location to natural calamities. For instance, in India flood-prone areas of Kerala and some cities of Maharashtra have affected the demand for housing in such areas and hence drove down their pricing. Other factors such as the rising level of pollution in major metro cities, and disputes over the allocation of water and power supply also have an enormous impact on housing pricing.

Not only this, rapid urbanisation and the resulting depletion of resources, rise in temperature in cities with a growing population (IPCC, 2021), and excessive use of public transport and automotive has been a major contributor to climate change. A rising trend in urbanization is likely to further amplify the projected air temperature change in cities in the coming future this effect is known as the "*urban heat island effect*".

In its latest fact sheet under the 6th Assessment Report (AR6) of IPCC, urban geometry, human activities, and materials used for the construction of buildings were identified as three major reasons for the urban heat island effect. Materials used for construction activities absorb and retain heat during the day and release that at night. To make the matters worse dense and taller buildings in closer proximity store heat because of reduced ventilation. Further, use of domestic and industrial heating or cooling systems, automobile engines, etc. contributes the most to GHG emission.

Hence, on one hand, climate change is causing a shift of population to less vulnerable cities but then on the other hand the same is becoming the cause of climate change as well. Therefore, India faces a challenge to provide affordable housing to all while dealing with its adverse impact on climate. Climate resilience is crucial for India's affordable houses. Under the present government, the Low-cost housing initiative -Pradhan Mantri Awas Yojana (PMAY) was launched in the year 2015, the same year as the signing of the Paris Agreement. It aims to provide 50 million affordable homes. While on the social front this flagship housing program was lauded by the citizen, the construction-heavy nature of the scheme has obvious challenges on the environmental front. Emissions from cement production contribute around 6% to India's total CO_2 emissions and it has been growing steadily for the past 3 decades (Le Quéré, Andrew, & Canadell, 2016).

7.2. Equity Market

In its latest report on "Trend and Progress of Banking in India 2020-21" the Reserve Bank of India addressed the concerns that climate change can adversely affect the stability of the financial system in India (Herwadkar, 2021). A portfolio comprised of securities that are significantly exposed to carbon-emitting and polluting sectors are most sensitive to effects and policies on climate change. Among the specific group of investors, long-term institutional investors are more sensitive to the systemic risk of climate change compared to short-term and medium-term investors. Particularly insurance companies' future liability is more directly linked to these adverse changes. For instance, a greater frequency and magnitude of natural calamities have increased the occurrences of insurance claims. For the year 2017, total global losses due to weather catastrophes were USD 340 billion out of which USD138 billion were insured losses (Jena, 2020). According to United Nations, India has suffered USD79.5 billion in economic losses in 19 years due to disasters caused by climate changes and delays in tackling these risks can cost businesses including investors nearly USD 1.2 trillion over the next 15 years (Intellecap, 2020). Further, government commitment to reduce emission to deal with climate change suggest future policy regulations conducive to carbon-mitigating economic activities and penalizing carbon-emitting businesses.

Therefore, a portfolio rebalancing to make asset allocations in favour of green businesses is imperative to diversify the risk. Historical data shows that the S&P BSE Greenex underperformed the S&P BSE Sensex during 2010-2019 (BSE India, 2022). And this is after the 2015 "Paris Agreement" in which India committed to cut down the carbon emission intensity of GDP by 33%-35%. This implies that the stock market has not captured environmental risks yet and hence lacks efficiency, because logically the green companies should have performed better in hope of future government policies to incentivize these green businesses. However, we can expect the market to be efficient in the long run

as the investors begin to recognise the impact of climate change on business and learn ways to interpret this material, climate change risk, and opportunity, information.

7.3. Businesses

Climate change can impact businesses in multiple ways. This impact can be in form of a permanent disruption in the demand and supply dynamics of goods and services. Subsequently, these disruptions can leave a ripple effect on the broader macroeconomic environment, and sovereign rating of the nation and increase the required rate of return for investment in such countries. Effect of climate channels through the interlinkages between macro environment, supply chain, operations, and consumer market, to ultimately reflect on the business.

7.4. Economic Growth

India's GDP is expected to increase faster than all other economies from 2013 to 2040 (International Energy Agency, 2015). At the same time, with growing concern over man-made climate change and its negative impact, India is focusing on alternative sources of energy and technologies to reduce its dependence on fossil fuels. Currently, India's total per capita GHG emission stands at 1.77 Gt. Compared to developed nations such as the USA (13.97 Gt). Canada (16.6 Gt), Saudi Arabia (15.47 Gt.) this figure is very small. However, the rapidly growing population continues to be a challenge (World Bank, 2019). In absolute terms, however, India's GHG emission is the world's third highest since 2008 (Le Quéré, Andrew, & Canadell, 2016). Being, a developing country, India's projection for economic growth is strong which requires growing energy consumption and emissions. This put India on a trajectory of

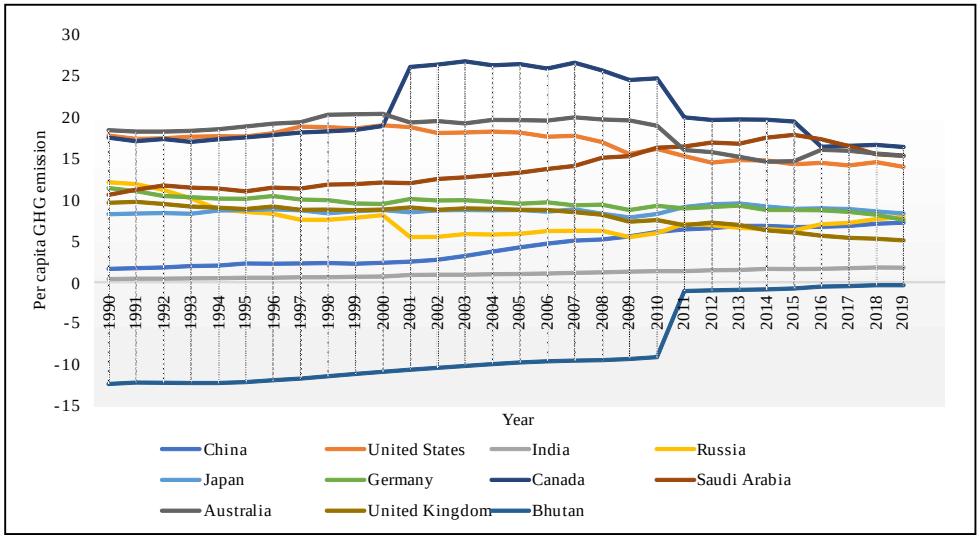

Figure 6: Total GHG Emission by Country (Per Capita)

Source: World Bank (2019)

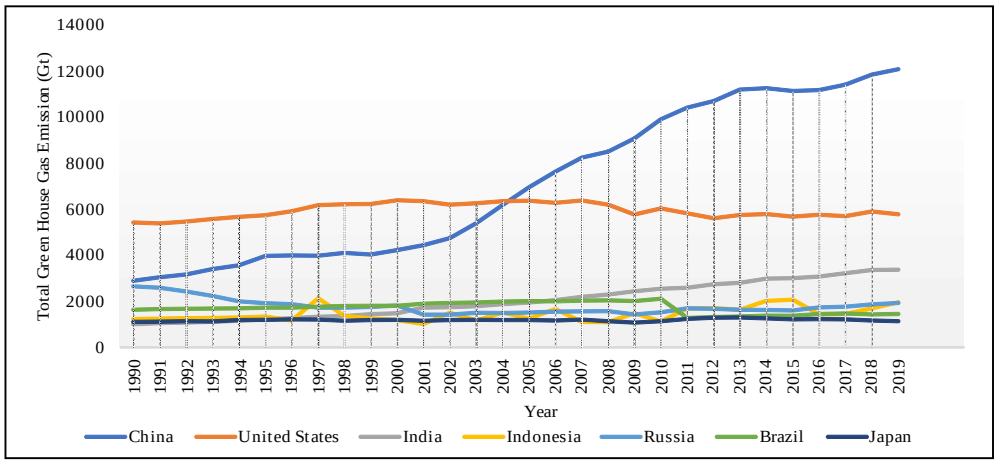

Figure 7: Total GHG Emission by Country

Source: World Bank (2019)

continuously rising GHG (Murthy, Panda, & Parikh, 1997; Raghuvanshi, Chandra, & Raghav, 2006; Sharma, Bhattacharya, & Garg, 2006).

As can be seen in Figures 6 and 7, the per capita GHG emission of India is very low compared to developed nations. But if the population continues to rise, which according to the United Nations projection is likely to surpass China's around 2025, then the total GHG emission is going to increase alarmingly (Jonas, Roy, Pal, Peters, & Andrew, 2020). Although energy consumption and level of emissions can be reduced by the use of new technologies. But any further effort to slow down the emissions growth will require strong decarbonisation of the energy sector.

8. Conclusion

A recent unprecedented chain of events has emphasized the need and importance of crisis preparedness and resilience building. The world has witnessed how 'tail events' such as the global pandemic crisis of Covid-19 can cause massive disruption in economic activity around the world. Not only this, the repercussions of the ongoing war between Ukraine and Russia have opened the eyes of many nations that are heavily dependent on carbon-intensive energy. The same has forced the nations to accelerate the transition to renewables.

Presently, the risk related to climate change is a major challenge for both developing as well as developed nations. However, low and lower-middle-income group countries are more vulnerable and hence require crucial financial and technical support from other developed and industrialised nations. Hence, several international funds have been established to help this poor nation to mitigate and/or adapt the effects of climate change. According to the present funding status, developed countries still fall short of their promised annual contribution of USD 100 billion. This, emphasise the need to mobilize both public and private finances to avoid any delay in policy actions.

While these climate change-related risks threaten the stability of the financial system of any economy, it also creates opportunities for investors to reallocate their capital towards assets with lower climate risk. This has important implications for portfolio rebalancing to diversify away climate change-related risk to the extent it is possible. Businesses that are focusing on providing goods and services to improve climate resilience mechanism/ adaptation planning are likely to be favoured. We have observed that the market has not been efficient in the pricing environment-related risks in security prices and the index based on green business has underperformed the broad market index. However, it can be argued that the market shall be efficient in the long run as the effects of climate change become more visible in portfolio returns. When it comes to the integration of climate risk in investment decision-making, the lack of reliable, consistent, and comparable data on companies' climate risk and opportunity remains to be the major deterrent. Therefore, the present study recommends policy actions to address the problem at hand.

9. Policy Recommendations

The present study emphasizes on India's deep vulnerability to climate change. As India will be dealing with the adverse effects of climate change over the next century as the frequency and severity of droughts is likely to increase, there will be greater variability in monsoon rainfall, and a marked rise in temperature. This requires proactive approach to formulate the appropriate policies. Some of these policy recommendation suggested by this study are presented below.

- *Integrating climate risk in ESG compliance framework:* Currently, ESG compliance guideline does not include climate risk as one of the evaluation criteria to arrive at the final ESG score. Mere compliance with the ESG norms does not indicate that the firm is not exposed to climate change risk.
- *Redefining the fiduciary responsibility of fund managers:* In India PFRDA, IRDA and SEBI regulate pension, insurance, and mutual funds. Currently, environmental risk and climate risk are not under the focus of these regulators. To ensure the integration of these imminent risks in investment decision-making and asset allocation, the same should be defined as a fiduciary responsibility of fund managers. SEBI should identify the climate change risk and opportunity as material information and makes the related disclosure mandatory for the listed companies. The availability of information on this risk factor shall enable the investor to make informed decisions.
- *Developing and strengthening the global climate information architecture:* A prerequisite for assessment of and pricing of climate risk for investment decision-making is the existence of strong information architecture. Strong information architecture has three pillars; first, availability of reliable and high-quality data, second consistency in disclosure related to climate risk, and third, principles to align investment to sustainability goals. Standard setting work should take into account the difficulties in data collection in emerging markets while ensuring that company-level disclosures are mainstreamed across these economies.
- *Mobilization of both public and private finance*: Reliance on global and international funds and domestic public sources of financing to mitigate the climate risk is not sufficient. As many

developing and poor economies continue to face challenges when it comes to access to finance, there is a strong need to understand the potential avenues to scale up private financing. According to the latest projection of IPCCC, in some economies, the requirement for climate finance is likely to go up by 3 to 4 times by the year 2030.

- *Need for a proactive attitude of supervisory and regulatory bodies on climate-related financial risks*: It is documented in several reports that climate risk exposes economies to systemic risk and threatens their financial stability. Therefore, it is necessary to capture the climate-related risk in supervisory processes for timely intervention to mitigate the effects.

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Appendix

Appendix 1: Major Recipient Countries

Country	*Fund (USD Million)*	*Country*	*Fund (USD Million)*
Afghanistan	69	Multi-country (Ghana, Kenya)	5
Angola	35	Multi-country (India, Indonesia, Philippines)	6
Bangladesh	652	Multi-country (Indonesia, Philippines)	30
Benin	79	Multi-country (Liberia, Madagascar)	1
Bhutan	114	Multi-country (Sudan, Somalia)	7
Bolivia	116	Multi-country (Uganda, Democratic Republic of Congo)	1
Burkina Faso	242	Multi-country (Ukraine, Tunisia)	45
Burundi	44	Myanmar	79
Cabo Verde	20	Nepal	324
Cambodia	260	Nicaragua	126
Cameroon	31	Niger	223
Central African Republic	28	Nigeria	93
Chad	62	Pakistan	168

contd. appendix 1

Country	*Fund (USD Million)*	*Country*	*Fund (USD Million)*
Comoros	80	Papua New Guinea	67
Congo, Dem. Rep.	354	Philippines	178
Congo, Rep.	91	Regional - East Asia and Pacific (Bhutan, Cambodia, Lao PDR, Myanmar)	6
Cote d'Ivoire	82	Regional - Sub-Saharan Africa (Benin, Kenya, Namibia, Nigeria, Tanzania)	80
Djibouti	63	Regional (The Comoros, Madagascar, Malawi and Mozambique)	14
Egypt	443	Rwanda	204
El Salvador	83	Sao Tome and Principe	35
Eritrea	24	Senegal	191
Ethiopia	392	Sierra Leone	55
Gambia	89	Solomon Islands	138
Georgia	98	Somalia	30
Ghana	203	South Sudan	28
Guinea	46	Sri Lanka	121
Guinea-Bissau	46	Sudan	128
Haiti	128	Swaziland	2
Honduras	155	Syrian Arab Republic	11
India	1,478	Tajikistan	164
Indonesia	851	Tanzania	335
Kenya	165	Timor Leste	98
Kiribati	60	Togo	59
Korea, Dem. Rep.	1	Tunisia	32
Kyrgyz Republic	70	Uganda	156
Lao PDR	130	Ukraine	397
Lesotho	84	Uzbekistan	35
Liberia	139	Vanuatu	82
Madagascar	72	Vietnam	434
Malawi	78	Yemen	48
Mali	185	Zambia	235
Mauritania	76	Zimbabwe	50
Micronesia	39	Multi-country (Colombia, Ecuador)	14
Moldova	27	Morocco	296
Mongolia	461	Mozambique	228

Source: Climate Fund Update

Appendix 2: Major Contributor Countries

Contributor Country	*Fund (USD million)*	*Contributor Country*	*Fund (USD million)*
United Kingdom	7,393	Cyprus	2
United States	5,885	Hungary	6
Germany	5,874	Estonia	2
Norway	3,442	Panama	1
Japan	4,852	Iceland	4
Sweden	2,149	Monaco	7
Australia	529	Indonesia	1
Canada	1,161	Poland	4
France	3,500	Bangladesh	0
Spain	685	Mongolia	0
Netherlands	696	5 EU Member States	47
Italy	851	11th EDF intra ACP allocation	89
Switzerland	555	APBN	5
Finland	407	Belgium (Brussels Capital Region)	13
Belgium	498	Belgium (Flanders)	29
Denmark	471	Belgium (Wallonia Regions)	23
European Commission	317	Belgium (Wallonia)	12
EC Fast Start Funding	84	BP Technology Ventures	5
Austria	254	Bulgaria	0
Ireland	107	Canada (Quebec)	2
European Development Fund	45	Cote d'Ivoire	1
Mexico	25	ENRTP programme	380
Luxembourg	108	European Union	16
China	19	Flanders	2
New Zealand	28	France (Paris)	1
Czech Republic	13	Global Goods and Challenges Programme (GPGC)	764
India	13	Intra Africa Caribbean and Pacific (ACP) Programme	47
Russian Federation	22	Investment Income	656
South Africa	7	Korea, Rep.	320
Slovenia	8	Malta	1
Peru	6	Nigeria	6

contd. appendix 1

Contributor Country	*Fund (USD million)*	*Contributor Country*	*Fund (USD million)*
Colombia	6	Petrobras - Brasil	8
Brazil	6	Private Sector Investors (24 investors from North America, Europe and Australasia)	112
TNC	5	Qatar	1
Pakistan	11	Qatar Fund for Development	1
Portugal	14	Sale of CERs	209
Greece	9	Slovak Republic	4
Turkey	2	Vietnam	1

Source: Climate Fund Update