

An Introduction to Climate Fintech

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Abstract. In this paper, the author tried to analyse the fundamental targets of Paris agreement to fix the global temperature at 1.5°C for which the needs and sources of climate finance were indicated for taking policies. Thus, the author initiated the central role, functions, area of finance of the climate fintech through the analytical framework of the climate finance and has shown a rosy prospect of climate fintech in the offing.

Key words: Climate Fintech, Green Climate Fund, Climate finance, decarbonization, Paris Agreement

JEL Classification Codes: G18, O31, Q2, Q3, Q4, Q5

Introduction

Nordhaus (2020) said in his lecture that the global CO₂ emission has been increasing at the rate of 2.6% per year during 1900-2018 significantly according to linear trend but the global decarbonization rate was decreasing the rate of only 1.5% per year as linear trend from 1970-2018, so that global temperature has been catapulting speedily in the sense that after 1910, it is steadily increasing upward although it was cyclically advancing from 500 to 1900.

Copenhagen targeted to fix global temperature at 2°C but the Paris agreement aims to keep global temperature below it at 1.5°C in which it requires that global emission should decline by 50% within 2030-31 from the current level of 53GtqCO₂ emission per year and it will be net zero emission by 2050. Thus, this study recommended that the development of the climate finance market should grow to the \$3–5 trillion+ of investment per year for decarbonization of 10 sectors that represent 75 percent of global emissions (Boston Consultancy Group and Global Financial Markets Association, 2020) in which its report found a roadmap for working of climate finance where the role of capital market participants can facilitate the transition to a low carbon economy to serve clients, investors and the societies.

The initiatives of financing in climate change for decarbonization had started a long ago in which UNFCCC pledges to scale up their provision of climate finance in developing countries to at least \$100 billion per year by 2020. In addition to public and private investment in climate finance, many multilateral financial institutions and agencies focused on climate finance in which Global Environmental Facility, the Climate Investment Funds, Green Climate Fund came in dominating funds and even the World Bank set climate related funds as portfolios.

To success the Paris climate target, the banks, financial institutions, and Fintech have been trying to concentrate on reducing financed emissions i.e., emission levels of client businesses by transforming to a low carbon economy by devising programs that track and measure greenhouse gas discharge. Total 31 nations comprising Canada, India, New Zealand, China, and European Union (EU) and even developing taxonomies define green initiatives and Environmental, Social, and Governance (ESG) disclosure standards and formed The Task Force on Climate-related Financial Disclosures which applied physical objects to capture, validate, and report real-time data on emission impact by allowing artificial intelligence, internet of things and blockchain in course of convergence of data, regulatory policy, and technology which can enable efficient visualization and reporting of ESG impact. To promote incubation and scaling of fintech which can decarbonize the global economy, there needs to be built business ecosystem and value proposition where climate fintech of as of today is a good startup (Muthukumar, 2021).

Objectives of the Paper

The paper endeavors to focus on the central theme towards the startup of the climate fintech, its working in national and international economies in dwindling global temperature as targeted by Paris convention and how the climate fintech fulfil its decarbonization program is the other corner of the study.

Methodology of the Paper

The fundamental climate finance reports, climate fintech reports and research papers, speeches, books, and other research proceedings are the principal sources for preparing this paper.

Some Researches

Bhowmik (2020) noted that in order to reach a desired 450ppm pathway 350 billion euro of incremental capital investment is needed between 2010 to 2020 and 595 billion euro between 2020 and 2030 in which developed countries require 220 billion euro per year between 2010 and 2020 and 315 billion euro between 2020 and 2030 and developing countries require 130 billion euro between 2010 and 2020 and 280 billion euro between 2020 and 2030. Within 2030, \$139-175 billion per year is needed for mitigation where developing countries fixed for \$600 billion or 1.5% of the developed countries' GDP.

Kotchen (2017) fitted a model to the understanding of how to maximize the impact of publicly provided climate finance to leverage the private sector where the public agencies seek to promote private investment may therefore have a choice between subsidizing projects or pilot projects. His model provides guidance about when subsidizing one or the other is more efficient suggesting to relate to optimal subsidy policy which depends on the choice of subsidizing projects and its characteristics on an institution's objective function.

Marke and Silvester (2018) stated that in combination of blockchain and fintech is a great provision of climate finance and green investment. By providing valuable production data the energy sector will find a new financial product in research and development in which blockchain is a revolutionary to the bottom level green finance architecture among the fintech including big data, cloud computing, machine learning and distributed computing technology which reduce regulatory cost and expand boundaries.

Höhne et al. (2012) defined that green finance is a type of financial investment which flows into sustainable development projects and initiatives, environmental products and policies.

Green finance is related to climate finance but not limited to it and ranges to industrial pollution control, water sanitation, biodiversity protection and finance in mitigation and adaptation in which the projects are related to reduce emission of GHG and to reduce the vulnerability of goods and persons to the effects of climate change.

Green FinTech, therefore, focuses on those FinTech-related innovations that address environmental protection and climate change which are considering the SDGs 7 (Affordable and Clean Energy), 11 (Sustainable Cities and Communities), 12 (Responsible Consumption and Production), 13 (Climate Action), 14 (Life Below Water), 15 (Life on Land), and 17 (Partnerships for the Goals) as one SDG, which generically has an impact on all SDGs.

Menon (2020) delivered lecture at Singapore Fintech festival where he emphasized to establish a consortium of financial institutions, FinTech firms, and industry players with expertise in Green FinTech to drive Project Greenprint that can quantify the ESG impact of potential investments and loan portfolios and the project will be supported by allotting 20% of the Financial Sector Technology and Innovation budget, or US\$37 million out of US\$185.

Arena et al. (2018) therefore defined green FinTech innovations by a blended-value mission entailing the coexistence of impact objectives (e.g., increasing the flow of financial

resources for sustainable development) and business objectives (e.g., safeguarding a financial return to be able to continue creating impact in the long run).

The role of FinTech in unlocking green finance in policy insights for developing countries in three areas of the possible application [i] blockchain applications for sustainability in general, [ii] specific blockchain use-cases for renewable energy, the decentralized electricity market, carbon credits and [iii] climate finance and innovations in financial instruments like green bonds. UN Environment Inquiry (2019) stated that the area of FinTech is primarily shaped on the national level by the State Secretariat of International Finance (SIF) and has three focus areas, namely [i] a regulatory sandbox that allows startups to experiment with up to CHF 1 million, [ii] a specific FinTech license for startups that allows them to operate without a full banking license, [iii] the possibility of public deposits for non-banks. Green FinTech solutions enable customers to directly engage in C2C transactions e.g., in indirect financial processes, power selling and purchasing or mobility transactions and can provide the possibility of directly linking different cross-industry ecosystems. The green FinTech seems to hold great potentials to achieve the Sustainable Development Goals. But, a major driver of green FinTech is the availability, transparency and reliability of data.

Puschmann, Hoffmann and Khmarskyi (2020) believed that “green FinTech” solutions are an emerging area with the purpose to alleviate climate change risks and which are relevant to policymakers, particularly in emerging and developing countries, as they pursue the implementation of the Paris Agreement and foster the achievement of the SDGs. Green FinTech connects all relevant participants in the value chain including consumers, (central) banks, insurers, non-banks (startups, big tech firms), (technology) providers, regulators, etc.

According to Finextra (2021) the fintech uses proprietary algorithms and remote sensor technologies to identify high quality projects and forecast the natural capital returns, pooling investment products and providing financial institutions with a simple way to invest in sustainable projects, such as regenerative grazing or planting trees. Dr Manuel Pinuela, co-founder and CEO of Cultivo, highlights how “nature-based solutions can provide at least 30% of the CO₂ mitigation goals by 2030, yet receive only around 3% of the funding allocated to carbon capture.” As a result, the fintech firm is on a mission to fill this “financing gap”, pushing the importance of natural restoration, carbon sequestration, and biodiversity protection.

Paris Agreement under Private Digital Funding

Wainstein (2021) examined the system of smart contract, new investment demands, tokenization of debt and impact outcomes, advancing next generation climate bonds and digital payments to integrate finance and accounting digital infrastructure.

To achieve 1.5°C, Paris agreement introduced the concept of Nationally Determined Contributions (NDC) to the scientifically defined goals allowing for the accounting and tracking of jurisdictional emissions and mitigation outcomes and will monitor in every five years in a process of the global stock take under green bond financing projects to accelerate decarbonization. In the dynamic linking process, central banks to their immediate ecosystem of climate action, climate finance, and the Paris agreements process have been shown in the Figure 1 where systems and feedback loops that the key perspective of central banks, presents three distinct cycles of financial risk management, investment automations within bonds’ climate action portfolios and the climate accounting of impact units back to the UNFCCC Paris process. Financial risk management ideally entails the divestment feedback loop from high carbon assets into climate aligned investment. Here, robust climate accounting utilising distributed ledgers can help identify and measure the high carbon risk segments within assets and portfolio. The system can [i] Track carbon emissions in investment portfolios in real-time; [ii] Reduce currently high certification and monitoring premiums of green assets (through automation and disintermediation) and address greenwashing concerns, and [iii] Reduce

transaction costs thereby lowering bond ticket sizes and improving scalability and applicability of green bonds to make them available for financing SME action.

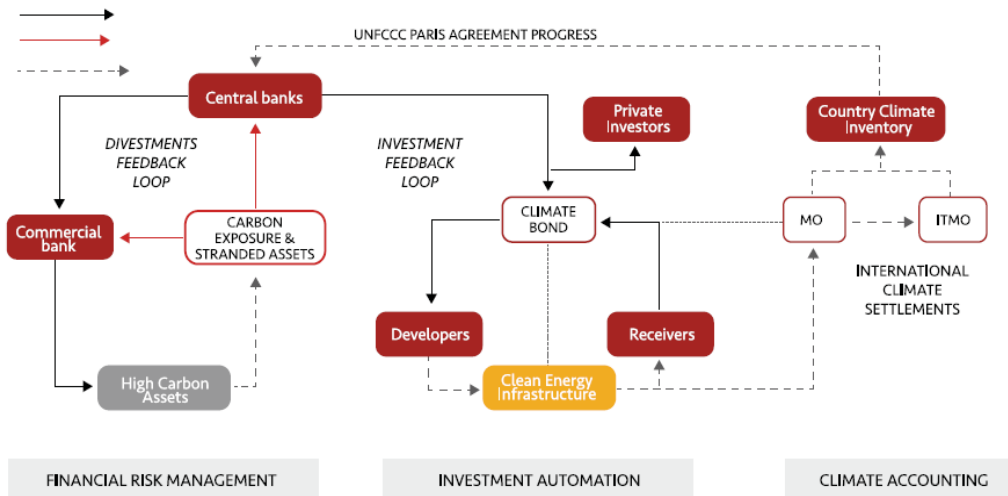


Figure 1: Funding system

Source: Wainstein (2021)

For an example, in a project, under digital payment structure, following NDC of Paris agreements, financing climate action project through tokenized bond can be shown in the Figure 2 below.

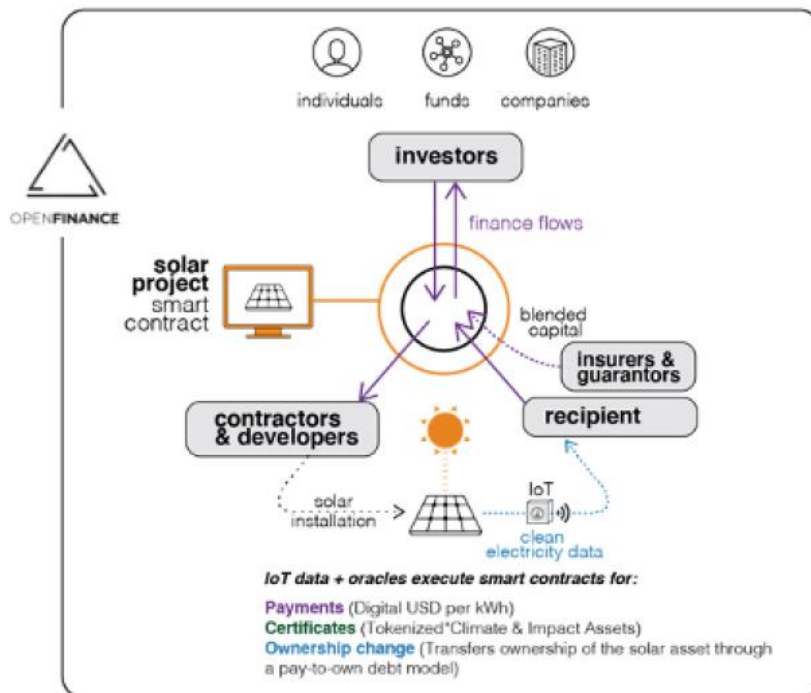


Figure 2: Mapping the system in a project module

Source: Wainstein (2021)

Thus, he concluded that the most important step and opportunity when financing climate action projects through tokenized bonds, is to ensure that their mitigation outcomes are incorporated into national inventories and form part of tracking the progress towards NDCs

(under Paris Accord) where climate accounting and emerging digital infrastructure becomes essential.

The Space of Climate Fintech

According to New Energy Nexus (2020), the basic features of climate fintech can be expressed as [i] it is purely digital, [ii] financial technologies catalyze decarbonization, [iii] both upstream and downstream benefits improve the daily lives of citizens and the behaviors of the largest financial institutions, [iv] the innovations of climate fintech influence consumer behaviour, investment and risk analysis, [v] application of climate fintech is related with artificial intelligence which synthesizes data quickly and improve decision making, [vi] climate fintech ecosystem can attract investment opportunities for climate-conscious and fintech-friendly asset owners, [vii] in increasing capital flows, Europe leads US and China in climate fintech innovations and policy making and commitments, [viii] decarbonization investment indicates key moment which can foster innovation in the offering, [ix] climate fintech integration is facilitated by acute business unit relevance, a dedicated culture or team of Open Innovation and use of Open Banking, and securing an executive-level internal champion which can advocate value propositions.

The trio of climate, finance and digital technology can create climate fintech where digital innovations, applications, and platforms serve as crucial financial intermediaries and mediums between all stakeholders pursuing decarbonization which relates most directly to climate action (SDG 13) and clean & affordable energy (SDG7). In this applied context, fintech has the maximum potential to dwindle GHG emissions whose impact benefited the other SDGs. Climate fintech claims both upstream and downstream benefits. The former is vast and diverse which influence large scale financing decisions, investing behavior and risk analysis modeling. Many financial institutions related with Science Based Targets initiative with target of net zero commitments have been working on decarbonization to help them for technological advancement. The later downstream benefit empowers citizens by access to energy and banking infrastructure that can improve quality of life via impact on gender equality and challenge conventional thinking by youths and people to bring justice. The overlap – benefits revealed excess, efficiency, transparency, accountability and education which are experienced by all stakeholders and market participants. How Climate Fintech startups to integrate into the financial system, impacting the decarbonization of capital flows can be explained in Figure 3 below.

Climate Fintech Startups from individual, venture capital and private equity, universities and accelerators have been integrating central banks, investment banks and retail & commercial banks which released funds by managers with the investment from insurance companies, sovereign wealth funds and pension funds which ultimately decarbonize through renewable investment.

There are more than 250 Climate Fintech companies around the world which are engaging climate finance in which Europe constitutes 43%, US 32%, China 8% and other 17% respectively although 75% of Climate Fintech companies are early stage – having received USD 10 million in corporate capital or less. Germany constitutes 5% of Fintech covering UN SDGs showing lower rate of decarbonization in fintech ecosystem.

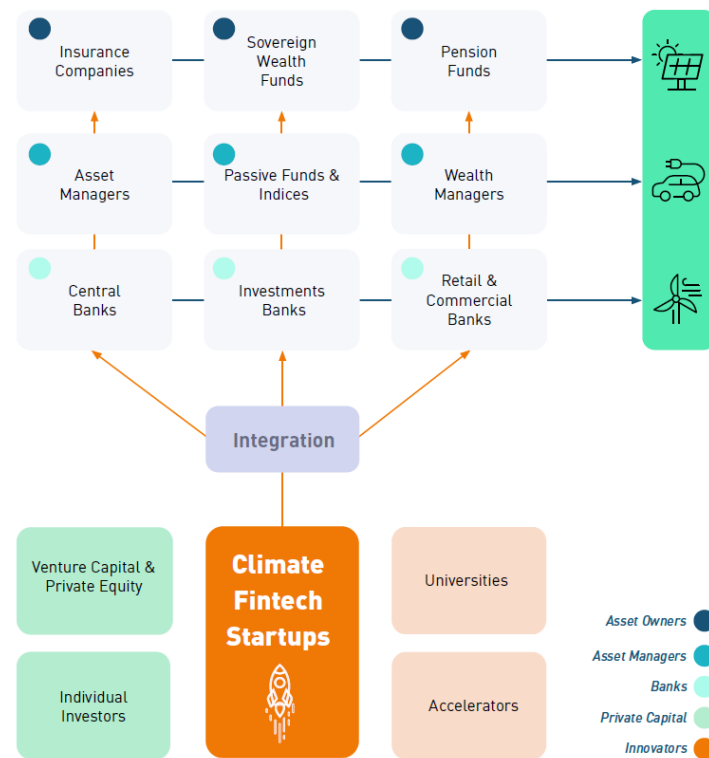


Figure 3: Working of climate fintech

Source: New Energy Nexus (2020)

Climate Fintech-Rise Insights report (2021) revealed that the FinTech sector has seen huge growth in the first half of this year 2021. The great success stories in the Fintech ecosystem can be mentioned as Rise member companies, alumni of the Barclays Accelerator, powered by Techstars, and other FinTech. Some examples are given below:

- The valuation of 3S Money stood £40 million on a £3 million Series B funding round
- Chainalysis secured a \$100 million Series C financing and its valuation became over \$2 billion
- Cognism provided \$12.5 million to support its plans to raise further across Europe
- Cutover mobilized \$35 million in Series B funding
- First Boulevard secured \$5 million in seed funding from Barclays, Anthemis and angel investors
- Flutterwave landed unicorn status with \$170m in Series C funding, tipping its valuation north of \$1 billion
- Safello became public with a highly oversubscribed pre-IPO fundraising round
- Tomo Credit collected \$7 million in a seed funding round joined by Barclays
- Waffle secured its total pre-launch funding to \$5.2 million with an additional \$3 million

Case Study of India

Paris agreement target of net zero emission goal by 2100 under given several policies such as 2.5°C-2.9°C, 2.4°C, 2.1°C, and 1.8°C have been plotted in the Figure 4 where the optimistic scenario is 1.8°C. The global GHG emission per year curve must steadily fall for consistent 1.5°C in comparison other targets in which 2030 target is more or less feasible. However, Only 27 countries have outlined a plan to get to net-zero emissions. The reliance on carbon offsets in many companies' net-zero plans means less focus in tackling source GHG emissions from their activities and supply chains.

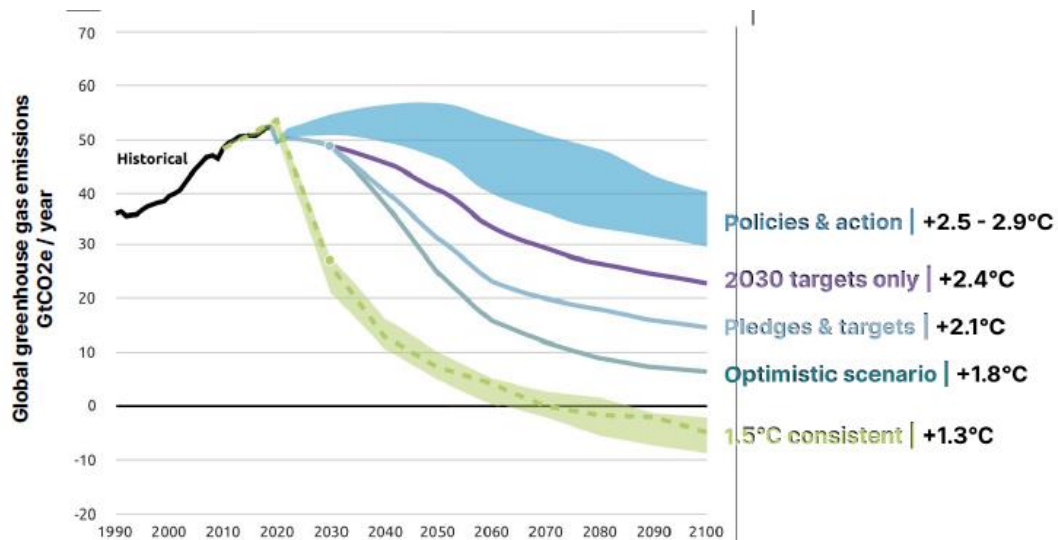


Figure 4: Net zero target of global emission by 2100

Source: unituscapital

India announced a net-zero target, to be achieved by 2070 at the start of the Glasgow COP26 Summit, backed by revised and strengthened country-level objectives around strengthened renewable energy and non-fossil fuel-based energy targets, and an absolute carbon emissions reduction target by 2030. The announcement is a good first step that will require policies, infrastructure, and industries to move towards reducing carbon emissions. India’s 2019 emissions were 3.15 GtCO₂, a 7% share of global emissions. India’s annual emissions were estimated to grow to 4.2 GtCO₂ by 2030 based on pre-cop26 which would be around 3.2 GtCO₂ based on cop26. For achieving net zero emission India’s 2030 emission target must be at around 2.6 GtCO₂. All these possibilities have drawn in Figure 5.

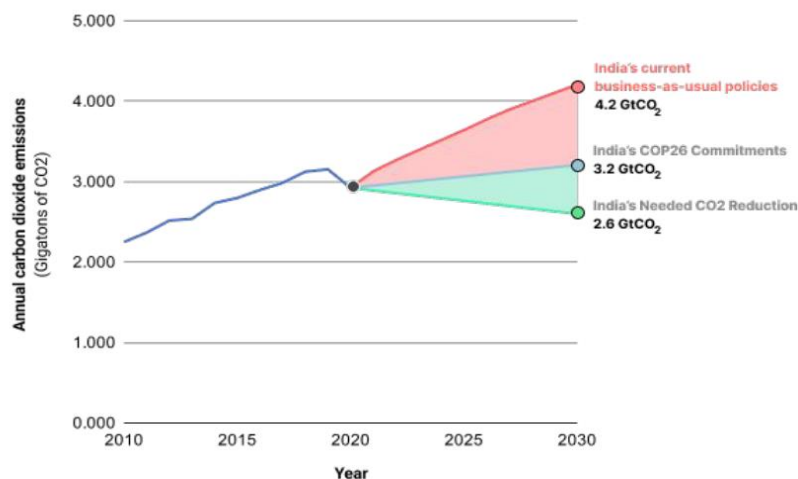


Figure 5: India’s pathways until 2030

Source: unituscapital

Among 10 largest companies, 8 companies set net zero goals by 2030 where Reliance India committed \$80 billion to green energy projects along with Amazon, LG, Hyundai who are pushing their value chain towards greener options.

Sareen and Shankar (2021) prepared a report based on climate finance structure of India which will need to combat climate change come in three forms: [i] Breakthrough Technologies, [ii] Adopting a Successful Global Solution, [iii] Adapting a Solution for India.

The key players that contribute to this ecosystem include in Indian Climate Innovation Financing Ecosystem are [i] Product Development Funders, [ii] Accelerators, [iii] Seed Funds Focused on Climate, [iv] Early-Stage Debt for Climate Startups.

Three lessons emerge out of the Infuse story in funding R&D, e.g., [i] Climate entrepreneurs need long term investment horizons, [ii] Investment vehicles need to figure out logical next steps for investees, [iii] Investment vehicles need to be careful about the choice of their investors and backers

Naturally, India's Climate Innovators come from [i] Research/Academic investors, [ii] industry investors. Climate Innovation in India requires targeted support platforms to mainstream early-stage climate innovations. We propose two financing and innovation structures for bridging this gap: The Innovation Demonstration Facility and Climate Venture Studio. All these can find two broad solutions, [i] Pick Winning Innovations, [ii] Create High Impact, Scalable Businesses. The Climate Finance Initiative looks to collaboratively build the climate finance ecosystem in which the efforts focused on three areas: [i] research and thoughts leadership, [ii] upcoming climate ventures, [iii] need climate asset financing fund through green founder. Sareen and Shankar (2020) also opined that the target of Investing \$100 billion a year, every year for climate finance must be gap of funding for action which demands Driving Private Finance Towards Climate Action.

The State of Indian Fintech Report 2022 claimed that India constitutes 102 Fintech which set to raise \$1.3 trillion investment by 2025 where the break up as per classification of fintech are 4.8% in neobanking, 9.5% each in lending tech, investment tech, Fintech SaaS, and cryptocurrencies, 14.3% in Insurtech and 42.9% in payments respectively. In 2021, Indian Fintech raised funding of \$9 billion. Sareen and Shankar (2022) estimated that ESG Funds in India now stood USD 1.7 billion in assets under management, up ~40% from 2020 where 67 Indian companies committed to climate targets, 14 committed to net zero goals and Climate tech businesses received USD 7 billion in equity funding in 2021 which is fourfold increase over the USD 1.87 billion in equity funding raised by all climate tech sectors in 2020 but the bulk of the climate financing still goes towards renewables followed by electric vehicles. The sectoral break up of equity funding in climate tech in 2021 are renewable-64.6%, electric mobility-23.2%, agri-supply chain-8.8%, and others -3.3% respectively. Emission Investment target in 2030 are in the areas of [i] resilient cities-18.8% (\$190 billion), [ii] renewable energy-19.8% (200 billion), [iii] sustainable foods-27.7% (280 billion), [iv] generation efficiency-9.9% (100 billion), [v] demand efficiency-5.9% (60 billion), [vi] electric transportation-17.8% (180 billion) respectively. In India there are 220+ investors in which a few are entering in the climate finance. Only 9% of climate tech investors are dedicated climate focused funds, or those with singular segment focus like [i] agritech, EVs and circular economy, [ii] 62% Usually tech focused VCs and PEs have started to make climate allocations, [iii] 17% Climate investments from angel funds and family offices picked up pace in 2021, a trend we expect will continue this year as well, [iv] 12% are corporate VCs. In 2021, green bonds provide large cleantech firms with an accessible, affordable option to raise patient capital of USD 6 billion. Venture equity, a multitude of debt providers, and green bonds are creating viable funding options for climate tech at scale at an early-stage innovations facing hurdles of risks. Climate fintech are still hopeful in India to find new investment opportunity and are opening up climate finance as an asset class for hundreds of millions of retail investors who can invest as little as \$300.

Climate Fintech: A Great Momentum

Climate Fintech is a digital financial technology which catalyzes decarbonization in which the green portfolio within the ecosystem covers the portion of market accessible to the public of retail consumers and helpful to see broader ecosystem as products in which many of the products and services listed – lending for renewable energy projects, green bonds, and funds. The coupling of Big Data, AI, Blockchain, Internet of Things, and Cloud Computing with financial products focused on climate change opens up a variety of new services which are even easier for individuals and companies to address climate change in more efficient and effective manners (Greenportfolio team, 2021).

Paulson Institute Green Finance Center (2020) revealed that there are more than 60 entities in China utilizing fintech to provide services for green finance which have been conducting in ESG analysis, environmental risk management, measurement of environmental benefits, green credit, carbon finance, and green bonds. The main players in China's green finance market are financial institutions and large- medium-sized enterprises. The regulators such as the PBOC, CBIRC, and Ministry of Finance (MOF) have provided guidance to financial institutions through policymaking and inclusive finance pilot programs that encourage increased financing support to SMEs. PBOC set the policies in 2018 which focus on [i] building a green lending management system, [ii] improving green lending management capability of financial institutions, [iii] enhancing the accuracy of green lending data reporting, [iv] providing data support for macro decision making and policy making in terms of preferred industries, pricing, asset quality and environmental benefits. The Institute recommended that the government should set up pilots for development of climate fintech products and services in green finance pilot zones for expansion of fintech by sandbox approach in a controlled manner.

The developing countries have many limitations such as lack of capital and poor governance to conduct climate fintech properly and hurt by the carbon footprint of developed countries. Yet, climate fintech is driving innovation in reducing carbon emissions with direct benefits to emerging economies, especially in Africa and Latin America. Tools like big data, artificial intelligence and blockchain can help streamline the path to net zero emissions with limited capital required. The climate fintechs have been changing directly to the farmers' livelihood using big data, AI and blockchain and machine learning through agritech company, Gro Intelligence, leverages data from satellite images, crop forecasts, topography and precipitation forecasts to predict droughts and locust swarms in Africa. In future, fintech applications will play a subtle, yet ubiquitous role in the looming battle against climate change (Mondato, 2021).

UNFCCC is giving green signals to any initiative relating to climate finance conducted by climate fintech or welcome any attempt or negotiation or agreement regarding decarbonization *Pari-Passu* with Paris accord. Recently, the UNFCCC has expressed support for the CCC initiative and the potential of blockchain technology to contribute to enhanced climate action and sustainability in which Climate Chain Coalition (CCC) is an initiative to cooperatively support the application of distributed ledger technology ('DLT', including 'the blockchain') and related digital solutions to addressing climate change that was established by 40 organizations, including the International Emissions Trading Association (IETA), formerly the Carbon Disclosure Project (CDP), the Energy Web Foundation, and Power Ledger (Nassiry, 2018).

Commerz Ventures (2022) reported that the climate fintech startups raised \$1.2 billion in 2021 which is three times greater than the previous year. Europe is the home which increased four times than the US. Climate fintech startups comprises 43% in Europe, 32% in US, 8% in China and 17% in others. Climate fintech is an emerging space where 68% of all funding rounds occurred at the seed or pre-seed stage. Carbon accounting and carbon risk management

are the climate fintech subsectors that attracted the most funding in 2021 with \$410 million and \$304 million respectively. In EU and US, there are 292 climate fintechs which raised funds of \$624 million and \$576 million respectively in 2021. In Europe \$194 million in UK, \$143 million in France, \$96 million in Germany, \$59 million in Finland, and \$50 million in Sweden were the funding status. It is important to note that 68 companies are related with carbon accounting, 29 in impact investing, 27 in ESG reporting, 21 in climate risk management. Carbon accounting startups will spend funding of \$410 million followed by \$163 million in carbon offsetting funding, and \$304 million in climate risk management. In 2021, B2B startups raised \$1 billion which is six times larger than B2C startups and B2B2C model attracted overall funding of \$25 million. Therefore, it is no doubt that overall climate fintech has shown a great momentum.

Concluding Remarks

International Institute of Sustainable Development have begun to see successful projects incorporating fintech from local and global organizations especially experimental Lakes Area in Canada to explore the sustainable development world adopting fintech to sustainable development practices and applying AI how Lakes Area understand the future of its lakes set against the backdrop of a changing climate using 50-year dataset. It also explores how new technologies—like big data, the Internet of things, blockchain and artificial intelligence—can support smarter ecosystem management although there is risk of generating environmental data do not recognize and prioritize a culture of data openness and transparency where there is no tool to take advantage of those technologies (Gunn & Stanley, 2018).

Yet, international climate institutions did not formulate any clearcut policies on the climate fintech-its functioning scope, area of finance, co-ordination strategies, limitations and other governance so that nature of funding and investment process can be predicted for potential impact. Only in a report of UNFCCC in 2021, it is known that the Green Climate Finance funding comprises 34% private sector and 66% public sector funding and portfolio allocation amounts 48% for adaptation (\$3.1 billion) and 52% for mitigation (\$3.3 billion) respectively (GCF 10th Report, 2021).

However, in 2019, United Nations Environment Program has adopted private sector engagement strategy to contribute to sustained transformative changes and innovations that are aligned with its Medium Term Strategy and Program of Work. It will engage with private sector to contribute to achieve sustainable development goals reducing existing and emerging environmental risks by 2025.

IPCC proposes new business models (e.g., pay-as-you-go) facilitate the aggregation of small-scale financing needs and provide scalable investment opportunities with more attractive risk-return profiles and can promote capital markets' climate financing by providing quality information to price climate risks and opportunities such as SDG and environmental, social and governance (ESG) disclosure, including the Task Force on Climate-Related Financial Disclosures. It encouraged the Greater public-private cooperation to increase and broaden investments, within a context of safeguards and standards. The policy can be integrated into national climate change policies and plans (IPCC 6th Assessment Report, 2022).

The climate funds have continually neglected gender issues and failed to incorporate a gendered perspective into program and projects. Climate funds must also recognize that women are well positioned to be agents of change through mitigation and adaptation activities. The green climate fund must integrate gender considerations from top to bottom (Bhowmik, 2020) where the role climate fintech must have responsibility in conducting projects towards fulfilling SDGs.

Declaration

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