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Financing India's Climate Transition: The Role of Venture Capital in Accelerating Climate-Tech Innovation

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Abstract:

India aims to achieve net-zero emissions by 2070. To achieve this commitment, it is pivotal for India to transition to a low-carbon and climate resilient economy. Projections indicate multi-million-dollar capital flows as necessary across clean energy, sustainable agriculture, waste management, and mobility systems, and achieving this goal will require unprecedented levels of investments. While public finance and multilateral support remain crucial, private investment, particularly in the form of venture capital (VC) is emerging as a significant enabler of climate-tech innovation. This study uses a qualitative and exploratory methodology to examine the impact of venture capital in developing India's climate-tech innovation between 2015 and 2025.

Findings show that India is home to a growing number of climate-tech startups, with over 800 firms operating across domains like renewable energy, electric mobility, waste-to-value, and sustainable agriculture. Despite inflow of several billion dollars in VC in the last decade, majority of capital is concentrated in mobility and early-stage funding sectors, while later-stage financing and less commercially visible sectors remain underfunded. High risk perception, limited exit options, and regulatory ambiguity are major challenges. There exist opportunities in India's policy push and ESG-driven global finance. The study concludes that while venture capital is an essential catalyst for climate innovation, it is not enough on its own; institutional support, policy alignment, and integration into a larger ecosystem of blended finance are also crucial.

Keywords: Venture Capital, Climate-Tech Startups, Sustainable Finance, Green Economy, India, Climate Innovation, Low-Carbon Transition

1. Introduction:

Climate change poses a serious threat to India's economic development, social welfare, and environmental sustainability. India's extensive coastline and productive agriculture make it highly susceptible to agricultural stress, sea level rise, and extreme weather condition. (BK MUFG, 2024). India has pledged to achieve net zero emissions by 2070, which will require significant investments in clean technology, renewable energy, resilience, and adaptation. India will require approximately USD 10.1 trillion between 2020 and 2070 to realize its net zero targets, according to a recent CEEW analysis. Conventional sources might supply USD 6.6 trillion, leaving a

funding deficit of approximately USD 3.5 trillion (IFC India, 2024). The development necessitates new methods of capital mobilization, representing not only a technological challenge but also a financial one.

Private venture capital and risk capital have become necessary tools to accelerate climate-tech innovation. Climate and growth investing amounted to USD 32 billion globally in 2023. India alone attracted USD 804 million (ANDE, 2024). Indian climate-tech startups raised around USD 7.2 billion during the years 2018–2023 and mobility, charging infrastructure, and energy storage were the most heavily funded segments (Finding and Funding the Next Frontier of Climate Investments in India, 2024). Yet, there exist still pertinent funding gaps because few of these Indian climate-tech startups have proceeded beyond earlier-stage VC rounds (Series B and later) (BK MUFG, 2024).

India's reported green finance flows in FY 2021-22 were INR 3,712 billion (USD 50 billion). However, it is observed that the private sector contributions were highest, and flows into adaptation or early-stage innovation are minimal. Private equity and venture capital are majorly recorded in mitigation and make up a very small portion of financing for adaptation and innovation (less than 1%) (Landscape of Green Finance in India, 2024).

India's climate-tech ecosystem, therefore, is at a crossroads: there is tangible momentum in venture capital, but the scale and nature of capital are not sufficient to keep pace with climate transitions' ambitions. The ecosystem needs to access deeper capital, blended instruments, policy support, and strategic alignment to direct VC toward meaningful innovation.

Against that context, this paper aims to examine the contribution of venture capital to the development of climate-tech innovation in India, ascertain the opportunities and challenges faced by investors and start-ups, and shed new light on how the new VC-climate nexus could develop.

2. Objectives:

The primary objective of this study is to analyze and discuss venture capital's role in climate innovation financing in India with specific regard to the climate-tech ecosystem that encompasses clean energy, sustainable agriculture, waste-to-value, and mobility solutions. It attempts to explore case studies of climate-tech startups and funding channels, illustrating the ways early-stage and growth-stage funding shape the scalability of green innovations. It further seeks to analyze the possibilities and challenges between financial returns and long-term sustainability impact, particularly in a scenario where risk, profitability, and regulatory uncertainty converge. Lastly, the study intends to investigate how venture-backed climate innovation would affect India's sustainable development path, providing insights into how private capital could be made to support public policy to drive India's shift towards a low-carbon and climate-resilient future.

3. Results:

3.1. Growth of Climate-Tech Startups in India:

Since approximately 2015, India's climate-tech startup ecosystem has gained momentum, driven by policy measures (e.g. National Solar Mission, FAME, clean energy auctions) and Sustainable Development Goals (SDG) alignment. As per the *India Climate Tech Startup Landscape* report, the ecosystem has more than 800 active climate-tech startups. The same report identifies that approximately two-thirds of such startups have received seed funding, but less than 3% have moved towards Series B and later (BK MUFG, 2024).

The *Innovation for Impact* report indicates that between the years 2014 and 2024, Indian climate-tech startups collectively raised approximately USD 3.6 billion, although the proportion of growth-stage capital is still low. The report further suggests that fewer than 2.5% of climate-tech startups were able to raise Series A+ funding, a strong pointer towards structural financing gaps (IIMA Ventures & MUFG, 2024).

Across thematic sectors:

- *Renewable energy / clean energy*: Startups and companies innovating in solar, wind, battery storage, and hybrid systems have played a key role in India's energy transition. The cost reductions in solar PV and battery storage emphasize the need for low-cost capital to replace coal generation (Mohan et al., 2021). Companies like ReNew Power illustrate how climate-tech innovation at scale entails both entrepreneurial imagination and access to large-scale capital.
- *Mobility / EV sector*: Climate-tech funding is disproportionately skewed towards mobility, with EV startups receiving massive amounts of capital. The report from *Innovation for Impact* reveals transport and mobility industries to have accounted for ~85% of climate-tech investments in India, primarily due to EV and charging infrastructure businesses (IIMA Ventures & MUFG, 2024).
- *Waste-to-value / circular economy*: Modular biogas, waste-to-energy, recycling, and circular resource recovery startups have emerged over the years. For example, GPS Renewables has been involved in building modular biogas units that process organic waste into bioenergy. Although such models are promising, scaling them requires capital and operating support.
- *Agritech / sustainable agriculture*: Though less salient in funding, climate-smart agritech companies (precision nutrition, soil health, input optimization) are just emerging, backed by impact investors (Impact Investors Council, 2024).

Collectively, these trends indicate diversification of climate-tech is in progress, but most startups remain nascent, and growing beyond prototype or pilot scale continues to be a challenge.

3.2. Venture Capital Landscape in India (Green / Climate-Tech):

India's broader VC / PE ecosystem has remained robust even in the face of global headwinds. Bain's 2025 India Private Equity & Venture Capital Report observes that India's overall VC funding

recovered to USD 13.7 billion in 2024 (Bain India, 2025). While this includes all sectors, it indicates that capital is present, though competitively.

In climate-tech alone, financing has been volatile. The IEEFA's *Financing India's Climate Future* report states that fragmented flows prevent systemic scaling and posits the importance of blended capital and risk mitigation. India's draft climate finance taxonomy also highlights the requirement to categorize and direct "climate-aligned" investments in the right manner to mobilize private capital (Garg & Srivastava, 2025).

Major participants in Indian climate-tech are mainstream VCs like Sequoia India, Accel, Blume Ventures, as well as specialist climate / agritech funds (e.g. Omnivore) (IIMA Ventures & MUFG, 2024). For instance, MUFG itself has initiated the Bharat ClimateTech Initiative to fund growth investments in climate-tech startups in India (IIMA Ventures).

There is a conflict that arises between international climate funds and local VCs. Global funds tend to introduce deeper capital, cross-border skills, and risk tolerance compared to local VCs that offer local market knowledge, network and regulatory skills. Local funds might be slower and more cautious in investing in late-stage climate tech due to lengthy gestation and regulatory risk (Jena et al., 2025).

Consequently, venture capital investments in India's climate-tech are significant but remain relatively small in terms of overall VC investment; the break-out beyond seed/early stage is the critical gap.

3.3.Challenges:

3.3.1. High-Risk Perception and Limited Exits:

Climate-tech ventures usually tend to be deep-tech, capital intensive, and feature lengthy development cycle. The Series B / C funding gap persists: an INSEAD-referenced IEEFA analysis states that India's climate tech VC space is in its infancy and unable to close later-stage funding gaps (Jena et al., 2025). In the absence of strong exit channels (through M&A or IPOs), investors are unwilling to fund high-investment, long-term climate projects.

3.3.2. Policy and Regulatory Uncertainty:

There exist ambitious policies like Green Hydrogen Mission, EV incentives, renewable auctions, but with a lag in their implementation. Delayed land acquisition, grid interconnection issues, tariff changes, and state-level regulatory fragmentation inject uncertainties that discourage investment.

3.3.3. Trade-off Between Profit and Sustainability:

Startups must balance commercial returns with sustainability and environment related objectives. Most early climate-tech models have low margins or delayed ROI, which puts

pressure on VCs for short-term returns. This conflict discourages investment in more innovative or high-impact models.

3.3.4. *Ecosystem / Institutional Barriers:*

Talent shortages (particularly in niche areas), poor incubator connections, limited infrastructure in rural or semi-urban regions, and segmented markets hinder scaling. Inadequate reliable data, standards, and sector connections add to scaling difficulties.

3.4. Opportunities:

3.4.1. *Policy & Institutional Momentum:*

India's changing climate finance structure, through its draft taxonomy, urge for blended instruments, subsidies, and green procurement creates a positive setting to de-risk investment (Garg & Srivastava, 2025). Public capital or guarantees, for instance, could be used as "entrepreneurial state boosters" to trigger private investment in climate-tech (Jena et al., 2025).

3.4.2. *ESG and Global Climate Finance Inflows:*

Internationally, climate-tech continues to be the focus of institutional investors and specialized climate funds. As ESG mandates catch on, Indian climate-tech startups might see cross-border capital flowing into them. The draft taxonomy indicates intent to direct domestic capital more transparently.

3.4.3. *Market & Demographic Advantage:*

India's vast and expanding population, increasing electrification, agricultural dependence, and climate exposure represent large demand for climate-tech solutions. Startups capable of providing localized, low-cost solutions have potential for scalability, particularly in tapping India's deep software or tech talent pool.

3.4.4. *Blended Finance & Innovative Instruments:*

Blended funding approaches involving concessional public capital, guarantees, revenue-sharing or royalty rights, and equity can support risk reduction and private investor attraction. Public co-investment, de-risking products, or targeted grants can fill capital gaps.

4. Discussion:

The empirical data indicates that venture capital has started to contribute meaningfully towards India's climate-tech ecosystem, early-stage innovation being the main area. The aggregate quantum of VC funding, however, continues to be modest in comparison to the requirement. In the last decade, climate-tech companies raising ~USD 3.6 billion is encouraging but much less than the multi-trillion-dollar size of investment that will be needed for India's net-zero and climate resilience ambitions (IIMA Ventures & MUFG, 2024; Garg & Srivastava, 2025).

VC has accelerated experimentation, prototyping, and early traction particularly in mobility, clean energy, and waste-to-value startups. Examples of thriving businesses such as ReNew prove that climate-tech can be scaled with enough capital and implementation. Yet, numerous startups get stuck between demonstration and commercial scale due to a lack of funding, regulatory uncertainty, and market barriers.

The conflict between sustainability objectives and profit imperatives is still at the heart: not every climate-tech model meets conventional VC return profiles, so it implies that VC is going to have to be supplemented by catalytic and patient capital. India's scalable climate innovation will need an organized ecosystem with enhanced policy certainty, blended finance instruments, trustworthy valuation and exit arrangements, incubator assistance, global capital connections, and standardized structures (e.g. taxonomy).

In conclusion, the VC and climate action connection in India is evolving and promising. However, its existing magnitude is imperative but also inadequate at the same time. To completely leverage climate-tech innovation towards India's green transformation, venture capital needs to become part of a larger ecosystem involving public policy, finance architecture, and entrepreneurship support.

5. Conclusion:

This study has analyzed the changing role of venture capital in facilitating climate-tech innovation in India. Evidence suggests that although the industry has accelerated post-2015, with over 800 startups in operation and raising a provisional USD 3.6 billion in the past decade, the magnitude is still small compared to India's net-zero goals. Thematic analysis indicates that mobility and energy sectors lead venture flows, with waste-to-value and sustainable agriculture underfinanced even though they are strategic.

The findings highlight that venture capital is a required but not a sufficient driver of India's climate transformation. VC has facilitated early-stage risk capital, enabled experimentation, and sparked technology pilots. Yet, systemic constraints such as shortages in later-stage funding, regulatory uncertainty, and the balancing act between profit needs and sustainability objectives stymie its transformational potential.

Looking ahead, it will be essential to integrate VC into a larger ecosystem of mixed finance, public incentives, and international climate capital. Greater policy clarity, green finance taxonomies, catalytic instruments, and cross-border linkages can amplify scale-up opportunities. Venture capital, in this respect, can act as a valuable bridge between India's entrepreneurial energy and its sustainable development objectives, but only within a systemic, multi-stakeholder architecture (Mohan et al., 2021).

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