



GLOBAL
FINTECH
FEST

TECHNOLOGY & SUSTAINABLE FINANCING:

A Partnership for the Planet

Paper Abstract:

The world is facing unprecedented challenges, with climate change and environmental degradation at the forefront of global concerns. Sustainable financing is emerging as an imperative for capital providers, with developing economies like India requiring close to \$170 billion each year to meet their respective net-zero goals.

Technology can play an influential role in advancing sustainability goals by providing data-driven insights to financial institutions and promoting ESG integration and reporting in financing.

The paper explores how a technology framework can enable financial institutions and investors to assess and monitor the use of funds against their sustainability objectives. This is achieved by:

- Using unstructured data including, geospatial analytics and research reports
- Leveraging artificial intelligence to generate deep insights from data rapidly
- Utilizing cloud technology to store and process large amounts of data

The paper concludes with a discussion of similar approaches taken across the globe and the interventions being put in place from both regulatory and ecosystem standpoints to help create an environment for sustainable financing that is transparent and accessible.

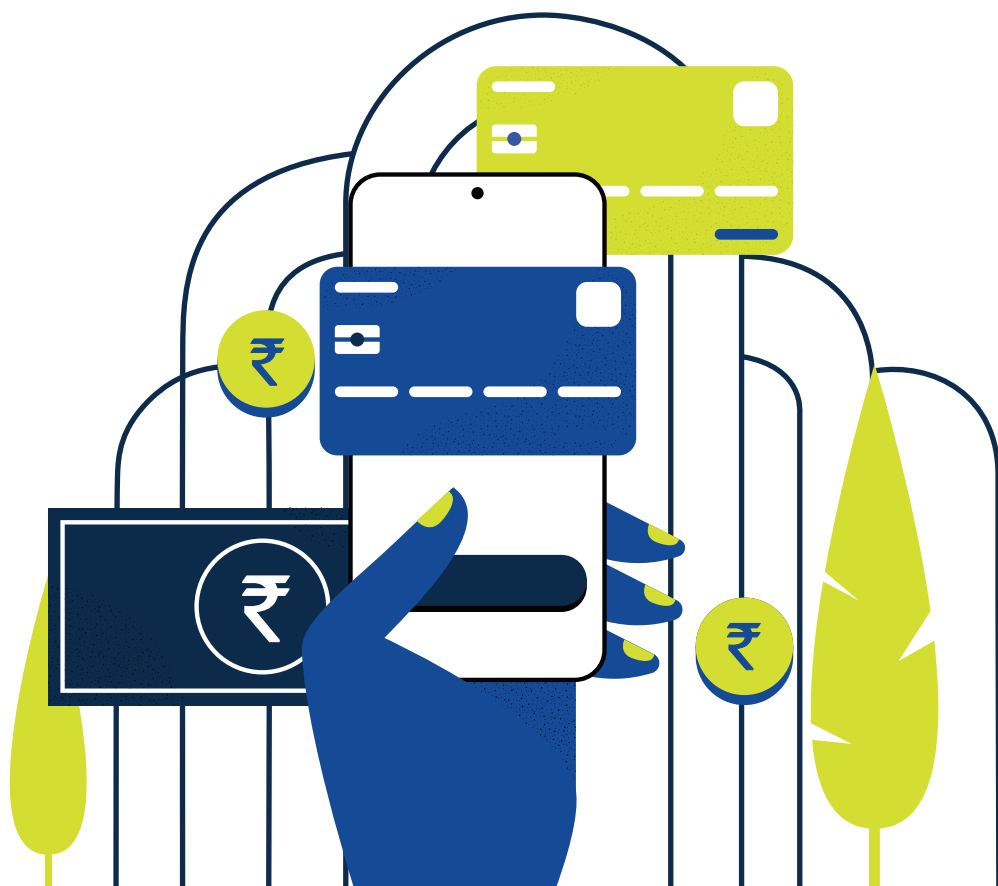


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INTRODUCTION & BACKGROUND:

SUSTAINABLE FINANCING



The world is facing unprecedented challenges, with climate change and environmental degradation at the forefront of global concerns. According to the 18th edition of the Global Risks Report 2023, released by the World Economic Forum (WEF), 'Failure to Mitigate Climate Change' and 'Failure of Climate Change Adaptation' stand as the two most severe risks facing the world in the upcoming decade. These are closely followed by 'natural disasters and extreme weather events' as well as 'Biodiversity loss and ecosystem collapse'.

Climate events such as heat waves across Europe, wildfires in North America, droughts in Africa, and floods in Asia have surged in frequency and severity. These occurrences underscore the climate-related catastrophes unfolding across continents. The evidence of climate change is abundantly clear in our surroundings, serving as a stark reminder of its pressing urgency. While national governments are at the forefront of the global response to this complex crisis, a growing consensus highlights the need for collective action involving all economic stakeholders.

With over 130 countries announcing or considering net-zero targets, the focus now shifts towards securing sufficient funds to translate these commitments into actionable laws and plans. Around \$50 trillion in incremental investments will be needed by 2050 to shift the global economy towards net-zero emissions, thereby preventing a climate catastrophe.

Developing economies like India require close to

\$170 BILLION

each year to meet their respective net zero goals.

AS OVER **130**

countries have expressed their commitment to achieving net-zero emissions, the emphasis now is to have adequate funds to convert these pledges into actionable laws and plans.

AROUND

\$50 TRILLION

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As outlined in its updated Nationally Determined Contributions (NDCs), India has committed to reduce the emissions intensity of its GDP by 45% by 2030 from 2005 levels. Additionally, it aims to achieve 50% of its cumulative electric power installed capacity from non-fossil fuel sources by 2030 with the help of the technology transfer and low-cost international finance including from Green Climate Fund (GCF). Further, India aims to create an additional carbon sink of 2.5 to 3 billion tons of CO₂e through increased forest and tree cover by 2030.

India's NDCs also indicate that the nation will require an estimated USD 170 billion annually for initiatives related to climate action. However, to significantly accelerate the climate transition and achieve a Net-Zero emissions status by 2070, India would need cumulative investments of USD 10.1 trillion.

Conventional lending practices, on their own, are inadequate in addressing the pressing requirement for sustainable development. Therefore, the demand for innovative mechanisms to fund sustainable growth at a rapid pace and substantial scale, to limit global warming to 1.5 degrees becomes paramount. This is precisely where the concept of sustainable financing emerges.

Representing a paradigm shift in investment principles, sustainable financing channels capital through innovative financial mechanisms into initiatives aimed to address critical global sustainability challenges. These encompass the protection of the environment, mitigation of climate change and efforts towards adaptation and resilience. Sustainable financing is steadily gaining prominence among capital providers for several compelling reasons. Firstly, there's a growing demand from investors to allocate their investments towards ESG initiatives, including sustainability. This requires financial institutions to have a comprehensive understanding of the environmental impact of their investments.

Secondly, the failure to effectively manage climate risks carries significant consequences. This jeopardizes their assets and profitability and has far-reaching implications on their relationships with various stakeholders. Within this landscape, prioritizing sustainable financing emerges as a responsible choice and a strategic imperative to ensure long-term success and resilience.

Sustainable Financing Landscape in India

Sustainable financing has gained significant prominence in India, especially in recent years. The financial landscape has witnessed a notable shift, wherein financial institutions and investors are increasingly recognizing the importance of aligning economic growth with global environmental and social well-being. However, a gap persists, according to conservative estimates by the Climate Policy Initiative study 'Landscape of Green Finance in India' published in August 2022, the currently tracked green financial activities in India represent around 25% of the overall funding needed across various sectors solely to achieve the NDCs. On the government end, funds have been established to facilitate green finance, including the National Clean Energy Fund (NCEF) in 2010, which channels revenue from coal taxes into clean energy projects.

Additionally, institutions like Indian Renewable Energy Development Agency (IREDA), play a pivotal role by extending financial support and loans to public and private entities engaged in renewable energy projects.

Apart from the government's efforts, private sector entities also play a significant role in advancing green finance in India. Numerous banks and financial institutions have introduced green bonds to fund environmentally sustainable projects. Guidelines issued by the Securities and Exchange Board of India (SEBI) govern their issuance and listing. This is in addition to the sustainability-linked loans provided by banks and active investments by venture capital firms and private equity investors to fund start-ups and early-stage companies focusing on sustainability and reducing environmental impact.



India has committed to reduce the emissions intensity of its GDP by **45%** by 2030 from 2005 levels.



According to India's NDCs, the nation is projected to need approximately **USD 170 billion** annually for climate-related initiatives



Achieve **50%** cumulative electric power installed capacity from non-fossil fuel sources by 2030



Enhance forest and tree cover to create an additional carbon sink equivalent of **2.5 - 3 billion tons** of CO₂ through additional forest and tree cover by 2030



To substantially elevate the climate transition and attain Net-Zero emissions by 2070, India would necessitate cumulative investments of **USD 10.1 trillion**

We need innovative mechanisms to fund the sustainable growth at a speed and scale to limit global warming to **1.5 degrees** – this is where sustainable finance comes into play.

The present tracked green financial activities in India represent around **25%** of the overall funding needed across various sectors solely to achieve the NDCs.

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ROLE OF TECHNOLOGY

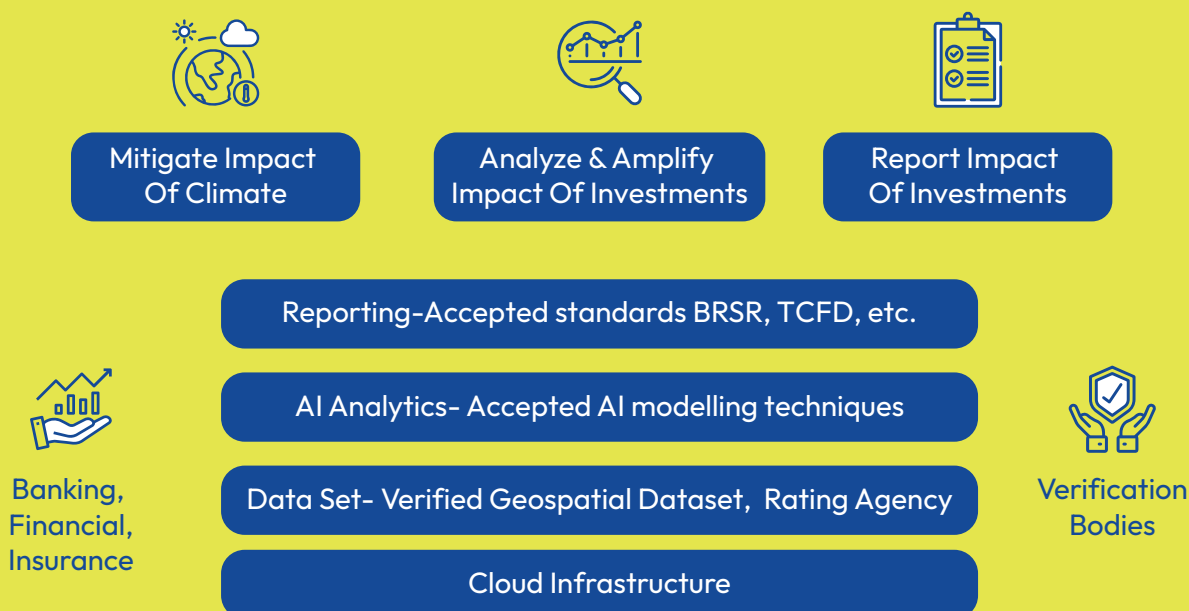
IN ADVANCING SUSTAINABLE
FINANCING



Technology is a potent enabler for sustainable financing, offering data-driven insights, promoting ESG integration and reporting, conducting risk assessments, measuring impact, and enhancing access to impact investing opportunities. The synergy between technology and sustainable financing unlocks transformative potential, facilitating well-informed, data-driven investment decisions that catalyze positive change.

This paper proposes a systematic framework, M.A.R.S (Mitigate, Analyze & Amplify, Report Impact for Sustainability goals), designed to harness technology effectively. At its core, the framework leverages cloud data computing capabilities to address complex AI-led scenario modeling. It also explores the utilization of geospatial analytics to enhance transparency in analyzing investment impact and subsequent regulatory reporting

M.A.R.S Technology Framework



Mitigate impact on Environment

Climate and environmental risks are critical considerations in sustainable financing. Spatial finance, a specialized field integrating geospatial data into financial theory and practice, employs advanced AI models to evaluate and mitigate the effects of funded projects on socio-economic and environmental factors.



AI based geospatial software can rank potential sites by weighting different screening criteria.

Banks across the globe are already embarking on this type of analysis. HSBC has developed a credit ranking tool capable of running multiple "what-if" climate risk scenarios simultaneously, leveraging the massive compute capabilities in the cloud to run complex AI/ML programs. Organizations can build their custom models by leveraging research such as the World Climate Research's Programme's Coupled Model Intercomparison Project (CMIP). There are also emerging SaaS solutions in the space that can help with AI and workflow capabilities - such as Climate Engine's SpatiaFi solution.

Closer to home in India, the Pradhan Mantri Fasal Bima Yojana is encouraging Indian banks and NBFCs to incorporate geospatial analytics into their disbursement decisions. Geospatial technology enables organizations to analyze satellite imagery using AI/ML techniques to identify crop types (rice, maize, wheat, etc.) and predict outcomes such as future yield or crop infestation. These insights prove crucial for underwriting agricultural investments.

Another notable trend is the growing interest in dedicated adaptation and resilience bonds. These innovative financial mechanisms not only have the potential to assist developing nations in managing their debt obligations but also to mitigate financial losses and reduce revenues arising from climate-related risks and disasters.

Consequently, these bonds pave the way for striking a delicate balance between maintaining economic stability and reinforcing nations' resilience against the impacts of climate change. AI platforms can play a role in simulating disaster scenarios, thereby assisting governments, emergency teams, and communities in understanding the potential effects of earthquakes and floods.

Analyze & Amplify Impact

Technology can be leveraged during the investment phase to comprehend the risks and rewards of investment in projects, assets and companies. It can also be utilized to gauge the environmental repercussions of the decisions undertaken. Some specific digital interventions encompass:



Data-driven decision-making

Technology empowers financial institutions to harness vast datasets for making well-informed investment decisions rooted in environmental, social, and governance (ESG) metrics. The digitization of financial data and the development of advanced analytical tools have enabled investors, businesses, and policymakers to access more profound insights into the ESG performance of companies and projects. In recent years, several rating agencies such as ESG Book, MSCI, Sustainalytics, and Bloomberg have begun to provide data via subscription on cloud platforms. These subscriptions can seamlessly integrate with financial institutions existing analytics and data warehousing solutions.



Technology-driven platforms can leverage geospatial and machine learning-based tools to identify investment opportunities in energy projects. For instance, financial institutions can ascertain the economic feasibility of a solar farm by employing geospatial analysis to comprehend solar irradiance, a critical determinant in solar generation. Some deep-tech organizations that provide this data at a higher frequency (measured in minutes, rather than days) and greater granularity (encompassing a 4 km² radius as opposed to larger areas), which was unattainable previously.

Organizations also have the option to construct their own tailored analyses by harnessing satellite imagery, such as the Global Solar Atlas dataset, which provides data at a 250m resolution. These illustrations also apply to other renewable energy sources such as, wind (Global Wind Atlas Dataset), which can help mitigate the risks associated with investing in a low-margin business.

Another emerging usage of data is to analyze the flood risk at a property level, rather than confining to the suburbs or cities. Without this granularity of understanding, FSIs (financial services institutions) may miscalculate risks enormously, both underestimating and overestimating them, potentially causing them to overlook safe investment opportunities that competitors have overlooked. Conversely, they might assume an excessive level of risk by relying on an average score.

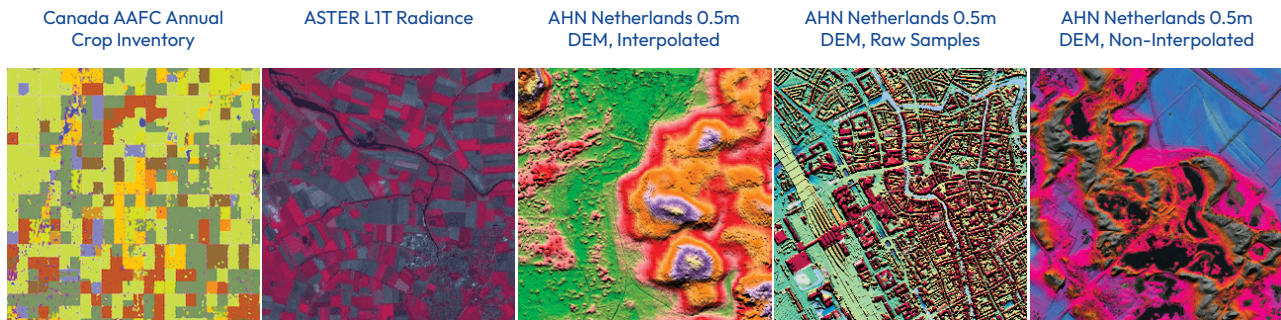


Exhibit: Geospatial data set available on Hyperscaler platforms like Google Cloud

Accelerating New Product Development Innovation Adoption

The integration of technology into sustainable financing has also catalyzed innovative financial products. Green bonds, for instance, have emerged as a prominent debt instrument for funding environmentally friendly projects. These bonds raise capital for initiatives such as renewable energy infrastructure, energy-efficient buildings, and clean transportation. Transparency, impact measurement and reporting are essential cornerstones of green bond financing, allowing investors to validate that their resources were used judiciously and helped generate the desired impact.

Technology streamlines the issuance and tracking of green bonds, ensuring that the funds raised are channeled into the intended projects and that their environmental impact is accurately measured. For instance, Distributed Ledger Technology (DLT) can play a pivotal role in shaping green bond issuance architectures and tracking platforms. It facilitates the seamless exchange of immutable data among various stakeholders, ultimately contributing to the transparency in fund allocation and fortifying the overall integrity of the bond market.

Looking ahead, the ongoing advancement of technology is anticipated to usher in a new wave of sophisticated tools and strategies within sustainable financing. As technology persists in its relentless progression, its significance in championing sustainability within the financial domain is on the brink of assuming an even more pivotal role.

Integrating technology into sustainable financing stands as a critical imperative, essential for propelling advancement, unveiling novel prospects, and harmonizing the financial sector with the pressing need for a globally sustainable and robust economy.

Process for Green Bond Issuance



Confluence of Technology in Green Bond Issuance

Challenges addressed through use of Technology in Green Bonds



Internet of Things (IoT)

Challenges Addressed

- Real-Time Data Collection: For precise analysis of project performance
- Monitoring Accuracy: IoT sensors for tracking project metrics (e.g. energy generation, emissions reduction) with precision
- Automated Reporting: Leveraging IoT data



Artificial Intelligence and Machine Learning

Challenges Addressed

- Efficient Project Evaluation: AI/ML analyzes large data for eco-friendly projects effectively
- Optimized Pricing: AI optimizes bond pricing using market analysis
- Personalized Investor Engagement: AI tailors marketing for better engagement
- Trend Analysis: ML identifies insights from ongoing data
- Risk Assessment: AI assesses project and investment risks accurately



Cloud Computing

Challenges Addressed

- Efficient Data Management: Cloud storage securely stores and access documents, reports, and communication
- Collaboration: Cloud tools enhance stakeholder communication and coordination
- Scalability: The cloud handles large data volumes from monitoring and reporting



Blockchain

Challenges Addressed

- Transparency and Accountability via Blockchain Immutable and auditable record of transactions and project progress.
- Fraud Prevention: A decentralized nature reduces the risk in transaction records
- Secure Data Sharing: Blockchain enables safe data sharing with integrity

Creation of New Avenues for Impact Investing

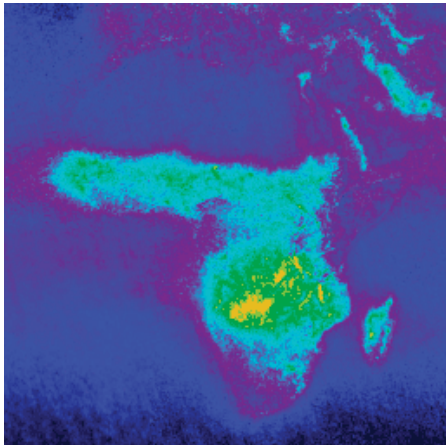
Technology facilitates the growth of digital platforms for impact investing, connecting investors with sustainable projects and businesses worldwide. These platforms play a pivotal role in democratizing sustainable financing. Online platforms and mobile applications have expanded access to sustainable investment opportunities, allowing retail investors to participate in projects that promote environmental and social well-being. Crowdfunding platforms and peer-to-peer lending networks facilitate direct investments in renewable energy projects, community initiatives, and sustainable startups, bypassing traditional intermediaries. There has been mushrooming interest and adoption of platforms like Lendahand, OpenInvest, Trine and Wefunder recently. This democratization fosters a broader engagement with sustainable financing, empowering individuals to allocate capital towards initiatives aligned with their values.

A significant factor in ensuring the adoption of technology in sustainable financing is the ability to track and report the impact of investments to stakeholders flexibly. Unfortunately, most organizations are grappling with this challenge and resorting to traditional, manual means of reporting. These methods are beset with issues of inconsistency, data staleness and at times malpractices in reporting. Technology, particularly geospatial analytics and machine learning is expected to play a crucial role in ensuring transparency around reporting.

The commercial feasibility and access to publicly available geospatial data through government entities (such as NASA and ESA) can simplify comprehending the impact of the Financial Institutes' investments on the environment. Best practices and insights can be drawn from industries beyond Financial Services. For instance, Unilever combines the analytical power of cloud and satellite imagery to store, analyze and comprehend the impact of their palm oil sourcing operations on the local environment and communities. Similar parallels can be contemplated within the financial services industry to establish an accurate and transparent methodology. Some examples of the use of technology in simplifying:

- Reporting the impact of green cover (loss, deforestation, forest fire) by leveraging time series analysis analyzing ESA's Sentinel-2 data, available at a resolution of 10m² and a refresh rate of 5 days.
- Reporting the impact on emissions such as CH₄, NO_x and SO_x over a specific land area by leveraging Sentinel-5P satellite data, which gathers data at a daily resolution of 1 km, as well as newer sources like GHGSat which are capable of capturing higher resolution emissions data.
- Reporting the impact of the organic carbon sequestration program through high-resolution optical imagery from planet augmented with high-resolution synthetic aperture radar data to measure tree canopy height.
- Reporting progress using high-resolution aerial or satellite imagery to ensure the installation of solar panels and water tanks, or to conduct accurate aboveground biomass calculations for carbon sequestration, ensuring the effectiveness of reforestation projects.

Sentinel-5P NRTI HCHO: Near Real-Time Formaldehyde



Dataset Availability

2018-10-02T07:58:03Z–2023-09-03T04:41:36

Dataset Provider

European Union/ESA/Copernicus

Earth Engine Snippet

```
ee.ImageCollection("COPERNICUS/S5P/NRTI/L3_HCHO")
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Exhibit: Geospatial data available via the Sentine-5P data. This dataset is for real-time formaldehyde formation, which is a precursor to GHG release.

DRIVERS FOR RAPID INTEGRATION OF TECHNOLOGY

IN SUSTAINABLE FINANCING



A confluence of influential factors propels the seamless integration of technology into sustainable financing. This convergence encompasses various elements, ranging from the ready availability of comprehensive data and the evolution of regulatory frameworks to the shifting preferences of investors and the pursuit of enduring resilience. As the trajectory of technological advancement continues unabated, its pivotal role in shaping the course of sustainable financing becomes increasingly pronounced. As these drivers synergize, they propel sustainable financing beyond a mere trend, solidifying it as a fundamental pillar of modern financial practice.



Regulatory Impetus: Catalyzing Technology-Enabled Sustainable Financing

The progressive evolution of regulatory landscapes also plays a pivotal role in integrating technology-facilitated sustainability and climate-focused initiatives within sustainable financing. Rapidly maturing reporting standards, aligned with the shared priorities of regulators, consumers, and investors worldwide, amplifies this driving force. Notable examples of these evolving standards include the directives of the US Securities and Exchange Commission (SEC), the European Union's Corporate Sustainability Reporting Directive (CSRD), the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD), and India's own Securities and Exchange Board (SEBI) Business Responsibility and Sustainability Reporting (BRSR) guidelines. Within this regulatory context, the Indian perspective on the BRSR particularly highlights the pivotal role of data security and reliability in attaining assurance of core ESG parameters.

Amplifying Investor Confidence and Enhancing Transparency

SEBI introduced a transformative dimension through its introduction of ESG-categorized mutual funds. This regulatory initiative empowers asset management companies in India to launch multiple ESG funds. The simultaneous enhancement of reporting rigour and transparency serves as a potent catalyst in bolstering investor confidence. In a parallel vein, India's sovereign financial landscape experiences a seminal moment with issuing the inaugural green sovereign bond. This landmark endeavor successfully garnered \$1 billion at a capital cost lower than conventional debt instruments. Concurrently, the Reserve Bank of India has committed to issuing novel guidelines encompassing climate stress testing, climate disclosure, and green deposits within the banking sector. SEBI has advanced its commitment by extending its green bond and corporate disclosure frameworks reflecting a comprehensive embrace of sustainability within the capital markets. Recent innovations include novel frameworks for blue (ocean) and yellow (solar) bonds, coupled with promulgating ethical guidelines to forestall the perils of greenwashing. These developments are significant driver for integrating a robust technology infrastructure for assessment, reporting, and decision-making.

Stakeholder Drive for Transparency and Accountability

The integration of technology into sustainable financing is significantly driven by improved data accessibility and enhanced accuracy. The digital age ushers in an era of extensive data collection, empowering diverse stakeholders such as businesses, investors, and policymakers. Extracting valuable insights from these data sources, including various environmental and social factors, establishes a robust foundation for making informed decisions.

Importantly, this surge in data emphasizes the growing need for increased transparency and accountability across ESG standards. Technology plays a vital role in facilitating transparency, by providing financial institutions with the means to effectively oversee, analyze, and disclose ESG metrics. This mutually beneficial interaction between technology and accountability bolsters investor trust and reinforces the commitment of financial entities to sustainable principles.



CHALLENGES



While technology is an enabler to increase transparency and comparability, there are a few barriers one needs to be mindful of. They are primarily around the following:



Reporting Standards Differences

Organizations use varying standards to report their sustainability-related data, depending on their jurisdictions. At times, this variance can occur depending on the adoption of voluntary frameworks like Task Force on Climate-related Financial Disclosures (TCFD), Global Reporting Initiative (GRI), among others. For instance, an oil and gas company listed company in India would use a mandatory Business Responsibility and Sustainability Report (BRSR) framework in compliance with SEBI regulations and may adopt a voluntary framework like an Integrated Reporting (IR) or TCFD. Whereas in the US, a company in the same sector would use the new ISSB standards and may adopt a voluntary framework like a Sustainability Reporting Guidance for the Oil and Gas Industry developed by the American Petroleum Institute (API) or the International Association of Oil & Gas Producers (IOGP). This inconsistency makes it challenging to accurately compare the sustainability performance of different companies or investments. The lack of uniformity can also impede efficient data collection and hinder meaningful comparisons. Collaborative efforts among stakeholders, including financial institutions, technology providers, and regulators, are imperative to counter this.



Guardrails for emerging technology

While the paper describes the merit of geospatial analysis, the reality is that there needs to be guardrails on data sets that can be used for analysis (for satellite data, for example, the acceptable spatial resolution and refresh frequency), the method for calculating climate impact (for example, accepted and defined methodology for calculating vegetative health using NDVI -Normalized Difference Vegetation Index over a given area) and acceptance (by regulators, government bodies, rating agencies). This approach will ensure the usage and reporting from the tools will be harmonized.



Data Availability & Orchestration

Sustainability data needs to be detailed, granular and meaningful. However, many existing data sources lack the required level of granularity, especially for specific environmental impacts or social factors. For instance, when evaluating the effect of a particular supply chain on deforestation, having granular data on the origin of each raw material is crucial. However, obtaining detailed data can be challenging, leading to approximations and potential inaccuracies in impact assessments. The whitepaper does address this challenge by leveraging cloud-based data ecosystems. Established Hyperscalers and enterprise solution providers are working towards a data ecosystem to reduce the challenges with sourcing, normalizing, and generating insightful reports.



Skill Availability

Another challenge is the availability of expertise both on the functional and technology domain. However, this circumstance is expected, considering the early stage of the problem and solution area. Nevertheless, with academic initiatives concentrating on climate technology and a growing surge in venture capital investment, this challenge is likely to fade as the situation matures.



Environmental Footprint

While widespread adoption of Generative AI can be highly innovative and transformational for the financial sector, it requires massive computational power, leading to increased energy consumption. The training and operation of these models demand substantial server farms, contributing to the carbon footprint. Additionally, water usage for cooling these data centers adds to the environmental strain. This necessitates focusing on energy-efficient infrastructure and sustainable practices to mitigate these impacts.

While there are challenges with technology adoption, these are transitory in nature. This is primarily because of the emerging trends that are providing an impetus to technology adoption.

EMERGING TRENDS



Despite the challenges described, significant tailwinds and encouraging signs which should help overcome the challenges posed in the whitepaper. Specifically, they are around the following:



Growing Climatech Investing Momentum

As per the research by Commerz Ventures covering more than 500 climate fintech startups in Europe and the US, 2021 was the breakthrough year for Climate FinTech. The total funding volume reached \$1.2bn, three times more than the combined total of all previous years. In 2022, investments in climate-focused FinTech reached an impressive milestone, surging to a record \$2.9 billion. This remarkable growth signifies a notable 2.4-fold increase compared to the previous year. This surge comes after a decade of relatively modest funding, with only \$405 million raised between 2010 and 2020. This swift progression illustrates the substantial strides the industry has taken in a concise span. As sustainable investing becomes mainstream and data-driven asset management technologies gain traction, significant players are actively engaging in acquiring startups. Notably, substantial acquisitions were observed across various regions in 2019 and 2020. A few cases being MSCI's acquisition of Carbon Delta, Morningstar's acquisition of Sustainalytics, and BlackRock's strategic partnership with Rhodium Group. Evidently, ESG data analytics and climate risk analysis has emerged as pivotal arenas where Climate FinTech applications play a crucial role in facilitating the decarbonization efforts of significant financial stakeholders. The investments and consolidation in the tech landscape should lead to ready and easy to use products for the banking ecosystem.

Funding Volume in \$m



- 2021 was the breakthrough year for Climate Fintech. The total funding volume reached \$1.2bn; 3x more than all previous years combined
- In 2022, Climate Fintech raised \$2.9bn; 2.4x more than in 2021
- This underscore the extraordinary momentum of the space especially in light of the recent downturn in fintech funding



Sovereign Initiatives:

There is a growing trend of countries leveraging technology platforms that help adoption within the finance context. An example from APAC is The Point Carbon Zero Program, a collaboration between the Monetary Authority of Singapore (MAS) and Google Cloud to drive the innovation, incubation, and scaling of climate fintech solutions in Asia. The program aims to:

- Provide mentorship and funding to fintech firms and solution providers to develop climate fintech solutions. This includes giving them access to Google Cloud's resources and expertise and connecting them with potential investors and partners.
- Give participants access to data and tools to measure and reduce their carbon footprint.
- Facilitate data sharing and collaboration between participants. This will allow participants to share data and best practices and collaborate on developing new climate fintech solutions.
- Deploy solutions on a dedicated platform to zero carbon. This will allow participants to test and deploy their solutions on a real-world platform and track their impact on carbon emissions.

The program is expected to catalyze the growth of climate fintech solutions in Asia and help businesses achieve net-zero carbon emissions, which can be achieved by providing resources, support, and infrastructure that fintech firms need to develop and scale their solutions.

Lighthouse Projects for Digital Carbon Market MRV

Businesses are pursuing net-zero goals, driving progress in carbon markets. However, there are challenges with transparency and intermediary complexities, particularly in the Monitoring, Reporting, and Verification (MRV) of related GHG emission reductions. A robust MRV process is a cornerstone of any carbon market, but the current process's manual and error-prone nature often leads to high costs and time consumption. Digital technologies can help address these challenges by automating data collection, processing, and reporting.

The World Bank's Climate Warehouse initiative is a prime example of how technology can be integrated into carbon markets. The initiative is creating the requisite digital infrastructure to enhance transparency and trust within carbon markets. The success of this initiative could accelerate the growth of carbon markets and make them more effective in addressing climate change. The project uses levers that are similar to the M.A.R.S framework. Specifically, the use of technology to:

- Automate data collection: Digital technologies can be used to automate the collection of data from a variety of sources, such as sensors, satellites, and online transactions. This can help reduce the time and cost of data collection and the risk of human error.
- Process data more efficiently: Digital technologies can be used to process data more efficiently, leveraging artificial intelligence and machine learning. This can help identify trends and patterns in data, which can help improve the accuracy and reliability of MRV results.

- Improve reporting: Digital technologies can be used to improve MRV reporting. This can include online platforms and dashboards, making it easier for stakeholders to access and understand MRV data.
- The success of these lighthouse engagements should drive the adoption of technology and the M.A.R.S framework described in the paper.

Democratization of Technology:

Technologies described in the paper hinges on the cutting-edge application of AI/machine learning. Open sourcing, along with the constant influx of academic research, on the technology should aid in enabling the adoption of technology. One example is Google Research's outsourcing of machine learning models that can help with automatic building damage assessments using aerial imagery of disaster sites. Another example is the availability of ready-to-use AI models and model pipelines on HuggingFace, resulting from a collaboration between NASA & IBM.



CONCLUDING REMARKS



The integration of technology and sustainable financing represents an imperative partnership that holds the potential to reshape the financial landscape for the betterment of our planet. As we stand at the intersection of digital innovation and global environmental challenges, the opportunities presented by this collaboration are boundless. From harnessing big data and artificial intelligence to streamlining ESG integration in investment decisions, to leveraging blockchain's transparency for effective carbon market operations, technology is a powerful enabler of positive change.

Moreover, the rise of climate FinTech, the exponential growth in investments and the evolving regulatory landscape and action across the globe underscore a collective recognition of the urgent need to address climate issues through innovative technical and financial solutions. As we navigate an era of unprecedented environmental challenges, the trajectory of sustainable financing guided by technology is instrumental in transforming sustainability ambition into tangible actions.

In this context, the proposed M.A.R.S framework (Mitigate, Analyze & Amplify, Report Impact for Sustainability goals) can serve as an important solution to maximize integration of technology in the sustainable financing arena, providing significant benefits to a variety of stakeholders, including the financial institutions, investors, project developers, policymakers, regulators etc.

However, there are concerns regarding the availability of data and necessary skills, and the regulatory and technological limitations. Addressing these challenges effectively is the need of the hour, for smoother integration of technology. This integration holds the potential to bring about the anticipated favorable outcomes in the realm of sustainable financing.

Nevertheless, as the adoption of emerging technologies gains prominence and policies and regulations attain standardization, the cultivation of a technology-driven ecosystem will contribute to nurturing the existing sustainable financing landscape. Policy-driven support and collaborative endeavors between the public and private sectors will ultimately be instrumental in harmonizing and advancing the sustainability goals.

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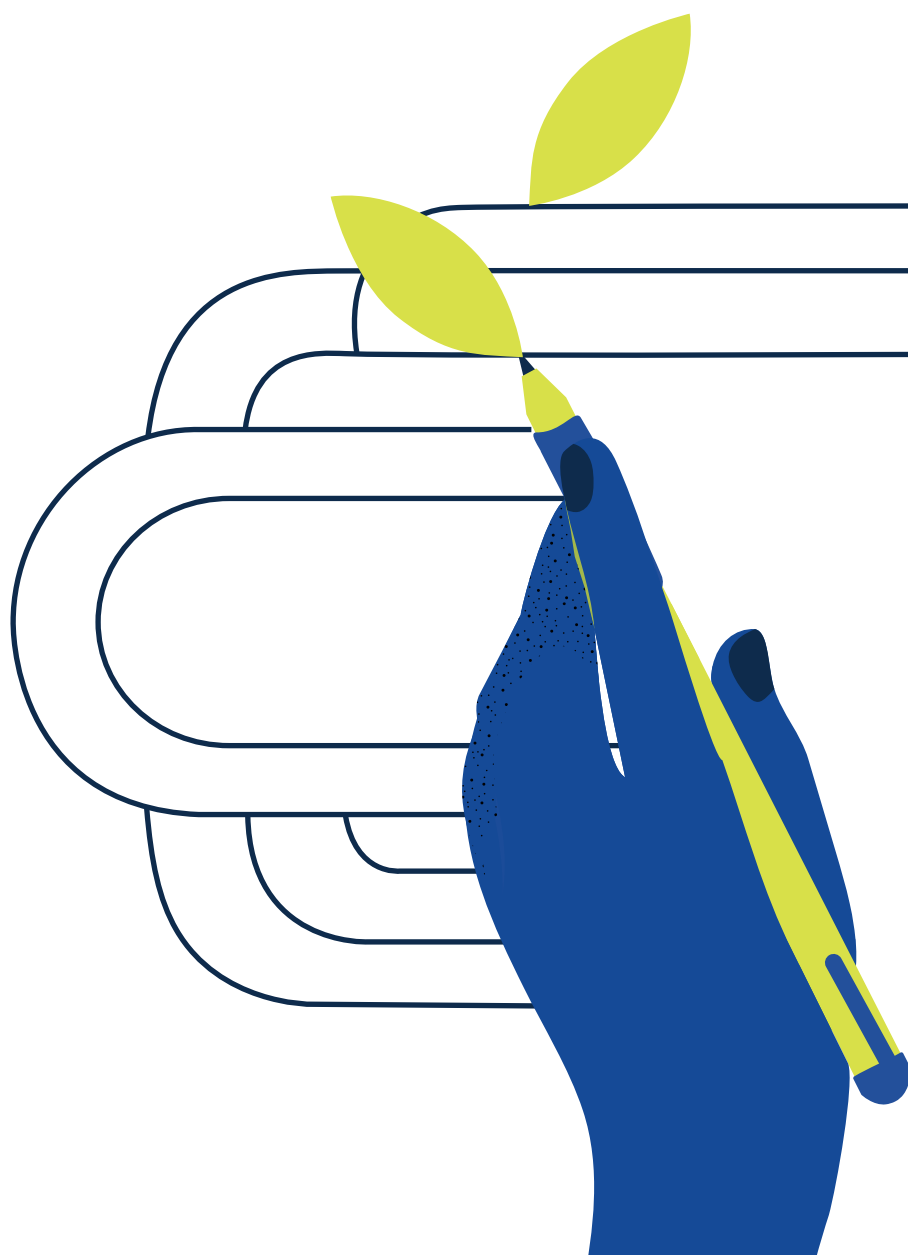
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GLOSSARY & BIBLIOGRAPHY



Glossary

Terms	Defination
Global Risks Report	Annual publication by WEF highlighting major global challenges and risks.
Emissions Intensity	Emissions produced per unit of economic activity.
Carbon Sink	Reservoirs absorbing and storing carbon dioxide from the atmosphere.
NDCs (Nationally Determined Contributions)	Nation-specific climate action plans under the Paris Agreement.
Spatial Finance	Financial analysis integrating geospatial data for risk assessment.
AI (Artificial Intelligence)	Machines simulating human intelligence processes.
Impact Investing	Investments generating positive environmental or social impacts.
DLT (Distributed Ledger Technology)	Decentralized digital system for recording transactions.
Green Bonds	Debt instruments finance environmentally beneficial projects.
Pradhan Mantri Fasal Bima Yojana	An Indian government scheme for crop insurance and support.
Sentinel Satellite Data	Earth observation data collected by European Space Agency's satellites.
Synthetic Aperture Radar	Radar creates high-res images by moving the antenna.
Carbon Sequestration	Capturing and storing carbon dioxide from the atmosphere.
SEBI (Securities and Exchange Board of India)	The regulatory authority overseeing Indian securities and capital markets.
Green Sovereign Bond	Government-issued bond specifically for funding environmentally friendly projects.
Climate Stress Testing	Assessing financial institutions' resilience to climate-related risks.
TCFD (Task Force on Climate-related Financial Disclosures)	Organization focused on climate risk disclosure recommendations.
GRI (Global Reporting Initiative)	Independent standards organization promoting sustainability reporting.
ISSB (International Sustainability Standards Board)	Board working on sustainability reporting standards.
MRV (Monitoring, Reporting, Verification)	Process of measuring and verifying emission reductions.
World Bank's Climate Warehouse	Digital infrastructure for enhancing transparency in carbon markets.

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