

The Role of Fintech Platforms in Expanding Access to Carbon Credit Markets

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Abstract- Financial technologies integrated into the carbon credit marketplace can help improve access and efficiency, particularly for stakeholders in developing countries. Carbon markets, which are critical in climate change mitigation, have been plagued by high transaction costs, fragmentation, and limited access. Fintech platforms offer innovative technologies that solve these problems through the reduction of coordination costs, enhancement of transparency, and improvement in liquidity. The contribution of FinTech platforms in promoting access to these carbon credit markets is investigated in this paper through gauging their contribution with regard to small-scale projects in carbon, assessing how they are integrated with blockchain technology, and furthering the cause of financial inclusion. The paper illustrates, through case studies and analyses, how FinTech platforms can facilitate easier and inclusive participation in the carbon credit market. The paper considers the future trend, regulatory considerations, and how fintech could use carbon credits to change their face in emerging markets.

Indexed Terms- Carbon credit markets; financial technology platforms; blockchain technology; climate finance; financial inclusions; Carbon Sequestration; Sustainable Development; Environmental Impacts; Digital Finance; and Market Access

I. INTRODUCTION

The introduction of a digital, distributed ledger called blockchain has the potential to reduce challenges that impair the interconnection of carbon offsets. Using blockchain means climate finance and carbon finance involving registration, trade, sending, reporting, and verifying emission reductions can address the problems in an easier way (Nassiry, 2018). Blockchain has the capacity to increase the integrity, precision, and especially the reach of project developers in

improving carbon emissions. The new financing model supports developing countries in achieving sustainable development based on low carbon, providing them with an accurate financial palette for combating climate change (Zhang et al., 2021). Blockchain projects that range from energy-saving big data sharing, energy-saving photovoltaic power plants, a variety of energy asset trading platforms, and many others that use blockchain as their transaction layer are executed. Many of them foster energy traceability in an effective way, utilizing the operation and maintenance of the blockchain to complete comprehensive energy traceability (Puschmann et al., 2020).

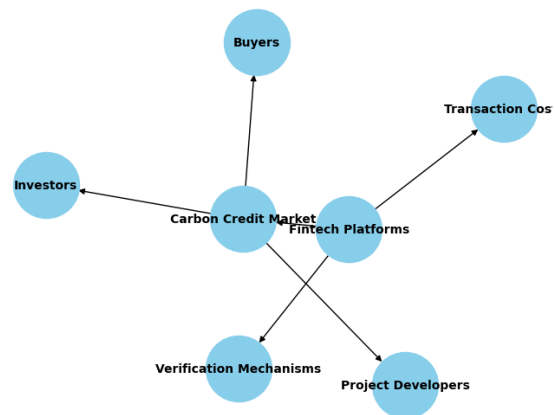


Figure 1: Conceptual Diagram of Fintech Platforms and Carbon Credit Market Interaction

1.1. Background and Significance

Development experts have long struggled to design innovative new mechanisms to make sustainable development finance work for countries that need it most. At the same time, the financial sector has been grappling for years with transformative disruptive technologies, which have immense potential to revolutionize financial intermediation (Dorfleitner & Braun, 2019). This report aims to bring a new angle on these familiar issues by exploring the barriers and challenges to carbon market access faced by sovereign

states with targets. There is broad consensus that access to finance is one of the three biggest challenges to the implementation of climate action and that the scale of financial flows requires more intervention than meeting the approximate needs for the private sector to enter the market (World Bank Group, 2018). Private sector intervention belongs to the carbon markets, and many different actors have already begun addressing these challenges and chipping away at the barriers that hold these markets back (Kim, 2018).

There are many reasons why states that need carbon credits face market barriers that limit their potential to sell carbon credits. One common reason is simply that the country cannot find a buyer or the price they are offered is not enough to meet the costs of project implementation. Small-scale projects that can produce and sell to small voluntary niche markets are one option. These small-scale mechanisms have operated relatively smoothly and could be expanded in principle to allow countries to access a few percentage points of the carbon market on some types of activities outside the framework (Schulz & Feist, 2021). However, the final and most frequent use of offsets in cap-and-trade systems for compliance reasons is far too large to be met by these small-scale technologies. Furthermore, while small-scale programs exist, only a handful of countries have managed to consistently generate marketable volumes. On the other hand, countries that have important national experiences find that they are still limited in their ability to generate high volumes of marketable credits, attributing this success to the fact that they operate a well-managed and financially lucrative program (Zhang & Chen, 2019).

1.2. Research Objectives

This research aims to examine the role of financial technology (fintech) startups in expanding access to carbon credit markets. The literature describes the function of carbon credit markets and their historic difficulty in facilitating access for emerging market and developing country actors (Yan et al., 2021). Fintech platforms provide purportedly neutral access points because they increase market access for high-risk agents that have historically participated minimally in the markets (Fong et al., 2021). Access to carbon credit markets is limited, both by the transaction costs for exchange and the high coordination costs required to qualify and develop

quantifiable markets (Pizzi et al., 2021). Fintech is optimized to decrease transaction and coordination costs. Using informant interviews and secondary data, this research will show fintech platforms dismantling barriers in carbon credit markets and adding to environmental sustainability (Thompson, 2017).

II. UNDERSTANDING CARBON CREDIT MARKETS

The carbon credit market is, at its core, a voluntary agreement. If you are a company that is in the process of harming the planet by releasing a tremendous amount of carbon into the atmosphere, you might, as part of your PR strategy, decide to seek a way to offset your carbon output. One possible strategy, which has broader public support and may also provide a secondary benefit to the company if it decreases its carbon output, would be for the company to invest in carbon offsets. The market for offsets is largely supplied by companies or entities that can prove that, either through their existing practices or by making specific investments, they are leading to a reduction in carbon output. Since we realize that a ton of carbon is a ton of carbon, if a ton is being reduced in, say, central India, then we don't really care where those emissions are being reduced, so long as they are, in fact, already tangibly reduced (Nassiry, 2018). Fintech, which in its simplest sense is the application of digital technology to the provision of financial services, seems to have a great deal to offer in this sector. By replacing layers of operational rigor with algorithms and distributed ledger technology, it might provide transparency that would appeal to potential buyers (Thompson, 2017). This paper presents both the good and the bad with these new fintech platforms, and makes a few suggestions about future trends and directions for this promising new market (Zhang et al., 2021).

2.1 Concept of Carbon Credits

Environmental issues have become a significant concern throughout the world, including global warming, climate change, and depletion of natural resources due to growing populations and increased consumption habits. The impact of climate change and global warming is felt across the world through increased natural disasters such as hurricanes, typhoons, wildfires, flooding, drought, and famine.

Such natural disasters often have a huge financial and welfare impact not only at the country level but also at the global level. There are various contributing factors to these problems, such as population growth, intensive use of fossil fuels, deforestation, air travel, and transportation of goods. Consequently, global leaders from 197 countries aim to keep global warming below 2 degrees Celsius above pre-industrial levels through sustainable development and the phase-down of hydrofluorocarbon production and consumption (Schulz & Feist, 2021).

One of the mechanisms for achieving this objective is through the implementation of the United Nations Framework Convention on Climate Change. To assist businesses in reducing greenhouse gas emissions, the Kyoto Protocol agreement allows businesses to buy carbon credits through the Clean Development Mechanism projects that fulfill the requirements of the Kyoto Protocol. In theory, the Clean Development Mechanism projects either reduce carbon emissions or sequester carbon from the atmosphere. Each project can accrue or issue one carbon credit for every ton of CO₂ that it either removes from the atmosphere or prevents from entering the atmosphere (Puschmann et al., 2020). Failure to comply with emission reduction commitments means that countries which sign and ratify the Kyoto Protocol agreement will be penalized through real emission reductions or by purchasing carbon credits. The fines or penalties received will be used to fund Clean Development Mechanism projects, which are comparatively effective ways for developed countries to reduce their emissions (Dorfleitner & Braun, 2019).

2.2 Market Dynamics

In order to understand the significance of fintech platforms and their role in widening accessibility to these new classes of carbon market participants, we need to start by briefly reviewing the current state of carbon market stakeholders, consisting of developers who are the entities with carbon reduction projects aimed at generating credits, investors who want to see the carbon credits generated by these projects to balance their associated emissions, registries that record the vital information of carbon projects, typically databases of information that provide trust in the transfers of the quality of carbon credits, validators and verifiers who validate and verify the project

criteria, methodology, and verification emissions, and auditors who verify the project’s financials and overall operation (Kim, 2018). These stakeholders operate under varying conditions, which influence the number of projects that are ultimately empowered. Factors such as market prices for carbon credits, project methodology costs, risks and quality independence, time periods of validation, approval, first issuance, transaction costs, compliance with the buyer’s quality requirements, transaction and contract costs, collection of credits or capital in advance, verification and resolution of disputes, and also varying between aforementioned create constraints on the size and efficiency of the fintech market segment (Foster et al., 2021). Historic figures of carbon projects show that the big growth days have already occurred. After market crashes, several projects came out of the market. It has been concluded that easy money and low bureaucracy are dangerous to handle (Stulz, 2019). This statement has some validity as the project fixed costs have not varied, and pricing is not maintained at a large quantity, but not a high market price due to increased efficiency in sustainable technologies. The result is a higher investment from small projects and social projects involving all the financial intermediaries (Yan et al., 2021).

Table 1: Stakeholders in the Carbon Credit Market and Their Roles

Stakeholder	Role/Function	Key Involvement
Fintech Platforms	Facilitate market access and reduce transaction costs	Decrease costs for buyers and sellers
Project Developers	Create carbon credit-generating projects	Develop and verify projects
Investors	Provide financial backing to carbon projects	Capital for projects, return on investment
Buyers	Purchase carbon credits to offset their emissions	Offsetting carbon emissions
Regulators	Ensure compliance with environmental laws and standards	Ensure carbon credit validity and quality

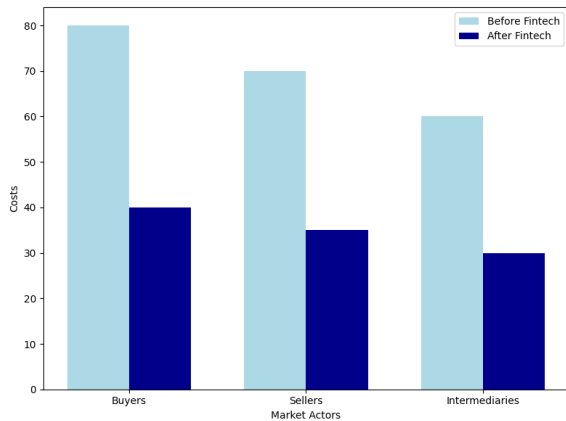


Figure 2: Effect of Fintech on Transaction and Coordination Costs in Carbon Credit Market

III. FINTECH PLATFORMS AND THEIR FUNCTIONS

Fintech generally includes any financial service provided through innovative technology and can apply not only to banking but also to a wide array of market services, including lending, digital payments, and insurance (Dorfleitner & Braun, 2019). With regard to access to carbon credit markets, Fintech's ability to reduce information costs and reduce investors' transaction costs through crowd-sourcing and other intermediation functions is of paramount importance (Zhang et al., 2021). More specifically, key to widening and deepening this market is the provision of reliable and transparent information, or assurance, that carbon projects have been developed and are being operated in a manner that meets any fund's or institutional investor's stated ESG criteria (Thompson, 2017). Similarly important is that the underlying carbon assets involved are adequately represented and made available in a manner consistent with the funding entity's legal rights and standing, along with any attendant disclosure requirements (Kim, 2018). Chapter 3 describes the technological improvements to come, many of which can feasibly and usefully be combined. The range of potential solutions that can be envisioned on a Fintech platform can include project financing and a number of subsequent related post-installment permit trading and financial policy measures (Schulz & Feist, 2021). Each case that a Fintech platform might address, including projects employing different technologies or having different

additional characteristics, can require a platform that is specifically tailored to accommodate all these features. The diversity of platform forms creates a pressing need for platforms targeted to specific sets or niches of projects (Puschmann et al., 2020).

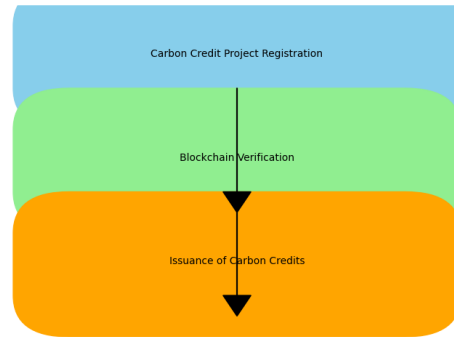


Figure 3: Blockchain and Carbon Credit Verification Process

3.1 Overview of Fintech Platforms

The database provides keys to understanding and addressing the root causes that keep people from participating more fully in the digital financial economy (Stulz, 2019). Two key drivers behind financial inclusion are access to – and usage of – mobile money and account ownership. As of April 2017, 515 million adults have opened mobile money accounts, allowing them to store money, and send and receive money securely account-to-account (Ikeda & Liffiton, 2019). As is evident from the data and other similar studies, mobile phone-based accounts are essential to reach the financially excluded, including women, youth, and low-income groups and those affected by emergencies and conflicts (Deng et al., 2019).

A growing interest and engagement by the private sector is evident with a range of new products and services targeted to the unbanked and underbanked using fintech and other platforms (Yan et al., 2021). These services rely increasingly on advanced digital information technology, and data, to service clients and lower transaction costs (Foster et al., 2021). These technologies include algorithms to verify customer identities, track customer behavior for targeted marketing, develop credit risk ratings, assess customer

income streams for credit, access traditional databases and online sources of personal and business data, and deliver customer education and capabilities for applications via smartphones and tablets (Meiling et al., 2021). The advantages of these advanced services can be leveraged to capture detailed customer data affordably, understand customer needs and payment capabilities better and more transparently than alternatives, engage using cost-effective digital communication, and develop valuable insights, products, and services by using intentional, behavioral, lifestyle and other characteristics in segmentation, targeting, and delivery (Pizzi et al., 2021).

3.2 Key Functions in Financial Inclusion

In this area, a series of studies and empirical experiences are showing how fintech platforms can contribute to improving customers' access to financial services, in addition to optimizing the delivery models of financial institutions (Chueca Vergara & Ferruz Agudo, 2021). In addition to enabling the digital onboarding of clients, digitizing micro and small enterprises (MSME) (these entities tend to face greater difficulties in determining the type and amount of credit they require due to the informality of their financial records), and facilitating transactions between payment habits, the integration of structured and unstructured data, machine learning, and artificial intelligence in the models designed by these platforms can help financial institutions generate a comprehensive understanding of customers and companies' behavior and their future capacity to generate resources (Dorfleitner & Braun, 2019). This affordable and instant credit assessment process based on innovative machine learning techniques allows financial institutions to improve their risk management models by developing a comprehensive understanding of customers' behavior and their future capacity to generate resources (Zhang et al., 2021). At the same time, it enables MSMEs to access resources. Similarly, machine learning can play a key role in the credit recycling of consumers. The following are case studies for fintech platforms that perform the operations we have described here: a global fintech platform providing instant credit assessment algorithms to accelerate financial inclusion in developing countries (Ikeda & Liffiton, 2019).

IV. INTERSECTION OF FINTECH AND CARBON CREDIT MARKETS

Many gains stand to be made when fintech is integrated with carbon credits. Fintech could help mitigate both demand and supply challenges while improving liquidity in new credit markets (Dorfleitner & Braun, 2019). At the heart of this is the proposition that fintech will facilitate automation of the credit access process. This includes borrower due diligence – using big data to inform credit underwriting, disbursing credit, and managing loan repayments (Zhang et al., 2021). Streamlined access via technology, capital lenders such as those active in peer-to-peer and leasing platforms involve investors directly in climate projects, offering transparent data on the environmental performance of these investments in a process known as impact labeling (Schulz & Feist, 2021).

The green mission of these platforms should align with the financial interest of climate investors, who seek to achieve a competitive return on their portfolio and, at the same time, maximize the positive social impacts resulting from their investment (Thompson, 2017). This paper analyzes how these platforms could support funding of projects that generate carbon credits from green technologies, thus addressing the current gap between the demand and the supply of carbon credits (Puschmann et al., 2020). We propose a framework to assess how fintech platforms could achieve this goal based on the expected differences in the ethical and financial motivations driving the behavior of the investors (Yan et al., 2021).

4.1 Current Landscape

Exclusive carbon offset platforms are designed mainly for corporate compliance purchasing programs. They do not address the growing demand from individual consumers, who are increasingly seeking to offset their carbon footprints (Ikeda & Liffiton, 2019). Despite the fact that many education and travel platforms nowadays provide information about the environmental impact of various activities, only a few enable consumers to take action through the purchase of carbon credits (Kim, 2018). These specialist platforms seek to educate and inform about carbon footprint reduction, leverage partnerships to facilitate access to sustainably sourced projects for purchase,

and offer air or family travel programs that include the reduction or neutralization of the participant’s environmental impact (Dorfleitner & Braun, 2019). However, most specialists are commercial actors, and their services are only provided through proprietary mechanisms that may lack transparency, the ability to support multiple sustainable development priorities, and scale (Stulz, 2019).

Public markets for carbon credits are developed in accordance with international agreements. These are also not well suited to serving the demand from individual consumers because the volumes that flow through markets serving the compliance requirements of businesses and governments dwarf the total demand that could be generated by individual actions (Foster et al., 2021). Furthermore, carbon credits are disproportionately allocated to large projects, many of which serve the specific needs of particular companies. As a result, only a few carbon projects can distribute benefits to a broad number of givers who commit time and funds to actions like cleanups or tree planting in their communities (Zhang et al., 2021).

4.2 Potential Benefits

There is a clear potential for platforms to establish a connection between the large number of small-scale carbon project developers and the finance needed, particularly as a growing number of corporations look to corporate sustainability programs as a way to build social and business value (Pizzi et al., 2021). Interest in CDM projects by commercial buyers is not only motivated by a desire to generate customer goodwill. Such projects may also produce positive externalities of ancillary interest (Foster et al., 2021).

The first is their potential to generate reductions beyond those required by regulation in the countries where they are located. Gold Standard projects, which may involve one or more of these technologies, can show higher sustainable development benefits than regular CDM projects (Thompson, 2017). Because of the investments within these Gold Standard projects, global climate benefits from reduced emissions from these projects exceed what is required under the Kyoto Protocol (Puschmann et al., 2020). Such voluntary Gold Standard projects are supported mainly by private funding from governments as well as the European Commission (Kim, 2018).

Table 2: Comparison of Carbon Credit Markets - Traditional vs. Fintech Platforms

Aspect	Traditional Carbon Markets	Fintech Carbon Markets
Accessibility	Limited, high transaction costs	Low-cost, transparent access
Verification Process	Manual, slow	Blockchain-based, real-time
Transaction Speed	Slow	Real-time transactions
Target Market	Large corporations	Small to medium-sized entities
Cost Efficiency	High	Reduced due to automation

V. CASE STUDIES

1. Long Carbon Inc.

Case description

Long Carbon Inc. is a retail and agricultural/agroforestry company in the Philippines. At its 100 ha of agroforestry sites, it intercroops coffee and cocoa with timber species and wood-like plants in a complex multi-layered canopy. With its canopy enrichment management, it significantly outperforms monocultures in terms of productivity. Long Carbon Inc. blends foliage with an ethanol by-product during milling processes, making bricks that are carbonized to produce charcoal and biochar, which improves soil fertility. This creates a circular economy and a cheaper and more sustainable production engineering. As deep shade plants, the company also grows tobacco, which can fetch up to Php 200,000 per ton and is a high source of income to defray production costs, enabling Long Carbon Inc. to scale up land acquisition to an additional 1,000 ha of rainforest A/R in the next three years.

Unique Factor

It ventures along the idea of a 24-hour carbon life. While developing the photosynthetic process for carbon sequestration, the canopy management, and the carbon capturing and carbon creation process, the population can engage or be involved at any time using

the unique business model of Long Carbon Inc. Philosophy, amenities, experiences, all within the Long Carbon ecological paradise helping repair minds and souls (Dorfleitner & Braun, 2019).

2. Wayback39 Corp.

Case description

WayBack39 Corp. focuses on reforesting former oil palm plantations in the Philippines. In order to achieve its objectives, the company is running a silvopastoral grazing operation using dairy cows. This operation intersperses incorporated and farmer-owned coconut trees with native tree species, particularly the Dipterocarps and other high-value timber, allowing perennials to flourish. This approach will allow the company to start producing natural flavoring agents, botanical extracts, skin care oil, and a series of biodiversity-friendly land-use products (Yan et al., 2021).

5.1 Successful Integration Examples

a. Blockchain-Based Projects

Blockchain-based companies are investing in markets in Africa to enable non-governmental organizations and local charities to support individuals by providing carbon token credits that can be redeemed. This is a radical market introduction, as usually individuals can never participate in the carbon credit market in the absence of a trading account held by the local host organization (Schulz & Feist, 2021). Another example is a project that works in both the Americas and Africa and has deployed a model that enables relatively small solar installations to create a small to medium number of carbon credits with a shorter than usual time span between installation and issuance. This shortens the time to market for NGOs, which could be relevant to effective implementation as NGOs often need several months to raise funds and then design the next solar project (Puschmann et al., 2020).

b. Non-Blockchain Projects

A system has, for several years, offered a solution that reduces the time taken from installation to issuance from several years to a matter of months, and by offering standardized contracts and bundling, it can increase the size of the projects that are covered. A few years ago, a project was launched in America, and it uses spare marketing budgets to fund tree planting activities, and also offers to sign up individuals at the

charity's market rates. Individuals are then financed by the company, and the charities are paid monthly, providing a form of income stream without having to wait for the full term to elapse (Foster et al., 2021).

5.2 Lessons Learned

Several lessons can be learned from the current use of technology tools in carbon markets. First, each market is different. A technology tool that has proved successful in the primary market may not find usage due to its limitations in other areas, for example, the secondary market (Thompson, 2017). In addition, some markets may require more than one tool for their effective de-integration. Second, technology tools can make a difference only if the content, the details describing or defining the technological function, of the market information being provided has significant value to the user. No tool can make money from providing content marketing. Users need to pay for content (Stulz, 2019). Third, technology tools, such as mobile communications, simplify the delivery of information. Despite simplifying delivery, there are other components that add value to the information. These could be payment systems, the ability to aggregate sector-specific information, or the ability to use search engines to focus on specific project developers (Zhang et al., 2021). Fourth, a general observation is that, at present, technology platforms are not removing intermediaries. Rather, they are changing the nature of the intermediary involved. For example, an intermediary may offer industry-specialized information that is derived from information collected through a technology platform (Fong et al., 2021). Somewhat paradoxically, it would seem that carbon finance will not remove the need for the old business model in the off-grid and grid-connected clean power generation sectors; it has modified the business model and extended it into off-grid and grid-connected conservation projects. These new models take advantage of the need for knowledge creation and transmission. Knowledge is the key ingredient now provided by the new facilitators, whether incumbents or new entrants (Schulz & Feist, 2021).

VI. REGULATORY CONSIDERATIONS

Valuation of these markets is currently impeded by a low volume of transactions, mismatches between

potential buyers and sellers of credits, and a lack of liquidity in the markets. This is happening while there is a growing demand for companies and other economic actors to comply with national and intergovernmental obligations that promote the mitigation of the greenhouse effect (Zhang et al., 2021). The generation and commercialization of these credits involve significant costs for the seller, such as the implementation of environmental management systems, the preparation and implementation of monitoring plans, third-party certification, and the preparation of a contract (Schulz & Feist, 2021). But on the demand side, particularly for smaller companies, their access to carbon finance is impeded by the high costs of intermediation (Puschmann et al., 2020).

The costs for both sellers and buyers to engage in carbon finance can be reduced through the use of financial technology platforms. This chapter concludes that as established principles of financial regulation can be used to properly manage the risks to the end users of the service and the wider financial system, governments should not fear the proliferation of these solutions in the carbon credit markets. These platforms should not be seen as a substitute for proper regulation of environmental and social impacts, but as a complement to promote strong environmental norms and to help evaluate the impact of such norms through the generation of sustainable development results (Fong et al., 2021).

6.1 Current Regulations

The assessment of the regulatory environment in the different jurisdictions cannot be straightforward when dealing with fintech platforms that grant loans through blockchain-based credit scoring techniques. Therefore, for each of the different game-changing methods, we combined inputs from both expert assessments on a scale from restrictive (level 1) to progressive (level 4). These ratings were supplemented by narrative boxes that give details on the current state and probable future developments in the assessed jurisdictions (Thompson, 2017).

Well-developed rule of law supports efficient and responsible use of fintech. In contrast, limited property rights or weak enforcement can lead to adverse selection and moral hazard problems, contributing to

the deterioration of borrower and lender quality (Yan et al., 2021). The relevant laws include a broader legal and regulatory framework relevant for any form of lending, misinformation and usury rules, credit bureaus, insolvency regimes, data protection laws, etc. When dealing with this NBT, it is important to also assess the state-of-the-art method of the loan agreement signature. The regulators have been enforcing Know Your Customer requirements against the last mile financial companies, while their requirement for other technologies is still somewhat nebulous (Zhang et al., 2019). The relevant laws can deal with the identity of parties, good documentation and secure contracting, consumer security, and communication data privacy, and can affect the level of activity and access to other financial services as well (Fong et al., 2021).

6.2 Challenges and Opportunities

One of the main challenges for NMOs is the high cost and complexity of the certification process and the risk of double issuance of certificates. These difficulties are compounded by the urgent need for finance to start the activities of small sustainable development projects, and in most cases, it is slow to build a pipeline of projects that can be financed simultaneously (Croutzet & Dabbous, 2021). The high transaction costs have led to many cases of single issuance of a single certificate for a larger project, making it unfeasible to start GHG mitigation activities and preventing the realization of an additional number of CERs (Dorfleitner & Braun, 2019). In this way, private capital through the purchase of CERs ends up benefiting this project and does not promote sustainable development in the interior of developing countries (Kim, 2018). Finally, one of the great challenges for NMOs, and especially for small players, is the difficulty in finding aggregate demand for their certified projects. In order to offer their services, a number of fixed cost-intensive activities need to be performed. To elevate these costs, the NMOs need to ensure that the demand for their services is guaranteed; in other words, they need to ensure a pipeline of projects that can be serviced (Foster et al., 2021).

VII. FUTURE TRENDS AND OPPORTUNITIES

Fintechs serving the carbon market are still in an experimental phase, often testing their platform model

in one jurisdiction or checking under one VR. Going forward, it is logical to expect that as financial institutions serving these markets and the quality of the underlying carbon assets improve, and as increasing numbers of VVRs implement the Paris Agreement, virtual carbon markets will continue to grow rapidly. These platforms represent the first wave of the emerging carbon fintech sector. They have become established and are now building the ecosystem that will support more extensive participation from all types of forecast participants, with diverse abilities and aspirations for carbon or climate benefits (Puschmann et al., 2020).

The business models of carbon fintechs range from simple facilitation of trading a small range of standardized instruments within a single jurisdiction to the more complex virtual carbon markets that allow and provide a menu of financial services to support trading of a wide range of carbon assets generated within every VVR that has implemented Article 6 of the Paris Agreement (Dorfleitner & Braun, 2019). Ultimately, fintechs that can attract capital to carbon-friendly projects economically will help to remove one of the market barriers limiting the ability of carbon pricing to scale and accelerate the decarbonization of regulated and non-regulated sectors in all jurisdictions (Schulz & Feist, 2021). Fintechs that can revolutionize the nascent and developing carbon markets and create highly liquid financial instruments that respond to different country, jurisdictional, and consumer demands for both purchasing and selling of carbon assets will benefit from a capital influx that can help rebuild our world to thrive and survive in a carbon-constrained environment (Thompson, 2017).

7.1 Emerging Technologies

Fintech may improve access to the carbon market by vastly lowering transaction costs, moving clearing and settlement to real time, and lowering counterparty risk. We explore four emerging technologies that may have this potential: Big Data Analytics can improve the accuracy of project documentation and monitoring substantially. Blockchain technology offers an electronic ledger that makes real-time exchange practical and counterparty risk low (Yan et al., 2021). While still in its infancy, crowdfunding offers new sources of finance to small carbon projects (Fong et al., 2021). The Internet of Things promises to turn

many small assets into active accounts, significantly lowering the cost of financial accounting (Zhang et al., 2021). At the same time, all of these technologies come with their own challenges. Concerns about privacy could slow the adoption of the first, the expectations of the investment community and regulatory concerns complicate the use of the second, and the underdeveloped legal system for renting or buying a project’s generated credits determines the ability of a third, while competition for standard setting between different vendors and product designers complicates the possibilities of the fourth. Each project is unique, so no one model for linking these technologies to promising projects exists, and some technologies are not ready for implementation yet (Foster et al., 2021).

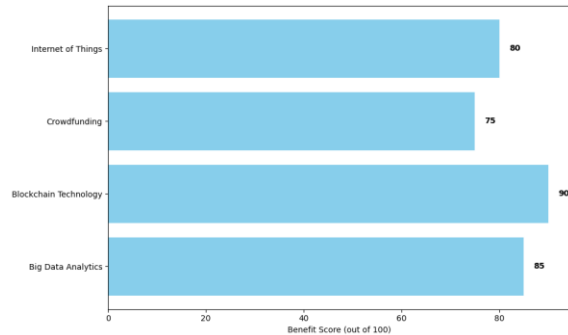


Figure 4: Emerging Technologies in Fintech for Carbon Credit Markets

7.2 Global Expansion

The emergence of different types of fintech platforms is also impacting the carbon credit markets, having a transformative role in the expansion and development of the markets, improving customer experience, and reducing costs. Inclusive fintech platforms, on the other hand, have the potential to bring in more participants and reduce market segmentation and environmental improvement investment barriers (Croutzet & Dabbous, 2021). They can serve customers that are currently not being served, increase the capability of others to serve new markets, improve the efficiency of the market, ameliorating its functioning, and can also undertake the mitigation or management of climate risks (Schulz & Feist, 2021). In doing so, they can do better in delivering ESG aspirations and objectives while, at the same time, expanding and positively impacting certain geographical markets and segments in which poverty

and lack of access to critical financial services is a major driver (Kim, 2018). The impact of fintech platforms on environmental improvements is just starting to be understood. Considering the impact that different types of fintech platforms may have, understanding the changing nature of financial products, observing how fintech platforms are redefining the value proposition, and identifying the incumbents and new institutions that are good partners or service providers, or may be disrupted, are paramount in the current market scenario (Yan et al., 2021). The critical mass in support of fintech platforms is increasing, and they are leveraging their experiences to enter new vertical markets and sectors, broaden their footprint across asset classes, geographies, and reach other types of emerging actors both at home and in other markets. This should lead to further research on the long-term implications of broader access to carbon credits, investments in environmental improvement, and the changes in the fintech ecosystem or the broader capital markets (Zhang et al., 2019).

CONCLUSION

This chapter demonstrates the promising role that fintech platforms can play in broadening the base of stakeholders who can gain benefits from investing in carbon sequestration. It works by deepening fintech involvement in the carbon credit market while still providing the same border-level integrity characteristics that are of value to the existing environment and climate constituency (Puschmann et al., 2020). By doing this, new sources of finance and expertise with customer management, trust management, and user experience become available to the regenerative agricultural and business community while at the same time incentivizing continuous improvement from that community in terms of societal good, reliability, and accountability (Dorfleitner & Braun, 2019). What's not to like? Parties that have been hitherto unwilling to part with their time, attention, and capital can receive a new level of benefit from this market, both financially and environmentally. Other companies that also have business models that package ecosystem services like carbon sequestration into acceptable investment products will receive a welcome asset class that they can easily investigate, report upon, trust, and compare.

This ultimately leads to more finance investment in mission-setting companies than simply independent targets of environmental damage like trees (Thompson, 2017).

8.1 Summary of Findings

Financial technology, or fintech, platforms can reduce the costs of identifying, verifying, and accounting for the benefits of carbon-sequestering investment projects located in developing countries (Schulz & Feist, 2021). In principle, fintech platforms can then make small projects with high liquidity risk and standardized crediting mechanism-eligible carbon credits more viable. This text seeks to understand the means by which fintech platforms might achieve these benefits and examine the potential impact of fintech on the design and functionality of carbon markets (Yan et al., 2021). Given the nascent state of fintech applications in this area, the review is necessarily conjectural. This text reviews the benefits and challenges of applying a number of common fintech innovations to the carbon credit creation and sales process and discusses the interdependencies between fintech, private finance, and the development of fungible, transparent, loss-adjustment-eligible carbon units (Zhang et al., 2021). The policies that would be needed to maximize these benefits, while minimizing negative impacts, are also discussed. Suggestions are also offered as to the steps that providers of finance, regulatory agencies, project developers, and the institutions responsible for managing the public good of carbon sequestration might take to further explore these benefits and gain experience with the policy challenges (Foster et al., 2021).

8.2 Implications for Policy and Practice

In addition to changing who, from which constituencies, can claim authorship over the various accounting units for which carbon credits are issued, the addition of regime-shaping fintech actors to existing regulatory spaces also changes the nature of the regulatory process (Croutzet & Dabbous, 2021). Traditional wisdom in the global South, characterized by the subjugation of the expertise of local actors to abstract Western ideas, taught us to see the global climate agenda as primarily discriminatory since local voices are poorly represented (Kim, 2018). However, virtual fintech interactions diminished "geographical and physical 'friction'" which recently helped

strengthen the inclusion of local input in the constitution and implementation of global lending standards and global energy governance (Schulz & Feist, 2021). Economies also had the distinctive effect of "giving voice" to a wide range of developing countries which are "barely audible" on the international stage (Puschmann et al., 2020).

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