

# **Financing the future: Integrating Fintech into Green finance and Sustainable development**

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#### Abstract:

Sustainable development seeks a harmonious balance among economic growth, social well-being, and environmental protection. Fintech has emerged as a powerful tool to drive sustainability initiatives by leveraging technology to create more efficient and transparent financial services. This study aims to identify the significant relationship among FinTech, green finance, and sustainable development through a systematic literature review of the extant literature in the field. In the context of the existing literature, the recent technologies, including Artificial Intelligence (AI), blockchain, the Internet of Things (IoT), Machine Learning (ML), data analytics, and robotics, are contributing to the development of green finance.

Keywords: Green finance, FinTech, Artificial Intelligence, Machine learning, Internet of Things

#### 1. Introduction

The world faces myriad global challenges, including climate change, pandemics, and global warming. While economic growth is essential, it must be environmentally sustainable, and Green Finance offers a potential solution by channeling investments toward eco-friendly projects. (Arner et al., 2020) discuss the intersection of Fintech, sustainability, and financial inclusion, highlighting how innovative financial solutions like Artificial Intelligence (AI), blockchain, Internet of Things (IoT), Machine Learning (ML), data analytics, and robotics can promote sustainable development and empower underserved communities. The main objective of this study is to provide a detailed overview of the key components and logically explain the impact of green finance, especially 'Fintech', on sustainable development. The paper describes an explanation of the basic terminologies of FinTech and identifies the significant relationship among FinTech, green finance, and sustainable development. As global economies increasingly confront the challenges of sustainability, understanding the mechanisms that facilitate or hinder green finance becomes paramount(Feng et al., 2022). This review synthesizes current research findings on the role of Fintech in promoting green finance, while also identifying gaps in the existing literature and suggesting avenues for future research.

## 2. Objectives

- 1. To review the extant literature in the field.
- 2. To understand the role of FinTech in sustainable development.
- 3. To identify the significant relationship among FinTech, green finance, and sustainable development.



# 3. Research Methodology

The methodology used for the article is a theoretical framework based on the existing literature on green finance, Fintech, and Sustainability development. A bibliometric analysis of the literature is also made using VOS Viewer to analyze and evaluate publications within the area of study. Bibliometric analysis helps researchers understand the structure, trends, and impact of the study by examining patterns in publication data, citations, and other related metrics.

#### 4. Review of Literature

#### 4.1 Sustainable development

Sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs (Report of the World Commission on Environment and Development, n.d.). It ensures inclusive and sustainable economic growth without depriving environmental quality. Considering a country's economic, social, and ecological interdependence, it is a long-term approach. The concept of Sustainability as a Service (SaaS) implies that financial services can be optimized for environmental and social outcomes. Ilona Kivimäki's thesis (2020) explores the concept of "Sustainability as a Service" (SaaS) within Fintech, emphasizing the need for innovative service models that align with sustainable development goals.

#### 4.2 Green Finance

Green finance is a collective name for new financial instruments such as green bonds, green banks, carbon market instruments, fiscal policy, green central banking, "fintech", community-based green funds, etc., that provide environmental benefits for achieving Sustainable Development Goals (SDG). Green finance is financing to achieve economic growth while reducing pollution and greenhouse gas (GHG) emissions, minimizing waste, and improving efficiency in the use of natural resources(John & Thakur, n.d.). Green banks and green bonds have some potential to support clean energy development (Sachs et al., 2017). A green bank can also help financial institutions reach stakeholders, projects, and places that have been underserved through collaboration and risk mitigation. Green bonds represent another mechanism to channel low-cost financing to clean energy (Natural Resources Defense Council 2016).

(Feng et al., 2022) argue that traditional finance often struggles to support green innovations due to various constraints, and propose that digital finance can effectively bridge this gap by providing more accessible funding options. Recent studies underscore the transformative potential of digital finance in fostering green technology innovation. Moreover, (Zhang, 2022) investigate the relationship between digital finance, green technology innovation, and carbon emission efficiency, emphasizing the spatial implications of these interactions. Their empirical analysis highlights that digital finance not only supports innovation but also yields broader environmental benefits, including reduced carbon emissions across regions.

## 4.3 Fintech

The financial technology, or fintech, refers to the group of companies introducing innovation into financial services through modern technologies for speedy delivery and increasing competition. Fintech is shorthand for a suite of technologies that have generated interest and investment in the financial world. Key technologies like Big Data, Artificial Intelligence, Internet of Things, and blockchain are now regularly used (Gunn et al., 2018).

#### a. Big data

Big data comprises any dataset with high volume (size and storage), high variety (many types of data), fa



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st velocity (frequency of collection), or variable veracity (confidence) that is sufficiently complex to handle and requires extra expertise beyond traditional analysis. Sometimes a fifth dimension, value (specific use and application), is used, which is relevant for personal, private, or sensitive data like healthcare records or traditional ecological knowledge (Pence, n.d.).

Electronic Health Record (EHR) systems represent another area that will require Big Data techniques for the medical field to become truly effective and sustained. Studies indicate that traditional defensive environments are compromised due to attackers' abilities to evade conventional security systems, requiring organizations to adopt an intelligence-driven security model that is more risk-aware, contextual, and agile, which relies on big data analytics (Sagiroglu & Sinanc, 2013).

#### b. Artificial Intelligence

Derived from computing and statistics, AI uses machine learning from big data to learn how to accomplish tasks, produce human-like chatbots, or drive vehicles, adding human-like pattern finding in images, and complex datasets may help experts manage the flood of data and advise investment portfolios which in turn results in sustainable economic growth. Also, it has been used to detect credit card fraud or recognize faces in social media posts. AI excels at recognizing context where simple threshold-based algorithms fail. Operating in a dynamic environment such as the international foreign exchange, or equity or bond markets, the movement of the price or rates is determined by the combination of ongoing trends, and patterns hidden in charts or graphs, the sentiment in the market, and other unforeseeable events of the future can be made efficient using Artificial Intelligence. (Green & Pearson, 1995)

#### c. Internet of Things

The Internet of Things refers to data derived from several Internet-connected devices, from smartphones to weather stations to toasters, that can actively transmit our thoughts, photos, and locations. IoT has a multidisciplinary vision to provide its benefit to several domains, such as environmental, industrial, public/private, medical, transportation, etc.(Kumar et al., 2019).

Users are voluntarily contributing information or providing data that helps them and others make better decisions. Developments in Wi-Fi, cellular, and satellite Internet connectivity allow for remote sensing of human and natural systems, which can contribute to a sustainable future. While apps like Google Maps (amenities), Waze (traffic), and Yelp (restaurants) are examples of how the IoT maps the human environment, others like OpenStreetMap (physical environment), CoCoRaHS (precipitation), and Missing Maps (humanitarian mapping) helps in GIS analysis, government decisions, etc. Beyond smartphones, the IoT includes automated weather and climate sensors that track sensitive species, measure ocean temperature, and provide early warning for disasters, which will ensure a sustainable environment (Chataut et al., 2023).

#### d. Blockchain

Blockchain allows for a single piece of digital data to be tracked from its source with an encrypted stream of information that can only be decoded by a distributed peer-to-peer network. Blockchain makes data more trustworthy to both data providers and users, allowing each to be certain of its provenance and integrity. Blockchain technology paves the way to provide security and privacy for large-scale IoT data storage as well as to enhance the decentralized storage application, eliminate the centralized trust server, and facilitate data traceability and accountability. Data provenance (enriched by blockchain technology) in Big Data applications enhances system security and privacy while ensuring data availability (Honar Pajooh et al., 2021)



#### **Bibliometric analysis reports**

1. Country-wise



#### Figure1. Country-wise analysis

An Analysis is made about the number of publications for each country with at least 4 publications, which are divided into 5 clusters. A country-wise analysis of the publications is a valuable aspect as it helps in understanding the global distribution of research output and revealing patterns of international collaboration. It is evident from the above figure that China has the largest number of publications in the field, followed by India and Malaysia.

#### 2. Citations per Author



Figure 2. Author citations



Analysis of bibliometric data revealed that Chen, Zhiang has the most citations in the field (15 citations for 2 documents). Author citation analysis helps other researchers identify key thought leaders, for the evolution of the theoretical framework, etc.

#### The Role of Fintech in Green Finance and Sustainability

Green finance and sustainable development are inextricably linked because sustainability cannot be achieved without green finance (John & Thakur, n.d.). The intersection of sustainability and fintech presents an additional layer of complexity and opportunity for financial inclusion and green financing, coupled with fintech advancements, can impact energy efficiency. This relationship explains the potential for fintech to not only enhance financial access but also promote sustainable practices among underserved populations, aligning with broader sustainability goals. The relationship between Fintech adoption and sustainability has obtained attention, particularly during the COVID-19 pandemic, as contactless payments were necessary (Yan et al., 2022).

(Bernards, 2019) reinforces this notion by discussing how fintech can facilitate access to sustainable financial products, thereby empowering marginalized communities. This perspective is crucial for understanding the multifaceted role of fintech in promoting not only financial inclusion but also social and environmental sustainability. As societal awareness of sustainability grows, the relationship between Fintech adoption and ethical considerations becomes increasingly relevant.

Research suggests that Fintech innovations can positively influence sustainability practices in banking (Mazambani & Mutambara, 2020). This is particularly pertinent for those who may prioritize ethical dimensions in their financial decisions. Understanding this relationship can enhance the appeal of Fintech services among environmentally-conscious consumers. Technology in finance can drive both economic and environmental benefits, thereby supporting sustainable development goals. This finding is particularly relevant for Fintech companies aiming to innovate their service models without compromising sustainability principles.

## Gaps in the Literature and Future Research Directions

Despite the insights gained from the existing studies, significant gaps remain in the literature. For instance, while the benefits of fintech in promoting sustainable development are well-documented, there is limited examination of its long-term impacts on smaller enterprises and startups. Future research could focus on the specific challenges faced by these entities in sustainable development and how these challenges can be mitigated.

Additionally, the spatial implications of fintech's impact on the Sustainable Development Goals merit further exploration. While existing studies highlight regional benefits, there is a need for more comprehensive analyses that consider the varying effects of fintech across different geographic contexts. Lastly, the interaction between various forms of environmental regulation and fintech remains underexplored. Future studies could investigate how different regulatory frameworks influence the effectiveness of fintech initiatives in promoting sustainable development.

#### Conclusion

Fintech has been recognized as a transformative force in enabling sustainable business models that can significantly contribute to sustainable finance. Fintech provides innovative solutions that allow countries to adopt circular economy principles, thereby enhancing sustainability. This assertion is echoed by



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(Vergara & Agudo, 2021) who illustrate how fintech initiatives, like Clarity AI and Pensumo, can promote green finance, thereby demonstrating the potential of fintech to facilitate sustainable business practices. Green finance significantly contributes to quality economic growth and environmental protection, while fintech enhances the effects of green finance on financial structure and environmental quality (Nenavath & Mishra, 2023)

Moreover, (Feng et al., 2022) investigate the relationship between digital finance, green technology innovation, and carbon emission efficiency, emphasizing the spatial implications of these interactions. Their empirical analysis highlights that digital finance not only supports innovation but also yields broader environmental benefits, including reduced carbon emissions across regions. The study underscores the potential of fintech companies to align with sustainable development goals and the positive relationship among fintech, green finance, and sustainable development. And also, how ethical tenets can foster financial stability and corporate social responsibility. These findings suggest that fintech's role in sustainability extends beyond mere financial transactions to encompass broader environmental and social impacts.

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