

# Analysis on the Development of Digital Green Finance Under Carbon Peaking and Carbon Neutrality Goals

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**Abstract.** In recent years, with the rapid progress of cutting-edge digital technologies such as big data, Internet of Things (IoT), artificial intelligence (AI) and blockchain, the financial industry is undergoing unprecedented changes. These digital technologies have not only revolutionized traditional financial formats, but also become the core driving force for the rapid development of green finance. However, the road to the rise of digital green finance is not smooth, facing multiple challenges such as the lack of awareness of digital transformation, the imbalance between financial data supply and demand, and the shallow application of technology. To promote the sustainable and healthy development of green finance, it is particularly critical to improve service quality, deepen digital awareness, and stimulate the public's enthusiasm for digital transformation. This study is dedicated to exploring how digital technologies can effectively enable green finance growth, solve digital transformation challenges, and encourage the financial sector to accelerate green transformation, contributing to the achievement of carbon peak targets and carbon neutrality vision.

**Keywords:** Digital transformation, green finance, carbon peaking, carbon neutrality goals, sustainable finance.

## 1. Introduction

The world community has come to agree on the carbon peaking and carbon neutrality targets considering the rising importance of environmental protection and global climate change. Governments and businesses have made steps to support energy transformation and green development to address the significant problems posed by climate change. Given this, it is especially vital and crucial that the banking industry, a fundamental pillar of the national economy, undergo a green makeover. Green finance can help businesses and society better manage increasingly strict environmental regulations and steer the global economy in a more sustainable direction, in addition to assisting in the development of low-carbon and environmentally friendly projects through the adjustment of capital flows.

The financial sector has seen significant transformation in recent years due to the quick growth of digital technologies including big data, IoT, AI, and blockchain. In addition to encouraging financial services innovation, these technologies offer fresh opportunities and stimuli for the advancement of green finance [1]. Digital technologies have greatly increased the effectiveness, accuracy, and openness of financial services. They have also streamlined the way that green finance operates, which has made it easier to promote green financial goods more widely. The development of digital green finance is still confronted with several obstacles, though, despite the promising use of digital technology in this field. These include underutilization of financial data, a lack of knowledge about financial institutions in digital transformation, and the limited depth and scope of digital technology in real-world applications.

The paper will examine in detail the crucial role that big data, artificial intelligence (AI), the Internet of Things (IoT), and blockchain technologies have played in the development of green finance. It will also examine how these technologies can improve the intelligence of green financial services, help financial institutions identify and manage environmental risks more effectively, and optimize financing decisions for green projects. To help financial institutions better utilize digital tools, encourage the healthy development of green finance, and assist in achieving the carbon peaking and carbon neutrality goals, the paper will also address the primary issues and challenges encountered

in the development of digital green finance. Additionally, it will propose strategies and recommendations for the bottlenecks in the digital transformation process.

## **2. Digital Technology in the Green Finance Development**

### **2.1. Big Data Technologies and Applications**

Big data technology is crucial to green finance. By recording and analyzing financial data, financial institutions may more thoroughly and precisely evaluate environmental hazards and the efficacy of green projects, thereby enhancing investment decisions and elevating the efficiency and quality of green financial services [2, 3]. In green finance, big data enables financial institutions to gather and analyze environmental, social, and governance (ESG) data in real-time to evaluate the sustainability performance of firms. This not only offers statistical support for green investments but also guarantees that the allocation of cash aligns with environmental objectives. Moreover, big data analytics enables financial organizations to enhance risk management and decision-making by discerning patterns in environmental concerns and forecasting possible issues proactively. For instance, with big data analytics, banks may evaluate the long-term effects of climate change on certain businesses and subsequently modify their lending policies to mitigate any environmental hazards.

### **2.2. AI Technologies and Applications**

AI technology, with machine learning algorithms, can effectively detect and categorize green financial goods while improving risk management and customer service intelligence. Moreover, AI can forecast market trends and assist financial institutions in refining their plans to enhance the sustainable advancement of green finance. In green finance applications, AI can autonomously analyze extensive data sets to pinpoint green initiatives and investment prospects, markedly decreasing the time and inaccuracies associated with manual analysis. Utilizing AI technology like Natural Language Processing (NLP), financial institutions may swiftly access global rules, regulations, and market trends to enhance the precision of their green investment choices. Simultaneously, AI may enhance the design and marketing of sustainable financial products, augmenting their alignment and relevance to satisfy the requirements of diverse investors. Utilizing smart contract technology, AI can assist banks and organizations in executing green financial transactions more efficiently, guaranteeing transparency and compliance in the allocation of funding for projects [2, 3].

### **2.3. Blockchain Technology and Applications**

Blockchain technology offers clear and stable data records for green finance, guarantees the legality and traceability of transactions, bolsters market trust, streamlines the circulation and trading of green financial goods, and expedites the advancement of green finance. Blockchain, using distributed ledger technology, successfully addresses information asymmetry and trust issues in traditional finance, enhancing the transparency of cash flow and project advancement while preventing fund misappropriation. In the green bond market, blockchain technology can monitor the allocation of funds to guarantee their application in environmentally sustainable projects. Moreover, blockchain streamlines cross-border transactions and settlements, minimizes middlemen, and cuts expenses. Smart contracts may autonomously execute and oversee green finance initiatives to guarantee timely completion and compliance with environmental regulations [4].

### **2.4. IoT Technologies and Applications**

IoT technology oversees and regulates the functioning of green initiatives in real-time by linking devices and sensors to guarantee adherence to environmental regulations. This real-time feedback system enhances the management efficiency of green financial assets and fosters the inventive

advancement of green finance. The Internet of Things (IoT) utilizes a network of sensors to gather real-time data on a project's energy consumption, pollutant emissions, and resource usage efficiency. For instance, IoT may oversee the functioning of wind farms or solar power facilities to guarantee their optimal performance. This data furnishes financial institutions with comprehensive operational insights to facilitate capital management and allocation, while improving the tracking and oversight of green assets to ensure alignment with environmental goals and establish a foundation for future investment decisions.

### **3. Current Development of Digital Green Finance in China**

#### **3.1. Market Size**

The green finance sector in China has had remarkable development, particularly in green loans and green bonds, which have greatly grown. Green credit, a significant instrument of green financing, has robustly facilitated several environmental protection initiatives, renewable energy projects, and the development of low-carbon infrastructure. As of 2023, the People's Bank of China (PBoC) reported that the balance of green credit in the nation surpassed Rmb15 trillion, reflecting an approximate 20% year-on-year increase. These credit funds have been extensively allocated to energy conservation, emission reduction, pollution prevention, and ecological preservation initiatives, offering essential financial assistance for achieving carbon peaking and carbon neutrality objectives.

Concurrently, the green bond market has sustained its swift growth. Green bonds serve as a financial instrument for funding environmentally sustainable initiatives, offering the benefits of reduced financing costs and more market transparency. Since China launched its inaugural series of green bonds in 2016, the market has consistently grown. As of the end of 2023, the total volume of green bonds issued in China surpassed R1.3 trillion, establishing it as one of the largest green bond markets globally. As the demand for green financing from enterprises and local governments rises, the green bond market is anticipated to maintain its robust growth trajectory, therefore bolstering China's sustainable development objectives.

#### **3.2. Policy Support**

The Chinese government prioritizes the advancement of green finance and has facilitated its institutionalization via several regulations and guidelines. In 2016, the State Council released the Guidelines on Establishing a Green Financial System, which delineated the developmental objectives, critical sectors, and strategies of green finance, signifying its integration into the national policy. Since that time, governments and authorities at various levels have released policy documents endorsing green finance, including explicit policy directives for financial firms. The PBoC has been instrumental in advancing the digitalization of green finance. The PBoC has implemented monetary policy instruments, including targeted quota reductions, to incentivize financial institutions to enhance their support for green projects and promote capital allocation to the green sector. The regulatory framework for green finance has been progressively enhanced, with authorities such as the China Banking and Insurance Regulatory Commission (CBIRC) and the China Securities Regulatory Commission (CSRC) issuing documents like green credit management measures and green bond guidelines to ensure the standardized issuance and transparent operation of green financial products, thereby further advancing the sustainable development of green finance [1].

#### **3.3. Technology Applications**

The utilization of blockchain technology in green finance is mostly seen in the green bond and carbon trading markets. The immutable nature and transparency of blockchain effectively address the trust issue in green financial solutions. In carbon emissions trading, blockchain can document and authenticate firms' carbon emissions data, ensuring its veracity and transparency, hence preventing "greenwashing" practices [2]. Big data technology is extensively utilized in environmental risk assessment and project performance monitoring within green finance. Financial institutions can

precisely assess the possible risks and advantages of green initiatives by examining business history, industry specifics, and environmental data. Banks utilize big data to monitor the environmental advantages of green lending initiatives in real time and rapidly modify their methods. Moreover, big data is utilized to evaluate the environmental credentials of organizations and to enhance the criteria for awarding green credits.

## **4. Issues in the Development of Digital Green Finance**

### **4.1. Insufficient Awareness of the Digital Transformation of Green Finance**

Despite the potential of digital technology in green finance, several financial institutions and enterprises remain unaware of digital transformation, resulting in inadequate technology implementation and hindering innovation and efficiency. Management typically exhibits caution over the expenses and hazards associated with digital transformation, resulting in some institutions forfeiting market leadership by not capitalizing on the opportunity promptly. The employees' insufficient acceptance and training in technology restrict the successful utilization of technologies like as big data, AI, and blockchain. Consequently, financial institutions must enhance the digital literacy of their whole workforce through training and awareness initiatives to facilitate a seamless transition to green finance.

### **4.2. Underutilization of Financial Data**

The collection and analysis of financial data underpin the advancement of green finance; however, the data management systems of numerous financial institutions are deficient, leading to the underutilization of substantial valuable data and constraining product innovation and informed decision-making. The primary issues are the absence of standardized data management protocols, resulting in "data silos," and the challenges associated with interdepartmental data exchange, which impairs the holistic evaluation of client requirements and project advantages. Furthermore, the data analysis technology in green finance remains rudimentary and does not utilize big data and artificial intelligence, hindering the appropriate evaluation of project risks and rewards. Financial institutions must have an effective data management system to guarantee data accuracy, completeness, and consistency, hence facilitating informed decision-making.

### **4.3. Insufficient Depth of Application of Digital Technologies**

Despite the application of big data, AI, blockchain, and IoT technologies in green finance, their depth and breadth remain inadequate. Numerous financial institutions employ these technologies just for fundamental environmental risk assessment and data analysis, neglecting to thoroughly integrate them with core business operations, hence constraining the technologies' potential. Most technologies just aid decision-making and lack deep integration into financial product design, customer service, and project management, hence impeding the optimization and sophistication of green financial services. Although blockchain technology possesses the capacity to enhance transaction transparency and money monitoring, its implementation remains nascent due to financial institutions' apprehensions over its maturity and stability. Despite offering real-time monitoring, IoT technology has not been widely used by several financial institutions and projects due to its substantial cost and technological intricacies [2, 3].

## **5. Strategies for the Development of Digital Green Finance**

### **5.1. Strengthen Digital Awareness and Optimize Green Financial Services**

To advance digital green finance, it is essential to enhance the awareness of digital transformation inside financial institutions and organizations. Management and staff should augment their comprehension of digital technology in green finance through training, seminars, and case studies.

Financial institutions must proactively implement digital technologies to streamline procedures, improve service quality, elevate customer experience, and catalyze digital transformation. Financial institutions should enhance the dissemination of digital green finance knowledge and share successful case studies through a blend of online and offline methods, including WeChat, short videos, and other new media, to elevate public awareness and engagement in green finance. Simultaneously, by providing customer training and advice, businesses may assist clients in comprehending and utilizing digital green financial services to improve their experience and pleasure [5].

## **5.2. Make Full Use of Financial Data to Promote Digital Financial Innovation**

The comprehensive use of financial data is essential for the advancement of green finance. Financial institutions must implement an effective data system to guarantee that the data are quasi-secure, precise, and comprehensive. By utilizing big data analysis, financial institutions may more effectively discover and evaluate the environmental advantages and risks associated with green initiatives, hence optimizing investment decisions. Simultaneously, financial institutions ought to leverage data analysis outcomes to enhance green financial goods and services in pursuit of the dual-carbon objective. Furthermore, financial institutions must proactively investigate data sharing and collaboration frameworks to dismantle data silos and improve the holistic utilization of data. By achieving data interoperability with other sectors, financial institutions may attain a more holistic view of the entire advantages of green initiatives, enabling them to make more informed and precise investment decisions. Financial organizations may utilize blockchain technology to guarantee data security and transparency, avert data manipulation and leakage, and bolster the confidence and stability of the financial system.

## **5.3. Deepen Digital Technology Applications to Create an Ecology**

Enhancing the utilization of digital technology in green finance is a crucial approach for advancing the holistic development of digital green finance. Financial institutions must proactively investigate and use technologies such as big data, artificial intelligence, blockchain, and the Internet of Things to establish a digital financial ecosystem. By thoroughly implementing these technologies, financial institutions may achieve intelligence, automation, and transparency in green financial services, while enhancing service efficiency and quality. Simultaneously, financial institutions ought to enhance collaboration with technology firms to collectively advance the inventive utilization of digital technology in green finance, establish a digital financial ecosystem, and attain financial enhancement and dual-carbon objectives.

## **6. Conclusion**

Under the auspices of carbon peaking and carbon neutrality objectives, digital technology is assuming an increasingly significant role in the advancement of green finance. This article examines the market size, legislative backing, and technological implementation of digital green finance in China, elucidating the current state of green finance and the problems it encounters. The increasing utilization of advanced technologies, including big data, AI, blockchain, and the IoT, has led to enormous growth in green finance, enhancing its efficiency, transparency, and intelligence. The swift expansion of green credit, green bonds, and related products indicates a rising market demand for green finance, with financial institutions facilitating the achievement of carbon peaking and carbon neutrality objectives by fostering the advancement of environmentally sustainable, low-carbon initiatives through financial backing. The utilization of digital technology has enhanced financial institutions' management of green projects and risks; yet, there is potential for advancement in the comprehensiveness and scope of technology application, particularly regarding data exchange and inter-industry collaboration.

Anticipating future developments, the progression of technology and the expansion of the global green finance business indicate a promising outlook for digital green finance. Financial institutions

must enhance the utilization of technology, governments need to refine their legislative frameworks, and cross-industry collaboration along with foreign exchanges will be essential catalysts for the advancement of green finance. Through these initiatives, China will preserve its preeminent status in the global green finance sector and offer a Chinese approach to international climate change and sustainable development.

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