



High Quality Development Paths of Green Finance Empowered by Artificial Intelligence

Wei Sheng*

Jinan NEW Channel-JUTES High School,Jinan,25000,China

Corresponding author. Email: sheng518702@qq.com

Abstract In recent years, with increasing attention to the environment and sustainable development, green finance as a solution has gradually received attention. The balance of green finance continues to grow, the investment scope of green finance continues to expand, and green finance has gradually become an important platform for multi-party cooperation. Moreover, green finance is gradually influencing mainstream investment decisions in the financial market. The development of artificial intelligence technology has provided support for green finance. Through big data analysis and machine learning, artificial intelligence can improve the accuracy of sustainability assessment for green finance projects, optimize investment portfolio management, and strengthen risk monitoring. This paper proposes the high-quality development paths of green finance empowered by artificial intelligence, including formulating green finance rating standards, conducting green finance investment evaluations, strengthening risk monitoring, and improving service efficiency, aiming to provide new perspectives and strategies for the future development of green finance.

Keywords: High quality development, development paths, green finance, artificial intelligence

1 Introduction

Due to climate change and environmental pollution becoming one of the main challenges facing the world today, various economies attach greater importance to the synergy between economic development and green environmental protection themes. In this context, the positive and important role of green finance is increasingly evident: green finance and sustainable economic development mutually promote and enhance each other, high-quality economic development also promotes the development of green finance, and the development of green finance is also an important condition for sustainable economic development [1].

Green finance refers to a financial model that incorporates environmental, social, and governance factors into financial decision-making and investment processes to promote sustainable economic development. The main purpose of green finance is to

encourage enterprises and individuals to invest funds in sustainable development areas, including but not limited to renewable energy, energy conservation and environmental protection, green transportation, ecological protection, etc. This financial model promotes the organic integration of economic development and ecological protection by guiding funds towards the fields of environmental protection and sustainability. With the increasing emphasis on sustainable development, the development of green finance has also shown a good momentum. In the current global and digital environment, green finance has become one of the important ways to achieve sustainable development. Its process includes promoting renewable energy, water sanitation, industrial pollution control, traffic pollution control, reducing deforestation and carbon emissions, etc. Mainly executed by private and public agents, such as commercial organizations, banks and government organizations [2]. Green finance provides a financial solution that can have a positive impact on society and promote environmental development. In order to adapt today's business models to the dynamic changes of the digital environment, enterprises must ensure that resources, especially technology, are responsibly and efficiently utilized to improve current and future life, and strengthen their relationship with the environment.

In recent years, due to the continuous development of artificial intelligence technology, the financial industry can improve its big data analysis capabilities through artificial intelligence, assist in green finance investment, evaluate various indicators of green finance for enterprises, and capture key data from enterprise environmental, social, and governance reports. This article will explore in depth the path of artificial intelligence empowering the high-quality development of green finance, providing new perspectives and strategies for the development of green finance.

2 Development Status and Trends of Green Finance

2.1 Development Status

The equilibrium of eco-friendly financing is persistently expanding. As depicted in Figure 1, China's green lending in both domestic and foreign currencies has seen a constant rise from the conclusion of 2019 to the conclusion of 2023, escalating from a figure of 10.22 trillion yuan to 30.08 trillion yuan. Between the years 2021 and 2023, the green finance balance has been in a phase of swift expansion, with an expansion rate exceeding 30%. The People's Bank of China has issued a statistical report detailing the investment directions of loans by financial institutions for the year 2023. According to the report, by the end of 2023, the green lending balance had experienced a year-on-year increase of 36.5%, which is a 2% decrease from the end of the prior year, and a 26.4% increase over the growth rate of all loans, resulting in an addition of 8.48 trillion yuan from the start of the year. Within this, the sum of loans that were invested in projects offering both direct and indirect carbon reduction advantages were 10.43 trillion yuan and 9.81 trillion yuan, respectively, making up a collective 67.3% of the total green loans[3].

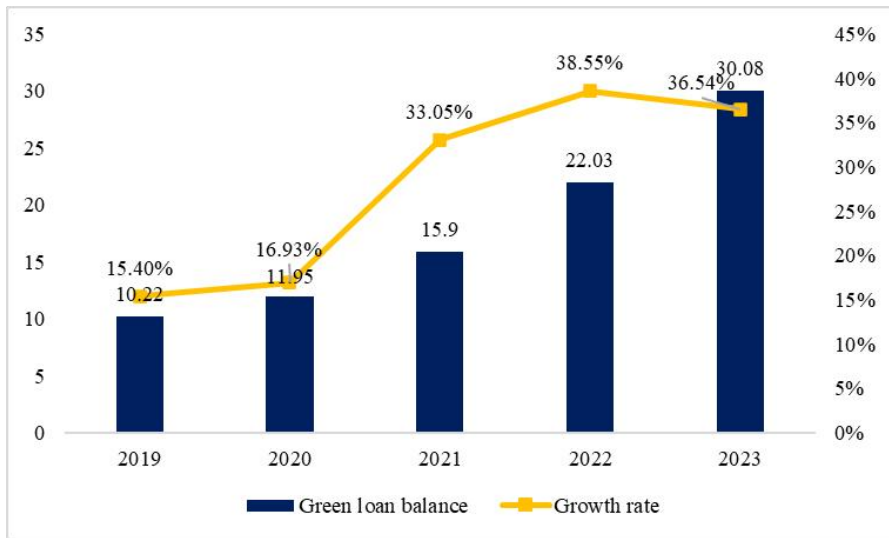


Fig. 1. Balance of green loans in China from 2019 to 2023 (figure credit: original)

The domain of green finance is progressively broadening. Beyond the conventional areas of green energy initiatives like wind, solar, and hydroelectric projects, the realm of green finance extends to various sectors including ecological conservation, sustainable farming, and urban planning that is sustainable. Concurrently, a variety of green financial instruments such as green bonds, green investment funds, and green insurance are continuously being introduced, offering a wide array of options for investors to choose from. As illustrated by Figure 2, in China for the year 2023, the distribution of green loan balances, categorized by their intended use, was as follows: 13.09 trillion yuan for the industry of infrastructure green upgrades, 7.87 trillion yuan for the clean energy sector, and 4.21 trillion yuan for the energy conservation and environmental protection sector, which correspond to respective shares of 44%, 26%, and 14% of the total green loan balance[3].

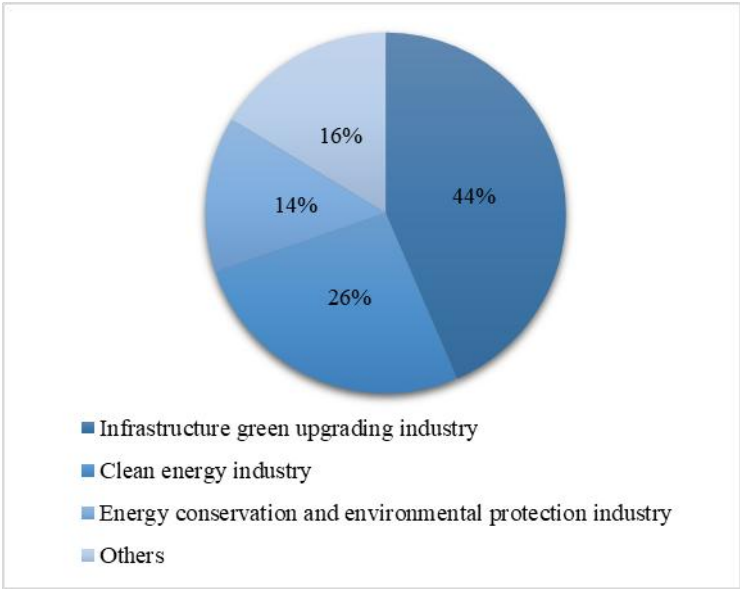


Fig. 2. Classification of the uses of green loan balances in 2023 (figure credit: original)

Green finance has gradually become an important platform for multi-party cooperation. Driven by the sustainable development agenda, governments, organizations, financial institutions, and enterprises have begun to actively cooperate to jointly promote the development of green finance [4]. This not only helps with application and popularization, but also helps all parties to jointly solve the challenges and problems in the development process of green finance. The government can provide policy support and regulatory frameworks, organizations can provide standards and certifications, financial institutions can provide financing and investment channels, enterprises can provide green projects and products, and jointly promote the transformation and development of the green economy. This kind of cooperation can also promote cross-border communication and knowledge sharing, thereby continuously improving the innovation ability and market competitiveness of green finance.

2.2 Development Trends

Under the guidance of top-level design, the policy system of green finance in the future should be continuously improved and perfected, and the targeting of green funds should also become stronger. Based on the green project catalo and classification criteria, improving the supporting role of green finance not only achieves the precision and effectiveness of green industry funding layout, but also helps to deeply integrate green finance with carbon peak and carbon neutrality stage goals, achieving precise and direct access to target industries at different time stages. For example, in the initial stage, supporting energy cleaning and green infrastructure

construction, incubating green technology innovation industries, and in the later stage, increasing investment in zero carbon and negative carbon technologies in energy and technology related fields [5]. At the same time, according to industry differences, providing long-term transformation support for different high emission industries, meeting the potential green needs of many non-green and carbon intensive industries, and expanding the industry service scope of green finance. Exploring the mechanism for realizing ecological value is also an important area for the sustained development of green finance in the medium to long term. Through tool and service innovation, green finance establishes the value of environmental rights with ecological carbon sequestration capabilities, further promoting ecological environment governance from the source, and improving the level of operation, development, and marketization of ecological products, integrating ecological value into the social wealth system. At the same time, exploring more ecological dividends in climate investment and financing business, and integrating ecological value assessment mechanisms, ecological protection compensation mechanisms, value realization guarantee mechanisms, incentive and constraint mechanisms into the green finance policy system, exploring and establishing an international market trading system for ecological rights.

3 Significance of Artificial Intelligence in Green Finance

Green finance projects often involve emerging technologies, cross industry cooperation, and complex environmental impact assessments, which increase the risk of investment. Artificial intelligence can more accurately identify and predict these risks through big data analysis and machine learning algorithms. Artificial intelligence can process and analyse a large amount of environmental data, market trends, and policy changes, helping financial institutions evaluate the sustainability, financial performance, and potential environmental risks of projects. Artificial intelligence can monitor project progress in real-time, adjust risk management strategies in a timely manner, and ensure the safety and profitability of investments. Green finance plays an important role in creating a sustainable environment on a global scale [6].

At present, China's green finance products are mainly green loans and green bonds. The carbon finance trading market has just started and its scale is still limited. There are few other green finance products such as green funds and green insurance, and green derivative instruments such as carbon options and futures are even rarer. Green financial products also lack innovation. Currently, the largest scale of green credit involves many national support areas such as dual carbon, energy conservation and emission reduction, energy consumption control, and environmental governance. Most of them are passive response products that conform to the government's macro direction, lacking proactive development oriented financial products. Artificial intelligence helps to develop new green financial products. Although artificial intelligence systems cannot replicate human intelligence, they can provide accurate outputs and greatly replace human labor. We need to analyze the advantages and limitations of artificial intelligence systems to demonstrate their effectiveness in

solving accounting and business problems. When accountants start operating relevant artificial intelligence systems, they will generate high-quality financial reports for investors. Artificial intelligence can help financial institutions develop personalized green investment solutions to meet the needs of different investors. Through these innovative products, green finance can attract more private capital and accelerate the transition to a sustainable economy.

4 Development Paths of Green Finance Based on Artificial Intelligence

4.1 Develop Rating Standards of Green Finance

In the field of green finance, the data processing capabilities of artificial intelligence are particularly important. The efficient data processing capability of Artificial intelligence can not only assist financial institutions in evaluating the sustainability of investment projects, but also provide accurate ratings for these projects. The core of green finance lies in supporting environmentally friendly projects, which requires financial institutions to conduct detailed assessments of the sustainability of projects. Artificial intelligence can capture and analyse data from environmental, social, and corporate governance (ESG) reports of green bond issuers through big data analysis and machine learning technologies. Artificial intelligence can identify key sustainability indicators and compare them with industry standards and best practices to evaluate the sustainability of a project [7]. The role of artificial intelligence in risk management is particularly prominent. By delving deeper into the data in ESG reports, artificial intelligence can identify potential risk factors such as environmental pollution, lack of social responsibility, or corporate governance issues. These risk factors are crucial for investment decisions. Artificial intelligence can rate bonds more accurately based on these risk factors and financial indicators, helping investors make wiser investment choices. Once the data model is constructed, artificial intelligence continuously updates the rating results based on the financial indicators and ESG related indicators of the issuing entity. In terms of information disclosure, further strengthening the environmental information disclosure of financial institutions can emulate the internationally recognized ESG disclosure design experience, help the market and various entities overcome the problem of market information asymmetry, and increase regulatory enforcement. Carry out carbon accounting, continue to develop carbon finance, expand the carbon market and carbon trading scale, and standardize the operating mechanism to achieve carbon control and emission reduction in a market-oriented manner.

4.2 Conduct Investment Evaluation of Green Finance

In the field of financial investment, obtaining and analysing information is crucial for the accuracy of decision-making. Artificial intelligence can obtain massive amounts of information in real-time from various news sources, social media platforms, and

other channels through automated data scraping technology, including news about green finance enterprises, emotions of market participants, and public opinion trends. Traditional investment analysis requires a lot of time and manpower, while artificial intelligence can quickly mine and analyse large-scale data through advanced algorithms and models [8]. Actively research and develop diversified green financial products such as new green loans, green bonds, green funds, and green insurance, and promote the diversified development of green products. In terms of green credit, we encourage commercial banks to expand their lending scope, create conditions for small and medium-sized enterprises to obtain green loans, and increase the proportion of green credit issued by commercial banks through policy support. In terms of green bonds, we will continue to encourage economic entities to raise funds through the issuance of green financial bonds, providing a green channel for energy-saving and emission reducing enterprises, environmental protection projects, and ecological engineering to issue green corporate bonds. In terms of green insurance, insurance companies are encouraged to develop green insurance products, pay attention to establishing effective linkage mechanisms with credit institutions, and link the purchase of environmental pollution liability insurance by enterprises with their various environmental assessment results and qualifications for obtaining credit. In terms of green industry funds, they are raised through government financial allocation and other means to directly invest in the development of green enterprise products, or through investment holding. With the help of cutting-edge algorithmic trading and intelligent investment advisory technology, artificial intelligence can accurately and efficiently automatically execute buying and selling transactions based on preset rules and objectives, optimizing asset allocation. The intelligent trading method can effectively reduce transaction costs, improve investment efficiency, and ultimately achieve better investment returns [9].

4.3 Strengthen Risk Monitoring of Green Finance

Artificial intelligence can assist financial management institutions in strengthening green finance risk monitoring. The application of artificial intelligence in the fields of financial regulation and risk monitoring is becoming increasingly widespread, and artificial intelligence has strong advantages in the efficiency and timeliness of data processing. In the past, financial regulatory agencies mainly relied on manual analysis and judgment to monitor risks in the financial market, which was limited by human and time costs and difficult to achieve comprehensive and timely market monitoring. The intervention of artificial intelligence has greatly improved the monitoring ability and efficiency of regulatory agencies. In response to the current high financing costs of green finance, it is necessary to improve the interest compensation mechanism and ensure the healthy and sustainable development of green finance. Opening up policy-based insurance business as support, exploring the establishment of financial risk sharing mechanisms, and guiding guarantee companies to carry out green financial guarantee business. Specific funds can be established as subsidies and incentives for green financial instruments. In terms of risk control, strengthen regulatory efforts and information disclosure to reduce the constraints of risk factors on the profitability of

green financial products [10]. Through real-time monitoring and analysis of data and reports from financial institutions, artificial intelligence can promptly detect potential violations and risk exposures, ensure compliance and risk control capabilities of financial institutions meet regulatory requirements, and maintain the healthy operation of the financial market. Meanwhile, artificial intelligence has strong advantages in monitoring anti money laundering and fraud. By setting anti money laundering and fraud indicators in regulatory settings, artificial intelligence can monitor abnormal transaction patterns, money laundering behaviours, and other fraudulent activities in real time through machine learning indicators and integrating big data analysis, helping regulatory agencies detect and stop potential illegal activities in a timely manner, and protecting the fairness and stability of the green financial market [11].

4.4 Improve Service Efficiency of Green Finance

The real-time response and all-weather characteristics demonstrated by artificial intelligence in serving green finance customers have given people a deeper understanding of the powerful advantages of this technology. Whether it's day or night, weekdays or weekends, artificial intelligence always maintains efficient operation, providing customers with the information and support they need [12]. Through tools such as chatbots, voice assistants, and automated trading systems, artificial intelligence can immediately meet the needs of customers, avoid waiting times caused by manual operations, and greatly shorten the cycle for customers to obtain information. The all-weather service model not only improves response efficiency, but also meets customer needs in different time zones and periods around the world. No matter where the customer is, as long as they open their phone or computer, they can always enjoy the convenience and efficiency brought by artificial intelligence. This timely response feature allows customers to feel truly attentive service, adding convenience and peace of mind to the development of green finance. Artificial intelligence can also ensure a consistent customer experience for green finance customers across different channels. Whether through official websites, social media platforms, or other channels, customers can receive the same professional and efficient service experience. This consistency not only improves the quality of customer experience, but also enhances customer trust and satisfaction with green financial services [13]. This cross-channel service consistency further enhances customer satisfaction and loyalty. Another significant advantage of artificial intelligence in the financial field is its efficient processing ability for a large number of financial transactions and customer requests. Through highly automated processes and intelligent systems, artificial intelligence can easily handle routine tasks such as account queries, transaction execution, and payment processing.

5 Conclusions

With the continuous advancement of technology, artificial intelligence has broad application prospects in the field of green finance, and its efficient and accurate data processing capabilities provide strong support for financial institutions. Through artificial intelligence technology, green finance can more effectively assess and manage risks, provide personalized investment advice, innovate financial products, and strengthen supervision and risk control. This not only helps to promote the high-quality development of green finance, but also makes important contributions to achieving global sustainable development goals. In the future, with the further development and application of artificial intelligence technology, green finance is expected to play a more critical role globally, promoting the harmonious development of the economy, society, and environment.

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