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Digital Technology, Green Finance and Sustainable Development: A Case Study of Ant Group's Voluntary Carbon Neutrality Efforts

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Abstract. This study explores the critical role of green financial innovation and digital technology in achieving carbon neutrality through a case study of Ant Group's voluntary carbon neutrality efforts. The study reveals that Ant Group has raised substantial funds for environmental projects by issuing green bonds and offering green credit products. At the same time, it has leveraged blockchain, big data, and other digital technologies to enhance the transparency and efficiency of carbon emissions tracking and management. However, the company also faces challenges, such as ensuring the accuracy of carbon emissions data, managing cost pressures, dealing with policy uncertainties, and navigating industry competition. The findings of this study provide valuable insights for other companies, highlighting the importance of developing green financial products, setting clear carbon neutrality roadmaps, and maintaining strong communication with stakeholders. Moreover, it is suggested that policymakers introduce more supportive policies for green finance and sustainable development to further global progress toward sustainability goals.

1 Introduction

In recent years, with the growing problem of global climate change, green finance has received increasing attention as a financial tool to promote environmentally sustainable development [1]. Green finance helps companies achieve the goal of sustainable development by directing funds to ecologically friendly projects [2]. To some extent, sustainable development has become a global consensus. Countries have set policies and targets to balance environmental protection and economic growth. Globally, green finance is gradually becoming important in combating climate change. Then, as an important part of green finance, carbon neutrality aims to achieve the goal of net-zero emissions by reducing and offsetting carbon emissions. It is significant to improve the quality of the environment and promote economic transformation [3].

Based on the above background, this study takes Ant Group's voluntary carbon neutrality as an example to explore the roles and challenges of green financial innovation and digital technology in achieving the carbon neutrality goal. Ant Group, a leading technology

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enterprise in China, has actively responded to global climate action by committing to voluntary carbon neutrality. This company has set an example for other enterprises through green financial innovation and the application of digital technology. Through an in-depth analysis of Ant Group, this paper reveals its practical experience in green finance, analyses its internal and external challenges, and proposes corresponding response strategies. This study aims to reference other enterprises and then promote the realisation of green finance and sustainable development goals.

The significance of this study is reflected in theoretical and practical innovation. For theoretical innovation, this study enriches the theoretical framework of green finance at first. By exploring the application of green finance in carbon neutrality, the theoretical framework of green finance is further enriched and improved. Secondly, this study explores the synergies between green finance and digital technology in achieving carbon neutrality. The application of digital technology in green finance provides new possibilities for the realisation of carbon neutrality. Exploring the synergies between them is therefore of far-reaching significance. For practical significance, this study provides examples of corporate practices to develop some suggested policies to promote the green transformation of society first. This study proposes some feasible solutions to optimise the carbon neutrality pathway of this corporation, and then help more corporations to achieve carbon neutrality and promote the green transformation of the whole society. This study also enhances public awareness and participation to a certain extent. By studying and promoting the successful experiences of enterprises in green finance and carbon neutrality, public awareness and participation in green finance and carbon neutrality can be enhanced.

2 Literature Review

2.1 Theoretical Foundations of Green Finance

The concept of green finance encompasses a broad range of financial operations that are employed to promote environmental conservation and foster sustainable development. Green finance, as defined by Lindenberg, refers to the provision of financial resources for both public and private green investments [3]. The concept of green finance, as defined by Wang and Zhi, encompasses the integration of environmental conservation efforts with economic profitability. According to Ozili, green finance can be defined as the provision of financial resources for projects that yield economic advantages while concurrently fostering environmental sustainability. Benefits are obtained while also fostering a sustainable environment [1]. The components of green finance include 1) green financial products and instruments, such as green bonds, green loans, and green investment funds, etc. 2) Prominent stakeholders in the advancement of green finance, such as banks, institutional investors, research institutes, public institutions, central banks, and international financial organisations, among others, etc. 3) The implementation of strategies aimed at promoting green finance includes the creation of business environments that are favourable to green financing, the establishment of transparent disclosure requirements, and the provision of financial and regulatory incentives, etc. [1].

2.2 Sustainable development

Sustainable development involves a balance between social equity, ecological protection, and economic growth. It requires a development process that respects the limits of ecosystems and ensures the rational use of natural resources to preserve sufficient resources to create a good living environment for future generations [4].

The three fundamental principles of sustainable development, commonly known as environmental preservation, social accountability, and corporate governance (ESG), hold significant significance within the contextual framework of sustainable development. Environmental protection places significant emphasis on the imperative to safeguard the natural environment and its associated ecological processes. To secure the long-term availability of natural resources, it is imperative to incorporate the assessment of environmental impacts into economic activities, hence promoting sustainable development [5]. Conversely, social responsibility places attention on the influence of corporate activities on society, with a particular focus on the welfare of individuals and the promotion of social equity. The concept of sustainable development promotes the simultaneous pursuit of economic growth, improving the general welfare of society, and mitigating poverty and inequality [6]. Nevertheless, corporate governance places significant emphasis on the principles of openness, accountability, and ethical standards. Corporate governance plays a crucial role in enabling enterprises to simultaneously pursue profitability and uphold their environmental and social responsibilities, making a significant contribution towards the attainment of sustainable development goals [7]. The interconnection of these pillars establishes a theoretical framework for sustainable development, which underscores the imperative for businesses and society to strive for equilibrium between the economy, the environment, and society [8].

Based on the principles of sustainable development, carbon neutrality has emerged as a goal in the global effort to mitigate climate change. Carbon neutrality is defined as the balance between the amount of GHG emissions and the amount of GHGs removed through various means (e.g., afforestation, carbon capture and storage, etc.) over a specific period, thus achieving net zero emissions [9]. According to the Paris Agreement, countries are required to submit updated Nationally Determined Contributions (NDCs) and long-term Low Greenhouse Gas Emission Development Strategies (LTSs) to combat climate change [10].

3 Case Description

The Ant Group was chosen mainly because of its leading position in the industry and its aggressive carbon-neutral goals. Firstly, as a technology platform giant, the influence and market share of Ant Group in digital finance gives it an important position in the industry. Hence, the well-established internet platform has the dual advantage of both platform role and technological capability when helping society achieve carbon neutrality [11]. Similarly, the group actively responds to the national goal of "carbon peak and carbon neutrality" by releasing its own carbon neutrality goal in 2021, becoming the first Internet company in China to propose a carbon neutrality goal, and releasing its “Ant Group Carbon Neutrality Roadmap” in 2022, which promises to achieve carbon neutrality in operational emissions from 2021 and net-zero emissions by 2030. Its specific measures include promoting the construction of green office parks, enhancing employees’ awareness of carbon neutrality, and establishing a green procurement mechanism [12]. Since its inception in 2016 in collaboration with Beijing Environment Exchange, Ant Forest has successfully engaged over 613 million individuals in adopting low-carbon lifestyles, producing over 20 million tonnes of renewable energy [13]. The present project has the dual purpose of engaging the public in emission reduction efforts using “virtual tree planting for real tree planting” and fostering the diversification and financialisation of the carbon trading market by implementing personal carbon accounts. The proactive approach of Ant Group in the realm of carbon emission reduction aligns with the prevailing contemporary movement towards green emission reduction within the framework of achieving carbon neutrality. Despite the potential challenges in generating substantial money in the short term, Ant Forest has demonstrated its financial viability in the long run, displaying notable advertising efficacy and social influence [13].

After extensive study and practical application, Ant Group has formulated a comprehensive action strategy centred upon the utilisation of digital technology to facilitate the achievement of carbon neutrality and promote environmentally sustainable and high-quality development across many industries. To enhance the utilisation of technology in the realm of green low carbon, Ant Group aims to conduct autonomous research and development. Additionally, the company intends to offer digital carbon management services and facilitate the secure transmission of carbon data and multi-scenario applications. To a certain extent, it shows that Ant Group has become an important participant and leader in the process of promoting China's carbon neutrality goal.

4 Green financial innovation and digital technology

4.1 Green financial innovation

Green finance mainly consists of green bonds, green credits and green funds. One of the primary characteristics of green bonds is their special design as debt instruments intended to fund environmental projects. They offer investors an investing opportunity to contribute to sustainable development, while simultaneously providing the requisite financial resources for development projects [1]. Secondly, green credit pertains to loans extended by banks and financial organisations to projects or businesses that adhere to environmental criteria. This credit usually has lower interest rates to encourage more businesses and individuals to participate in green investments [3]. Thirdly, green funds are a category of investment funds that focus on investing in environmentally friendly and sustainable projects or companies. Fund managers integrate environmental considerations by adopting best practice strategies or thematic investment strategies [2].

4.2 Application of Digital Technology in Green Finance

The use of digital technology in green finance commonly includes blockchain technology, big data analysis and financial technology. Firstly, the application of blockchain technology in green finance is mainly reflected in the tracking and trading of carbon emissions. Through blockchain, companies can transparently record and trade carbon credits, ensuring compliance and traceability of carbon emissions [1]. Secondly, big data analytics can analyse large amounts of environmental data. Then, the financial institutions can more accurately assess a project's environmental risk and thus make more informed investment decisions [3]. Thirdly, the application of financial technology (Fintech) can give personalised green investment advice through smart investment platforms. Then, investors will make better choices in sustainable investments [2]. In summary, innovations in green finance and the use of digital technologies complement each other and together they contribute to the process of sustainable development.

4.3 Ant Group's Green Finance Innovation Practice

Ant Group actively explores green financing strategies in the field of green finance, aiming to support environmentally friendly projects and enterprises through sustainable financial products and services [14]. Firstly, Ant Group has launched the Ant Forest project through its Alipay platform, encouraging users to participate in carbon emission reduction. This project not only promotes users' environmental awareness but also provides new ideas for green financing. Using the concept of personal carbon accounts will promote the diversification and financialisation of the carbon trading market [13]. Secondly, Ant Group has adopted a series of innovative financing strategies in the field of green finance, aiming to promote the green transformation of small and micro enterprises. By joining hands with the People's Bank of China and other organisations, Ant Group has developed a green evaluation standard for MSMEs to help financial institutions assess the environmental contribution of MSMEs, thereby building a bridge between green finance and inclusive finance [11]. Thirdly, Ant Group actively promotes the development of green consumption and low carbon economy by launching a variety of green financial products. For example, Ant Group has set up the "88 Carbon Account" system. It encourages consumers to participate in carbon reduction actions. Users can earn carbon reduction points by purchasing low-carbon products in their daily lives, which effectively promotes consumers' awareness of environmental protection.

At the same time, Ant Group also uses digital technology to promote the innovative practice of green finance. Firstly, Ant Group has developed the "Carbon Matrix" management platform based on blockchain technology to provide carbon account management, carbon footprint measurement and carbon footprinting for enterprises to help enterprises realise green transformation [11]. Users can participate in emission reduction activities through the Alipay online payment function. This kind of promotion has effectively attracted many users to participate [15]. Secondly, the group uses digital technologies such as big data and cloud computing to optimise green financial services. Then, it can provide SMEs with solutions for low-carbon operations to help them account for their carbon emissions better. This technology-driven green finance model not only improves financing efficiency but also enhances transparency to promote sustainable development [12].

5 Challenges of Voluntary Carbon Neutrality in the Ant Group

5.1 Internal challenges (SWOT)

5.1.1 Strengths

Ant Group not only has positive practices and high public perception in the field of ESG but also has a strong technological base and innovation capability to drive the achievement of the SDGs [12]. In addition, the concept of shared value creation embodied in its sustainability report can attract more stakeholders [11].

5.1.2 Weaknesses

Firstly, the standard guidelines still need to be improved. This is because firms may face a lack of clear internal standards and guidelines when implementing ESG management. Then, it leads to inconsistent implementation across different departments or teams and affects the overall management effectiveness [14]. Secondly, Ant Group's sustainability report does not disclose detailed information about the correlation between ESG performance and directors' and executives' remuneration, which may affect its transparency and public trust [11]. Because achieving carbon neutrality requires a large amount of capital investment, it may put pressure on a company's financial position, especially in the case of economic volatility. The lack of financial reporting in this situation may lead to an inadequate assessment of their economic value creation capacity by external stakeholders [13]. Thirdly, Ant Group has imperfections in the calculation of carbon emissions, especially the carbon emissions of its directly operated commodities are not fully integrated into its carbon emission calculations, which has led to the accuracy of the carbon emission data being questioned [15]. Then, companies' assessment methods in the supplier access and screening process mainly rely on negative screening and lack a comprehensive assessment system. This may lead to an incomplete assessment of suppliers' ESG performance and affect the effectiveness of decision-making [14]. Moreover, the way to incentivise and guide suppliers may not be strong enough to enhance the ESG performance of suppliers [13]. This means that the firm may face insufficient human, financial and technical resources in promoting ESG management, which limits the implementation and effectiveness of ESG management [14].

5.1.3 Opportunities

With the global emphasis on sustainability and ESG standards, provides good opportunities for Ant Group to enhance its brand image and market competitiveness by improving its reporting and transparency [11]. Secondly, through the application of digital technology, Ant Group can further promote the green transformation of micro and small enterprises and meet the market demand for green finance [13]. In addition, Ant Forest aims to let the public "see" the actual effects of low-carbon behaviours. However, how to effectively transform these invisible low-carbon emission reductions into perceptible ecological effects is not only an internal challenge but also an opportunity for Ant Group [15].

5.1.4 Threats

As the business continues to grow, Ant Group's carbon emissions are also increasing, with a 39.26 per cent increase in carbon emissions in 2022 compared to 2020. This puts additional financial pressure on the business, especially when setting emission reduction targets and implementing carbon reduction measures [15]. On the other hand, the rapid development of competitors in the field of digital finance and sustainability may pose a threat to Ant Group's market share too [13]. This leads to higher demands on the Ant Group.

5.2 External challenges (PEST)

5.2.1 Political

As the country's emphasis on CSR and sustainable development increases, this will have an impact on Ant Group's ESG strategy. Hence, the Ant Group needs to continuously adjust its business strategy to comply with new policies and regulations [11]. Similarly, for overseas markets, the companies need to adapt to the laws and regulations of different countries and regions. This may lead to compliance risks and additional costs for companies to implement ESG management globally [14].

5.2.2 Economic

The global economic volatility and market uncertainty may affect Ant Group's business performance as global economic volatility may affect the willingness of businesses and consumers to consume low carbon. After the pandemic, the economy's growth has been slow in many countries [12]. It causes the companies to control the budget of environmental investments. It may affect the development of Ant Group's green projects [14].

5.2.3 Social

There is a significant difference in awareness and market acceptance of carbon-neutral and green financial products. It may affect the effectiveness of Ant Group's carbon reduction initiatives [11]. However, the situation of "high awareness and low practice" still exists. Although the public has some awareness of low carbon living, their actual participation is still insufficient, which poses a challenge to Ant Group's project promotion [15]. Society is increasingly concerned about sustainable development and CSR, which means higher expectations of firms' ESG performance from investors and customers. If the firm fails to respond effectively to these expectations, it may face reputational risk and loss of market share [14]. This means the company needs to take more active measures in environmental protection and social responsibility to adapt to this social trend [13]. Hence, demonstrating its social and environmental value creation better in its sustainability report is needed [12].

5.2.4 Technological

The rapid development of digital technology gives valuable opportunities for Ant Group to innovate but also faces greater pressure for technological innovation. Ant Group faces fierce competition in the application of technologies such as blockchain, artificial intelligence and IoT, and how to maintain its technological leadership and effectively apply these technologies is one of its great challenges [15]. Hence, the firm must enhance its technological capacities to sustain its competitive advantage in the fintech industry [11].

5.3 Response Strategies

5.3.1 Environment (E)

Ant Group should set specific and implementable short-term carbon reduction targets to increase transparency and then disclose more comprehensive carbon emissions data so that stakeholders can better understand the company's environmental impact. Secondly, as the regulatory environment changes, Ant Group needs to adjust its business strategy promptly to ensure compliance, especially in terms of data security, privacy protection, and fair competition [15]. Meanwhile, enterprises should make use of overseas investment resources to participate in global climate governance.

5.3.2 Society (S)

In response to Ant Group's rectification efforts, Ant Group should take effective measures to ensure compliance and transparency, especially in terms of disclosure of information on the correlation between ESG performance and executive pay to enhance public trust and corporate image [11]. Secondly, Ant Group should continue to increase its investment in social responsibility and public welfare, especially in the areas of rural revitalisation, poverty alleviation and support for disadvantaged groups [13]. By actively participating in social welfare activities, the social image and brand value of the company will be enhanced. Thirdly, Ant Group should continue to promote the combination of digital technology and green low carbon transformation and utilise its technological advantages to provide more green financial products and services to small and micro enterprises to help their green transformation [11]. Through independent research and development and technology application, it enhances the digital carbon management capability of enterprises and promotes carbon neutrality of the whole industrial chain (Ibid). Lastly, Ant Forest has designed a "public welfare incentive mechanism" to encourage the public to reduce carbon emissions in a low-carbon life. This is because the public's low-carbon behaviour will have a direct impact on corporate donations and support, thus creating more "visible green". This mechanism effectively combines personal behaviour with social welfare, forming a virtuous circle [15].

5.3.3 Corporate Governance (G)

Ant Group should make full use of its dual shareholding structure to guard against potential governance disadvantages and ensure the effectiveness of corporate decision-making [12]. Enterprises should refer to international supply chain ESG management standards, combine them with their stage of economic development and industrial structure characteristics, accelerate the construction of policy systems, and improve enterprise supply chain ESG management standards. Secondly, the Ant Group needs to strengthen the internal control mechanism and corporate governance level and set short-term and long-term emission reduction targets [11]. A detailed carbon-neutral action plan with clear targets and timetables for each phase was developed to disclose specific implementation steps to ensure transparency and compliance with corporate governance to cope with external regulatory pressures [13]. Ant Group needs to strengthen internal and external communication. Effective communication strategies are necessary to engage stakeholders and the public, as effective communication with stakeholders can increase understanding and support for carbon neutrality goals, thus enhancing consumer and market engagement [15]. The Group must implement a green supply chain management strategy that incentivises suppliers to adopt environmentally friendly and low-carbon practices. This can be achieved by collaborative efforts with suppliers to promote green procurement and low-carbon production, as well as the establishment of a comprehensive green supply chain management system [13]. The aforementioned collaboration will not just contribute to the mitigation of carbon emissions on a broader scale, but also bolster the sustainability of the complete value chain (Ibid).

6 Suggestions

To enterprises, they need to increase the development and application of green financial products to meet the market demand for sustainable investment. This not only helps to enhance the corporate image but also attracts the attention of more investors. Secondly, companies should still pay more attention to the progress of digital technology and its application in green finance. For example, using blockchain technology to improve transparency and track the flow of funds, or optimising carbon emission management and green financing processes through big data and cloud computing. Moreover, enterprises should strengthen their internal culture to enhance employees' recognition of and participation in sustainable development to promote the implementation of green practices. When it comes to decision-makers, they should establish policies related to green finance and sustainable development. It can provide a better development environment for enterprises. This includes providing tax incentives, subsidies and incentives such as technical support, training and resource sharing to encourage businesses to better understand and invest in sustainable projects. In addition, policymakers must establish comprehensive norms and methods for corporate ESG disclosure. This is crucial to guarantee the public and investor confidence in the transparency of company information about environmental, social, and governance factors. Therefore, by implementing these suggestions, industries and policymakers may enhance their efforts in fostering the growth of green finance, ultimately achieving the objective of sustainable development.

7 Conclusion

By examining the case of Ant Group's voluntary carbon neutrality, green financial innovation and digital technology play a key role in achieving carbon neutrality goals. Ant Group has successfully raised a large amount of funds for environmentally friendly projects by issuing green bonds, providing green credit and other financial instruments. Meanwhile, the application of blockchain, big data and fintech has improved the transparency and efficiency of carbon emissions tracking and management. However, Ant Group also faced internal and external challenges in achieving carbon neutrality. Nevertheless, Ant Group's successful experience provides valuable lessons for other enterprises. Enterprises should strengthen the development and application of green financial products, continue to focus on and apply digital technology, develop a clear carbon neutral roadmap, and maintain good communication with internal and external stakeholders. In addition, policymakers should introduce more policies that support green finance and sustainable development and encourage companies to adopt innovative green financial instruments.

References

1. Ozili, P. K, Green finance research around the world: a review of the literature. Int. J. Green Econ., **16(1)**, 56-75 (2022)
2. Berrou, R., Dessertine, P., & Migliorelli, M, An overview of green finance. The rise of green finance in Europe: opportunities and challenges for issuers, investors and marketplaces, 3-29 (2019)
3. Lindenberg, N, Definition of green finance, (2014)
4. Blewitt, J, Understanding sustainable development. Routledge (2012)
5. Parris, T. M., & Kates, R. W, Characterizing and measuring sustainable development. Annu. Rev. Environ. Resour., **28(1)**, 559-586 (2003)
6. Pezzey, J, Sustainable development concepts. World, **1(1)**, 45 (1992)
7. Elliott, J, An introduction to sustainable development. Routledge (2012)
8. Jabareen, Y, A new conceptual framework for sustainable development. Environ. Dev. Sustain, **10**, 179-192 (2008)
9. He, J., Li, Z., Zhang, X., Wang, H., Dong, W., Du, E., & Zhang, D, Towards carbon neutrality: a study on China's long-term low-carbon transition pathways and strategies. Environ. Sci. Ecotechnol, **9**, 100134 (2022)
10. Gil, L., & Bernardo, J, An approach to energy and climate issues aiming at carbon neutrality. Renew. Energy Focus, **33**, 37-42 (2020)
11. Huang S, Practical Theory of Shared Value Creation--Based on the Case Analysis of Ant Group. Financ. Account. Mon, **44(13)**, 3-11 (2023)
12. Wu H, Research on value analysis and management optimisation of ESG practices in Alibaba Group. North China Electric Power University (Beijing) (2023)
13. Zhao Y, How can Chinese Internet giants seize new development opportunities in the context of carbon neutrality, Intro. Sustain. Dev. Econ,**05**, 32-33 (2021)
14. Yi J, The application and development of ESG concept in enterprise supply chain management. Financ. Vert, **09**, 25-31 (2023)
15. Xie Z, Fan C, Peng Yijie, president of Ant Group's social welfare and green development business group: green and low-carbon behaviour dilemma is being broken by digital platforms. Daily Economic News, September 06(2021), 003