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ROLE OF BLOCKCHAIN TECHNOLOGY IN GREEN BANKING

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Abstract. Climate change, a general deterioration in the global composition of the planet's atmosphere and the growing expectations of the interested parties make a significant difference to the strategic priorities of the banking sector. In this context, green marketing has become a dominant approach to promoting the development of environmentally friendly products. This approach is applied by different businesses, which in turn increases the brand image, transparency of the company or organisation, and consumer confidence. Additionally, blockchain technology, with its own properties of decentralisation, transparency, and stability, offers new opportunities to adopt and implement eco-marketing factors. This article examines the convergence of eco-marketing and blockchain technology in financial institutions, with a focus on commercial banks. A description of how the blockchain methodology can enhance the credibility and consistency of sustainability initiatives, while reducing the risk of non-transparent activities. Based on a comprehensive literature analysis, the study explicitly addresses the key theoretical and empirical aspects of green banking practices, the development of consumer perception, and the potential for mitigating opacity. The results may indicate that, although blockchains can increase confidence in green marketing, their implementation often involves high energy costs, unavoidable integration with existing systems, and potential uncertainty regarding existing regulations. The article presents a conceptual framework for banks to develop sound, technologically based green marketing strategies that align with environmental sustainability and the expectations of interested parties. Research may contribute to increasing attention to digital sustainability and provide theoretical and practical insight into sustainable financial innovation in the banking sector.

Keywords: Green marketing; blockchain technology; green banking; sustainability; consumer confidence; fintech; ESG communication

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1. Introduction

Constant climate change, a general deterioration in the world's ecological environment, and increased expectations from consumers and regulators, like other stakeholders, have compelled financial and credit institutions to reassess their strategies and activities. New green marketing, which promotes products, services, and institutional practices that highlight environmental advantages, is becoming increasingly important in the banking sector, as commercial banks are becoming more willing to demonstrate social responsibility, sustainability, and transparency. At the same time, the technology of blockchains, which has the characteristics of transparency, sufficient stability, and decentralised management, has considerable potential to increase confidence in green finance and marketing initiatives. At the same time, these two challenges - how to link environmental protection and new technologies - merge and open up prospects for the formation of eco-

marketing and blockchain technologies, thereby making green banking and marketing a crucial area of systematic research.

At the same time, green marketing is an activity that promotes green initiatives, increases the brand value of financial services and improves customer loyalty and corporate image. The aim is to enhance the value of trademarks, goods, and information services, taking into account environmental aspects and promoting social responsibility. These practices include the supply of environmentally friendly products and services, product restructuring to reduce environmental impacts, sustainable production processes, and price-setting strategies that combine environmentally friendly cost reduction factors. This approach encourages the expansion of channels for environmentally friendly activities that mitigate environmental damage. As consumers' awareness of the environmental impact of goods and services continues to increase, credit institutions, like other companies, are adapting their marketing strategies to meet these social needs. In commercial banking, this trend is reflected in green loans, ESG-related financial products, green bonds, sustainable investment opportunities, environmental disclosure and reporting.

The growing need for research is increasingly looking at green marketing. Authors such as Camilleri et al. (2023) claim that sustainability is becoming increasingly important. According to public regulatory legislation and the changing market needs, large companies are adapting their processes to provide goods and services that are either more environmentally friendly or less environmentally damaging. Lievano Pulido and Ramon-Jeronimo (2023) stress that organic marketing is not only a practice of aesthetic or public relations, but also includes planning, implementation, and control, particularly in the areas of pricing, promotion, and distribution, to meet both consumer expectations and institutional objectives of organisations while respecting the limits of ecosystems. At the same time, Alkhatib et al. (2023) emphasise that green marketing encompasses product redesign, sustainable production, and integrated marketing campaigns.

In addition, studies such as Wijekoon et al. (2021), Sani et al. (2024) show that eco-innovation practices over the whole life cycle of goods and services (including end-of-life) have an impact on overall consumer perception. Górska-Warsewicz et al. (2021) explored how new design, packaging, labelling, and communication can help consumers understand environmental initiatives, thereby strengthening trust and customer loyalty. The publication by Ktisti et al. (2022) focuses on genuine green advertising and its role in achieving credibility and influencing consumer decision-making. Research conducted by Majeed et al. (2022) and Mirza et al. (2023) demonstrates that green marketing can provide a competitive advantage when all parties concerned meet sustainability objectives by enhancing the value of all goods or services.

However, the banking sector has fewer practical applications. For example, Pawar & Munuswamy investigate the relationship between green banking practices and green loyalty from the customer's perspective, confirming that green banking practices have a positive impact on the ecological image and ecological confidence. However, the implications for loyalty is less consistent (Pawar & Munuswamy, 2022). Such studies demonstrate that consumers value environmental practices in banking; however, they often overlook how advanced technologies, such as blockchain, can impact or enhance environmental factors.

In the field of financial technology, several research groups have examined how sustainable funding can be ensured through the implementation of emerging technologies. For example, Garg et al. (2021) investigated the perceived benefits of blockchain technology in the banking sector, surveying bank managers and industry experts to identify the key aspects of potential advantages, such as greater security, enhanced transparency, improved efficiency, and increased trust in transactions. Within the framework of sustainable finance, Ren et al. (2023) conducted a systematic review and research agenda that provides a detailed description of how blockchain research interacts with sustainable funding. Their work identifies key directions, including smart green finance contracts, investment traceability, financial inclusion, and governance. Similarly, Mbaidin et al. (2023) summarised the literature on blockchain adoption for sustainable development in the banking sectors of developing countries. Their findings emphasise that regulatory uncertainty, data privacy, and cybersecurity remain the main challenges, while advanced green contracts, risk reduction, and transparency represent emerging opportunities for sustainable banking innovation.

In general, some directions of literature overlap in part. For example, Ling and Wang (2024) examine the green credit markets in China and demonstrate that blockchain technology can reduce the non-transparent "washing" of green credits and increase the efficiency of green credit systems. Another study, by Baig and Yadegaridehkordi (2024), employing mixed methods (SEM-fsQCA), demonstrates that the use of blockchain strengthens the link between green marketing / green technology practices and sustainability outcomes, acting as an intermediary rather than a mere aid measure. In addition, Mzoughi et al. (2024) examine the effects of risks arising from the intersection of blockchain markets and green finance, revealing the dynamics of environmental impacts in the context of price fluctuations and investment risks.

Despite the abundance of recent studies, several potential shortcomings remain. In particular, although studies have been conducted to assess the benefits or models of technology deployment, there has been less specific analysis of how eco-marketing communications are produced, verified, and disseminated in the commercial banking sector, and how customers react to these information messages. Secondly, in the context of marketing green banks, the potential barriers to blockchain adoption have not been sufficiently addressed, particularly with regard to green energy consumption, other costs, joint integration into existing systems, data privacy, and regulation. Thirdly, research into different regulatory authorities and larger markets for commercial banks is relatively low, and often such research results are concentrated in new emerging markets. Fourth, the impact of adapting green marketing blockchain on final results, such as product confidence, brand perception, customer loyalty, and financial results, is not well understood.

This article, therefore, aims to analyse the characteristics of the eco-marketing of financial products in the banking sector to partially address these gaps, to examine whether blockchain technology is or may be used to support or verify the environmental marketing claims, to examine consumer attitudes to these features and to examine barriers and challenges to trade in such services. The results of this study may provide an additional pillar for banking institutions to develop sound, transparent, and consistent financial marketing strategies that align with general environmental sustainability and customer expectations.

2. Green marketing and blockchain technology literature analysis

2.1. Green marketing and green marketing in the banking sector

Green marketing can be defined as the activity that promotes and advertises environmentally friendly activities, thereby increasing brand value and brand awareness. The implementation of green marketing measures increases customer loyalty and improves the company's image, aiming to enhance the value of the brand, goods, information products, and services related to environmental aspects and social responsibility for the environment. It includes the inclusion of environmentally friendly products, information products and services, as well as practices that promote environmental conservation. This trend is developing rapidly as consumers become more aware of the environmental impact of goods and services. Companies are adjusting their marketing to meet these social needs.

Camilleri et al. (2023) consider sustainability to be an increasingly important topic. According to Camilleri et al. (2023), companies, both large and small, guided by regulatory laws and updated market needs, are adapting their production processes to supply environmentally friendly products to the market. Lievano Pulido and Ramon-Jeronimo (2023) mentioned that green marketing is not only inseparable from an environmentally friendly approach, but also includes planning, implementation, and control. Lievano Pulido and Ramon-Jeronimo (2023) stated that it refers to the pricing, promotion, and distribution of the final product in a way that fulfils three requirements: satisfying consumer needs, achieving the entity's objectives, and achieving both of these objectives in a manner that is respectful and compatible with various ecosystems. Alkhatib et al. (2023) considered green marketing to be a strategy that reduces the environmental impact of a product through product redesign, sustainable production, and integrated marketing campaigns, thereby promoting environmentally friendly products and meeting the demand for sustainable consumption. Moravcikova et al. (2017) stated that green marketing, as part of overall marketing activities, examines both positive and negative aspects, as well as a limited range of environmental issues. Shabbir et al. (2020) considered green marketing to be a management process that involves identifying, anticipating, and satisfying consumer needs and wants. Correia et al. (2023) noted that green marketing is aimed at all consumers, to encourage them to adopt greener habits and appreciate

companies' environmentally friendly approaches when selecting their products. Majeed et al. (2022) stated that the primary goal of green marketing is to gain a competitive advantage by strategically positioning products in the minds of customers, and all stakeholders in the value chain must align with green marketing goals, encompassing cooperation and environmental awareness among all stakeholders. Bhardwaj et al. (2023) stated that green marketing has experienced significant growth over the past two decades, and knowledge about green marketing has expanded proportionately across different continents and various topics. Ktisti et al. (2022) noted that green advertising and green marketing have garnered considerable interest from researchers, as consumers and businesses have become increasingly concerned with sustainability issues and green practices in recent years. García-Salirrosas et al. (2022) considered that green marketing is related to consumer purchasing behaviour, is limited and focused on green product purchasing decisions. Górská-Warsewicz et al. (2021) noted that, in this regard, green marketing considers environmental requirements throughout the product design, production, and packaging processes. Skackauskiene et al. (2023) stated that green marketing uses two approaches from an impact perspective. According to Skackauskiene et al. (2023), the first approach focuses on the impact of green marketing on customer purchasing behaviour, while the second one systematises the potential effect on the organisation (with or without customer purchase intention as a moderating/mediating variable). Nabivi (2025) stated that green marketing can increase perceived informativeness because such posts are essentially intended to convey practical insights about sustainability. Vilkaite-Vaitone et al. (2022) mentioned that green marketing was conceived as a combination of organisational activities designed to promote the causes of environmental problems and to propose solutions to neutralise, prevent, and eliminate them. While these ideas remain an integral part of the current green marketing concept, over time the concept has crystallised and enriched considerably. Guerreiro et al. (2021) analysed that as green marketing has become more popular around the world, so has “green education” and consumer scepticism. Wijekoon et al. (2021) considered that eco-innovation involves sustainable environmental practices at every stage of the formation of goods and services. Chen et al. (2015) stated that as green movements gain momentum, consumers will eventually change their purchasing behaviour and become more receptive to green products. Lopes et al. (2023) analysed that combating green manipulation and promoting a sustainable economy is a multifaceted task that is best approached through a set of coherent and interrelated actions. First and foremost, education is at the heart of this process. The first step is to organise educational campaigns to inform the public about what green manipulation is and how to recognise it.

Summarising, it can be stated that green marketing can increase perceived informativeness, as such posts are essentially intended to convey practical insights about sustainability, aimed at promoting awareness of environmental problems and offering solutions to neutralise, prevent, and eliminate them, associated with environmentally conscious consumption.

2.2. Blockchain technology

The essence of blockchain technology is innovative data storage and transmission technology, the essence of which is decentralisation and data immutability. Unlike conventional databases, the blockchain structure allows information to be stored in blocks that are chronologically connected one after the other in a chain. Due to this property, it is practically impossible to change or falsify information, which is why the blockchain is characterised by greater reliability and security.

The blockchain is associated with a decentralised system - this means that there is no single central controller or server. Instead, data is distributed among network participants located worldwide. Each block of the blockchain contains a certain amount of information, such as transaction records, and is linked to the previous block using a unique cryptographic key (hash). A new block can only be added when network participants (through a process called consensus) confirm that all data is accurate and correct. The features of blockchain technology are presented in Table 1.

Table 1. The features of blockchain technology

Author	The features of blockchain technology
Habib et al. (2022)	Blockchain is a particularly promising and revolutionary technology because it helps reduce security risks, eliminate fraud, and achieve such transparency.
Tran et al. (2023)	Decentralisation, immutability, transparency, security, efficiency, traceability, and programmability are the features that make blockchain so attractive.
Thanasi-Boçe et al. (2025)	Blockchain technology is increasingly recognised as a transformative digital infrastructure that drives environmental, economic, and social sustainability. Still, academic research on its sustainability potential remains fragmented, with limited integration of theoretical models, sector-specific applications, and systemic-level impacts.
Masa'deh et al. (2024)	A distributed database that records all digital events between participants in a decentralised manner.
Baashar et al. (2021).	Decentralised network management is another feature of blockchain in decentralised governance.
Koptyra et al. (2021)	Blockchain is a breakthrough technology used to create distributed databases. Data is stored in the form of a chain that gradually grows, and the stored information is immutable.
Khanfar et al. (2021)	Blockchain technology is a decentralised and distributed data structure. Data is shared in a peer-to-peer network, with open access. Transactions should be certified, verified, and approved by members of the network community.
Johar et al. (2021).	Blockchain provides decentralised, transparent, and secure systems. It is a distributed ledger technology that maintains a ledger of transactions and protects it with cryptography. Transactions are recorded in blocks, and these blocks are linked together through hashing algorithms.
Mohammed et al. (2024)	The existing literature on blockchain technology for business is highly fragmented, making it challenging to fully understand its potential for business applications.
Kitsantas (2022)	BT is the most popular decentralised digital currency. It has been proven to be a viable solution for building trust in a trustless ecosystem that lacks a central authority for financial transactions, such as banks and financial institutions.
Capece & Lorenzi (2020).	Blockchain technology enables the secure and continuous creation and maintenance of large, distributed databases, primarily designed to manage transactions (data record operations).
Soltani et al. (2022)	This technology has created a new space for various applications by providing a distributed platform along with encryption algorithms. Initially, this type of technology was used to create a financial transaction platform, with the primary goal of developing a system that could prevent double-spending.

Rahman et al. (2024) stated that the use of blockchain technology is not limited to the banking sector and encompasses various other industries such as asset management, tourism, and traceability systems. The integration of blockchain technology into the tourism sector is gradually materialising through the implementation of innovative business models.

To summarise the opinion of scientists, it can be stated that blockchain is an up-and-coming and revolutionary technology, as it helps reduce security risks, eliminate fraud and achieve such transparency, is recognised as a transformative digital infrastructure that promotes environmental, economic and social sustainability, but academic research on its sustainability potential remains fragmented, with limited integration of theoretical models, sector-specific applications and systemic-level impacts.

3. Research methodology

The article employs a methodological approach that combines scientific literature and case analysis. Analysing scientific literature helps to assess how thoroughly the chosen topic has been researched and how many articles have been published on this topic. Maslauskaitė (2008) states that when conducting a scientific literature analysis, one must be familiar with the significant sources of scientific information necessary for analysing the problem. Not all selected sources of information may be directly helpful in analysing the problem writing style. Chapman (2021) mentioned that qualitative literature analysis must reflect complex intellectual work – systematising the similarities and differences of the analysed sources, emphasising contradictions between different authors' positions and their problematic nature, evaluating the methodologies and results of previously conducted research, applying concepts and empirical tools, and commenting on the connections between different parts of the written work being prepared.

Case studies are a popular research method in many fields, including business. A case study involves an in-depth analysis and examination of a specific subject. It can reveal insights into problem-solving techniques or provide evidence to support the effectiveness of a particular product or service. Once you have chosen an appropriate case study topic, it is essential to conduct preliminary research. This step helps you gain a better understanding of the topic and ensures that you have all the relevant information.

4. Case studies

Danske Bank green marketing. Danske Bank has set three main priorities in its sustainability agenda: climate change, nature and biodiversity, and human rights and social impact. These priorities are interrelated and reflect the main challenges that Danske Bank aims to address through its sustainability efforts, which are divided into three priority areas: supporting customers in their transition to sustainability, ensuring a strong and resilient bank, and managing societal impacts. Danske Bank has set specific emission reduction targets for its various business areas. (Danske Bank, 2025a, 2025b).

Bank of Jiangsu green marketing. The BoJ's commitment to sustainable development focuses on enhancing human well-being, with a particular emphasis on financing for well-being. The bank integrates sustainability into its operations through a comprehensive management framework, with green financing as one of its key pillars. This approach ensures that the BoJ is aligned with global sustainability goals. The BoJ benchmarks its practices against global standards and engages with the PRB community to learn about good practices. The BoJ has established a green finance support framework to integrate environmental performance into its operations. (Bank of Jiangsu, 2025).

The Bank of Lithuania initiated the project "LBChain", which is the first blockchain technology platform service for the financial sector. This project aims to combine technological and regulatory expertise and help the financial and FinTech sectors create innovative services, research new technologies, and apply them in practice. The project provided an opportunity for both Lithuanian and international financial companies and startups to experiment in a safe, innovation-friendly environment. The aim was to promote innovation, deepen knowledge about blockchain technologies and strengthen the competitiveness of the sector (Inovacijų agentūra, 2025).

5. Discussion

Lymperopoulos et al. (2012) reveal specific ideas that can be implemented, such as supporting environmental projects, educating customers and employees to be more environmentally conscious, and participating in relevant events. Lima et al. (2025) examine the following question: Does green marketing influence customer loyalty perceptions, brand associations, perceived quality and brand equity in Brazilian banks? According to Lima et al. (2025), green marketing emerges as a strategic approach that promotes sustainable practices, balancing consumer needs with environmental protection. This approach has been driven by growing ecological awareness and the need to align organisational activities with the principles of sustainable development. Nevertheless, in this context, aspects such as brand equity, quality perceptions and value perceptions are strongly influenced by green marketing strategies. As stated by Lima et al. (2025), brand personality, which reflects the values of the organisation, plays a crucial role in strengthening relationships with consumers, shaping their behaviour and influencing purchase intentions. In the banking sector, sustainable practices can increase customer loyalty, brand recognition, quality perceptions and perceived value, as customers view green products as higher-quality alternatives that meet their environmental concerns.

Sharma (2023) summarises the literature on four concepts – green brand image, green brand value, green brand trust, and green purchase intention – into a single framework, develops five hypotheses, and empirically validates them using structural equation modelling in the Indian banking sector, thereby filling a significant research gap. Sharma (2023) reveals a positive relationship between the four concepts, with green trust partially mediating the relationship between green brand image and green brand value. Sharma's (2023) study has theoretical, managerial, and social implications and will be helpful for researchers, policymakers, and stakeholders worldwide in developing green banking strategies for a resource-efficient future.

Conclusions

The impact of green marketing is related to compliance with legal requirements on environmental issues, improving the brand image in the market and among the general public, and better control of the production of polluting substances to reduce negative environmental impacts.

An analysis of the case study presented in the article and a literature review accompanying it indicate that the combination of green marketing and blockchain technology is a relatively viable approach for banks to increase confidence and transparency among market players while pursuing overall sustainability objectives. Danske Bank and Bank of Jiangsu illustrate how key banks adopt multi-dimensional sustainability agendas, including environmental, social, and governance aspects in their strategic priorities. Danske Bank's focus on climate change, nature and biodiversity, human rights and/or social impact, as well as overall objectives for reducing emissions and efforts to support customer attraction indicate that green marketing is not only a means of business marketing communication but also an integral part of business strategy and business planning (Danske Bank, 2022, 2024; Danske Bank, 2025a, 2025b). The commercial bank combines various loan and investment portfolios with set targets, offering green loans, sustainable financing, and new investment products tailored to sustainability priorities (Danske Bank, 2024b; Danske Bank, 2023). In the meantime, the other Bank of Jiangsu incorporates sustainability into its management system, making green financing the primary pillar of its banking activities and adopting established standards, such as balancing principles and the principles of responsible banking (Bank of Jiangsu, 2023; JSB China, n.d.). At the same time, these cases demonstrate how banks can implement green marketing in alignment with holistic ESG strategies, integrating the supply of their services and products, portfolio management, and stakeholder engagement.

Thus, based on the studies mentioned and the literature examined, several conclusions can be drawn. Firstly, eco-marketing in banking has undergone a fundamental shift from symbolic signs to more specific actions, such as green financing, setting emission reduction targets, incorporating environmental criteria into risk assessment, and aligning investment portfolios with scientifically sound objectives. Therefore, these are key steps towards making the marketing in question generally meaningful and not just used for advertising. Secondly, consumer confidence is crucial: consumers respond positively when green marketing is based on measurable, verifiable actions and accountability for activities. Without authenticity, banks risk claims of greenwashing, which can erode brand integrity, trust, and loyalty. The literature reviewed (e.g., Lima et al., 2025; Green Banking and customer loyalty studies) shows that the image of the brand, its perceived quality and value depend largely on how green marketing of financial products is implemented.

Third, blockchain technology has the potential to strengthen green marketing by providing immutable verification, traceability, and transparency of sustainability claims. While blockchain is less visible in many of the case studies you cited, and more visible in literature outside of the banking cases, its capacity to reduce information asymmetry, enable verifiable tracking of emissions or sustainability outcomes, and enhance governance practices is substantial. However, this potential is conditioned by regulatory environments, technological maturity, cost, energy efficiency, and how well stakeholders (including customers) understand and trust the blockchain-enabled claims.

Fourth, substantial challenges remain. Among them are trade-offs associated with blockchain (e.g. energy consumption, scalability, cost), variation in regulatory and reporting standards across jurisdictions, internal capacities (technical, managerial) to deploy both green marketing and blockchain technologies effectively, and a gap in empirical research assessing the impact of combining green marketing + blockchain on customer outcomes like loyalty, trust, and willingness to pay for green financial products.

Ultimately, to maximise the benefits, a framework for banking sector features of green marketing should include: (a) clearly defined sustainability priorities (e.g. emissions, biodiversity, human rights), (b) quantifiable and science-aligned targets, (c) transparency of progress and metrics, (d) verification mechanisms (potentially blockchain or other trust-enhancing technologies), (e) communication strategies that educate and engage customers, (f) organisational structures that embed sustainability into lending, investment, risk management, and product development.

For future research, longitudinal studies are needed to track how green marketing efforts backed by blockchain evolve in real banking institutions; comparative studies across different regulatory jurisdictions; and studies that measure the quantitative effect on consumer behaviour, financial performance, and risk exposure. Moreover, research should focus on how the energy efficiency of blockchain solutions is managed to avoid undermining the environmental benefits with high indirect costs.

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