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Green Banking in the Metaverse: An Economic Analysis of Digital Marketing Opportunities Based on NFTs and Green Assets

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Abstract

In response to the expansion of green banking and the emergence of the metaverse, this study investigates digital marketing opportunities enabled by non-fungible tokens (NFTs) and green digital assets. This research addresses a critical gap in the literature concerning the integration of green banking with metaverse environments, blockchain technology, and NFTs. The study aims to develop a conceptual framework for leveraging green NFTs in banking, enhancing customer engagement, fostering trust through blockchain-based transparency, promoting sustainability, and identifying security and regulatory challenges. The central research question is: *How can banks utilize green NFTs within the metaverse to design sustainable digital marketing strategies?* Adopting an exploratory qualitative approach, the study employs thematic analysis within an interpretive research paradigm. The research population comprises experts in business management, digital marketing, and blockchain— including faculty members from universities such as Mazandaran and Shahid Beheshti—as well as experienced metaverse users active on platforms such as Decentraland. Data were collected through snowball sampling and 23 semi-structured interviews, conducted until theoretical saturation was achieved. The analysis resulted in 244 initial codes, 30 organizing themes, and six overarching themes: (1) the impact of green NFTs on customer engagement and loyalty, (2) the role of blockchain in trust-building, (3) the influence of NFT design features on environmental perceptions, (4) the promotion of sustainable behaviors through digital campaigns, (5) implementation challenges, and (6) the role of influencers in advancing green initiatives. The findings indicate that green NFTs enhance emotional engagement and customer loyalty, blockchain technology strengthens trust and transparency, and environmentally conscious NFT design positively shapes sustainability perceptions. Practical implications include integrating NFTs into banking loyalty programs, leveraging blockchain for transparent green claims, developing sustainability-oriented interface designs, launching gamified green marketing campaigns, and adopting AI-based security and risk management systems. These insights offer valuable guidance for banking executives and digital marketers, while also highlighting the need for future research to examine the long-term effectiveness and behavioral impacts of green NFT–based marketing strategies.

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Introduction

Green banking, as an innovative approach in the financial industry, seeks to align banking services with environmental goals and sustainable development. This concept has gained increasing significance, particularly in recent decades, due to climate change and heightened awareness of environmental protection. Banks aim to reduce the negative environmental impacts of their economic activities through green initiatives, investing in environmentally friendly projects, and helping customers adopt sustainable practices (Bukhari et al. , 2021). In this context, green assets refer to environmentally designed assets that have no negative impact on the environment or even contribute to its improvement. These assets may include renewable energy projects, decarbonization efforts, and other green initiatives across various industries. In the realm of green banking, green assets typically refer to projects that are financed in line with environmental sustainability objectives (Wendt, 2020). The topic of green banking in the metaverse, particularly from the perspective of digital marketing opportunities using NFTs and green assets, represents an emerging and highly compelling field of study. The metaverse, as the convergence of the physical and virtual worlds, provides innovative pathways for banking and financial services. As the banking industry adapts to this digital transformation, it is essential to examine how technologies such as NFTs and blockchain can facilitate sustainable approaches and novel marketing strategies (Barua et al., 2025).

The metaverse offers an immersive and interactive environment where users can engage, create, and transact. This digital landscape provides unique opportunities for banks to enhance customer interaction and streamline processes. In this context, NFTs (Non-Fungible Tokens), as unique digital assets, play a significant role in transforming digital marketing models. NFTs enable the buying and selling of irreplaceable digital assets, offering new opportunities in ownership and investment. This technology utilizes blockchain as its underlying infrastructure to ensure the authenticity and ownership of digital assets. By leveraging NFTs, banks will be able to create unique digital assets that represent ownership or authenticity, contributing to the development of a new form of customer engagement and loyalty (Zade et al., 2024). Moreover, the integration of blockchain technology ensures transaction security and transparency, which is crucial for building trust in digital banking environments (Gadekallu et al., 2022). These innovations not only improve service quality but also enhance customer loyalty in green banking (Arabshahi & Mokhareghi, 2022).

Green banking initiatives can significantly benefit from the capabilities of the metaverse. By adopting green digital assets, banks can align their marketing strategies with environmentally friendly practices. For instance, offering green loans or financing sustainable projects within the metaverse can attract environmentally conscious clients (Dubey et al., 2022). This approach not only strengthens a bank's brand image but also contributes to broader environmental goals. Furthermore, the metaverse enables the design of innovative marketing strategies that can reach global audiences. Banks may leverage immersive and interactive experiences to showcase their green initiatives, engage customers in participatory campaigns, and educate them about sustainable financial practices (Din et al., 2024). Additionally, the potential for cross-border transactions in the metaverse expands the market reach of green banking products, making them accessible to a wider range of customers (Mohamed & Faisal, 2024). However, the implementation of such strategies is not without challenges. Issues such as digital data security and the need for regulatory frameworks in the metaverse must be addressed to ensure trust and consumer protection (Awadallah et al., 2024). The rapid pace of technological change also requires banks to continuously innovate and update their strategies to remain competitive (Rahimi & Fani, 2025; Chen et al., 2023). The role of artificial intelligence (AI) in enhancing cybersecurity in the metaverse is also critical. As banks expand their use of NFTs and other digital assets, AI-driven solutions can mitigate risks associated with cyber threats, thereby safeguarding financial transactions and customer data (Asif et al., 2024). This integration not only protects bank assets but also enhances the overall customer experience by delivering secure and efficient services.

The intersection of green banking, the metaverse, and digital marketing offers a rich array of opportunities for financial institutions. By embracing emerging technologies such as NFTs and blockchain, banks can simultaneously strengthen sustainability, customer engagement, and trust. Given the rapid evolution of this field, continuous research and development are essential to overcoming challenges and maximizing the potential of green banking in the metaverse (Haryati et al., 2025; Firmansyah et al., 2024).This exploration of digital marketing opportunities in green banking within the metaverse underscores the importance of aligning financial operations with environmental sustainability—a trajectory that ultimately fosters more responsible and innovative banking practices (Anousheh et al., 2021).

Given the rapid growth of green banking and the emergence of the metaverse as an innovative digital platform, examining digital marketing opportunities through NFTs and green assets is of significant importance. The NFT market has experienced substantial growth in recent years and is projected to reach approximately $489.1 million in 2026, with the number of NFT market users expected to rise to 11.87 million (Statista, 2024). Additionally, it is forecasted that the metaverse market will reach $5 trillion by 2030 (McKinsey & Company, 2022). These statistics present vast opportunities for green banking through innovative technologies. However, limited research has explored the integration of green banking with the metaverse and NFTs in digital marketing, highlighting a research gap that requires further investigation. The necessity of this study arises from this point, as it seeks to explore how these technologies can be leveraged to strengthen sustainable digital marketing and promote environmentally responsible behaviors by banks. Studies have shown that only a small percentage of banks currently utilize the metaverse and NFTs in their digital marketing strategies (Iqbal et al., 2024). This statistic underscores the potential opportunities in this area and emphasizes the need for the development of a comprehensive framework to harness these technologies. The aim of this research is to develop a framework for utilizing green NFTs and digital assets in the metaverse to enhance customer engagement, strengthen trust through blockchain transparency, and promote environmental sustainability. This study will also examine security and regulatory challenges to provide solutions for the successful implementation of these strategies. The primary research question is: How can banks utilize green NFTs and digital assets in the metaverse to design sustainable digital marketing strategies that increase customer engagement and loyalty?

Theoretical Foundations

In recent years, the role of institutional variables and governance requirements in enhancing the sustainability of the banking system has gained increasing significance. Banks, in response to the evolution of advanced technologies and the need to strengthen trust and transparency, are striving to introduce innovative solutions for risk management and the improvement of financial stability (Rouhani Rad, 2023). In this regard, strengthening supervisory structures, ensuring operational transparency, and addressing environmental considerations can contribute to the development of sustainable banking and the consolidation of the banking system (Karimi et al., 2025). Green banking in the metaverse, particularly in relation to digital marketing opportunities through NFTs and green assets, involves a multidimensional analysis of technology, sustainability, and consumer behavior. This comprehensive perspective seeks to establish a robust framework for understanding how these elements interact and shape the evolution of banking practices in a digital environment. The following discussion integrates key concepts to explore this domain and highlight the interconnections between its components.

Green banking refers to initiatives and practices adopted by financial institutions to promote environmental sustainability (Davoodi et al., 2025). Such measures include offering environmentally friendly loans, financing renewable energy projects, and embedding sustainable practices into banking operations (Bang et al., 2023). The theoretical framework of green banking emphasizes aligning financial services with environmental goals, thereby contributing to a sustainable economy. Within this context, the metaverse serves as a new frontier—an immersive digital environment blending physical and virtual realities—where users can engage in innovative interactions (Mohamed & Faisal, 2024).

Digital marketing in the metaverse leverages technologies such as NFTs and blockchain to create unique experiences for consumers. NFTs, as digital assets, can signify ownership of virtual goods and services, allowing banks to offer exclusive products to environmentally conscious consumers (Siddique et al., 2023). This approach not only enhances brand loyalty but also aligns with sustainable marketing practices. Furthermore, the metaverse enables banks to involve customers in sustainability initiatives through interactive campaigns and educational experiences (Dubey et al., 2022). For instance, banks may organize virtual events to familiarize customers with the benefits of green products—an interaction that is vital for cultivating long-term relationships and ensuring the coherence of sustainability and digital engagement.

Beyond interactivity, technological innovation and trust play pivotal roles in this domain. The adoption of advanced technologies such as artificial intelligence (AI) and blockchain in metaverse banking enhances data security, streamlines operations, and guarantees transaction transparency—factors essential for establishing trust in digital banking (Gadekallu et al., 2022). Specifically, these integrations facilitate the creation of innovative financial products tailored to the needs of environmentally conscious consumers. Nevertheless, while the metaverse offers vast opportunities for green banking, it also presents challenges, such as regulatory requirements, data security, and the need for consumer education (Ooi et al., 2023). Overcoming these obstacles demands comprehensive risk management strategies.

Another emerging dimension is influencer marketing in the metaverse, where brands collaborate with influencers to promote green initiatives (Karabacak & Güngör, 2023). This strategy enhances brand visibility and credibility, particularly among younger generations inclined toward socially responsible brands. Moreover, understanding consumer behavior in the metaverse is critical for developing effective marketing strategies, as research indicates that consumers increasingly favor brands aligned with their values, particularly sustainability (Lim et al., 2025). Regulatory frameworks also hold importance; as banks enter the metaverse, they must consider the legal landscape surrounding digital assets and environmental sustainability, since regulatory compliance is vital for consumer trust and the legitimacy of green banking (Rahmani & Doodangeh, 2024).

Future research directions suggest that the convergence of green banking and the metaverse constitutes an emerging field requiring further exploration. Studies should focus on the long-term impacts of digital marketing strategies on consumer behavior, the effectiveness of NFTs in promoting sustainability, and the role of emerging technologies in advancing green banking (Acheampong et al., 2023). Of particular relevance are green NFTs, designed on low-energy blockchains to minimize environmental impacts. Their development can support banks in effectively marketing eco-friendly products (Sereti et al., 2025). Cultural and ethical considerations are equally crucial; integrating these dimensions into marketing strategies is essential for success in the metaverse, ensuring alignment with the values of diverse consumer groups, particularly regarding sustainability and social responsibility (Hindolia et al., 2024). For example, in culturally diverse societies, banks could design campaigns that combine local values with green objectives to foster broader acceptance. This approach aligns with green management models in financial organizations and strengthens the overall sustainability of the sector (Rangriz & Karim, 2024).

In addition, the impact of telepresence on consumer behavior highlights that the sense of presence in a digital environment significantly shapes user behavior in the metaverse. Research suggests that increased telepresence enhances consumer engagement and purchase intention (Muhammad Sohail Jafar et al., 2024). In this regard, sustainable marketing strategies in the metaverse can deepen customer interaction and brand loyalty. By emphasizing the environmental benefits of products and services, banks can attract eco-conscious consumers and differentiate themselves in competitive markets (Zhong & Zhao, 2023). Consumer trust and acceptance are also essential; studies show that perceived risk, service quality, and regulatory support strongly influence consumers' willingness to adopt metaverse-based banking services (Alhanatleh et al., 2024).

Nevertheless, both the bright and dark sides of metaverse marketing must be acknowledged. While the metaverse offers unprecedented marketing opportunities, it also raises concerns regarding digital privacy and sustainability (Lim et al, 2025). The future of digital sustainability in the metaverse—particularly in sectors such as fashion and banking—appears vast. By employing digital tools to convey sustainability messages, brands can

foster eco-friendly behaviors and enhance their market presence (Blazquez, 2024). In this context, collaborative marketing models that integrate sustainable practices with technological innovations can enhance the effectiveness of metaverse marketing strategies. Such models, by fostering cooperation among banks, technology developers, and consumers, strengthen sustainable growth and innovation (Nalbant & Aydın, 2023). Moreover, enhancing customer experience in the metaverse is vital for increasing engagement and loyalty, as research indicates that factors such as immersiveness and environmental realism significantly influence consumer behavior (Tao et al., 2025).

In conclusion, the theoretical foundations of green banking in the metaverse underscore the substantial capacity for innovation and meaningful customer engagement. By adopting digital marketing strategies and emerging technologies, banks are able to foster sustainability while simultaneously enhancing customer experiences. Ongoing research and collaborative efforts remain vital to addressing challenges and maximizing the opportunities offered by the metaverse.

Table 1. Research Background.

Previous Study	Primary Focus of the Previous Study	Identified Research Gap	How the Present Study Addresses the Gap
Dubey et al. (2022)	Customer engagement in green banking initiatives	Focus on traditional interactions without addressing the metaverse or using NFTs for green educational campaigns	This study extends customer engagement into the metaverse through green NFTs and proposes models for sustainable interactive campaigns.
Gadekallu et al. (2022)	The role of blockchain in security and transparency of digital banking	Examination of general security without integration with green sustainability or NFT-based marketing	The present research combines blockchain with green NFTs to ensure transparency in sustainable metaverse marketing and to enhance trust in green banking.
Bang et al. (2023)	Definition of green banking and traditional sustainable practices (e.g., green loans)	Lack of integration of green banking with emerging digital spaces such as the metaverse, without exploring sustainable marketing opportunities	This study integrates green banking into the metaverse through green NFTs, providing a practical framework for sustainable digital marketing and extending sustainability to virtual environments.
Siddique et al. (2023)	Application of NFTs in digital marketing for virtual asset ownership	Examination of general NFTs without connection to green banking or environmental sustainability	This study introduces green NFTs as a marketing tool in metaverse banking and addresses the gap by demonstrating their role in promoting sustainable assets.
Ooi et al. (2023)	Challenges of the metaverse such as regulation and data security	Focus on general challenges without offering green solutions or NFT-based marketing approaches	This study addresses such challenges through green NFT marketing strategies and proposes solutions for regulatory compliance in sustainable metaverse banking.
Acheampong et al. (2023)	Future research directions in green banking and emerging technologies	Proposes general research without practical emphasis on the metaverse and green NFTs	This study operationalizes future directions by examining long-term green NFT marketing in the metaverse and offers a comprehensive framework for future research.
Mohamed & Faisal (2024)	The metaverse as an interactive platform for banking services	Focus on general metaverse interactions without linking to environmental sustainability or green marketing tools such as NFTs	This research explores the metaverse with a focus on green NFTs to promote green initiatives, highlighting digital marketing opportunities to attract environmentally conscious customers.
Lim et al. (2025)	Consumer behavior in the metaverse and alignment with sustainable values	Examination of general consumer behavior without specific tools such as NFTs for green alignment	This research analyzes consumer behavior with a focus on green NFTs and provides models for aligning environmental values within digital marketing.

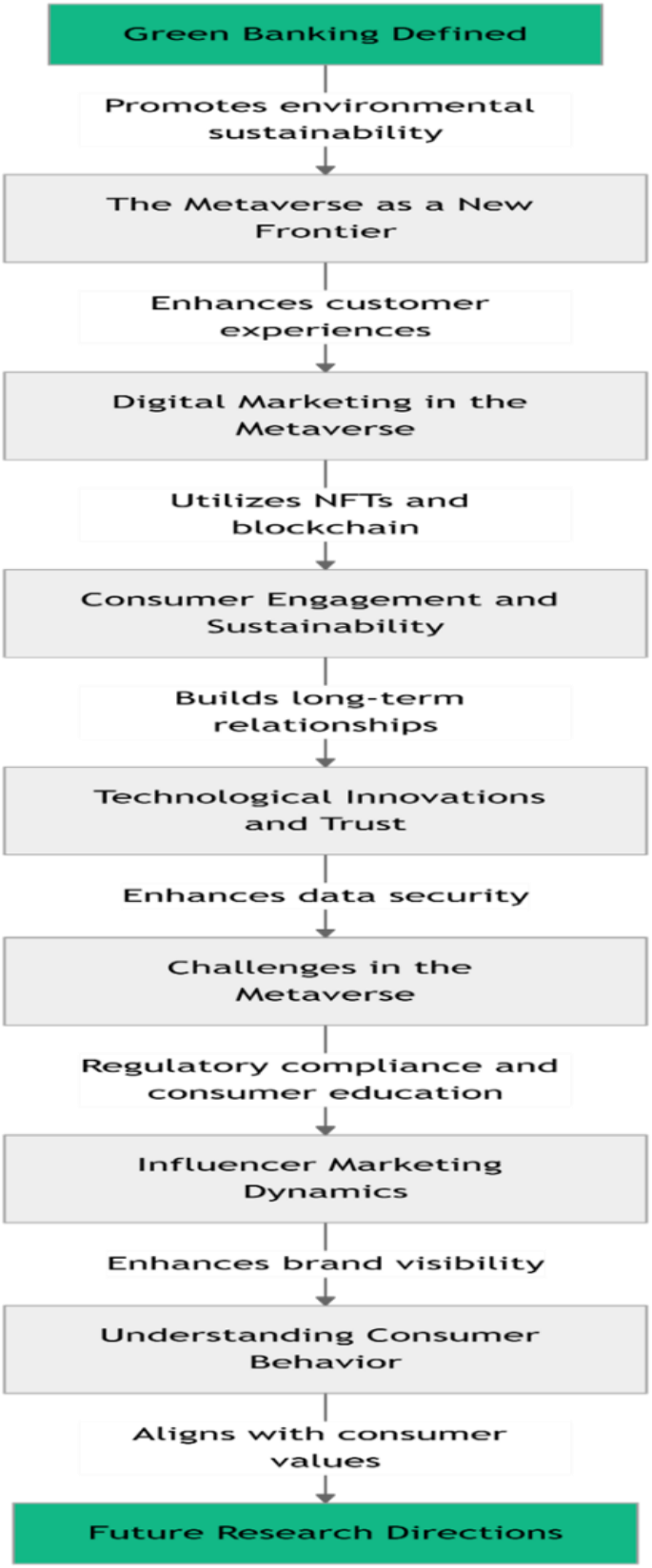

Figure 1. The relevance of green banking concepts in the metaverse.

The above diagram illustrates the interconnections among the key aspects related to green banking in the metaverse. It begins with the definition of green banking, which promotes environmental sustainability and leads to the exploration of the metaverse as a new frontier for enhancing customer experiences. This, in turn, facilitates digital marketing strategies that leverage NFTs and blockchain technologies to strengthen consumer engagement and sustainability. The importance of technological innovation and trust is highlighted, while addressing challenges such as regulatory compliance and the need for consumer education. Furthermore, the dynamics of influencer marketing enhance brand visibility, while understanding consumer behavior ensures alignment with customer values. Ultimately, the need for future research directions is emphasized to further explore these issues. The sources of these aspects include Bang et al. (2023), Mohamed & Faisal (2024), Siddique et al. (2023), Dubey et al. (2022), Gadekallu et al. (2022), Ooi et al. (2023), Karabacak & Güngör (2023), Lim (2024), and Acheampong et al. (2023).

Materials and Methods

The present study is an exploratory qualitative investigation aimed at examining digital marketing opportunities in green banking within the metaverse, utilizing NFTs and green digital assets. The research employs thematic analysis for data interpretation and is designed using an inductive approach grounded in interpretive philosophy. The study population comprised two main groups. The first group included experts in business management, digital marketing, and blockchain technology. This group consisted of faculty members from reputable universities such as the University of Mazandaran, Shahid Beheshti University, Semnan University, Hazrat Masoumeh University (Qom), and Ilam University, with expertise in digital marketing, green banking, blockchain, and the metaverse. Selection criteria included academic expertise (publication of relevant articles in reputable journals), practical experience in projects related to digital technologies or banking, and a managerial background of more than four years.

The second group consisted of active users in metaverse environments. This group included individuals with at least six months of experiential engagement with metaverse platforms (such as Decentraland, The Sandbox, or Rang Metaverse), NFTs, or digital assets, primarily located in Tehran and Mashhad. The inclusion of this group aimed to capture the sensory, emotional, and behavioral dimensions of user interactions with green digital assets and services in the metaverse.

Snowball sampling was employed, where experts and active users were identified through mutual referrals. In total, 23 participants were selected. This sample size was determined based on achieving theoretical saturation, as by the 17th interview, repetitive codes emerged and no significant new information was added.

The primary data collection instrument was semi-structured interviews conducted online via Google Meet, as well as by telephone and in-person sessions. Online interviews facilitated participation for experts and users located in different geographic regions, while telephone interviews were used for participants without stable internet access or those who preferred this method. These approaches allowed flexibility in data collection and direct interaction with participants.

The research questions were designed to rigorously and systematically address various aspects of green banking in the metaverse:

1. How can the use of green NFTs in the metaverse influence customer engagement and loyalty in green banking?
Objective: To examine the impact of green NFTs as a digital marketing tool on enhancing emotional engagement and customer loyalty to banking brands, with a focus on environmental sustainability.
2. What is the relationship between blockchain transparency in the metaverse and consumer trust in green banking services?
Objective: To analyze the role of blockchain in ensuring transaction transparency and its effect on customer trust and acceptance of green banking services.

3. How do the design features of green digital assets (e.g., NFTs) in the metaverse affect consumers' perceptions of environmental sustainability?
Objective: To investigate the influence of visual and functional design of green digital assets on consumer understanding and acceptance of sustainable banking initiatives.
4. How can interactive metaverse-based marketing campaigns reinforce sustainable consumer behaviors?
Objective: To assess the effectiveness of interactive marketing campaigns (e.g., virtual events or educational experiences) in promoting environmentally friendly behaviors among customers.
5. What are the security and regulatory challenges in implementing green NFTs in metaverse banking, and how can they be managed?
Objective: To identify obstacles related to data security and regulatory frameworks, and to propose solutions to mitigate risks in digital green banking.
6. What role do virtual influencers in the metaverse play in promoting green banking initiatives, and how do they affect consumer behavior?
Objective: To examine the impact of virtual influencers in enhancing brand visibility and encouraging consumers to adopt green products and services in the metaverse.

Validity and Reliability of the Study

To ensure the credibility of this study, triangulation was employed. Data were collected from three primary sources: (1) managers and deputies of banks and financial institutions involved in digital banking, (2) faculty members from universities in Tehran and Semnan specializing in business management and digital marketing, and (3) active users in metaverse environments with experience in NFTs and digital assets. This triangulation enabled the researcher to obtain a comprehensive understanding of multiple perspectives related to the research topic, namely digital marketing opportunities using NFTs and green assets in metaverse-based green banking. Collecting data from diverse sources not only enhanced the depth and breadth of the data but also facilitated a more nuanced and multifaceted analysis of the findings.

Additionally, existing theoretical and empirical literature on green banking, the metaverse, NFTs, and digital marketing (e.g., Bang et al., 2023; Mohamed & Faisal, 2024; Siddique et al., 2023) was used as a complementary resource. This combination provided a broad and diverse perspective, allowing the study to examine the topic from theoretical, practical, and behavioral viewpoints.

To further ensure the validity of the findings, a quality control process was implemented. After analyzing the collected data, the results were summarized and shared with a subset of interviewees (at least five participants from each source group). The purpose of this step was to verify the accuracy of the researcher's interpretation of interviewees' statements and the extent to which the findings aligned with their actual perspectives. Participants provided feedback, and any discrepancies between the researcher's interpretation and the participants' intended meaning were identified. Based on this feedback, portions of the findings were revised to ensure greater alignment with participants' perspectives. This process, known as Member Checking, not only demonstrates acceptable validity but also ensures that the results are coherent and consistent with the interviewees' viewpoints. In the context of analyzing digital marketing opportunities in metaverse-based green banking, this method provided deeper and broader insights and strengthened the study's scientific credibility.

In addition to triangulation and Member Checking, Peer Debriefing was employed to enhance validity. In this phase, preliminary findings were reviewed by two experts in qualitative research (one faculty member from Semnan University and an independent researcher in digital marketing) to ensure impartiality and accuracy of analysis. This process reduced potential researcher bias and externally validated the findings. Moreover, for transferability, rich descriptions of the research context, study population, and data collection procedures were provided, enabling readers to assess the applicability of the findings in similar contexts. For confirmability, an audit trail was maintained throughout all research stages (from question design to final analysis) to ensure transparency and reproducibility of the process.

To ensure dependability of the research instruments, several approaches were applied to guarantee that the tools used could produce consistent and reliable results. A key method to improve dependability was the precise definition and clarification of terms and key concepts. This was particularly important for semi-structured interviews, which constituted the primary data collection method. Ambiguities in terminology could threaten the reliability of the instruments; therefore, all terms and concepts (e.g., "green NFTs," "sustainable digital assets," "green banking in the metaverse," and "interactive digital marketing") were designed to be fully understandable and clear to participants.

To this end:

- Interview questions were repeatedly reviewed to ensure clarity and comprehensibility.
- Pilot testing was conducted with three participants (two bank managers and one metaverse user) to assess whether participants interpreted the terms and concepts consistently with the researcher's intent. Questions were evaluated by asking, "Do respondents understand the concepts in the same way as the researcher intends?" and modifications were made based on feedback.

An additional criterion in instrument design was attention to face and content validity. Questions were formulated to be engaging and motivating for participants, achieved through appropriate wording, question structure (e.g., open-ended questions to encourage detailed responses), and creating an appealing environment for responses. Tools with clear and visually appealing formats (e.g., properly formatted online interview forms) generally led to higher-quality responses.

To ensure data reliability and accurate interpretation of participants' statements:

- Findings from the initial analysis were shared with at least five interviewees to evaluate the accuracy and alignment of the data with their intended meanings. Feedback was used to revise and improve the findings.
- Inter-Coder Reliability was applied by having the primary researcher conduct the initial coding, followed by review from an independent colleague with expertise in qualitative analysis. The agreement rate between coders was approximately 74%, and any discrepancies were resolved through discussion.

Table 2. Inter-Coder Agreement.

Interview Title	Number of Codes	Agreements	Disagreements	Inter-Coder Reliability (%)
A	12	9	3	75.00
B	10	7	3	70.00
C	11	8	3	72.73
D	8	6	2	75.00
Total	41	30	11	Average 73.17

In this study, the researcher, together with a co-researcher (serving as the second coder), assessed the reliability of the coding process. To this end, four interviews were randomly selected, and both researchers independently coded them. The coding results were then compared, and the level of agreement and disagreement between the codes was analyzed. To calculate the inter-coder reliability coefficient, the following formula was used:

$$\text{Reliability percentage} = \frac{Number\ of\ agreements * 2}{Total\ number\ of\ codes}$$

This coefficient indicates the degree of consistency and agreement between the codings of the two researchers. The closer this coefficient is to one, the higher the reliability of the coding process.

Six-Phase Thematic Analysis

For the analysis of qualitative data, the Thematic Analysis method based on Braun and Clarke (2006) was employed. This approach, suitable for identifying patterns and themes in textual data, was implemented step by step. The six phases are as follows:

1. Familiarization with the Data: In this stage, the researcher read the interviews multiple times actively to gain a deep and comprehensive understanding of the data, searching for meanings and patterns related to digital marketing opportunities in green banking within the metaverse. Note-taking and marking initial concepts (such as the role of NFTs in customer engagement or security challenges in the metaverse) began at this stage for use in subsequent steps.
2. Generating Initial Codes: After familiarization with the data, initial coding was conducted. In this step, the researcher identified relevant segments of the data (e.g., bank managers' statements about green assets or metaverse users' experiences trading NFTs) and coded them based on the research focus (such as blockchain transparency or consumer behavior). Coding was data-driven (inductive) to extract natural themes from the data.
3. Searching for Themes: The initial codes were systematically categorized and organized into potential themes. Certain codes were grouped into main themes (e.g., "Opportunities of Green NFTs in Marketing"), while others formed sub-themes (e.g., "Impact on Customer Loyalty"). Codes that were not relevant were discarded to ensure clarity and focus.
4. Reviewing Themes: In this stage, the identified themes were reviewed and refined. This process was conducted at two levels: first, reviewing the themes at the level of summarized codes, and second, evaluating the themes in relation to the entire dataset. Coding and theme development continued until a satisfactory thematic map was achieved (e.g., alignment of themes with the research questions).
5. Defining and Naming Themes: Once the themes were finalized, the researcher defined, named, and analyzed them. This step included revisiting themes and specifying the details of the data under each theme (such as real examples from interviews regarding interactive campaigns in the metaverse).
6. Producing the Report: In the final stage, the researcher conducted the final analysis and prepared the research report. The report included the refined themes, related analyses, and connections to the existing literature (e.g., referencing Dubey et al., 2022).

Research Findings

In this study, to examine the digital marketing opportunities in green banking within the metaverse through the use of NFTs and green assets, semi-structured interviews were conducted with 23 experts and specialists in relevant fields. The participants included university faculty members specializing in business management, digital marketing, and blockchain technology (from universities such as Mazandaran, Shahid Beheshti, Semnan, Hazrat Masoumeh in Qom, and Ilam), as well as active users of metaverse environments (with at least six months of lived experience on platforms such as Decentraland, The Sandbox, or Metaverse Rang, primarily from Tehran and Mashhad).

Regarding gender, 70% of the interviewees were male and 30% were female. In terms of age groups, 70% were under 40 years old (mostly younger users active in the fields of metaverse and digital technologies), while 30% were 40 years and above (mainly experienced academics and domain experts). From the perspective of educational background, 15% held a bachelor's degree, 35% a master's degree, and 50% a PhD. With respect to professional experience, 40% had less than 10 years, 40% had between 10 and 15 years, and 20% had more than 15 years of experience in areas such as business management, digital marketing, blockchain technology, green banking, or interactions within the metaverse and digital assets. This diverse composition of participants—balancing younger, digitally engaged users with more

experienced experts—enabled a comprehensive and up-to-date exploration of digital marketing opportunities in green banking within the metaverse. It also provided deeper insights into customer engagement, blockchain transparency, and the environmental sustainability challenges associated with this emerging domain.

Table 3. Descriptive Statistics of the Study

Variable	Level/Group	Frequency	Percentage (%)
Gender	Male	16	70.0
	Female	7	30.0
Age Group	Under 40 years	11	47.8
	40 years and above	12	52.2
Education	Bachelor's	3	13.0
	Master's	8	34.8
	PhD	12	52.2
Professional Experience	Less than 10 years	9	39.1
	10–15 years	9	39.1
	More than 15 years	5	21.7

Table 4. Sample Interview Excerpt

Interview Segment (Dialogue Text)	Extracted Open (Base) Codes
"Honestly, when I interact with a green NFT in the metaverse, I feel like it's mine! For example, I got a digital tree there that becomes greener with each transaction, and this makes me engage with it more. It feels like it motivates me to show my loyalty."	Digital ownership feeling, motivation from green interaction, promotion of loyalty, visual feedback, increased engagement, reinforcement of environmental commitment, personalized experience, innovation in rewards
"Yesterday, I attended a virtual event in the metaverse about green banking. I learned a lot of new information and felt good sharing my opinions with others. It felt like a green community was formed where we all grow together!"	Participation in virtual events, enhancing environmental awareness, green social interaction, sense of virtual community, expansion of collective participation, promotion of sustainability culture, innovation in interactive content, improvement of collective relationships
"Once in the metaverse, I saw an NFT design made with green colors and nature elements. It really caught my eye and made me feel that this bank truly cares about the environment. This made me trust it more."	Sustainable visual design, increased visual appeal, integration of environmental symbols, improved perception of sustainability, strengthening consumer trust, impact on environmental responsibility feeling, innovation in digital design, expansion of green digital symbols

The analysis of the interview data led to the identification of 244 initial codes, which were subsequently grouped into 30 organizing themes (sub-categories). Ultimately, these organizing themes were synthesized into 6 overarching themes.

Table 5. Banking in the Metaverse

Overarching Theme	Organizing Theme	Basic Theme
Impact of Green NFTs on Customer Engagement and Loyalty	Emotional Engagement through Green NFTs	Enhanced emotional engagement – creation of digital ownership – strengthening brand loyalty – promoting sustainable behaviors – integration of virtual experiences – fostering environmental commitment – improving long-term customer relationships – expanding green social networks
	Sustainable Interactive Campaigns	Design of green virtual events – sustainable gamification – immersive experiences – raising environmental awareness – promoting eco-friendly behavior – improving green purchase intentions – innovation in interactive content – expanding collective participation
	Green Digital Asset Design	Strengthening green brand identity – creating shared environmental values – increasing visual appeal – integrating green symbols – improving sustainability perception – innovation in digital design –

Overarching Theme	Organizing Theme	Basic Theme
		influencing environmental responsibility – expanding green digital symbols
	Digital Ownership and Brand Loyalty	Creating a sense of exclusive ownership – enhancing digital loyalty – increasing social engagement – promoting green values – integrating emerging technologies – enhancing personalized experiences – improving brand communications – expanding sustainable digital networks
	Social Interactions and Sustainability Culture	Enhancing green social interactions – increasing user participation – promoting sustainability culture – integrating digital gamification – improving interactive experiences – innovation in virtual events – strengthening sense of green community – expanding digital connections
Role of Blockchain in Trust for Green Services	Blockchain Transparency in Transactions	Transparency of digital transactions – reducing fraud risk – blockchain-based trust – asset authenticity assurance – enhancing green data security – integrating modern cryptographic protocols – improving environmental tracking – strengthening adoption of sustainable services
	Smart Contracts and Transparency	Use of smart contracts – increasing financial transparency – reducing human error – ensuring compliance with standards – enhancing consumer trust – innovation in financial processes – improving transaction efficiency – expanding green traceability
	Blockchain Security and Digital Trust	Reducing cyber risks – creating digital trust – improving security protocols – integrating encryption technologies – enhancing adoption of digital services – blockchain security innovation – expanding trust in green assets – optimizing verification processes
	Environmental Tracking and Transparency	Tracking environmental impacts – transparency in green projects – increasing trust in sustainability initiatives – integrating blockchain data – improving environmental reporting – innovation in digital tracking – strengthening authenticity of green assets – expanding transparency in sustainable projects
	Enhancing Trust through Transparency	Strengthening trust via transparency – reducing perceived risks – creating digital assurance – integrating blockchain technologies – improving adoption of green services – innovation in trust protocols – expanding customer relationships – optimizing secure interactions
NFT Design Features and Environmental Perception	Sustainable Visual Design	Sustainable visual design – green graphic elements – energy-efficient performance – integrating environmental symbols – improving visual perception – innovation in green user interfaces – influencing sense of environmental responsibility – expanding green digital symbols
	Green Interactive Elements	Green interactive elements – sustainable immersive experiences – integration of green augmented reality – enhancing virtual presence – innovation in interactive design – promoting environmental awareness – expanding digital interactions – optimizing green interfaces
	Digital Performance and Efficiency	Energy-efficient performance – optimization of digital resources – reducing carbon footprint – integrating green algorithms – improving NFT efficiency – innovation in sustainable technologies – expanding green accessibility – optimizing speed and security
	Green Symbols and Icons	Integration of environmental symbols – green visual markers – impact on responsibility perception – innovation in digital symbols – promoting green culture – optimizing symbolic design – promoting sustainable values – enhancing visual interaction
	Innovation in Green User Interface	Innovation in green user interfaces – sustainable user experience – integration of ecological elements – improving digital accessibility – expanding green interactions – optimizing user-centered design – impact on loyalty – promoting sustainable behavior

Overarching Theme	Organizing Theme	Basic Theme
Enhancing Sustainable Behavior via Metaverse Campaigns	Virtual Interactive Campaigns	Virtual interactive campaigns – green educational events – immersive experiences – promoting eco-friendly behavior – integrating sustainable gamification – raising environmental awareness – innovation in interactive content – expanding collective participation
	Promoting Environmental Awareness	Enhancing environmental awareness – sustainable virtual education – impact on consumer behavior – innovation in green messaging – expanding educational campaigns – optimizing awareness content – promoting green culture – improving learning interactions
	Gamification and Green Incentives	Integration of sustainable gamification – digital green rewards – increasing environmental motivation – innovation in game-based approaches – expanding gamified interactions – optimizing motivational experiences – promoting sustainable behavior – improving loyalty through gamification
	Collective Participation in the Metaverse	Expanding collective participation – green group events – impact on virtual community – innovation in digital collaboration – expanding sustainable networks – optimizing social interactions – promoting collective responsibility – improving community relations
	Improving Purchase Intent and Behavior	Enhancing green purchase intent – campaign impact on decision-making – innovation in behavioral marketing – expanding access to green products – optimizing purchase processes – promoting sustainable consumption – improving green conversion rates – developing behavioral strategies
Challenges of Implementing Green NFTs and Solutions	Cybersecurity Challenges	Cybersecurity challenges – digital threats in the metaverse – blockchain risk management – advanced cryptography solutions – integration of AI-based security – innovation in regulatory frameworks – reducing data vulnerability – improving crisis management protocols
	Regulations and Compliance Frameworks	Emerging digital regulations – compliance with blockchain laws – legal risk management – innovation in green policy-making – expanding international frameworks – optimizing regulatory adherence – promoting global standards – improving legal management
	Technical Risk Management	Blockchain risk management – technical challenges of NFTs – innovative technical solutions – integration of hybrid technologies – innovation in resolving technical issues – expanding technical capabilities – optimizing system performance – promoting technical security
	AI Integration in Security	Integration of AI-based security – cyber threat prediction – improving risk detection – innovation in security algorithms – expanding AI applications – optimizing data protection – promoting intelligent security – improving threat response
	Innovation in Crisis Management	Innovation in regulatory frameworks – reducing green vulnerabilities – improving crisis protocols – expanding sustainable solutions – optimizing risk management – promoting novel approaches – improving flexibility – developing crisis strategies
Role of Influencers in Promoting Green Banking	Role of Virtual Influencers	Role of virtual influencers – promoting green initiatives – impact on consumer behavior – integrating impactful campaigns – innovation in digital collaborations – expanding sustainable brand visibility – improving social interaction – strengthening environmental credibility
	Promoting Green Initiatives	Promoting green initiatives – collaboration with influencers – impact on audience awareness – innovation in virtual campaigns – expanding green messaging – optimizing influential content – promoting sustainable values – improving engagement rates
	Impact on Consumer Behavior	Impact on consumer behavior – changing purchasing habits – innovation in influencer marketing – expanding social influence –

Overarching Theme	Organizing Theme	Basic Theme
		optimizing behavioral strategies – promoting green consumption – improving loyalty through influence – developing behavioral models
	Integration of Digital Campaigns	Integration of impactful campaigns – virtual collaborations – innovation in metaverse platforms – expanding audience reach – optimizing digital interactions – promoting green brands – improving visibility – developing hybrid strategies
	Innovation in Digital Collaboration	Innovation in digital collaboration – influential networking – expanding green partnerships – optimizing digital relationships – promoting joint innovations – improving brand credibility – developing collaboration models – impact on virtual community – enhancing sustainability through networks

Discussion and Conclusion

The findings of this study, based on thematic analysis of semi-structured interviews with 23 experts and active metaverse users, highlight the transformative role of green NFTs and digital assets in green banking within the metaverse. By identifying 244 basic codes, 30 organizing themes, and 6 overarching themes, the study provides a comprehensive framework for understanding digital marketing opportunities, challenges, and practical applications of these technologies. The discussion is structured around these overarching themes and grounded in both the existing literature and the empirical data collected. Particular attention is given to basic and organizing codes to provide a deeper and more precise explanation of the mechanisms through which these technologies operate, including the extraction of codes from interviews and their connection to consumer behavior and environmental sustainability. Ultimately, the study emphasizes the necessity of strategic adoption of green NFTs and blockchain technology while highlighting security and ethical challenges as key managerial priorities.

The findings of the research indicate that the application with the highest consensus among experts and users was the provision of fully digital and native metaverse NFTs as a tool for green marketing and rewards, rather than the tokenization of physical assets. These NFTs function as exclusive digital assets that customers store in their metaverse wallets, trade, or utilize for experiential benefits (such as access to events or virtual green spaces). Tokenizing green physical assets was also proposed as a complementary option; however, due to legal complexities, regulatory issues, and higher energy consumption, it holds a lower priority in the short- and medium-term marketing strategies of banks.

One of the main overarching themes identified is the impact of green NFTs on customer engagement and loyalty (emotional engagement through green NFTs, sustainable interactive campaigns, green digital asset design, digital ownership and brand loyalty, social interactions and sustainability culture). This theme demonstrates that green NFTs not only create a sense of exclusive ownership but also, through the integration of sustainable gamification and virtual events, deepen emotional engagement and strengthen brand loyalty via long-term customer relationships. For instance, basic codes such as “expansion of green social networks” and “optimization of group interactions” were extracted from interviews in which users described how NFTs form a virtual community in which the promotion of sustainability culture becomes part of daily behavior. These codes illustrate a mechanism in which green social interactions, by creating shared environmental values, enhance green purchase intentions and transform loyalty from transactional to relational.

Interviewees emphasized the role of NFTs as digital reward tools that, by recalling prior interactions and personalizing experiences, create an immersive experience and enhance marketing efficiency through interactive campaigns. These findings underscore that, in metaverse green banking, this technology transforms customer interactions and reinforces sustainable loyalty, although careful design is required to prevent digital fatigue.

The integration of green NFTs in customer interactions and loyalty enhancement is supported by recent research. For instance, Centraco & Santoro (2025) demonstrates how incorporating non-fungible tokens (NFTs) into corporate marketing strategies can strengthen brand-customer relationships and increase customer engagement. The study highlights that while NFTs can provide exclusive experiences and ownership opportunities, actual participation in NFT-related communities is often driven more by financial incentives than by emotional bonds or brand loyalty. This finding suggests that the emotional engagement observed in the present research requires further exploration to effectively align with brand loyalty.

In another study, Komariyatin (2025) investigates how brand experiences in the metaverse, including gamification and the use of NFTs, contribute to emotional engagement and consumer loyalty. The findings indicate that participatory and personalized experiences foster stronger emotional connections with brands, supporting the notion that gamification and social interactions can enhance brand loyalty through deeper emotional ties.

One of the main overarching themes identified is the role of blockchain in fostering trust in green services (blockchain transaction transparency, smart contracts and transparency, blockchain security and digital trust, environmental tracking and transparency, enhancing trust through transparency). This theme illustrates that blockchain enhances consumer trust by reducing human errors and enabling the tracking of environmental impacts through financial and security transparency. For example, basic codes such as "improving environmental tracking" and "expanding green traceability" were derived from interviews where experts described how blockchain ensures the authenticity of green projects. The findings underscore the necessity of blockchain for environmental tracking and data security to maintain transaction transparency and reduce cyber risks. Consequently, this technology can address trust challenges in digital environments but requires integration with advanced protocols to mitigate new vulnerabilities.

Udeh et al. (2024) emphasizes how blockchain technology enhances transparency and trust in green finance markets. The study shows that blockchain provides immutable and secure transaction records, significantly improving transparency and efficiency in green financial mechanisms. This transparency strengthens stakeholder trust and addresses traditional challenges such as lack of transparency and high transaction costs, aligning with the current research findings on the importance of blockchain in building consumer trust through transparency and security.

In another study, Mulukanuri et al. (2025) examines blockchain's role in promoting sustainability by improving financial integrity and regulatory compliance. The paper demonstrates that blockchain's decentralized and immutable nature enhances trust and accountability in financial transactions, particularly in sustainable investments. These findings support the present research, indicating that blockchain can resolve trust challenges in digital environments by ensuring transaction transparency and mitigating cybersecurity risks.

Another major overarching theme identified is the design features of NFTs and environmental perception (sustainable visual design, green interactive elements, digital performance and efficiency, green symbols and icons, innovation in green user interfaces). This theme shows that NFT design with ecological elements reinforces environmental responsibility perception and guides consumer behavior toward sustainability. Basic codes such as "impact on environmental responsibility perception" and "expanding green digital symbols" describe a mechanism where innovations in green user interfaces optimize sustainable user experiences and enhance positive brand perception. Interviewees highlighted that visual design affects the perception of green values, leading to higher acceptance of sustainable banking initiatives. These findings emphasize that design should prioritize energy efficiency to reduce carbon footprints and ensure perceived sustainability aligns with reality.

Burkert et al. (2023) explores how consumers with higher green consumption values perceive the environmental and social benefits of sustainability more strongly than those with lower values. The study

indicates that these perceptions enhance overall sustainability awareness of products, potentially leading to greater adoption of sustainable offerings. This aligns with the current research, showing that innovative NFT design elements can reinforce environmental responsibility and steer consumer behavior toward sustainability.

Complementing Burkert et al. (2023), Chen et al. (2025) examines how perceived threats from unsustainable practices influence sustainable consumer behaviors. Findings reveal that when consumers feel that unsustainable behaviors threaten their identity, they are more motivated to engage in sustainable environmental practices. This supports the present research, indicating that NFT design elements can strengthen environmental responsibility perception and encourage sustainable consumer choices.

Another overarching theme identified is the promotion of sustainable behaviors through metaverse campaigns (interactive virtual campaigns, environmental awareness promotion, gamification and green incentives, collective participation in the metaverse, improvement of purchase intentions and behaviors). This theme shows that campaigns deepen environmentally friendly behaviors and enhance green purchase intentions through awareness and green incentives. Basic codes such as “innovation in gamification” and “improvement of green conversion rates” were derived from interviews where users reported, “Gamification campaigns made my behavior greener because they created a sense of competition and reward.” These codes describe a mechanism in which collective participation (from the organizing theme of collective participation in the metaverse) spreads a green culture and transforms behavior. The research findings emphasize the effectiveness of virtual events in fostering collective participation, ultimately shaping consumption habits. The study highlights the importance of interactive education in the metaverse to institutionalize sustainable behaviors.

Shahzad et al. (2023) examines the impact of gamification on green consumer behavior, showing that integrating game design elements such as rewards and competition can significantly encourage adoption of sustainable consumption behaviors. This aligns with the present research, suggesting that gamified metaverse campaigns can reinforce green behaviors and enhance green purchase intentions through interactive and competitive elements.

Complementing Shahzad et al. (2023), Blazquez (2024) explores the metaverse’s capacity to promote digital sustainability, emphasizing that immersive marketing approaches can enhance environmental awareness. The study notes that metaverse campaigns effectively communicate sustainability messages and engage consumers, fostering a culture of sustainability and positively influencing consumer behaviors.

One major overarching theme identified is the challenges of implementing green NFTs and potential solutions (cybersecurity challenges, regulations and regulatory frameworks, technical risk management, integration of AI in security, crisis management innovation). This theme illustrates that implementation faces cybersecurity threats and legal requirements but can be addressed through crisis management innovations and AI integration. Basic codes such as “cyber threat prediction” and “risk management optimization” describe a mechanism in which regulatory frameworks (from the organizing theme of regulations and regulatory frameworks) enhance flexibility. The research emphasizes the importance of managing blockchain risks to maintain trust, which can be addressed through hybrid models. Findings also suggest that banks should focus on green standards to reduce vulnerabilities.

Consistent with these findings, Familoni (2024) examines cybersecurity challenges arising from AI integration and emphasizes the necessity of intelligent threat detection systems and adaptive defense mechanisms. The study highlights that regulatory frameworks and industry standards play a key role in shaping AI-based cybersecurity solutions capable of managing complex threats across various sectors, including green technologies.

Ige et al. (2024) explores the intersection of cybersecurity and green infrastructure, identifying challenges and strategic approaches necessary to protect these systems from cyber threats. This research underscores the importance of regulatory frameworks and interdisciplinary collaboration in enhancing

cybersecurity strategies, aligning with the present study's findings on the need for innovative solutions and AI integration in managing risks associated with green NFTs.

Another major overarching theme identified is the role of influencers in promoting green banking (virtual influencers, promotion of green initiatives, impact on consumer behavior, integration of digital campaigns, innovation in digital collaboration). This theme indicates that influencers, by amplifying green messages and creating impactful networks, shape consumer behavior and increase brand visibility. Basic codes such as "changing purchase habits" and "optimizing advertising strategies" emerged from interviews where users stated, "Influencers made me think more about green banking because they presented it authentically and appealingly." These codes describe a mechanism in which integrating digital campaigns (from the organizing theme of integrating digital campaigns) enhances environmental credibility. The research findings highlight that digital collaboration is crucial for promoting green awareness and increasing loyalty. Moreover, influencers should align with cultural values to maximize impact. In line with this, Nursansiwi (2024) examines social media influencers' impact on consumer behavior in digital contexts, emphasizing their role in shaping consumer attitudes and behaviors and effectively promoting green initiatives and brand visibility. The findings underscore the need to understand influencers' roles when designing effective marketing strategies, consistent with observations in this study regarding their influence on consumer behavior toward green banking.

Overall, the findings indicate that green NFTs and digital technologies in the metaverse provide unique opportunities for green banking marketing but require careful management of challenges for sustainable success. By adopting these technologies, banks can enhance customer engagement and contribute to environmental goals, fostering a vision of more responsible banking. Future research should focus on the long-term impacts of these strategies to address existing gaps, and hybrid models combining NFTs with AI are recommended to further enhance digital sustainability.

Practical Recommendations

Based on the findings of this study, derived from a thematic analysis of interviews with metaverse experts and users, and focusing on overarching themes such as the impact of green NFTs on customer engagement, the role of blockchain in trust, NFT design features, promotion of sustainable behaviors through campaigns, implementation challenges, and the role of influencers, five practical recommendations are proposed for the banking industry. These recommendations are directly drawn from the study's basic and organizing codes (e.g., enhancing emotional engagement, blockchain transparency, sustainable visual design, green gamification, and technical risk management) and are valuable for bank managers, digital marketers, metaverse developers, sustainability policymakers, and researchers in digital finance. These stakeholders can utilize the results to innovate green services, increase customer loyalty, and manage digital challenges.

1. **Integration of Fully Digital and Native Metaverse NFTs into Loyalty and Green Marketing Programs:** Banks should offer green NFTs as exclusive digital rewards (without the necessity of physical backing) for customers' sustainable behaviors, such as obtaining green loans, investing in green funds, making carbon-neutral card payments, and more. These NFTs may include green digital artworks, exclusive avatars or clothing, access to events or sustainable virtual lands, or VIP membership levels in the bank's green community within the metaverse. Customers store, display, or trade these NFTs in their metaverse wallets or on secondary markets. This approach, based on the strong consensus among experts and users (the dominant theme), has the most significant impact on fostering a sense of digital ownership, emotional engagement, and long-term loyalty. Compared to the tokenization of physical assets, it involves significantly less technical complexity and regulatory challenges.
2. **Leveraging Blockchain for Transparency in Green Transactions:** Through blockchain smart contracts, banks can ensure traceability of sustainable projects. This recommendation stems from

basic codes such as "digital transaction transparency" and "reducing fraud risk," which contribute to increased customer trust. This is particularly relevant for sustainability policymakers and metaverse developers, as interviewees highlighted the importance of environmental tracking to address trust challenges in digital environments.

3. **Designing Green User Interfaces for NFTs:** Focusing on sustainable visual design with energy-efficient elements (e.g., green icons and interactive interfaces), based on basic codes such as "sustainable visual design" and "innovation in green user interfaces," enhances customers' environmental perception. This recommendation is useful for digital marketers seeking to differentiate the brand, as users described in interviews that such designs increase their sense of responsibility.
4. **Launching Interactive Metaverse Campaigns with Gamification:** Banks can organize virtual campaigns with green gamification to promote environmental awareness. This recommendation derives from basic codes such as "integration of sustainable gamification" and "expanding collective participation," which strengthen sustainable behaviors. This is particularly useful for digital finance researchers and marketing managers, as interviewees emphasized that such campaigns improve green purchase intentions.
5. **Managing Security Challenges through AI Integration:** To overcome implementation challenges of NFTs, banks should integrate artificial intelligence to predict cybersecurity threats, based on basic codes such as "integration of AI in security" and "innovation in crisis management," thereby reducing risks. This recommendation is valuable for metaverse developers and risk managers, as experts in the interviews stressed the need for regulatory frameworks to maintain trust.

Research Limitations

Limitations are an inevitable part of any research and can serve as a foundation for future studies and the development of innovative solutions. The limitations of this study include:

1. **Subjectivity in qualitative analysis:** Data analysis based on the interpretive paradigm may be influenced by the researcher's biases and preconceptions. However, this study sought to mitigate such biases through strategies such as member checking and peer debriefing.
2. **Data collection methods:** Data were collected solely through semi-structured interviews. Complementary methods, such as quantitative surveys, direct observation of user behavior in the metaverse, or big data analysis from digital platforms, could enhance the robustness of the findings.
3. **Temporal constraints:** The study focused on a specific time frame, emphasizing users' current experiences. This may not fully capture dynamic changes in user behavior or digital markets, such as rapid technological developments in the metaverse. Longitudinal studies are recommended to examine these evolving trends.
4. **Geographical and cultural limitations:** The sample primarily included Iranian experts and users (e.g., faculty from universities such as Mazandaran and Shahid Beheshti, and users from Tehran and Mashhad). Local factors, such as technology access and consumption culture, may influence the results, limiting generalizability to global markets (e.g., Europe or the United States). International comparative studies are recommended to address this limitation.
5. **Focus on qualitative and marketing aspects:** While the study emphasizes digital marketing opportunities, technical and economic aspects—such as the implementation costs of NFTs, blockchain energy consumption, or economic analyses of return on investment (ROI)—were less explored. Future studies using mixed methods, including economic modeling, are suggested to address these aspects.

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Appendix

Ethical considerations were fully adhered to in this research, including:

- **Informed consent:** Prior to the interviews, participants were fully informed about the research objectives, interview procedures, and data usage. All participants volunteered and provided either written or verbal consent.
- **Confidentiality and anonymity:** Participants' identities were kept confidential, and pseudonyms or identification codes were used in reporting to ensure privacy.
- **Voluntary participation:** Participants had the right to withdraw from the study at any stage without any pressure or consequences.
- **Transparency in data usage:** Collected data were used solely for research purposes and were not shared with unauthorized individuals.
- **Respect and impartiality:** Interview questions were framed to avoid any bias or evaluative judgment of participants' viewpoints.
- **Secure data storage:** Audio recordings and research notes were stored in a secure database accessible only to the research team.