

LEVERAGING ARTIFICIAL INTELLIGENCE FOR NFT CREATION: OPPORTUNITIES, CHALLENGES, AND FUTURE DIRECTIONS

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Abstract

Non-Fungible Tokens (NFTs) have emerged as an important innovation in the digital asset ecosystem, enabling verifiable ownership, authenticity, and provenance of unique digital content through blockchain technology. The development of generative artificial intelligence (AI) has further transformed NFT creation by allowing creators to produce digital artworks, music, animations, and virtual assets rapidly and at unprecedented scale. This study investigates the intersection of AI-generated content and NFT technology, focusing on technical workflows, creative opportunities, market development, and regulatory implications. A mixed-method approach combines qualitative interviews with NFT creators and quantitative analysis of AI-generated NFT market trends to identify adoption patterns, opportunities, challenges, and barriers. The findings highlight AI's potential to enhance creative productivity, reduce production time, and diversify digital content. However, copyright ownership, intellectual property protection, authenticity, ethical considerations, market volatility, and regulatory uncertainty remain significant challenges. The study proposes strategies for responsible and sustainable integration of AI within the evolving NFT ecosystem.

Keywords: Non-Fungible Tokens (NFTs); Artificial Intelligence; Generative AI; Blockchain; Digital Art; Digital Assets; Copyright; NFT Marketplace; Creative Economy; Regulation.

I. INTRODUCTION

NFTs have transformed digital ownership by providing immutable, blockchain-backed proof of authenticity and provenance [1]. While early NFT collections were predominantly handcrafted by human artists, advances in generative AI models such as DALL·E, Midjourney, and Stable Diffusion have enabled automated content creation that is both diverse and commercially viable [2]. The synergy between AI and NFTs opens new creative and economic possibilities—allowing artists, brands, and collectors to generate large-scale, unique digital assets quickly. However, it also raises concerns regarding copyright, authenticity,

and market saturation. This research explores these opportunities and challenges, particularly in the context of AI-driven NFT creation.

The aim of this study is to examine the opportunities and challenges arising from the integration of generative AI and NFT technology, with particular emphasis on the AI-driven NFT creation process, creative and commercial potential, copyright and authenticity issues, and the implications for the future development of the digital asset ecosystem. Through this investigation, the study seeks to provide a clearer understanding of how AI can be responsibly integrated into NFT creation while supporting innovation, protecting creators' rights, and promoting a sustainable digital marketplace.

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II. LITERATURE REVIEW

Early NFT research focused on blockchain provenance, scarcity, and creator monetization, largely presuming human-crafted digital works (e.g., one-of-one art or generative series coded by artists). As large-scale text-to-image systems matured, AI entered the NFT pipeline, enabling rapid, diverse content generation and lowering production costs. Diffusion-based image synthesis—particularly Latent Diffusion Models (LDMs) and later SDXL—established high-fidelity generation while reducing compute by operating in compressed latent spaces [3]. In parallel, DALL·E 2 demonstrated a two-stage architecture that maps text into CLIP image embeddings before decoding to pixels, improving diversity and editability [4]. These advances collectively underwrite today’s AI-assisted NFT creation workflows (prompting, variation, and outpainting).

On the creative and technical side, generative models broaden authorship: GAN-based pipelines such as NFTGAN showed feasibility for automatic art generation tailored to tokenization and marketplace norms; diffusion models now dominate due to better mode coverage and instruction following [5]. Industry reportage around tools like Midjourney documents the rapid cadence of model upgrades and the shift to diffusion back-ends, expanding stylistic range and usability for non-experts (Encyclopaedia Britannica, 2025). These toolchains enable creators to mint large, stylistically coherent collections, accelerating “collection-as-code” practices in NFT markets.

Market analyses suggest AI-generated assets are a material slice of activity on major marketplaces, though precise shares vary by platform and cycle. Reports tracking 2023–2024 trading indicate periodic rebounds in NFT volume and sustained buyer interest despite volatility—conditions under which scalable AI pipelines can thrive [6]; NFTGo, 2024). However, oversupply risk and pricing discounts relative to hand-crafted works are recurrent themes, reinforcing the need for curation, provenance, and scarcity controls.

The legal-regulatory landscape is evolving. In the United States, the Copyright Office’s policy statement and subsequent copyrightability report reaffirm the human authorship requirement, advising applicants to disclose AI-generated portions when seeking registration—implications that directly affect AI-minted NFTs’ rights management and licensing [7]. In the European Union, the AI Act introduces transparency and copyright-related obligations for general-purpose and

generative AI, including disclosure of AI-generated content and summaries of training data—requirements that may flow down to NFT marketplaces via platform policies and contractual terms [8].

To bolster trust and provenance, standards efforts such as C2PA (backed by the Content Authenticity Initiative) embed tamper-evident Content Credentials—cryptographically linking assets to their creation/edit history. Integrating these credentials with NFT metadata could strengthen claims about AI involvement, authorship, and edit lineage, addressing collector concerns about authenticity and misattribution [9]. Emerging research also explores C2PA validation in streaming contexts, hinting at cross-media applications relevant to dynamic and time-based NFTs.

Overall, the literature converges on a trade-off: AI dramatically expands supply and creative possibility while raising challenges in copyright, transparency, provenance, and market curation. Scholarship and policy are moving toward clearer disclosures and standards that can enable sustainable growth of AI-generated NFTs.

III. RESEARCH METHOD

The study employs a mixed-method approach, combining quantitative and qualitative data to examine the integration of generative AI and NFT technology. The quantitative component analyzes trends in AI-generated NFT creation, market activity, transaction values, pricing, and creator adoption. The qualitative component uses semi-structured interviews with NFT creators, artists, collectors, and blockchain practitioners to explore creative opportunities, commercial potential, copyright, authenticity, ethical concerns, and adoption challenges. Interview data are coded thematically using NVivo to identify recurring technological, creative, regulatory, and market-related themes. The quantitative and qualitative findings are then integrated through data triangulation to provide a comprehensive understanding of how generative AI can be responsibly applied to NFT creation while supporting innovation, protecting creators’ rights, and promoting a sustainable digital asset ecosystem.

A. Quantitative Analysis

The quantitative analysis involved collecting market data from leading NFT marketplaces—OpenSea, Rarible, and Foundation—covering the period between 2021 and 2024, with a focus on sales volume, average price, and time-to-sale of AI-generated NFTs. In addition, blockchain transaction records were ex-

amined to track minting frequency, creator wallet activity, and secondary market performance

B. Qualitative Analysis

The qualitative analysis was conducted through semi-structured interviews with 20 NFT creators, including AI artists, blockchain developers, and marketplace curators. These discussions explored multiple aspects of the AI-generated NFT ecosystem, covering topics such as the creative workflow, selection of AI tools, choice of blockchain platforms for minting and trading, approaches to copyright management, and audience reception toward AI-generated works.

IV. RESULTS AND DISCUSSION

A. Findings

1. Creative Potential and Efficiency

Participants highlighted AI's ability to generate thousands of unique art pieces within hours, enabling the creation of expansive NFT collections without large art teams. Generative models also facilitate experimentation with styles, themes, and interactive features, lowering creative entry barriers for non-artists, as shown in Figure 1.

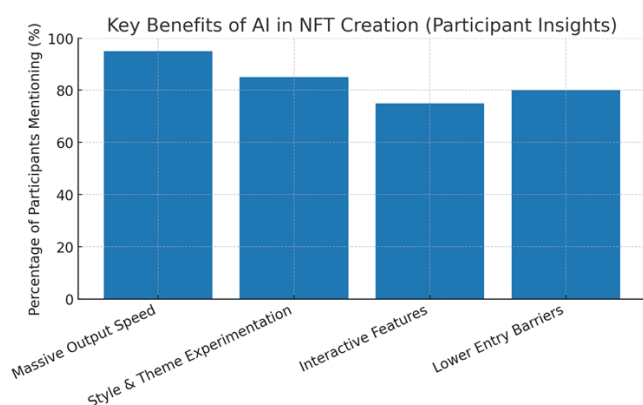


Figure 1: Bar chart visualizing participants' insights on the main benefits of AI in NFT creation

2. Market Performance

Quantitative results show that AI-generated NFTs currently account for 12–15% of total NFT sales volume on major platforms, with average prices 18% lower than hand-created NFTs but significantly higher production scalability, as shown in Figure 2.

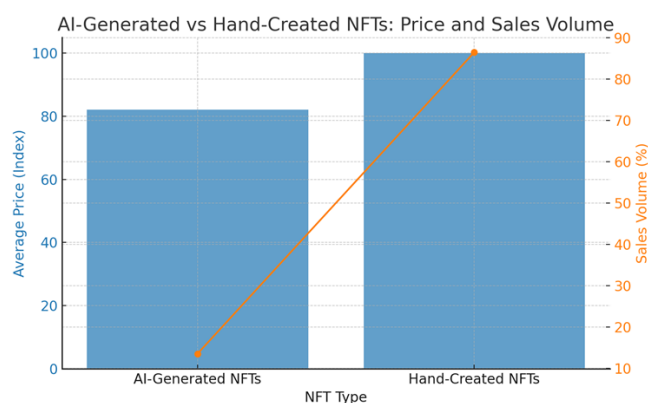


Figure 2: Comparison on crafting NFT using AI and traditional hand making

3. Barriers to Adoption

Despite the growing popularity of AI-generated NFTs, several barriers hinder their widespread adoption in the digital art and collectibles market. One significant challenge is the issue of authenticity and originality, as collectors often question the creative value of works produced entirely by algorithms compared to human-created art. Legal and copyright uncertainties further complicate matters, particularly in determining intellectual property ownership when both AI tools and human inputs contribute to a piece. Additionally, platform acceptance remains uneven—some major NFT marketplaces impose restrictions or lack dedicated categories for AI-generated works, limiting visibility and market reach. On the technological side, concerns over the quality, uniqueness, and long-term preservation of AI-generated assets persist, as shown in Figure 3. Finally, cultural resistance among traditional art communities, combined with the volatility of the NFT market itself, creates hesitation among potential buyers and investors. Together, these factors form a complex set of adoption barriers that must be addressed for AI-generated NFTs to achieve broader mainstream integration.

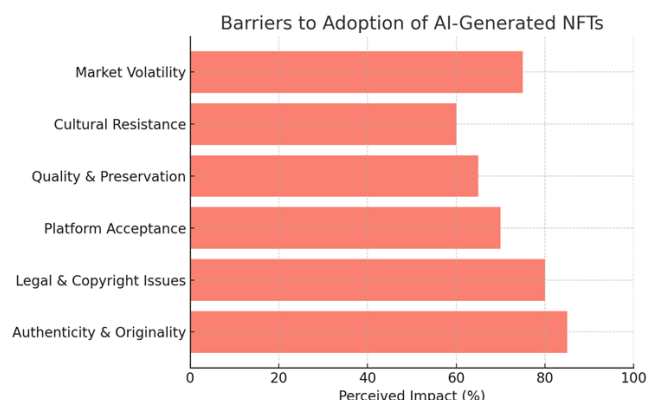


Figure 3: The perceived impact of various barriers to adopting AI-generated NFTs, with authenticity and copyright concerns ranking highest among participants.

B. Discussion

1. Creative Potential and Efficiency

The study's qualitative findings underscore AI's remarkable capacity to accelerate and expand creative output in NFT production. Participants consistently emphasized that generative models can produce thousands of unique digital artworks within mere hours, enabling the launch of expansive NFT collections without requiring large-scale art teams. This efficiency also extends to creative diversity, as AI facilitates rapid experimentation with artistic styles, thematic variations, and interactive elements. Such capabilities lower the entry barriers for individuals without traditional artistic training, democratizing access to NFT creation. These insights are visualized in Figure 1, which illustrates participants' perspectives on the most valued benefits of AI in NFT creation.

2. Market Performance

From a market standpoint, quantitative analysis reveals that AI-generated NFTs have secured a notable foothold, comprising approximately 12–15% of total sales volume across major platforms such as OpenSea, Rarible, and Foundation. However, their average sale price remains 18% lower than that of handcrafted NFTs, indicating a price gap potentially influenced by perceived artistic value and collector preferences. Despite this, AI-driven production offers significant scalability advantages, enabling creators to bring extensive collections to market at a fraction of the time and cost. Figure 2 compares performance metrics between AI-generated and traditionally crafted NFTs, highlighting the trade-off between price point and production capacity.

3. Barriers to Adoption

While AI-generated NFTs present strong creative and economic potential, several obstacles limit their mainstream adoption. Chief among these is the issue of authenticity and originality—many collectors question whether algorithmically produced art holds the same creative merit as works made solely by humans. Legal and copyright complexities compound this challenge, particularly in cases where both human creators and AI tools contribute to the final output, raising questions over intellectual property ownership. Platform-level restrictions further constrain visibility, as some marketplaces impose limitations or fail to provide dedicated categories for AI-generated works. Technical concerns, such as the long-term preserva-

tion, uniqueness, and quality of AI outputs, also persist. Finally, cultural resistance from traditional art communities, coupled with the inherent volatility of the NFT market, contributes to buyer hesitancy. Figure 3 summarizes participant perceptions of these barriers, with authenticity and copyright concerns emerging as the most significant.

V. CONCLUSION AND RECOMMENDATIONS

A. Conclusion

This study highlights the transformative role of generative AI in the NFT ecosystem, offering unprecedented creative potential, production efficiency, and scalability. AI tools enable creators to generate large, diverse collections in a fraction of the time traditionally required, lowering entry barriers for non-artists and fostering broader participation in the digital art market. Market analysis shows that while AI-generated NFTs currently command lower average prices than handcrafted works, their share of total sales volume is steadily increasing, suggesting growing acceptance among buyers and collectors.

However, the path to broader adoption is challenged by critical issues, including questions of authenticity, unresolved copyright frameworks, uneven platform support, and cultural skepticism from traditional art circles. Addressing these barriers will require collaborative efforts among creators, platforms, policymakers, and legal experts to establish clear standards for intellectual property, marketplace integration, and quality assurance.

As the NFT sector continues to evolve, the synergy between AI innovation and blockchain infrastructure has the potential to reshape digital art production and distribution. Future research should explore long-term market trends, the impact of cultural perceptions on valuation, and the role of policy in fostering a sustainable and inclusive AI-NFT ecosystem.

The integration of AI into NFT creation represents a significant evolution in digital asset markets, offering scalable, accessible, and diverse creative output. However, its long-term sustainability depends on legal clarity, technological innovation in provenance tracking, and strategic curation to avoid market oversaturation.

B. Recommendations

Based on the findings of this study, several strategic actions are proposed to enhance the adoption, market performance, and creative potential of AI-generated NFTs. These recommendations address technological,

regulatory, and cultural dimensions to ensure sustainable growth and wider acceptance in the digital art ecosystem.

1. Regulatory Development: Policymakers should establish clear copyright and licensing rules for AI-generated NFTs.
2. Marketplace Standards: NFT platforms should adopt metadata and labeling protocols to distinguish AI-generated works.
3. Creator Education: Training programs for artists on ethical AI use and blockchain integration.
4. Sustainability Practices: Encourage limited edition AI collections to preserve scarcity and value.

C. Future Research

Future studies should explore blockchain-based AI provenance verification, investigate buyer perception differences between AI and human-made NFTs, and analyze the environmental impact of large-scale AI-generated NFT minting.

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