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NFTs in the digital creative industries: A theoretical review of their impact, applications, and challenges

Los NFT en las industrias creativas digitales: revisión teórica sobre su impacto, aplicación y desafíos

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Abstract

This article examines the impact of non-fungible tokens (NFTs) on contemporary digital culture. **Purpose**. It aims to understand the role of NFTs from the perspective of the hybridization between art and social sciences, evaluating their applications and intersection with different cultural formats. **Methodology**. A critical and exhaustive literature review was conducted, applying inclusion and exclusion criteria through the PRISMA protocol to ensure the validity of the analyzed studies. **Results and conclusions.** Findings suggest that NFTs have high potential to transform digital culture by enabling new forms of ownership, authenticity, and interaction across industries such as art, music, and gaming. However, they also pose challenges regarding regulation, sustainability, and financial speculation. **Original contribution.** This study highlights the relevance of NFTs in today's creative industries, assessing their feasibility as a cultural management tool and their role in redefining the concept of digital ownership within a decentralized environment.

Keywords

NFT, blockchain, creative industries, digital art, digital culture, digital ownership, creative economy.

Resumen

El presente artículo analiza el impacto de los tokens no fungibles (NFT, Non-Fungible Tokens) en la cultura digital contemporánea. ***Propósito.*** *Se busca comprender el rol de los NFT desde la perspectiva de la hibridación entre el arte y las ciencias sociales, evaluando sus aplicaciones y su intersección con diferentes formatos culturales.* ***Metodología.*** *Se realizó una revisión crítica y exhaustiva de la literatura científica existente, aplicando criterios de inclusión y exclusión mediante el protocolo PRISMA para garantizar la validez de los estudios analizados.* ***Resultados y conclusiones.*** *Se evidencia que los NFT poseen un alto potencial para transformar la cultura digital, facilitando nuevas formas de propiedad, autenticidad e interacción en sectores como el arte, la música y los videojuegos. No obstante, también presentan desafíos en términos de regulación, sostenibilidad y especulación financiera.* ***Aportación original.*** *Este estudio destaca la relevancia de los NFT en las industrias creativas actuales, analizando su viabilidad como herramienta de gestión cultural y su papel en la redefinición del concepto de propiedad digital en un entorno descentralizado.*

Palabras clave

NFT, blockchain, industrias creativas, arte digital, cultura digital, propiedad digital, economía creativa.

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1. Introduction

Historically, concentration of power, discrepancies in remuneration, and concerns about copyright infringement have posed significant challenges for creative businesses (Cardona, 2024), not only in a hegemonic industry such as film, but more broadly across the entire business structure, from a digital diversity perspective (García-Cisneros & Parejo, 2024). These dynamics create disparities between platforms and creators (Lacruz, 2021). In response, blockchain technologies seek to prioritize the needs of creators by offering artists greater control over the management and distribution of their content (Martín-Núñez, García-Catalán & Marzal-Felici, 2022; Luco-Rojas, 2018). Consequently, the advent of these blockchain technologies is profoundly reshaping the processes of content creation, distribution, and revenue generation from the dissemination of works (Patrickson, 2021).

Thus, in the age of digitization, Non-Fungible Tokens (NFTs) have emerged as one of the most innovative revolutions within the blockchain environment. NFTs are digital assets registered on a blockchain, a data storage structure that utilizes a mathematical algorithm to ensure its security and traceability. These assets are traded through smart contracts, and automated programs that execute the buying, selling, and transfer of assets. These NFTs are supported by various blockchain technologies, including Ethereum, Binance Smart Chain, and Polygon, which facilitate the creation and management of digital tokens through smart contracts. These smart contracts are autonomous programs that verify, execute, and record transactions on the blockchain transparently and securely (Colle, 2017). These tools have fundamentally changed how people interact with art, video games, collectables, and other cultural goods, completely redefining the concept of digital property in the 21st century (Laucius, 2023).

Their development has been driven by blockchain technology, first conceptualized in Nakamoto's paper (2008), which introduced Bitcoin as a decentralized, cryptography-based currency. This technology functions as a distributed and immutable ledger, guaranteeing digital assets' authenticity and ownership (Swan, 2015). However, to understand the impact of NFT, it is crucial to analyse its historical and scientific context, from the most immediate antecedents to its application in various industries, even corporate culture in this type of activity (Rodríguez-Monteagudo & Olivares-Delgado, 2017).

The concept of NFTs began to take shape in 2012 with the creation of Colored Coins, which were small fractions of Bitcoin representing real-world assets (Kräussl & Tugnetti, 2024). The first recognized NFT was Quantum, created by Kevin McCoy and Anil Dash in 2014. Quantum used blockchain technology to register ownership of digital artwork (Kräussl & Tugnetti, 2024). In 2015, the development of Ethereum expanded the functionality of blockchain to include smart contracts, which facilitated the automated execution of transactions without intermediaries (Buterin, 2014). These smart contracts laid the technical foundation for NFTs, allowing the creation of unique tokens on the Ethereum blockchain through the ERC-721 standard (John et al., 2025).

The market for NFTs experienced exponential growth in 2017 with the introduction of CryptoPunks and CryptoKitties, two pioneering projects that demonstrated the viability of NFTs as collectable digital assets (Poposki, 2024). CryptoPunks and CryptoKitties are blockchain-based games where users can buy, sell, and breed unique digital cats. This initiative not only popularized NFTs but also demonstrated the potential of blockchain technology to establish digital scarcity.

Since then, NFTs have found applications and gained popularity in various creative and technology industries, such as digital art, music, video games, photography, the metaverse and, even to talk about the rest of the mass media in general. So, when talking about the relationship between the canons (photographic, iconic, etc.), the mass media and, in general, the changing artistic and ontological status of the image in general (transcending beyond formats), it is necessary to know the point of departure (Blanco Pérez, 2022). This has allowed creators to monetize their work directly and buyers to acquire verifiable property rights. This innovation has opened new possibilities for digital markets and generated debates around issues such as environmental sustainability, financial speculation, and copyright (ConsenSys, 2021). In the art sector, NFTs have facilitated the sale of digital works with assured authenticity and rarity (Sestino, Guido & Pelusol, 2022). The NFT market experienced significant growth in 2020 and 2021, with many artists and celebrities launching their collections. A notable example is the digital artist Grimes, who sold her NFT collection for USD 6 million. Or the American rock band Kings of Leon, who have used NFT to sell albums and exclusive content (Peters & Cartwright, 2023). Also in the video game industry, NFTs have facilitated the creation of decentralized virtual economies, as in the case of the video game Axie Infinity (Attaran & Gunasekaran, 2019).

From a scientific perspective, NFTs have been the subject of research in fields such as digital economics, cryptography, and environmental sustainability. Research (Dowling, 2022a; Ante, 2021) has demonstrated that NFTs can influence the digital economy by redefining the value of digital goods (Dowling, 2022b). Furthermore, the cryptography employed in NFTs ensures their security and authenticity, thereby mitigating the risks of counterfeiting (Narayanan et al., 2016).

However, NFTs have also been criticized for their environmental impact due to the high energy consumption of blockchain (De Vries, 2021). In response, solutions such as the migration to proof-of-stake (POS) blockchains, as seen in Ethereum 2.0, have emerged to address this issue (Buterin, 2020). This has led to a polarized debate surrounding NFTs, with perspectives ranging from a technological revolution that democratizes the creation and trade of digital assets (Ante, 2021) to a speculative bubble with derived ethical and environmental implications (Nadini et al., 2021; De Vries, 2021). On the one hand, they provide artists with a new avenue for monetizing their work; on the other hand, they enable collectors to acquire unique pieces. However, concerns have been raised about market speculation (Tan, 2025).

Nonetheless, NFTs are unique digital assets representing ownership or proof of authenticity of a specific item within a blockchain. Unlike fungible tokens, such as cryptocurrencies, NFTs are not directly exchangeable for other assets of their type due to their uniqueness. Each NFT possesses distinct characteristics and metadata, setting it apart from any other token (Nadini et al., 2021). This technological innovation has profoundly impacted the digital landscape, redefining the concepts of ownership and value in the online realm. As technology and the market continue to evolve, there is growing interest in seeing how they develop and what new opportunities and challenges will emerge in the future.

2. Research questions and objectives

In the contemporary context of the creative industries (Jhally, 2022), the following research questions have been posed:

1. Are NFTs a useful tool for managing digital culture?
2. How do NFTs reach audiences?
3. What roles do NFTs play in the creative industries?

The inquiries mentioned above have led to the formulation of both direct and indirect objectives that underpin this theoretical research:

The general objective of this text is to know NFTs from the perspective of the hybridization and intersection between art and social sciences as a phenomenon. This will allow us to learn about the possibilities they offers in their application to current and contemporary culture and their intersection in different formats.

Specific objectives:

- SO1: To review the concept of the NFT from the instrumental perspective in the management of digital culture.
- SO2: To determine how NFTs reach audiences.
- SO3: To understand the possibilities for the implementation and distribution of NFTs in the global market of culture and the arts.

3. Methodology

To understand the intricate digital system impacting the expanding digital creative industry, it has become imperative to formulate a deductive and analytical research method grounded in a meticulous examination of the extant scientific literature. This approach has facilitated the contextualization and theoretical substantiation of the findings. By Creswell and Creswell (2018), the literature review has facilitated the identification of knowledge gaps, the delineation of the research scope, and the substantiation of the topic's relevance.

The literature review was conducted using current and research-relevant primary and secondary sources, including scientific articles, original documents, books, and reports from specialized bodies, as well as situation maps. To ensure the credibility and reliability of the information collected, the selection of sources was conducted through recognized academic databases, such as Scopus, Web of Science, and Google Scholar. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol, as implemented by Moher et al. in 2009, was employed to ensure the transparency and reproducibility of the literature review. This protocol enabled the identification, selection, and synthesis of relevant studies.

The protocol in question was applied following the steps defined by these authors (Figure 1 below shows the process in a visual way): 1. Formulation of the research question, applying the PICO model

(Population, Intervention, Comparison, Outcome or results); 2. Systematic literature search, defining the relevant databases (PubMed, Scopus, Web of Science, etc.) and establishing search strategies with keywords and Boolean operators, as well as including the inclusion and exclusion criteria of the studies found. The application of inclusion and exclusion criteria helped to filter out the most relevant studies and reduce the risk of bias in the interpretation of the results. The following criteria were employed:

Table 1: Inclusion and exclusion criteria in the application of the PRISMA protocol

Criteria	Axiom
Inclusion	Type of source
	Year of publication
	Thematic relevance
	Methodology of the study
	Language of publication
	Accessibility and reliability
Exclusion	Non-academic or unverified sources
	Outdated publications
	Lack of relation to the central theme
	Weak or unrigorous methodologies
	Publications in inaccessible languages
	Duplication or redundancy

Source: Own elaboration (2025) based on Moher et al. (2009)

The inclusion criteria employed were meticulously defined to ensure a high level of rigor and relevance. Specifically, the following criteria were applied:

1. Type of source: To ensure a broad yet focused scope, the selection was limited to indexed journals, academic conferences, specialized books, and technical papers from recognized entities such as IEEE, ACM, Springer, and Elsevier. Additionally, reports from companies specializing in blockchain were included to provide a comprehensive view of the field.

2. Year of publication: Given the recent emergence of NFTs, studies published within the last seventeen years (starting from 2008) have been included, as the term "non-fungible token" emerged in 2012, while literature on Bitcoin has been available since 2008. This ensures that the information is both current and pertinent, highlighting the significance of research conducted within the last five years.

3. Thematic relevance: Studies were selected that addressed fundamental aspects of NFTs, such as their definition, applications (digital art, gaming, intellectual property, virtual real estate), economic impact, legal regulations, and technological challenges.

4. Study methodology: Empirical studies, systematic reviews, case studies, and theoretical studies that provide solid evidence on the phenomenon were included.

5. Language of publication: Priority was given to publications in English and Spanish, given that English is the predominant language of scientific publications.

6. Accessibility and reliability: The studies included were accessible through academic databases such as Scopus, Web of Science, IEEE Xplore, Google Scholar or university repositories such as Mendeley or Zotero.

The following exclusion criteria were considered:

1. Non-academic or unverified sources: Non-scientifically authored blogs, opinion pieces, non-

academic news, and social media content were excluded unless they were from reputable sources or peer-reviewed journals.

2. Outdated publications: Studies published before 2012 were excluded, as they may not reflect current developments in blockchain technology and crypto assets, beyond using Nakamoto's studies (2008), because of the location of Bitcoin technology.

3. Lack of relation to the central theme: Studies that only superficially mentioned NFTs, without a deep analysis of their impact, technological development, applications, or economic and legal implications, were discarded.

4. Weak or insufficiently rigorous methodologies: Studies with speculative analyses, lacking empirical evidence, unsupported by data, or without a clear scientific structure were also excluded.

5. Publications in non-accessible languages: For pragmatic reasons, articles in languages that were not comprehensible to the authors or could not be readily and reliably translated were excluded.

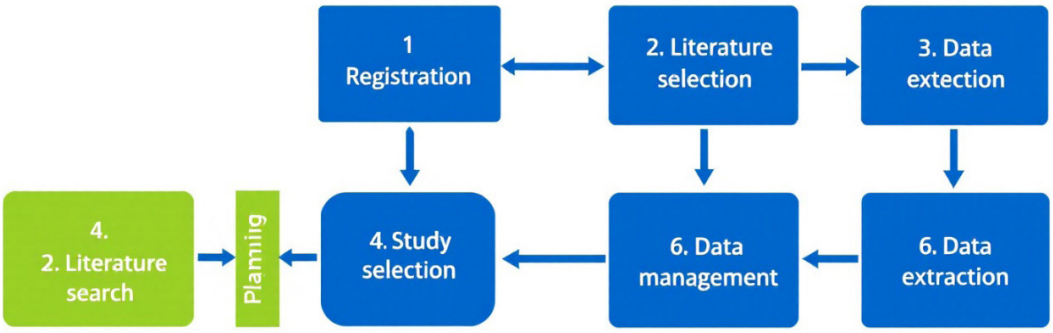
6. Duplication or redundancy: If a study is published in different versions or formats without providing additional information, only the most complete or updated version was considered.

These criteria were applied to ensure a rigorous, reliable, and representative literature review on NFTs, avoiding irrelevant or low-quality information. This approach guaranteed a more accurate and reliable literature review on NFTs.

Subsequently, we turned to a third phase (3) of study selection (PRISMA flowchart) which is used to document the study selection process following four phases: a) Identification: total number of studies found; b) Screening: elimination of duplicates; c) Eligibility: review of titles and abstracts; d) Inclusion: final selection of relevant studies. Once this is done, we moved on to the fourth phase (4) of data extraction and analysis.

A comprehensive analysis of the main components of these assets has been conducted to understand their complexity and usefulness in the creative industries and digital culture. To this end, a comprehensive literature review has been conducted on the properties of the components, the birth of NFTs in the 2010s, their evolution, and their use in different forms and platforms until today (until 2025).

Figure 1: PRISMA protocol in a visual way



Source: Own elaboration (2025) based on Moher et al. (2009)

It is important to note that the analysis and synthesis of the literature was not limited to a mere collection of information; rather, it involved a critical evaluation of the content. As Fink (2019) notes, researchers should compare previous findings, and identify trends, contradictions, and gaps in the literature, as already noted by other authors (Bermejo & Montes, 2015) about digital cultural pieces. This evaluation process enabled the development of a robust theoretical framework and the establishment of clear study objectives. After establishing the theoretical foundations, we proceeded to examine various academic works that analyzed the technology's usefulness and applicability across diverse economic and technological sectors, considering its introduction and development. However, it is crucial to note that acceptance and integration by users, consumers, and companies continue to act as barriers to its expansion in certain areas. Following the establishment of a comprehensive theoretical and analytical foundation, we proceeded to review a range of academic reports, books, and practical publications

that offer insights into the components and evolution of NFTs in the digital age. This comprehensive research initiative has enabled the establishment of a framework encompassing the concepts of exclusivity, value, and interaction of NFTs, the decentralization of blockchain technology, and the potential for NFTs to be utilized in the future as a management and verification tool in today's digital landscape. This has enabled the development of a specific analysis, which is presented in the "Results" section below.

Finally, the writing of the literature review has followed a logical and structured approach, with information organized by themes, theories, or approaches. According to Machi and McEvoy (2022), a well-written review should present a coherent and reasoned argument that guides the reader in understanding the research problem. This objective has been met throughout the text.

4. Results

4.1. Technical operation

To comprehend the intricacies of this technology, it is essential to review the fundamental technical components of NFTs and the key concepts underpinning them. These components form the foundation for developing a comprehensive NFT scheme. In this discussion, we will specifically address blockchain technology, the Ethereum protocol, smart contracts, and data encryption.

4.1.1. Blockchain technology

Non-fungible tokens (NFTs) are based on blockchain technology, typically on the Ethereum network, though other networks such as Solana, Polygon, and Tezos are also in use. The blockchain concept was initially proposed by Nakamoto (2008), with Bitcoin utilizing the proof-of-work algorithm to validate transaction data in a decentralized network. Blockchain is a peer-to-peer (P2P) network of computers that share data (Gordillo, 2020). Each computer connected to this network is called a node, and this network is like a distributed database where all nodes have stored values and bytecodes (Chevet, 2018). The blockchain is akin to an almost immutable ledger that records data and an extensive transaction history. This concept emphasizes security through the decentralization of data and resources, with a copy of the ledger residing on every computer, or node, that participates in the network. This ensures the integrity and transparency of the transaction history, making it highly resistant to any form of manipulation or fraud. In the event of an attempt to defraud, or modify a blockchain record on a single node, the network's other nodes will detect the change and overwrite it with the official version of the chain. To modify the content of a blockchain, it would be necessary to alter the content on at least 50% + 1 of the nodes in the copies of this cell. Once the data shared on the blockchain is confirmed on most of the distributed nodes, it becomes immutable because any change to the stored data will invalidate all subsequent data. Ethereum, the most widely used blockchain platform in NFT schemes, provides a secure environment for executing smart contracts. New protocols have been developed and implemented on top of the blockchain concept. A protocol can be considered a set of guidelines that govern the interaction between users on a network. There are several blockchain networks in existence, including Bitcoin, Ethereum, and Ripple. Each of these networks utilizes its own currency (Choi, 2018). A total of 18 different objectives are associated with these protocols. The primary focus of Bitcoin is monetary transactions, while Ethereum is a protocol used for smart contracts. Ethereum is the most popular protocol for this purpose, although other protocols, such as Waves and Neo, exist.

4.1.2. Ethereum protocol

Ethereum is currently the most widely used blockchain protocol for creating smart contracts. It was founded in January 2014 by Vitalik Buterin, and it enables the execution of fraud-proof software because it is immutable on the network (Buterin, 2015). In addition to the logic/intelligence in the Ethereum network, the cryptocurrency Ether 16 is also managed in the system, at the same layer (Ante, 2021). This allows for money to be transferred from one network address to another, by the business rules established during the development of the smart contract.

4.1.3. Smart contract

NFTs utilize smart contracts, which define ownership, transfer rules, and potential royalties. Szabo originally introduced smart contracts to speed up, verify, or executing digital trading. Ethereum has further advanced smart contracts within its blockchain system. These smart contracts utilize Turing-complete scripting languages to achieve sophisticated functionalities and execute full state transition replication over consensus algorithms to ensure final consistency (Ante, 2021). When a smart contract is sent to the Ethereum network, an address is generated that will be associated with this contract. This address serves as the recipient of transactions issued by Ethereum network participants seeking to interact with the contract. Most NFT solutions rely on blockchain platforms based on smart contracts to ensure their order-aware executions.

4.1.4. Data encoding

Encoding is the process of converting data from one form to another. Typically, many files are encoded in efficient compressed formats to save disk space or in an uncompressed format for high quality/ resolution (Garcia-Monleon et al., 2022). Major blockchain systems, such as Bitcoin and Ethereum, use hexadecimal values to encode transaction elements, including function names, parameters, and return values (McDonald, 2017). In the context of NFTs, asserting ownership of the underlying hexadecimal values signed by the creator effectively establishes a claim to the intellectual property. This means that anyone can copy this data without it being processed. However, it should be noted that only the owner of the NFT can formally claim ownership.

4.2. Key characteristics of NFTs in digital culture

Non-fungible tokens have emerged as a disruptive innovation in the field of digital culture. Specifically, they have been (and are being) transformative within the creative industries, enabling the authentication, ownership, and monetization of digital assets in a decentralized manner (Nadini et al., 2021). This section will explore the key characteristics of NFTs and their impact on creative industries, from digital art to music and video games.

First, every NFT system presents the main general fundamental characteristics (Regner, Urbach & Schweizer, 2019; Chen, Huang & Zheng, 2022), such as each NFT is unique and cannot be replicated, which confers a distinctive value. Besides, it is necessary to show the indivisibility: They cannot be divided into smaller parts; they are bought, sold, or owned in their entirety. In this line, we need to expose the transferability: They can be transferred from one owner to another through specific marketplaces, facilitating the buying and selling of digital assets. And, so, the verifiable scarcity: The quantity of NFTs is limited, and this scarcity is verifiable on the blockchain, increasing their perceived value.

In addition, a series of specific peculiarities arise in the case of the creative industries, making this system particularly interesting due to several factors. For instance, the digital ownership and authenticity: One of the most salient features of NFTs is the certification of digital ownership and authenticity. Conventional digital files can be replicated indefinitely without perceptible alterations. In contrast, NFTs are inscribed in a blockchain, which allows their originality and provenance to be verified (Wang et al., 2021). This immutable record of authorship is essential for creators, as it prevents plagiarism and counterfeiting in the digital art market (Boido & Aliano, 2023). Moreover, scarcity and exclusivity: NFTs are also characterized by their programmed scarcity, which gives them value in the market. A creator can decide the number of copies of an NFT, establishing a limited supply that incentivizes demand (Dowling, 2022a). This mechanism is particularly beneficial in industries such as music and digital collectibles, where rarity directly influences price and consumers' perception of value (Kugler, 2021). Furthermore, NFTs have introduced new methods of revenue generation, allowing creators to monetize their work in a way that was previously unattainable. NFTs have completely redefined monetization strategies in the creative industries. Through smart contracts, creators can receive royalties automatically every time their NFTs are resold on the secondary market (Ferro et al., 2023). This functionality allows artists and musicians to earn recurring revenue, which is not possible with traditional forms of marketing digital goods (Jones, 2021). Likewise, interoperability and expansion in the metaverse: Another key feature of NFTs is their interoperability, meaning that they can be used across multiple platforms and digital ecosystems (Chen, Huang & Zheng, 2022). This quality is especially relevant in metaverse development, where NFTs can represent avatars, virtual goods, and other transferable elements between different digital environments (Casale-Brunet et al., 2022).

4.3. Uses and applications

A new understanding of artistic ownership has emerged with NFTs. Due to their nature, digital artistic works can be easily and simply copied and replicated; however, NFTs allow for authentication of ownership and authorship of a particular work, be it a visual work or another type of application. In any case, and without preventing copying, and despite the numerous applications and potential of NFTs, some challenges and considerations need to be addressed. One of the main ones is the issue of intellectual property rights and authenticity. Although an NFT certifies ownership of a token, this does not always imply copyright ownership of the underlying content, which can lead to confusion and legal disputes (AlKhader et al., 2023). Be that as it may, these are the main applications of NFTs:

1. Digital Art: Digital art has been one of the earliest and most prominent areas to adopt NFTs, even more considering the creative industry as a space for creative reflection (Deltell, 2024). Artists around the world have used this technology to tokenize their work, enabling the sale and ownership of digital art in a verifiable and secure manner. A prominent example is the sale of artist Beeple's 'Everydays: The First 5000 Days', which was auctioned for $69 million in 2021 (Wiratno & Callula, 2024). This sale marked a milestone in the acceptance of NFTs in the contemporary art market.

2. Video games: In the video game industry, NFTs are used to represent in-game assets, such as characters, weapons or special items. These assets can be bought, sold or exchanged between players, and their ownership is secured by the blockchain. This introduces an in-game economy model, where players can monetize their digital achievements and possessions (Akpan, 2024).

3. Music: Musicians and artists have begun to explore NFTs to distribute and monetize their work. By tokenising exclusive songs, albums or experiences, artists can sell directly to their fans without intermediaries, offering unique and limited content. This not only provides a new source of revenue but also strengthens the connection between the artist and their audience (Celle, 2022).

4. Sports: Sports organizations have adopted NFTs to create digital collectables, such as player cards, highlights or virtual merchandise. For example, the NBA launched "NBA Top Shot", a platform where fans can buy, sell and collect game highlights in the form of tokenized short videos (Ortiz-Gonz**á**lez, 2023).

5. Fashion: In the fashion industry, brands are exploring NFTs to create digital versions of their products, allowing users to buy and own virtual garments or accessories. This is especially relevant in the context of virtual worlds and the metaverse. Furthermore, in the real estate sector, NFTs are used to tokenize properties, facilitating the purchase, sale and transfer of real estate more efficiently and transparently (Yaseen & Batur, 2024).

6. NFTs have introduced innovative monetization strategies to the creative industries, facilitating the automated distribution of royalties to creators whenever their NFTs are resold in secondary markets (Çağlayan & Özkan, 2021). This functionality enables artists and musicians to generate ongoing revenue, a capability unattainable through conventional digital asset marketing (Jones, 2021).

7. Furthermore, NFTs have enhanced interoperability, paving the way for expansion within the metaverse (Jones, 2021). Another key feature of NFTs is their interoperability, meaning that they can be used across multiple platforms and digital ecosystems (Chen, Huang & Zheng, 2022). This quality is especially relevant in metaverse development, where NFTs can represent avatars, virtual goods, and other transferable elements between different digital environments (Casale-Brunet et al., 2022). Beyond digital art, interoperability extends the scope and utility of NFTs, facilitating their adoption in video games and immersive experiences (Tavares et al., 2023).

8. Transparency and security are further enhanced by blockchain technology, which offers a high level of transparency and security. Every transaction is publicly and immutably recorded, reducing risks of fraud and manipulation in the market (Regner, Urbach & Schweizer, 2019). The decentralization of the blockchain network is another key benefit, as it eliminates the need for intermediaries, reducing the risk of fraud and manipulation. This independence from intermediaries also directly empowers creators by eliminating unnecessary costs.

9. The impact of NFTs on the creative industries is significant and varied. In the digital art sector, NFTs have created new opportunities for independent artists, who previously encountered challenges in monetizing their work in the traditional market (Nadini et al., 2021). In the music industry, NFTs have empowered artists to sell exclusive albums and experiences directly to their fans, eliminating the need for record labels (Kugler, 2021). In the video game industry, NFTs have completely transformed the landscape of digital property, empowering players to own, trade, and sell in-game assets (Shaji, Madaan & Tuteja, 2022).

4.4. NFT marketplaces and platforms

NFT marketplaces have transformed the digital economy, offering new opportunities for artists, creators and collectors. Platforms such as OpenSea, Rarible and SuperRare have led the way in this space, while new options such as Magic Eden and LooksRare continue to innovate in the sector. The future of NFT marketplaces will depend on the evolution of blockchain technology, mass adoption and the development of appropriate regulatory frameworks, with NFTs being bought and sold on marketplaces such as OpenSea, Rarible, Foundation, Magic Eden, and Nifty Gateway, among others. It happens that some platforms use auctions, fixed prices or private sales to trade NFTs. In any case, NFT marketplaces allow users to mint, buy, sell and exchange digital assets. But in terms of usability and utility for users: which platforms are most relevant?

1. OpenSea: One of the largest and most popular NFT marketplaces. It was founded in 2017 and operates on the Ethereum blockchain, although it also supports other networks such as Polygon and Solana. OpenSea allows the buying and selling of digital art, collectibles, video game

objects and other tokenized assets (OpenSea, 2023). Its main features include: A direct auction and sales system; support for multiple cryptocurrencies; the ability to mint NFT without high costs through patented and proprietary lazy minting technology.

2. Rarible: Another platform that operates on Ethereum and allows creators to issue and trade their NFTs without the need for advanced technical knowledge. Unlike OpenSea, Rarible has a decentralised governance system based on its native token, RARI, which allows users to participate in decisions about the development of the platform (Voshmgir, 2020). Key features of Rarible include: A decentralised model with community participation, a royalty system that allows creators to receive payments for future resales, and full compatibility with various blockchain networks, such as Flow and Tezos.

3. Foundation: Focused on digital art and the creation of exclusive content, this platform runs on the Ethereum blockchain and is distinguished by its invitation model, where artists must be invited by other members to participate (Foundation, 2023). This approach ensures quality curation and a more selective community of creators and collectors. The main features of the Foundation are: An auction-based system for the sale of NFT, a selective community of artists and collectors, and a high focus on authenticity and exclusivity of content.

4. SuperRare: Focused on high-quality digital art, it also runs on Ethereum and operates under a strict curation model, in which artists must be approved before they can sell their NFTs (SuperRare, 2023). The platform focuses on digital scarcity and authenticity, offering NFTs in limited editions. Its core features support: An exclusive, high-quality digital art marketplace, automatic royalties for creators, and the use of the $RARE token for decentralized governance.

5. Nifty Gateway: A platform that facilitates the purchase of NFTs through credit cards, making it more accessible to users who do not own cryptocurrencies. It is known for hosting well-known artist releases and celebrity collaborations (Nifty Gateway, 2023). The essential features of Nifty Gateway are: It involves an auction system in addition to direct sales, it is support for cryptocurrency purchases, and it is very focused on limited editions and collaborations with famous artists.

6. Magic Eden: Highlighted in the Solana ecosystem, this platform has become a leading marketplace for NFT, thanks to its low transaction fees and fast transaction confirmation (Magic Eden, 2023). This platform is popular for digital collectibles and NFT-based gaming projects, characterized primarily by low transaction fees, ease and speed of transactions, built on a strong and solvent ecosystem for gaming and collectibles.

7. LooksRare: An NFT marketplace that promotes itself as a decentralized alternative to OpenSea. Its main attraction is its incentive model, where users can earn rewards in the $LOOKS token for trading on the platform (LooksRare, 2023). It is characterized by offering a reward system based on platform usage, with a decentralized approach with community participation and lower fees compared to OpenSea.

Table 2 summarises each marketplace's key features, grouping them into advantages and disadvantages. However, the same characteristic can sometimes have both positive and negative interpretations. The last column indicates the type of user or activity for which each marketplace is most attractive and recommended.

Table 2: Main features in the studied NFT marketplaces

Marketplaces	Advantages	Disadvantages	Recommended to
OpenSea	Largest market Wide variety of NFTs Multi-chain User-friendly interface Low fees per transactions	High gas fees on Ethereum High competition for creators Security issues	Newcomers, Get liquidity and high exposure

Marketplaces	Advantages	Disadvantages	Recommended to
Rarible	Decentralized market Royalties for creators Multi-chain	High gas fees on Ethereum Lower traffic	Exclusive art community
Foundation	Curated market High quality art Royalties for creators Exclusive community	Access by invitation Limited NFT selection Lower traffic	Exclusive art community
SuperRare	Curated market High quality art Royalties for creators Strong community	Access by invitation Only art NFT Highest fees for creators	Those interested in a community-driven system
Nifty Gateaway	Credit card payment Exclusive drops/ collections from renowned artists User-friendly interface	Centralized market Limited NFT selection High fees for creators	Newcomers
Magic Eden	Increasing popularity Low fees per transactions Low gas fees on Solana	Small market Solana-centric	Those interested in affordable fees
LooksRare	Native token rewards Low fees per transactions Decentralized	Small community Not solid yet Wash trading issues	Those interested in a community-driven system

Source: Own elaboration (2025). Based on the mentioned marketplaces' official websites, Caldwell (2024), Synodüs (2024), and Voshmgir (2020).

4.4. Factors affecting the success of NFT markets

The growth and adoption of NFT markets depend on several key factors, such as the adoption (or not) of the blockchain (Wang et al., 2021) as a system, the ease and attractiveness of the user interface and experience, the actual transaction cost or the actual security between trading activities. In detail, the issues that make NFTs successful are, as an illustration, the infrastructure: The existence of blockchain infrastructures on which NFTs operate is one of the main factors affecting success. Blockchain networks provide the basis for issuing, transferring and storing NFTs. Ethereum has been the dominant blockchain in this sector due to its support for smart contracts, but it presents challenges such as high transaction fees and network congestion (Wang et al., 2021). To address these problems, solutions have emerged such as Layer-2 networks (which reduce costs and improve transaction speed, such as Polygon and Arbitrum), alternative platforms with lower fees and higher scalability, such as Solana or Tezos (Chen & Bellavitis, 2020), or the implementation of efficient consensus mechanisms that reduce energy consumption and speed up operations. More to the point, the ease of use: Simplicity of interface and user experience are essential to attract both creators and buyers. Thus, for NFT marketplaces to be successful, they must provide an accessible interface and intuitive user experience. Many non-technical users encounter barriers to NFT adoption due to the complexity of digital wallets, the need to purchase cryptocurrencies, and the understanding of smart contracts (Voshmgir, 2020). Also, the price is important: Transaction costs are a critical element. High fees have driven the development of alternative solutions (Chen

& Bellavitis, 2020). Indeed, issues such as gas tariffs in Europe because of the Ukraine invasion have added costs that have challenged the mass adoption of NFTs, as they have increased the total cost of transactions (Wang et al., 2021). To mitigate this problem, strategies have been developed such as: the use of blockchains with lower costs, smart contract optimisation (reducing the size of contracts) and the Lazy Minting, a technique that allows NFTs to be minted without paying upfront fees, transferring the cost to the buyer.

In another way, we want to indicate aspects as regulation: The legal and regulatory environment poses a crucial factor for the success of NFT markets, so regulation of NFTs continues to evolve, and platforms must ensure the security of transactions and authenticity of assets (Voshmgir, 2020). As these digital assets gain popularity, governments have begun to develop regulatory frameworks to prevent fraud, money laundering and tax evasion (Chen & Bellavitis, 2020). Some key aspects include consumer protection regulations to ensure authenticity and transparency in transactions (Jiménez-Marín & Checa, 2021) or regulation of tax regulations, as sales taxes and reporting of digital assets vary from country to country. Security is also a remarkable element: Protection against fraud is a key aspect of user confidence in NFT markets. Fraud and scams have been a recurring problem in the industry, ranging from plagiarism of works, to hacks of digital wallets (Voshmgir, 2020). To address these challenges, platforms have adopted measures such as creator verification, smart contract audits, two-factor authentication (2FA) or "Anti-Money Laundering" (AML) and "Know Your Customer" (KYC) protocols. Open-source machine learning tools have also been created to detect fraudulent NFT projects presented on social media. Using this technology, Roy et al. (2024) analyzed 36% of fraudulent NFT projects promoted through Twitter accounts (the social network currently known as X).

Anyway, the success of an NFT marketplace depends mostly on user trust, public perception of the technology and, with that, market adoption. Thus, factors such as the stability of the blockchain ecosystem, the reputation of the platform or the adoption by celebrities and industries influence the demand for NFT (Wang et al., 2021). Illustrative examples are collaborations by well-known brands (such as the NFT collection in popular markets by Adidas), the involvement of influential artists and creators (which increases the legitimacy of the sector) or financial trends for investment. Besides, NFTs are gaining popularity as marketing communication tools for promoting prestigious brands, contributing to the rise of the so-called user confidence feature. Deventer, de Sousa y Pirnay (2024) reflect on the values delivered by brands through NFT initiatives. Their study analysed 50 NFT projects presented by 42 advertising brands from various sectors, including fashion, sports, and food. The NFTs used, of various types, predominantly art and collectibles, were able to associate the brands with values such as efficiency, excellence, leisure, aesthetics, status, esteem, ethics, and spirituality.

And, in a final way, the sustainability is another factor affecting the success of NFTs is the ecological footprint and environmental sustainability, as blockchains using Proof of Work (PoW) have been criticised for their high energy consumption (Chen & Bellavitis, 2020). In recent years, there has been a migration to Proof of Stake (PoS), the use of green blockchains or carbon offsetting to reduce environmental impact. However, when the sustainability challenge is approached from a broader perspective, NFTs still raise high concerns among experts. Moro-Visconti (2024) approach their study from the ESG framework, which includes environmental, social, and governance (ESG) criteria and represents best-practice standards used by investors to evaluate and support sustainable projects. They conclude that NFTs pose worrying social and governance risks that must be urgently addressed.

4.5. Ownership and Rights: Legal Analysis

The decentralized nature of the blockchain system and the absence of clear regulations have led to uncertainty regarding ownership and rights associated with these digital assets (Boido & Aliano, 2023). Consequently, a thorough legal and technological analysis of NFT ownership is imperative to address concerns related to copyright, licensing, and beneficial ownership.

It is essential to distinguish ownership of the NFT and ownership of the linked digital asset. It is important to note that purchasing an NFT does not automatically grant the buyer copyright ownership of the underlying work. Creators can specify whether the NFT confers reproduction rights or solely digital ownership rights. Additionally, creators can program royalties to be received in future sales. Because an NFT is essentially a record on the blockchain that points to a file hosted on an external server, this implies that the acquisition of an NFT does not automatically guarantee ownership of the copyright of the associated content (Soares, Kauffman & Berlanga, 2024). A prevalent misconception about NFTs is the belief that purchasing an NFT automatically grants full rights to the digital content. In most cases, purchasing an NFT only grants ownership of the token on the blockchain, not the rights to exploit, distribute, or modify the content (Bamakan et al., 2022). Unless otherwise specified by the creator in a licensing agreement, the purchaser of an NFT does not acquire the copyright inherent in the digital asset. However, creators of NFTs can grant various levels of rights to buyers through smart contracts and licenses. Some platforms allow the terms of use and resale to be set. For instance, some NFTs include

conditions that grant the buyer only personal viewing rights, while others allow for limited commercial use (Dowling, 2022a). Smart contracts have the potential to ensure creators receive royalties each time an NFT is resold, providing a reliable source of income for digital artists (Kugler, 2021).

However, despite the established and well-established regulation, NFTs present numerous legal challenges, such as the lack of clear regulation, issues of authenticity and fraud, and the tax and economic implications at the local, national, or international levels. As a relatively recent phenomenon, NFTs legislation has not yet established a clear regulatory framework. In many countries, the lack of specific legal categories for NFTs complicates their interpretation within intellectual property and digital contract laws (De Filippi & Wright, 2018). The market for NFTs has also experienced numerous cases of fraud, including the sale of unauthorized NFTs based on stolen works of art. The absence of a universal verification system can lead to uncertainty regarding the authenticity of copyright ownership, potentially resulting in fraudulent activities (Antonopoulos & Wood, 2018). From a fiscal and economic perspective, NFT transactions raise concerns about their taxation. In some countries, sales of NFTs are subject to capital gains taxes, while in others, their tax treatment remains unclear (Kumar & Thakur, 2024).

Indeed, while NFTs represent a technological innovation with significant implications for digital property and copyright, their mass adoption has also exposed legal and regulatory challenges (Kumar & Thakur, 2024). While NFTs represent a technological innovation with significant implications for digital property and copyright, their mass adoption has also exposed legal and regulatory challenges that require attention. To ensure a sustainable and secure ecosystem, it is essential to establish clear legal frameworks that protect both creators and buyers, ensuring transparency and legitimacy in the NFT market.

7. Discussion

Non-fungible tokens (NFTs) represent a technological innovation with significant implications for the creative industries. Despite the high rate of growth and awareness in different divisions of the field of digital culture, several criticisms and challenges must be addressed for the full development and realization of NFTs. For instance, there is a pressing need to address their environmental impact, as evidenced by the substantial energy consumption associated with blockchains. While the development of proof-of-participation mechanisms aims to mitigate this impact, the subject remains a point of debate and discussion. Additionally, concerns regarding the long-term sustainability of NFTs due to their price volatility have emerged. Critics contend that the market for NFTs is being fuelled by speculators, which could potentially lead to a financial bubble. Additionally, the lack of understanding surrounding the practical application of intellectual property and copyright in the sale of digital assets, such as NFTs, gives rise to complex questions. It is important to note that owning an NFT does not necessarily imply ownership of the underlying work, which may lead to legal confusion and variations across different geographical areas.

However, as an external critique of the situation, it is worth considering whether the end of the NFT certification market bubble may have arrived, and whether the value of these assets is approaching a low value. It can by no means be said that the NFT system is dead, as some publications, such as the one published by DappGamble (2023), have claimed; However, it is true that there is a high percentage (around 95% of investments, which represents, in absolute terms, around 23 million people) with a market capitalisation of 0 Ether (ETH -the native token of the Ethereum blockchain, the value of the official currency-), so it is worth rethinking the value of these assets in a very high percentage of activity. On the other side of the scale we find that, despite the collapse of the NFT market, work continues to regulate, know and balance this system, as shown by the celebration, in February 2025, of the NFT Paris Conference, which brought together 20,000 attendees who, as digital creators, showed their resistance to decline (Szadkowski, 2025), despite a trend of declining market share during 2024 (Vismaya, 2025).

Be that as it may, the reality is that NFT sales began to fall sharply from 2022 onwards, losing up to 52% of their value during 2023, but picking up at the end of 2024 with the global NFT market recording a trading volume of $130 million during the first week of January 2025 (Cruzado, 2025).

Consequently, and as a summary, it can be stated that we are in a situation of uncertainty as well as suggesting a possible resurgence, which does not imply, in any case, that the NFT ecosystem, its consequences on the stock market and artistic and creative markets in the digital culture environment, should be disdained.

8. Conclusions

Non-fungible tokens (NFTs) represent a technological innovation with a significant impact on the digital economy. Their development has been made possible by the evolution of blockchain technology and its application in smart contracts. Despite the criticism they have received, NFTs are transforming industries and posing new challenges in terms of regulation and sustainability. As research in this field progresses, it is anticipated that NFTs will continue to evolve and find new applications in the future.

In the creative industries, NFTs have had a profound impact, providing new monetization opportunities and redefining digital property. From the arts to music, to video games and entertainment, NFTs have fundamentally changed the way creators engage with their audiences and generate revenue. However, significant challenges remain in terms of sustainability, regulation, and market stability. The future of NFTs in the creative industries will be shaped by the evolution of blockchain technology and the development of appropriate regulatory frameworks. Indeed, NFTs represent a paradigm shift in contemporary digital culture, offering new creative and economic possibilities. However, they also pose significant challenges that require critical analysis. The future of NFTs hinges on addressing issues such as environmental sustainability, speculation, and legal frameworks.

The impact of NFTs on the creative industries is yet to be seen. We can summarize the role of NFTs in the democratization of art and their potential to transform the creative industry as follows:

1. The digital art market has been significantly impacted by the emergence of NFTs. Historically, digital artists have encountered challenges in monetizing their work due to the ease of unregulated copying and distribution (Regner, Urbach & Schweizer, 2019). However, with NFTs, each artwork is linked to a unique token on the blockchain, enabling the certification of its authenticity and ownership (Wang et al., 2021). Additionally, smart contracts facilitate the distribution of royalties to artists each time their work is resold, thereby providing a sustainable revenue stream (Van Haaften-Schick & Whitaker, 2022).

2. Disruption in the music industry: The music industry has also undergone a radical transformation with the emergence of NFTs. These tokens enable musicians to directly offer their creations, including songs, albums, and exclusive experiences, to their supporters, bypassing traditional intermediaries like record labels or streaming platforms (Kugler, 2021). This shift empowers creators with enhanced financial and creative autonomy, while also facilitating novel forms of engagement with their fanbase. Nevertheless, challenges persist regarding the extent of its adoption and the regulation of copyrights (Jones, 2021).

3. NFTs in the Video Game Industry: NFTs have transformed the video game industry by introducing the concept of real ownership of digital assets within games. Instead of players purchasing virtual items that only exist in the ecosystem of a specific game, NFTs allow these assets to be transferable between different platforms and markets (He et al., 2023). This shift has led to the emergence of the play-to-earn model, where users can generate income through the purchase, sale, and exchange of NFTs within blockchain gaming environments (Casale-Brunet et al., 2022). However, concerns regarding the economic sustainability and environmental impact of these systems remain unresolved (Chen, Huang & Zheng, 2022).

4. Entertainment industry opportunities and challenges: Beyond the domains of art and video games, NFTs are finding application in the entertainment industry, encompassing film production and live events. Movie studios, for instance, can release exclusive NFTs related to their films, providing fans access to exclusive content or customized experiences (Dowling, 2022). Similarly, NFTs are being used to sell digital tickets to concerts and events, helping to prevent fraud and counterfeiting (Wang et al., 2021). Though, the lack of regulation and concerns about speculation in the NFT market may pose obstacles to widespread adoption (Boido & Aliano, 2023).

5. Ethical and regulatory challenges. Despite the excitement around NFTs, their integration into the creative industries poses significant challenges. A primary concern is environmental sustainability, as most NFTs are based on blockchains, which consume significant energy (Kumar & Thakur, 2024). Additionally, speculation in the NFT market has led to substantial price fluctuations, which can pose financial risks for creators and buyers (Nadini et al., 2021). Concerns have also been raised regarding copyright and unauthorized reproduction of digital content, emphasizing the necessity for clear regulations to safeguard artists and consumers (Jones, 2021).

The future of NFTs in the creative industries is promising. The potential for NFTs to transform digital culture is significant, and as technology and understanding of NFTs evolve, their integration into the creative industries is likely to deepen. Their integration is anticipated in areas such as education (where NFTs can certify skills and achievements), real estate (representing virtual properties in digital communities or societies), tourism, and healthcare, providing new forms of interaction and consumption.

However, despite this review, several limitations have been encountered throughout the study that will be reviewed and improved as future lines of research. The study on the theoretical review of NFTs has several limitations, depending on the focus and scope of the research. Thus, from a marketing point of view, the reality is that we have a very rapid evolution of the market, which can quickly make the information collected obsolete, even if such compilation is done in an updated way. To this must be

added the lack of academic consensus, as it is a relatively new field, there is a lack of consolidated theories and consensus in the academic literature on its impact, regulation and applications, which is added to the availability of reliable sources, where blogs, industry reports and social networks prevail, which can affect the rigorousness of the study. Academic research in this area is still limited, and the perspective may be biased, depending on the sources used, as the review may be inclined towards optimistic or critical perspectives without a balanced view, as has been proven about the claims of death and resurrection of the NFTs ecosystem. It is precisely for this reason that this text aims to provide a solid literary basis for a response and a commitment to the definition of the system.

9. Specific contribution of each signatory

Task	Author 1	Author 2	Author 3
Conceptualisation	X	X	X
Content curation	X	X	X
Formal analysis	X	X	X
Acquisition of funds	X	X	X
Research	X	X	X
Methodology	X	X	X
Project management	X	X	X
Resources	X	X	X
Software	X	X	X
Monitoring	X	X	X
Validation	X	X	X
Visualization	X	X	X
Writing: original draft	X	X	X
Writing: proofreading and editing	X	X	X

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12. Declaration of conflict of interest

The authors declare that there is no conflict of interest.

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