A Legal And Economic Analysis of Non-Fungible Tokens on The Art Market

by

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Declaration

I, Titose Chembezi, declare that this thesis is composed of my original work, it contains no material previously published or written by another person except where due reference has been made in the text. This thesis is submitted to the University of Cape Town for the Master of Philosophy specialising in Financial Technology degree.

Signed by candidate

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Abstract

This thesis conducts a legal and economic analysis of Non-Fungible Tokens (NFTs) in the art market, exploring the integration of intellectual property rights and the financial implications of these digital assets. It examines the challenges of applying existing copyright laws, such as the right of first sale and fair use doctrines, to the novel context of NFTs, highlighting the need for enhanced regulatory practices within NFT marketplaces. Proposals include the development of reverse image search technologies to mitigate copyright infringement and foster a more robust legal environment. Economically, the thesis compares the valuation of NFTs to traditional art portfolios, acknowledging the difficulty in assessing their intrinsic value due to subjective perceptions and speculative influences. To counteract speculative volatility and establish more grounded valuations, it suggests the adoption of a hybrid approach that combines the expertise of curators with machine learning models and standardized valuation frameworks. The analysis concludes that while NFTs provide significant opportunities for artists by increasing market access and liquidity, the current environment is fraught with legal uncertainties and economic instability. The thesis advocates for the ongoing evolution of economic and legal frameworks to fully leverage the benefits of NFTs in the art market, ensuring they contribute positively to the sustainability and growth of artists' careers and stakeholders.

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Abbreviations and Acronyms

AI . . . . . Artificial Intelligence

ALI . . . . . American Law Institute

AIR . . . . . Automatic Image Recognition

ARS . . . . . Artists Right Society

BAYC . . . . . Bored Apes Yacht Club

DeFi . . . . . Decentralised Finance

ERC721 . . . . . Ethereum Request for Comments 721

EU . . . . . European Union

GANs . . . . . Generative adversarial network

IP . . . . . Intellectual Property

IPFS . . . . . InterPlanetary File System

NFTs . . . . . Non-Fungible Tokens

ROI . . . . . Return on Investment

UCC . . . . . Uniform Commercial Code

ULC . . . . . Uniform Laws Commission

US . . . . . United States

USDC . . . . . USD Coin

1. Introduction

Copyright law has been slow to progress with artwork because of the expensive legal, administrative, and logistical constraints that are considered transaction costs for artists. Non-Fungible Tokens (NFTs) are popular because they reduce transaction costs by automating contract law thereby allowing artists and creators to guarantee their rights, ensuring that their works will be used or exploited only as specified and that they will be reimbursed for their future use (Haaften-Schick and A. Whitaker 2022). NFTs are units of data stored on a blockchain ledger to verify ownership and tradeable rights of digital assets (Dowling 2022 ; N. Jones 2021). The tokens establish links with underlying assets that possess distinctive characteristics and are not interchangeable in kind (Bowden and E. T. Jones 2021. It is crucial to clarify that an NFT is not the artwork itself or transformed into the artwork either. Instead, it serves to document the creation and ownership of the artwork on the blockchain (Murray 2022). NFTs are unique and non-fungible, meaning that no two NFTs are similar. This technology idealizes a marketplace for digital creators and consumers through the concept of scarcity (Nadini et al. 2021). However, the high pricing of certain NFTs has been questioned because images can be obtained from a public website and utilized without payment or credit to the creator (Murphy 2021). Having exclusive rights to the asset is a driver for the NFT market and value of these tokens as they are purchased for sentimental and or investment purposes. While NFTs are sometimes considered their own distinct genre of art, the difficulties in valuing them are actually rather similar to that of more traditional works of art. As with NFTs, artworks cannot be effectively modelled with discounted cash flows because there are no financial flows to discount, hence they are difficult to appraise (A. Whitaker 2022). Consumers pay rates that surpass their own appraisal because they anticipate finding a buyer prepared to pay much more in the future. Even when tiny changes in opinions are sufficient to trigger a trade, this causes a considerable bubble component in asset prices (Scheinkman and Xiong 2003).

The interplay between NFTs and traditional artworks highlights the evolving nature of property rights in the digital age, where the assurance of ownership and proper compensation for creators becomes critical. They can be viewed to be more than a

specialized technology that facilitates online collectables. NFT sales constitute the sale of personal property as an asset (Fairfield 2022). The study of property rights has been crucial in explaining economic performance. Property rights are the permissions to use, generate money from, and transfer or trade assets and resources (Muthoo 2004). When property over economic resources is insecure, individuals often incur transaction costs in order to defend their claims. In the traditional art market, there is no system of registered titles, like in real estate, that would make it possible to confidently track the history of ownership of a work of art, even though its worth often depends on its provenance, which includes information about prior owners (Posner and Landes 1996). There is a higher potential for dispute between the current owner and persons who claim to be in the chain before him because of the characteristics of works of art that make it possible to trace the chain of title over a long period of time but also make it difficult to trace the chain of title with certainty. Uncertainty about ownership, and hence the chance of a dispute, increases when there is no public registration that requires a search of the registry as a condition of a legitimate transfer of title.

In the early days of the Internet, there was no mechanism to sell digital assets without risking rampant piracy as described by Fairfield (2022). In reaction, courts substantially enlarged copyright law and liability. Now, the technology exists to generate unique digital assets, and as such the legal framework has veered in the direction of regulating all such transactions via copyright legislation. A "digital original" might be created using NFTs, making blockchain an ideal instrument for safeguarding the rights of artists and other creative professionals. These tokens provide a utopian vision for artists, where proof of ownership and originality can exist for the first time in the digital realm. They enable artists to bypass intermediaries and distribute directly to customers and provide digital and underrepresented artists the chance to earn from their works on the digital market. For NFTs to fulfill the utopian vision of protecting artists from the existing need to sign away copyrights and ownership of creative work, copyright protection must exist over the creative work minted into an NFT (McAndrew 2022). The NFT certificate transforms this lack of digital scarcity and allows digital art to function as a singular and salable object and provides a legitimate public register of transferable assets.

The extremely liquid and continually trading NFT market has attracted particularly speculative purchasers, who are primarily interested in purchasing and reselling in a short period of time for financial gains. As a result of the anonymity of transactions, there are fewer obstacles to entry for purchasing and selling than in the traditional art market. According to the 2022 Art Basel and UBS Report, there were around 1,370 active buyers on NFT platforms in 2019 across both primary and secondary trade and 865 active sellers. By 2021, the number of buyers and sellers had increased to 130,696 &

84,182 respectively. Rapidly escalating prices are one of the reasons why the number of purchasers on these platforms has increased. In 2020, the average values of non-fungible tokens pertaining to art were $200 for primary sales and $265 for secondary resales. In 2021, these values increased to $1,462 and $5,486 respectively (McAndrew 2022).

This thesis undertakes a qualitative analysis of the legal and economic frameworks that intersect with the advent of Non-Fungible Tokens (NFTs) in the art market, particularly focusing on how these digital assets challenge and potentially enhance intellectual property rights and financial dynamics within the industry. The introduction sets the stage by highlighting the traditional challenges faced by artists, including high transaction costs and complex copyright issues, which NFTs aim to mitigate by leveraging blockchain technology to automate and enforce legal rights and transactions efficiently. This foundational perspective underscores the necessity to explore NFTs not merely as technological innovations but as pivotal elements reshaping art ownership and copyright enforcement.

Each chapter of the thesis systematically addresses a segment of the overarching research problem—how NFTs are integrating into and impacting the art market from both legal and economic viewpoints. Chapter 3 delves into the current state of copyright law, revealing its sluggish adaptation to digital art forms and the unique challenges posed by NFTs, such as the difficulty in defining what constitutes original artwork in the digital realm. The literature reviewed establishes that while NFTs provide a platform for asserting ownership and facilitating trade, they do not inherently resolve the nuanced copyright issues seen with digital art, thereby necessitating a reevaluation of legal strategies to better cater to digital and NFT-based artworks. The analysis extends in Chapter 4 to the economic implications of NFTs, examining them as financial assets within the art market. This section draws on economic theories and previous market analyses to argue that while NFTs open up new revenue streams for artists and reduce barriers to market entry, they also introduce volatility and speculative pricing challenges. The literature suggests that the pricing of NFTs is often driven by market speculation rather than intrinsic artistic value, a factor that complicates stable market development. To address this, the chapter proposes the integration of curated valuation frameworks and the use of machine learning models to derive more objective pricing mechanisms, thereby supporting a more sustainable economic environment for artists. Finally, Chapter 5 evaluates the direct impact of NFTs on artists, juxtaposing the potential benefits with the actual market dynamics that often replicate traditional power structures. The review discusses how NFTs, despite their potential for democratization, still favor established networks and high-profile artists, thus not fully resolving the disparities in market access. The literature underscores the need for ongoing research and policy development to

harness the full potential of NFTs in fostering a fair and equitable art market.

Overall, this thesis provides a critical literary analysis that not only highlights the transformative potential of NFTs in the art market but also identifies significant gaps and challenges that require further research and innovative solutions. By proposing that NFT marketplaces take a more active role in enforcing copyright and suggesting economic strategies to mitigate speculative risks, the study contributes valuable insights to the literature and lays a foundation for future explorations that could help realize the full benefits of NFTs for artists and the art market at large. Therefore, the paper is modelled to answer the following specific research questions for each chapter in line with this:

1. How is copyright legislation incorporated in the NFT market and enforced?
2. How is NFT pricing influenced by speculation and value?
3. How are artists faring in the era of NFTs compared to before their advent?

2. Methodology

From an ontological viewpoint, the review is grounded in relativism, which posits that reality is subjective and varies according to different people's experiences and interpretations. In the context of NFTs, this means acknowledging that the legal rights, economic value, and impact on artists can be perceived and experienced in diverse ways, influenced by the stakeholders' positions within the art market ecosystem. The philosophical tradition guiding this review is post-positivism, which, while rooted in the empirical observation and measurement central to positivism, also recognizes that absolute truth can never be fully established due to the limitations of human knowledge and research methods. This approach is particularly suited to exploring the emerging and rapidly evolving field of NFTs in the art market, where new legal and economic frameworks are being tested and where empirical data may be scarce or rapidly changing.

Post-positivism supports a critical examination of existing theories and legal frameworks, encouraging a questioning attitude towards understanding the economic and legal dimensions of NFTs. It implies that this review will be open to revising understandings in light of new evidence and will engage in a critical appraisal of both quantitative and qualitative research to build a comprehensive understanding of the topic and remain open to evolving interpretations as the field of NFTs in the art market continues to develop. This philosophical foundation not only guides the review's methodological approach but also informs its analytical and interpretive strategies, ensuring a rigorous and reflective examination of the topic.

2.1 Methodological Approach

This thesis will utilize a research methodology that combines both qualitative and quantitative methodologies. An in-depth analysis of authoritative books, reports, and expert comments will be done to comprehend the importance of NFTs in the art world. In addition, statistical data and notable case studies are to be examined to determine the extent of expansion and influence of NFTs in the art market. The literature review is structured to ensure a comprehensive and unbiased collection of data on the legal and

economic impacts of NFTs in the art market. This approach aligns with the constructivist belief in the value of diverse perspectives and the post-positivist acknowledgement of the limitations of any single method or dataset. The review will thus synthesize findings from a variety of sources, including empirical studies, legal analyses, market reports, and case studies, to construct a nuanced understanding of how NFTs are reshaping the art market legally and economically. By grounding the review in these philosophical traditions, the research is framed in a way that appreciates the complexity of the subject matter and values the various contributions to the topic.

2.1.1 Search Strategy

1. Identify and select multiple electronic databases relevant to both the legal and economic aspects of the art market, including academic databases like JSTOR, Google Scholar, Social Science Research Network (SSRN), Elsevier , and specialized databases for legal research and economic analyses. Additionally, consider databases that index art journals and technology publications.
2. Develop a list of search terms and phrases that encompass the scope of the research questions. Use both broad and specific terms related to NFTs, copyright law, art market economics, and artist impacts. Boolean operators (AND, OR, NOT) will be used to refine search results. For example, searches will include combinations like "NFTs and art market," "copyright law and NFTs," "economic impact of NFTs," and "artists' experiences WITH NFTs", "art investment" and "machine learning art valuation.
3. Search Limits: Apply filters to limit search results to peer-reviewed articles, legal analyses, and studies published in English. Consider setting a publication date range for majority of the paper to focus on the most relevant and current literature given the rapid evolution of NFTs. Website articles from reputable sources.

2.1.2 Selection Criteria

1. Inclusion Criteria involves relevance to the research questions, focus on legal and economic analyses of NFTs in the art market, and studies that provide empirical data or theoretical discussions on the impact of NFTs.
2. Exclusion Criteria: Outline clear reasons for excluding studies, such as those not directly related to NFTs in the art market, lacking a legal or economic focus, or being opinion pieces without empirical data or analysis.

2.1.3 Screening and Selection Process

1. Screen titles and abstracts based on the inclusion and exclusion criteria. This step helps in quickly identifying potentially relevant studies.
2. Obtain and review the full text of potentially relevant studies to confirm their eligibility based on a more detailed assessment of their content and relevance to the research questions.
3. Keep detailed records of the search and selection process, including the number of studies screened in a google folder, assessed for eligibility, and included in the review.

2.1.4 Quality Assessment

1. Assess the quality and credibility of included studies using standardized checklists or tools appropriate for the types of studies being reviewed. This may involve evaluating the methodological rigor, transparency of reporting, and potential biases within the studies.
2. Use a standardized form to extract key information from each study, including objectives, methodology, findings, and conclusions. Synthesize data from the included studies, looking for patterns, themes, and discrepancies in the findings related to the legal and economic analysis of NFTs.

2.1.5 Synthesis of Findings

Thematic Analysis: Employ thematic analysis to identify common themes, trends, and gaps in the literature. This involves coding and categorizing data according to themes relevant to the research questions.

Narrative Synthesis: Present the findings in a narrative format, integrating the results of the thematic analysis and discussing them in the context of the review's aim and research questions. This includes a critical discussion of the implications of the findings, their relevance to stakeholders, and suggestions for future research.

By following this methodological approach, the review aims to provide a comprehensive and systematic analysis of the existing literature on the legal and economic impacts of NFTs in the art market, contributing to a deeper understanding of this emerging field.

3. Intellectual property rights of artwork for NFTs

3.1 Introduction

This chapter explores the intricate relationship between copyright legislation and the emerging NFT market, with a particular focus on the art market. As NFTs revolutionize both digital and physical art ownership, it becomes essential to understand how laws enforce copyright. Traditionally, copyright law aims to protect creators' exclusive rights to reproduce, distribute, and display their works. However, these laws now face challenges in the digital era, where art is easily replicated and distributed globally without loss of quality. This situation prompts critical questions about the effectiveness and adaptability of copyright legislation in an increasingly digital marketplace, especially in the context of the innovative and rapidly evolving NFT market.

The core of this analysis examines how current copyright laws apply to the art market, which is undergoing transformations due to digital technologies and NFTs. It scrutinizes the mechanisms for enforcing these laws, considering the rise of digital art that blurs the lines between originals and copies. This requires a revaluation of legal frameworks to better address the realities of the digital age. The enforcement of copyright in relation to NFTs is particularly complex, involving not only traditional legal principles but also the technical specifics of blockchain technology and the nuances of digital ownership. The section examines the practical challenges and legal innovations emerging as the art market adapts to new digital paradigms. This analysis directly responds to the broader research question of how legal and economic frameworks adapt to the unique characteristics of NFTs on the art market, offering insights into the evolving intersections of law, technology, and art.

3.2 Copyright law in art

Copyright law is a subset of intellectual property law, the primary role of which is to outline the entities that may be subject to exclusive private control and to identify the individuals who may be granted such rights (WIPO 2016). A copyright is a bundle of rights that are automatically granted to the creator of an original work of authorship, such as a book, music, film, or piece of software. These rights include the ability to reproduce the work, create derivative works, distribute copies, as well as publicly perform or show the work. In copyright law, a derivative work is a creative expression that incorporates significant copyrightable components of prior, original work and requires a considerable alteration or adaptation that nevertheless reflects substantially on the original creator[1]. Derivative works include, for instance, a revised version of a book, a sequel, or a film based on a novel. In order for the law to recognize an artwork as an object of property, it must be identifiable and self-sufficient, attributable to a particular author, and perceptible to the senses via the physical medium on which it is recorded or embodied (Barron 2002). When an artist sells a unique physical or digital embodiment of their work, they are typically selling the rights to possess and show the piece. After the sale, the buyer does not acquire the artist's other copyright protections, such as authorship, reproduction, or the right to create derivative works based on the original work ("Massachusetts Museum of Contemporary Art Foundation, Inc. v. Büchel" 2010).

It is worthy of remark that in eschewing the category of art and focusing instead on defining instances of "artistic work" such as painting and sculpture in purely technical terms, copyright law cannot accommodate any artistic gesture that is not realized in one of these forms, because it assumes that "art" manifests itself only in a predetermined array of species including engravings, sculptures, paintings, photographs and drawings (Barron 2002). The result of this taxonomy method to determine copyright objects can be discriminatory, simply because the law's classifications are restrictive and fail to reflect the diversity of contemporary art. This trend also attests to the challenges provided to the law by the amorphous nature of intangible things, as it satisfies the requirement for objective and precise criteria to define these entities in the process of isolating them for legal protection. There is no single sub-category of "artistic work" that can include installation art, video art, environmental art, body art, or performance art, nor is there a general overarching category of "art" that can accommodate the products of these disciplines. This is due to the complexity of copyright rather than deliberate aesthetic discrimination Barron (2002).

Digital art, formerly known as computer art or new media art, is any creative endeavor

[1] *copyright Alliance* (2022)

that employs digital technology as an integral aspect of the artistic process and falls within the broader genre of new media art created using software or other electronic equipment (Bravic 2020). Similar to traditional fine art, digital art allows artists to express themselves through a variety of mediums and styles, from digital photography, computer graphics, and pixel art to more experimental mediums such as artificial intelligence-generated art and augmented reality art. Digital art is more than a digital representation of physical artwork, as it takes the same creative approaches and talents as traditional art. Regardless of the medium, the basic objective of art is to express the emotions of the artist. Traditional art consists of artworks created utilizing physical means, as opposed to digital artworks.

Traditional art evolved under the social conditions of the division between the body and the mind, in which the advantages of elite art are significantly greater than those of public art. These advantages are protected by the social hierarchy, but they have been enhanced by the strengthening of the copyright system (Du, Li, and Gao 2010). The original work of the artist is recognized as a valuable asset because traditional works of art emphasize originality and authority. Typically, the value of an artwork's copy can be lower as it is reliant on the quality of the copied artwork. Prices deteriorate as the number of copies increases. The works of digital art contrast starkly because neither the original nor the duplicate differs in quality. It is not only simple to repair errors, but also to determine their value based on the extent of their dissemination and involvement. This in a world where the act of digital circulation is equally the act of replication. Watermarks and other basic security measures can be quickly removed by a technically knowledgeable counterfeiter with access to a cloud storage service, making online sales of visual art particularly vulnerable to fraud (Brown 2022).

Housing, automobiles, and food all contribute to what economists call "rival goods" since their consumption inhibits the consumption of others. Consolidation in property relations and the belief that a price system provides the most efficient means of supplying such products characterize markets for them. However, 'non-rival' goods like: information, knowledge and cultural commodities do not prevent others from using, enjoying, or consuming them(Benkler 2006; Schwartz 2017). While media players, laptops, books, etc. may be rivals, the material itself does not prevent another person from enjoying the same concept, film, or piece of music. Similar to how the initial production costs of cultural commodities such as making a film, recording an album, or creating a work of digital art are expensive, the costs of reproduction through file formats or downloads are minimal. As a result, there is a need to apply strategies that "artificially" make these cultural goods scarce and limit their simple replication by raising prices and erecting new barriers to trade. The significance of copies, reproductions and derivative works is

amplified in digital environments, where it is simple to create exact digital reproductions of files, where the "original" work of art may change continuously, and where multiple authors can create an infinite number of derivative works. In context to the effects of artificial scarcity, digital environments present a formidable obstacle. Scarcity is a prerequisite for markets by more efficiently allocating scarce resources. There is no market for public goods since there is no shortage to be addressed. In order to create a market for works of authorship, copyright has to create artificial scarcity by granting exclusive reproduction rights to writers (Frye 2022). However, the art industry did not require copyright because "authenticity" created scarcity. Only the "original" artwork is authentic, hence the "original" artwork has value.

Copyright infractions are more likely to be uncovered in an electronic network environment, because all artists, not just the famous ones, have access to a wide audience for their work. Depending on the display or reproduction method, a single piece of data can produce numerous works that differ in size, colour, and media. It is extremely challenging to go through these logical contradictions and determine what creative art is in the age of computer simulations and virtual reality art. The actual pieces of art themselves might be original, but they might also mimic real objects and experiences like photographs. The creative value of computer simulations and virtual reality environments is predicated on their resemblance to the original, just like with pictures. Since it is possible to create exact copies of artwork, virtual interpretations of the original may be the essence of the creative process, and copies are needed for data transmission over electronic networks, copies or reproductions in the digital medium have the same commercial value as originals. Therefore, copyright legislation that safeguards the freedom to produce copies takes on additional relevance for digital works of art (Search 1999).

3.3 What are Non-Fungible Tokens?

Every time something is copied and distributed virtually, it becomes an exact replica of the original. As a result, there is a drive in the digital art world to find novel approaches to monetizing digital cultural objects. A "digital original" might be created using NFTs, making blockchain an ideal instrument for safeguarding the rights of artists and other creative professionals. As far as tokens go, they are not unique to blockchain technology. Digital transactions have long relied on tokens as a kind of security, most notably in the case of financial transactions. A token is a line of computer code that contains digital information, and the code states what the token represents. Tokens are digital assets that can represent any value that people agree on and are protected by cryptographic

protocols from a legal point of view (Aksoy and Uner 2021). A classic example of a fungible token is a payment token like Bitcoin or Ether. Token fungibility refers to the notion that a token's content is identical to that of other tokens that are also fungible (Kaulartz and Schmid 2021). As a result, fungible tokens can be used in place of, or as a substitute for, another asset of the same type. NFTs, on the other hand, are one-of-a-kind and cannot be replicated. The unique characteristic of NFTs that makes them difficult to comprehend is that they can be anything. It can symbolize tangible or digital artwork, a historic sports moment, music, films, papers, and so forth. Today, its most widespread application is in digital and physical artwork. Therefore, NFTs are better viewed as originality certifications. A comparison of the early days of the Internet to the present web3 craze uncovers surprising similarities and distinctions. The friction between copyright and digital habits appears to be back, albeit with a twist. Twenty years ago, the issue was whether exclusive rights could be reconciled with digital abundance and limitless copy ability; today, the question is whether copyright can be reconciled with the newly discovered digital scarcity (Bodó et al. 2022).

The reconciliation is attempted through NFTs written and stored in smart contracts. A smart contract is a computerized transaction protocol that implements the conditions of a contractual agreement (Szabo 1994). Sales and purchases of NFTs, as well as their terms and conditions, are ultimately governed by contract law. The contract's legal context is not derived from the term smart contract, which can be misleading; rather, it is offered for sale with a list of its terms and conditions, and some or all of these terms may be encoded into the smart contract. These contracts automate the execution of blockchain transactions when particular circumstances are met, i.e., without the parties to the transaction intervening (Giancaspro 2017). There can only be one owner of the token, and other people can only have copies of the same material, as a result of this method (Histed et al. 2021). Artworks' authentic provenance is thus safeguarded in a secure manner. The Ethereum blockchain's ERC-721[2] implementation of the NFT Standard ERC-721 brought the concept of NFTs to the attention of the blockchain world. In 'CryptoKitties,' the new protocol was introduced. It contained tokenized and for-sale virtual kittens. It didn't take long for the CryptoKitties market to account for a large portion of the Ethereum blockchain's transaction activity. For a creator to secure and defend their copyright in a genuine NFT transaction, they must typically rely on the construction and language of the contract. Contract law is crucial to the enforcement of copyright law for NFTs. This allows the artist to designate what rights, if any, are transferred with the purchase by contracting directly with the buyer instead of utilizing an intermediary.

[2]See Wackerow (2022) for detailed documentation of the ERC 271 standard.

3.4 The Intersection of NFTs and the Art Market

The art industry consists of artists, art dealers, collectors, public and private organizations, critics, consultants, and auction houses as major market participants in the historic practice described by (Bsteh 2021). Art markets can be further divided into primary, secondary, and illicit trade segments or segmented based on characteristics such as: geography, price range, storage and transit expenses, as well as significant transaction costs and a high degree of information asymmetry which is relevant to this article. NFTs and cryptocurrencies were intended as the realization of "the techno-libertarian fantasy of a decentralized system for capital control" (**Murray_2021**). The objective was to eliminate the intermediary between production and the consumer. In the case of art, for instance, non-fungible tokens eliminate the need for galleries, agents, and specialists to verify authenticity, while digital currencies eliminate the need for banks, credit card firms, and federal reserves to facilitate transactions (Belk, Humayun, and Brouard 2022). Primary market sales can be a persistent problem for visual artists since they typically occur before the value of their work has accrued (Whitaker 2021). Even if the buyer and seller have equal information about the future, they have difficulties appreciating value to the degree value can be recognized at all when they first enter into a transaction. This is called "symmetrical ignorance" (Caves 2003). This uncertainty about the future value of art has been addressed legislatively by resale royalties (Van Haaften-Schick 2018) or as proposed academically, through retained fractional equity in art (Whitaker and Kräussl 2020; Whitaker 2018). Creators typically retain a little portion of the value they generate with the first initial transaction (Malik et al. in press). These market dynamics make for a good use case of blockchain technology as private blockchain start-ups such as Verisart[3] are re-creating public title registries and handling provenance and authenticity studies that were carried out by museums, foundations, and galleries, respectively. In the art market and in particular the resale market, anonymity is a frequent practice, and the affixing of a resale certificate necessitates the foregoing of secrecy around the sale anonymity being widespread practice in the art market (Whitaker 2021). The key benefits of blockchain technology are transparency, anonymity, permanence, speed, and security. All of these promises appear to be of great appeal to the contemporary art market (Bsteh 2021). This is especially true for companies that have stringent privacy and security standards.

When artwork is kept and traded on the blockchain as an NFT, the record of ownership strengthens the evidentiary value of the blockchain network for copyright enforcement claims. Tokenized artwork, also known as a cryptocollectible, is inherently resistant

[3] See *Verisarts website* (2022) & *Artory's website.* (2022)

to theft or misuse because it can only be accessed via the original owner's private cryptographic key (Brown 2022). Users without the accompanying private key will not be able to see the asset, copy it into their own digital work, or show it publicly. To make a copy of the work in violation of the copyright of the original artist, one must have access to the work in the first place, and this additional layer of authorization makes that number of people much smaller.

3.5 Enforcing copyright through NFTs

3.5.1 Right Of First Sale Doctrine

While legal aspects of ownership with respect to tangible works of art fall under property law, it is a copyright law that governs intangible rights (Fisher 2019). Copyright is therefore the protection extended to the author of an original work. It provides exclusive rights to the use and distribution of the work and typically expires after a certain period of time. One of the restrictions of copyright ownership under U.S. copyright law is known as the right of first sale doctrine. 17 U.S.C. 109 which authorizes the resale or other disposition of tangible copies of copyrighted works. For example, a sale of an oil painting from a personal collection does not require authorization from the artist. With the first-sale doctrine, organizations and individuals can resell legally acquired copies of copyrighted information without risk of intellectual property owner infringement claims. The notion is essential for firms and individuals who resell things, such as used books. It serves as a defense against charges of copyright infringement.

In contrast to digital artwork, in 2001 the U.S. Copyright Office issued an opinion saying that a right-of-first sale could not exist because digital works are copies by definition. Examining a use case scenario, intriguing difficulties are raised under the first sale theory of copyright law when an NFT that does not comprise a digital file but merely a physical item is offered for sale. For instance, the attempt to sell an NFT of book excerpts. Given the file work is a digital creation, the ReDigi problem arises with the attempt to resale an original digital file when acquired by posting it online (Carroll 2022). Capitol Records, LLC v. ReDigi Inc in the 2018 case determined that the first sale theory does not apply to digital works since each time a digital item is transferred, a copy of that digital item is created somewhere. Congress held that, in the case of digital transfers, a proprietor is not exercising control over tangible property, and as a result, the proprietor's right to alienability could not be restricted (Lim 2022). New and old copies are indistinguishable in digital files, which would preclude perfect competition. Additionally, Congress stated that digital copies do not decay like physical

copies. Due to the fact that digital copies are easily reproducible and do not decay, some academics have determined that they cannot be considered competitor products. This infringes the exclusive right to produce copies under section 102, not the right to distribute. Contrary to the right of first sale doctrine for distribution rights, the copyright owner's continued reproduction right would apply to this type of transfer. Despite the fact that blockchain technology can relieve some of the difficulties regarding digital copies, such as provenance, the act of a copy being added to a blockchain ledger renders a right of first sale impossible (Moshayedi 2022).

When NFTs first gained popularity, the crypto community emphasized an additional issue of whether a purchaser of an NFT acquires exclusive rights to the underlying work. Instead, the author retains the same control over the copying and distribution of the creative work as before the NFT was issued. Thus, when an individual purchases an NFT of a protected work, the owners of the copyright retain the exclusive right. The artist retains the sole right to copy, develop derivative works, distribute copies, and publicly display the artwork, just as when the artwork is purchased physically. Generally, purchasing physical works confers the right to sell, distribute, and transfer the exact physical work to a future owner, in accordance with the time-honored "first sale doctrine." However, it is uncertain if the first sale doctrine protects an NFT purchaser and comparing a physical copy to a digital copy ignores the nature of NFT technology and its impact on market behavior.

3.5.2 Fair Use

The purpose of copyright law is to prevent unauthorized duplication, but it does not cover all uses of copyrighted works. One of the exceptions is "fair use," where some uses are permissible. The fair use exception allows the unlawful use of a copyrighted work for certain purposes, including criticism, commentary, news reporting, teaching, scholarship, and research (Carroll 2022). The fair use argument is a legal defense against copyright infringement accusations. In the absence of a determination of fair use, however, a person is liable for copyright infringement if they violate the exclusive rights of a copyright holder without permission.

Generative adversarial network (GANs) artwork is one type of NFT art that has gained in popularity. By training computer models to recognize commonalities among several photographs, they develop a machine-learning method that can generate such imagery. As a result, the final artworks produced by this method are dependent on both the initial training set and the artist's hand. As most laws stem from judicial rulings, the cost to artists can vary widely depending on whether a particular usage is considered

fair use or an infringement of copyright. The usage of GANs that have been trained on copyrighted works to produce new pieces of art is not always an infringement. There are two components to consider when evaluating the fair use of GAN-generated artwork. The first concern is if the photos used to train the GAN were stolen, and the second is whether the final product produced by the artist is similar to a previously existing piece. The commercial and transformational nature of the use will be crucial to the fair use examination in both circumstances.

3.5.3 Other Legal limitations of NFTs

Given the infancy of NFTs, not much is known about the market dynamics and regulatory environment. Furthermore, the analysis of the latter is made more difficult by the fact that it is still evolving. In the first place, there is the matter of how and where legal disputes over NFTs are settled. It is difficult to identify where a lawsuit would be brought and what legislation would apply because blockchain is anonymous or pseudonymous. On a public blockchain like Ethereum, everyone can observe how an NFT is formed and linked to the underlying right or asset. Although the NFT owner/wallet creator's address and associated metadata can be seen, matching them with the real-life owner or creator is not enough (Aksoy and Uner 2021).

Secondly, not everything about the NFT can be coded. For example, a vendor of an NFT cannot impose a contractual provision that bans customers from utilizing the underlying work of art for commercial purposes. Although smart contracts are self-enforcing, certain terms cannot be analyzed and therefore cannot be operated by the smart contract. To impose such an obligation on the buyer, the seller must employ traditional procedures like demand letters and litigation (Dimatteo and Poncibo 2019). Secondly, scholars have noted that all contracts, including smart contracts, are imperfect since it is impossible to anticipate every eventuality and negotiate every answer in advance (Rodrigues 2019). It is particularly apparent in the arts, where the difficulty of determining long-term value is challenging. In circumstances like the one with the Old Master painting, where the artwork has changed ownership numerous times in the past. Even if the information is kept on a blockchain, it is unlikely that it is reliable and free of misinformation, errors, or even fraud (Wierbicki and Rottermund 2019).

The paper by (Okonkwo 2021) explores the logical question of whether NFTs are protected by copyright. An online literary work is formed when the artist uploads a unit of data, such as a contract depiction of a painting, to the digital ledger. Whether or not the depiction is sufficient to constitute a literary piece is another question as usually the real artwork, whatever it is or where it is located, is linked, or embodied in some way. In

other words, whatever it is that's being exchanged is something that already exists. The objective here is to construct a non-fungible token, a trading card out of it, and profit from it. In Okonkwo's opinion, while the extremely novel concept of the NFT operational platform may have been subject to patent protection, little or no copyright is created. The right to reproduce, publish, perform, produce, and otherwise commercially exploit, offer for sale, hire, adapt, or otherwise distribute work is safeguarded by copyrights. Infringement occurs when a copyrighted work is exchanged as NFT by someone who is neither the copyright holder nor an authorized representative of the copyright holder. NFTs themselves are not intellectual property rights. Instead, it is a technique for commercializing intellectual property rights. The method does not violate copyright law as it is now understood; rather, it complements it. NFTs provide intellectual property rights holders' with an opportunity to explore and expand the commercialization of their intellectual property.

With regard to provenance, academics have cautioned that the verification of data prior to its publication on blockchain and its oracle remains a cause for concern over the validity of blockchain's authenticity (Caldarelli and Zardini 2020). On OpenSea, the largest NFT Marketplace at present admitted that 80% of NFTs created using the Shared Storefront smart contract tool produced were plagiarized works, fake collections, and spam (Gottsegen 2022). Once digital files or memes are in circulation, it is impossible to prevent one from enjoying a digital work, and this enjoyment by one person does not generally hamper enjoyment by another. This makes images non-excludable and non-rivalrous. Replicability and lack of digital scarcity of artworks engage market failure in the form of a public good in an increasingly digital age (Whitaker 2021). The main value of using blockchain technology is to provide a public registry list of copyrightable digital assets yet it does not stop another entity from registering a duplicate of an NFT asset on the same ledger. Blockchain technology cannot evaluate if a digital image or link leading to a file contains a copy. It also cannot assess if the owner of the copy has been given licensing or copyright access by the owner of the original file nor permission to mint as an NFT. However, all these functions are done by patent and trademark institutions with the difference of the register being centralized. Therefore, the value of whether NFTs can confer copyright or at least aid the courts in case law comes into question.

3.5.4 The role of NFT Marketplaces

In terms of copyright responsibility and infringement, the most significant tensions originate from the distribution of NFTs on online platform markets. From the perspective

of copyright law, the most relevant actions of platforms are their facilitation of the minting process and hosting of digital copies of tokenized works, both at the locations where the NFT points to and on the platform's front-end website for the purpose of operating the marketplace (Bodó et al. 2022). As the application of law strongly relies on precedent, early judicial rulings in the forthcoming wave of NFT-related litigation will have a disproportionately large effect. In the near future, a judge will need to decide certain fundamental questions about the legal status of NFTs that will have significant ramifications for the arts and commerce even on the metaverse. In the past, courts and lawmakers have recognized that the unlicensed transmission of a copyrighted work hinders the author's ability to make use of additional distribution channels (Ginsburg 2001). Congress gave copyright owners the freedom to choose whether or not to enter new markets in an effort to encourage authors to take part in new modes of exploitation and promote widespread distribution. For NFTs, courts will likely acknowledge that the ability of creators to disseminate their works in this new digital market is diminished when copyrighted works are distributed without authorization (Carroll 2022). This can be solved by lawmakers imposing partial regulatory requirements on NFT marketplaces that do not stifle the platform's adoption but bring standardization in the industry. These intermediaries assist the minting process, establish market regulations, the technological and legal frameworks for NFTs and the files or content to which they refer. According to the marketplaces' Terms and Conditions (T&Cs), they are responsible for policing the everyday operations of the market by enforcing any private ordering rules that may exist. These marketplace operators frequently intervene more substantially in these processes by promoting works on their properties, enforcing their own originality standards, providing template copyright licenses for the underlying work in the file the NFT points to (Bodó et al. 2022). Additionally, they detect copyfraud and policing minting, and deploying notice and action mechanisms to remove or disable access to content that is illegal or in violation of their terms of service.

The article by (Bodó et al. 2022)breaks down marketplaces into three categories namely:

1. Platforms that operate as open marketplaces for all minted NFTs - Permit anyone to mint or exchange NFTs (minted elsewhere). They are the eBays of the NFT marketplace and include OpenSea and Rarible which lead this market in terms of volume. These platforms impose the fewest restrictions on third-party-issued NFTs and unique NFT kinds. This transparency enables them to function on a greater scale because they appear to be driving the expansion of NFT markets.
2. Platforms that operate as collection-based marketplaces - Marketplaces centered around collections produce, curate, mint, and advertise niche NFT-based digital

collectibles. A few well-known digital collectibles have their own dedicated marketplaces: CryptoPunks, CryptoCats, and NBA TopShots. When it comes to content recognition, determining the terms of entry for interested parties in the marketplace, and articulating the community norms destined to govern the behavior of artists, rightsholders, users, buyers, and sellers, the uniqueness of these platforms lies in the a priori close control that they perform.

3. platforms that operate as curated marketplaces - The economic model of curated marketplaces is predicated on a high level of curatorial control over the entities that are granted permission to generate, mint, and trade NFTs through their platform. The websites SuperRare, Foundation, and Nifty Gateway are all examples of curated marketplaces. In contrast to collection-based marketplaces, curated marketplaces do not lay claim to monopoly status in the NFT development and sale processes. They instead have sway over who can create NFTs, distribute them, and sell them outright.

Category I platforms avoid checking user-provided copyright-relevant information, such as checks on originality, authenticity, and other rights required to engage in the NFT market. By minting an NFT or offering an NFT for sale on OpenSea[4], the user attests that they possess the essential rights to the underlying work of art. In the event of a dispute, the OpenSea marketplace commits to react to notices from rights' holders with takedowns of the content in question or other actions that are equivalent. In an interview, cofounder of OpenSea Alex Atallah mentioned that he manages the company's efforts to combat infringement on OpenSea's art marketplace by monitoring instances of infringement and banning accounts that sell counterfeit tokens proactively (Brown 2022).

Regarding collection-based marketplaces [category (ii)] mentioned in the NFT, the licensing of copyright-protected content is remarkably diverse. The first thing to note is that while open marketplaces strike a delicate balance between their large-scale operations and copyright liability risk, these specialized marketplaces are less prone to risk because the platform provider is either the rightsholder of the works associated with the transacted NFT or has strict control over the parties authorized to trade on it. Therefore, the copyright licenses displayed on these markets accurately depict the link between the rightsholder and the tokenized content. To be more explicit, where the rightsholder is the platform provider in issue, the copyright licensing will be incorporated into the marketplace's terms and conditions or by adding a reference to a specific license to the collection of tokenized works. When the rightsholder is assumed to be a marketplace-authorized content creator, the marketplaces establish in their terms and

[4] *OpenSea is the largest NFT platform.* (2022)

conditions that the NFT creator attests to being the rightsholder for the tokenized work. Category III has fewer chances of copyright infringement because the marketplaces display curated work but however can be exclusionary given that the platform owner has sway over listings.

The High Court explained in Osbourne v. Persons Unknown case mentioned that the "lex situs of a crypto asset is the place where the person or corporation that holds it is domiciled" in light of Ion Science Ltd v. Persons Unknown and others (unreported) [2020] (Comm). Ultimately, the court issued a restraining order against OpenSea's host, Ozone Networks, freezing the NFTs in those accounts, and Bankers Trust disclosed information "compelling [OpenSea] to divulge information regarding the two account holders now holding the NFTs" (Bhaghat 2022). Repeatedly in the recent past, highly skilled hackers have stolen high-profile NFTs by taking advantage of security vulnerabilities and lax practices. Unfortunately, hackers have been largely untraceable, and the stolen NFTs have not been recovered, because the NFT market is uncontrolled and decentralized (Hern 2022). This judgment could eliminate doubt regarding whether the attribute of NFTs, as code-based tokens, must be different from the item they represent (e.g., a digital work of art). The ruling of the High Court would also empower victims of NFT theft to obtain court injunctions against individuals whose cryptocurrency has been detected as containing a stolen NFT, as well as against the NFT marketplace on which the stolen asset is sold (Mattei 2022).

Upon examining the intricacies of copyright legislation application to the NFT Market, the impersonal, borderless, standardized, and automated regulatory solution offered by blockchain technology is difficult to reconcile with the hyper-fragmentation of copyright law in regards to, for example, territoriality, subject matter, exclusive rights, and context-based exceptions. Therefore, to reduce copyright infringement the marketplaces should collaborate in ensuring that they do not list duplicate NFTs to avoid double counting. The proposal is to develop a proprietary reverse image search engine that checks at scale prior to each listing and can search through existing databases, that checks at scale prior to each listing and can search through existing databases. This line of thinking is supported by the Artists Right Society (ARS)[5] in partnership with ADAGP, the 1st french visual artists' rights management organisation, on a project[6] for Automatic Image Recognition (AIR). AIR utilizes digital fingerprinting, a method that can recognize, extract, and filter huge amounts of data from photos that have been searched. Due to the complexity of the analysis required to discover infractions, it remains to be seen when automated approaches to compliance and enforcement will

[5] *Artists Right Society* (2022) & *ADAGP* (2022)
[6] See *The AIR Project* (2022) for more information.

be feasible. Existing technology, like as artificial intelligence, is likely to be enhanced and new technologies will be created to make automated tracking and deletion of illegal content more practical, despite the seemingly insurmountable obstacles that enforcement currently provides (Noh, Odenkirk, and Shionoiri 2022).

Marketplaces can also form an association that interacts with legislators to strengthen them as vehicles for commercializing IP for artists playing the role of provenance to aid law practitioners. There are likely to be more listings on marketplaces because digital artists are less likely to list their artwork if they are to bear the cost to enforce their property rights on marketplaces. The notion that secrecy is a socially expensive means of defending property rights is not unique to the art industry. The concept is a cornerstone of patent law, which encourages the inventor to publish his creation rather than keeping it a trade secret in exchange for the ability to restrict duplication for a period of years. The greater the security of property rights in works of art, the greater the likelihood that these pieces would circulate, thereby providing value to art enthusiasts, academics, other artists, and users of marketplaces.

3.6 Prevailing regulation of NFTs

In the United States, on the 13th of July 2022, the Uniform Laws Commission (ULC) and American Law Institute (ALI) accepted revisions aimed to modernize the law for the Uniform Commercial Code (UCC). The revisions primarily address transactions utilizing developing digital asset technologies, including virtual currencies, NFTs, and digital assets with embedded payment rights[7]. By establishing a new Article 12 (Controllable Electronic Records) and altering provisions of Article 9 (Secured Transactions) and other substantive articles, the proposed UCC modifications clarify the status of NFTs and other digital assets. The fundamental objective of the modifications is to develop new types of assets inside current property categories, with new methods for establishing ownership and control. Control is determined using a functional test that requires more than private key control and focuses on the ability to use the asset, the ability to stop others from using the item, and the ability to sell or otherwise transfer the asset to other people (Hinkes 2022). The revisions confer property status on NFTs and provide some stability to loans backed by NFTs, but make it clear that possession of the token does not equate to ownership of the files connected with the token.

In the United Kingdom, The Council presidency and the European Parliament reached a preliminary agreement on the markets in crypto-assets (MiCA) proposal on 30 June 2022, which covers issuers of unbacked crypto-assets, stablecoins wallets, etc and where

[7] *Amendments to the Uniform Commercial Code* (2022)

they are stored[8]. NFTs on the other hand are excluded from the scope unless they come under one of the existing crypto-asset categories. Within 18 months, the European Commission is entrusted with preparing a complete review and, if considered required, a precise, proportionate, and horizontal legislative proposal to create a framework for NFTs and manage the rising risks of this new market. The issue is that there are several distinct areas of law that are relevant to NFTs, the majority of which are national laws. The fields of contract law, property law, and tax law are only a few examples. NFTs can be viewed as securities or crypto-assets, which means they fall under the purview of national and EU rules, which can also implicate banking law[9]. Additionally, NFTs are related to anti-money-laundering legislation, which are mostly harmonized within the EU. Finally, NFTs have implications for copyright law and other forms of intellectual property protection. The underlying smart contract and other contractual framework linked to an NFT determines what the NFT is and what rights it provides. The issuing of crypto-assets as non-fungible tokens in a big series or collection, the Foundation[10] marketplace, is later indicated as an indicator of their fungibility. It is not possible to definitively label a crypto-asset as unique or non-fungible just by assigning it a unique identity. If a crypto-asset is unique and non-fungible, then the assets or rights it represents must also be special and non-transferable.

In the lack of EU-wide property law harmonization, the answer may vary according to the various national regimes. Due to the absence of physicality of the solely digital tokens, NFTs cannot be classified as property under Section 90 of the German Civil Code, according to German civil law. However, there is a debate regarding an analogous interpretation of Section 903 of the German Civil Code in the sense that NFTs are not comparable to data, which the German legislature opted not to classify as property because data can be replicated easily. In Osbourne v. Persons [2022] EWHC 1021 (Comm), the High Court of the United Kingdom recognized NFTs as "legal property." This case will likely have a substantial effect on future legal challenges about the legal status of NFTs. Two of the NFTs belonging to Lavinia Osbourne, the creator of Women in Blockchain Talks, were stolen from the Boss Beauties collection. By recognizing NFTs as property, the UK High Court matched this decision with AA v. Persons Unknown, Re Bitcoin, which addressed whether crypto assets might be the subject of a proprietary injunction. According to this judgement, there are four property principles: being definable, identifiable by third parties, capable of being assumed by third parties by virtue of their nature, and possessing some value.

Similar to personal property, NFTs can be purchased, sold, displayed, gifted, and

[8] See European Union (2022)
[9] See Garbers-von Boehm, Haag, and Gruber (2022)
[10] See *The Foundation* (2022) website.

destroyed. An academic proposal, however, suggests that the law has not kept up with the need for exclusive digital property. Specifically, the rules developed for the internet of the twenty-first century emphasized growing intellectual property licensing and online contracts to the point where customers are merely users and not proprietors of digital assets (Fairfield 2022). This "end of ownership" legal structure starkly contrasts with the aspirations of individuals who develop, purchase, trade, and invest in NFTs. Fairfield argues that since NFT transactions resemble purchases, the law governing sales of personal property should apply. The paper concludes by stating that NFTs will serve as a powerful illustration of digital personal property, a legal form of ownership. It serves as a foundation for others and allows the law to once again classify purchasers of scarce and valuable digital goods as actual owners as opposed to mere users.

Private agents' efforts such as that of an artist to eliminate uncertainty in their socioeconomic environment can lead to the development of property rights (Teraji 2008). For property rights to exist, each agent must have faith that others will not steal the beneficial result he or she has produced. Security must be so robust that it is not worthwhile to attack another member of the community. Most blockchain platforms function as communities and it is almost impossible for a malicious user to alter transactions on the platform without community members noticing. Thereby NFTs present themselves as an opportune vehicle to enhance the rights of artists. The most effective way to avoid an inefficient transaction is for the attacker to be deterred, rather than for the owner to suffer expenses of self-protection because the thief incurs expenditures to bring about a transfer that is not on average socially wealth-maximizing (Posner and Landes 1996). Furthermore, the higher the costs of self-protection, the lower the demand for art (because owning it will cost more), which in turn leads to less art being created, conserved, and discovered than under a legal system that entitles the owner to the recovery of his property from the attacker. Examining who benefits from an increase in value and who bears the costs of a decrease is a common legal method for establishing who actually owns a piece of property. Such is the case in NFTs because an artist becomes a secret owner of a portion of the NFT when they embed code tracking their share of price changes inside the token itself. Artists are better off with the advent of NFTs because of the capital flow into the art industry driven by NFTs, renewed interest in the arts as a whole, and the enabled ability to participate in secondary market sales cost-effectively. However, there is still a lack in reducing copyright infringement that is heightened in digital environments which is why this paper argues in chapter 3 for the NFT Marketplaces to play a larger role in enforcing creators' IP to invoke confidence in the market. When artists have to settle infringement cases in courts, this undermines the efforts of NFTs' impact to help artists.

3.7 Summary of Findings

In conclusion, this chapter has demonstrated that copyright legislation faces significant challenges in adapting to the digital transformations brought about by NFTs within the art market. As NFTs redefine the concept of ownership in art, both digital and physical, they prompt a revaluation of copyright laws that were originally designed for a less fluid, more tangible art marketplace. The unique properties of NFTs, such as their indivisibility and the permanence provided by blockchain technology, complicate the enforcement of these laws, raising questions about the adequacy of traditional copyright frameworks in a digital-first environment.

This analysis has uncovered that while digital technologies offer new ways to enforce copyright, they also introduce scenarios where the boundaries of legal protection become ambiguous. The potential of blockchain to track ownership and provenance could enhance the enforcement of copyright, yet the digital nature of NFTs allows for reproductions that challenge conventional legal interpretations of copyright infringement. A key finding from this exploration is the necessity for more robust and technologically adapted solutions to enforce copyright in the digital realm. The proposed development of a proprietary reverse image search engine represents a pivotal advancement in this direction. This technology, designed to check at scale and search through existing databases prior to each NFT listing, would significantly enhance the ability to detect and prevent copyright violations. By automating the verification of authenticity and originality, this tool could serve as a crucial mechanism in maintaining the integrity of the NFT market and protecting artists' copyright on a platform where digital files are easily replicated and shared.

Transitioning to the next chapter, the focus will shift from the legal frameworks to the economic aspects of NFTs, specifically exploring the question, "How is NFT pricing influenced by speculation and value?" This next phase of the analysis will examine the factors that contribute to the pricing dynamics of NFTs, assessing the balance between intrinsic value such as artistic merit and copyright authenticity and the speculative behaviors that often characterize digital and art markets. Understanding these pricing mechanisms is essential for comprehending the broader implications of NFTs on the art market and their potential as investment assets. This discussion will build on the copyright issues addressed in this chapter by linking the perceived value of NFTs, bolstered by technologies like the reverse image search engine, to their market valuation amid speculative trends.

4. Pricing of NFTs

4.1 Introduction

In this chapter, we explore the dual nature of NFTs as both speculative assets and valuable cultural commodities within the art market. This dual role significantly influences their pricing mechanisms. As alternative investments, artworks, including art NFTs, often carry emotional dividends that provide subjective value to collectors. However, the financialization of art as demonstrated by the growing trend of using artworks as collateral for loans or as parts of complex financial instruments introduces a speculative dimension to its valuation.

This chapter explores the complex dynamics that influence the pricing of NFTs in the art market, focusing on the roles of speculation and intrinsic value. As NFTs gain prominence as a distinct asset class, they challenge traditional valuation models with their unique characteristics. Unlike typical investments, the value of NFTs does not solely hinge on conventional market dynamics; instead, it is also shaped by cultural significance, rarity, and the digital uniqueness of each token. In this analysis, we examine how speculative behaviors, driven by media exposure and social trends, intersect with fundamental valuations to shape the NFT market. We investigate various economic models and empirical studies that seek to understand and predict NFT pricing behaviors, illuminating the nuanced interplay between market speculation and the inherent value of digital art. This section not only assesses the economic impact of NFTs but also considers the broader cultural and technological implications of their rise in the art world.

4.2 Art as an alternative investment vehicle

Due to art's dual character as a consumption and investment product, financial considerations are likely to be significant for the majority of collectors, including those who purchase art primarily for their own enjoyment. The value of artwork deviates significantly from those of traditional investment options. In the model used by (HECParis

2019), there is an account for the different types of payouts and the higher transaction costs associated with art when developing a model. To begin, the dividend paid by a work of art is not monetary but rather emotional. This means its worth is subjective, rather than objective, like the returns received from investing in stocks or the rent collected on a rental property. For another, there is a substantial overhead associated with the exchange of artwork. In the case of artworks with a price of less than $200,000, auction houses can take a commission of up to 25% in the US. For more expensive works of art, the percentage drops to approximately 12 percent. Since (Baumol 1986) implies that a specific stock's inventory consists of a huge number of identical securities, they are all ideal substitutes for one another. In contrast, the value of two similar works of art may vary significantly if they are made by different artists or sold on different marketplaces. Accordingly, alternative asset classes are also referred to as heterogeneous products or imperfect substitutes (Stein 1977).

Artistic goods are increasingly being modeled for their worth as financial assets and derivatives rather than in the context of an economy focused on the value of the product as a scarce cultural commodity. According to (Taylor 2011), when art becomes the currency of exchange for hedge funds and private equity funds, it is traded like any other financial asset, and so ceases to be merely a commodity to be bought and sold. Although art has long been used as collateral for loans and as illiquid assets, there has recently been a movement to increase access to liquid capital for artworks through the introduction of new financial instruments and services like art-backed loans (Deloitte and ArtTactic 2017). Blockchain business models for digital art raise ontological questions about the status of the original work in relation to replication, as discussed by (Zeilinger 2016) and (Lotti 2016). However, they also bring to light major shifts in IP protection, the role of scarcity in cultural economies, and the increasing fuzziness between capital, assets, and intangible cultural products. In addition to open data, velocity is another characteristic of crypto art that distinguishes it from traditional art. In crypto art, transactions can be instantaneous: an artist creates a new piece or accepts a collector's bid, a collector bids on an artwork or purchases it outright, and two artists or collectors exchange the associated non-fungible tokens. The crypto art system is a real-time stream of events that more closely resembles financial trading than conventional art.

During a qualitative interview, respondents mentioned that a drawback of trading and collecting NFT art is that the primary trading currency is Ether (ETH) (Bsteh 2021). Ethereum's value is said to be fluctuating because of its novelty, and its use makes payments more complicated for newcomers and pricing accurate. To mitigate price volatility, using a stablecoin such as USDC as the trading currency can reduce the volatility. Another point to note is that private keys to participants' wallets could be lost

if servers storing artwork are damaged or not future-proofed. Typically, the ERC721 smart contract does not keep the digital artwork on the blockchain. In fact, it may cost as much as $4 million to store 1 GB of digital art in its entirety on the Ethereum Blockchain (Omaar 2017). The critical security of blockchains necessitates a constraint on data recording velocity, which makes storage costly. Therefore, the ERC721[1] contract only stores an external URL where the digital art is saved or a unique checksum such as SHA-1 of the pixel representation of the digital art. The reliance on external URL links might be a source of potential risk if the link is broken or compromised. The ERC721 contract's checksum for digital art gives higher trustworthiness. One may compare the checksum recorded in the NFT with the checksum of a copy of the digital artwork saved centrally or in any distributed file system, such as InterPlanetary File System (IPFS). This offers some protection against a hijacker who claims ownership of digital artwork.

The worth of an NFT is established by the market's estimation of its potential use, which is influenced by the NFT's perceived connection to its maker and the quality of the marketing surrounding it. Additionally, NFTs are sold on a more irregular basis than corporate stocks or cryptocurrency exchanges. An NFT's ownership has changed multiple times over the course of its sale history, which spans multiple time periods. Since the next buyer's willingness to pay for an NFT depends on their present opinion of the NFT, the price at which an NFT is sold is not indicative of its true value. For example, In March 2021, Sina Estavi made waves when he paid $2.9 million for an NFT of Twitter's former CEO Jack Dorsey's first tweet. However, his effort to resell it has failed, since the highest bid as of April 2022 was only $9,968 (Winters 2022).In another study by (Fridgen et al. 2023), the findings indicate that NFTs are predominantly speculative assets, with their price and probability of sale being significantly influenced by the floor and the most recent sales prices, regardless of any underlying value. The study centers on the comprehensive NFT market, examining each art collection and transaction conducted on Ethereum. The sample consists of 860,067 art non-fungible tokens (NFTs) that have been implemented on the Ethereum blockchain and have experienced a total of 317,950 transactions

The study by (Kapoor et al. 2022) examines the proliferation of NFTs, profiles the Twitter users who spread the word about NFT assets and evaluates how various Twitter functions affect the spread of NFTs. Specifically, they attempt to quantify the value of the NFT and determine if the size of its Twitter following has any bearing on its value. For OpenSea, Twitter accounts for more than 70% of all social media traffic. In conclusion, tracking social media reach demonstrates how the expansion of NFTs

[1]The Ethereum Request for Comments (ERC) 721 is a data standard for creating non-fungible tokens. Each token is unique and cannot be divided or directly exchanged for another ERC-721 token *ERC721* (2022)

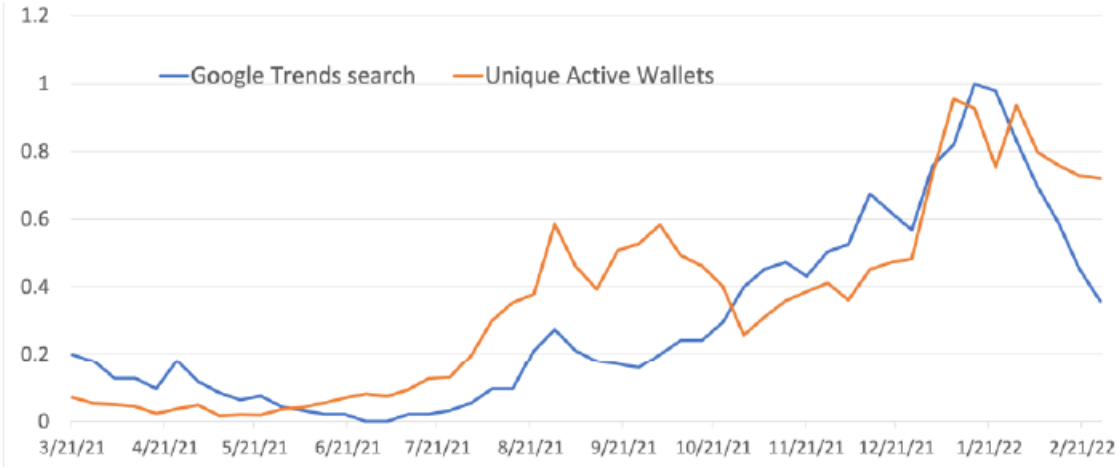

Figure 4.1: An illustration of the relationship between the number of Google searches for "NFT" and the number of unique active Ethereum wallets between March 2021 and March 2022 Source: (R. Kräussl and Tugnetti 2022). The two measurements have been normalized to unity.

value is affected. The models used to forecast asset value find that the number of Twitter features mentioned and the characteristic of a user's username has a substantial impact on asset value. In contrast, using data from the Foundation NFT Marketplace, the findings reveal that artist success is dependent on both platform and external visibility on Twitter, although external measures of the following have a smaller impact than internal measures of the on-platform following (Vasan, Janosov, and Barabási 2022). Media coverage to the industry as a whole has generated activity in the industry especially during 2021 as depicted in figure 4.1.

There are considerations of factors outside price that can motivate new users. How can a "rare digital photograph of a bored ape" be valuable if it is possible to copy and save the underlying jpeg file? Or why would a unique item have value in a market that is illiquid? Fundamentally, the argument asserts that intrinsic value is irrational in NFT markets because they lack widely accepted use cases. They are non-fungible and require sufficient user action to set the initial price, much less ongoing price movement when market liquidity is not assured. It is essential to recognize that not everyone perceives worth in terms of money. The art on a wall may be a reproduction of a Pablo Picasso painting to fill space, but many people desire an original piece that they will likely never be able to sell. Culturally, they draw value from a different system, and in contrast to profit maximization, the majority of individuals make irrational rather than rational choices. Its legitimacy is enhanced by the fact that its worth is relative to the group of individuals who are interested in it and is reflected externally through its price in a manner that can be interpreted by a variety of audiences. Veblen himself did not support the concept that the price of an object had a direct effect on its utility, nor did he believe

that people deliberately overpay for the mere joy of being overcharged (Bagwell and Bernheim 1996). Instead, he believed that people desire status and that tangible displays of riches improve prestige. The value of a non-fungible token fluctuates based on a number of variables, including its content, its utility, and its rarity. The inherent value of an NFT is mostly determined by its kind. Certain NFTs will have greater intrinsic worth for individuals than others, hence their intrinsic value is subjective. An opposing perspective would be that the value of the NFT is extrinsic, not intrinsic. The value of a (BAYC) NFT is not derived from its artwork. It stems from: the execution of the team, the historical significance of the project, the opportunity to leverage and store value for ETH, and the influence and network benefits of holding the NFT among other factors.

4.3 The NFT asset bubble

A bubble can be loosely defined as a period of rapid price inflation in one asset or a group of assets, wherein the initial price increase leads to expectations of further price increases and attracts new buyers typically speculators more concerned with making a profit from trading in the asset than actually using it or earning money from it (Eatwell, Milgate, and Newman 1987). According to this concept, investors who acquire with the intention of selling to other investors at a higher price (known as "momentum" investors) are fueling an unjustifiable (i.e., unrelated to "earnings capacity") price increase. By associating 'fundamentals' with shifts in asset prices, economists add nuance to the definition of a bubble (Siegel, 2003). The fundamentals of an asset are the underlying economic elements, such as cash flows and discount rates, that collectively define its market value. The challenge, though, lies in ascertaining an artwork's true worth (Kräussl, Lehnert, & Martelin, 2016). The current price movement is often used to determine whether or not a bubble exists. This is not a good strategy for an asset with a long expected lifespan, like a work of art, whose current worth is contingent on its expected growth in value over many years in the future.

In a study to ascertain the NFT as an asset bubble, significant highlights from the paper by (Wang, et al., 2022) were the following: NFTs' $2.5 billion sales volume in 2021-July-07; Stephen Curry's $180k NFTs purchase 2021-Aug-28; NFTs' 315% increase month-on-month from 2021-Sep-09; NFTs' $24.4 million new record selling price 2021-Sep-10. Bored Ape Yacht Club had 58,118% ROI in 2021-Oct-13. These market trends in the NFT market stimulate substantial demand for NFT assets, resulting in an ongoing price increase for NFTs. When NFT owners sell significant amounts of NFTs to engage in arbitrage, this inflates the price bubble of NFT assets. As shown in figure 4.2, the NFT market value increased significantly from 2019 to 2021, reaching a peak of 16

billion USD in 2021. The market valuation of NFT projects surged 4,440 percent over a year. Concurring with Kapoor's (2022) findings, (Wanga et al. 2022) states that the NFT markets are mostly driven by herding behavior and are media-induced. Moreover, when the percentage of bubble days in the Decentralized Finance (DeFi) and NFT markets is compared to that in the cryptocurrency markets, findings show that the DeFi and NFT markets contain more price-explosive bubbles than the cryptocurrency markets, indicating the DeFi and NFT markets' significant price inefficiency. Their findings demonstrate that NFT assets are comparable to rare and valuable artworks in terms of their trading frequency. For this reason, some NFT assets may only enjoy widespread acclaim in certain subcultures. When this occurs, NFT asset trades are more likely to see sudden, large price spikes. Additionally, news-driven transactions NFTs are propelled by unique behavioral economic factors including media publicity and NFT-specific herding. The same line of results is drawn by (Maouchi, Charfeddine, and Montasser 2022) DeFi and NFTs are less susceptible to bubbles than pure cryptocurrencies. Their results indicate that the average magnitude, as assessed by the price increase each bubble day, is greater than that of pure cryptocurrencies. The empirical findings indicate that while DeFi and NFTs had bubbles that overlapped the main cryptocurrencies, bubbles exclusive to DeFi marketplaces were found in the summer of 2020. In addition, bubble characteristics vary between DeFi and NFTs on the one hand and pure cryptocurrencies on the other. This conclusion implies that the pricing dynamics of DeFi and NFTs differ from those of pure cryptocurrencies.

Hype plays a crucial role in driving the NFT ecosystem and has a direct impact on trade (Sakar 2022). A considerable amount of enthusiasm surrounding NFTs stems from the fear of losing out (Financial Conduct Authority 2022 on anticipated future benefits, such as increasing value or utility. As a result of the ambiguity brought about by a lack of in-depth understanding and the significant correlation with the cryptocurrency market, as well as the NFT market's collapse, numerous commentators have cast doubt on the potential of NFTs in the art space (Deventer, Amaral, and Pirnay 2024). The concept that NFTs and cryptocurrencies inherently provide value due to their authenticity and scarcity features is not consistently validated in certain initiatives. For example, (Serada, Sihvonen, and Harviainen 2020) demonstrated that in the CrypoKitties game, which utilizes NFTs, the most scarce game tokens saw rapid devaluation as a result of insufficient player participation. Furthermore, the lack of success observed in certain endeavors, whereby non-fungible tokens are exclusively issued for distinct assets, implies that these attributes alone are inadequate for the initiative to effectively provide substantial value. They have hypothesized that their exponential growth was due to excessive speculation.

The findings presented in the papers of this section have a limitation on the restricted

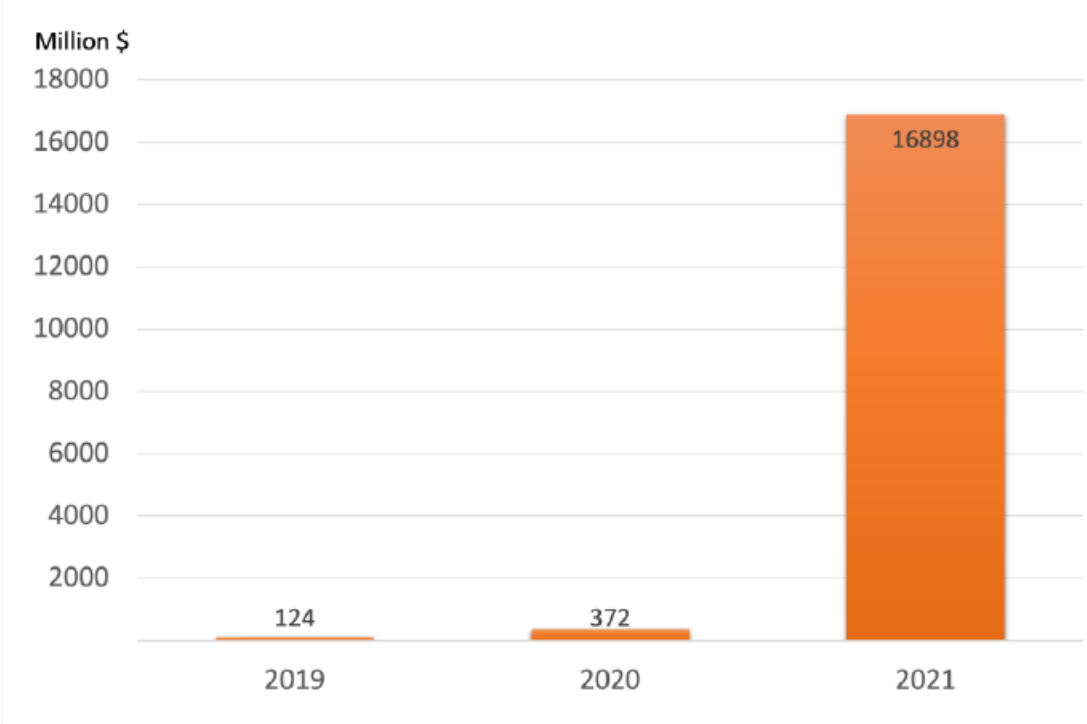

Figure 4.2: NFT Market Capitalization: This chart illustrates the development of the NFT market capitalisation in millions of dollars from 2019 to 2021 Source: (R. Kräussl and Tugnetti 2022). The information was collected from the NonFungible database at nonfungible.com/market-tracker on 10 March 2022 .

data set range that is available of NFT market data given its nascent nature. Most studies pertaining to NFTs as an asset consider the time-series sales, volume, trading and price changes of individual NFT projects or indices which capture the extrinsic value. It is much more difficult to capture the intrinsic value of pricing NFTs assets. This is an important question to consider if the underlying art value or project has a bearing on a bubble or herding trend. However, in Chapter 5, this thesis presents findings related to a crypto art artist's success and sales of artwork based on the appraisal of collectors. Separately, the studies in this section collate NFT datasets but there are different categories namely: Art, Gaming, Utility, Collectible, Metaverse & Other/Miscellaneous (i.e real estate) which are discussed further in chapter 5. Future studies can investigate the same behavior between the subsets of the NFT market.

4.4 The Veblen effect

The proliferation of the Internet has made it possible for everyone, with or without the consent of data creators, to access an infinite amount of digital media. Since content creators' work can be duplicated and shared online without their knowledge or

compensation, they have always been concerned about the internet's seemingly endless supply of data and the methods through which it is disseminated. A good's value is grounded in the economic principle that scarcity confers a benefit. The real-world manifestation of scarcity, as exemplified by precious metals, is that of increasing value as scarcity increases. By imposing restrictions on the conditions of digital material ownership, NFTs create a sense of scarcity that contributes significantly to their appeal and craze. While NFTs solve the problem of scarcity, it does not necessarily generate demand. Although numerous expensive NFTs have garnered widespread attention, the value of the technology is not determined by its price or the potential profit that can be made from a popular NFT. As with any artwork, the value of each NFT is derived differently by the artist and the consumer.

Torsten Veblen (1899) discovered a phenomenon in which the price elasticity of demand was tested by certain sorts of commodities whose demand, and hence price, increased according to their desirability. These came to be known as Veblen goods, a category of conspicuous objects for the purpose of advertising wealth and so gaining a higher social position (Bagwell and Bernheim 1996). Wealthy collectors love objects such as exquisite art, fashionable clothing, rare wines, and expensive automobiles for their appeal as a status symbol and hence seek them out. Non-fungible tokens are the first digital Veblen products in the world (Disparte 2021). Art is exemplary of a Veblen good. Possession of fine art is regarded as a mark of distinction. It demonstrates a particular degree of affluence and knowledge to be able to place works costing millions of dollars on walls, therefore it is not surprising that NFT digital art is consistent with this effect. The rarity of possessing a one-of-a-kind NFT is a major factor in the high cost of the items. With a Veblen good, total demand decreases rather than increases as prices fall. In the example of Weird whales, Benyamin Ahmed, a 12-year-old programmer, shared his story of launching his own NFT project. Nearly all 3,350 computer-generated "Weird Whales" were purchased by his touching backstory. Hours after being sold for 0.033 ETH (approximately $66 at the time), these pixelated whale images fetched 3 ETH approximately $6,000 (Schmalfeld 2021). NFT influencers promoted this venture as the next great NFT to have as more people joined. Meanwhile, one user who googled "pixel whale" discovered that the project's artwork appeared to be an exact copy from another, using a pixel image that was four years old as the basis for all the Weird Whale photographs. Whether or not the Weird Whale project is IP theft is still unclear. Either the original artist made the underlying image available for public use, or Benyamin Ahmed was granted permission to use it. However, once news of the possible IP theft spread, investors started selling their whales at a loss, and interest in the enterprise quickly waned. In this example, the actual collection of the NFT project didn't change

but the perceived status in owning a piece did. The Veblen effect is comparable to other conceptual anomalies in microeconomics, such as the snob effect, which happens when buyers demand luxury things based on their exclusivity, and the bandwagon effect, in which consumers acquire a product because it appears to be popular. This is an area of digital economics in that NFTs can be studied further.

Buyers of modern art have a basic uncertainty problem when it comes to price, as it is hard to establish what constitutes excellence and more difficult to predict how a particular piece of art will perform as an investment. To complement the market, the use of curators by NFT marketplaces can perform the intrinsic value at periodic intervals for leading collections of the Art NFT submarket. This thesis proposes manual art evaluation despite the fact that it is slow, costly, and restricted by the number of human experts, given that it is currently more accurate than machine learning models in crafting estimates (Bailey 2020). Machine learning may not be as precise as humans, but it can improve efficiency, throughput, and frequency of estimates. All artworks, on and off the market, might be routinely valued automatically using machine learning, rather than just those whose prices are being estimated for an upcoming auction. In the real estate industry, organizations such as Zillow, Redfin, and Trulia have already adopted the automation method. In order to accomplish this, Sotheby's has been experimenting with machine learning to price all previous lots and establish an automated end-to-end sales procedure (Bailey 2020).

In contrast to fungible equities that move in large volumes, each artwork is unique and distinct, and works might spend decades between sales, making it difficult to establish any logical pattern or change in value. Following the notion that estimating art value should be driven by visual analysis, convolutional neural networks poorly perform in predicting the auction price of art on their own in Bailey's (2022) study. The performance of models based on numerical and textual data is vastly superior to those based solely on photographs. The results indicate that access to prestigious institutions has a substantial impact on the career trajectory of an artist and has a significant influence in forecasting the sale price of their work. It is worth noting that Bailey's (2022) study did not include NFT trades whereas in the findings of (Kong and T. Lin 2021), the hedonic regression model indicates intrinsic characteristics. It is not an appraisal method but finds a pattern for predicting the likelihood of high prices in the CrytoPunk collection. For example, the property "beanie," increases the starting price by five times, whereas tokens with undesirable traits are sold at discounts (e.g., attributes such as "pilot helmet" and "tiara") as shown in Table A.1. By examining the time frame spanning June 2018 to May 2021, (Schaar and Kampakis 2022) come to very similar conclusions. The strong explanatory power of over 95 percent is found when the price variation of the CryptoPunks collection

is explained in terms of the CryptoPunks type (such as "alien" or "zombie") and the quantity and sort of attributes. However, as with the scalability of manual appraisal, these hedonic regression models are specific to the collectible dataset and would thereby not be scalable.

Experts amass distinctive industrial expertise and offer implicit assurances regarding the quality of the items. They play a vital role in markets by serving as certification organizations. Specialization and economies of scale enhance the efficiency of collecting and processing information. Consequently, specialists generate value that can be monetized at a higher price. The additional value is intangible and hence hard to measure. As blockchain technology and metaverse environments evolve, new profiles of intermediaries, such as NFT-specialized managers or agents, may emerge to assist artists and buyers in the crypto-art market (Radermecker and Ginsburgh 2023). Future research should focus on the shifting profiles of traditional and novel intermediaries in the market for NFT-secured art. The utilization of blockchain technology for more transparent and standardized contract terms can aid in regulating the speculative tendencies of the market. Implementing standardized smart contracts that include detailed metadata about the artwork, its provenance, and copyright information can ensure more consistent and reliable valuation across different platforms. Curators are transforming from traditional gatekeepers of physical art to cultural researchers and producers in the digital and NFT art spaces (Ghidini 2019). They engage in curatorial projects that reflect and adapt to the shifting paradigms of art in the digital age, focusing on the cultural, political, and economic implications of digital art within the internet ecosystem The intersection of NFTs with social media has transformed these platforms into virtual galleries that amplify artists' visibility and facilitate global engagement, highlighting the curator's role in these dynamics. Curators in the NFT space are instrumental in promoting and ensuring the quality of digital art collections by leveraging social media to enhance the visibility and understanding of NFTs (Mehr and Shahim 2023).

However, curatorship also poses significant challenges that can further asymmetrical issues in the art world, necessitating careful consideration and intervention to ensure equitable access and representation. Information asymmetry is a significant cause of market frictions (Pavan and Vives 2015. It refers to a scenario when one party involved in a transaction possesses superior knowledge about the worth of a product, leading to an imbalance of power. This situation arises when information is not readily accessible to all parties involved. The asymmetry in the transaction will disrupt the market for the specific product, since both parties are cognizant of their respective positions. Information asymmetries appear to persist even with large increases in freely available information and a smaller perceived distance between trading partners as a result of

advances in technology (Gertsberg 2019). What testifies this is the continued reliance on intermediaries as experts who step in and lower the costs associated with information asymmetries across a large variety of industries and products. While technology may facilitate access to information, this development is counterbalanced with increases in complexity making valuation more difficult.

The majority of economists concur that improved market liquidity results from increased market transparency. This will ensure that prices are not just driven by the activity of high-value sales, social media influence & herding behavior. The aesthetic reputation of a piece or an artist is established through an intersubjective process of appraisal and conferral of reputation by specialists in the art field, including gallery owners, curators, critics, art dealers, journalists, and collectors (Beckert and Rossel 2013). The quality signals emanating from the art industry enable consumers to evaluate the monetary worth of art objects. These are experts who can position themselves at the crossroads of art and technology and, most crucially, communicate their findings effectively. Specifically, art experts must confront the: volume, velocity, variety, and strong linkages to the currency of blockchain art. In other words, art experts increase visibility, promote common recognition, and stimulate debate in the arts sector; in blockchain art, they amplify the impact of particular works on generic spectators and introduce them to this new genre, thus promoting their cultural return. Curators contribute to the temporary suspension of the sheer volume and monetization of art; by disseminating art-mined information, they help give each artwork a spotlight, interact with viewers, and ultimately demonstrate its cultural significance in the digital environment (Franceschet and Braidotti n.d.). Curatorial perspectives may appear to be at odds with the decentralized nature of the crypto community, but art-mined information helps create a context for art to be enjoyed and understood by the audience, which is crucial for meaningful engagement with the arts and culture, frequently resulting in both an economic and cultural reward. This mitigates the potential major losses that uninformed investors make when purchasing NFTs in the hopes of capital gains. Once the market stabilizes and reflects the true market value of the industry, the use of NFTs in enforcing intellectual property rights will become more apparent as the noise will have been cleared. Further research needs to be done to investigate what percentage of the market is driven by use cases versus speculation. This can be answered through market data and human-centered research.

In contrast to human curatorship, the study conducted by (Kong and T. Lin 2021) and Schaar and Kampakis (2022) examines the collection of CryptoPunks and using hedonic regression models to ascertain the significant influence of rarity on their pricing. In a market characterized by a significant surplus of demand, investors see non-fungible

tokens with unique features as being less abundant and hence, commanding higher prices. However, according to (Kireyev and R. Lin 2021), there is a negative correlation between the price of CryptoKitties NFTs and the quantity of NFTs produced. The authors contend that the hedonic regression methodology is not the most effective way for estimating the pricing of NFTs. They assert that models like the gradient boosting machine (GBM) are preferable due to their ability to effectively address any selection bias. (Horky, Rachel, and Fidrmuc 2022) establish a strong correlation between the price of NFTs and the complexity of their format, such as whether they are stored in a.mp4 or.jpeg file, as well as the market capitalization of the collection. This correlation is demonstrated using a combination of hedonic regression and random forests. Upon examining several collections, (Nadini et al. 2021) see a robust link between prices in the secondary market and the primary market for each NFT. They further argue that the visual characteristics of NFTs serve as reliable indicators of their price. (Oh, Rosen, and Zhang 2022) suggest that seasoned investors consistently surpass inexperienced investors by an average of 10% on each transaction. This is due to the fact that NFT collections acquired by experienced investors are sold out more frequently and rapidly in primary markets, and also experience greater price appreciation in secondary markets. The success of experienced investors suggests that there is an identifiable underlying value to be observed from NFTs by the eye that is able to understand the peculiarities of digital art.

Combining curatorship with the implementation of standardized smart contracts that include detailed metadata about the artwork, its provenance, and copyright information can significantly enhance valuation consistency and reliability across different platforms. Curators bring expert judgment and cultural context to digital art, ensuring the quality and authenticity of the pieces. When their expertise is augmented by smart contracts, the metadata can provide a transparent and immutable record that aids in assessing the artwork's value, reducing discrepancies in valuation. Furthermore, integrating machine learning into this framework can complement human efforts by increasing the efficiency, throughput, and frequency of processing and analyzing large datasets of artwork information. While machine learning may not match the nuanced understanding of human experts, its ability to handle vast amounts of data swiftly can streamline operations and support curators by providing preliminary analyses that they can refine. This hybrid approach harnesses the strengths of both human insight and algorithmic processing, potentially leading to a more robust and dynamic NFT art market. This collaborative model not only enhances market efficiency but also helps in maintaining a fair and equitable trading environment by minimizing information asymmetry and ensuring that all parties have access to reliable and comprehensive data.

4.5 Summary of Findings

Chapter 4 explores the dual nature of Non-Fungible Tokens (NFTs) within the art market, highlighting their roles as speculative assets and valuable cultural commodities. It addresses the complex dynamics influencing NFT pricing, emphasizing the interplay between speculative behaviors and intrinsic value assessments. The chapter delves into how NFTs, as alternative investments, carry both emotional dividends for collectors and financial speculation opportunities due to their uniqueness and digital rarity. Various economic models and empirical studies were discussed to illuminate how NFT pricing mechanisms are distinct from traditional investments, shaped significantly by media exposure, social trends, and the cultural significance of the digital art pieces.

The analysis in this chapter shows that while NFTs introduce innovative avenues for artists to gain visibility and monetize their works, they also present challenges due to the speculative nature of their market. This speculation often leads to price volatility and challenges in ascertaining the true economic value of digital artworks, making the market susceptible to bubbles as seen in other speculative markets. To address the complexities identified in the valuation and market behavior of NFTs, several solutions are proposed in Chapter 4:

- Implementation of Standardized Valuation Models bring consistency and reduce speculation. The recommendation is for the development and adoption of standardized valuation frameworks that consider both the intrinsic artistic value and the speculative elements of NFTs. These models could help stabilize the market and provide more realistic pricing guidelines.
- Machine learning models when employed to analyze vast datasets of NFT transactions and market trends, can provide more assessments of intrinsic values based on historical data and predictive analytics. This technological approach helps to identify underlying patterns and factors that might not be immediately apparent through human analysis alone. The quality and availability of data also impact the performance of ML models. Inconsistent data about sales, incomplete metadata on NFTs, and lack of standardized reporting across platforms can lead to inaccuracies in model outputs.
- Development of Curatorial Practices in NFT Marketplacesn could help in assessing the artistic value of NFTs. Curators could provide expertise in the digital art domain, ensuring that artworks sold as NFTs meet certain artistic standards and are not merely speculative tokens.

Building on the findings from Chapter 4, the next chapter, "How are artists faring in the era of NFTs compared to before their advent?" directly addresses the main research

question by evaluating the actual impact of NFTs on artists' economic and creative environments. This chapter will assess whether NFTs have substantively benefited artists by providing a sustainable source of income and reducing barriers to market entry, as theoretically suggested by their ability to bypass traditional art market gatekeepers and directly connect with collectors.

Furthermore, it will explore whether the advent of NFTs has led to a democratization of art sales, allowing more artists to thrive, or if it has perpetuated existing disparities by favoring already popular artists due to the network effects and speculative dynamics discussed in Chapter 4. This analysis will provide a nuanced view of the NFT impact, contrasting the theoretical benefits and the practical challenges faced by artists in this evolving digital landscape. By examining how artists navigate these new market conditions—balancing creative expression with the economic realities of the NFT marketplace—the chapter will offer insights into the broader implications of NFTs on the art community and contribute to understanding their role in the future of digital and traditional art markets.

5. NFTs' impact on the Art Market

5.1 Introduction

Chapter 5 delves into the profound transformation instigated by Non-Fungible Tokens within the art market, a domain traditionally governed by a complex array of gatekeepers such as galleries, museums, and critics. These traditional intermediaries have fostered exclusive networks that often determine the trajectory of artistic careers and art valuation. However, the advent of NFTs and the emergence of crypto art have introduced a paradigm shift, creating a more transparent and accessible marketplace for artists and collectors alike. This chapter aims to explore how NFTs have democratized the art market, breaking down the barriers imposed by traditional gatekeepers and facilitating direct interactions between artists and collectors. The digital nature of NFTs allows for transactions and the provenance of artworks to be recorded transparently on the blockchain, providing an open-access ledger that anyone can verify. This shift not only makes the art market more accessible but also allows for a more empirical analysis of market dynamics and the network of relationships within it.

Moreover, the chapter will examine how these changes have affected artists' careers and the overall dynamics of the art market. Key to this analysis is the role of personal connections in the success of artists in the NFT space, as highlighted by recent studies which suggest that success in the NFT art market might replicate familiar patterns seen in the traditional art world, where established relationships often dictate market success. The potential for NFTs to alter these dynamics lies in their ability to bypass traditional channels, offering new artists a platform to gain recognition and build direct relationships with collectors. In addressing these transformative impacts, Chapter 5 will critically assess whether NFTs have truly leveled the playing field for artists or simply replicated existing power structures under a new guise. By exploring these themes, the chapter seeks to provide a comprehensive understanding of the NFTs' impact on the art market, exploring both the opportunities and challenges that this new digital frontier presents.

The art world is ruled by a combination of gatekeepers and informal networks that rely on insider knowledge (Vasan, Janosov, and Barabási 2022). The development of

the art ecosystem is propelled by unrecognized ties between artists, galleries, museums, collectors, and curators (Harris 2013). The rise of crypto art and the NFT-based digital marketplace surrounding it gives an unparalleled opportunity to explore the dynamics that govern the formation of artistic networks. The ensuing transparent art ecosystem is open to all participants without formal gatekeepers or obstacles, presenting opportunities to quantify and comprehend the forces, mechanisms, and hidden networks that affect its evolution. As a key byproduct, crypto art generates an increasing amount of publically available organized and unstructured data, which is likely the main aspect that distinguishes it from traditional art (Franceschet 2021). All trades in crypto art are immutably recorded on a public blockchain, and this data is immediately available for examination.

Collectors in the conventional art world typically encounter new artists through visits to museums and galleries. In turn, gallerists collaborate with museum curators to promote the careers of up-and-coming artists by exhibiting their works in both commercial and public institutions. Given the absence of traditional intermediaries like gallerists, curators, and museums, the success of crypto art depends on the potential for personal connections between artists and collectors (Fraiberger et al. 2018). In the study article by (Vasan, Janosov, and Barabási 2022), the findings highlight the importance of artist-collector ties to an artist's income and imply that the success of NFT artists depends on their ability to cultivate relationships with collectors who are willing to make repeat purchases of their art rather than on their ability to attract new collectors. These familiar relationships between artists and collectors are a replication of the tendencies seen in the traditional art world, where collectors favor the works of a select few. It is important to note that the marketplace they used as data was Foundation[1]. In an opinion article by (Frye 2022), the author proposed that the art market has always primarily functioned as an NFT market. Collectors seek out influential works. The inclusion of an item in a renowned artist's catalogue raisonné gives that item significant weight. A work's value increases if it is considered influential, as this increases the interest it garners from other collectors. It's not so much the aura of the genuine piece that's in short supply, but rather the aura of true ownership. Thus, NFTs facilitated the development of a market for property rights. They essentially made a market for influence instead of power.

The authors Vasan, Janosov and Barabási (2022) use data collected from the Foundation marketplace because it is a free, public resource, where any working artist or collector can suggest others to join. This makes it easier to examine artistic careers, the development and impact of social networks among artists and the many groups with an interest in their work, and the norms that determine the achievements of certain artists. There is substantial evidence for the theory of the first mover advantage, finding that

[1] See *The Foundation* (2022)

pioneering and early majority artists earned more than their later counterparts and that early collectors have been more actively invested in the art market as depicted in Figure 5.1. Additionally, they discover that the price of artworks is consistent over the course of an artist's career and that the range of prices sold characterizes the artist's notoriety and popularity (Vasan, Janosov, and Barabási 2022). However, the price of artwork by the same artist can fluctuate widely. This stands in stark contrast to the trends observed in the traditional art market, where the value of established artists rises in tandem with their increasing notoriety and price decreases are avoided by galleries. Below is the categorization of the reputation of artists into low, medium, and high categories based on the maximum price of the artwork sold, and find that high-quality artists consistently command high prices for their works, providing evidence of market-driven reputation impacts that persist over time.

Figure 5.1 shows The earnings of innovators, early majority, majority, and laggards, observing a monotonic decline in overall earnings with increasing platform adoption time, indicating that artists who joined the platform later have earned significantly less than those who joined early. The research on innovation divides the adoption of new technology into five distinct phases. Adoption by innovators (or initial adopters), which corresponds to the first 2.5% of artists/collectors who joined the platform from 21 January, 2021 to 22 February, 2021; (2) Arrival of early adopters (or early majority), representing the next 13.5% from 23 February to 10 March; (3) Emergence of majority (34%) and late majority (34%) between 11 March and 18 May; and (4) Adoption by laggards, representing the last 16% from 19 May to 18 June. Overall, the study finds that new artists have a limited ability to sell art due to two interrelated factors: (1) the market's extensive supply makes it difficult for new artists to capture collectors' attention, and (2) the demand for digital art has leveled off.

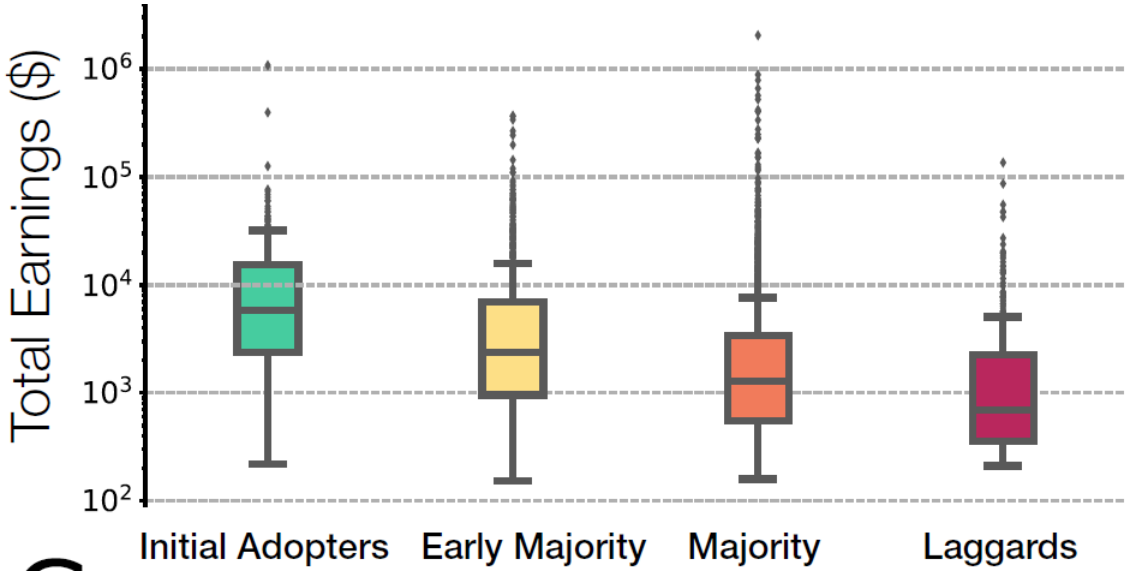

Figure 5.1: Earnings of Innovators, Early majority, Majority, and Laggards. Source: (Vasan, Janosov, and Barabási 2022).

Figure 5.2 shows the daily listing and selling price of art, indicating that despite the changes in the NFT adoption rate, the economic value of art has remained unchanged. The massive influx of artists and collectors into the NFT area and the intricate temporal dynamics of the platform have had little to no effect on the value of the artwork.

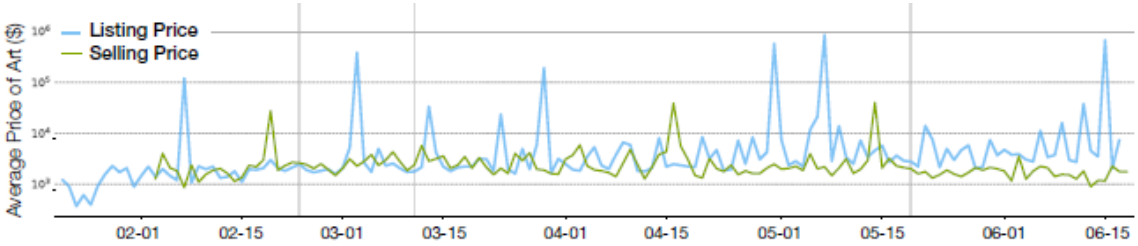

Figure 5.2: Daily Listing and Selling Price of NFT art. Source: (Vasan, Janosov, and Barabási 2022).

5.2 NFTs as new financial instruments to support artists

Current practice requires the seller to notify the artist of any resale money received from secondary sales of their original artwork if the artist privately contracts to receive a resale payment from such sales (Schechter Dec. 2004;Alberge 2014). In this scenario, the vendor is assumed to have complete knowledge of the original artist's identity, current location, and means of receiving money. Sellers would be able to quickly and

easily meet their resale payment commitments if the process was automated using a blockchain platform to deposit the agreed-upon amount into the cryptocurrency wallet of the original artist following the consummation of a transaction. By automating the process, vendors would be able to meet their resale contract requirements promptly and affordably, as well as be prepared for the changes necessitated by pending law. Websites that accept cryptocurrency as payment have a lower overall cost of doing business since they don't have to pay a middleman to process payments, and they can put that money into increasing the percentage they take in from primary sales of artists' work (Brown 2022). Further, the commission rates agreed upon by the artists at the time the tokens are coined are preserved in perpetuity given the smart contract restrictions that automate the payment terms for primary and secondary transactions. Artists anticipate that the technology will assist them in monitoring the value of their artwork, efficiently collecting any associated payments from sales or royalty licensing, and providing emerging artists with a sales platform that enables them to earn a sustainable living from their work.

As a result of the royalty and equity structure, artists have more access to finance, as well as the opportunity to diversify their investments in the art market. Resale royalties, which were previously employed speculatively by artists of previous generations, have become more practical due to blockchain's capacity to overcome the contracting and transacting limits (Whitaker and Kräussl 2018). These tokens are not just valuable at the moment of an art sale but can be traded at other times as well (Helguera et al. 2014). Former oil painter-turned-software designer Matt Kane revealed the $1.25 million sale of his NFT Monetization Generation, which he had previously sold in March 2021 for $75,000. In an interview with Wired, he stated, "Before NFTs, I would not see a cent in the traditional art world. He received a sum of money equal to $125,000 from the secondary sale (Rizzo 2022). The standard mark set for NFT secondary markets is approximately 10% (Bsteh 2021). Value for digital artworks is said to be determined by pricing an artist's background and the innovations they've introduced, all of which may be found in secondary markets. This can involve new technologies, algorithms, games, communication methods, and an artist's overall brand. On Monegraph, artists used to receive 15% of the resale value of their work, but with the new platform, they can receive whatever royalty structure their gallery specifies as seen in Table A.2. SuperRare, created in 2018, has paid artists a 10% or 3% resale royalty depending on when they joined. As a secondary market seller, SuperRare pays artists 85% of the initial primary market price (SuperRare.org, 2020).

Blockchain technology is being used by Dada[2], a startup that facilitates the sharing of ownership of collaborative work. It allows users to express themselves through sketching.

[2]See *Dada* (2022) website.

The NFTs created by artists build on previous work which could symbolize an entirely new way of creating shared value and cooperative ownership. Using automatic income sharing through smart contracts, for instance, artists face fewer risks from contract violations by their collaborators, including those with whom they have never worked or are unknown. However, all writers in interactive collaborative works have the same intellectual property rights under copyright legislation. The extent or degree of the inventiveness of each person's contribution is unimportant. The law simply provides that a work created by two or more authors with the aim that their contributions be combined into inseparable or interdependent elements of a unitary whole is a copyright-eligible work of joint authorship. In circumstances involving many authors, each author or artist is the owner of the work's copyright. Therefore, each artist may unilaterally authorize the reproduction of the artwork and the creation of new works drawn from the artwork. Pamela Samuelson, an expert on intellectual property rights in computers, observes: "Joint authorship fragments rather than consolidate ownership rights" (Samuelson 1986).

In the study by (Whitaker and Kräussl 2018, many artists would have fared better on the stock market from the 1960s to the 1990s if they had retained equity in their works sold in the primary market. Secondary markets that allow collectors to expand their holdings while maintaining ties to artists could be enabled by such a registry of fractional shares, as this would allow for secondary markets. There is a vetted listing problem that is solved by provenance companies such as Artory & Verisart in partnership with auction houses, but in this scenario blockchain data would originate from the artist's studios instead. In order to reduce the risk of their resale royalties, artists can form collaborative investment trusts. Collective royalties would also allow musicians to protect their own interests by owning a diverse portfolio of exposure to those of other musicians as well as their own (Whitaker and Grannemann 2019).

Due to the novelty of blockchain-enabled consignment contracts in the art market, no standard form of contract has yet emerged. Different parties may have different opinions about how blockchain technology might best be used to increase confidence in copyright interests. From the standpoint of the purchaser, blockchain is most useful as a receipt, guaranteeing that they are acquiring the rights to possess, display, and resale the work as specified under the artist's copyright protections attached to the work (Macdonald-Korth, Lehdonvirta, and Meyer 2018). From the creator's point of view, blockchain is most useful when it serves as a form of insurance, enforcing the artist's right to be paid and any other rights they may have for the duration of the copyright (Brown 2022). The artist's privately negotiated resale royalties and the licensing market for the work's reproduction and derivative rights can have a significant impact on the artist's remaining rights, which can be quite different depending on the medium of the work. The adoption of blockchain

as a copyright-enforcing mechanism in these contracts is met with both optimism and trepidation, both of which are inherent to the various contending viewpoints.

5.3 Adverse issues of the NFT market on artists: Copyright infringement

In (Dowdeswell and Goltz 2022)'s study, they propose that the current structure of NFT markets facilitates different forms of copyright infringement as well as lawful and illegitimate forms of rent-seeking from copyrighted works. One artist, known as Weird Undead, discovered that a bot dubbed @tokenizedtweets was capturing photographs of her Twitter-shared artwork, minting them as NFTs, and selling them on Open Sea. After filing a legal notification, Open Sea pulled down the NFTs. Much copyright fraud in NFT markets is enabled on an industrial scale by bots such as @tokenizedtweets. As determined by Weird Undead, the burden of locating and prosecuting infringers lies on the creator. When pitted against bots that can mine the internet and social media for millions of desirable photographs to sell, artists with limited awareness of copyright regulations and fewer resources will always be millions of steps behind. (Guadamuz 2021) asserts that current NFT platforms offer little more than 'click-wrap' agreements that compel artists and content creators to just check a box, with no actual negotiation or explanation of how the conditions will affect their IP rights. There are currently no systems in place to prevent copyright fraud from occurring in the first place, despite that NFT platforms do remove illegal content when notified of it. In another instance, a fake NFT presale of artist Ludvig Holmen's NFT collection was conducted on an NFT marketplace in late September 2021. His Kingdoms of Ether series consisted of 25 digital 3D miniatures with unique designs. In a matter of minutes, the presale had sold out, earning its creator $138,000 in Ether (Sergeenkov 2021). Those who purchased NFTs during the pre-sale instead received emoji packs, and the perpetrator has since deactivated their Twitter account and taken the money with them.

Due to the decentralized nature of the Web3 blockchain on which NFT platforms run, unlike typical online marketplaces, NFT platforms do not require sellers to undergo any sort of "know your customer" or other audits before they are permitted to make a trade. Copyright laws, such as the WIPO Copyright Treaty (WCT) of 1996 and the Digital Millennium Copyright Act (DMCA) of 1998 in the United States, apply to platforms. However, in order to enforce these laws, the copyright owner or agent must first discover or be made aware of the infringement before preparing and sending a takedown notice to the service provider requesting that the infringing material be removed (McAndrew

2022). Despite several platforms discussing limitations and bans on known infringers, it is possible for them to continue operating using a different wallet and pseudonymous identity due to the relative anonymity afforded by these assets.

5.4 Current Market Overview for NFTs

The invention of NFTs has injected liquidity into an otherwise illiquid art market that can help artists with sustainable income and benefit from the appreciation of their artwork over the years since it is difficult to evaluate with the initial sale. There are two ways observed that the technology has introduced liquidity namely by capital transferred and ease of trading. The art NFTs account for $11.1 billion in 2021 compared to $65.1 billion of the general art market excluding NFTs (McAndrew 2022). For most NFTs, the duration between purchase and resale for art NFTs is 33 days. Essentially, the average time between the purchase and resale of an artwork NFT is one month versus the average resale period on the art market of 25 to 30 years. Velocity is a characteristic of crypto art that distinguishes it from traditional art, as it more closely resembles financial trading than traditional art (Franceschet 2021). In crypto art, a transaction can occur at any moment: an artist creates a new piece or accepts a collector's bid, a collector bids on or purchases an artwork, and two users trade artworks. From the perspective of data science, the crypto art market resembles an open, real-time stream of occurrences.

In the 2022 Art Basel and UBS Report, data on NFT platforms is obtained from NonFungible.com, which monitors all qualified sales of NFTs on the Ethereum, Flow, and Ronin blockchains. In 2020, the primary market accounts for 75% of art-related NFT sales by value, while by 2021, resales on the secondary market account for 73% of the value as seen in Figure 6. Three-quarters of the value of art-related NFT transactions conducted on Ethereum-based platforms in 2021 consists of resales, a significant increase from 2020 and hardly surprising, given that art NFTs are typically held for less than a month before being resold. In 2021, art-related NFTs were purchased and resold in an average of 33 days, whereas the typical resale time on the art market was between 25 and 30 years.

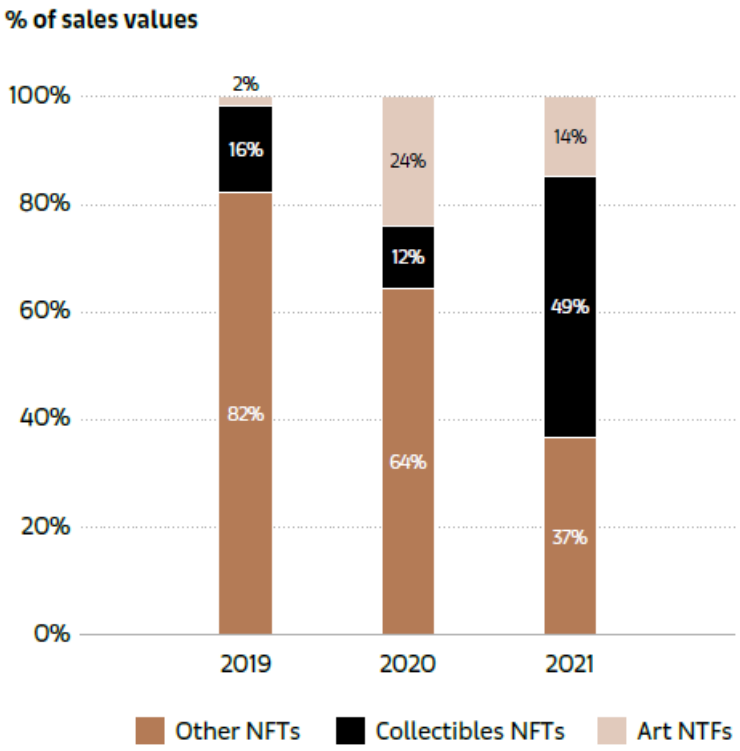

Figure 5.3: Share of Value of Art and Collectibles in all NFT Sales 2019 - 2021. Source: (McAndrew 2022), with data from Nonfungible.com

Multiple categories of NFTs are traded on platforms, including art, sports, music, and entertainment collectibles and an assortment of digital in-game things. Figure 5.3 shows that in 2019, art-based non-fungible tokens accounted for only 2% of the total value of non-fungible token sales, while collectibles accounted for 16%. In 2020, however, art-based NFTs comprised a larger proportion (24%) than collectibles (12%). By 2021, art and collectibles accounted for the majority (63%) of the value of NFT sales, but art was once again the smaller component of sales (with 14%) of the two.

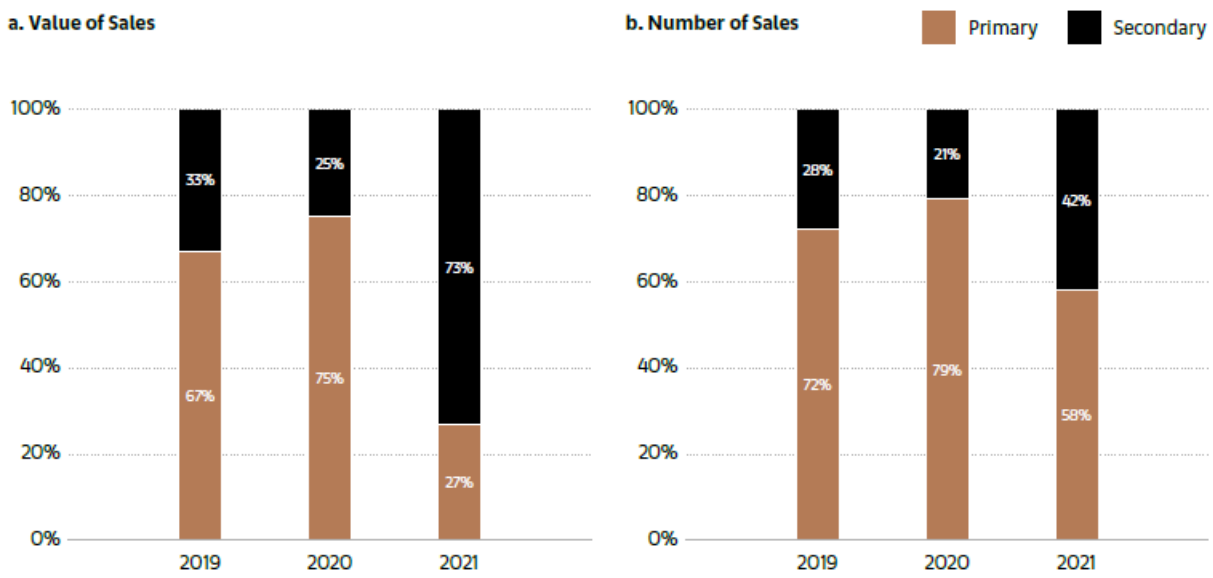

Figure 5.4: Share of Primary Versus Secondary Sales of Art NFTs 2019 -2021. Source: (McAndrew 2022)

In Figure 5.4, the majority of art NFTs in 2020 were associated with primary sales, which amounted for 75% of total values and 79% of transactions. In 2021, however, the backdrop between these two sides of the market altered drastically, with resale value dominating. In 2021, resales accounted for 73% of the value of trading in art-related NFTs, while primary sales decreased to 27%. This is in stark contrast to the collectibles market, where resales account for an average of 79% of total prices from 2019 to 2021. In terms of value traded in both markets, the below figure demonstrates the market.

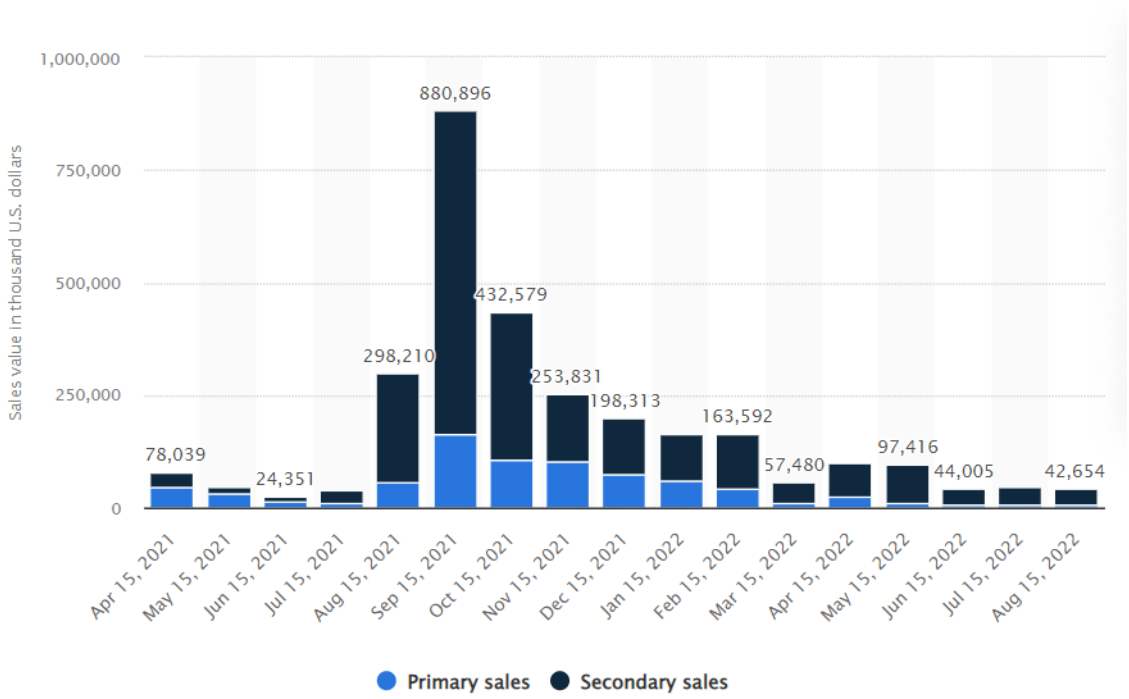

Figure 5.5: Total value of sales involving a non-fungible token (NFT) in the art segment worldwide over the previous 30 days from April 15, 2021 to August 15, 2022 (in 1,000 U.S. dollars). Source: (Statista 2021).

In figure 5.5, the overall value of art market transactions settled in NFTs varied widely between April 15, 2021 and August 15, 2022. As of 15 April 2021, the total value of all NFT transactions recorded across the Ethereum, Ronin, and Flow blockchains during the previous 30 days was roughly 78,000,000 USD. In 30 days up to August 15, 2022, sales totaled almost $43 million USD. The Majority of value for artists comes from secondary markets and the use of NFTs has made it easier for artists to benefit from secondary markets. The use of blockchain additionally has the benefit of providing visibility on the performance of the secondary market by providing a public immutable register.

5.5 Summary of Findings

Chapter 5 investigates how NFTs have reshaped the art market by creating new pathways for artists and collectors, bypassing traditional art market gatekeepers. The rise of NFTs and crypto art has led to a more transparent art ecosystem, where interactions and transactions are visible and accessible to all participants. This openness not only changes how artists are discovered and how art is bought and sold but also impacts the valuation of art due to the public availability of transaction data. Democratization of the

Art Market: NFTs have facilitated a shift from a closed, often opaque system dominated by galleries and curators to an open market where artists can directly connect with buyers. This has allowed artists to maintain greater control over their work and its distribution. All transactions involving NFTs are recorded on a blockchain, providing a transparent, immutable ledger that is accessible to anyone. This has introduced a new level of public accountability and data availability, allowing for detailed analysis of market dynamics.

Despite the democratization potential of NFTs, the importance of personal connections remains significant. Established relationships and networks continue to play a crucial role in an artist's success in the NFT market, mirroring traditional art market dynamics. Unlike the traditional art market, where the value of an artist's work generally increases with their notoriety, NFT art prices can fluctuate more widely based on market trends and the speculative nature of cryptocurrencies. The main research question explores whether NFTs have fundamentally changed the art market for the better and how they impact artists' ability to thrive. While NFTs offer new opportunities for artists to gain exposure and control over their sales, the findings indicate that challenges such as market volatility and the continued importance of social networks and personal connections still play a significant role in determining success.

Overall, NFTs have introduced significant changes to the art market, impacting how art is valued, sold, and collected. While they provide opportunities for more artists to participate in the market and potentially earn a sustainable income, the persistence of traditional dynamics like the importance of personal connections and the speculative nature of the market presents ongoing challenges. The research illustrates that while NFTs have the potential to democratize and transform the art market, they do not entirely eliminate the traditional barriers and dynamics that have long influenced artists' careers.

6. Conclusion

The overarching research problem of this thesis explores how the integration of Non-Fungible Tokens within the art market affects the legal and economic frameworks that govern intellectual property rights and artist monetization. The literature review conducted across the various chapters addresses this complex issue by examining the multifaceted implications of NFTs—from legal challenges and solutions to economic opportunities and barriers for art market stakeholders. The findings have highlighted the dual functionality of NFTs: as digital proofs of ownership and as innovative mediums for art commerce, which both challenge and enrich the traditional art market dynamics. The analysis identified that NFTs, while reducing transaction costs and enabling artists to secure royalties through smart contracts, still face significant challenges in copyright enforcement. The existence of 'copycat' artists and the lack of effective mechanisms to prevent unauthorized minting highlight the ongoing legal challenges in the NFT space.

6.1 Integration and Synthesis of the Literature Review

The literature reviewed in Chapter 3 highlights the existing gaps in copyright laws when applied to digital artworks and NFTs. By discussing cases and legal theories, illustrates the necessity for evolving legal norms and practices to accommodate the unique attributes of NFTs, such as their digital nature and the blockchain technology that underpins them. Proposed solutions in this section are i) Enhanced copyright enforcement and ii) New regulatory Frameworks. There is a crucial need for NFT marketplaces to implement stricter copyright verification processes to combat the proliferation of unauthorized duplicates, thus protecting original artists' rights and supporting genuine creativity. Lawmakers should introduce balanced regulatory measures that ensure marketplaces are held accountable for facilitating IP rights without stifling innovation. These regulations could include mechanisms for better collaboration among platforms to prevent the listing of duplicate NFTs, thus reinforcing their role in commercializing and proving the

provenance of digital art.

In Chapter 4, the economic analysis of NFTs as an asset class reveals both the opportunities and challenges posed by their speculative nature. The literature underscores the potential for NFTs to provide artists with new revenue streams and greater market access, while also cautioning about the volatility and speculative bubbles that could harm uninformed artists and investors. Addressing the gap in understanding the intrinsic value of NFTs, especially those representing art, requires a multi-facted approach. The combination of curators, Machine learning models and standardized valuation frameworks as metadata for smart contracts is key. By combining human expertise with data-driven technology, the strategy enhances transparency and accuracy in pricing, thereby reducing speculative tendencies and grounding NFT valuations in more robust, diversified data inputs. Chapter 5 delves into how NFTs are reshaping the art market dynamics, particularly the traditional roles of galleries and curators. The literature reviewed shows how NFTs democratize access to the art market, yet replicate some traditional dynamics like the importance of network and reputation. This directly responds to the research problem by assessing whether NFTs genuinely democratize the art market or if they merely transform the mode of operation within existing power structures.

These proposals could guide policymakers and industry stakeholders in fostering a secure and vibrant digital art market. By addressing both legal and economic challenges, the NFT market can evolve into a more reliable and respected investment field, benefiting artists, collectors, and other market participants alike. The rapid evolution of NFTs and blockchain technology means that legal and economic frameworks must continuously adapt. Future research should therefore focus on long-term studies of regulatory impacts and the development of more robust methods for valuing digital artworks as NFTs mature as an asset class.

The literature review conducted through this thesis provides a comprehensive examination of the transformative impact of NFTs on both legal and economic aspects of the art market. It not only identifies the current shortcomings of these frameworks but also proposes forward-looking solutions that could help in adapting to the changes brought by digital technologies and NFTs. This approach ensures a holistic understanding of the challenges and opportunities NFTs present, offering actionable insights for policymakers, legal experts, and market regulators.

In conclusion, while NFTs present significant opportunities for artists and collectors by injecting liquidity and reducing transaction costs, they also introduce challenges that necessitate cautious yet innovative approaches to governance and market behavior. The potential of NFTs to reshape the art market is immense, offering a new paradigm where

digital and traditional art forms can coexist and enrich each other, provided that the emerging risks are managed effectively.

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A. Appendices

Top 10	Attributes	Coefficient	Price Impact	Bottom 10	Attributes	Coefficient	Price Impact
1	Beanie	1.8639***	544.91%	1	Knitted Cap	–0.0900**	–8.60%
2	Pilot Helmet	1.3674***	292.51%	2	Front Beard Dark	–0.0460	–4.49%
3	Tiara	1.2663***	254.78%	3	Cap Forward	–0.0288	–2.84%
4	Orange Side	1.1343***	210.90%	4	Stringy Hair	–0.0278	–2.74%
5	Choker	1.0466***	184.80%	5	Mohawk	0.0016	0.16%
6	Welding Goggles	0.9268***	152.64%	6	Frumpy Hair	0.0118	1.19%
7	Hoodie	0.8976***	145.38%	7	Bandana	0.0227	2.30%
8	Buck Teeth	0.8228***	127.68%	8	Mohawk Dark	0.0279	2.83%
9	Pink With Hat	0.7632***	114.51%	9	Headband	0.0344	3.50%
10	3D Glasses	0.7332***	108.17%	10	Mohawk Thin	0.0424	4.33%

Figure A.1: Rankings of CryptoPunk attributes. Source: (Kong and T. Lin 2021)

Contract	Author/Founder	Date	Resale Royalty	Term	Other Rights
The Artist's Reserved Rights Transfer and Sale Agreement New York, NY, U.S.A.	Seth Siegelaub and Robert Projansky	1971	15% of gains every time work is transferred	life of the artist plus life of surviving spouse (if any) plus 21 years	notification of exhibition including veto rights right to borrow the work for 2 months every five years (at no cost to collector) right to be consulted on repairs half of all rental income all reproduction rights right to know the current owner of the work
Monegraph Brooklyn, New York, U.S.A.	Kevin McCoy and Anil Dash	2015	15% on resale *(borrowed directly from The Artist's Contract)*		ability to buy and sell in fiat or cryptocurrency remix rights under creative commons
UppstArt Calgary, Canada	Brent Cheal and Steve Gow	2018 (defunct)	4% on resale *(similar to EU rate)*		ability to buy in fiat currency resale of works executed through smart contracts and registered on ethereum blockchain
SuperRare Newark, Delaware, U.S.A.	Jonathan Perkins, John Crain, Charles Crain	2018	varies 3% to 10% on resale		primary market sales: 15% commission, 85% to artist; 3% commission on all sales
Nifty Gateway Founded in San Francisco, CA, U.S.A.	Duncan Cock Foster, Griffin Cock Foster	2018	resale royalty is set by artist, any percentage		ability to buy in fiat currency platform collects 5% + 30 cents of each secondary market sale
OpenSea New York, NY, U.S.A.		2017	resale royalty is set by artist, up to 10%		authors choose to list nfts as auctions, fixed-price listings, and declining-price listings. platform collects 2% of each transaction

Figure A.2: Resale Terms of the Artist's Contract and Selected Blockchain Platforms. Source: (Whitaker 2021).