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The Digital Shift in Contemporary Art Markets: The Impact of Technology on Valuation, Transaction, and Consumer Engagement

Shuhan Zhang[1,*]
[1] NYU Steinhardt School of Culture, Education, and Human Development, New York, 10003, United States
Corresponding authors: (e-mail: rebecca.shuhan@gmail.com).

Abstract The digital transformation of the contemporary art market has brought about profound changes in the way art is created, traded, and consumed. This paper explores the impact of emerging digital technologies, such as cryptocurrencies, blockchain, and artificial intelligence (AI), on the art market. These technologies have introduced new avenues for art creation, authentication, and commercialization, significantly reshaping the market's dynamics. Moreover, this study examines the broader societal and economic implications of these technological advancements. The introduction of virtual and augmented reality (VR/AR) technologies into art exhibitions and online galleries has further transformed the art viewing and purchasing experience, allowing customers to engage with art in immersive, personalized ways. However, the adoption of these technologies remains uneven, with some sectors of the market showing reluctance towards their integration. Despite the challenges, the increasing integration of digital tools into art market practices has accelerated the globalization and democratization of the art world, enabling greater participation from diverse audiences. Looking ahead, the paper argues that future research should focus on the intersection of digital technologies and traditional art market structures, considering the role of innovation in shaping new business models, intellectual property frameworks, and regulatory approaches. The ongoing evolution of the digital art market, coupled with its potential to disrupt existing paradigms, requires scholars to engage with interdisciplinary research methods and collaborate with industry stakeholders to better understand the complexities of this rapidly evolving field.

Index Terms Contemporary Art Markets, digital transformation, digital technologies, virtual and augmented reality (VR/AR)

I. Introduction

The digital shift in the contemporary art market involves a multidisciplinary approach, drawing from economics, management, sociology, psychology, communication studies, art theory, aesthetics, law, and other related fields. Scholarly discussions of the art market, both domestically and internationally, have primarily relied on art transaction records, financial reports, and relevant legal documents. Between the 1960s and 1970s, British art historian Gerald Reitlinger made a groundbreaking contribution with his three-volume work The Economics of Taste. Since then, particularly in the 21st century, there has been a significant increase in the global scholarship and research on the art market. Traditionally, art transactions have been conducted offline, with industry professionals viewing the internet merely as a technological tool to facilitate transactions. As a result, the academic community has not paid much attention to the internet's role in expanding the art market. However, with the ongoing impact of the COVID-19 pandemic, scholars have recognized that digital technologies are no longer just marketing tools; cyberspace has evolved into a distinct segment of the art market, with its own unique characteristics and development models. In this new era of technological innovation, both practitioners and scholars must analyze the current art market within cyberspace and explore the specific technologies that may influence and expand the contemporary art market in the future, in order to better understand the conceptual shift that digital technologies bring to the art market.

II. The Rise of the Online Art Market

With digital knowledge and information as key production elements and cyberspace as its medium, the advancement of information and communication technologies (ICT) and electronic information devices has accelerated the production, delivery, and consumption of modern goods, facilitating the digital economy. Digital technologies have also intensified art innovation and globalization, as artists expand the boundaries of contemporary art by creating new works using digital tools. Participants in the art market are increasingly utilizing new technologies for the protection, display, and promotion of artworks. Just as the digital economy is divided into foundational and integrated digital economies, art is also being categorized into two levels: “as a local vanguard at the forefront of various art fields, and as a global commodity that transcends institutions and borders” [1]. Regarding the art market, digital technologies are transforming the paradigms of art mediation and transaction, stimulating the emergence of a “new business structure in which art, technology, and commerce mutually support each other” [2]. In fact, the online art market is not a recent phenomenon. In the 1990s, the internet era thrived, and networks for art sales emerged. However, during the dot-com bubble around 2000, numerous internet companies collapsed, and most art sales networks were not spared from the resulting losses. Despite these setbacks, the products and services enabled by new technologies disrupted traditional concepts and transaction methods. The future vision for the art business in the era of globalization has never faded, and emerging forces in art sales continue to compete for online attention. Meanwhile, discussions surrounding NFTs, media convergence, digital copyrights, and other topics have also entered the research landscape of the contemporary art market.

Accurately assessing the online art market has become increasingly difficult due to the varying statistical data provided by different analytical reports. The Art Market 2021, a report led by art economist Clare McAndrew for Art Basel and UBS, indicates that the global art market contracted by 22% in 2020, but online sales surged to $12.4 billion, double the amount of 2019. A quarter of all artworks were sold online, and the share of online sales revenue for dealers tripled from 13% to 39% [3]. According to the Hiscox Online Art Trade Report 2021 from Hiscox, 66% of artworks were sold online in the first half of 2021, although the share of fine art sales online dropped below 32% compared to 2020 [4]. NFTs have also introduced new possibilities for the collection of both digital and physical artworks. The Hiscox Online Art Trade Report 2020 disclosed that “the online art market responded positively to the pandemic, with online sales of artworks skyrocketing to 67%, marking an increase of more than 50% compared to 2018 and 2019” [5]. Additionally, Citigroup’s The Global Art Market and COVID-19 report reveals that 72% of galleries attempted to operate online in 2020. Although most galleries were small with limited risk tolerance, “the share of online sales revenue for galleries still jumped from 10% in 2019 to 37% in the first half of 2020” [2]. Overall, these data indicate that, over time, online art transactions have evolved from a mere marketing tool to an independent segment of the art market with its own distinct characteristics and development model. This transformation represents a “restructuring of the ways, places, and people that influence the art world” [6].

As an independent part of the contemporary art market, the online art market offers an alternative to traditional offline transactions. On one hand, its ability to enable real-time communication between artists and art buyers has allowed the online market to “reach new buyers and significantly expand the market” [7]. On the other hand, while existing in cyberspace beyond national borders, the online art market “can be held by any number of suppliers from across the world and showcased on a single website,” making it accessible to more potential customers. Though buyers may still hesitate to “stay at home and browse galleries” before purchasing, especially during the pandemic, they have increasingly accepted online transactions as a viable option [8].

In terms of market models, the online art market can be divided into “hybrid” and “pure” online categories. Participants in the “hybrid” online art market include traditional galleries and auction houses, which can operate both offline and online. By leveraging cyberspace, they open new marketing channels and increase sales. According to McAndrew’s Resilience in the Dealer Sector: A Mid-Year Review 2021, the proportion of physical companies transitioning to online sales has continued to grow, with “91% of respondents believing that sales will either continue to grow or remain stable, and only 9% forecasting a decline in the market” [9]. Notably, large auction houses like Christie’s, Sotheby’s, and Phillips held 133 online auctions out of 258 in the first half of 2021, with total online sales reaching $670 million, a 70% increase compared to the same period in 2020. Christie’s alone saw its online sales reach $223 million, an increase of 178% from 2020 [4]. These physical companies have “truly embraced digitization, no longer viewing it merely as a temporary solution” [10].

In contrast, participants in the “pure” online art market exist solely in cyberspace and include online galleries, online auction houses, and trading platforms. The COVID-19 pandemic has made online viewing and purchasing more attractive to the new generation of buyers. Consequently, online galleries such as Affordable British Art, Artand.Cn, Discreteart.Com, and Saatchi Art, which serve as virtual exhibition spaces, have attracted dealers unwilling to spend on physical gallery spaces. Compared to traditional auction houses, online auction platforms such as Artsper, Barnebys, Birdsquare, and Heritage Auctions allow buyers to bid for art from the comfort of their homes, somewhat alleviating the social status and wealth requirements traditionally associated with bidding at physical auction houses. Online trading platforms like 1stdibs, Artsy.Net, Artshare.Com, and Curiator.Com offer entry points for a new generation of buyers, ensuring direct communication between artists, dealers, and buyers, and allowing buyers to purchase art without the need to engage in bidding [11].

As the online art market model continues to evolve, it is reasonable to expect the emergence of new participants in the market. More importantly, the increasing influence of social media on the online art market is a noteworthy trend. Hiscox's Online Art Trade Report 2021 highlights that purchasing art via smartphones and tablets became the mainstream method in 2021, with mobile sales totaling $3.1 billion in the first half of the year, accounting for 46% of online sales. Among social media platforms, Instagram emerged as the dominant channel for online art transactions, comprising 89% of the online art market, with Facebook and YouTube following in second and third place. Furthermore, live streaming has transformed the auction experience into a viewing event, with over a million global viewers watching Christie's live stream auctions in 2020 [12].

Why has the share of online art market transactions risen so significantly within the contemporary art market? One primary reason is that the online art market has made transactions more convenient and comfortable. Experienced dealers and buyers can visit multiple websites randomly, making it easier to find target artworks than through any other channel. Another reason is that the younger generation of buyers is more willing to engage with the art market. Traditional galleries and renowned auction houses often intimidate new buyers with their "cold reception or mysterious rituals" [13]. Despite the increasing number of online art platforms, these platforms still struggle to establish sufficient trust among older, influential buyers. As Hiscox pointed out in its 2019 Online Art Trade Report, "building consumer trust is the greatest challenge faced by all participants in the online art market" [14]. The main problem facing the online art market is the inability to verify the authenticity and integrity of artworks. In 2018, 62% of online buyers expressed concerns about purchasing fakes, and 74% complained about being unable to inspect artworks before buying. However, after more than two years of development, the online art market has maintained positive growth. Data shows that "the number of artworks sold online in the first half of 2021 increased, and the average price rose by 202%, with buyers more confident in purchasing art online than ever before" [5].

Overall, the digital shift of the contemporary art market, or rather its online transformation, has had a significant impact on both art evaluation and transactions. On one hand, "due to changes in distance and sales methods, the level of interaction between buyers and sellers has been minimized", which has led the online art market to create a new chapter in intelligent art commerce. On the other hand, as the online art market has developed and improved, a new generation of buyers has gradually emerged. Their perspectives have become more diversified, moving beyond traditional terms such as money, power, and aesthetic value to assess art. Instead, they tend to "engage in digital image identification and price comparisons, and opt to transact via electronic payments in the comfort of their own homes". From an academic standpoint, the digital shift in the contemporary art market has also contributed to the emergence of Art History 3.0. The integration of art and technology has given rise to new forms of the art industry, creating new art languages. Technological innovations are driving the research and outcomes of the contemporary art market towards data analysis, visualization of management, and the establishment of effective digital archives, all of which contribute to social governance.

III. Digital Technology Expands the Contemporary Art Market

At present, academic discussions on the art market have yet to attract the collective attention of scholars from disciplines such as sociology, psychology, and art studies. However, globally renowned art economists and art market data analysts have been highly sensitive to the rapid development of art commerce. Research institutions such as the European Art Foundation, Art Basel, Hiscox Insurance, and the Artron Art Market Monitoring Center have all recognized the substantial impact of cryptocurrencies, non-fungible tokens (NFTs), and blockchain on the online art market. After more than three years of development, cryptocurrencies and blockchain ignited discussions in the capital markets in 2021, and by the end of the year, the topic of NFTs surged once again. News from the media regarding art and cryptocurrencies, NFTs, and blockchain increased significantly, and forums centered on digital assets became increasingly prevalent.

Looking back, in May 2018, Ethereum startup ConsenSys hosted the Ethereal Summit in New York. Since the company began promoting blockchain technology as an open standard in 2017, the contemporary art market has become more transparent and democratic. In July of the same year, Christie's Auction House held an Art + Tech Summit at its London headquarters, openly discussing new trends in art commerce, and argued that blockchain technology would empower the art market. The art provenance service, Bidpoc, developed by Shanghai Jiulian Information Technology Co., Ltd. based on blockchain technology, also gained widespread attention in the industry. By 2021, the Fourth Annual Art & Technology Summit further explored issues such as the tokenization of artworks, the role and impact of emerging technologies in the art world, and announced the first NFT contract standard, TRC721. If 2021 is regarded as the year of NFTs, then 2018 marked the beginning of the blockchain application and the rapid development of the industry. In that year, the creative and appraisal functions of blockchain were deeply explored. During Bitcoin's (BTC) 10th anniversary, Art (R) Evolution held an art exhibition in France centered on Bitcoin and cryptocurrency, allowing transactions in Bitcoin, Ethereum (ETH), Monero (XMR), and Litecoin (LTC). The exhibition also specifically discussed the role of cryptocurrencies in the contemporary art market, asserting that crypto-art redefined the way artists engage with audiences. Cryptocurrency was seen not only as a financial revolution but also as a cultural one.

Undoubtedly, research into the impact of cryptocurrencies and blockchain on the online art market is relatively new. From an economic perspective, cryptocurrency is a digital asset primarily used as a medium of exchange. “It operates on the principle of decentralized control, allowing users to make payments without the need for a central authority”. In 2009, Satoshi Nakamoto created Bitcoin and launched the Bitcoin financial system, using cryptographic mechanisms to ensure smooth financial transactions and control the creation of new units of “virtual” currency. To date, Bitcoin has become the most widely used cryptocurrency globally. To ensure the stable development of Bitcoin without a central issuer, Nakamoto designed a lottery-like competitive mechanism in the Bitcoin financial system: participants run the “mining” program to verify all Bitcoin transactions that occurred in the past 10 minutes. The first to calculate the result receives new Bitcoin and transaction fees as a reward. In other words, Bitcoin serves as a reward for the “mining” process, making it “a specific form of ‘virtual’ currency, also representing the operation and record-keeping of computer processing power”. The ledger of the Bitcoin financial system is the blockchain, and any financial transaction conducted using Bitcoin is verified and recorded in a specific block of the blockchain. Since the blockchain is essentially a decentralized database, the likelihood of human manipulation and data corruption is extremely low, ensuring the “security of the peer-to-peer network communication protocol embedded in specific cryptocurrency operation and verification algorithms”.

Leading global art market data analysts have identified cryptocurrencies and blockchain as the most significant digital technologies that will shape the future of the art market. Since 2018, Art Basel and UBS Group, in their The Art Market 2018 report, have highlighted the advantages of cryptocurrencies and blockchain within the art market, such as improving artwork verification, protecting buyers’ private information, and tracking the sales and commissions of artworks. However, they also cautioned that “while blockchain technology helps reduce fraud in certain areas, the anonymity of cryptocurrencies could lead to black market transactions, potentially harming the reputation of a new generation of buyers in the online art market” .

In the Art Market 2019 report, researchers further analyzed how blockchain technology was dominating public forums and media discourse within the contemporary art market. The use of cryptocurrencies was amplified, and the report pointed out that “the key issue with the tokenization of art is the continued lack of demand for this concept”. The The Art Market 2020 report emphasized that blockchain provided significant support for the online art market, stating that “the number of people participating in art transactions through cyberspace continues to grow, and the data generated will continue to provide insights into the behaviors and preferences of art market participants”. In the The Art Market 2021 report, global auction data was used to further explore the application value of blockchain in tracking artwork copyrights and distinguishing between trusted and untrusted data.

In addition to the continuous mention of cryptocurrencies and blockchain in the Global Art Market Reports, an interesting phenomenon can also be observed through public forums and media discourse. As a new form of currency in art transactions, cryptocurrencies have become increasingly desirable among both public art institutions and private collectors for conducting art trades, rather than relying on traditional fiat currencies. Likewise, both physical and online galleries, auction houses, and trading platforms are gradually adopting and utilizing cryptocurrencies as alternative payment methods. For instance, the Moniker Art Fair in the UK began accepting Bitcoin for tickets in 2015, becoming the first global art fair to bridge the gap between art and technology. Furthermore, in 2018, the Dadiani Syndicate gallery in the UK partnered with the Maecenas art investment platform to host the world’s first blockchain-based online art auction, selling fractional ownership of Andy Warhol’s 14 Small Electric Chairs (1980). The artwork was converted into an Ethereum-based digital certificate on the art trading platform, with Dadiani maintaining 51% control over the work while bidders received ownership digital certificates. In the end, Ethereum smart contracts using over 6 million ART tokens secured 49% ownership, with the total transaction value reaching $6.5 million.

In contrast to the active participation of art market players, public museums and galleries have yet to formally adopt cryptocurrencies due to the absence of clear legal documentation. However, this does not indicate a lack of interest in digital technologies. In 2015, the MAK Museum Wien in Austria used a certain number of Bitcoins to purchase a screensaver designed by Danish artist Harm van den Dorpel. In 2017, the State Central Museum of Contemporary History of Russia hosted the world’s first blockchain-based art exhibition, Birth, where each work in the exhibition was accompanied by a publicly available digital certificate. In September 2021, the State Hermitage Museum in Russia conducted its first NFT auction, with five artworks collectively valued at over $444,000. In China, the Palace Museum has already partnered with Tencent to explore the use of blockchain technology for the digital certification of cultural relics. Similarly, the National Museum of China has participated in the construction of the “Cultural Heritage Blockchain” project by Baidu, producing blockchain-based certification for museum collections. For public museums and galleries, the role of digital technologies extends beyond merely revitalizing collections with new technologies. More importantly, these technologies address critical issues such as the theft, loss, and authentication of genuine versus counterfeit artifacts.

The significance and impact of digital technologies in the contemporary art market are increasing rapidly. As a result, "virtual" currencies have influenced the general principles of art transactions and have altered the norms of art-based market lending. Traditionally, the art market has been a system where "dealers are provided with liquidity liens" and "help collectors monetize their art assets" [15]. However, with the rise of "virtual" currencies, future art-based market lending services are becoming more ambiguous. Technological innovation, through alternative mechanisms of art sponsorship, has diversified art financing. Simultaneously, art institutions are integrating business operations and focusing on the development of the online art market. In this context, the lending services of the online art market may experience "value changes and economic surges" [16]. Moreover, the impact of digital technologies offers new perspectives for research in the contemporary art market. With the rapid development of technological innovation and the digital economy, academic channels for obtaining data and information have become more diversified. Specifically, data based on blockchain technology can be considered as vital foundational materials for the art market and cyberspace, which will further accelerate the circulation and sharing of global academic resources.

IV. Artificial Intelligence and the Future Art Market

According to the Global AI Talent Report by Element AI, by the first half of 2021, the number of AI professionals worldwide exceeded 470,000. In 2017, the State Council of China released the "New Generation Artificial Intelligence Development Plan," elevating artificial intelligence (AI) to a national strategic priority. As an interdisciplinary and integrated application, AI has now permeated everyday life, and art activities urgently need to root themselves in reality, finding their place in the digital and intelligent age within cyberspace. Therefore, AI has become an important tool for art market participants.

In October 2018, the first AI-generated artwork, Edmond de Belamy, from La Famille de Belamy (2018), was sold at Christie's for $432,500, far exceeding the pre-auction estimate of $7,000 to $10,000. This work was created using a training set of over 15,000 portrait paintings from the 14th to the 20th century through a Generative Adversarial Network (GAN), producing a mysterious virtual figure. The painting also clearly displayed an algebraic formula—min G max D Ex [log (D(x))] + Ez [log(1 – D (G(z)))]—as the artist's signature. In 2019, German artist Mario Klingemann's installation Memories of Passersby I (2019), created with AI, learned from thousands of portraits dating from the 17th to the 19th century. The piece continuously generated live portraits of viewers staring at the artwork, ultimately selling for around $60,000 (Figure 1).

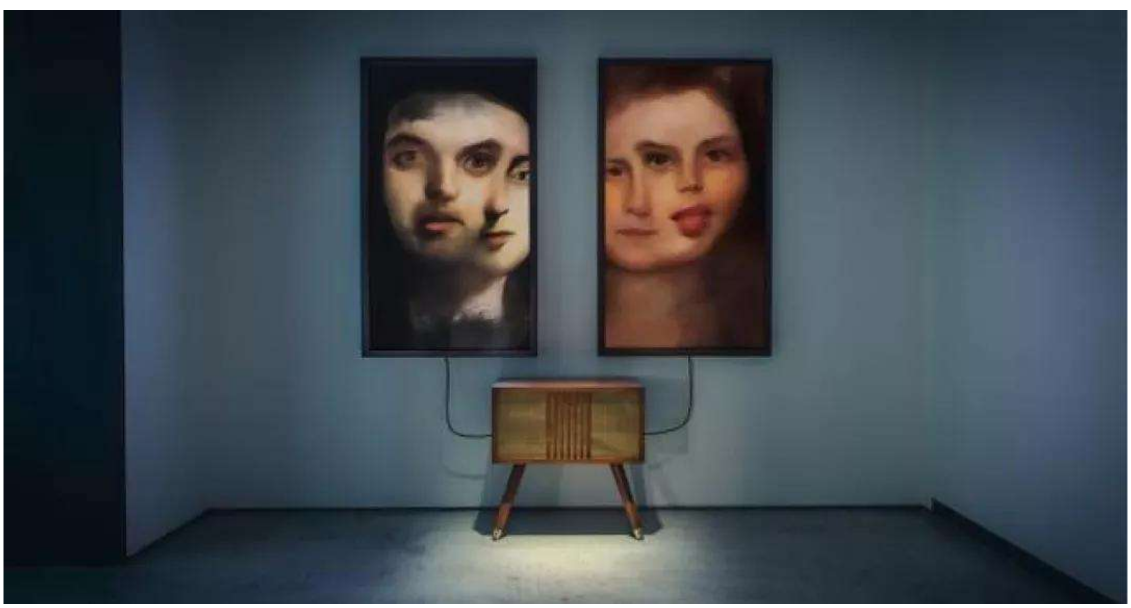

Figure 1: Mario Klingemann, Memories of Passersby I, Installation Art, 2018

In fact, Edmond de Belamy and Memories of Passersby I are not the first AI-generated art pieces. In 1956, John McCarthy, Marvin Minsky, and other young computer scientists first coined the term "artificial intelligence." In 1981, Peter Kugel's article "Artificial Intelligence and Visual Art" discussed the use of algorithms and programs as models for artistic creation beyond the human brain. In 2017, the Art and AI Lab at Rutgers University, the Department of Computer Science, the Facebook AI Research (FAIR) group, and the Department of Art History at the College of Charleston introduced a new art creation system, Creative Adversarial Networks (CAN). This system generates new artworks by observing and learning styles, enhancing creativity by deviating from learned styles. Experiments showed that viewers had difficulty distinguishing whether an artwork was created by a human artist or a computer, often rating the computer-generated images more highly.

Simultaneously, AI authentication systems, such as Recurrent Neural Networks (RNN), have quietly emerged. In 2017, the Art and AI Lab at Rutgers University proposed a new algorithm to segment brushstrokes. Ahmed Elgammal digitized 300 original works by Pablo Picasso, Henri Matisse, and Egon Schiele, breaking them into over 80,000 brushstrokes, and used machine learning to build datasets for each artist. Experimental results showed that “this algorithm detected individual brushstrokes with an accuracy rate of 70-90%, and aggregated graphic detection exceeded 80%, without being deceived by forgeries (with forgery detection accuracy of 100% in most cases)” [17].

Beyond the computer science field, museums and galleries are also exploring the application of AI in exhibitions and public education. In the United States, the Smithsonian National Museum of Natural History’s Skin and Bones application uses AI to “bring back to life” 13 vertebrate skeletons, creating new ways to interact with the public. In 2018, French President Emmanuel Macron announced a national investment of 1.5 billion euros into AI, following which the Galeries Nationales du Grand Palais in Paris hosted an exhibition Artists and Robots, showcasing 30 artworks created by robots. This exhibition not only disrupted the viewers’ perceptions of time and space but also critically assessed the interaction between human cognition and the immersive digital world in an increasingly “robotized” society.

In recent years, art exhibitions and forums focused on artificial intelligence have become a new trend in China. Events such as Future Black Box, Shanghai Brainstorm, Awakening All Things, Digital Creativity, and the Asia Digital Art Exhibition have enthusiastically used digital technologies to interpret artistic creation, responding to issues related to technology, cross-media, and human societal development. As we enter the intelligent era, algorithmic recommendation systems, with their unique advantages, have been widely applied across various fields, including information dissemination and commercial marketing, to satisfy the personalized and customized demands of customers. Statistics show that algorithm-based personalized content recommendations currently account for 80% of all internet content distribution. Researchers in the contemporary art market have begun to recognize that the integration of algorithmic recommendations and commercial marketing has reshaped marketing and service models, enabling interaction between dealers and consumers.

As an emerging electronic marketing tool, artificial intelligence assists dealers in improving customer experiences, quickly analyzing and acquiring potential clients, and accelerating sales processes. Online trading platforms now recommend new artworks “based on the visual similarity to the artworks selected by the buyer”, or provide artists with insights into future buyers’ demands, helping to address issues such as art copyright. Despite the widespread use of artificial intelligence in art creation, authentication, exhibitions, and marketing, its application remains limited when it comes to unique and valuable artworks. As such, “the applicability of AI is still constrained”, as it can neither create nor find perfect substitutes for these one-of-a-kind pieces. In response to growing demand for immersive, experiential engagement, digital technologies such as Virtual Reality (VR) and Augmented Reality (AR) have opened new possibilities for the art market. VR first appeared in science fiction and cinema in the 1970s, and from 2011 onwards, research in the VR and AR fields has advanced significantly. In recent years, with declining foot traffic in physical art galleries and auction houses, VR and AR have become essential components of art sales. Online galleries and trading platforms such as Saatchi Art and Artsy.Net now offer VR and AR preview functions, allowing clients to view over one million artworks online before deciding whether to purchase. Although academia is promoting deeper applications of digital technologies, the industry’s reception to these new technologies is mixed. A 2020 report revealed that “56% of galleries have never used virtual reality technology, and 72% have never used augmented reality technology”.

In summary, the integration of artificial intelligence (AI) into art creation, authentication, exhibition, and marketing has played a crucial role in shaping contemporary art market research. First, AI-generated artworks have reshaped the boundaries of what is often referred to as the “creative economy.” Broadly speaking, creativity can be defined as “the act of creating new things while generating new types, genres, and forms”. The introduction of digital technology into the cultural and creative industries has fostered the emergence of a creative economy, where technology, culture, and economics intersect and interact. This has become a typical concept during the phase of industrial transformation and upgrading. Within this context, artificial intelligence, as a specific form of digital technology, has advanced the development of the concept of creativity, influencing “the ownership and remuneration of creative products”. It has also had a significant impact on “what we think, and how we express, share, and communicate”. Second, algorithms and programs have altered the singularity of art, giving rise to the term "technological singularity of art", which suggests that non-biological intelligence (such as computers) can simulate biological intelligence (humanity) and merge with it at a high level. Unlike AI-generated artworks, AI-based art markets primarily focus on transforming data into intelligence to facilitate art market analysis driven by machine learning technologies.

V. Conclusion

The digital shift in the contemporary art market has brought new opportunities and challenges to academic research. On one hand, the introduction of cryptocurrencies, blockchain, and artificial intelligence has opened up new areas of study, methods, and standards. On the other hand, digital technologies are challenging the research paradigms of traditional disciplines such as economics, management, communication, art studies, aesthetics, and law. Looking to the future, scholars should focus on horizontal research in the art market, enhance interactions with market participants, and embrace interdisciplinary research methods. Furthermore, the transformation of sectors and business models in the contemporary art market, institutional innovations, and the new operational mechanisms they create remain areas ripe for further exploration.

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